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NIILO A. VAPPULA
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Tikkurila, Finland

HELSINKI 1965

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Helsinki 1965 — Sanoma Osakeyhtiö

FOREWORD

The present comprehensive work on the distribution and significance of pests appearing in agricultural crops in Finland is principally based upon the very extensive material compiled since the 1890's, during the entire period of activity of the Department of Pest Investigation of the Agricultural Research Centre. Most of the reports of pest occurrence have been made by individual farmers, but many have also been received from workers in advisory organizations, instructors at agricultural and horticultural schools, and other interested persons. There are also included some details of observations made by researchers of the Department of Pest Investigation.

The publication of this volume is extremely necessary. Primarily, it is needed by Finnish research workers, agricultural schools and advisory organizations, but foreign scientists will also be able to benefit from it. No such comprehensive listing of Finnish crop pests has been made earlier in Finland. In the years until 1927, detailed reports on pest occurrence were made either annually or at intervals of several years; in 1933, Professor UUNIO SAALAS published a university textbook which contained a large part of the data available at that time. However, in later years, partly by reason of insufficient funds, only brief annual reviews have been published. The present volume accordingly fulfils a very urgent need.

Dr. NIILO A. VAPPULA, the author of this book, has devoted many years to the extremely difficult and demanding task of arranging the rich material for publication. Now that he has completed this extensive compilation, the Department of Pest Investigation is greatly indebted to him for this useful and skilfully-performed work.

Veikko Kanervo
Director, Department of Pest Investigation

Tikkurila, December 1964

AUTHOR'S PREFACE

In preparing the present work I tried to take into consideration all the records mentioned in publications, along with numerous unpublished reports on the occurrence of different pest species on cultivated plants in Finland. In the furtherance of this task, I have made use of the observations and scientific studies made by many investigators in this country.

In the compilation of material and the determination of species, valuable assistance has been rendered by research workers of the Department of Pest Investigation of the Agricultural Research Centre, and I wish to express my sincere thanks to them. I am especially grateful to the Director of the Department, Professor VEIKKO KANERVO, for his able help during the various phases of the work, as well as for his useful advice and additions to the manuscript. I am also indebted to OSMO HEIKINHEIMO, M. A., and MARTTI MARKKULA, Ph. D., both of whom provided data on the pest species relevant to their own special fields. Similarly, I have greatly appreciated the information and suggestions provided by TAHVO KONTUNIEMI, Ph. D., with respect to sawflies.

Thanks are also due to EDVIN RISSER, M. A., for translating the manuscript into English, and to Mr. FRED A. FEWSTER for his valuable help in proof-reading.

During the final phases of this work, I received a grant from the State Research Council for Agriculture and Forestry, to which I tender my sincere thanks.

Niilo A. Vappula

CONTENTS

Introduction

It is probable that insects and other pests have appeared on cultivated plants ever since man began to grow them as crops for his food supply. In view of the great economic importance of these pests, scientific studies were begun rather early, in an attempt to determine the reasons for the damage caused, and to find means for their control. In Finland, research activity concerned with agricultural pests started in the 1700's at Turku Academy, where PEHR KALM (1716—1779) and PEHR ADRIAN GADD (1727—1797), together with their students, carried out studies — which were quite modest by present-day standards — on many pest species. They published their results in the form of academic dissertations. Even at that early time numerous species of pests were known, such as the slug, wireworm, cockchafer, common rustic moth, large white butterfly, antler moth, leatherjacket, frit fly, aphids, and so on. Many methods were proposed for the control of these pests; most of these methods were very primitive, and often quite amusing from our modern viewpoint.

However, systematic pest investigation did not begin in Finland until the beginning of the 1890's. As a result of the great destruction caused by the antler moth in 1881—1886 and 1889—1893, O. M. Reuter made some investigations, initiated and financed by the Finnish Economic Society, on the life habits and occurrence of this pest, together with trials for its control (O. M. REUTER 1892—1894). His investigations were followed by those of Enzio Reuter, who studied harmful insects in addition to the antler moth. The studies of this researcher were initially financed by an annual grant made by the State Board of Agriculture (1894—1898); but from October 1, 1898, and until the year 1912, he served as both State entomologist and director of the Entomology Department of the newly-founded Agricultural-Economic Experiment Station. This institute was associated with the University of Helsinki. The Entomology Department carried out its activities for a number of years in the Agricultural Entomological Laboratory of the University until 1910, when it acquired its own laboratory premises in the Agricultural-Economic Experiment Station at Tikkurila. As successor to Enzio Reuter, Walter M. Linnaniemi was State entomologist until 1924, when agricultural research activity was reorganized and separated from the University. At the same time, the position of State entomologist was discontinued; his former duties were transferred to the Department of Pest Investigation of the present Agricultural Research Centre. KANERVO (1959) has published a historical review of agricultural pest investigation work in Finland during the 60-year period 1898—1958.

Both Reuter and Linnaniemi published the results of their investigations and other records of pest occurrence in their annual reports (E. REUTER 1895, 1897—1899, 1901, 1901 a, 1902—1905, 1908, 1909, 1910, 1912, 1912 a, 1914, 1914 a; LINNANIEMI 1915, 1916, 1920, 1935). The Department of Pest Investigation has also issued reports on the occurrence of pests in the years 1924—1925 and 1926—1927 (HUKKINEN and VAPPULA 1935; HUKKINEN et al. 1936). No extensive accounts have been published since then, but brief summaries relating to the appearance of the most important species have been issued for the periods 1929—1937, 1948 and 1950—1961 (VAPPULA 1930, 1931, 1931 a, 1932, 1932 a, 1933, 1935, 1937, 1938, 1939, 1951, 1952, 1952 a, 1953, 1955 a, 1956, 1957 a, 1958, 1959 b, 1960, 1961, 1962; KANERVO 1948).

Number of pest species and their increase

The previously-mentioned annual reports made by the State entomologists Reuter and Linnaniemi contain much valuable information on the occurrence of pests in Finland, and thus serve as a sound basis for pest investigations in this country. According to the calculations of HUKKINEN (1922, 1923), the numbers of different species mentioned in each year during the period 1894—1916 are as follows:

1894	34 species	1906	28 species
1895—1896	52 „	1907	19 „
1897	41 „	1908	30 „
1898	26 „	1909	30 „
1899	46 „	1910	31 „
1900	51 „	1911	35 „
1901	38 „	1912	38 „
1902	21 „	1913	102 „
1903	29 „	1914	138 „
1904	33 „	1915	205 „
1905	33 „	1916	174 „

In earlier annual reports, the information furnished was based principally on the State entomologists' own investigations and observations, together with the occasional reports received, and consequently the number of species was relatively low, annually amounting to 19—52. After the year 1913, however, there was a considerable increase in numbers, mainly ascribable to the increased efficacy of pest investigation and the collection of data. In order to determine the occurrence of pests and the damage they occasioned, the Department began to make more and more use of questionnaires. In 1915 a network of observers was organized which covered the entire country; at first this consisted of 700—800 persons who provided information on pests, a service which has been maintained to the present time.

In the final state entomologists' report for the period 1917—1923, there is mentioned a total of about 240 species of animals harmful to cultivated plants. In each of the subsequent two extensive reports published under the auspices of the Department of Pest Investigation of the Agricultural Research Centre, and relating to the years 1924—1925 and 1926—1927, about 150 species are listed. In later

years observations and records of 150—200 pest species are received by the Department annually.[1])

As research activity in this country has become more effective and intensified, our knowledge of the total number of pest species has become more complete, since recognition is constantly being made of new species, of which many are extremely dangerous and are already found extensively throughout the country. Thus in the five-year period 1913—1917 there was established a total of 177 new species injurious to crops; at that time the total number exceeded 400 different pest species (HUKKINEN, op.cit.). Since then, the number of species has increased from year to year, and simultaneously the accumulating reports have served to furnish a more complete general picture of the distribution and injurious nature of the previously-known species. Some of the new species are ones which originally lived on wild plants and which have only recently begun to damage crops; others have been introduced into this country from abroad through the agency of living plants or parts of plants, or by other means of dispersal.

The list at the end of this volume, which comprises a total of 1060 different species of pest animals, was prepared from data compiled up to the year 1961. The main sources of this list were the published reports of pest occurrence during the period 1894—1927 and other relevant literature, as well as the extensive material received by the Department of Pest Investigation and containing information sent from various parts of the country, along with observations made by the Department's research workers. The pests are divided into the following groups:

I. Insects (*Insecta*)			
Springtails (*Collembola*)	4	species	
Grasshoppers, etc. (*Orthoptera*)	2	„	
Earwigs (*Dermaptera*)	1	„	
Thrips (*Thysanoptera*)	25	„	
Plant bugs, aphids, etc. (*Hemiptera*)	162	„	
Beetles (*Coleoptera*)	146	„	
Sawflies, ants, etc. (*Hymenoptera*)	96	„	
True flies (*Diptera*)	99	„	
Butterflies, moths (*Lepidoptera*)	400	„	935 species
II. Myriapods (*Myriopoda*)			6 „
III. Mites (*Acarina*)			44 „
IV. Crustaceans (*Crustacea*)			3 „
V. Molluscs (*Mollusca*)			9 „
VI. Worms (*Vermes: Nematoda, Annelida*)			8 „
VII. Birds (*Aves*)			32 „
VIII. Mammals (*Mammalia*)			23 „
		Total	1060 species

[1]) In addition to the species harmful to crops, many reports have also been received of pests infesting stored products and dwellings, forest pests, etc.

Number of pest species in different parts of Finland

It is natural that the number of different pest species is more abundant in the southern parts of Finland, where crop husbandry is older and more diversified, nature more luxuriant, and the weather milder than in other parts of the country. For this reason, the economic damage caused by crop pests is more substantial in south Finland than, say, in the eastern and northern areas of the country. Against this, it should be realized that the severity of damage is not directly correlated to the number of pest species, since in the northern, climatically-unfavourable regions, relatively few species may cause — at least at certain times — proportionately greater damage than in the south of the country.

The list at the end of this volume (pages 196—225) shows the distribution of pest species in the biogeographical provinces of Finland (see map, p. 226), based upon data obtained up to 1961. Especial emphasis is laid upon the list not indicating the actual geographic distribution of the species as such, but rather their occurrence as crop pests. Many species are distributed much more widely than is shown in the list, but they live and reproduce on wild plants if no suitable cultivated crops are available. In addition, it should be borne in mind that currently very little information is available with respect to the extent of damage caused by certain pests, particularly the less important species. Table 1 shows the numbers of different pest species in the biogeographical provinces in Finland.

As a result of the wars of 1939—1940 and 1941—1944, Finland was forced to relinquish the entire provinces of the Carelian Isthmus (Kk) and Petsamo Lapland (PsL), in which the numbers of pest species were respectively 121 and 5. In addition, the greater part of South Carelia (EK) and Ladoga Carelia (LK) was lost, as well as sections of North Carelia (PK) and Kuusamo (Ks). Reports from these areas are also included in the figures.

On examination of the figures presented in Table 1, it should be remembered that they do not give a completely accurate picture of the distribution of the species as pests of cultivated plants. This is because the southern and western parts of the country, especially Finland Proper (V), Uusimaa (U) and South Häme (EH), have been much more intensively investigated in this respect than have the eastern and northern regions, with the consequence that the figures for the former regions are disproportionately high. On the other hand, in the archipelago of Ahvenanmaa (A) (Aland Islands) studies of pest species are as yet incomplete.

Table 1. Numbers of pest species in Finland by biogeographical provinces

Province	*Collembola*	*Orthoptera*	*Dermaptera*	*Thysanoptera*	*Hemiptera*	*Coleoptera*	*Hymenoptera*	*Diptera*	*Lepidoptera*	*Myriopoda*	*Acarina*	*Crustacea*	*Mollusca*	*Vermes*	*Aves*	*Mammalia*	Total
Ahvenanmaa (A)	—	—	—	2	25	40	25	16	166	—	23	—	1	1	—	3	302
Finland Proper (V)	3	1	1	15	90	66	40	49	175	—	28	—	3	4	8	5	488
Uusimaa (U)	3	1	—	23	123	84	62	61	249	6	41	3	6	5	14	9	690
South Carelia (EK)	—	—	—	8	37	40	15	30	65	—	18	1	1	1	3	5	224
Satakunta (St)	1	—	—	7	37	39	14	19	49	1	18	2	2	2	6	7	204
South Häme (EH)	1	1	1	19	96	73	41	39	207	2	26	2	4	5	15	8	540
South Savo (ES)	1	—	1	11	51	47	14	28	85	1	15	2	2	2	2	6	268
Ladoga Carelia (LK)	—	—	—	5	23	32	11	15	34	—	12	—	2	—	2	4	140
South Ostrobothnia (EP)	—	—	—	10	41	33	12	21	45	—	13	—	2	—	4	5	186
North Häme (PH)	1	—	—	5	18	30	6	17	31	2	13	—	1	1	4	5	134
North Savo (PS)	—	—	—	7	49	36	11	25	37	1	13	—	1	—	8	3	191
North Carelia (PK)	1	—	1	5	22	34	8	21	38	—	6	—	1	—	2	5	144
Central Ostrobothnia (KP)	—	—	—	6	30	32	14	29	41	1	9	—	2	1	5	4	174
Kainuu (Kn)	—	—	—	2	9	22	4	15	14	1	8	—	1	—	1	—	77
North Ostrobothnia (PP)	1	—	—	7	29	27	14	28	28	—	9	—	—	1	3	7	154
Kuusamo (Ks)	—	—	—	3	5	12	4	12	6	—	—	—	—	1	—	2	45
Kemi Lapland (KemL)	—	—	—	2	4	11	2	12	7	—	2	—	—	1	—	2	43
Enontekiö Lapland (EnL)	—	—	—	—	—	3	—	2	2	—	—	—	—	—	—	6	13
Inari Lapland (InL)	—	—	—	1	5	2	—	10	5	—	—	—	—	—	—	1	24

Number of pest species in different crops

In his studies of the pest species to be found on Finnish cultivated plants, HUKKINEN (1922, 1922 a, 1923) presented some data concerning the number of species encountered in different groups of agricultural crops. According to his figures, the numbers of pest species found up to the year 1918 in different crops were as follows: cereals 58, grasses 44, clovers 19, peas 34, beets 16, fibre plants 3, potatoes 26, crucifers 67, vegetables 137, fruit trees 72, berry bushes 57, and ornamental plants 75.

With intensification of the studies relating to pest investigation there has been a corresponding increase in the numbers of destructive species found on cultivated plants. Table 2 presents a summarized tabulation of the species mentioned in the list at the end of this volume. This table, based upon information available up to the year 1961, illustrates the distribution of the various pest species among different crops or groups of crops.

The table makes it apparent that numerous injurious species occur on most of the crops grown in this country, especially as regards cereals, crucifers, fruit trees, berry bushes, as well as ornamental plants and park trees. Only a part of these species is constituted by those which regularly or occasionally cause great destruction to the crops; most of them are less injurious, or appear but rarely. However, experience has shown that species which occur rarely, or which are considered to be unimportant, can suddenly or gradually develop into harmful pests.

The destructiveness of the pests included in the table is divided up, by both animal and plant groups, into three classes: 1) highly destructive species = ***, 2) moderately destructive = ** and 3) slightly destructive = *.

Obviously, it is not possible to draw clear lines of demarcation between these three categories; for example, certain slightly destructive species may bring about rather extensive localized damage. In addition, both Table 2 and the list at the end of this volume include many species which are not as yet known to be significant as crop pests, but whose larvae have on occasion been found to cause injury to the plant concerned. Such species are indicated by the symbol (*).

Table 2. Numbers of pest species in different crops, and their distribution according to destructiveness

Crops	*Collembola*	*Orthoptera*	*Dermaptera*	*Thysanoptera*	*Hemiptera*	*Coleoptera*	*Hymenoptera*	*Diptera*	*Lepidoptera*	*Myriopoda*	*Acarina*	*Crustacea*	*Mollusca*	*Vermes*	*Aves*	*Mammalia*	Total	Distribution of species by destructiveness (cf. p. 13) ***	**	*	(*)
Cereals	—	1	—	6	11	19	3	20	11	—	3	—	1	1	13	17	106	23	25	42	16
Gramineous fodder plants	—	—	—	9	8	11	3	12	31	—	3	—	2	1	—	9	89	18	18	31	22
Peas	—	—	—	1	1	7	—	5	12	—	1	—	1	—	11	1	40	4	8	21	7
Fodder legumes	—	—	—	1	7	21	—	3	34	—	1	—	1	1	1	2	72	5	16	17	34
Potatoes	—	—	1	—	11	6	—	3	9	—	1	—	2	1	6	5	45	6	13	18	8
Beets	1	—	—	1	6	7	—	2	10	—	—	—	—	1	—	2	30	6	8	9	7
Cruciferous root and fodder crops	1	—	—	—	7	16	1	6	20	—	—	—	3	—	4	7	65	18	14	19	14
Cruciferous seed and oil crops	—	—	—	1	5	10	1	7	10	—	—	—	2	—	9	2	47	12	17	15	3
Fibre plants	—	—	—	—	1	3	—	1	3	—	—	—	—	—	1	—	9	—	3	5	1
Hops	—	—	—	—	3	—	—	2	8	—	1	—	—	—	—	—	14	2	2	3	7
Tobacco	—	—	—	—	3	1	—	1	9	—	1	—	1	—	—	1	17	1	2	10	4
Spices and medicinal plants	—	—	—	—	1	2	—	2	4	—	—	—	—	—	—	—	9	—	2	5	2
Osier willows	—	—	—	—	—	1	—	3	3	—	—	—	—	—	—	—	7	—	1	5	1
Field vegetables:																					
Crucifers	—	—	1	—	7	22	2	8	21	—	1	—	4	—	1	3	70	20	13	35	2
Onions	1	—	—	1	—	6	—	9	13	—	3	—	1	—	4	1	39	6	7	16	10
Beans and garden peas	1	—	—	2	6	8	—	6	7	1	1	—	1	—	4	3	40	5	6	26	3
Cucumbers	1	—	—	1	6	8	1	3	4	—	3	—	2	—	—	3	32	2	5	23	2
Beets	—	—	1	—	4	5	—	1	2	1	—	—	2	—	—	3	19	4	4	9	2
Carrots	—	—	—	—	5	3	1	2	6	—	—	—	3	—	—	5	25	5	8	10	2
Others	—	—	1	1	12	13	1	7	17	—	1	—	3	—	1	3	60	4	6	41	9
Fruit trees	—	—	—	3	24	33	14	2	110	—	9	—	2	—	13	9	219	29	29	104	57
Berry bushes	1	—	1	—	26	29	14	6	79	1	6	—	4	1	16	8	192	22	23	84	63
Ornamental flowers	—	—	1	2	15	25	4	11	55	1	4	—	2	2	—	4	125	4	22	51	48
Ornamental shrubs	—	—	—	1	40	18	28	6	91	—	5	—	2	—	1	5	197	9	21	71	96
Ornamental trees	—	—	—	1	42	30	39	10	172	—	12	—	—	—	—	5	311	10	22	85	194
Greenhouse plants:																					
Tomatoes	1	—	—	—	4	2	1	1	3	—	1	1	—	1	—	1	16	2	4	10	—
Cucumbers	1	—	—	2	3	2	1	—	—	3	3	2	1	1	—	1	20	6	5	8	1
Other vegetables	1	—	—	—	2	1	—	—	—	1	—	1	1	—	—	—	7	—	2	5	6
Ornamental plants	1	1	—	10	23	3	5	5	10	4	10	—	3	3	—	4	82	15	19	42	—
Grape and peach	—	—	—	1	4	—	—	—	—	1	1	—	—	—	—	—	7	1	2	4	—
Mushrooms	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1	—	—	1	—
Distribution of species by destructiveness ***	—	—	—	7	26	21	5	14	20	—	10	—	3	1	2	5	114				
Distribution of species by destructiveness **	—	—	—	7	31	26	12	20	39	2	6	2	1	5	4	3	159				
Distribution of species by destructiveness *	4	1	1	10	77	78	62	46	105	3	20	1	3	2	25	10	447				
Distribution of species by destructiveness (*)	—	1	—	1	28	22	16	19	236	1	8	—	2	—	1	5	340				
	4	2	1	25	162	147	95	99	400	6	44	3	9	8	32	23	1060				

Pests of different crops

1. Cereals

Grasshoppers (*Orthoptera*). In 1942, *Tettigonia viridissima* L. was found at Nauvo (V) to have caused damage to the green panicles of oats (NORDMAN 1944 a).

Thrips (*Thysanoptera*). Thrips are very common pests in Finland and cause considerable damage to cereals. From an economic standpoint, the most important are *Limothrips denticornis*, *Frankliniella tenuicornis* and *Haplothrips aculeatus*. They often live within the uppermost leaf sheath of cereal plants, damaging the young head, and causing either complete or partial white-heads, or other disturbances in the normal development of the head and grains. To date, there has been no thorough clarification of the parts played by the various species in causing such injuries.[1])

Limothrips denticornis HAL., which has spread as far north as Kemi Lapland, occurs as a causal agent of partial white-heads, mainly in rye, but also in barley and wheat (E. REUTER 1902 a, 1903; HUKKINEN 1934). It also feeds on the inside of leaf sheaths, producing white, translucent spots in them. In some instances, damage to rye heads has amounted to as much as 25—30 per cent, and yield losses estimated at 5—10 per cent; but usually the injuries are less than this. According to HUKKINEN (1936, p. 29), *Frankliniella tenuicornis* Uz. occurs everywhere in Finland, including the northernmost regions of the country. The observations of E. REUTER (1901, 1901 b, 1902 a) indicated that this species caused complete white-heads in oats, in addition to partial white-heads mainly to be found in barley, to some extent in rye, and least of all in wheat. The investigations made by KANERVO (1950) in 1931 indicate that the first generation damages heads by living in the uppermost leaf sheaths, principally in rye, but also to a lesser extent in winter wheat. Later, this species moves to barley, oats and spring wheat, where the second generation causes injury to leaves, leaf sheaths and spikelets. The most serious harm to barley occurs when the insect penetrates the spikelets and destroys the ovules

[1]) The significance of thrips as causal agents of white-heads in cereals in Finland has been investigated by E. REUTER (e.g. 1902 a) and HUKKINEN (e.g. 1917, 1917 a, 1934). It has also been found that other factors may be responsible for this kind of injury, especially in the case of oats (POHJAKALLIO and GRUNDSTRÖM 1941). Frost injury in barley resembles to some extent the damage brought about by thrips.

(intrafloral damage). In the summer of 1931, studies made in 32 localities of Ostrobothnia showed that the amount of empty grains averages 12 per cent, ranging from 2 to 30 per cent. In later years, as in 1959, damage more extensive than the normal has occasionally been encountered. This species can be considered one of the most injurious barley pests in Finland. It has also been found to injure the stem leaves and bracts of the ear in maize (HÅRDH 1955). *Haplothrips aculeatus* FABR. is a common species in all parts of Finland, often causing partial white-heads, especially in rye, barley and wheat (E. REUTER 1902, 1902 a, 1903; HUKKINEN 1934). Sometimes, the damage can be extremely great (HUKKINEN 1936 a). In addition, this species has been found to be an important causal agent of »notched ears» in rye (HUKKINEN and VAPPULA 1936; BRUMMER 1939). For instance, 1934 was marked by the abundant occurrence of injury in wheat fields in southwestern Finland, in 1935 in wheat and rye, and in 1937 in rye; in the last-mentioned instance 2.6 to 9.1 per cent of the empty spikelets were found to have been injured by these thrips. In 1943, this species was observed to have caused great damage to wheat heads at Jokioinen (EH) (Annual Report of the Dept. of Pest Invest. 1943; INKILÄ 1960). *Frankliniella intonsa* TRYB. was found by E. REUTER (1902 a, 1903) to cause partial white-heads in barley, rye and wheat. Other species of thrips found on cereals have been *Anaphothrips obscurus* MÜLL. (O. M. REUTER 1899, p. 43; E. REUTER 1902, p. 58; HUKKINEN and VAPPULA 1936) and *Aptinothrips stylifer* TRYB. (E. REUTER 1912, p. 19), but it is probable that their importance as cereal pests is small. The former species was found abundantly in 1960 on oats and barley, being responsible for leaf injuries (Köppä), but its significance is being more closely studied.

Injuries produced by thrips are often found on fully-developed cereal kernels, but at least as far as wheat is concerned this has not been observed as directly lowering the baking qualities of the flour. Nevertheless, under certain weather conditions it may increase the germination of the grains, and thus exert an unfavourable effect upon the quality of the flour (NUORTEVA and KANERVO 1952). Furthermore, injured grains are susceptible to infection by *Alternaria* (P. NUORTEVA 1952).

Plant bugs, aphids, etc. (*Hemiptera*). *Lygus* bugs[1]) are often very abundant on the heads of cereals, especially barley and wheat, where they cause damage to the soft grains. An especially serious outbreak of *Lygus rugulipennis* POPP. occurred in South, Central and North Ostrobothnia in 1959. Damage similar in kind is caused to rye and wheat by the meadow capsid bug (*Leptopterna dolabrata* L.), which additionally injures the stem by the incisions it makes during oviposition. A third species, the sloe bug (*Dolycoris baccarum* L.), is occasionally encountered in large numbers at the end of the summer; it is found on the spikes of rye, barley and wheat, where it sucks the juice from the developing grains, the rachis, and

[1]) According to LINNAVUORI (1951 a), four species of *Lygus pratensis* group are found in Finland: *L. pratensis* L., *L. rutilans* HORV., *L. gemellatus* H.S., and *L. rugulipennis* POPP. The last-mentioned species is the commonest in this country (cf. also VARIS 1959).

sometimes also from the portion of the stem just below the spike (HUKKINEN 1913; 1913 b, p. 38—39; 1915). As a result, the grains shrivel and the spike becomes pale-coloured before the normal time. The above-mentioned three species of plant bugs occurred with especial abundance on wheat in 1935, during the ripening period of this crop (HUKKINEN and VAPPULA 1936).

It is assumed that the sloe bug, in common with other plant bugs, excretes proteolytic enzymes or enzyme activators in its saliva during feeding upon grains of the cereal heads, with the consequence that the baking quality of the flour, especially that of wheat, is sharply reduced (HUKKINEN 1935 a; P. NUORTEVA 1953, 1953 a; P. NUORTEVA and REINIUS 1953). Usually from ½ to 4 per cent of the wheat grains are injured by plant bugs; often, the figure is greater, the maximum recorded being 87.3 per cent. In general, however, the effect of such injury is milder in Finland than in more southern countries (P. NUORTEVA 1953 a, 1960). The part played by the different plant bug species in causing such damage, a matter of major importance to the milling industry, has not been fully investigated. The species *Lygus rugulipennis* POPP., the most common grain-damaging species in Finland, has not been found to have any great significance in this respect (P. NUORTEVA and VEIJOLA 1954; P. NUORTEVA 1954, 1960).

Only on one occasion has the common froghopper (*Philaenus spumarius* L.) been reported (Vesilahti (EH) in 1923) as occurring abundantly on barley. The occurrence of damage by the grass leafhopper (*Psammotettix* sp.)[1]) was unexpectedly great in many communes of southwestern Finland in 1918.[2]) In the early part of the summer, this species fed on the leaves of the seedlings of wheat and rye, causing them to wither and yellow. In some places, the destruction to the fields was complete. Later, the insects moved to fields of spring cereals (mainly oats), although the damage here was relatively small in comparison with that apparent in winter cereals. The losses in yield as a result of this serious outbreak of grass leafhoppers in southwestern Finland rose to a value of at least one million, perhaps several million, Finnish marks (LINNANIEMI 1920 a, 1935). Since that time there have been no reports whatsoever of further damage caused by this species.

It has only recently been established that the leafhopper *Calligypona pellucida* FABR., a common species in south and central Finland, is a harmful cereal pest. In a number of detailed investigations (e.g. KANERVO et al. 1957; KANERVO 1957, 1958; HEIKINHEIMO 1959 a; RAATIKAINEN and TINNILÄ 1959, 1959 a) it was determined that there could be attributed mainly to the leafhopper the serious outbreak of oat damage in the western coastal area of Finland. The first records of this damage appear in respect to the years 1948—1949, when it was observed in

[1]) This species was earlier given the name *Deltocephalus striatus* L., but at the present time this name is no longer used. It has not yet been established which species occurred as a pest during the outbreak mentioned.

[2]) In the report of LINNANIEMI (1935), the year 1919 was erroneously given as the year of this pest outbreak (cf. also HUKKINEN 1925, p. 26).

the region of Vaasa (EP). Subsequently the extent of injuries increased, and the area of the region affected spread eastwards at an average speed of some 6 miles annually, attaining its maximum size in the years 1954—1956. In 1955, the yield losses were estimated to be at least 1 thousand million marks. Investigation showed that in 1956 the oat damage occurred in a region along the coast about 250 miles long and from 6—38 miles wide, extending from Lokalahti (V) to Himanka (KP). This region comprised about 11 per cent of the area under oats in this country. The most severe damage occurred between Siipyy (EP) and Kokkola (KP), where the yield losses generally amounted to 40—100 per cent; as a result, oat cultivation was discontinued at many places as an unprofitable undertaking. Towards the interior, the severity of the damage decreased quite rapidly. In 1957, a similar type of damage to oats was observed at Kaavi (PK). During the years 1957—1960, no more than very slight injuries to oats were caused by this pest. In 1961, however, considerable destruction again appeared, both in the original coastal area, and also in some districts in North Häme, South and North Savo, as well as in South and North Carelia (HEIKINHEIMO and IKÄHEIMO 1962).

Investigations carried out at the Department of Pest Investigation in 1958 resulted in the finding that the leafhopper effects two different kinds of damage to oats. One of these is partial or complete sterility, and an abundant formation of tillers. The second type of damage is characterized by rapidly-spreading pale yellow streaks in the leaves, a cessation in growth of the plant, and shrivelling of the grains; in severe cases, the oat plant dies. In trials made at the Department of Pest Investigation in 1957—1959, it was found that the leafhopper caused leaf streaking, shrivelled grains, reddening of the leaves and death also of spring wheat plants, symptoms which in many respects resembled those observed in oats. These trials led to the conclusion that this was a case of two different virus diseases. In later greenhouse trials made with leafhoppers, IKÄHEIMO (1960, 1961) demonstrated that the leafhopper is capable of transmitting two different virus diseases which produce in oats and wheat symptoms similar to those described above. One of these diseases, oat sterile-dwarf virus, induces damage of the type first mentioned above (IKÄHEIMO 1962), and is the principal causal agent of the outbreaks of damage to oats (HEIKINHEIMO and IKÄHEIMO 1962). The second disease, European wheat striate mosaic, produces the second type of symptom in oats, and also in wheat and other cereals (cf. KANERVO et al. 1957, p. 30—32). Cereal plants injured by this latter virus have been found throughout the whole of south and central Finland as far north as the latitude of Oulu (PP) (HEIKINHEIMO and IKÄHEIMO 1962), but its economic significance in oat cultivation is relatively much less than that of the first-mentioned virus disease.

Reasons for the damage caused by the leafhopper were discussed by P. NUORTEVA (1958, 1959, 1959 a, 1959 b), who doubted the virus character of the damage, believing it to be caused exclusively by the greater toxicity of the saliva of those leafhoppers in the region of oat damage. In later investigations (P. NUORTEVA

1962), he established that saliva toxicity could act as an agent of the oat disease, but also admitted that viruses also had a share in causing damage to oats.

The appreciable amount of destruction to cereals attributable to virus diseases transmitted by leafhoppers has been observed as being accompanied by a corresponding abundance of this pest. In badly-damaged oat fields, as many as over 2000 nymphs of leafhoppers to the square metre were found in the autumn. Since the species overwinters in the nymphal stage principally in the stubble of spring cereals sown as nurse crop for timothy leys, it possesses favourable conditions for reproduction. The prevalence of this kind of cultivation method in Finland is consequently one of the reasons for the abundance of the leafhopper (cf. RAATIKAINEN and TINNILÄ 1959), and for the resultant occurrence of damage caused by viruses transmitted by this pest, especially in oats and spring wheat.

Not only *Calligypona pellucida*, but also another species, *C. obscurella* BOH., has been found to transmit the previously-mentioned virus diseases in winter wheat and oats (IKÄHEIMO and RAATIKAINEN 1961). However, this species is much less prevalent than the former one.

Other species of leafhoppers encountered on oats possess scarcely any significance as pests (KANERVO et al. 1957, p. 29—30; RAATIKAINEN 1960).

As regards the aphids, the two commonest species which occur on cereals in Finland are the bird-cherry aphid and the English grain aphid. The bird-cherry aphid (*Rhopalosiphum padi* L.), found as far north as Inari Lapland, lives in early summer on the leaves of the bird-cherry tree, often in very great numbers. Later in the summer, winged generations migrate to cereals, principally oats, to feed on the leaves and leaf sheaths of this crop. If the attack is severe, the plants may become completely yellow, and the entire stand may be destroyed. Although aphids are common on bird-cherry trees, relatively few reports are available of serious damage to oats. On occasion, severe outbreaks have been observed in some localities, for example, in 1926, 1947, 1954 and 1957; during 1954 and 1957, the aphid attacks were concentrated especially in the eastern regions of the country. In 1959, there was particularly widespread and serious damage ascribable to the bird-cherry aphid in nearly all parts of Finland. In South and Central Ostrobothnia, North Savo. North Carelia, as well as in certain localities in Uusimaa, South Carelia, South Häme, South Savo and North Ostrobothnia, the reports indicated especially extensive damage. In the regions where damage was most marked, the losses to oats were estimated at 15—30 per cent, with an average perhaps slightly over 20 per cent. For the country as a whole, the losses were under 15 per cent. In addition to oats, barley also suffered damage in many localities, whereas spring wheat was only slightly harmed by this aphid (KANERVO 1960, p. 194—200). According to the figures of RAATIKAINEN and TINNILÄ (1961), the losses to oats averaged about 12 per cent, to barley 8 per cent, and to wheat 3 per cent; the total losses caused by the bird-cherry aphid in the whole country were 3 thousand million marks in 1959. This species has also been found to be a vector of barley yellow dwarf virus

(IKÄHEIMO 1960, 1962). — In 1956, a few of the species *Schizaphis* sp. were found on oats in the province of South Ostrobothnia (KANERVO et al. 1957, p. 30).

The English grain aphid (*Macrosiphum avenae* FABR.) is a very common pest in Finland, often appearing abundantly at the end of the summer on the panicles of oats and spikes of spring and winter wheat, but less often on barley and rye. In dry summers in particular, this aphid, by sucking juices from the developing grains, may cause them to wither and fall off. In normal summers, however, the aphids appear so late that the grains have already begun to harden, and thus the damage is seldom great. The English grain aphid, found as far north as Inari (InL), has been recorded in this country since 1894, and most substantially in the years 1915, 1917, 1920 (north Finland), 1930, 1946—48, 1952, 1956 and 1958. In the summer of 1959, a species new to Finland, the rose grass aphid (*Metopolophium dirhodum* WALK.), was found at Laihia (EP) to cause considerable damage to oats, and somewhat less to wheat. This species has also been encountered at Tikkurila (U) (Heikinheimo; cf. RAATIKAINEN and TINNILÄ 1961), and at Luvia (St) in 1961 (Raatikainen).

Beetles (*Coleoptera*). The larvae of click beetles (*Elateridae*), also known as wireworms, have long been known to be harmful cereal pests. Every year, in all parts of the country, they cause damage of varying degree to the seedlings of both winter and spring cereals. Fields sown after leys are especially threatened by these pests. Only some of the species of click beetles found in Finland are harmful, but to date no thorough investigations have been made to determine the significance of the different species in this respect. The reports compiled indicate that the most prevalent seedling-damaging species are *Agriotes obscurus* L., *A. lineatus* L. (in south and central Finland), *Corymbites aeneus* L., and *C. pectinicornis* L. In addition, *C. cupreus* FABR. subsp. *aeruginosus* FABR., which has spread to this country from the east, is the most common species of click beetle in Kainuu, and evidently also in certain parts of Kuusamo and North Carelia. It is often the cause of severe damage to barley, oats and rye, especially in the province of Kainuu (LINNANIEMI 1920, p. 24—28; SAALAS 1923; HILLI 1933). Other species have also been found in cereal fields in this region, for example *Corymbites melancholicus* FABR. — The larvae of the cockchafer (*Melolontha hippocastani* FABR.) have often been encountered in fallow, and also as harmful pests of rye and oat seedlings. In one case, they also injured the roots of maize. The beet carrion beetle (*Aclypea opaca* L.), which is distributed throughout the entire country, occasionally appears as a pest among barley and oat seedlings, especially in north and central Finland. This species is one of the most widespread pests in Finland, and damages nearly all cultivated plants. Injuries which could be laid to its score have been observed in Finland ever since 1892, when larvae were abundant not only in the barley fields of South Ostrobothnia, but also elsewhere (O. M. REUTER 1893 a; E. REUTER 1895, p. 39—42). In 1960, larvae were found to be especially numerous on the seedlings of spring cereals in the provinces of South, Central and North Ostrobothnia.

The best-known species of flea beetle which occurs on cereals is the barley leaf beetle (*Phyllotreta vittula* REDTB.), which causes the greatest damage to barley and spring wheat, but occasionally injures the seedlings of rye, winter wheat and oats. The larvae live in the soil on the roots of the seedlings, without occasioning any substantial harm.[1]) Damage attributable to flea beetles was commonest in the southern parts of the country in the years 1935—1937, 1940—1942 (slight injury), 1949 and 1960. In addition to the barley leaf beetle, other species have also been found on the leaves of seedlings in south Finland. These species, with numbers much less than those of the former, include *Chaetocnema hortensis* GEOFFR., *Ch. mannerheimi* GYLL.[2]) and just a small number of *Ch. aridula* GYLL. By means of rearing, it has been shown that the larvae of these species live in the stems of barley and spring wheat, bringing about a type of damage to the basal part of the stem which had been earlier noted in various parts of the country, and attributed erroneously to the barley leaf beetle.

On several occasions, the larvae of the cereal leaf beetle (*Lema melanopa* L.) have been found on the leaves of oats, barley and spring wheat, where they produce long, translucent feeding strips. Usually the injury is very slight, but in the years 1936—1937 there was relatively severe damage in some districts of South Ostrobothnia; in one instance, this damage resulted in a field of spring wheat having an completely withered appearance. Determination of the species was confirmed by rearing. — The larvae of *Galeruca tanaceti* L. have only rarely been encountered on the leaves of oats, but induce no appreciable damage to the plants. On one occasion the larvae of *Cassida nebulosa* L. were observed on oats (E. REUTER 1897), but this can be regarded as just a chance occurrence.

The heads of rye are occasionally injured by *Potosia cuprea* FABR. and *Cetonia aurata* L., but usually only very slight harm is done. *Anomala dubia* SCOP. var. *aenea* DEG. was once found in large numbers in a rye field (Pälkäne (EH) in 1904), where it damaged the grains and rachis of the spikes (LINNANIEMI 1915). Likewise, *Hylobius abietis* L. was once observed to devour the soft grains of rye (Revonlahti (KP) in 1934).

Sawflies, etc. (*Hymenoptera*). E. REUTER (1902 a; 1908, p. 11—12) reported the finding of larvae of *Cephus* sp. in straws of grasses and cereals. Similarly, LINNANIEMI (1920, p. 74) mentioned similar findings in rye and oats, although the exact species was not determined. HÅRDH (1950) has claimed that *Mesopolobus* (*Amblymerus*) *graminum* HÅRDH is a pest of spring wheat. The larva of this species lives in the basal part of the stem of the wheat plant; this researcher is of opinion that it is one of the reasons for shrivel-heads of wheat. This damage has most generally appeared in South and Central Ostrobothnia, and in South Savo; it

[1]) Earlier records in the literature (E. REUTER 1902, 1902 a, 1902 c, 1903, 1904, 1905, 1909 a, 1911; LINNANIEMI 1915, 1920, 1935; HUKKINEN 1925) mentioned the larvae of this species as occurring in the basal part of cereal stems; however, these records were erroneous, and referred to other species of flea beetles.

[2]) This species was plentiful at Jokioinen (EH) in 1935 (INKILÄ 1960).

was especially common in the 1930's and 1940's, and also attained serious proportions in 1951 and 1952. It does considerable harm to spring wheat cultivation, often destroying 15—20 per cent of the crop; in some cases, losses have been as high as 50 per cent or even more (JAMALAINEN 1946). A detailed study of shrivel-heads of wheat has been published by HÅRDH (1953). In later years, doubt has been expressed concerning the rôle of *Mesopolobus graminum* as a pest of spring wheat (v. ROSEN 1957, p. 17—19; P. NUORTEVA 1959). According to RAATIKAINEN (1961), it appears evident that this species does not cause shrivel-heads, but may be harmful by destruction of the egg predators of *Calligypona pellucida*. At Sulva (EP) in 1959, larvae of *Eurytoma suecica* ROSEN were found for the first time in Finland in about 4 per cent of the stalks of spring wheat (RAATIKAINEN 1960 a).

True flies (*Diptera*). This order includes some of the most harmful cereal pests in Finland. From the economic viewpoint, the most important of them is the frit fly (*Oscinella frit* L.), whose larvae attack all kinds of cereal crops. In warm summers, at least in south Finland, this fly generally produces three generations during the course of the growing season. During the 1950's, however, when the summers were generally cool and rainy, it was remarked that in south and central Finland the frit fly produced in one year only two complete generations in addition to a partial third (JAMALAINEN and KANERVO 1953, p. 71; TIITTANEN 1959). Larvae of the spring generation damage the seedlings of spring cereals, particularly oats and barley but rarely wheat, either by complete destruction of the seedling, or by causing excessive tillering in it. Injury is more pronounced in late-sown fields of spring cereals. Larvae of the summer generation are principally responsible for damage to the panicles or spikes; the nature of the damage may vary considerably, dependent upon the stage of development of the plant. In oats, some of the spikelets become pale-coloured, and at times even form white shreds, or the grains may be eaten empty by the larvae; complete white-heads occur but seldom (cf. E. REUTER 1902 a). In barley also, the larvae feed upon the grains until they become hollow. In spring wheat, the larvae often destroy the terminal spikelets of the head. In the case of midsummer rye, this generation does great damage to the seedlings. The third, or autumn generation, destroys the seedlings of winter cereals, especially those of rye. The frit fly, found in all parts of the country, even those far to the north, was mentioned as early as in the 1894 annual report of the State entomologist (E. REUTER 1895, p. 35—37); ever since then, there have been reports of this pest almost every year to the effect that it has caused serious or slight damage in various parts of the country. In the 1930's in particular, seedling injuries in spring cereals and rye were often substantial, but subsequently, with the observance of suitable sowing times becoming commoner, damage has fallen in extent. Light grains have appeared most markedly in barley; for example in 1925, in eastern and south-eastern Finland 25—50 per cent of the grains of native barley varieties were injured, and according to TIITTANEN (op. cit.) localized yield losses in the 1950's were sometimes 10—25 per cent. In addition, it has been established that the frit fly is a pest

of maize (HÅRDH 1955). The years of the most serious damage were 1920, 1925, 1934—1939, 1944—1945, 1948, 1950—1951, and 1954—1956 (cf. also KANERVO 1960 c). This species can be regarded as the most harmful cereal pest in Finland.

Several other species of flies bring about injury which is similar to that caused by the frit fly. *Elachiptera cornuta* FALL., with a larva which lives in the seedlings of spring cereals, is distributed throughout the whole country, but its significance as an agricultural pest has not yet been established. *Opomyza florum* FABR. was found in spring in winter wheat at Tikkurila (U) in the years 1948—1950, and in rye at Ylistaro (EP) and Mikkeli (ES) in 1949 (KALLIO 1950). Furthermore, the following species were encountered in oats at Tikkurila in 1948: *Lasiosina cinctipes* MEIG. (also in rye), *Conioscinella albipalpis* MEIG., *Hylemyia liturata* MEIG., and *Aphanotrigonum trilineatum* MEIG. (KALLIO, op.cit.). Larvae of the wheat bulb fly (*Hylemyia coarctata* FALL.) were discovered in winter wheat and rye seedlings during spring 1930 in Finland Proper (Halikko, Lieto), and in Uusimaa (Tikkurila, Tuusula) (LISTO 1932).

The goat fly (*Chlorops pumilionis* BJERK.), found as far north as Kemi Lapland, injures the head and head stalk of barley within the leaf-sheath, with the result that the seedling remains short and dwarfed; frequently the head fails to emerge from the sheath. Damage to spring wheat and oats is rarer. Larvae of the second generation attack the seedlings of winter wheat and rye, causing them to stop growth, and often to tiller. The greatest damage attributable to this species occurs in barley. Especially serious destruction was noted in the following years: 1903 in Uusimaa, and in certain spots in the administrative district of Turku and Pori (V and St), the extent of injury to barley being approximately 15—20 per cent; in 1916—1917, and apparently also in 1920, in North Ostrobothnia and Lapland, the injury amounting to 8—20 per cent in some localities; in 1925, in many communes of South Savo, about 30 per cent of the barley crop was destroyed by this species and the frit fly; in 1935, attacks were common in Central Ostrobothnia, and the damage to barley heads was 5—20 per cent; in 1949 substantial damage occurred in some communes along the Tornio and Kemi Rivers; in 1960, the damage was appreciable in some spots at Harjavalta (St) and Tuulos (EH), amounting to about 25 per cent. The goat fly is indeed one of the most harmful pests, as far as barley is concerned, although its presence is often not noticed by farmers.

One of the species which cause white-heads in cereals is *Meromyza saltatrix* L. According to E. REUTER (1902, 1902 a, 1902 d, 1903), the larva of this pest lives in the uppermost leaf-sheath of wheat and oats, injuring the stem for a distance of 2—3 cm — about 1 in. It was first observed in Finland in 1901 in a wheat field at Parainen (V); in this instance 30 per cent of the white-heads resulting from injury to the plant above the uppermost node had originated in this species. It has been observed at certain places in south and central Finland (V and EP), but it is evidently not important as a pest. Larvae of the timothy fly (*Amaurosoma* sp.) were reported by E. REUTER (1902, p. 50) as having injured rye heads at Parainen (V), Siuntio (U) and Pirttikylä (EP).

Hydrellia griseola FALL. presents itself as a leaf miner in barley and oats, rarely in winter wheat and rye. This species, which has spread as far north as Lapland, was first observed in Finland in 1913 (cf. E. REUTER 1908, p. 10). It was responsible for considerable damage in 1917 at Sodankylä (LKem), where in some fields it destroyed 50—90 per cent of the barley crop; in 1919 it led to heavy damage to barley and oats at Tenhola (V) and in the region near Kajaani (Kn), and in 1922 to barley in eastern Finland. However, the greatest destruction ascribable to this species took place in 1923, when it appeared more abundantly than ever before in wide areas of the southern and eastern parts of the country. As a result of the injury caused, fields of barley became prematurely yellow as early as the middle or end of July, and had as result a delay and hindrance in development of the grain. In the following year, there was a great deal of evidence of damage to barley and oats at Tammisaari (U), Sonkajärvi (PS) and Kuusamo (Ks). Since then, reports have been received only of localized attacks, such as those at Kalajoki and Siikajoki (KP) in 1947, when the losses to barley were 40—70 per cent.

Certain species of the family *Agromyzidae* have also been found as leaf miners in cereals (E. REUTER 1904, p. 6—9; 1908, p. 10; LINNANIEMI 1915, p. 52), but it is not certain which species they were. SAALAS (1933, p. 455) was of the opinion that the species met with in 1903 at Messukylä (EH) was *Phytomyza avenae* DE MEIJ.; today, this is believed to be the same as the species *Phytomyza fuscula* ZETT. In 1946, *Phytomyza nigra* MEIG. was found in an oat leaf sample sent from Maaninka (PS). In the years 1959—1960 there were many reports of leaf miners in oats, barley and rye, particularly in the central and northern regions of Finland; according to Frey, the species was possibly *Phytomyza fuscula* ZETT. FREY (1949, p. 16) mentions a total of 12 species of *Agromyzidae* which live as leaf miners in cereals in Finland, but their economic significance has not as yet been established.

The Hessian fly (*Mayetiola destructor* SAY) was first observed in Finland in oats at Tyrväntö (EH) in 1909 (E. REUTER 1912). In the years 1921—1922, this pest made its appearance at Sysmä (EH), the damage caused being mainly to rye and barley, although winter wheat also suffered slight damage. In the worst cases, as much as 20—30 per cent of the rye and barley fields were destroyed, but in general the injuries were milder (HUKKINEN 1922 d). Since that time, localized outbreaks have been reported in various parts of the country as far north as Pudasjärvi (PP); damage has also been remarked in spring wheat, in some cases amounting to 5—10 per cent. Pupae of this species were found in 1½ per cent of the samples collected in 1949 from South and Central Ostrobothnia (HÅRDH 1950 a). One unverified report of the occurrence of *Mayetiola avenae* MARCH. in oat stems was received in 1916 from Tohmajärvi (PK) (LINNANIEMI 1920, p. 144).

The literature on the subject contains very little information on the occurrence of the wheat blossom midge (*Contarinia tritici* KIRBY) in Finland; records are from the provinces V, U, EH and St. Observations have shown that this species may at times assume particular importance as a wheat pest, with particular reference to

the southern parts of the country. For instance, it appeared in substantial numbers in winter wheat in the region of Loimaa (St) in 1937 (Kanervo). In 1943, the species appeared in large numbers in the heads of wheat at Jokioinen (EH), leading to considerable damage to the trial fields (Ann. Report of the Dept. of Pest Invest. 1943; INKILÄ 1960). Also in 1946, it brought about losses in yield in certain localities which amounted to 20—30 per cent in winter wheat, and about 5 per cent in spring wheat (KANERVO 1951 a). *Sitodiplosis mosellana* GEH. has been found occasionally as a pest in rye heads, for example in southwest Finland in 1935 (HUKKINEN and VAPPULA 1936), and in the region of Mikkeli (ES) in 1938 (Kanervo), but to date no further investigations concerned with this species have been made.[1]) In 1923, a sample of oats was received from Vanaja (EH) consisting of a panicle within a leaf-sheath, and containing red larvae of a gall midge (LINNANIEMI 1935, p. 93); the species was not determined.

Maggots of the crane fly (*Tipula* sp.)[2]) often subject the seedlings of spring and winter cereals to considerable damage. Reports of damage were received from Liperi (PK) (rye) in 1915—1916, from Jokioinen (EH) (rye) (INKILÄ 1960) in 1930, from Revonlahti (KP) (barley) in 1935, from Nurmes (PK) (barley) in 1944, and from Pusula and Nummi (V) (barley) in 1946. Injury was widest spread in 1953, when in the early part of the summer the maggots attacked seedlings of barley, wheat, oats and rye at many places in Satakunta, South and Central Ostrobothnia, North Häme and North Savo; most often the attack was concentrated in fields sown after leys. In autumn of the same year, damage to rye seedlings was noted at Parkano (St). Destruction brought about by this pest was also apparent in some places in south and west Finland in 1954—1955, and there was a great deal of damage to oats and barley at Kälviä (KP) in 1960. In 1926, a sample of maggots of *Bibio* sp. was received from Sysmä (EH), with the report that they had caused considerable injury to rye; however, this report should be considered unreliable.

M o t h s (*L e p i d o p t e r a*). Cutworms (*Agrotis*) constitute one of the pests most injurious to cereal seedlings; in the latter part of the summer or autumn, they feed on the seedlings of winter wheat and rye, sometimes completely devouring small or large areas of the growth in the fields. Also in the springtime, before pupation, they may effect damage to the seedlings of both winter and spring cereals. The most important species in Finland is regarded to be *Agrotis segetum* SCHIFF. (HUKKINEN 1913, 1913 a, 1913 b), but it is obvious that other species, especially *Agrotis exclamationis* L., cause damage similar in nature to cereal seedlings (HUKKINEN 1925, p. 75; LINNANIEMI 1915, p. 28). The years marked by the most severe destruction were 1896—1898, 1911—1915, 1925—1927, 1930—1931 and 1938, the damage being heaviest in South and North Häme, and South and North Savo. In 1956, larvae of the rosy rustic moth (*Hydroecia micacea* ESP.) appeared in large numbers

[1]) An observation made at Espoo (U) in 1900 (E. REUTER 1901, p. 22) on the occurence of orange-coloured larvae in the heads of rye evidently referred to *Sitodiplosis mosellana*.

[2]) The species in question has not yet been elucidated.

in barley fields at Pyhäranta (V), where they caused yellowing of the seedlings. Larvae of the antler moth (*Cerapteryx graminis* L.) may occasionally injure seedlings of cereal plants — for example, oats and rye — which happen to be in their path, but as a rule they do not feed on cereals. Also, in 1946 larvae of the silver Y moth (*Phytometra gamma* L.) were found to have slightly injured seedlings of barley, wheat and oats (KANERVO 1947). Larvae of *Polia pisi* L. have occasionally been encountered on the leaves of older plants, at least as far as wheat is concerned, those of *Arsilonche albovenosa* GOEZE on barley (EKHOLM 1948) and those of *Tortrix paleana* HB. on oats (E. REUTER 1893, 1895, 1897, 1899 b, p. 41—43).

An occasional yet important rye pest is the common rustic moth (*Parastichtis secalis* L.), whose larvae destroy seedlings in the autumn, and then continue their destructive work in the following spring in the uppermost leaf-sheath of older plants, damaging the head or the soft stem, with resultant complete white-heads.The species occurs as a pest as far north as the Kajaani (Kn) region. Substantial damage was caused in wide areas of east Finland in the years 1896—1897; the losses there were estimated at 2 million marks. In certain communes, the average losses rose to 50 per cent, but on some individual farms they were as high as 80—100 per cent (E. REUTER 1898, p. 19—42; 1902 a). In 1913—1914, injury was rather common, especially in Savo and Carelia, but the damage was not so severe in nature. In the following two years, many reports of slight damage were received from the southern and central regions of the country. Subsequently, outbreaks of this pest have been noted in various parts of the country, on the most recent occasion in South Savo in 1960, but damage has been relatively moderate.

Another common rye pest is the rustic shoulder knot moth (*Parastichtis basilinea* FABR.), whose larvae injure the grains in the later part of summer by hollowing them out, or by feeding upon them and later completing their destruction on shocks and in granaries. Damage to winter wheat or to other cereals is of rarer occurrence. At times, the larvae move to the seedlings of newly-sown rye in the autumn, destroying them in the same manner as do *Agrotis* larvae. Damage caused by this moth has been encountered from time to time in various parts of the country, extending to Central Ostrobothnia and North Carelia. In the annual reports of the State entomologists, this species was first mentioned in 1894. Larvae were especially abundant in 1916—1917, particularly in Uusimaa and South Häme, and also in 1936, when they were wide-spread in south and central Finland, and by way of example brought about the destruction of 25—40 per cent of the grains in some localities in Satakunta.

According to the observations of E. REUTER (1904 b, p. 53—54), white-heads of rye are seldom caused by larvae of *Ochsenheimeria taurella* SCHIFF.; this pest lives in the uppermost leaf-sheath, feeding on the stem or head within it. Rather slight damage has been encountered in different places in south Finland (E. REUTER 1897, p. 22; 1899, p. 38; 1901 a, p. 16; 1904, p. 12; 1905, p. 5), but generally the species is quite rare in this country. E. REUTER (1902 a; 1903, p. 4—5, 9—10) includes a pyralid moth (*Anerastia lotella* HB.) among the pests which cause white-

heads; its larvae live in the basal part of the stem of rye and wheat. However, injury caused by this moth has not as yet been reported in Finland.

Mites (*Acarina*). *Siteroptes* (*Pediculopsis*) *graminum* E. REUT. damages the soft part of the stem above the uppermost or the penultimate node, thus producing complete white-heads in all kinds of cereals (E. REUTER 1902 a). Nevertheless, the infliction of injury on these plants by the mite has never been great in Finland. The bulb mite (*Rhizoglyphus echinopus* FUM. & ROB.) occasionally attacks the basal part of cereal stems. E. REUTER (1901 a, 1901 c, 1902 a) reported the occurrence of this species in 1900 on oats, and in the following year on wheat, barley and rye. He also mentioned the gall mite species *Eriophyes cornutus* E. REUT. as a causal agent of white-heads in wheat (E. REUTER 1902, p. 57; 1902 a, p. 331). LIRO (1940, p. 1) thought that this species is not a separate one, but that it is rather conspecific with *Eriophyes tenuis* NAL. The latter, which has been found on spring wheat and barley, lives freely upon the leaves of gramineous plants, and only seldom in their spikelets (LIRO and ROIVAINEN 1951, p. 136).

Molluscs (*Mollusca*). The most important species of this group is the grey field slug (*Deroceras agreste* L.), which is to be found throughout the whole country as far north as Inari Lapland. Particularly in rainy, warm summers, slugs can occasion considerable destruction to entire areas of winter cereal seedlings. Spring cereals are attacked less often. Rather extensive damage to seedlings was reported in 1903 (mainly in the administrative districts of Uusimaa, Häme and Viipuri), 1923 (at various places in east Finland), 1924 (in Satakunta, South Häme and South Ostrobothnia), 1928—1929 and 1943—1945 (at many locations in south and central Finland), as well as at scattered localities in 1957. However, there has not yet been established the extent to which the related species *Deroceras reticulatum* MÜLL. was responsible for these occurrences of damage.

Worms (*Vermes*). The corn eelworm (*Ditylenchus radicicola* GREEFF) is met with as a pest in north Finland, especially along the Tornio and Kemi Rivers. It lives mainly on barley, and produces characteristic galls in the roots of this plant. If barley is cultivated in the same field for many years, the infestation becomes increasingly serious, and the growth of barley gradually comes to an end. A milder form of damage has been observed in rye and oats. The corn eelworm was first remarked in the 1880's, when it appeared as a serious pest in barley fields, and to date injury has been reported from many communes in northern Finland (PP, Ks and LKem), such as Kemijärvi, Kuolajärvi (Salla), Pelkosenniemi, Kittilä and Pudasjärvi. According to the studies made by HILLI (1933 a), there are two major infestation centres in north Finland, one located in the Tornio and Muonio River Valley (Alatornio, Karunki, Ylitornio, Turtola, Muonio) and the other at the upper reaches of the Kemi River (Kemijärvi and Pelkosenniemi). There was especially heavy damage inflicted at Kemijärvi (PP) in 1931. In certain localities, eelworms were so numerous that the barley yield was only 25 per cent of the normal, and by the end of the summer the infected fields were covered with weeds (HILLI 1933,

1933 a). The last report of eelworm damage was received in 1953 from Pudasjärvi (PP).

Birds (*Aves*). The hooded crow (*Corvus corone* L.), which appears in large flocks, often causes considerable damage to cereal fields; in the spring, it eats newly-sown seed and young seedlings, and in late summer it tramples the ripening crop and devours grain in stands or in shocks. In some instances, it has been estimated that grain losses attributable to crows have amounted to 10—25 per cent (HILLI 1927, 1929). Against this, crows can also be useful by eating harmful insects and their larvae, as well as small rodents. The jackdaw (*Corvus monedula* L.) damages cereal fields in the same way as the crow (BRANDER 1956; 1958, p. 103; INKILÄ 1959). The rook (*Corvus frugilegus* L.), which lives and nests in large colonies, has appeared as a pest in some localities of west Finland; it sometimes destroys large areas of springsown fields, especially early sowings of oats. It further damages mid-summer rye and green-fodder crops, as well as fields of winter and spring wheat. The magpie (*Pica pica* L.) and the continental jay (*Garrulus glandarius* L.) also eat the grains of cereals, but the damage ascribable to them is relatively light.

The continental chaffinch (*Fringilla coelebs* L.) has on occasion been seen eating the grains of oats, barley and wheat growing on experimental fields. The house sparrow (*Passer domesticus* L.) often greatly damages ripening cereals by devouring the grains of heads and panicles; such damage has been reported as far north as Rovaniemi (PP). The yellow bunting (*Emberiza citrinella* L.) and the fieldfare (*Turdus pilaris* L.) have sometimes been observed feeding on grains. Mallards (*Anas platyrhynchos* L.), possibly along with other wild ducks, are sometimes the cause of substantial damage at the end of the summer, when they invade cereal fields in large swarms, eating the grains and trampling down the stalks. They also feed on cereals which have been harvested on stakes or in shocks. The wood pigeon (*Columba palumbus* L.) occasionally takes the rôle of a pest by feeding on newly-sown seeds of cereals or by destroying ripening grains in the autumn. For instance, pigeons caused considerable damage to some trial plots of winter wheat at Jokioinen (EH) in 1956 (INKILÄ 1959). A similar kind of injury is inflicted by the stock dove (*Columba oenas* L.) (K. E. KIVIRIKKO 1940, p. 475). In some cases, common cranes (*Grus grus* L.) have caused injury on their migration flights; in the spring, they stir up newly-sown fields of cereals, and in the autumn they trample in grain fields or overturn sheaves, and eat grains from the ripened heads (Metsästys ja Kalastus 38, 1949, p. 156).

Mammals (*Mammalia*). The common mole (*Talpa europaea* L.) is generally considered to be a useful animal because it destroys the larvae of insect pests, but on occasion it becomes a nuisance by building mounds of earth on the surface of the ground, resulting in the death of the plants at these points. The European hare (*Lepus europaeus* PALL.) and the mountain hare (*Lepus timidus* L.) often occasion damage, especially to fields of seedlings situated near forests. Among the species of mice, the yellow-necked field mouse (*Apodemus flavicollis* MELCH.)[1])

[1]) The investigations of SIIVONEN (1948) showed that in Finland at least *Apodemus flavicollis* MELCH. occurs, whereas *A. sylvaticus* L. has so far not been found.

and the harvest mouse (*Micromys minutus* PALL.) occur as cereal crop pests. At the end of the summer, they appear in large swarms, eating the grains from harvested cereals on stakes or in shocks. Similar damage is caused by the house mouse (*Mus musculus* L.), and in southeast Finland by the field mouse (*Apodemus agrarius* PALL.). In addition, the Norway rat (*Rattus norvegicus* ERXL.) is frequently found as a pest on cereal fields.

The most harmful species of voles are the field vole (*Microtus agrestis* L.) and the continental vole (*Microtus arvalis* PALL.). The former is common throughout the country, whereas the latter is a newcomer to Finland, appearing for the first time in southeast Finland in 1913 (KORVENKONTIO 1921, 1921 a), later spreading continuously into the southern and central regions of the country. These species of vole live in cultivated fields, and destroy grain in process of ripening, or which has been harvested in shocks. They also eat the seedlings of rye and winter wheat during winter, as well as the seedlings of spring cereals during the growing season (MYLLYMÄKI 1959, p. 79). In summer 1942, serious damage was brought about by the field vole to fields of spring wheat and barley in the communes of Kivennapa and Terijoki in the Isthmus of Carelia. The water vole (*Arvicola terrestris* L.) occasionally acts as a pest in fields under cereals; its activity is characterized there by extremely large mounds of earth. This species was found in particular abundance in 1931 on a 2000—3000-hectare area at Lapua (EP), but during the following severe winter the voles disappeared completely. The muskrat (*Ondatra zibethica* L.), introduced into Finland as a fur animal in 1922, may at times occasion some damage to fields along waterways by eating grain and digging tunnels in the soil.

The red squirrel (*Sciurus vulgaris* L.) has been observed — in those areas where conifer trees failed to produce cones — to feed in winter on unthreshed grain (oats, wheat and rye) which it obtained from storage sheds or from shocks in the field (VARTIO 1946, p. 66). The badger (*Meles meles* L.) also damages cereal fields, especially those under oats, in its search for food in the vicinity of its habitat (NYHOLM 1956).

The elk (*Alces alces* L.) frequently damages cereals, especially in fields located near forests or in isolated outlying stands. It eats seedlings, tramples the growing stands of cereals, and overturns harvested oats on stakes. In some instances, the injury inflicted has amounted to 50—75 per cent of the yield. Oats and rye are most often damaged. In most cases, elks invade fields of oats at the time of ripening, and eat the grains from the stalks (SAINIO 1956). In 1961, the damage brought about by elk on 618 hectares of cultivated fields was estimated at 9.3 million marks, for which the state paid compensation to the farmers to a total of 82 per cent, or about 7.4 million marks. Reports of elk damage had been received from 103 communes. In addition, the white-tailed deer (*Odocoileus virginianus* BODD.) has sometimes been seen on rye fields in the spring and autumn, especially on remote fields, where it may be the author of substantial damage (SALMI 1949, p. 116—117; SUOMUS 1961; BRANDER 1962, p. 79).

The brown bear (*Ursus arctos* L.) sometimes feeds on oat fields in forested regions, and tramples on the cereal stands (VIHERVAARA 1950).

2. *Gramineous fodder plants*

Thrips (*Thysanoptera*). Certain species of thrips inflict injury on grasses, especially in seed fields, by causing white-heads and thus lowering the seed yield. The most common and important species is *Aptinothrips stylifer* TRYB.[1]), which is found even in the spring in the leaf-sheaths of various cultivated grasses. It causes damage either by feeding on the soft part of the stem, or by attacking the developing spike or panicle. In the former case, complete white-heads result; in the latter, partial white-heads are produced. Such damage has been found in about 20 different species of grass, including timothy, meadow foxtail, sweet vernal grass, tufted hair grass, meadow grass and red fescue. In his studies from 1899 to 1901, E. REUTER (1902, p. 35) established that about 13 per cent of all the cases of white-heads which he examined were caused by this species of thrips. It occurs throughout the entire country, including Lapland.

Partial white-heads, particularly in timothy and meadow foxtail, are also brought about by *Limothrips denticornis* HAL., and especially in meadow foxtail by *Chirothrips hamatus* TRYB., *Chirothrips manicatus* HAL., *Haplothrips aculeatus* FABR., and *Frankliniella tenuicornis* UZ. (E. REUTER 1902, p. 47—48; HUKKINEN 1934, 1936 b). In addition to these, many other species of thrips have been found on meadow foxtail, such as *Frankliniella intonsa* TRYB., *Anaphothrips obscurus* MÜLL., and *Bolacothrips jordani* UZ., of which at least the latter is known to be a causal agent of white-heads (HUKKINEN 1936 b, p. 67).

Of all the above-mentioned species of thrips which reduce the seed yields of meadow foxtail, by far the most important is *Chirothrips hamatus* TRYB. In the early part of the summer, it lives in the leaf-sheaths, often causing white-heads, and later invades the spikelets, depositing its eggs in the ovary. The larvae of the new generation destroy the ovules, and winter in the spikelets. As an indication of the importance of this species, it may be noted that in samples collected in the years 1932—1935 25.4—36.8 per cent of the spikelets showed intrafloral damage, but if the white-heads resulting from extrafloral injuries are taken into consideration, the total damage attributable to this thrips rose to 38.5—45.9 per cent (HUKKINEN 1936 b, p. 90; 1938). In 1955, about 35 per cent of the seed yield at Jokioinen (EH) was destroyed by this species (INKILÄ 1960). In comparison, the injuries occasioned by gall midges are generally on a minor scale. The above-mentioned thrips is distributed as far north as the region of Oulu (PP). Other species of thrips, for example

[1]) Earlier this species went under the name *Aptinothrips rufus* GMEL. f. *stylifera* TRYB., but today it is usually known as *A. stylifer* TRYB. The species *A. rufus* GMEL. (main form) is rather rare in this country.

Chirothrips manicatus HAL. and *Aptinothrips stylifer* TRYB., may live within the spikelets of meadow foxtail and destroy the ovules. The former species appeared abundantly at Rovaniemi (PP) in 1953 and 1956.

Plant bugs, aphids, etc. (*Hemiptera*). *Lygus* bugs, meadow capsid bug (*Leptopterna dolabrata* L.) and sloe bug (*Dolycoris baccarum* L.) occasionally appear in large numbers on timothy and other grasses, where they may, by feeding on the spikes, result in damage to seed production. However, no detailed investigations have as yet been made of the significance of these species as grass pests. Larvae of the common froghopper (*Philaenus spumarius* L.) are also often found on the stems of grasses.

The bird-cherry aphid (*Rhopalosiphum padi* L.) brought about serious local damage in the summer 1959 to seedlings of timothy sown under spring cereals (KANERVO 1960, p. 197). *Brachycolus mühlei* C. B. was found on timothy leaves in a trial plot at Tikkurila (U) in 1961 (Ikäheimo). The English grain aphid (*Macrosiphum avenae* FABR.) was reported by E. REUTER (1900, p. 86—87, 94, 100) as of frequent occurrence on meadow foxtail and timothy, where by feeding on the heads it might cause complete or partial white-heads. This same investigator also found the coccid *Phenacoccus hordei* LINDEM. (*Pseudococcus graminis* E. REUT.) in the uppermost sheaths of meadow grass and timothy at Parainen (V) and in South Ostrobothnia (E. REUTER 1902, p. 15—16; 1903, p. 2; 1904, p. 1; 1904 a, p. 66—67); this species also belongs to the group of pests which originate white-heads in cultivated grasses. Another coccid species *Eriopeltis festucae* B. D. F. was found on leaves of bent-grass at Lohja (V) (E. REUTER 1904 a, p. 66).

Beetles (*Coleoptera*). In north Finland, the beet carrion beetle (*Aclypea opaca* L.) has sometimes damaged timothy. *Galeruca tanaceti* L. has occasionally been encountered in large numbers in leys and hay-fields on timothy, for instance, but in spite of its prevalence throughout the entire country, it does not appear to cause great injury to grasses (E. REUTER 1895, p. 24—26; 1897, p. 7). KONTKANEN (1928) reported that *Chaetocnema mannerheimi* GYLL. had damaged cocksfoot in addition to barley. Mention is made in the relevant literature that the common leaf weevil (*Phyllobius piri* L.) has been found feeding on meadow foxtail growing under a birch tree (LINNANIEMI 1920, p. 48), but this seems to be a chance occurrence. At Ylistaro (EP) in 1928, staphylinids (*Anthobium minutum* FABR.) were found in abundance on the heads of meadow foxtail, evidently feeding on pollen. Also on the heads of meadow foxtail, *Amara plebeja* GYLL. was met with at Jokioinen (EH) in 1936, although no damage was observed.[1])

Among the pests of grasses which reduce the forage yield of the crop, the larvae

[1]) NORDMAN (1944) reported the discovery of numerous specimens of this species in 1939 on the panicles of tufted hair grass (*Aira caespitosa*) at Föglö (V), but was of the opinion that they were searching for insects living on the plants. He also referred to the plentiful occurrence of *Amara aulica* PANZ. on the heads of meadow foxtail at Ylistaro (EP) in 1929; it was observed that the insect was chewing open the spikelets, evidently with a view to feeding on the larvae of the foxtail midge living within them.

of click beetles (*Elateridae*) are commonest. They live especially in old hay-fields, and feed on the roots of different grasses. Although they weaken the growth of the plants, they do not bring about complete damage. Detailed studies of the significance of various species of click beetles in grasslands have not been made to date, but the most common species are evidently *Agriotes obscurus* L., *Agriotes lineatus* L., and *Corymbites aeneus* L.; in addition, *Corymbites cupreus* FABR. subsp. *aeruginosus* FABR. is found in the province of Kainuu. In old hay-fields and pastures, the larvae of the cockchafer (*Melolontha hippocastani* FABR.) are occasionally responsible for serious damage in certain localized areas, sometimes appearing so plentifully that the grasses begin to yellow and wither. The greatest damage reported has been in respect of dry, sandy soil types in the eastern parts of the country, especially on old burnt-over clearings (SAALAS 1939). In addition to wild grasses, the larvae also destroy cocksfoot and timothy. The species is found as far north as the 65th parallel of latitude, but the most severe damage is met with below the 63rd parallel, where the mean annual temperature is about +2°C. Other related species, such as the garden chafer (*Phyllopertha horticola* L.), may also injure cultivated grasses, but practically speaking they have been the subject of no studies whatsoever in Finland.

Sawflies, etc. (*Hymenoptera*). E. REUTER (1900, p. 88—89, 95—97) places stem sawflies (*Cephus* sp.) among the pests which may cause white-heads in grasses, and reported finding the larvae of a stem sawfly in the stems of *Calamagrostis epigejos* and *Elymus arenarius* (E. REUTER 1902, p. 25, 30—33, 48; 1909, p. 10). However, he did not determine the species. R. FORSIUS (1909 a) found that *Cephus infuscatus* THOMS. had oviposited in the stem of reed canary grass (*Phalaris arundinacea*). According to a report by LINNANIEMI (1935, p. 57), a species of sawfly (*Dolerus* sp.) mildly injured timothy heads. *Isthmosoma calamagrostidis* SCHLECHT. was found to produce galls in the upper part of the stems of smallreed, and *Isthmosoma hyalipenne* WALK. (*I. graminicola* GIR.) commonly lives in the tops of couch-grass (E. REUTER 1902, p. 16—18, 30—49; 1908 c). In addition, *Mesopolobus* (*Amblymerus*) *graminum* HÅRDH is also met with in couch-grass (HÅRDH 1953).

True flies (*Diptera*). In Finland, at least 26 species of leaf miners belonging to the family *Agromyzidae* have been found living in grasses. Evidently, most of these are pests to both wild and cultivated grasses (FREY 1946). At the moment, it has not yet been established which of these species are most injurious. LINNANIEMI (1915, p. 52) mentions that a species, according to him *Agromyza atra* MEIG. (= *A. graminis* KALT.) was the origin of mild injury to rye and timothy (cf. FREY, op.cit.). In 1960, mines caused by some species of *Phytomyza* (*Ph. ?fuscula* ZETT.) were found in leaves of timothy.

The larvae of crane flies (*Tipulidae*) are common pests in both natural meadows and cultivated hay-fields. They damage the roots and other underground parts of the plants, as well as the leaves and stems. These pests apparently favour relatively moist and light soils. By reason of dense growth on the leys, the damage caused by the larvae is not often apparent. So far, it has not been established which species

occur as injurious pests in Finland, but probably the most harmful are *Tipula oleracea* L., *T. paludosa* MEIG., and *Pachyrrhina maculata* MEIG.

E. REUTER (1902, p. 14—15; 1903, p. 2) observed large numbers of larvae of *Lasioptera calamagrostidis* RÜBS. living in the upper leaf-sheath of smallreed; they caused yellowing and premature withering in the panicle. In 1924, R. FORSIUS (1925) found that *Mayetiola joannisi* KIEFF. had caused stem galls in wood poa at Uusikirkko (Kk).

The most harmful seed pests of timothy in this country include timothy flies (*Amaurosoma flavipes* FALL. and *A. armillatum* ZETT.). Both species are very common throughout the country, and are found even in the northernmost regions. Injuries attributable to these pests occur almost every year in different parts of the country; the extent of damage to timothy seed yields can vary from year to year, but is often quite large. In the most severe instances, as much as 50—100 per cent of the heads may be damaged, with a resultant appreciable drop in seed yield. Destruction by these species was especially common and severe in the years 1899, 1900 (South Ostrobothnia), 1901 (east Finland), 1916—1918, 1924—1925 (especially in east Finland), 1927—1929 (south Finland), 1930 (south and east Finland), 1931 (east Finland and South Ostrobothnia), 1935—1939 (especially in south Finland), 1942 (east Finland), 1943—1945, 1950—1953, 1957 (certain places in east Finland), 1958 (South and Central Ostrobothnia), and 1959 (Central Ostrobothnia). An investigation carried out in 1936 (MANTERE 1937), showed that no pronounced differences were discernible between the various timothy strains grown in this country as regards their infestation by timothy flies; the extent of damage was approximately 6—10 per cent.

E. REUTER (1900, p. 75—76) reported finding the larvae of *Oscinis* or some other related species in the upper leaf-sheath of timothy; the larvae fed on the soft part of the stem, thus bringing about complete white-heads in the plants.

One of the most important seed pest of meadow foxtail grass is the foxtail midge (*Dasyneura alopecuri* E. REUT.); its larvae live in the spikelets, damaging the ovary and the developing ovule, and then winter within the spikelet. During the process of threshing, the larvae are left in the seed, to be returned to the field in the following spring, where they pupate and continue their life cycle. The foxtail midge, described by E. REUTER (1895) as a new species, is a common pest in the southern and central parts of Finland, occurring as far north as North Ostrobothnia, and frequently the reason for considerable losses in seed yields. In inspections of meadow foxtail heads collected in south Finland in the years 1932—1935, it was found that 8.2—19.2 per cent of the spikelets had been damaged by gall midges (HUKKINEN 1936 b, p. 89—90; 1938). In addition to the foxtail midge, two other species of midges are also found in the spikelets of meadow foxtail. One of these is *Stenodiplosis geniculati* E. REUT., which E. REUTER (1895 a) described as a new species living in marsh foxtail, and which HUKKINEN (1936 b, p. 16) found to be commonly infesting the seed of meadov foxtail.[1]) The other species is *Contarinia merceri* BARNES, which

[1]) In England this species has also been found living in timothy and cocksfoot (BARNES 1958).

BARNES (1946, p. 90) found in a sample sent from Finland. Larvae of the latter species live for only a short time in the spikelets; when fully-grown, they drop to the ground and do not winter in the heads.

Damage to timothy heads is caused by the midge species *Contarinia kanervoi* BARNES, whose larvae inhabit the spikelets, destroying the developing seeds. The species was first described by BARNES (1958) on the basis of samples sent from Finland. Larvae were observed for the first time in 1899 in many communes in South and Central Ostrobothnia (E. REUTER 1900, p. 105; 1901, p. 28—30). The destruction was most marked on fields situated on peat soil and was sometimes so severe that no seed whatever was obtained.[1]) Damage has since been reported from Nivala and Ylivieska (KP) in 1939, from Jurva (EP) in 1948, and again in 1955—1959 this pest brought about serious damage at Nivala, and in some communes of South Ostrobothnia (cf. also TINNILÄ 1959 a). In addition, it has been found in samples from Punkalaidun, Luvia and Jämijärvi (St), Uurainen (PH) and Vaala (PP) (Savas). Obviously, this species is occasionally of major importance as a serious seed pest of timothy.

B u t t e r f l i e s and m o t h s (*L e p i d o p t e r a*). In old grasslands, especially those containing wild grasses, injury attributable to *Crambus* species is of frequent occurrence; the larvae of these pyralids sever the stems and leaves of the plant at ground level, and consequently completely bare spots appear in the field. Such damage has sometimes been seen in old, moist fields which principally contain tufted hair grass and bent-grass. Rearings have shown that at least *Crambus culmellus* L., *Cr. pascuellus* L. and *Cr. tristellus* SCHIFF. were responsible for such injuries (LINNANIEMI 1920, p. 108). In addition, E. REUTER (1909 a, p. 8) mentions that *Cr. pratellus* L. and *Cr. hortuellus* HB. are common. All of the above-mentioned species are met with as far as north Finland.

E. REUTER (1909 a, p. 7) lists other moth species whose larvae eat the roots of grasses or sever the stems at ground level. They include *Parastichtis monoglypha* HUFN., *P. lateritia* HUFN., *P. rurea* FABR., *Tholera popularis* FABR., *Agrotis segetum* SCHIFF., *A. exclamationis* L., and *A. clavis* HUFN. He also lists several butterfly species, such as *Pararge maera* L., *P. hiera* FABR., *Aphantopus hyperantus* L., *Epinephele jurtina* L., *Coenonympha pamphilus* L., and *C. tiphon* ROTT., whose larvae are found living on grasses. Larvae of *Brenthis ino* ROTT. were also found in a hay field where they inhabited both *Filipendula ulmaria* and tufted hair grass and poa (at Nivala (KP) in 1934; Kanervo). Furthermore, larvae of *Cosmotriche potatoria* L. were encountered on cocksfoot (E. W. SUOMALAINEN 1920, p. 81; E. KIVIRIKKO 1941, p. 155) as well as on other grasses (SEPPÄNEN 1954, p. 282) and larvae of *Macrothylacia rubi* L. and *Dasychira selenitica* ESP. were found inhabiting hay-fields. The latter species, in particular, often appears plentifully in the southern parts of Finland, feeding on both clover and grasses (LINNANIEMI and HUKKINEN 1921, p. 25). In 1946, larvae of the silver Y moth (*Phytometra gamma* L.) brought about slight injuries to seedlings of

[1]) According to one grower's report, larvae appeared abundantly in timothy as early as 1892 (E. REUTER 1901, p. 30).

timothy (KANERVO 1947, p. 100). Other species of butterflies and moths also live on grasses (cf. SEPPÄNEN 1954, p. 282—290), but these have not been taken into consideration in this description.

Of all the moth species which inhabit grasses, the most important is the antler moth (*Cerapteryx graminis* L.), long considered to be the most destructive pest of old hay-fields and natural meadows. The earliest report of this species is to be found in a dissertation presented at the Turku Academy (ALGENIUS 1766); since then, the species has been thoroughly described both in reports of the State entomologists and in other publications (O. M. REUTER 1892—1894; VAPPULA 1926 a). During last century, serious epidemics of this pest broke out in 1881—1886 and in 1889—1892; heavy outbreaks also occurred in 1898—1900. During the present century, extensive damage was reported in 1906, 1909, 1914, 1920, 1925—1927, 1932—1934, 1942—1943 and 1953. Destruction attributable to this pest has taken place in nearly every part of the country, even as far north as Kemi and Inari Lapland; the heaviest damage has been reported from Ostrobothnia and other places in the central regions of Finland. The larvae feed principally on tufted hair grass, but other grass species provide a suitable food supply for them. During the times of greatest destruction, larvae appear in large swarms, completely devouring all the grass plants over wide areas.

At times, timothy and certain other grass species are attacked by the plain yellow twist (*Tortrix paleana* HB.). Larvae of this pest unite the two uppermost leaves of the plant into a tube-like shelter, from which they feed on the leaves. If the pest occurs abundantly in a field, the stand becomes pale green in colour, and the yield losses may be very great. Damage by this species was first observed in 1892 at Paimio and Mietoinen (V) [1]) (E. REUTER 1893, 1895, 1897, 1899 b), and since then damage has been noted from time to time in south Finland, extending as far north as South Ostrobothnia, North Häme and North Savo. The larvae may occasionally damage also the stem and head of grass plants, resulting in white-heads (E. REUTER 1900, p. 35—39).

The common rustic moth (*Parastichtis secalis* L.) generally brings about no more than slight incidence of white-heads in meadow foxtail, timothy and couch-grass. *Procus strigilis* CL. and *Pr. latrunculus* HB. produce the same condition in timothy. Likewise, *Ochsenheimeria taurella* SCHIFF. apparently lives in grass plants, and causes white-heads in them (E. REUTER 1900, p. 23—24). In any case, the larvae have been found in the stem of meadow foxtail (E. REUTER 1902, p. 25; 1904 b, p. 54). In the years 1954—1955, tortricid larvae (*Cnephasia* sp.) appeared on timothy in some spots in Uusimaa and South Ostrobothnia; they injured the young spikes which had not yet emerged from their sheaths (VAPPULA 1955). In

[1]) Particularly in the years 1892—1895, larvae were abundant in southwest Finland, resulting in very serious localized destruction. For instance, during the three years 1892—1894, they damaged 90 hectares of timothy fields at the Saari farm at Mietoinen (V), with yield losses estimated to be as much as 114 000 kg. In 1895—1896, damage at the same farm occurred over an area of 105 hectares.

1955, the damage was quite substantial in certain fields. This species had been encountered as early as 1932 on timothy heads at Nummi (V) (Kanervo).

Larvae of the rustic shoulder knot moth (*Parastichtis basilinea* FABR.) were mentioned by E. REUTER (1897, p. 20) as having caused considerable destruction to a timothy ley. In general, however, they usually attack meadow fescue seed fields, at least in the provinces of Uusimaa, South Häme and South Ostrobothnia. The larvae pierce holes in the seeds, and hollow them out. In one instance, slight damage was also found in the seeds of cocksfoot.

Mites (*Acarina*). The most common species of pest which causes white-heads in grasses is *Siteroptes* (*Pediculopsis*) *graminum* E. REUT., first described by E. REUTER (1900). It inhabits the upper or the following sheath of grass plants, and damages the soft part of the stem above the node; as a consequence, the vascular system is disrupted, and the head or panicle becomes completely white. Sometimes, this mite may also be the originator of partial white-heads by attacking the inflorescence within the sheath. It has been found that this species injures 27 different grass species and 4 cereal species (E. REUTER 1908, 1910). It is distributed as a common pest in the southern and central parts of the country, and is evidently encountered as far north as North Ostrobothnia. In some years, it is the author of great economic losses, especially to timothy seed growers, and the falls in yield attributable to it are often as large as those caused by the timothy flies.

Another mite species which produces white-heads in grasses is *Tarsonemus culmicola* E. REUT., which similarly feeds on the stem within the uppermost leaf-sheath without leaving any visible wound. This species occurs in the southern parts of Finland, extending to South Ostrobothnia. Investigations made by E. REUTER (1902) indicated that an average of 54 per cent of the white-heads to be found on leys, and whose causal agent was determined, were attributable to *Siteroptes graminum*, and 18 per cent to *Tarsonemus culmicola*. Thus these two species are responsible for a much greater proportion of white-heads in grasses than are other pests. White-heads in timothy occurred most abundantly in the years 1897, 1900—1901, 1904—1905, 1915—1917, 1926, 1930—1932, 1935—1936 and 1940.

E. REUTER (1900) also lists two species of gall mites as causal agents of complete white-heads, viz. *Eriophyes cornutus* E. REUT. and *Eriophyes tenuis* NAL. The former species, as mentioned above (p. 27), was believed by LIRO (1940) to be identical with *E. tenuis*. Liro was also of the opinion that *Eriophyes tenuis* lives freely on the leaves of grasses, often causing sterility in the host plant, but that it is found only rarely in damaged spikelets. Accordingly it cannot be asserted that it is a causal agent of white-heads. The species is distributed as far north as Lapland, and has been found on 45 species of grass and two of cereals (LIRO and ROIVAINEN 1951, p. 133—136). The observations made by H. ROIVAINEN (1947, p. 11) indicate that when this mite occurs profusely on meadow foxtail, it induces partial sterility, discoloration of the leaves, and pronounced twisting of the leaf edges. In his opinion, detailed studies should be made of the various mite species found on grasses.

Molluscs (*Mollusca*). The grey field slug (*Deroceras agreste* L.), and possibly other related species, are often discoverable on grasses, damaging timothy and meadow fescue as well as other grasses. *Fruticicola hispida* L. was observed in large numbers in the autumn of 1953 on roads, pathways and the edges of fields at Lappeenranta (ES); along field borders there could be counted some hundreds of them in a square metre.

Worms (*Vermes*). The corn eelworm (*Ditylenchus radicicola* GREEFF) (cf. p. 27), which is common in barley in north Finland, also lives in the roots of certain grass species, such as meadow foxtail, timothy, meadow grass, and tufted hair grass.

Mammals (*Mammalia*). The common mole (*Talpa europaea* L.) often constitutes a nuisance by reason of its digging tunnels in meadows and hay-fields, and making mounds of earth on the field surface. The mole is to be found throughout south Finland, extending as far as South Ostrobothnia and North Carelia. The Norway lemming (*Lemmus lemmus* L.), which lives in Lapland, causes destruction during what are termed the lemming years. At such times, large hordes of these animals invade fields in the summertime, and eat the grass; in the autumn and winter they attack hay-stacks and barns, destroying the hay stored in them (MUNSTERHJELM 1913, p. 14). The field vole (*Microtus agrestis* L.) is frequently harmful on grasslands, where it feeds on the aerial parts of various grass crops. The continental vole (*Microtus arvalis* PALL.) digs tunnels in the fields, and eats the roots of grasses. In the autumn, voles move to hay-sheds and hay-stacks, causing damage there. Similarly, the water vole (*Arvicola terrestris* L.) often lives in leys and meadows, especially near bodies of water; it occasions damage by eating the growing grass, and forming large mounds of earth on the surface of the fields. Slight damage is brought about by the bank vole (*Clethrionomys glareolus* SCHREB.), to be found throughout Finland, as well as by *Clethrionomys rutilus* PALL., *Clethrionomys rufocanus* SUND., and *Microtus ratticeps* KEYS. & BLAS., all of which are found only in the northern parts of the country (MUNSTERHJELM 1913).

3. Peas

Thrips (*Thysanoptera*). The pea thrips (*Kakothrips robustus* Uz.) appears at times as a very damaging pest as regards field and table peas; it is responsible for withering of the flowers, shrivelling of the terminal parts of the shoots, and discoloration and twisting of the pods. At times of heavy infestation, losses in yield may mount to a figure of 50—75 per cent. Severe damage was reported especially in the years 1915—1916, 1927 and 1945—1946. This species has been found as a pest only in the provinces V, U, St, EH and ES.

Aphids (*Hemiptera, Aphidoidea*). The upper parts of pea shoots, along with the young pods, are sometimes attacked by the pea aphid (*Acyrthosiphon pisum* HARR.), which appears as far north as Kuopio (PS). Only rarely, however, does it cause serious damage. The species was found in abundance on peas at Jokioinen (EH) in the years 1935, 1938 and 1955 (INKILÄ 1960).

Beetles (*Coleoptera*). Two cases have been reported (1911 at Tyrväntö (EH) and 1934 at Revonlahti (KP)) of the species *Bembidion quadrimaculatum* L. having injured young pea plants by feeding on the stems and severing them.

The most harmful pest to attack young pea seedlings is the pea weevil (*Sitona lineatus* L.); in the early part of the summer, it often appears in huge swarms, chewing notches in the edges of the leaflets, and in the most serious instances completely destroying the leaves and stems. The larvae of this pest injure the bacterial nodules of pea plants. Damage attributable to the depredations of this species has been observed in cultivations of both field and table peas, and has been reported from locations as far north as Central Ostrobothnia and Kainuu. Literature makes reference to serious outbreaks of this weevil as early as in 1874 at Uskela (V) (O. M. REUTER 1878). Since 1897, local damage has been experienced in many years, at times so substantial that pea seedlings have been completely destroyed. From the rather meagre information available, it can be concluded that damage was considerable at least in the years 1916—1917, 1920, 1925—1926, 1931—1933, 1936, 1939, 1943, 1945, 1954, 1959 and 1960. According to observations by HUKKINEN (1913 b, p. 63), peas at Loppi and Kuhmoinen (EH) were injured by *Sitona sulcifrons* THNBG and by the above-mentioned species in 1911—1912. Moreover, small numbers of *Sitona decipiens* LINDB. have been found on peas, and on certain rare occasions *Sitona flavescens* MARSH. has been encountered (MARKKULA and KÖPPÄ 1960).

In some cases, the beet carrion beetle (*Aclypea opaca* L.) has been reported as damaging peas. Wireworms (*Elateridae*) occasionally attack peas, even though this plant is generally considered to be unfavoured as a host plant.

True flies (*Diptera*). Larvae of the genus *Agromyza* were found mining at the base of pea stems in Helsinki commune (U) in 1913, and at Kuhmoinen (EH) in 1914 (LINNANIEMI 1915, p. 53; 1916, p. 56; cf. also E. REUTER 1912 a, p. 15). The species was not determined, nor has this kind of injury been mentioned in the literature (FREY 1946, p. 15). Similar damage was reported in pea seedlings again at Tikkurila (U) and Paimio (V) in 1961.

In this country, several pest species have appeared as leaf miners of peas. These include *Phytomyza atricornis* MEIG.[1]) (*Ph. geniculata* MACQ.) and possibly *Liriomyza strigata* MEIG. A causal agent of blister mines is *Scaptomyza flaveola* MEIG.[2]) Leaf mines were especially abundant in the years 1915—1916 (LINNANIEMI 1920, p. 170). Tiensuu also found leaf mines caused by *Scaptomyza* in the leaves of field and sweet peas at Hattula (EH) in 1951, and at Lammi (EH) in 1955.[3]) In addition to the

[1]) FREY (1937, p. 92) also mentions finding mines made by this species in the leaves of field peas.

[2]) Linnaniemi employed the name *Scaptomyza graminum* FALL. for this species, but according to the literature it does not live in peas.

[3]) Tiensuu gave this species the name *Scaptomyza pisi* n.sp., but later established that it was actually *Sc. montana* WHEEL. (pers. communication 1955; cf. also HACKMAN 1955, p. 82). Later investigations by HACKMAN (1959, p. 62) resulted in it being designated *Sc. flaveola* MEIG., the grey form of which, found in Finland, might be a sibling species.

above-mentioned species, THUNEBERG (1959) reported finding leaf mines made by *Liriomyza obliqua* HEND. in peas at Joutseno (ES) in 1959.

The shoots, flowers and pods of peas are often seriously injured by the larvae of the pea midge (*Contarinia pisi* WINN.). So far, this pest has been found in the provinces of Finland Proper (V), Uusimaa (U) and South Häme (EH). At certain times, heavy damage has been reported, such as at Tenhola (V) in 1923, where 50—75 per cent of the pea yield was destroyed on a ½-hectare field.

M o t h s (*L e p i d o p t e r a*). The larvae of the common dart moth (*Agrotis segetum* SCHIFF.), as well as perhaps most often those of other related species, frequently damage peas by severing the stems at ground level. In 1934, larvae of *Euxoa obelisca* HB. attacked various crops at Viipuri commune (EK) including peas and other legumes. On occasion (i.e., at Tikkurila (U) in 1913) larvae of the cabbage moth (*Barathra brassicae* L.) have been encountered in pea fields, where they feed on the lowermost pods, severing the stems, and even penetrating into the interior of the stems. Also larvae of *Polia oleracea* L. once appeared on a trial plot of peas, injuring the leaves and pods. Frequently, larvae of the broom moth (*Polia pisi* L.) are found singly on the leaves of pea plants, but generally they bring about slight damage only.

In 1922 there was a serious outbreak of the silver Y moth (*Phytometra gamma* L.) in wide areas of southwest Finland, and the Ahvenanmaa Islands. Larvae appeared mostly in pea fields, where in the main they damaged the leaves, but also to some extent the flowers and pods (LINNANIEMI 1935, p. 72—73). The infestation was so heavy that in many fields a large proportion of the yield was destroyed. This was the first time that the silver Y moth, found commonly throughout the entire country, had appeared in such destructive numbers. A second epidemic of this pest occurred in 1946, when the damage inflicted was substantial not only in southwest Finland and Ahvenanmaa, but also in other parts of the country, extending as far north as Central Ostrobothnia and the region of Oulu (PP). The reports received gave 233 hectares of pea fields as being destroyed, and it was estimated that the losses to this crop amounted to a minimum of 1.9 million marks (KANERVO 1947).

Larvae of the following species have also been found on peas: *Acronycta rumicis* L., *Polia contigua* SCHIFF., *Polia thalissina* ROTT., *Xylina vetusta* HB., and *Spilosoma lubricipedum* L. (SEPPÄNEN 1954, p. 343). In certain instances, larvae of *Cnephasia* sp. have injured the seedlings of pea plants by rolling the leaves.

The most harmful destroyer of seeds within the pod is the pea moth (*Laspeyresia nigricana* FABR.), which is very common in Finland, and found as far north as North Ostrobothnia and Kainuu. The extent of damage varies considerably from year to year. At times of heaviest infestation, 50 per cent or even more of the pods may be injured by the larvae. The most substantial damage occurs in Ahvenanmaa and Finland Proper, and in other localities of southern Finland where pea cultivation is common (cf. also EKHOLM 1959, 1961). In these regions, the years of greatest destruction were 1913—1917, 1920, 1926—1927, 1933, 1935—1937, 1942—1946,

1948—1950, 1955—1956 and 1958—1959. Observations made at Jokioinen (EH) showed that the pea moth was exceptionally plentiful in the years 1948 and 1959. In 1948, an average of one-third (32.8 per cent) of the trial pea yields suffered damage as a result of this pest. In 1959, the infested pods in certain pea fields rose to a figure of 37—40 per cent (INKILÄ 1960). Trials showed that early-flowering varieties were more badly damaged than late-flowering ones (INKILÄ 1948).

Mites (*Acarina*). E. REUTER (1914, p. 8) reported a mild infestation of a »red spider mite» (evidently *Tetranychus urticae* KOCH) on the leaves of field peas at Tikkurila (U).

Molluscs (*Mollusca*). Slugs (*Deroceras agreste* L., etc.) occasionally cause rather great damage to peas by feeding on their nethermost leaves.

Birds (*Aves*). The house sparrow (*Passer domesticus* L.), hooded crow (*Corvus corone* L.), jackdaw (*Corvus monedula* L.) and wood pigeon (*Columba palumbus* L.) are often responsible for damage to pea fields, especially when the birds appear in large flocks. They feed on sprouting seeds just after sowing, trample on young seedlings, and later in the summer peck holes in the pods. Other species of pigeons (stock-dove, house pigeon) may also be responsible for this kind of injury. Other species of birds, such as the fieldfare (*Turdus pilaris* L.), continental jay (*Garrulus glandarius* L.), rook (*Corvus frugilegus* L.) and magpie (*Pica pica* L.) are sometimes encountered in pea fields. Mallards (*Anas platyrhynchos* L.) on their migratory flights frequently cause damage to pea fields located near bodies of water (HILLI 1927, 1929; K. E. KIVIRIKKO 1940).

Mammals (*Mammalia*). Certain voles, such as the continental vole (*Microtus arvalis* PALL.), sometimes injure peas by gnawing the pods.

4. Clover and other fodder legumes

Thrips (*Thysanoptera*). Seed fields of red and alsike clover are sometimes damaged by *Haplothrips niger* OSB., which live in great numbers in the flower heads, and feed on both the receptacle and the flowers. Mention has often been made of considerable losses in yield caused by this pest, sometimes as much as 25—70 per cent. Nevertheless, the damage inflicted is not easy to distinguish from, say, an absence of fertilization following a lack of pollinating bumble bees. This species, first reported as a pest in Finland in 1913 (LINNANIEMI 1915, p. 6—7), is a common insect in southern and central Finland and has been encountered as far north as Kemi Lapland (Markkula).

Plant bugs, aphids, etc. (*Hemiptera*). *Halticus apterus* L. has sometimes been found to cause leaf injuries to red clover (Kanervo). At times, large numbers of the sloe bug (*Dolycoris baccarum* L.) have appeared on red and alsike clover at the time the flower heads ripen. They suck the juices from the inflorescence axis and flowers, which makes the flower heads dry (HUKKINEN 1913, p. 173—176; 1913 b, p. 25—28; 1915, p. 6). Less important and sporadic pests of clover are the

Lygus bugs (HUKKINEN 1920). Larvae of the common froghopper (*Philaenus spumarius* L.) occasionally live on clover, but as a rule, they cause very slight damage. On occasion, the pea aphid (*Acyrthosiphon pisum* HARR.) may appear on vetch and clover, where it feeds on the top leaves. This species was found in abundance on red clover at Jokioinen (EH) in 1935 (INKILÄ 1960). The aphid species *Triphyllaphis luteola* C.B. was observed on red clover in 1960 at Anjala and near Helsinki (U), and in addition *Brachycaudus helichrysi* KALT. was found at the same time in the vicinity of Helsinki (U) (Markkula).

Beetles (*Coleoptera*). The most common pests which damage the roots of legumes are the larvae of click beetles (*Elateridae*), which are particularly injurious in old clover leys. There is no data currently available on the relative importance of the different species as regards clover, but according to SAALAS (1923, p. 159) *Corymbites cupreus* FABR. subsp. *aeruginosus* FABR. at least has been found to injure clover. In addition, larvae of *Melolontha hippocastani* FABR. sometimes damage clover-containing leys (SAALAS 1939, p. 47). In 1949, the garden chafer (*Phyllopertha horticola* L.) was reported to have appeared in large numbers in hay-fields at Taipalsaari (ES); it fed on the vegetation growing in the fields, especially on clover leaves.

The leaves of clover and other field legumes are commonly and at times seriously damaged by various *Sitona* species. The investigations of MARKKULA (1958, 1959) and MARKKULA and KÖPPÄ (1960) resulted in the following species being observed as pests of cultivated legumes: *Sitona sulcifrons* THNBG, principally on red clover (cf. also E. REUTER 1901 a, p. 14; HUKKINEN 1913 b, p. 29; LINNANIEMI 1915, p. 20; HUKKINEN and VAPPULA 1935, p. 40); *S. decipiens* LINDB., mainly on red and alsike clovers as well as on lucerne, but also to a slight extent on white clover, vetch and white melilot; *S. flavescens* MARSH., on red, alsike and white clovers (there was a heavy infestation on red clover at Kokemäki (St) in 1959 in a ley sown with a cereal nurse crop); *S. hispidulus* FABR., on red, white and alsike clovers (cf. also LINNANIEMI 1935, p. 38); *S. lineatus* L., on red, alsike and white clovers, lucerne, white melilot and vetch (cf. also E. REUTER 1898, p. 9—11); *S. suturalis* STEPH., on red clover. Several other species of *Sitona* (*S. puncticollis* STEPH., *S. lineellus* BONSD. and *S. ononidis* SHARP.) have also been found on clover, but only in very small numbers. Larvae of at least the first four species mentioned have been observed damaging the roots of red clover; adult insects are found during the whole growing season on clover stands. *Sitona lineatus* lives in summer principally on peas, finally moving to clover fields at the end of the summer or autumn. As a rule, *Sitona suturalis* lives on meadow vetchling, but is also found on red clover during the whole summer.

Sitona species which attack clover include *S. sulcifrons*, *S. decipiens* and *S. lineatus* as the most common pests of this plant in Finland. The first two, together with *S. flavescens*, *S. hispidulus* and *S. suturalis*, are distributed as far north as parallels of latitude 65—67° N. *S. lineatus* has been found as far north as the regions of Oulu (PP) and Kajaani (Kn) (MARKKULA and KÖPPÄ, op.cit., p. 248—249). To date,

no determination has been made of the exact economic importance of these various species in Finland.

HUKKINEN (1913 b, p. 30) reported finding light damage to clover leaves caused by the strawberry root weevil (*Otiorrhynchus ovatus* L.). In one case, large numbers of the mangold flea beetle (*Chaetocnema concinna* MARSH.) were found on vetch, where they chewed holes in the leaves (LINNANIEMI 1916, p. 15). Moreover, *Galeruca tanaceti* L. was reported by E. REUTER (1895, p. 25) as having injured clover leaves.

The most important clover seed pests are the *Apion* weevils, of which the commonest and most destructive is the clover seed weevil (*A. apricans* HBST), found as far north as Kemi Lapland. Similar damage is also caused by *A. assimile* KIRBY, which is also found throughout the entire country, extending to the regions of Enontekiö (EnL) and Sodankylä (KemL). A third harmful seed pest of red clover, *A. trifolii* L. (*A. aestivum* GERM.), is to be found only in Finland Proper, occasionally in large numbers. Samples collected in the years 1956—1958 from different parts of the country showed that seed weevils were more plentiful in occurrence in the eastern and northern parts of the country, and fewer in number in the western regions. In 1958, *Apion apricans* infestation was most heavy in South Carelia, South Savo and North Carelia, while *Apion assimile* was most abundant in the north part of North Ostrobothnia, North Carelia and North Savo. If the country is considered as a whole, the former species assumed a proportion in the total number of seed weevils of 68.6 per cent and that of the latter 30 per cent. The findings in 1936 were similar, although the number of individuals was much greater (cf. MARKKULA and VALLE 1959). It has been observed that the numbers of both species increase as the ley ages. Against this, a diminution in the clover content of the ley brings about a decline in the number of *A. apricans*, but a considerable increase in *A. assimile*. In the areas of heaviest infestation in the eastern regions of the country, the average loss in seed yield attributable to these species in 1958 was estimated to be at least 10—15 per cent, but in some individual cases the damage was much greater. From observations extending over a period of many years, it was established that seed weevils, together with other pests, were responsible for the destruction of 50—75 per cent, or even more, of the seed harvest of red clover.

The most important seed pest of alsike clover is the clover shoot weevil (*Apion flavipes* PAYK. = *A. dichroum* BEDEL), whose larvae also damage the flower heads of white clover, but seldom red clover (cf. LINNANIEMI 1915, p. 19; O. VALLE 1936; MARKKULA and VALLE 1959). It is very common in this country, and has been noted as far north as Enontekiö Lapland; to date its economic importance has not been studied.

The larvae of *Apion virens* HBST live in the stems of red clover plants. In some years this is a prevalent species in red clover leys, and appears to favour mixed leys. It presents itself at least in south and central Finland. The species was first mentioned as a clover pest in 1923 in the rural commune of Helsinki (U) (SAULI 1924). Similar damage to the stems of alsike clover is caused by *Apion seniculus*

KIRBY, which is rather common, and to be found in the south and central parts of the country. No detailed studies have as yet been made as regards the destructiveness of these two species.

The adults of all the previously-mentioned species of *Apion* injure clover leaves. Those weevils in particular which appear at the end of the summer can often bring about considerable damage to the leaves of young clover plants growing under a cereal nurse crop. In the autumn, these pests are found in large numbers, especially near hay-sheds.

The above description of the occurrence of *Apion* species, and their significance in damaging clover seed is based principally upon the extensive studies made at the Department of Pest Investigation on clover insect pests (MARKKULA 1955, 1957, 1958, 1959 a, 1959 b; MARKKULA and MYLLYMÄKI 1957, 1958, 1958 a).

In addition to the *Apion* species, the clover leaf weevil (*Phytonomus nigrirostris* FABR.) is undoubtedly one of the most damaging clover-seed pests in the country. The species is widely distributed, and is found as far north as Pello (PP) (MARKKULA 1959 b, p. 14)[1]). Large numbers of this pest are frequently to be found in clover fields, and it is often responsible for major-scale damage to seed fields of red and alsike clover. During the years 1953—1955, when a detailed study of the biology of this species was made at the Department of Pest Investigation (MARKKULA and TINNILÄ 1955, 1956), it was established that the greatest relative damage caused by the clover leaf weevil occurs in clover leys which are three years of age or older, but that there can be substantial injury even in second-year leys. Where heavy damage is inflicted, the forage yield may be reduced. In 1954—1955, when the appearance of this pest was approximately normal, its larvae were found at Tikkurila (U) to have destroyed about 10—15 per cent of the shoots of red clover, and about 5 per cent of the flower heads of this plant (MARKKULA 1955, p. 169). In west Finland particularly, this species appears — at least in certain localities — to be more injurious than the *Apion* seed weevils (MARKKULA 1959 b, p. 18).

The related species *Phytonomus meles* FABR., when in the larval stage, lives exclusively in red clover flower heads, causing injury to the developing seeds. It mainly occurs in Ahvenanmaa and Finland Proper, but is also found in Uusimaa, North Carelia, and in a rather wide area extending from South Ostrobothnia to Rovaniemi (PP) (op.cit., p. 15) [2]).

A further weevil species found to be a seed pest of alsike and white clover is *Miccotrogus picirostris* FABR. (O. VALLE 1936; MARKKULA 1959 a), which is quite prevalent in south and central Finland.

True flies (*Diptera*). The clover seed midge (*Dasyneura leguminicola* LINTN.) damages the flower heads of red, alsike and meadow clover; its larvae penetrate into the flowers, destroying the ovules or seeds. This species was first

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[1]) Subsequently, it has been discovered as far north as Kemi Lapland (Markkula).

[2]) The species has since been noted in Kemi Lapland (Markkula).

mentioned in 1911 (E. REUTER 1914, p. 7) under the name *Perrisia flosculorum* KIEFF., which can be considered almost certainly to be synonymous with *D. leguminicola* (BARNES 1946, p. 35). The clover seed midge was referred to in the annual reports of the State entomologists as having been observed in Uusimaa, South Häme and South Carelia, but according to HUKKINEN (1922 b) it was distributed throughout the whole of south Finland as far as Vaasa (EP), Kuopio (PS) and Joensuu (PK). To judge from the samples collected in 1958, it is obvious that the species is prevalent in the entire country, with an area of occurrence extending as far north as Kittilä and Sodankylä (KemL) (MARKKULA 1959 b, p. 13). In certain localities it has been responsible for appreciable damage to clover seed. Larvae of *Dasyneura gentneri* PRITCH. have been found in flower heads of white clover at Ylitornio (PP), as well as at some other locations (MARKKULA 1959 a, 1960).

Two leaf-mining flies have been found on clover, *Agromyza nana* MEIG. and *Phytomyza brischkei* HEND. (FREY 1937, p. 87, 93; 1946, p. 40). At least the former species has sometimes inflicted slight injury to red clover. Mines made by the latter species were observed in the leaves of white clover near Helsinki (U) in 1938.

Butterflies, moths (*Lepidoptera*). Lycaenid larvae have been found as pests of red and meadow clover; they live on the flower heads, injuring the flowers, and thus preventing seed formation (HUKKINEN 1926 a). It is possible that the species concerned was *Polyommatus semiargus* ROTT., which is common in this country and occurs as far north as the southern limits of Lapland. The damage it caused was relatively light.

Another rather prevalent species is *Coleophora deauratella* ZELL., whose larvae injure the flowers and seeds of clover, and thus occasionally cause appreciable losses in seed yield. The moth was first reported as a pest in Finland in connection with observations made in 1912—1919 (HUKKINEN 1920; LINNANIEMI 1935, p. 80). Since then, only scattered reports have been received from south and central Finland. Not until the extensive samplings of 1958—1959 were made did it become apparent that this species is distributed throughout the entire country, extending to Kolari and Pelkosenniemi (KemL). Larvae are found principally on red clover, and to some extent on alsike clover, although only very rarely on white clover (MARKKULA and MYLLYMÄKI 1960).

During the years of silver Y moth (*Phytometra gamma* L.) epidemics, larvae of this species cause considerable damage to the leaves and flower heads of red and alsike clover. Slight damage has also been noted on vetch. Similarly, larvae of the broom moth (*Polia pisi* L.) have on occasion been found in the aftermath of clover stands. In addition, larvae of *Polia persicariae* L. and *Amphipyra tragopogonis* L. have also been discovered on red clover at Tikkurila (U) (Markkula). In late summer, larvae of *Macrothylacia rubi* L. frequently appear in hay-fields, especially those containing clover, but they bring about practically no damage. On the other hand, another species, *Dasychira selenitica* ESP., may be very harmful. Between August and October in some years, the larvae of this species appear with extreme abundance

(as many as 157 per square metre have been found in places) in the aftermath of clover, where they wholly destroy the leaves, and thus greatly damage the field. Destruction of the field leads to a poor crop in the following year; in addition, animals, especially horses, do not like to feed on pasture infested with larvae. This pest appears to favour red clover, but damage has also been remarked on white and meadow clovers, vetch, and on various grasses (LINNANIEMI and HUKKINEN 1921, p. 9—10, 25). Exceptionally large numbers of larvae appeared in 1914—1917 and 1921, particularly in various parts of the Uusimaa province. Later epidemics occurred in 1926 (Hyvinkää) (U), 1938 (Somero) (EH), 1952 (Somero (EH), Järvenpää (U), Sippola (EK)) and 1953 (Kärkölä) (EH).

Red clover is sometimes rather mildly attacked by the plain yellow twist (*Tortrix paleana* HB.), whose larvae roll and eat the leaves. Similar damage is attributable to the larvae of *Cnephasia virgaureana* TR., which in some years appear in large numbers on red and alsike clover. On one occasion vetch was also infested. Larvae were found in great profusion on red clover in 1954—1955 in many places in south and central Finland, where they were responsible for substantial damage.

At the beginning of the summer, larvae of *Anthrocera meliloti* ESP. and *A. lonicerae* ESP. are found on clover (E. KIVIRIKKO 1941, p. 175; SEPPÄNEN 1954, p. 346), but they cause very little damage. Larvae of *Monima gracilis* FABR. have been observed on red clover (SEPPÄNEN, op.cit., p. 345). Once the writer found many such larvae on lucerne, which they injured severely by twisting the top leaves together (VAPPULA 1943).

According to the data compiled by SEPPÄNEN (1954, p. 345—346), larvae of the additional following species have been found on cultivated clover: *Plebejus idas* L., *Polyommatus icarus* L., *Lasiocampa quercus* L., *Acronycta rumicis* L., *Polia dissimilis* KNOCH, *Monima incerta* HUFN., *Monima opima* HB., *Xylina vetusta* HB. (also on lucerne), *Eumichtis satura* SCHIFF., *Gonospileia glyphica* L., *Eupithecia centaureata* SCHIFF., *Eupithecia satyrata* HB., *Gonodontis bidentata* CL., *Semiothisa clathrata* L., *Ematurga atomaria* L., *Diaphora mendica* CL., *Spilosoma lubricipedum* L., *Phragmatobia fuliginosa* L., *Rhyparia purpurata* L., *Diacrisia sannio* L., and *Arctia caja* L.

Mites (*Acarina*). The hop red spider mite (*Tetranychus urticae* KOCH) is of common occurrence on cultivated clover, especially in the southern parts of the country.

Molluscs (*Mollusca*). Slugs (*Deroceras agreste* L., etc.) appear abundantly at the end of the summer in some years; they invade clover aftermath, and can bring about considerable destruction to the plants.

Worms (*Vermes*). The clover nematode (*Ditylenchus dipsaci* KÜHN) has been found in red clover in Finland in no more than a few localities in the southern region of the country (MARKKULA 1955, p. 165). In at least two cases (in the rural commune of Helsinki (U) 1949—1950 and Padasjoki (EH) 1953) the nematode had been introduced to the fields through the agency of infested seed from Sweden (TINNILÄ 1959, 1960). Thus far, the species has not caused serious damage in this country.

Birds (*Aves*). According to HILLI (1927, p. 127; 1929, p. 42), the wood pigeon (*Columba palumbus* L.) uses cultivated vetch as part of its food supply.

Mammals (*Mammalia*). Voles, especially the continental vole (*Microtus arvalis* PALL.) and the field vole (*Microtus agrestis* L.), prefer to inhabit clover leys, where they often inflict considerable damage by feeding on the roots and aerial parts of red, alsike and white clover.

5. Potatoes

Earwigs (*Dermaptera*). Earwigs (*Forficula auricularia* L.) were once reported to have eaten holes in potato leaves (at Heinola (EH) in 1954).

Plant bugs, aphids, etc. (*Hemiptera*). Plant bugs (*Lygus* spp.) and the common green capsid (*Lygus pabulinus* L.) occur throughout the country, often in potato fields. They prefer to feed on the young leaves, which subsequently become frayed and full of small holes. At times, the damage may be so severe that the tops appear to be withered (HUKKINEN 1913 b, p. 59—60). In two cases[1]) *Calocoris fulvomaculatus* DeG. was found to have inflicted the same type of injury on potato foliage. The sloe bug (*Dolycoris baccarum* L.) and the cabbage shield bug (*Eurydema oleraceum* L.) have also sometimes been observed to attack potato plants.

According to data compiled by P. Nuorteva, potato pests include two species of leafhoppers: *Empoasca flavescens* FABR. (at Hattula (EH) and Helsinki (U)) and *E. kontkaneni* Oss. (at Helsinki) (cf. also P. NUORTEVA 1950; 1952 a, p. 29).

Potato plants are further injured by certain species of aphids; Heikinheimo observed the green peach aphid (*Myzus persicae* SULZ.) as well as *Aulacorthum solani* KALT. and *Aphis* sp. to be potato pests in Finland. The direct damage they cause is generally slight, but it is evident that they can be quite harmful as vectors of virus diseases. According to LIRO (1926), *Macrosiphum euphorbiae* Thos (= *M. solanifolii* ASHM.) also spreads potato virus diseases.

Beetles (*Coleoptera*). The foliage of potato plants, especially in north Finland, is frequently attacked by the beet carrion beetle (*Aclypea opaca* L.), which may in some years cause very severe damage. For example, at Petsamo, no longer a part of Finland, it was known to be perhaps the most harmful potato pest; sometimes it was so plentiful in numbers that it destroyed the young plants as they emerged from the soil (PARVELA 1931, p. 55). LINNANIEMI (1935, p. 35) reported that *Longitarsus luridus* SCOP. once slightly injured potato leaves by chewing small notches in them.

The most destructive potato pests in Finland are undoubtedly wireworms (*Elateridae*), which are often found in great numbers in potato fields. They bore into the tubers, and often render them unfit for consumption. Potato fields which are established following leys are especially susceptible to wireworm attacks. So

[1]) In one case (at Raahe [KP] in 1918) the species was reported as uncertain (LINNANIEMI 1935, p. 111).

far, it has not been established which species of *Elateridae* is the most injurious to potatoes, but damaging species include *Agriotes obscurus* L., and in Kainuu *Corymbites cupreus* FABR. subsp. *aeruginosus* FABR. as well as possibly *C. melancholicus* FABR. Potato tubers are also attacked by larvae of the cockchafer (*Melolontha hippocastani* FABR.), which have in some cases destroyed more than one half of the yield. In addition, they also cause damage by severing the potato stems at ground level.

True flies (*Diptera*). *Liriomyza solani* MACQ. was found to be a leaf-mining potato pest in the rural commune of Helsinki (U) in 1938, and at Kirkkonummi (U) in 1946 (cf. also FREY 1937, p. 90). Larvae of the lesser bulb flies (*Eumerus tuberculatus* ROND. and *E. strigatus* FALL.) have sometimes been observed to injure the stems of potatoes (e.g. E. REUTER 1897, p. 24), and occasionally they damage the tubers (Kanervo).

Moths (*Lepidoptera*). In epidemic years, larvae of the silver Y moth (*Phytometra gamma* L.) can cause considerable damage to potatoes by eating the leaves. Such damage occurred in some locations in 1922 and 1946. Occasional pests of potato leaves are *Polia oleracea* L. (SEPPÄNEN 1954, p. 369), *Antitype chi* L., *Polia pisi* L.[1]) and *Polia persicariae* L.

The stem of the potato plant is frequently damaged by larvae of the rosy rustic moth (*Hydroecia micacea* ESP.), which live inside the stem and make it wither. Destruction caused by this pest has been reported since the year 1906 in various parts of the country, and extending even as far as North Ostrobothnia. In general, damage has been relatively slight, although on occasion appreciable injury has been remarked, especially in small potato fields. Particularly numerous reports of damage were received in the years 1931, 1950—1952, 1955—1956 and 1958—1960.

Larvae of the common dart moth (*Agrotis segetum* SCHIFF.) have at times been observed to injure potatoes by severing the stems at ground level to enable them to feed on the tender top foliage. At times, the tubers are also hollowed out by the larvae (HUKKINEN 1913, p. 157—159; 1913 a). Other closely-related species may also inflict similar damage. In 1943, tubers were reported to have been injured by larvae of *Agrotis ypsilon* ROTT. near Porvoo (U). In 1915 and 1918, larvae attacking potato tubers appeared at Alatornio and Tornio (PP); the species was not positively determined, but was probably *Hepiolus fusconebulosus* DEG. (LINNANIEMI 1920, p. 140; 1935, p. 90; HUKKINEN 1925, p. 71—73). In 1918 especially, the destruction was very great, amounting in certain places to as much as 75 per cent of the potato crop.

Mites (*Acarina*). In a vegetable garden at Helsinki (U), severely infested with hop red spider mites (*Tetranychus urticae* KOCH), potato plants were also found to be injured by these pests. Similarly, mites were plentiful on potato plants in a small plot at Revonlahti (PP) in 1959. E. REUTER (1912, p. 15) mentioned receiving from Sodankylä (KemL) a sample of potato leaves which had been infested with mites.

[1]) This species was observed to a certain extent on potato foliage at Jokioinen (EH) in 1959 (INKILÄ 1960).

Molluscs (*Mollusca*). Grey field slugs (*Deroceras agreste* L., etc.) occasionally feed on the leaves and stems of potato plants; further, they may attack the tubers and hollow them out, with the result that considerable yield losses are suffered. Similar damage to tubers is caused by *Arion circumscriptus* JOHNST., which may continue its harmful work also during storage. A report from Mustiala (EH) in 1900 mentions that, together with wireworms, this pest caused the destruction of 50—100 per cent of the tubers in certain spots in a field of one hectare.[1]) The species has been found as an injurious pest as far north as Central Ostrobothnia (Alahärmä, Lappajärvi).

Worms (*Vermes*). The potato root eelworm (*Heterodera rostochiensis* WOLL.) has so far been found in 1946 at Hyvinkää (U), in 1951 at the rural commune of Helsinki (U), in 1952 at Helsinki and Hanko (U), in 1954 at Lohja (V), in 1956 at Sipoo (U), and in 1959 at Helsinki (U). At Hyvinkää, about 50 plots were infested, but in all the other instances the extent of injury was very small.

Birds (*Aves*). Certain birds, especially the hooded crow (*Corvus corone* L.) and the rook (*Corvus frugilegus* L.), but also sometimes the jackdaw (*Corvus monedula* L.), magpie (*Pica pica* L.) and continental jay (*Garrulus glandarius* L.), have been observed to feed on potatoes in the field (HILLI 1927, p. 122—125; 1929, p. 35—38). The common crane (*Grus grus* L.) may also occasionally damage potato fields at the end of summer.

Mammals (*Mammalia*). Voles, especially the water vole (*Arvicola terrestris* L.), often cause considerable damage to potato fields by eating the tubers or by collecting them in their underground storage chambers. Such chambers may be 60—70 cm wide and 12 cm high, and may contain 15—45 litres of potatoes. Voles favour only white-skinned potatoes, and leave the red-skinned ones undamaged (R. PALMGREN 1916). This species has been observed to harm potato fields right from the south coast to Lapland (MUNSTERHJELM 1913, p. 10). The field vole (*Microtus agrestis* L.) also uses potatoes for its food supply, but does not store them. However, it sometimes continues to eat potatoes in storage cellars. In the vicinity of dwellings, the Norway rat (*Rattus norvegicus* ERXL.) has in certain instances damaged vegetable gardens and potato plots. In the northern parts of the country, *Clethrionomys rutilus* PALL. has been observed as an injurious pest in the small potato fields in that region (MUNSTERHJELM 1913, p. 9—10). This same investigator also reported that the Norway lemming (*Lemmus lemmus* L.) completely devoured potato stems but did not touch the tubers.

6. Beets

(sugar beet and mangel)

Springtails (*Collembola*). The garden springtail (*Bourletiella pruinosa* TULLB.) has occasionally been found to damage the leaves of young seedlings (LINNANIEMI 1920 b, p. 17).

[1]) On the basis of a report by ABT (1917), LEHTINEN (1957) assumed that the species in question was *Arion fasciatus* NILSS.

Thrips (*Thysanoptera*). In 1953, sugar beets at Kemiö (V) were attacked by thrips larvae which injured the internal leaves of the seedlings. The causal agent was possibly cabbage thrips (*Thrips angusticeps* Uz.).

Plant bugs, aphids (*Hemiptera*). At the beginning of the summer plant bugs (*Lygus* spp.) often attack young seedlings of sugar beet and mangel, on occasion when they are still in the cotyledon stage. The insects feed on the growing point and developing leaves, with the result that the growth of the plant is hindered, or even completely checked. By far the most abundant species is *Lygus rugulipennis* Popp.[1]) Damage caused by this pest was especially severe to sugar beets in 1960. The sloe bug (*Dolycoris baccarum* L.) and the cabbage shield bug (*Eurydema oleraceum* L.) have also been reported in certain individual cases as having damaged plants. At Tikkurila (U), minor evidences of injury attributable to certain *Piesma* species were found on sugar beet seedlings (Kanervo).

The bean aphid (*Aphis fabae* Scop.) has occasionally appeared on sugar beet plants. Generally, the aphids are found on the flowering stalks in groups of varying size; more rarely they appear on the leaves of non-flowering plants. Aphids seldom occur in numbers sufficiently great actually to cause serious damage to the crop. However, the summer of 1959 was an exception, as in that year an exceedingly heavy infestation occurred on sugar beets, especially in the southern and south-western parts of the country, extending to the regions of Pori—Tampere—Kotka (St—EH—EK). Damage was less than had been expected; this was explained by the short period of their occurrence, and the control measures put into effect (cf. Kanervo 1960, p. 201—203).

Beetles (*Coleoptera*). One of the most destructive pests of sugar beet seedlings is the beet carrion beetle (*Aclypea opaca* L.). Both in the adult stage, and as a larva in particular, it can inflict severe damage by destroying virtually all the leaves of young seedlings, and chewing large holes in the leaves of older plants. The gaps often seen in sugar beet fields are usually ascribable to carrion beetles. As early as in 1894, serious damage to sugar beets was observed in southwest Finland (E. Reuter 1895, p. 40). The worst epidemic years were 1920—1921 and particularly 1925—1927; in the latter period destruction was very great and wide-spread throughout practically the whole area of sugar beet cultivation. In 1927, this pest completely destroyed 12 hectares of a 26-hectare area under sugar beet in South Ostrobothnia; this resulted in a serious set-back to the newly-established cultivation of sugar beets in this area. Quite serious damage in localities of south Finland also occurred in the years 1930—1932, 1943—1944, 1951—1952, 1954 and 1960, although in later years effective control measures have generally kept the damage to a minimum. From larva samples, *Aclypea undata* Müll. has been established as a sugar beet pest at Elimäki (U) and Tuulos (EH) (Vappula 1952). This species may possess a greater significance than can be assumed from these two individual reports.

[1]) The ability of different *Lygus* species (*L. pratensis* L., *L. punctatus* Zett. and *L. rugulipennis* Popp.) to injure sugar beet seedlings has been experimentally studied by Varis (1959).

Seedlings of sugar beet and mangel are often injured by the mangold flea beetle (*Chaetocnema concinna* MARSH.). Damage attributable to this pest was first observed in 1895, and in 1920—1921 there was an especially heavy infestation together with the beet carrion beetle. Localized attacks were reported in 1927—1928, 1956 and 1958—1960. The principal region of occurrence of the mangold flea beetle includes the provinces of Finland Proper, Uusimaa, Satakunta and South Häme, but outbreaks have also been observed from as far north as Central Ostrobothnia and North Carelia.

The pigmy mangold beetle (*Atomaria linearis* STEPH.) has been found to cause slight injuries to sugar beet seedlings, at least in the region of Salo (V) (Kanervo).

At certain times, *Bembidion* species (mainly *B. quadrimaculatum* L. and *B. lampros* HBST but also *B. rupestre* L.) abound in fields of root crops, but to date there is no positive evidence of their destructiveness to the seedlings. Specimens of *Gastroidea polygoni* L. were once found among the insects collected from mangel (at Joutseno (ES) in 1934), but it is not certain whether it had been responsible for injury.

Older plants are sometimes harmed by the beet tortoise beetle (*Cassida nebulosa* L.) and by its larvae. The species was first mentioned as a crop pest in Finland in 1895. Its principal host plants are various species of goosefoot, but when these are no longer available, the larvae or adults move to sugar beets or mangels. Damage is usually localized in a relatively small area, say, at the edges of a field, and does not spread very far. Only seldom is the injury distributed throughout the entire field. The beet tortoise beetle, which can also injure red beets and other related vegetables, occurs as a pest as far north as North Ostrobothnia.

Wireworms (*Elateridae*), often attack the young seedlings of sugar beet and sever the main root of the plant. Later in the summer, they inflict damage by boring into the root and eating cavities in it. Wireworm destruction has been most marked in Finland Proper and somewhat less in Uusimaa, Satakunta and South Häme. In 1920, especially severe damage was caused to sugar beet fields in many places. In a few instances, larvae of the cockchafer (*Melolontha hippocastani* FABR.) have destroyed seedlings of sugar beets and mangels.

True flies (*Diptera*). In addition to the beet carrion beetle, the beet fly (*Pegomyia hyoscyami* PANZ.) is another destructive pest of beets; it is found throughout the entire country as far north as Kemi Lapland. It produces two generations of larvae during the summer; these produce large blister mines in the leaves, and in severe cases the leaves may become dry. Young seedlings may wither completely, and in older plants the injury may retard the development of roots and diminish their quantity of sugar. Damage attributable to this pest has been reported in this country since 1901, and can be remarked on sugar beets, mangels, red beets, and other related crops. The worst epidemic years have been 1923 (losses of 25—100 per cent in Ahvenanmaa, Finland Proper, Uusimaa, Satakunta and South Häme),

1930, 1936—1939, 1950—1951 (in certain localities), 1955, 1958, and 1959. In the last-mentioned year, beet flies were observed in greater abundance than perhaps at any other previous time (KANERVO 1960, p. 203—207). Considerable damage also took place in the years 1903, 1905, 1916, 1924, 1926, 1948, 1956, 1957, and 1960.

Sometimes the larvae of crane flies (*Tipula* sp.) have been observed to injure sugar beet seedlings.

M o t h s (*L e p i d o p t e r a*). Larvae of the rosy rustic moth (*Hydroecia micacea* ESP.) are harmful to seedlings of sugar beets; they bore into the stem or root, which results in the withering of the plant. However, injury is generally relatively slight, with perhaps no more than 3—10 per cent destruction in the most severe cases. This species has been reported from time to time, mainly in the provinces of Finland Proper, Satakunta and South Häme. In addition, larvae of the common dart moth (*Agrotis segetum* SCHIFF.), together with other related species, have sometimes been found to damage beets; they eat holes in the roots, or even sever them completely just below ground level.

Among the leaf-injuring pests of beets, the silver Y moth (*Phytometra gamma* L.) is especially harmful. In 1922, larvae of this species appeared in relatively wide areas in southwest Finland, causing rather slight damage to beets (LINNANIEMI 1935, p. 72—73). A second serious epidemic of this pest occurred in 1946, and produced rather large-scale destruction to sugar beet fields, especially in the southwestern parts of the country. A survey revealed that damage had been inflicted over a total area of 70 hectares of beets, and that the losses amounted to 2 million marks (KANERVO 1947, p. 103). Occasional pests on leaves of beets are larvae of *Polia* (LINNANIEMI 1935, p. 69). Small numbers of *Polia oleracea* L. (SEPPÄNEN 1954, p. 314), *P. pisi* L. and *P. dissimilis* KNOCH have been found on sugar beets. In addition, larvae of *Xylina vetusta* HB. and *Eumichtis bathensis* LUTZ. have also been encountered on sugar beet leaves.

Young sugar beet seedlings are sometimes very seriously attacked by larvae of *Cnephasia virgaureana* TR., which feed on the leaves and roll them, thus retarding the development of the seedlings. This pest was found at Tikkurila (U) in 1927, in the region of Salo (V) in 1933, and in certain localities of south Finland in 1953—1955; in some cases, they damaged about 25 per cent of the seedlings. At Uskela (V) in 1928, a few larvae and pupae of *Tortrix paleana* HB. were discovered on sugar beets.

W o r m s (*V e r m e s*). The beet eelworm (*Heterodera schachtii* SCHM.) was encountered for the first time in Finland as a sugar beet pest at Salo (V) in 1961; it caused slight injury to the crop. Eelworm cysts have also been found in sugar beet fields at other locations in south Finland (O. ROIVAINEN 1962).

M a m m a l s (*M a m m a l i a*). Voles, especially the field vole (*Microtus agrestis* L.) and possibly also the water vole (*Arvicola terrestris* L.), damage the roots of sugar beets and mangels. On occasion, they have been known to eat entire roots, which can result in appreciable yield losses.

Springtails (*Collembola*). The garden springtail (*Bourletiella pruinosa* TULLB.) has sometimes caused slight injury to seedlings of swede, turnip and cabbage, both in the field and in frames (LINNANIEMI 1920 b, p. 17; 1935, p. 12).

Plant bugs, aphids, etc. (*Hemiptera*). Plant bugs (*Lygus* sp.), of which the most common is *Lygus rugulipennis* POPP., sometimes occur abundantly on crucifers, where they make the tender leaves curl and wither; on young seedlings, they often destroy the growing point. Damage attributable to these pests has been observed since 1912 on crops such as turnip, swede and marrow-stem kale. Destruction has been especially severe in Kainuu and North Ostrobothnia. Mass appearances by the sloe bug (*Dolycoris baccarum* L.) have also taken place in some years on crucifers (turnip and swede). This bug injures either the leaves, which become prematurely withered and brown, or the above-ground portion of the root, of which the outer surface becomes scabby and cracked (HUKKINEN 1913, p. 169—171; 1913 b, p. 55—59; 1915, p. 4—6); at the same time the growth of the plant is checked. Sloe bug damage has been reported in Finland since 1912, principally in the southern regions of the country.

The most destructive species of plant bug in regard to crucifers is the cabbage shield bug (*Eurydema oleraceum* L.), which was mentioned as early as 1877 as a cabbage pest at Piikkiö (V) (O. M. REUTER 1881). Often, it attacks turnips, swedes and marrow-stem kale, sucking the leaves and bringing about browning and twisting. Usually these pests spread in a field by advancing from its borders. To date damage has been inflicted as far north as Central Ostrobothnia (Haapavesi) and North Savo (Kiuruvesi). The most serious epidemic years have been 1913—1914, 1915—1917, 1935—1937 and 1939—1943. EKHOLM (1948) is of the opinion that mass occurrences of the cabbage shield bug take place about every ten years.

An abundant incidence of the leafhopper species *Tettigella viridis* L. and *Euacanthus interruptus* L. was observed at Liperi (PK) in 1919 on cabbage, swede and turnip (LINNANIEMI 1935, p. 113). The cabbage aphid (*Brevicoryne brassicae* L.), which occasions great damage to various cabbage species as well as to cruciferous seed and oil crops, often appears as a harmful pest of swede and turnip. Similarly, *Lipaphis erysimi* KALT. was observed on turnips at Mikkeli (ES) in 1937 (Kanervo).

Beetles (*Coleoptera*). The most important and destructive pests to crucifers in the seedling stage are flea beetles (*Halticinae*), which appear almost every year, and which often completely destroy fields of seedlings just at the cotyledon stage. Damage is particularly marked when the weather is warm and dry. Flea beetles have been found in all parts of the country, extending as far north as Utsjoki (InL) in northern Lapland. From the economic standpoint, the most important species of flea beetle is *Phyllotreta undulata* KUTSCH., which is distributed as far north as North Ostrobothnia and Kainuu. In southern Finland *Ph. atra*

FABR. is occasionally found in large numbers, and is sometimes as abundant as the first-mentioned species. *Ph. vittata* FABR. and the more uncommon species *Ph flexuosa* ILL. are distributed throughout most of the country, the latter as far as northern Lapland. *Ph. nemorum* L. has been found as far north as Central Ostrobothnia. The three species last-mentioned, however, play no more than a comparatively minor rôle in the destruction caused to crucifers in this country.

In addition to flea beetles, the mustard beetle (*Phaedon cochleariae* FABR.) is very important as a crucifer pest. Destruction attributable to it was first reported in 1908, when it abounded in turnip fields at Nastola (EH) (E. REUTER 1910, p. 10—12)[1]). During the years 1913—1923, the area of damage spread extensively to comprise all of Uusimaa, the southeastern part of South Häme, South Savo and practically all South Carelia. In southeastern Finland, the beetle was encountered at Sakkola (Kk) and in the north it had spread as far as Varkaus (PS). In some localities, damage was quite great. From 1924, the destruction brought about by the mustard beetle to crucifers in southern Finland became especially severe; every year it has spread further to the north. In 1930, the area of distribution of this pest extended to the region Pori—Tampere—Jämsä (St, EH) in the west and to Leppävirta—Värtsilä (PS, PK) in the east. In the following year, damage was greater and more extensive than it had ever been before, and it was found that the insect had spread not only into several communes in South Ostrobothnia, but also to the communes of Maaninka and Muuruvesi in North Savo and to the region of Joensuu in North Carelia. In 1935, it had spread to the area limited by Merijärvi—Pulkkila—Sonkajärvi—Valtimo (KP—PS—PK), and in 1939 to as far north as Kuivaniemi and Pudasjärvi (PP). Ten years later the mustard beetle had reached Kemijärvi (PP) and Kolari (KemL). Concurrently with this species gradually spreading to the north, its frequency in the southern parts of the country was clearly declining (VAPPULA 1934). In recent years, the damage has been most appreciable in South Carelia, South and North Savo, as well as South Ostrobothnia, but localized destruction has also been remarked in other parts of the country. According to observations by researchers (e.g., HUKKINEN 1931, 1931 a), the beetle attacks the seedlings of all crucifers with almost equal severity, but swede and marrow-stem kale are the ones most badly damaged. Later in the summer, it abandons these crops and attacks turnips, preferably depositing its eggs on the leaves of this plant, even late in the summer. The larvae which subsequently emerge then complete the work of destruction even in very luxuriant vegetation. This species also inflicts great damage on the big-leafed turnip. During the worst epidemic years of the 1920's and 1930's, the mustard beetle was so numerous and destructive that many growers were forced to abandon the cultivation of cruciferous crops.

The beet carrion beetle (*Aclypea opaca* L.) is a polyphagous pest often responsible for substantial damage to crucifers, such as swede and turnip, and occasionally

[1]) E. REUTER used the name *Phaedon armoraciae* L. for the species, but subsequently LINNANIEMI (1915, p. 13) established that the pest was actually *Ph. cochleariae* FABR.

marrow-stem kale. The damage inflicted has been most severe in the central and northern parts of the country. In rare cases, larvae of the beet tortoise beetle (*Cassida nebulosa* L.) have been found injuring the leaves of the turnip and swede, but such instances can be regarded as chance occurrences.

At times, *Bembidion quadrimaculatum* L. and *B. rupestre* L. have been found on seedlings of swede and cabbage, but no certain evidence of damage has been established.

Otiorrhynchus dubius STRÖM appeared in large numbers on cabbage and swede seedlings at Kuusamo (Ks) in 1915; this pest occasioned slight injury by feeding on the leaves and stalks (LINNANIEMI 1920, p. 47—48). Damage attributable to larvae of the cabbage stem weevil (*Ceuthorrhynchus quadridens* PANZ.) has sometimes been observed in the seedlings of some crucifers, such as swede and turnip. These larvae make mines in the stems and leaf stalks of the plants, with the result that the leaves yellow and wither.[1]) The turnip gall weevil (*Ceuthorrhynchus pleurostigma* MARSH.) produces galls on the roots of crucifers, including turnips. Especially heavy infestations of galls have sometimes been seen on wild radish.

The most important root-damaging crucifer pests are wireworms (*Elateridae*), which have in many parts of the country often caused serious injury to young seedlings of swede and turnip, as well as to other crucifers. Pest species include *Agriotes obscurus* L., and, especially in Kainuu, *Corymbites cupreus* FABR. subsp. *aeruginosus* FABR., but obviously other species may also share responsibility for the damage. In addition, larvae of the cockchafer (*Melolontha hippocastani* FABR.) have often caused damage to crucifers, mainly in some localities in east Finland.

Sawflies (*Hymenoptera*). Larvae of the turnip sawfly (*Athalia colibri* CHRIST.) have from time to time inflicted serious injury, particularly to turnip but sometimes also to swede, big-leafed turnip and marrow-stem kale. Damage attributable to this species was first observed in Finland in 1897, at Kaarina, Kuusisto and Parainen (V), as well as near Helsinki (U) and at Tammela (EH) (E. REUTER 1898, p. 53). Subsequently the pest has been reported from various parts of Finland, as far north as Rovaniemi (PP). Particularly heavy infestation occurred in 1937 and 1955—1956, although turnip-rape was the plant most affected in the last-mentioned years. It has also been fairly abundant in some localized areas in the years 1936, 1938, 1939, 1940, 1948 and 1959—1960.

True flies (*Diptera*). The most destructive crucifer pests include the cabbage root fly (*Hylemyia brassicae* BCHÉ) and the turnip root fly (*H. floralis* FALL.). Both species are very prevalent in all parts of Finland; the turnip root fly is generally found in greater numbers, and is more important from an economic standpoint. Several other related species also cause damage to crucifer roots (cf. p. 69). Destruction brought about by the two above-mentioned species occurs every year with varying degrees of severity in different regions of the country. Swede, turnip,

[1]) The two weevil species *Ceuthorrhynchus chalybaeus* GERM. (*timidus* WSE) and *C. contractus* MARSH. were reared from thickened leaf stalks of the big-leafed turnip collected from Aitolahti (EH) and Rovaniemi (PP) in 1951 (VARIS 1952).

big-leafed turnip[1]) and marrow-stem kale are attacked by these pests, and in the worst event yield losses may be as high as 25—50 per cent. These species are particularly harmful in north Finland, where they greatly hinder the cultivation of crucifers (HUKKINEN 1925, p. 91; PARVELA 1931, p. 65; HILLI 1933; SALONEN 1954). In south Finland, the cabbage root fly often produces two generations, against the usual one of the turnip root fly during the course of the growing season (KANERVO 1954). LINNANIEMI (1920, p. 145—146) reported finding, in damaged swede roots (at Kitee (PK) in 1915), larvae belonging to the family *Stratiomyiidae*, along with larvae of the cabbage root fly. However, attempts to identify the species by means of rearing proved unsuccessful. Larvae of crane flies (*Tipula* sp.) have sometimes been observed to cause appreciable damage to seedlings of, *inter alia*, swedes.

Larvae of *Phytomyza rufipes* MEIG.[2]) bore tunnels in the petioles of crucifers (especially turnips, but also swedes and cabbage), inducing a reddening or yellowing of the leaves. The damage, first observed in Finland in 1910 (E. REUTER 1912 a, 1914), has on occasion been very severe, with losses in the worst instances rising as high as 60—70 per cent of the leaves being destroyed by larvae. The species has been reported from as far north as North Ostrobothnia. At times blister mines are found in the leaves of crucifers; the causal agent is some species of *Scaptomyza*, most likely *Sc. flaveola* MEIG. Damage was especially great in turnip leaves in a field at Kuhmalahti (EH) in 1924.

Butterflies, moths (*Lepidoptera*). Many important crucifer pests belong to this order. One of the most common and injurious of them is the large white butterfly (*Pieris brassicae* L.), whose second-generation larvae appear almost every year in large or small numbers on all kinds of crucifers (swede, turnip, and marrow-stem kale). They have been reported from all parts of the country, as far north as Inari Lapland. Larvae have been especially numerous in the years 1914, 1915—1916, 1917, 1920, 1924—1925, 1932, 1935, 1936, 1939, 1946, 1951 and 1953, although substantial local damage has also been inflicted in other years. For instance, in the latter part of the summer and in the autumn of 1950, larvae were so numerous in some areas of southwestern Finland that in some fields the foliage of the big-leafed turnip was almost completely destroyed (KANERVO 1951, p. 108). Two further species which attack crucifers are the small white butterfly (*Pieris rapae* L.) and the green-veined white butterfly (*Pieris napi* L.). The former is occasionally found quite abundantly on turnips and swedes in the southern and central parts of the country. The latter is distributed throughout the whole of the country as far north as Lapland, and principally causes damage to cruciferous root crops, although its depredations extend to marrow-stem kale. Nevertheless, these two species are much less economically harmful than the large white butterfly.

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[1]) The susceptibility of different strains of big-leafed turnip to injury by larvae of the cabbage root flies has been investigated by VARIS (1958).

[2]) Earlier, the name *Phytomyza flavicornis* FALL. was used in Finland, but according to FREY (1946, p. 15) the correct title is *Ph. rufipes* MEIG. (= *flavicornis* BECK. nec FALL.).

One of the most destructive crucifer pests in Finland is the diamond-back moth (*Plutella maculipennis* CURT.), whose larvae often cause severe injuries to the leaves of swedes, and less marked damage to those of turnips and big-leafed turnips. In years of heavy infestation, they also feed on the leaves of marrow-stem kale, with the result that appreciable losses to this crop are sustained (HUKKINEN 1931 b). The diamond-back moth, to be found in all regions of the country, usually produces two generations during the summer, but in especially warm or long summers even a third generation may appear (KANERVO 1936, p. 47; 1949). Damage attributable to this moth was particularly severe in the years 1895, 1905, 1915, 1918, 1928, 1940, 1946 and 1958, and fairly severe in 1894, 1906, 1914, 1917, 1919, 1922, 1926, 1929, 1932, 1936, 1941, 1950, 1952, 1954 and 1956. The numbers of the diamond-back moth are influenced not only by weather conditions, but also by natural enemies and diseases, which sometimes destroy about 70 per cent of the larvae. It is well worth noting that in many instances the most profuse appearance of this species coincides with the sunspot maxima (KANERVO 1949). It has also been found that when there are continual south or southeast winds — such as in 1958 — the moth has been brought into many parts of Finland from abroad (KANERVO 1960 b). Another moth pest of crucifers is *Plutella annulatella* CURT.; this applies particularly to north Finland, where according to E. REUTER (1904 b, p. 11; 1908, p. 21) it appeared to be more common than in south Finland. Larvae of the garden pebble moth (*Mesographe forficalis* L.) mainly inflict injury on cabbage leaves, but sometimes in the southern and central parts of the country they have been rather commonly found also on swedes, and occasionally on marrow-stem kale and turnip.

Slight injuries to swede leaves have sometimes been caused by larvae of the cabbage moth (*Barathra brassicae* L.) and tomato moth (*Polia oleracea* L.). The leaves of turnips, big-leafed turnips and swede have been injured by larvae of *Polia pisi* L. The following species have also been found on crucifer plants: *Polia contigua* SCHIFF., *Polia thalassina* ROTT., and *Polia dissimilis* KNOCH (SEPPÄNEN 1954, p. 323). During its epidemic year, 1922, the silver Y moth (*Phytometra gamma* L.) was responsible for generally slight damage to cabbage, swede and turnip in southwest Finland. In 1946, on the other hand, in many places damage was quite severe on swedes and turnips, although in very many instances the plants managed to recover after the attack, with the result that the losses were less than had been expected (KANERVO 1947, p. 99—100). Species which have only rarely been found on crucifers include *Orgyia antiqua* L. on turnips, *Cidaria fluctuata* L. on the leaves of greenhouse-grown swede (VAPPULA 1940) and *Cidaria designata* HUFN., also on swede (SEPPÄNEN 1954, p. 324).

Larvae of the common dart moth (*Agrotis segetum* SCHIFF.) occasionally injure swede and turnip roots. They eat holes or large cavities in the underground parts of the plants, and at times may sever the root completely or hollow out its interior (HUKKINEN 1913, p. 155—161; 1913 a; 1913 b, p. 44—53). Similar damage is

also brought about by other related species, such as *Agrotis exclamationis* L. (HUKKINEN 1913 b, p. 53), *Euxoa nigricans* L., and *Triphaena pronuba* L. (SEPPÄNEN 1954, p. 323). At Viipuri (EK) in 1934, larvae of *Euxoa obelisca* HB. were found damaging vegetables in a garden, including the severing of swede seedlings at ground level.

Molluscs (*Mollusca*). Slugs (*Deroceras agreste* L., etc.) often cause destruction in root crop fields in the latter part of the summer and in autumn. Slugs appear most plentifully in rainy summers. In two cases (Viiala (EH) and Alahärmä (KP)), *Arion circumscriptus* JOHNST. was found feeding on swedes. At Janakkala (EH) in 1916, *Succinea putris* L. was reported to have damaged swede and cabbage. This species, which is prevalent in all parts of the country, has otherwise never been mentioned in Finland as a crop pest.

Birds (*Aves*). The hooded crow (*Corvus corone* L.) has sometimes been seen feeding on various seedlings, including those of the swede. The magpie (*Pica pica* L.) and continental jay (*Garrulus glandarius* L.) have also occasionally appeared in fields of crucifer root crops (HILLI 1927, p. 124; 1929, p. 37—38). Rooks (*Corvus frugilegus* L.) once caused severe damage to a field of fodder turnips near Pori (St) by pulling the seedlings out of the ground and eating their roots (K. E. KIVIRIKKO 1940, p. 119).

Mammals (*Mammalia*). Hares (*Lepus* sp.) have sometimes been seen eating the tops of swedes, and thus causing slight injury. Voles, especially the water vole (*Arvicola terrestris* L.), field vole (*Microtus agrestis* L.) and continental vole (*Microtus arvalis* PALL.), often become troublesome pests in fields, where they feed on swedes, turnips and other crops. Similarly, the common mole (*Talpa europaea* L.) is frequently the originator of considerable damage by making mounds of earth on the ground and digging tunnels in the topsoil; this results in injury to the roots of the young plants. An occasional pest is the Norway rat (*Rattus norvegicus* ERXL.), which has been observed to damage swedes along with other vegetable crops. Injuries to root crops caused by the muskrat (*Ondatra zibethica* L.) have generally been very slight (ARTIMO 1949, p. 41).

8. Cruciferous seed and oil crops

(including poppy and linseed)

Thrips (*Thysanoptera*). Cabbage thrips (*Thrips angusticeps* UZ.) was especially abundant in the spring of 1950 at Tikkurila (U) on false flax (*Camelina sativa*), but caused virtually no harm to the plants (KANERVO 1951, p. 109).

Plant bugs, aphids (*Hemiptera*). *Lygus* bugs sometimes attack oil crops, especially poppy, false flax and linseed. In 1943, they rather severely damaged poppy fields at Pälkäne (EH), Maaninka (PS) and Revonlahti (KP),

injuring the young shoots so badly that they were unable to develop into normal plants. Similar damage was remarked on poppy and false flax at Tikkurila (U) in 1945. At times, *Lygus* bugs have been found in great numbers on the leaves and pods of winter rape and turnip rape, as well as on the inflorescences of other cruciferous seed crops. The cabbage shield bug (*Eurydema oleraceum* L.) is similarly sometimes found in great numbers on such plants as turnip rape, white mustard, seed plants of swede, turnip and cabbage, where it feeds on the leaves and brings about their distortion and withering. This pest also injures the buds and flowers of inflorescences, and was once reported to have destroyed a seed field of radishes. From time to time, the sloe bug (*Dolycoris baccarum* L.) has been the author of considerable damage to fields of cruciferous seed crops by feeding on their leaves, stems and inflorescences. In one case they reduced the yield by 50 per cent.

In years of heavy infestation, the cabbage aphid (*Brevicoryne brassicae* L.) generally attacks cruciferous oil crops (KANERVO 1951, p. 109; MARKKULA 1953, p. 82—85), and damages the shoots, inflorescences and pods of the plants. In 1950—1952, for example, it was present in great numbers in parts of south Finland, and found on both winter turnip rape and spring rape. Seed plants of swede are also badly injured by this pest, which congregates on the flower stalks, making them stunted and reddened, and in extreme cases destroying them completely. In 1954, small numbers of *Lipaphis erysimi* KALT. were found on the shoots and pods of winter turnip rape at Pälkäne (EH) and Ylistaro (EP).

B e e t l e s (*C o l e o p t e r a*). In the spring and early part of the summer, leaves of cruciferous oil crops are occasionally damaged by flea beetles, especially *Phyllotreta undulata* KUTSCH. These pests are particularly numerous on cruciferous seed plants which have just started their growth; these beetles may in fact destroy all the leaves, and even gnaw the stalks of the plants. Destruction of a similar type is also caused by mustard beetles (*Phaedon cochleariae* FABR.), which in epidemic years are very injurious to turnip and swede grown for seed. They also injure winter turnip rape and white mustard plants. On occasion the beet carrion beetle (*Aclypea opaca* L.) is found on cruciferous seed crops.

The most harmful pest of cruciferous seed crops in Finland is the blossom beetle (*Meligethes aeneus* FABR.). In the spring, it attacks the inflorescences with the result that pods do not develop. However, the blossom beetle is not so harmful as regards flowers which have already opened. This pest also damages spring turnip rape and spring rape, but as a rule winter turnip rape is free from its attack; this crop begins its development so early in the spring that most of its flowering is at an end before the blossom beetle makes its appearance. Nevertheless, in some years, such as 1951, 1957, 1959, 1960 and 1961, this species was responsible for substantial localized damage to winter turnip rape also. The blossom beetle is a very common insect throughout the whole of Finland, but reports of its injurious effects on cultivated crops have originated only in the southern and central parts

(up to PP) of the country. The annual reports of the State entomologists make mention of this species from the year 1897 as a prevalent pest recurring nearly every year on the seed crops of swede, turnips and cabbage. Sometimes, the damage has been on a large scale, and the seed yield almost completely lost. The years of most serious damage have been 1916—1917, 1925—1926, 1928, 1930—1931, 1935—1936 (South and Central Ostrobothnia), 1943 and 1945.

In addition to the blossom beetle, certain species of cabbage weevils (*Ceuthorrhynchus* spp.) often give rise to serious damage to crops, especially in fields of winter turnip rape. In the spring, the weevils attack the inflorescences, and later in the summer the adults of the new generation injure the pods by gnawing holes in them. In the middle or latter part of July, they may move from ripe fields to adjacent fields of turnip rape just at the seedling stage, and inflict appreciable damage on the young plants. Damage of this type was observed, for example, at Tikkurila (U) in 1950 (KANERVO 1951, p. 107).

The stalks and petioles of cruciferous seed and oil plants are often injured by the cabbage stem weevil (*Ceuthorrhynchus quadridens* PANZ.) (cf. p. 68), whose larvae live in great numbers within these parts of the plants and hollow them out. As a result of the depredations, the plant grows poorly and the yield is small; in extreme cases it may be broken off and die. This pest, found as far north as South Ostrobothnia, North Häme and North Savo (S. ROIVAINEN 1957), has on many occasions caused considerable destruction to seed fields of cruciferous crops. The seed plants of turnips are most severely attacked, and may often die, whereas swedes are only slightly injured by the larvae (SAULI 1924). Seed fields of the big-leafed turnip may also suffer substantial damage (KANERVO 1951, p. 105). The increase in cultivation of oil crops has brought in its train a corresponding rise in numbers of this pest. Larvae have often been extremely numerous in winter turnip rape in particular, for instance in 1949 and 1950 at Tikkurila (U). Even though the infestation is not always externally visible, it results in a weakening of the plants and reduction of the yield. Larvae of the cabbage curculio (*Ceuthorrhynchus rapae* GYLL.) have at times been found in the stems of cabbage, swede and turnip seed plants, as well as in some cruciferous weeds (shepherd's purse and treacle mustard). This species occurs as a pest principally in south Finland, but scattered reports of its presence have been received from as far north as Kemijärvi in North Ostrobothnia (S. ROIVAINEN 1957).

A common pest of cruciferous seed and oil plants is the cabbage seed weevil (*Ceuthorrhynchus assimilis* PAYK.), whose larvae live in the pods and eat the developing seeds. This species has also greatly increased in numbers along with the extension of oil crop cultivation, and has spread as far north as South Ostrobothnia and North Savo (S. ROIVAINEN, op.cit.). In extreme cases, it can destroy as much as 70 per cent of the seed yield. Observations made at Tikkurila (U) indicate that winter rape is most susceptible to injury by this pest, whereas winter turnip rape and spring rape are somewhat more resistant (KANERVO 1951, p. 111).

At Rovaniemi (PP) in 1953 *Amara eurynota* PANZ. was observed to inflict moderate damage on winter turnip rape by feeding on the pods (Varis).

In a few cases, injuries to the roots of oil crops have been caused by wireworms (*Elateridae*). Larvae of the cockchafer (*Melolontha hippocastani* FABR.) are also occasionally harmful, but in general neither of these pests causes serious damage; the sole exception to this was at Padasjoki (EH) in 1943, when the species was responsible for large-scale depredations in fields of poppy (HUKKINEN, Ann. Report of the Dept. of Pest Invest. 1943).

Sawflies (*Hymenoptera*). Larvae of the turnip sawfly (*Athalia colibri* CHRIST.) occasionally give rise to substantial damage, especially to seedlings of winter turnip rape, by feeding on the leaves during August and September. The years 1955—1956 were marked by an unusually heavy outbreak of this pest in fields of turnip rape, and it was only by means of insecticides that many fields could be saved from complete destruction. With the increase in cultivation of turnip rape, this species also has become more prevalent throughout the regions where this crop is grown.

True flies (*Diptera*). Larvae of *Phytomyza rufipes* MEIG. damage the leaves of cruciferous oil crops, especially winter turnip rape. Injury has been quite extensive in some localities, but has not resulted in serious economic losses. It was evidently this species which was referred to by E. REUTER (1901 a, p. 30) in his report on the appearance of certain fly larvae in the leaf stalk and midrib of swede seed plants. At Virolahti (EK) in 1929, the leaves of turnip seed plants were badly injured by *Scaptomyza flaveola* MEIG. which had produced blister mines in them. Similar leaf mines were observed in 1956 at Revonlahti (KP), especially in rape.

The flower buds of cabbage, swede, and turnip are often injured by larvae of the Brassica flower midge (*Gephyraulus raphanistri* KIEFF.), which inhabit the buds and cause them to swell into large galls. In some instances when there are many galls, the seed yield is appreciably reduced. At times, the species also attacks cruciferous oil crops. This pest was first observed in Finland in 1918 at Tikkurila (U) (LINNANIEMI 1935, p. 93). Larvae of the pod midge (*Dasyneura brassicae* WINN.) were encountered in small numbers in the pods of swede and cabbage at Tyrväntö (EH) in 1932 and 1944. This species was clearly that found infesting a seed lot of turnip imported from Denmark in 1921 (LINNANIEMI, op.cit.). Since the year 1951, it has often been found as a serious rape and turnip rape seed pest. If the cultivation of these crops continues, it is evident that the species will steadily increase in numbers.

The roots of cruciferous oil crops, particularly those of winter turnip rape, have often been badly injured by larvae of cabbage and turnip root flies (*Hylemyia brassicae* BCHÉ and *H. floralis* FALL.). The larvae eat holes and tunnels in the roots at the end of the summer and autumn, and may in extreme cases completely destroy the roots. In the spring of 1952, larvae of *Muscina assimilis* FALL. were found

in the roots of winter turnip rape in the communes of Kalajoki and Ylivieska (KP). They had penetrated the neck of the root, which led to its decay; the infection was obviously primary.

Butterflies, moths (*Lepidoptera*). The leaves of cruciferous seed and oil crops are generally injured by the same species of butterflies and moths as those which damage cruciferous root crops. Perhaps the most important of these is the large white butterfly (*Pieris brassicae* L.), whose larvae have in epidemic years given rise to severe damage on seed plants of swede and turnip, sometimes destroying them completely. The larvae have also attacked oil crops; in the late summer and autumn of 1950 there were very large numbers of larvae on seedlings of winter rape and turnip rape in the southwestern region of Finland (KANERVO 1951, p. 108). Larvae of other butterfly and moth species have more rarely been found in seed fields of crucifers; such species include the small white butterfly (*Pieris rapae* L.) and the broom moth (*Polia pisi* L.) on swede and turnip, and the green-veined white butterfly (*Pieris napi* L.) on oil crops. Larvae of the diamond-back moth (*Plutella maculipennis* CURT.) have occasionally appeared in large numbers on the leaves of crucifer seed and oil plants. At times they have also attacked the pods, eating holes in them, or even penetrating to their interior. Similar damage is also attributable to larvae of the garden pebble moth (*Mesographe forficalis* L.). At Lohja (V) in 1951, the author found larvae of *Xylina exoleta* L. on spring turnip rape. In 1946, larvae of the silver Y moth (*Phytometra gamma* L.) were responsible for appreciable damage to crops which included linseed (KANERVO 1947, p. 100).

Larvae of *Euergestis extimalis* SCOP. have appeared sporadically on the pods of cruciferous seed and oil crops. They gnaw holes in the pods, but to date this species has not been the author of actual damage. At Tikkurila (U), larvae of *Cnephasia* sp. were once found on the inflorescence of turnips, which they had destroyed.

Molluscs (*Mollusca*). Slugs (*Deroceras agreste* L., etc.) have sometimes attacked the seedlings of winter turnip rape, but as a rule the damage has been slight. In fields of ripening linseed, slugs often shake down and break the capsules, and eat all seeds within them. In 1943, *Arion circumscriptus* JOHNST. inflicted severe injury in poppy fields in the region of Hämeenlinna (EH). It severed the stems of full-grown plants at ground level, and fed on the flower stalks (HUKKINEN, Ann. Report of the Dept. of Pest Invest. 1943).

Birds (*Aves*). Large flocks of house sparrows (*Passer domesticus* L.) occasionally invade fields of turnip rape and other cruciferous seed crops; they can bring about substantial damage by breaking the ripening pods and eating the seeds or scattering them on the ground. According to observations made at Tikkurila (U), similar damage is also caused by *Carduelis cannabina* L., *Chloris chloris* L. and *Carduelis spinus* L., which may appear in large flocks in the fields about 1—2 weeks before the turnip rape harvest. *Chloris chloris* has been mentioned as having caused heavy damage at the Tammisto Plant Breeding Station near Helsinki (U), by eating crucifer seeds or scattering them on the ground (HILLI 1927, p. 126; 1929, p. 40—41).

In addition, *Fringilla coelebs* L., *Emberiza citrinella* L., *Carduelis carduelis* L. and *Columba palumbus* L. have also injured turnip rape. The fieldfare (*Turdus pilaris* L.) sometimes eats turnip seeds (HILLI, op.cit.).

Mammals (*Mammalia*). The European hare (*Lepus europaeus* PALL.) feeds on seedlings of turnip rape in the winter by digging through the thin snow cover, but no serious damage has been reported. Voles, especially the continental vole (*Microtus arvalis* PALL.), injured winter turnip rape in the winter of 1959 in Jaala (EH) by severing the root at soil level, or the stem just above ground level. Similar damage was also reported from Tyrvää (St) on a 1-hectare field in 1955.

9. Fibre crops

(flax and hemp)

Plant bugs (*Hemiptera*). In addition to the injury it inflicts on many other plants, the sloe bug (*Dolycoris baccarum* L.) attacks hemp, feeding on the upper parts of the shoots and the flowers (LINNANIEMI 1916, p. 59).

Beetles (*Coleoptera*). The flax flea beetle (*Longitarsus parvulus* PAYK.) lives on young flax seedlings, and may at times seriously disturb the growth of the plant. However, serious damage has been of rare occurrence. The species, discovered as a pest for the first time in 1915 near Helsinki (U), appeared in flax fields in various parts of southern Finland (provinces V, U, EK, Kk, St and EH) in the years 1916, 1918, 1937, 1939 and 1948; another species of flea beetle, *Aphthona euphorbiae* SCHRK, was found together with it on flax at Karjalohja (V) (SAALAS 1938). In 1943, larvae of the beet carrion beetle (*Aclypea opaca* L.) were reported to have damaged hemp at Rovaniemi (PP).

True flies (*Diptera*). Leaf mines were on one occasion found in flax (at Raahe (KP) in 1915), and were evidently the work of the chrysanthemum leaf miner (*Phytomyza atricornis* MEIG.) (LINNANIEMI 1920, p. 170).

Moths (*Lepidoptera*). In 1922, larvae of the silver Y moth (*Phytometra gamma* L.) were found generally in southwest Finland, where they slightly damaged flax and other crops. During the second epidemic of this pest, which was in 1946, the damage to flax was very severe; the larvae destroyed the leaves, flowers and young capsules, with the result that the growth of the plants came to a complete stop. Estimations were made that the destruction to flax covered an area of 158 hectares, the sum involved being 2.1 million marks (KANERVO 1947). In that year, larvae appeared over a considerably wider region than in 1922. In one case damage to hemp was also reported. In 1946, especially large numbers of *Polia persicariae* L. larvae were observed in a flax field at Loppi (EH); together with the species first-mentioned, they brought about heavy injury to the plants (SAARINEN 1947). In 1944, larvae of *Polia pisi* L. appeared in large numbers on flax at Nauvo (V) (Nordman; cf. also SEPPÄNEN 1954, p. 355).

Birds (*Aves*). Of the different bird species, at least the wood pigeon (*Columba palumbus* L.) can be mentioned as having eaten flax and hemp seeds (HILLI 1927, p. 127; 1929, p. 42).

10. Hops

Aphids, leafhoppers (*Hemiptera*). The hop-damson aphid (*Phorodon humuli* SCHRK) has on occasion appeared in large numbers on the leaves and inflorescences of hops; in the worst cases, it has given rise to the withering and falling of the leaves, along with damage to the cones. By the excretion of honeydew it produces a sticky layer on the surface of the leaves, which can in consequence easily become infected by sooty mould. The species, mentioned for the first time in the annual report of the State entomologist in 1917, has a distribution which extends as far as South Ostrobothnia and North Savo. The two leafhopper species *Helicoptera lapponica* ZETT. and *Hypospadianus torneellus* ZETT. have also been found on hops at Hattula (EH) (P. NUORTEVA 1952 a, p. 19, 25).

True flies (*Diptera*). Leaf mines in hops are caused by three species of leaf-mining flies, all to be found in Finland. *Agromyza igniceps* HEND. was apparently abundant at Revonlahti (KP) in 1945. It was also found at Saltvik in Ahvenanmaa (FREY 1946, p. 18), and at Virolahti (EH). In several other cases, hops were damaged by large numbers of leaf mines, although it was not established whether the causal agent was *Agromyza flaviceps* MEIG. or the chrysanthemum leaf miner (*Phytomyza atricornis* MEIG.). The former species was found by FREY (op.cit.) at Karjaa (V), and by the writer at Tikkurila (U) in 1936.

Butterflies, moths (*Lepidoptera*). The most important pest which injures hop leaves is the buttoned snout moth (*Hypena rostralis* L.), whose larvae often destroy the leaves so completely that only the petioles and main veins remain. Damage inflicted by this pest has been observed since 1895—1896 in the southern and central parts of the country as far north as Kannus (KP) and Kuhmo (Kn). Larvae of *Vanessa urticae* L. cause similar forms of injury; they make their original habitat on nettles, but move to nearby plantings of hops when the host plant has been consumed and sometimes destroy them completely. Instances of this have been reported from Puumala and Leivonmäki (ES) in 1917 and from Revonlahti (KP) in 1937. Moreover, larvae of *Polygonia c-album* L. have at times been found feeding on hop leaves, for example in the region of Vaasa (EP) (LINGONBLAD 1944, p. 112), Hollola (EH) (HEINÄNEN 1947, p. 11) and Lempäälä (EH) (SALO and SOTAVALTA 1952, p. 95). In addition, larvae of *Pyrameis atalanta* L., *Orgyia antiqua* L., *Acronycta rumicis* L. and *Eupithecia assimilata* DBLD. have been found on hops (SEPPÄNEN 1954, p. 310). Once the writer observed larvae of the European leaf roller (*Cacoecia rosana* L.) inflicting their typical injury on the leaves of hop plants.

Mites (*Acarina*). In some cases, exceedingly large numbers of the hop red spider mite (*Tetranychus urticae* KOCH) have appeared on hops and discoloured the leaves.

11. Spices and medicinal plants

Aphids (*Hemiptera, Aphidoidea*). Damage to the inflorescences of fennel occurred at Turku (V) in 1947; the causal agent was apparently *Cavariella aegopodii* SCOP.

Beetles (*Coleoptera*). The green tortoise beetle (*Cassida viridis* L.) was found by the writer at Järvenpää (U) in 1924 and at Tikkurila (U) in 1944 on mint (*Mentha aquatica* and *M. piperita crispa*) as well as on *Melissa officinalis;* larvae ate holes in the leaves, with resultant considerable damage to the plants. *Chrysomela polita* L. damaged the leaves of mint (*Mentha piperita*) at Helsinki (U) in 1943.

True flies (*Diptera*). Mines attributable to the larvae of *Trypeta artemisiae* FABR. were found in the leaves of *Artemisia dracunculus* (LINNANIEMI 1913, p. 85), and mines made by *Philophylla heraclei* L. were encountered in the leaves of common lovage at Turku (V) in 1942.

Butterflies, moths (*Lepidoptera*). Larvae of *Papilio machaon* L. have been observed on caraway, lovage and *Ruta graveolens*, those of *Barathra brassicae* L. on hyssop (*Hyssopus officinalis*) and those of *Dasypolia templi* THNBG on lovage (SEPPÄNEN 1954). In 1956, many larvae of *Depressaria* sp. appeared on a 3-hectare caraway planting at Piikkiö (V); they injured about 50 per cent of the flowers.

12. Tobacco

Plant bugs, aphids (*Hemiptera*). In 1912, the sloe bug (*Dolycoris baccarum* L.) was mentioned as having damaged certain crops, especially tobacco, at Sysmä (EH) (HELLÉN 1913). The cabbage shield bug (*Eurydema oleraceum* L.) has at least on one occasion made a mild appearance on tobacco. In spring 1943, the writer found black aphids on some tobacco plants at Sipoo (U), but the species was not determined. The peach-potato aphid (*Myzus persicae* SULZ.) has also been observed on tobacco (HEIKINHEIMO 1944, p. 4).

Beetles (*Coleoptera*). Wireworms (*Elateridae*) have at times damaged tobacco seedlings. In 1943, severe injury occurred at Sipoo (U), where about 4 hectares of a 10-hectare field were completely destroyed. The wireworms penetrated the stem at ground level, and hollowed out the stem even as far as to the terminal parts of the shoots. As a result the plants were stunted and curved, and had ceased growth.

True flies (*Diptera*). In 1946 the larvae of crane flies (*Tipula* sp.) were reported to have destroyed tobacco seedlings by severing their stems at ground level.

Butterflies, moths (*Lepidoptera*). The most injurious moth species is the cabbage moth (*Barathra brassicae* L.), whose larvae were observed as early as 1911 on tobacco seedlings at Tikkurila (U). During the period 1943—1945,

when tobacco was commonly cultivated in Finland, larvae of this species appeared in many localities; they ate large holes in the leaves, or sometimes even destroyed the entire leaf. In addition to this species, small numbers of the larvae of other moths were also found on tobacco leaves at Tikkurila; these included *Polia oleracea* L., *Polia pisi* L. and *Polia persicariae* L. In 1946 slight damage was caused to tobacco by larvae of the silver Y moth (*Phytometra gamma* L.) (KANERVO 1947, p. 100). Larvae of *Eumichtis bathensis* LUTZ. were discovered on tobacco at Lempäälä (EH) in 1945 (SALO and SOTAVALTA 1952, p. 109). Larvae of *Pieris brassicae* L. and *P. rapae* L. have been observed on Virginia tobacco (SEPPÄNEN 1954, p. 370).

As a tobacco pest larvae of the rosy rustic moth (*Hydroecia micacea* ESP.) have been found twice (at Siilinjärvi (PS) in 1932 and at Tyrväntö (EH) in 1943); the larvae damaged the plants by hollowing out the roots and lower part of the stems.

Mites (*Acarina*). The writer once found a light infestation of hop red spider mites (*Tetranychus urticae* KOCH) on home-grown tobacco at Helsinki (U) in 1936.

Molluscs (*Mollusca*). During the years 1943—1945, slugs (*Deroceras agreste* L.) were responsible for severe damage to tobacco in certain localities; they fed on the basal part of the stem, and made large holes in the lower leaves. A small species of snail was also observed on the leaves of tobacco at Tikkurila (U) (Kanervo).

Mammals (*Mammalia*). At Laukaa (PH) in 1944, the field vole (*Microtus agrestis* L.) was reported to have damaged tobacco seedlings growing in frames.

13. Osier willows

Beetles (*Coleoptera*). The brassy willow beetle (*Phyllodecta vitellinae* L.) has sometimes been found to have damaged the leaves of the purple willow.

Sawflies (*Hymenoptera*). At Mouhijärvi (St) in 1952, sawfly larvae were observed on the terminal shoots of common osier, but the species was not determined.

True flies (*Diptera*). Globular or knobby-shaped stem galls caused by *Rhabdophaga salicis* SCHRK have been observed several times in the shoots of different species of willow (*Salix purpurea, S. purpurea nana* and *S. viminalis*). R. FORSIUS (1927, p. 36) mentioned finding stem galls of *Rhabdophaga dubiosa* KIEFF. (*Rh. dubia* KIEFF.) in *Salix ?purpurea* at Tikkurila (U) in 1924. Curled galls on the edges of the leaves of osier willow due to *Rhabdophaga marginemtorquens* BREMI were found at Helsinki (U) in 1922 (R. FORSIUS 1922; FREY 1925).

Moths (*Lepidoptera*). Larvae of *Amorpha populi* L. have been observed feeding on the leaves of purple willow at Tikkurila (U). The shoots of osier willow plants at Mouhijärvi (St) were found in 1952 to be infected with leaf rolls produced by the larvae of *Cnephasia virgaureana* TR. Similar injury occured on purple willow at Hyvinkää (U) in 1945; in this case at least 59 per cent of the leaves — or even more in some plants — were curled by the larva of *Cacoecia rosana* L.

14. Russian dandelion

The Russian dandelion (*Taraxacum kok-saghyz*) was experimentally cultivated in Finland during the period 1943—1948, with a view to acquiring raw material for rubber manufacture. With rubber again being imported from abroad after the war, the cultivation of this plant was abandoned. The Russian dandelion was found to be damaged by the following pests (SUOMELA 1950, p. 109—111):

Beetles (*Coleoptera*). Wireworms (*Agriotes* sp.) caused very slight injury at Porvoo (U) in 1943 and Savio (U) in 1946 by feeding on the roots.

Ants (*Hymenoptera, Formicidae*). Ants were a very troublesome pest to Russian dandelion plantings, especially on sandy soils. The most harmful of them was the common black ant (*Lasius niger* L.) which injured the roots of the young seedlings to such a degree that they remained short and stunted. In some locations 30—70 per cent of the seedlings were damaged.

Molluscs (*Mollusca*). In 1946, grey field slugs (*Deroceras agreste* L.) completely destroyed the leaves of Russian dandelion plants over an extent of several ares at Hanko (U).

15. Field vegetables

A. Crucifers

This group of crops is attacked largely by the same species of pest as those affecting cruciferous root and forage crops. However, as cruciferous vegetables form a group of their own, and are often subjected to more severe damage than field crops, it is useful to deal with their pests separately.

Earwigs (*Dermaptera*). The earwig (*Forficula auricularia* L.), which was earlier quite rare in Finland, has become extremely prevalent since 1952 in many places in the southern regions of the country, extending to Jyväskylä (PH), Kuopio (PS) and Joensuu (PK). In the years 1952, 1953 and 1956 in particular, many reports were made of its occurrence in yards, gardens and hay fields. It has also been found as a pest on vegetables, such as cauliflower.

Plant bugs, aphids, etc. (*Hemiptera*). From time to time, large infestations of plant bugs (*Lygus* spp.) have appeared on cabbage seedlings in the early part of the summer. They damage the growing point of the seedling, and feed on the leaves; in severe cases they kill the plant. In some years, destruction has been particularly great in the provinces of Kainuu and North Ostrobothnia. Plant bugs have also attacked seedlings of radish, horse-radish and turnip. The sloe bug (*Dolycoris baccarum* L.) has sometimes appeared profusely on various cruciferous plants, feeding on turnip, radish, horse-radish and cabbage seedlings. Radishes in frames are attacked at an early stage by this pest, and either they are destroyed completely, or their development is greatly hindered. The cabbage shield bug (*Eurydema oleraceum*

L.) has often brought about substantial injury to cabbage seedlings, as well as to turnip, radish and horse-radish. LINNANIEMI (1935, p. 113) mentioned a rather heavy infestation of the leafhopper species *Tettigella viridis* L. and *Euacanthus interruptus* L. on cabbage plants at Liperi (PK) in 1919; larvae of the diamond-back moth were also present in the infestation.

Large swarms of the cabbage aphid (*Brevicoryne brassicae* L.) live on the under surface of the leaves of various cruciferous vegetables, especially cabbage and cauliflower. In some years, they may be so numerous that they hinder the cultivation of these crops. This species, mentioned first in the 1906 annual report of the State entomologist (E. REUTER 1909, p. 11), was remarked in great numbers on cabbage and other related plants in 1920 and 1950—1952. Currently, its distribution extends as far as to the regions of Pori (St), Tampere (EH), Mikkeli and Lappeenranta (ES) (MARKKULA 1953, p. 5). *Lipaphis erysimi* KALT. has been found on radish (Heikinheimo), and on cabbage at Tikkurila (U) in 1959 (Markkula).

Beetles (*Coleoptera*). In general, the pests which attack seedlings of cruciferous vegetables are the same as those attacking cruciferous root crops. Flea beetles, particularly *Phyllotreta undulata* KUTSCH., commonly damage or completely destroy young seedlings of radish and cabbage. At times, they also feed on the leaves of horse-radish. Other species of flea beetles which similarly cause damage are *Ph. vittata* FABR., *Ph. nemorum* L. and *Ph. flexuosa* ILL., of which the last-mentioned has occasionally been found on horse-radish. *Ph. atra* FABR. has now and then appeared profusely on cabbage and cauliflower. One particular pest of horse-radish is the horse-radish flea beetle (*Ph. armoraciae* KOCH), which has in some places been the originator of severe injury to this plant. However, the species is quite rare in Finland, and found as a pest only in the provinces of Finland Proper, Uusimaa and South Häme. Its larvae live in the petioles of horse-radish, and bore tunnels in them (POPPIUS 1901 a).

The mustard beetle (*Phaedon cochleariae* FABR.), a serious pest of cruciferous root crops, has often brought about severe depredations to cabbage, cauliflower, radish and horse-radish, especially in the epidemic years of the 1920's and 1930's. As an example of its destructive effect, in 1924 this pest completely destroyed 1000—2000 cabbage seedlings on each of three fields. In later years, the damage caused by this beetle has been milder. One of the host plants of *Phaedon armoraciae* L. has been found to be horse-radish (KANERVO 1939, p. 147). In 1915, a moderate infestation of the rove beetle (*Trogophloeus pusillus* GRAV.) occurred in cabbage frames at Loppi (EH), but the vigorously-growing seedlings were injured but slightly.

The blossom beetle (*Meligethes aeneus* FABR.) has at least once been reported as appearing abundantly on cabbage in the vicinity of a turnip rape field, but no appreciable damage was done. In 1959, there was an outbreak of this pest on cauliflower and broccoli at Piikkiö (V), where the inflorescences of the plants were damaged (Annual Report of the Dept. of Horticulture 1959). The beet carrion

beetle (*Aclypea opaca* L.) has on occasion subjected cruciferous vegetables (cabbage, cauliflower, radish) to severe attack, feeding on the leaves of young seedlings, and sometimes destroying them completely. Such attacks are most common in the central and northern parts of Finland, but occur at times in the southern regions of the country. Large numbers of *Bembidion quadrimaculatum* L., along with other species of *Bembidion*, have sometimes been found in cabbage fields, but their destructiveness to the crop has not yet been established. One single instance has been reported of the beet tortoise beetle (*Cassida nebulosa* L.) severely damaging cabbage seedlings growing in a frame (LINNANIEMI 1935, p. 36).

Otiorrhynchus dubius STRÖM, which is rather common, and has spread as far as Lapland, has appeared twice (at Kuusamo (Ks) in 1915 and at Raahe (KP) in 1918) as a pest of cabbage and swede, feeding on the stalks and leaves of young seedlings (LINNANIEMI 1920, p. 47—48; 1935, p. 37). The adult cabbage stem weevil (*Ceuthorrhynchus quadridens* PANZ.) injures cabbage seedlings, at times when they are growing in frames, by gnawing small holes in their leaves. In the larval stage, however, this pest is responsible for many times as much economic loss with respect to cabbage. On occasion, it has caused great damage to cabbage plants transplanted on the field. Cabbage fields situated in the vicinity of the previous year's turnip rape cultivations are especially threatened by this pest. In one case (at Helsinki (U) in 1955), 90 per cent of 20 000 seedlings of cabbage, cauliflower and Brussel sprouts were destroyed, with the consequence that the whole field had to be ploughed under. At the end of the summer, furthermore, large swarms of new generation adults may migrate from turnip rape to adjoining cabbage plantings, and damage the crop to some extent. The cabbage seed weevil (*C. assimilis* PAYK.) has likewise been observed to migrate from turnip rape to cabbage. In the spring, horse-radish has sometimes found to be infested by the cabbage seed weevil and the cabbage curculio (*C. rapae* GYLL.), as well as by smaller numbers of *Ceuthorrhynchus roberti* GYLL., but apparently no resultant damage. Root galls produced by the turnip gall weevil (*C. pleurostigma* MARSH.) have sometimes been plentiful in seedlings of radish and turnip in certain places in south Finland. A published report (HUKKINEN and VAPPULA 1935, p. 43) mentioned the finding of galls apparently caused by *C. contractus* MARSH. in the stems and petioles of cabbage seedlings. But as later investigations have proved that larvae of this weevil live as leaf-miners, there is no doubt that these galls were the work of another pest species.

Wireworms (*Elateridae*) have often caused substantial damage to seedlings of cabbage and cauliflower, and in addition sometimes attack radish. Wireworm pests infesting cruciferous vegetables also include mention of *Agriotes obscurus* L., and uncertain reports of *Corymbites aeneus* L. and *C. pectinicornis* L. In one case, the dorbeetle (*Geotrupes* sp.) was observed to have dug tunnels in the plant beds of a vegetable garden, thereby damaging cabbage seedlings (E. REUTER 1909 a, p. 12).

Sawflies, ants (*Hymenoptera*). Large numbers of larvae of the turnip sawfly (*Athalia colibri* CHRIST.) have at times been found on cabbage and

cauliflower. Wood ants (*Formica rufa* L.) have been observed to inflict slight injury on the leaves of cabbage seedlings growing in a garden at the edge of a forest.

True flies (*Diptera*). Cabbage and related vegetable plants are commonly, and often very severely, attacked by the cabbage root fly (*Hylemyia brassicae* BCHÉ) and the turnip root fly (*H. floralis* FALL.). Nearly every year, these pests are responsible for losses in yield amounting to 10—20 per cent, and may in severe cases destroy entire plantings. Damage is inflicted throughout the whole country, including Lapland. The larvae damage not only cabbage, but also injure radish, and on rare occasions horse-radish. These two species of flies can be considered as the most destructive cabbage pests in Finland. Other species with cabbage as a habitat include *H. liturata* MEIG. (*H. florilega* ZETT.) and *H. platura* MEIG. (*H. fusciceps* ZETT.). According to the studies of KANERVO (1954), based on an extensive collection made over many years, the proportions of the different cabbage fly species were as follows: *Hylemyia floralis* 53—85 per cent, *H. brassicae* 5—30 per cent, *H. liturata* 3—15 per cent and *H. platura* 2—7 per cent. The proportion of other species was 3—8 per cent; of these *Hylemyia radicum* L. might inhabit the roots of cruciferous vegetable crops.

In the early and middle part of the summer, cabbage seedlings are quite often damaged by the larvae of crane flies (*Tipula* sp.), which sever the stem at soil level. Such damage has appeared since 1914 in the southern and central parts of the country, extending as far north as Kainuu. In many cases the injuries have been very severe, with destruction of as much as 75—100 per cent of the seedlings. The most important species appears to be the common crane fly (*Tipula oleracea* L.); this species was reared from a sample obtained in 1931 from Sääminki (ES).

Larvae of *Phytomyza rufipes* MEIG. have sometimes been observed to cause slight injury to the petioles of cabbage and turnip leaves, with resultant yellowing of the leaves. On some rare occasions, blister mines have been found in cabbage leaves; the causal agent was apparently *Scaptomyza flaveola* MEIG.

Butterflies, moths (*Lepidoptera*). In general, cruciferous vegetables are attacked by the same pests as those which damage cruciferous field crops. A very common and harmful pest, especially as regards cabbage, is the large white butterfly (*Pieris brassicae* L.), whose larvae, at the end of summer, often feed so completely on the leaves that only the petioles and larger veins remain. Damage has also been found from time to time on garden turnip, horse-radish and plants of the genus *Raphanus*. The worst epidemic years of this pest are listed on page 55. In some years, large numbers of the larvae of the green-veined white butterfly (*Pieris napi* L.) and the small white butterfly (*P. rapae* L.) appear on cabbage, and more rarely on radish and horse-radish; often they are found together with larvae of the large white butterfly.

An especially destructive cabbage pest throughout all Finland is the diamond-back moth (*Plutella maculipennis* CURT.), whose larvae do great damage by feeding on the leaves. Young seedlings suffer in particular, since their inner, succulent leaves

are favoured by the larvae. In cauliflowers the larvae penetrate the inflorescence and bore tunnels therein, spoiling it completely. Occasionally leaves of radish, horse-radish and garden cress are also damaged. In general, the diamond-back moth apparently prefers cabbage and swede to turnip (KANERVO 1936, p. 18). Similar injury is attributable to *Pl. annulatella* CURT., with special reference to north Finland.

The garden pebble moth (*Mesographe forficalis* L.), first mentioned as a pest in this country in 1913, has in some years appeared in destructive numbers on cabbage, and sometimes also on garden turnip and horse-radish. The larvae are especially noxious to cabbage seedlings, of which they often severely damage the inner leaves. They also eat the leaves of horse-radish so completely that only the leaf skeleton remains. Destruction caused by this pest has been reported from south and central Finland, ranging as far north as North Ostrobothnia (Muhos, Utajärvi) and Kainuu (Hyrynsalmi).

Larvae of the cabbage moth (*Barathra brassicae* L.) occasionally appreciably damage cabbage and cauliflower in the autumn, by boring tunnels in heads and inflorescences and by fouling them with their excrement. In the period 1914—1917, this species was very common over wide areas of the country, and in 1917 particularly caused very severe damage to cabbage. Epidemic years have since occurred in 1935—1936, and particularly 1941 (HUKKINEN 1942; BRUUN 1949, p. 110) and 1945. At Lohja (V), observations made by H. KROGERUS (1946, p. 48—49) showed that the species began to reappear in 1941, after having been completely absent or present only in small numbers during the period 1910—1940. Similar observations were made by HEINÄNEN (1947, p. 31—32) in the region of Lahti (EH) and by NORDMAN (1943, p. 146) elsewhere in south Finland. At Forssa (EH), larvae were especially abundant in 1933 (KERÄNEN 1958). The larvae have been found not only on cabbage, but also on radishes (SEPPÄNEN 1954, p. 324). Destruction effected by the cabbage moth has been reported as far up as North Ostrobothnia. Larvae of the tomato moth (*Polia oleracea* L.) have appeared as pests of various vegetables, markedly so in south Finland (NORDMAN 1943, p. 145—146). Also in the region of Vaasa (EP) larvae have been found on cabbage plants (LINGONBLAD 1944, p. 133). On occasion, larvae of *Polia pisi* L. have slightly injured cabbage and horse-radish, *Xylina vetusta* HB. cabbage, and *Orgyia antiqua* L. cabbage seedlings. Similarly, larvae of *Amphipyra tragopogonis* L. have infested cabbage and related crops (KERÄNEN 1958). On one occasion, larvae of the peppered moth (*Biston betularius* L.) were observed to have migrated from apple trees and berry bushes to nearby cabbage plants, where they fed on the leaves (K. J. VALLE 1917).

In 1946, there was a serious outbreak of the silver Y moth (*Phytometra gamma* L.) in wide areas of southern and central Finland; larvae appeared on many kinds of plants, including cabbage and related crops, and damaged them severely (KANERVO 1947, p. 99; EKHOLM 1947). Larvae had earlier been found on cabbage at Tikkurila (U) in 1915 and throughout many parts of southwest Finland in 1922, although in

these two years the injuries were appreciably less pronounced. At times, larvae of *Cnephasia virgaureana* TR. have attacked cabbage seedlings, and inflicted damage by rolling the leaves and feeding on them. In a few instances, larvae of the rosy rustic moth (*Hydroecia micacea* ESP.) have bored into the stems of cabbage seedlings.

Among the most destructive pests of cruciferous vegetables in this country are larvae of *Agrotis*, often the cause of great damage by destroying the underground parts of the plants. One important species is the common dart moth (*Agrotis segetum* SCHIFF.), which has in the autumn been observed to sever the roots of cabbage and cauliflower, and also to feed on the leaves and stems of the plants (HUKKINEN 1913, p. 157; 1913 a). In early summer, the larvae damage cabbage seedlings by chewing the stem and sometimes completely severing it at or near ground level. As an example, in 1934 larvae destroyed about 8000 cauliflower seedlings in a plantation near Helsinki (U). However, damage occurring in the early summer is usually the work of species other than the common dart moth. Other cabbage seedling pests have been *Euxoa tritici* L. at Rauma (St) in 1952, *E. obelisca* HB. near Viipuri (EK) in 1934 and according to GRÖNBLOM (1941) *Triphaena pronuba* L. at Tampere (EH) in 1941. In addition, it has been reported that *Agrotis clavis* HUFN. (*A. corticea* HB.) has damaged many kinds of garden vegetables, particularly young seedlings (SAALAS 1933, p. 549).

Mites (*Acarina*). *Uropoda* (*Urosternella*) *obnoxia* E. REUT. has occasionally inflicted injury on seedlings of red cabbage, cauliflower and radish in south Finland. The mites congregate at the base of the stem and feed on it; sometimes considerable damage ensues (NORDENSKIÖLD and E. REUTER 1904; E. REUTER 1904, p. 17—18; 1905 a).

Molluscs (*Mollusca*). Grey field slugs (*Deroceras agreste* L.) often seriously injure cabbage and cauliflower, as well as other related crops in south and central Finland. They feed on the plants either in the seedling stage or — more commonly — at the end of the summer, sometimes destroying complete fields by boring tunnels into the cabbage heads, or injuring the cauliflower inflorescences. Radish has also been attacked. Another occasional cabbage pest is *Deroceras laeve* MÜLL. On one occasion (Janakkala (EH) in 1916), *Succinea putris* L. was found to have inflicted mild injury on cabbage by eating holes or grooves in the leaves. In 1949, *Arianta arbustorum* L. was responsible for some injury to horse-radish at Karjaa (V).

Birds (*Aves*). At certain times, the hooded crow (*Corvus corone* L.) has been seen eating seedlings of various plants, including cabbage and swede (HILLI 1927, p. 122; 1929, p. 35).

Mammals (*Mammalia*). BRANDER (1960) reported that in the spring the mountain hare (*Lepus timidus* L.) severed cabbage seedlings at soil level, and thus greatly damaged recently-transplanted seedlings. The European hare (*Lepus europaeus* PALL.) is a common visitor to cabbage fields, where it feeds on the heads of the cabbage. The Norway rat (*Rattus norvegicus* ERXL.) has been observed to

establish itself in frames, where it stirs up the soil and feeds to a slight extent on radish seeds (at Lappeenranta (ES) in 1936). Damage by rats also occurred in a Helsinki (U) garden in 1943; in this instance, cauliflower and kohl-rabi were damaged. According to MYLLYMÄKI (1959, p. 79) voles (*Arvicolidae*) may inflict injuries on cabbage and swede.

B. Onions

Springtails (*Collembola*). In 1945, springtails were observed in rather large numbers on onions at Tikkurila (U); they caused slight injury by eating small holes in the leaves (Kanervo).

Thrips (*Thysanoptera*). Onion thrips (*Thrips tabaci* LIND.) are often abundantly present on onions, where they produce light-coloured spots in the leaves; in severe cases, the leaves may wither completely. This polyphagous species is common in the southern and central parts of the country.

Beetles (*Coleoptera*). The lily beetle (*Lilioceris merdigera* L.), whose damage was observed for the first time in Finland near Helsinki (U) in 1915, has several times been encountered as a pest of set, seed and Egyptian onions. Injuries attributable to this beetle have mainly been reported in south Finland, but in 1954 they were reported at Teerijärvi (KP), and in 1934 from as far off as Kuhmoniemi (Kn). Since 1947, the species has invaded onion plantings in some localities in Ahvenanmaa (NORDMAN 1957). *Phyllotreta undulata* KUTSCH. was once observed injuring seed onions by eating small holes in the leaves.

Damage caused by wireworms (*Elateridae*) has been reported from various parts of the country, sometimes to such a great extent that the yield has been partly or completely spoiled. The larvae eat holes in set onions, and sever the seedlings of seed onions. One report stated that they had severed the stalks of leek at ground level. The most important onion pests are *Agriotes obscurus* L., and, with special reference to the south of the country, *A. lineatus* L., and possibly *Corymbites aeneus* L. Larvae of the cockchafer (*Melolontha hippocastani* FABR.) have sometimes been observed causing damage by destroying onions and leeks.

True flies (*Diptera*). This order of insects includes the most injurious onion pests, viz. the onion fly and the small bulb flies. The onion fly (*Hylemyia antiqua* MEIG.), first reported as a pest in 1903, is distributed as far north as Inari Lapland. It produces two generations during the summer, of which the first larval generation in the middle of summer causes more severe damage than the second generation at the end. Injuries are principally observable in onions, whereas leek and grass onion are only slightly damaged (KANERVO 1939, p. 7). Similar damage is generally caused by the larvae of the small bulb flies (*Eumerus*), first accorded serious consideration in 1915. At first these flies were thought to belong to a single species, until KANERVO (1935, 1942) showed that there are two species living in

onions, *Eumerus strigatus* FALL. and *E. tuberculatus* ROND., of which the latter appears somewhat more prevalent. Both are distributed as far north as Lapland. Together with the onion fly, small bulb flies every year cause substantial damage to onion plantings, regularly destroying 20—25 per cent of the yield, and sometimes as much as 50—100 per cent. Set onions are the most frequent objectives of both these genera, whereas larvae of the onion fly alone are generally found in seed onions. Other species found attacking onions include *Hylemyia liturata* MEIG. and *Muscina assimilis* FALL. (KANERVO 1954). Larvae of the spotted crane fly (*Pachyrrhina maculata* MEIG.) were once observed (at Korso (U) in 1913) to have injured onion plants (LINNANIEMI 1915, p. 47). In 1936 larvae of *Thereva* sp. were found in seed onions at Tikkurila (U) (Kanervo).

Occasionally, large numbers of mines made by the chrysanthemum leaf miner (*Phytomyza atricornis* MEIG.) have been observed in onion leaves, but the damage was slight.[1]) Observations made at Tikkurila (U) indicated similar injury as being inflicted by the larvae of *Hydrellia griseola* FALL., which are sometimes found in profusion, especially in the strains of set onions with wide and flattened leaves (Kanervo).

M o t h s (*L e p i d o p t e r a*). Several species of noctuids have been found as leaf-injuring onion pests. In the epidemic year 1946, larvae of the silver Y moth (*Phytometra gamma* L.) also caused rather serious damage to onions (KANERVO 1947, p. 99; EKHOLM 1947). In 1936, many larvae of *Triphaena pronuba* L. and small numbers of *Scotogramma trifolii* ROTT.[2]) and *Polia contigua* SCHIFF. were discovered on seed onions at Tikkurila (U). According to investigations made at Tikkurila in 1945, onions were mostly infested by larvae of *Barathra brassicae* L. and to some extent by the above-mentioned species; in addition, larvae of *Hadena reticulata* VILL., *Polia pisi* L. and apparently also *Polia thalassina* ROTT. were found; the larvae fed on the interior of the leaves (Kanervo). At Oulainen (KP) in 1935, onions were infested by larvae of *Amphipyra tragopogonis* L., which fed only on those leaves diseased by downy mildew (Kanervo). Larvae of *Xylina exoleta* L. have been reported on onions in Ahvenanmaa (SEPPÄNEN 1954, p. 280). Similarly, larvae of *Tortrix politana* HAW. were once observed (at Tikkurila (U) in 1946) to have injured onion leaves (Kanervo).

Larvae of *Euxoa nigricans* L. appeared in 1932 at Kuusjoki (V), where they damaged onions by severing the stalks at soil level (VAPPULA 1940). The same species destroyed young onion plants growing in frames at Lempäälä (EH) in 1950. On several other occasions, similar types of injury have been observed, for instance on leek, but the exact species has been unknown. R. PALMGREN (1916 a) found cutworms in the bulbs and stalks of grass onion growing on an outer island in the Gulf of Finland.

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[1]) As early as 1915—1916, LINNANIEMI (1920, p. 171) found mines in the leaves of onions at Tuusula (U) and Raahe (KP), but the species was not determined.

[2]) Larvae have been found on onions in Ahvenanmaa and Finland Proper (SEPPÄNEN 1954, p. 280).

Larvae of *Arctia caja* L. have also been observed on grass onion in Uusimaa (SEPPÄNEN 1954, p. 280).

Mites (*Acarina*). The bulb mite (*Rhizoglyphus echinopus* FUM. & ROB.) has sometimes appeared as a pest in onion cultivations. Its attack results in the plants beginning to decay even in the field, and the onions after harvest may completely spoil. *Eriophyes tulipae* KEIFER is mainly a pest of stored onions. It was found for the first time in Finland at Lepaa (EH) in 1942 (LIRO 1942; 1943, p. 29—31); the damage it inflicted was estimated at about 30 per cent. The species lives principally on the succulent scale leaves, and gives rise to drying of their outer surface. So far, this mite has been found as remotely as North Ostrobothnia (LIRO and ROIVAINEN 1951, p. 140—141). Slight infestations of *Uropoda* (*Urosternella*) *obnoxia* E. REUT. have been observed on onions growing in frames.

Molluscs (*Mollusca*). In severe epidemic years, the grey field slug (*Deroceras agreste* L.), possibly with other related species, has heavily attacked onions, sometimes bringing about complete loss of the crop.

Birds (*Aves*). The hooded crow (*Corvus corone* L.), jackdaw (*Corvus monedula* L.), magpie (*Pica pica* L.) and house sparrow (*Passer domesticus* L.) have sometimes been seen eating onions (HILLI 1927, 1929).

Mammals (*Mammalia*). In some instances, the common mole (*Talpa europaea* L.) has been responsible for great damage by digging tunnels through onion fields; the plants withered and died as a consequence.

C. Beans and garden peas

Springtails (*Collembola*). *Onychiurus armatus* TULLB. was once mentioned (at Vihti (V) in 1904) as having injured beans just after their emergence (E. REUTER 1906 b; 1908, p. 14—15).

Thrips (*Thysanoptera*). Pea thrips (*Kakothrips robustus* UZ.), mentioned for the first time as a pest in Finland in 1906—1907 (E. REUTER 1910, p. 12—13), has from time to time appeared as a destructive pest of both garden and field peas (cf. p. 37). In many cases it has meant losses of 50—60 per cent, and sometimes the entire crop has been almost completely destroyed. The species seems especially to favour sugar peas. In 1936, there was a very severe infestation of *Taeniothrips atratus* HAL. in the flowers of dwarf bean in a Helsinki (U) garden. Most of the flowers were quite full of these thrips, and apparently for this reason were withered (HUKKINEN and SYRJÄNEN 1940, p. 128).

Plant bugs, aphids (*Hemiptera*). *Lygus* bugs have been seen on beans, but with no appreciable injury being caused. The sloe bug (*Dolycoris baccarum* L.) was once reported as abounding on the pods of peas and broad beans, where they inflicted slight damage. The pea aphid (*Acyrthosiphon pisum* HARR.) is relatively common on pea plants, but only rarely does it occur in injurious numbers on the

foliage and pods of garden peas. Occasionally, the bean aphid (*Aphis fabae* SCOP.) has appeared abundantly on the shoots of broad beans. In addition, the peach-potato aphid (*Myzus persicae* SULZ.) and *Aulacorthum solani* KALT. (*Macrosiphum pelargonii* KALT.) has been reported on beans grown in the greenhouse (HEIKINHEIMO 1945).

Beetles (*Coleoptera*). In a few rare cases, the beet carrion beetle (*Aclypea opaca* L.) has given rise to severe damage to garden peas, and milder damage to beans and broad beans. The pea and bean weevil (*Sitona lineatus* L.) (cf. p. 38), along with other related species, is frequently very prevalent on sugar peas, round-seeded and wrinkled-seeded peas; they feed on the young seedlings, sometimes destroying them almost completely. At times, they have also damaged the seedlings of beans and broad beans.

Large numbers of *Apion flavipes* PAYK. and *A. assimile* KIRBY appeared in 1933 on the leaves of beans at Vehmaa (V); they made small holes in the leaves, which as a result turned partly brown. No other instances of *Apion* damage to beans have been reported in Finland. In 1900, flea beetles (*Halticinae*) appeared on young bean plants and injured their leaves (E. REUTER 1901 a, p. 23), but the species was not mentioned.

Although legumes are generally considered to be less favoured as host plants by wireworms (*Elateridae*), reports have in some cases been received of these larvae invading in great numbers garden peas and dwarf beans, and causing substantial damage. Apparently the main destructive species was *Agriotes obscurus* L. Larvae of the cockchafer (*Melolontha hippocastani* FABR.) have occasionally injured bean plants. The dorbeetle (*Geotrupes* sp.) was once reported as having dug tunnels in the soil of a garden, with the result that seedlings of peas and beans were almost completely destroyed. Undecomposed manure had been mixed with the soil; this had attracted the dorbeetles, and thus gave a part explanation of the poor growth of the plants (E. REUTER 1909 a, p. 12).

True flies (*Diptera*). Crane flies, principally the common crane fly (*Tipula oleracea* L.), were reported by E. REUTER (1909, p. 7—9) to have injured peas and beans, but to date no particular observations have been made of damage attributable to these flies. At Siilinjärvi (PS) in 1943, there was a severe infestation of larvae of *Hylemyia liturata* MEIG. in young seedlings of dwarf beans. The larvae lived in the stems, where they bored tunnels, even into the cotyledons, with the consequence that the seedlings grew slowly or were destroyed. In addition to the above-mentioned species, larvae of *Hylemyia pilifemur* RINGD. were also responsible for damage.

Occasionally, large numbers of both tunnel mines and blister mines have been found in the leaves of garden peas; the causal agents were probably the species *Phytomyza atricornis* MEIG. or *Liriomyza strigata* MEIG. and *Scaptomyza flaveola* MEIG. (cf. p. 38). LINNANIEMI (1913, p. 52) observed that also in the leaves of broad beans there were to be seen fine, twisting tunnel mines, whose causal agent he gave as

Agromyza scutellata FALL. However this name has since disappeared from the taxonomy. According to FREY (1946, p. 15), leaf-miners of broad beans include *Liriomyza congesta* BECK., *L. strigata* MEIG. and *Phytomyza atricornis* MEIG., all of occurrence in Finland.

The shoots, flowers and pods of sugar peas and other kinds of garden peas are sometimes severely damaged by larvae of the pea midge (*Contarinia pisi* WINN.) (cf. p. 39). In the region of Helsinki (U), in particular, these larvae have substantially damaged garden peas, principally by curling the leaves of the terminal shoots.

Moths (*Lepidoptera*). Cutworms (*Agrotis* sp.) have at times damaged the seedlings of peas, beans and broad beans by severing the stem at soil level and feeding on the lowermost leaves. In 1934, larvae of *Euxoa obelisca* HB. damaged garden legumes in this manner at Viipuri (EK), and in 1951 larvae of *E. nigricans* L. destroyed peas growing in a frame at Tampere (EH). In the epidemic years 1922 and 1946, the silver Y moth (*Phytometra gamma* L.) was responsible for severe damage to both peas and beans (cf. p. 39), by feeding on the leaves and injuring the flowers and pods. The writer once observed (at Helsinki (U) in 1925) a larva of *Xylina vetusta* HB. eating the leaves of broad beans, and Heikinheimo reported that *Xylina exoleta* L. appeared at Perniö (V) in 1945, where it gave rise to slight injury by feeding on the tips of garden pea shoots. Larvae of *Orgyia antiqua* L. were also found once on broad beans.

The most destructive pest to garden pea seeds is the pea moth (*Laspeyresia nigricana* FABR.), whose larvae often destroy most of the seeds, and at the same time make the pods undesirable for consumption (cf. p. 39).

Mites (*Acarina*). The hop red spider mite (*Tetranychus urticae* KOCH) has occasionally infested runner beans, dwarf beans and sugar peas; runner beans suffer considerably from its depredations.

Myriapods (*Myriopoda*). One myriapod species was once mentioned (at Messukylä (EH) in 1915—1916) as having injured the seeds of sown beans and peas (LINNANIEMI 1920, p. 219). Myriapods were also responsible for severe damage to germinating peas at Kangasala (EH) in 1951.

Molluscs (*Mollusca*). In some epidemic years, grey field slugs (*Deroceras agreste* L.) and other related species, heavily attack garden peas and beans. Slugs have at times appeared in large numbers even at the beginning of the summer, damaging germinating bean seeds, or completely destroying large numbers of seedlings.

Birds (*Aves*). House sparrows (*Passer domesticus* L.) have sometimes proved a nuisance in gardens by breaking open unripe pea pods and eating the seeds. According to data collected by HILLI (1927, 1929), the continental jay (*Garrulus glandarius* L.), fieldfare (*Turdus pilaris* L.) and wood-pigeon (*Columba palumbus* L.) have sometimes been seen feeding on peas and beans.

Mammals (*Mammalia*). The yellow-necked field-mouse (*Apodemus flavicollis* MELCH.) was said by K. E. KIVIRIKKO (1940, p. 61) to have caused damage

by breaking pea pods in gardens. In a similar fashion, the Norway rat (*Rattus norvegicus* ERXL.), when in large numbers, may destroy pea pods (for example, at Korkeasaari in Helsinki (U) in 1943). According to VÄLIKANGAS (1942), bank voles (*Clethrionomys glareolus* SCHREB.) were particularly numerous in 1941—1942 at Sipoo (U), where they gnawed at pea pods, and carried them away to their winter storage places; as a result the yield of one variety of round-seeded pea was reduced by at least 30 per cent. According to MYLLYMÄKI (1959, p. 79), damage attributable to voles (*Arvicolidae*) has also been found on the young shoots of garden pea plants.

D. Cucumbers

Springtails (*Collembola*). The garden springtail (*Bourletiella pruinosa* TULLB.) has at times injured the leaves of cucumber seedlings, both in frames and in outdoor plantings (LINNANIEMI 1920 b, p. 17).

Thrips (*Thysanoptera*). Onion thrips (*Thrips tabaci* LIND.) seriously infested cucumbers in frames at Piikkiö (V) in 1935 (HUKKINEN 1936 a, p. 132).

Plant bugs, aphids (*Hemiptera*). *Lygus* bugs have occasionally appeared in profusion on cucumbers, which they damage, and particularly the young terminal leaves. At Anjala (U) in 1951 and 1952, these pests destroyed 50—75 per cent of the cucumber crop. At Raahe (KP) in 1918, the common green capsid (*Lygus pabulinus* L.) was observed in large numbers together with *Calocoris ?fulvomaculatus* DEG. on cucumbers growing out-of-doors; the plants withered as a result of the infestation. At Tuusula (U) in 1915, larvae and adults of some psyllid (*Psylla* sp.) appeared on the lower surface of the cotyledons of cucumber seedlings which had been transplanted outdoors; the pests caused yellow spots in the leaves. The species was not determined (LINNANIEMI 1920, p. 180—181). Occasionally, small numbers of aphids have been found on the leaves of cucumbers in various parts of the country, but to date it is not known whether these were melon aphids (*Aphis gossypii* GLOV.), as was presumed by LINNANIEMI (1935, p. 121—122). According to E. REUTER (1901, p. 33), aphids severely infested cucumbers, especially those in frames, at Espoo (U) in 1900, with the result that the leaves wilted and shrivelled. The peach-potato aphid (*Myzus persicae* SULZ.) has also been observed on cucumbers (Heikinheimo).

Beetles (*Coleoptera*). Cucumber seedlings growing in frames are sometimes severely attacked by rove beetles (*Trogophloeus pusillus* GRAV.), which make holes in the leaves and fruits. The damage was observed for the first time in Finland near Helsinki (U)[1]) in 1906. Subsequently the species has appeared as a destructive pest in the region of Turku (V), Uusimaa (in and near Helsinki, Per-

[1]) The cause of the damage was stated by E. REUTER (1909, p. 11) to be *Trogophloeus corticinus* GRAV., but evidently the species was in fact *Tr. pusillus* GRAV. (LINNANIEMI 1915, p. 7).

naja), South Häme (Loppi, Tyrväntö, Ylöjärvi) and Central Ostrobothnia (Raahe). Once apparently this species attacked the seedlings of melon growing in frames.

The false cabbage flea beetle (*Haltica oleracea* L.) was mentioned by E. REUTER (1901 a, p. 32) as having injured the leaves of cucumbers growing outdoors at Espoo (U) in 1900. *Bembidion quadrimaculatum* L. and *B. lampros* HBST have on a few occasions been reported as damaging cucumber plantings; in one case, the insects fed on the leaves, and perhaps also severed the plant at the root. The beet carrion beetle (*Aclypea opaca* L.) when in large numbers has also injured cucumbers. At Miehikkälä (EK) in 1934 *Harpalus pubescens* MÜLL. was seen to have severed cucumber seedlings, and fed on the sown seeds so that no more than the empty hull remained.

Wireworms (*Elateridae*) sometimes inflict considerable damage on cucumbers growing outdoors. In some instances, nearly all of the seedlings were destroyed by the larvae. Larvae of the cockchafer (*Melolontha hippocastani* FABR.) have also appeared in damaging amounts in cucumber beds.

Ants (*Hymenoptera, Formicidae*). Ants often constitute a nuisance by building their nests in cucumber frames or in outdoor beds, with the result that the young seedlings suffer from desiccation.

True flies (*Diptera*). In at least one case, larvae of crane flies, most likely the common crane fly (*Tipula oleracea* L.), have damaged outdoor cucumbers. At Piikkiö (V) in 1937, large numbers of the larvae of *Hylemyia liturata* MEIG. appeared as miners in the stems of cucumbers, destroying 60—70 per cent of the seedlings (VAPPULA 1937 b). Evidently injury attributable to the same species occurred in 1943 at Siilinjärvi (PS) and in 1953 at Kuusisto (V); in the latter case the larvae were reported to have injured germinating seeds, later penetrating the stem and hollowing it out. Tunnel mines have sometimes been found in cucumber leaves. Once, such mines were found by LINNANIEMI (1913, p. 116) to originate in the chrysanthemum leaf miner (*Phytomyza atricornis* MEIG.). Small numbers of the same species appeared in 1946 in the leaves of cucumbers growing in frames at Kirkkonummi (U).

Moths (*Lepidoptera*). Cutworms (*Agrotis* sp.) have occasionally appeared in profusion in cucumber beds; in one case they inflicted rather severe injury by severing the seedlings at ground level. Very often, it was not possible to determine which species was responsible. In 1934 at Viipuri (EK), the causal agent was found to be *Euxoa obelisca* HB., and in 1952 at Rauma (St) *Euxoa tritici* L. was established as the pest. In 1946, larvae of the silver Y moth (*Phytometra gamma* L.) caused rather severe localized damage to cucumbers (KANERVO 1947, p. 99). Larvae of the cabbage moth (*Barathra brassicae* L.) have sometimes been found on squash (SEPPÄNEN 1954, p. 376).

Mites (*Acarina*). The hop red spider mite (*Tetranychus urticae* KOCH) has at times attacked cucumbers growing outdoors; as a result of their feeding, the leaves become pale and blotched. This pest has on occasion been responsible for

20 per cent yield losses. The mite is often even more destructive to cucumbers in frames; in the worst cases, the leaves of the plants may wither markedly, resulting in a very poor yield. Squash and melons have also been found infested by this species.

Seedlings of cucumbers in frames are injured by *Uropoda* (*Urosternella*) *obnoxia* E. REUT., which appears in dense clusters at the base of the stem, in some cases bringing about the complete destruction of the seedlings. The species, found for the first time in 1902 at Vanaja (EH) (E. REUTER 1904, p. 17—18; 1905 a; NORDENSKIÖLD and E. REUTER 1904), has since been met as a pest as far away as the region of Kajaani (Kn). It has injured not only cucumbers growing in frames, but also those out-of-doors.

In 1900, there was a large infestation of *Scheloribates laevigatus* KOCH (*Oribata lucasi* NIC.) in one locality at Espoo (U). The pest had as especial target of attack the surface of the fruits of frame cucumbers, feeding on them, and causing their shrivelling and discoloration. The damage was very great, since at least half of the cucumber yield was lost (POPPIUS 1901; E. REUTER 1901 a, p. 33).

Molluscs (*Mollusca*). In years of great destruction, grey field slugs (*Deroceras agreste* L.) and other related species invade cucumbers and feed on their leaves. In one case, slugs were reported to have destroyed two sowings of cucumbers at the cotyledon stage, as well as transplanted seedlings. *Arion circumscriptus* JOHNST. has also been observed to eat cucumber seeds in the spring.

Mammals (*Mammalia*). In one certain case (at Korkeasaari, Helsinki (U) in 1943) Norway rats (*Rattus norvegicus* ERXL.) were mentioned as having attacked various vegetables, including cucumbers. The bank vole (*Clethrionomys glareolus* SCHREB.) was observed to eat young cucumber fruits in 1941—1942 at Sipoo (U) (VÄLIKANGAS 1942). In 1954, at Kumlinge (A), damage was found in the seedlings of this plant which was evidently the work of field voles (*Microtus agrestis* L.) (Myllymäki). Injury attributable to voles has also been found in melons (MYLLYMÄKI 1959, p. 79).

E. Beets

Earwigs (*Dermaptera*). Earwigs (*Forficula auricularia* L.) gave rise to damage to the Swiss chard at Korppoo (V) in 1960, by making large holes in the leaves.

Plant bugs, aphids (*Hemiptera*). There have often been severe infestations by *Lygus* bugs on red beets, where they hinder the growth of the plants by damaging the growing point or — in extra severe cases — they partially or completely destroy the plant. Damage has also been observed on Swiss chard. From time to time destruction has been widespread in the Tornio and Kemijoki River Valleys (PP). The cabbage shield bug (*Eurydema oleraceum* L.) has sporadically been found in very small numbers on red beets. At Karttula (PS) in 1942, large numbers

of *Piesma capitata* WOLFF appeared on young red beet seedlings, where they damaged the lower part of the stalk. The bugs completely destroyed the first sowing of beets, and considerably thinned the second sowing. Also at Tikkurila (U) in 1945, slight injury inflicted by *Piesma* sp. was found on both sugar and red beets (Kanervo). In 1959 the bean aphid (*Aphis fabae* SCOP.) was in a few cases observed on the leaves of red beets.

Beetles (*Coleoptera*). The most destructive pest of red beets in Finland is the beet carrion beetle (*Aclypea opaca* L.), which is often found abundantly in gardens, destroying the young seedlings before they have started to grow. The species is particularly noxious in north Finland, where the cultivation of red beets is at certain times considered to be impossible. Three sowings are sometimes necessary if a reasonable crop is to be obtained. Damage attributable to this pest has also been found on Swiss chard.

Another pest of beet seedlings is the mangold flea beetle (*Chaetocnema concinna* MARSH.), which often riddles the leaves with holes. Injury has been observed almost exclusively in the southern parts of the country, and has as a rule been relatively mild, although severe damage has occasionally been inflicted on red beets and Swiss chard. The beet tortoise beetle (*Cassida nebulosa* L.), whose main host plant is *Chenopodium album*, sometimes moves to red beets, feeding on their leaves and in the worst event destroying them completely; red beet fields in south and central Finland have been damaged in this way.

In a few instances, wireworms (*Elateridae*) have injured the seedlings of red beets. Similarly, larvae of the cockchafer (*Melolontha hippocastani* FABR.) have at times damaged gardens by severing the roots of the beet seedlings. Larvae are most numerous in fields previously under ley.

True flies (*Diptera*). The larvae of the beet fly (*Pegomyia hyoscyami* PANZ.) (cf. p. 50) at times constitute serious pests in beet plantings. When the attack is severe, the leaves dry almost completely, and the yield is consequently low. Thus, in 1923 50—100 per cent of the crop was destroyed in some localities.

Moths (*Lepidoptera*). Larvae of the silver Y moth (*Phytometra gamma* L.) injured beets, generally mildly in 1922. Against this, there was a serious epidemic of this species in southwest Finland in 1946, when red beets were included among the plants attacked and in many cases almost completely defoliated by the larvae (KANERVO 1947, p. 99—100). As the damage was done at the end of the summer, the plants were able to recover following rain. In 1933, larvae of *Scotogramma trifolii* ROTT. were found on red beets at Helsinki (U).

Myriapods (*Myriopoda*). Evidently a species of myriapod was responsible for severing red beet seedlings at the base of the stalk in one instance (at Pori (St) in 1915); there were large numbers of this pest, which destroyed about 60 seedlings on a surface area of one square metre (LINNANIEMI 1920, p. 218—219).

Molluscs (*Mollusca*). Occasionally slugs (*Deroceras agreste* L., etc.) invade plantings of red beets and severely damage their leaves. *Arion circumscriptus*

JOHNST. injured red beets in two cases, one of which resulted in the destruction of about 90 per cent of the plants.

Mammals (*Mammalia*). The common mole (*Talpa europaea* L.) has destroyed entire rows of red beet seedlings by digging tunnels in gardens. Norway rats (*Rattus norvegicus* ERXL.) were mentioned as having invaded a vegetable garden at Helsinki (U), damaging red beets. The bank vole (*Clethrionomys glareolus* SCHREB.) has also been a destructive pest in red beet plantings, for example at Sipoo (U) in 1941 (VÄLIKANGAS 1942). According to MYLLYMÄKI (1959, p. 79), damage attributable to voles (*Arvicolidae*) has also been found on red beets.

F. Carrots

Plant bugs, aphids, etc. (*Hemiptera*). In certain instances, *Lygus* bugs have inflicted substantial damage on young carrot seedlings. Such injury has been particularly rife in North Ostrobothnia; sometimes the entire carrot crop has been ruined. *Lygus kalmi* L. has also been found on carrots (Kanervo). Only seldom have large numbers of the common froghopper (*Philaenus spumarius* L.) been observed on carrots.

One of the most destructive carrot pests in Finland is *Trioza apicalis* FÖRST., which sucks the juice from the leaves which thus become twisted and curled. As a result, the yield is low, and sometimes the plants die. In the southern parts of the country, this pest has often been responsible for large-scale damage, at times amounting to complete destruction of the crop. The species was found for the first time as a pest in Finland at Tikkurila (U) in 1935 (VAPPULA 1935 a, 1935 b), but apparently injury had been inflicted in the commune of Helsinki at least two years earlier. By 1939, damage was observed as far away as Lohja (V), Hausjärvi and Orimattila (EH) (NORDMAN 1941), and reports were also received from Ahvenanmaa. The species later spread to the north, and was in 1957 found in the regions of South Ostrobothnia, Jyväskylä (PH) and Kuopio (PS). Almost no severe injury has been observed north of the line Pori—Tampere—Mikkeli—Lappeenranta. At times, severe twisting of carrot leaves attributable to aphids has been remarked (especially in 1959); the causal agent was evidently *Cavariella aegopodii* SCOP. Damage has been inflicted as far away as Pudasjärvi (PP) in North Ostrobothnia.

Beetles (*Coleoptera*). On a number of occasions, the beet carrion beetle (*Aclypea opaca* L.) has been the cause of rather severe injuries, especially in north Finland, by feeding on young carrot seedlings. Wireworms (*Elateridae*), principally *Agriotes obscurus* L., have often been noxious in gardens. Larvae of the cockchafer (*Melolontha hippocastani* FABR.) have also at times injured carrot seedlings and caused gaps in the stand.

Ants (*Hymenoptera, Formicidae*). Wood ants (*Formica rufa* L.) were once mentioned as having inflicted rather severe damage on young carrot seedlings.

True flies (*Diptera*). In addition to *Trioza apicalis*, the carrot fly (*Psila rosae* FABR.) is an extremely harmful carrot pest; the larvae often completely destroy young seedlings. In more mature plants, they bore reddish-brown tunnels, with the result that the injured carrots easily spoil in storage. In southern and central Finland usually two generations are produced, of which the second appears at the end of the summer. The carrot fly has often brought about appreciable damage, on many occasions destroying 50—100 per cent of the crop. In general, damage appears as scattered, localized instances. This species was first mentioned as a pest in 1905, when it appeared at Pornainen (U) (E. REUTER 1908, p. 22—23). It was particularly destructive in 1922; subsequently the damage it inflicted was most severe in 1948—1951. In south Finland this pest often makes its appearance together with *Trioza apicalis*.

It is probable that mines made by the chrysanthemum leaf miner (*Phytomyza atricornis* MEIG.) have been found in carrot leaves (FREY 1937, p. 92).

Moths (*Lepidoptera*). In a few cases, larvae of *Euxoa nigricans* L. have been responsible for damage, especially to carrots growing in frames, by severing the seedlings below soil level.

Leaf-damaging carrot pests include the silver Y moth (*Phytometra gamma* L.), which inflicted injury on carrots in southwest Finland in 1922. In 1946 the damage done to carrots was severe or very severe in many localities. In view of the comparative shortness of the period during which the larvae attacked the plants, the carrots recovered, especially following rain, and the damage done was less than expected (KANERVO 1947, p. 99—100).

A moderately severe infestation of larvae of *Epermenia chaerophyllella* GOEZE occurred in a carrot field at Korppoo (V) in 1940. The pests ate the leaves from the underside, so that only the upper epidermal layer remained. Slight damage brought about by this species was observed elsewhere in the same commune (VAPPULA 1940). This is the first record of this species as a pest in Finland. In summer 1955, larvae of *Cnephasia virgaureana* TR. were common in a number of plants, including young carrot seedlings. They were particularly abundant in a 2-hectare field at Padasjoki (EH), where they evidently hindered seedling development by twisting the leaves into compact curls.

In south Finland, larvae of *Papilio machaon* L. have sometimes been found feeding on carrot leaves. In Uusimaa, larvae of *Hoplodrina alsines* BRAHM have also appeared on carrots (SEPPÄNEN 1954, p. 352).

Molluscs (*Mollusca*). Grey field slugs (*Deroceras agreste* L.), or other related species, have at times been a nuisance in carrot plantings; in the spring they may devour all the seedlings. In epidemic years, they have been most numerous at the end of the summer and in the autumn, when they feed on and damage the leaves and roots of the plants. On at least one occasion *Arion circumscriptus* JOHNST. was observed eating carrots, causing the destruction of about 90 per cent of the crop. Damage inflicted by *Arianta arbustorum* L. has also been found on carrots (at Karjaa (V) in 1949).

Mammals (*Mammalia*). Voles are frequently the authors of great damage in gardens, where they feed greedily upon carrots. The field vole (*Microtus agrestis* L.) injures carrots by gnawing at the roots from the surface of the ground; damage may sometimes be quite considerable. The water vole (*Arvicola terrestris* L.) is also a voracious eater of carrots, and carries them to its winter storage places; moreover it does harm by digging tunnels and making large piles of earth on the ground. In some localities, for example at Loppi (EH) since 1917, common moles (*Talpa europaea* L.) have proved a nuisance in vegetable gardens. They dig tunnels just below the ground surface, with the result that carrot and other plants collapse and die. The piles of earth it makes are also harmful to the plants. In 1941—1943, the Norway rat (*Rattus norvegicus* ERXL.) was reported to have damaged carrots at Helsinki (U) so severely that the entire yield was lost. At Sipoo (U) in 1941—1942, large numbers of bank voles (*Clethrionomys glareolus* SCHREB.) appeared and damaged vegetables, including carrots in August and September (VÄLIKANGAS 1942).

G. Other outdoor vegetables

(rhubarb, orache, quinoa, spinach, parsley, asparagus, dill, celery, parsnip, tomato, chicory, Spanish scorzonera, lettuce, and artichoke)

Earwigs (*Dermaptera*). Earwigs (*Forficula auricularia* L.) were observed in 1937 near Mikkeli (ES) inside the petioles of rhubarb leaves, and also in their flowering stalks (Kanervo).

Thrips (*Thysanoptera*). In 1936, cabbage thrips (*Thrips angusticeps* Uz.) appeared as a head lettuce pest at Tapanila (U) by Helsinki; they fed on the lower surfaces of the leaves, making brownish-grey spots in them (HUKKINEN and SYRJÄNEN 1940, p. 123—128).

Plant bugs, aphids, etc. (*Hemiptera*). *Lygus* bugs have on occasion injured spinach, whose growing point they destroy, as well as rhubarb and dill. The common green capsid (*Lygus pabulinus* L.) and *Calocoris ? fulvomaculatus* DEG. have appeared as pests on rhubarb. In young plants, they make the leaves shrivel and dry, and in older plants they leave holes at their feeding spots. Similar injuries to rhubarb are attributable to the sloe bug (*Dolycoris baccarum* L.), which invades gardens in large numbers in the spring, and may completely check the growth of the plants. This species has also been found to damage tomatoes. On a few occasions, *Lygus kalmi* L. has harmed celery and dill. In 1946 at Turku (V) this species inflicted especially severe damage to celery seedlings. Among leafhoppers, the species *Centrotus cornutus* L. has been established as feeding on the leaves of rhubarb (P. Nuorteva).

The most serious aphid pest is the willow-carrot aphid (*Cavariella aegopodii* SCOP.), which has in certain localities appeared profusely on dill. This aphid causes

the leaves and shoots to become curled and brown, thus hindering the growth of the plant. Small numbers of the peach-potato aphid (*Myzus persicae* SULZ.) have been found on the lower leaf surface of lettuce growing in frames; the thistle aphid (*Brachycaudus cardui* L.) has been observed on globe artichoke in frames (Heikinheimo). In addition, the bean aphid (*Aphis fabae* SCOP.) has sometimes abounded on spinach, rhubarb and quinoa. Intermediate host plants of the lettuce aphid (*Nasonovia ribisnigri* MOSL.) have been found to be lettuce and chicory (HEIKINHEIMO 1952, p. 96). At Tikkurila (U) in 1950, the writer observed lettuce root aphids (*Pemphigus bursarius* L.) on the roots of lettuce, but no apparent damage was done to the plants, which had already formed flower stalks. In the case of young plants, this pest may weaken their growth. In 1960, the species appeared on the roots of lettuce at Varkaus (PS).

Beetles (*Coleoptera*). The beet carrion beetle (*Aclypea opaca* L.) is a common garden pest, especially in central and north Finland. It particularly favours spinach, and often destroys all the seedlings. In addition, it attacks lettuce, parsnip, rhubarb, and evidently other vegetables. In 1942, spinach seedlings at Heinävesi (PS) were destroyed by larvae of *A. undata* MÜLL., which has since been established as a sugar beet pest also.

The rove beetle (*Trogophloeus pusillus* GRAV.) on one occasion damaged lettuce growing in a frame at Helsinki (U) in 1914 by producing brownish spots in the leaf tissues (LINNANIEMI 1916, p. 8). Rose chafers (*Cetonia*) have often been numerous on certain plants such as parsnip, but no damage attributable to them has been observed (LINNANIEMI 1920, p. 13). *Potosia cuprea* FABR. has been seen to attack lettuce (at Piippola (KP) in 1953), and sometimes inhabits the inflorescences of rhubarb.

One of the pests doing most damage to rhubarb is the mangold flea beetle (*Chaetocnema concinna* MARSH.), which injures the leaves by eating holes or brown pits in them. In the most serious cases, the young plants have completely died in the spring, whereas the injury inflicted on older plants has been milder. In the beginning of the summer, *Phytonomus rumicis* L. has on several occasions appeared on rhubarb, whose young leaves and petioles have been damaged; later in the summer, the beetles congregate on the inflorescences with a view to feeding on the flowers. The species has been reported on rhubarb as far north as Oulu (PP). In 1918, *Rhinoncus pericarpius* L. slightly injured rhubarb leaves at Oulu; the pest had migrated to this plant from nearby stands of *Rumex domesticus*. On a few occasions, *Gastroidea polygoni* L. and *G. viridula* DEG. have been observed to cause mild injury to rhubarb by eating holes in the leaves.

Wireworms (*Elateridae*) are common pests in vegetable gardens, where they often devote the major attack to tomatoes and chicory; they bore into the roots or the lower part of the stem and as a consequence make the plant wither. They also favour lettuce, whose main root is severed at ground level; sometimes spinach, Spanish scorzonera and artichoke have also been injured. The most

important species are apparently *Agriotes obscurus* L., along with certain *Corymbites* species. Larvae of the cockchafer (*Melolontha hippocastani* FABR.) have at times severed the roots of vegetables (such as lettuce and celery) below the ground, with the result that the young plants collapsed and died.

Ants (*Hymenoptera, Formicidae*). Ants have quite often been harmful by building their nests in vegetable beds and frames; in some cases, they have been reported as having destroyed all the seeds in the frames.

True flies (*Diptera*). Perhaps the most important of the leaf-injuring pests is the beet fly (*Pegomyia hyoscyami* PANZ.), whose larvae produce blister mines in the leaves of spinach. Occasionally, the damage has been so great that the crop has been completely useless. The writer has also observed similar injury in orache (*Atriplex hortensis* and *A. roseus*). Similarly, blister mines of *Pegomyia albimargo* PAND. were found in spinach leaves at Naantali (V) in 1951 (TIENSUU 1951). In some localities, leaf mines in celery and parsnip produced by the celery fly (*Philophylla heraclei* L.) have been found, but with almost no damage as a result. In addition, parsnip has been found to be infested with mines of *Phytomyza pastinacae* HEND. (THUNEBERG 1958). At Korso (U) in 1912 LINNANIEMI (1913, p. 69—70) found winding tunnel mines in head lettuce and presumed that they were made by some species of *Phytomyza.*

On one occasion (near Viipuri (EK) in 1920) damage brought about by the carrot gall midge (*Kiefferia pimpinellae* F. LW) was found in the fruit of dill, which had turned into swollen, hollow galls. This midge usually lives in the fruit of wild umbelliferous plants, particularly those of *Pimpinella saxifraga.*

The underground parts of vegetables of the *Umbelliferae* are injured by larvae of the carrot fly (*Psila rosae* FABR.); in general, it has been a matter of mild damage in parsnip, celery, parsley and dill. The syrphid species *Chilosia illustrata* HARR. was found at Lohja (V) in 1931; its larvae had eaten holes and tunnels in parsnip roots (VAPPULA 1940).

Butterflies, moths (*Lepidoptera*). In 1922, larvae of the silver Y moth (*Phytometra gamma* L.) inflicted slight injury to lettuce and parsley in south-west Finland. In 1946, there was a more wide-spread and destructive epidemic of this pest, which resulted in very severe damage to lettuce, and moderately severe damage to spinach and parsley (KANERVO 1947, p. 99); the injury to artichoke was mild. Occasionally, larvae of the cabbage moth (*Barathra brassicae* L.) and the tomato moth (*Polia oleracea* L.) have damaged tomatoes, spinach and lettuce, while *Euplexia lucipara* L. has attacked tomatoes and lettuce (SEPPÄNEN 1954, p. 369, 385); leaves of tomato and spinach plants have been injured by larvae of *Polia persicariae* L. In addition, larvae of *Polia dissimilis* KNOCH, *Cucullia lactucae* SCHIFF. and *Spilosoma lubricipedum* L. have occasionally appeared on lettuce, and those of *Xylina exoleta* L. on spinach (SEPPÄNEN, op.cit, p. 315, 385).

The leaves and inflorescences of dill have been eaten by the larvae of *Papilio machaon* L. in various parts of the country as far as Raahe (KP); larvae have also

been found on parsnip (SEPPÄNEN, op.cit., p. 350). The inflorescences of dill have been infested by larvae of *Eupithecia trisignaria* H.S. in the province of Uusimaa (op.cit.). In a few instances, larvae of the parsnip moth (*Depressaria heracliana* DEG.) have injured the inflorescences and fruits of parsnip.

A prevalent rhubarb pest is the rosy rustic moth (*Hydroecia micacea* ESP.), whose larvae often live in the petioles, eating tunnels in them, and thus rendering them unfit for consumption. Sometimes the damage has been wide-spread and abundant even in large fields of rhubarb. The larvae have also been reported to have bored into the stems and fruits of tomato plants, the seedlings of chicory, and — in an unverified instance — the lower part of the stem of head lettuce.

Cutworms (*Agrotis* spp.) are quite common garden pests, and have occasionally been observed injuring tomatoes in particular, and parsnip more rarely. It is evident that several different species have been responsible for such attacks, with *Agrotis clavis* HUFN. being named as injuring many kinds of vegetable plants (K. J. VALLE 1940, p. 116—117). Larvae of this species, as well as of the related *A. exclamationis* L. have appeared on spinach and lettuce at least. Moreover, larvae of *Triphaena pronuba* L. have been found on rhubarb, spinach and tomato (SEPPÄNEN 1954, p. 313, 315, 369, 385). Larvae of *Euxoa nigricans* L. have also inflicted damage on dill plants growing in frames.

Mites (*Acarina*). *Uropoda* (*Urosternella*) *obnoxia* E. REUT. has on occasion proved to be an injurious pest on lettuce growing in frames, or in the open field. In one case, they destroyed all the tomato seedlings in a frame.

Molluscs (*Mollusca*). From time to time, slugs (*Deroceras agreste* L., etc.) have severely damaged various vegetable plants, such as lettuce, tomato, spinach, chicory and rhubarb. On at least one occasion, *Arion circumscriptus* JOHNST. was found feeding on the leaves of lettuce, and *Arianta arbustorum* L. injured lettuce at Karjaa (V) in 1949, and rhubarb leaves at Helsinki (U) in 1954.

Birds (*Aves*). The hooded crow (*Corvus corone* L.) has sometimes been seen feeding on certain garden vegetables such as tomatoes (HILLI 1927, p. 122; 1929, p. 35).

Mammals (*Mammalia*). In some cases, the water vole (*Arvicola terrestris* L.) has damaged celery. The field vole (*Microtus agrestis* L.) has also on one occasion destroyed all the seedlings, including tomatoes, growing in a frame; at Pinjainen (V) in 1941, it moderately damaged asparagus; and in the region of Hämeenlinna (EH), it injured lettuce and cucumber seedlings growing in frames. MYLLYMÄKI (1959, p. 79) also mentions voles as damaging lettuce and celery. The Norway rat (*Rattus norvegicus* ERXL.) was once reported to have eaten the seeds of spinach and radish sown in a frame, and in another case it invaded a garden, some of the damage inflicted included eating low-hanging tomatoes.

16. Fruit trees

Thrips (*Thysanoptera*). Flower thrips (*Frankliniella intonsa* TRYB.) were encountered in the summer of 1939 at Janakkala (EH) as pests on young apple trees, whose growth they considerably hindered. *Thrips major* Uz. also appeared as a pest of young apple seedlings in 1942 near Hämeenlinna (EH), although the injuries were mild (HUKKINEN, Ann. Report of the Dept. of Pest Invest. 1942). In 1936, rose thrips (*Thrips fuscipennis* HAL.) harmed young leaves and stalks of developing fruit on apple trees at Kalanti (V) and Loppi (EH) (VAPPULA 1938, p. 8).

Plant bugs, aphids, etc. (*Hemiptera*). Capsid bugs are often plentiful on apple, plum and cherry trees; they injure young shoots, and in severe cases the leaves become brown and withered. At times, unripe apples are damaged by these bugs, resulting in pits and brown patches on the surface. Fruit tree pests in Finland include at least Lygus bugs (*Lygus* spp.) and apple capsid bugs (*Plesiocoris rugicollis* FALL.), both of which occur as far as North Ostrobothnia (PP). Occasionally the sloe bug (*Dolycoris baccarum* L.) has appeared in large numbers on apple and pear trees in the spring, feeding on and injuring the young shoots. *Coreus marginatus* L. inflicted similar damage on apple trees at Sipoo (U) in 1898.

One of the most destructive apple tree pests in Finland is the apple sucker (*Psylla mali* SCHMIDBG.)[1]), whose larvae penetrate the unfolding buds in the spring and suck juice from them. Later, they inhabit in particular the base of the petiole and the unopened flower buds, causing the desiccation of these parts of the plant. At the end of June, adults are produced, which to some extent injure the leaves and fruits of apple trees. The apple sucker is very common in south and central Finland, where apples are grown, and it has been found as far north as the regions of Oulu (PP), Iisalmi (PS) and Joensuu (PK). At times the destruction it has brought about has been very great; in the worst cases, nearly all the flower buds have dried and become stuck to one another. This pest has also attacked pear trees. Reports have been made of considerable damage being done at least in the years 1915, 1933, 1937—1939, 1948—1950, 1952, 1954, 1959 (KANERVO 1960 a) and 1960. In south Finland (Finland Proper, Uusimaa, South Carelia) small numbers of another psyllid species, *Psylla costalis* FLOR, have been found on apple trees; it winters as an adult, and lays its eggs on the young leaves of opening buds.

Heavy infestations of *Psylla pyrisuga* FÖRST. have appeared in some areas on pear trees. The species has been found at least in Finland Proper (Angelniemi in 1953 and Lohja in 1955) and in Uusimaa (Hyvinkää in 1953, Helsinki in 1956). *Psylla pyri* L. has also been found as a pear tree pest at Parainen (V) (O. M. REUTER 1876, p. 70) and Karjalohja (V) (LINNANIEMI 1915, p. 60) and possibly also at Nauvo (V) (ÅBERG 1938).

[1]) LISTO (1930) was the author of an article on the apple sucker in Finland and the damage it inflicts in this country.

Among the species of aphids living on apple trees[1]), the most important from an economic standpoint is the green apple aphid (*Aphis pomi* DEG.) This species often attacks young trees, causing them to wither or to die. On older trees, the aphids often injure the developing fruits, which become shrivelled and pitted. The species is common throughout the country to North Ostrobothnia (PP), but only rarely is it found on pear trees.

As regards older fruit trees, the leaves are often twisted, or their edges infested with reddish or yellowish galls; these effects are brought about by aphids, but not serious from an economic standpoint. Such galls were especially common in 1920, 1928, 1933, 1938, 1943 and 1959, and have been observed in south and central Finland as far north as the regions of Vaasa (EP) and Kuopio (PS). In certain cases (in Uusimaa and South Ostrobothnia) the causal agent of the galls was found to be *Dysaphis anthrisci* C. B. (Heikinheimo). At Lohja (V) in 1955, large numbers of the rosy apple aphid (*Dysaphis plantaginea* PASS. = *Sappaphis mali* FERR.) were observed (HEIKINHEIMO 1959, p. 25); these pests brought about a pronounced deformation of apple-tree leaves. The oat-apple aphid (*Rhopalosiphum insertum* WALK.), which may cause slight curling of the leaves, has been observed on apple and Siberian crab apple trees in Finland Proper, Uusimaa and South Häme. At Lohja (V) in 1955 pear trees were subjected to a slight infestation of pear-coltsfoot aphid (*Anuraphis farfarae* KOCH); this species produces a tubular or pocket-shaped leaf gall (Heikinheimo).

The pest most injurious to plum and bullace trees in Finland is the mealy plum aphid (*Hyalopterus pruni* GEOFFR.)[2]), which sometimes appears so plentifully that the lower surfaces of the leaves, along with young shoots, are completely covered with aphids. The aphids also injure the fruits by feeding on them, and fouling them with their secretions. The writer once observed large numbers of this species on the leaves of apple trees growing near plum trees. It is a common pest in south Finland, and has also been found in central Finland, extending as far as the regions of Vaasa (EP) and Kuopio (PS).

The thistle aphid (*Brachycaudus cardui* L.) lives on the terminal shoots of plum and bullace trees, feeding on the leaves which as a consequence become twisted and prematurely discoloured. To date, it has been found as a pest in south Finland (Ahvenanmaa, Finland Proper, Uusimaa and South Häme). Another species, the leaf-curling plum aphid (*Brachycaudus helichrysi* KALT.), also produces similar compactly-coiled leaves in the shoots of plum and bullace trees. It also inhabits certain *Compositae*, including cultivated chrysanthemums, in which it has been found as far up as North Ostrobothnia.

The host plants of the hop-damson aphid (*Phorodon humuli* SCHRK) are both hops and *Prunus* species (such as plum and bullace). The aphids reproduce

[1]) cf. HEIKINHEIMO 1955.

[2]) A descriptive leaflet on the mealy plum aphid as well as other aphid pests of plum trees has been written by HEIKINHEIMO (1956 a).

prolifically on hops, and the damage they inflict on plum trees consists of a curling of the leaf edges. More rare is the water lily aphid (*Rhopalosiphum nymphaeae* L.), whose intermediate hosts include water-lilies and other water and marsh plants (HEIKINHEIMO 1959, p. 25).

The cherry blackfly (*Myzus cerasi* FABR.) lives on the leaves and shoots of cherry trees; when the infestation is heavy, curling of the leaves results. The species is common in south Finland, and has been reported as far north as Kauhajoki in South Ostrobothnia.

Hazel bushes in Finland Proper, Uusimaa, South Häme and South Savo have sometimes been infested by the hazel aphid (*Myzocallis coryli* GOEZE), harmful because of its secretion of honeydew. *Corylobium avellanae* SCHRK has also been found on hazel in the first two provinces mentioned above.

The brown scale (*Eulecanium corni* BCHÉ), a common pest of berry and ornamental shrubs, often appears plentifully on apple and plum trees in the southern parts of the country. In the two years 1949—1950, it caused considerable damage to plum trees at Rymättylä (V). Hazels have also been infested (GRANIT 1951). Small numbers of the mussel scale (*Lepidosaphes ulmi* L.) were once found (near Helsinki (U) in 1915—1916) on young apple trees (LINNANIEMI 1920, p. 209). The apple mealy bug (*Phenacoccus aceris* SIGN.) was observed on the trunks of old apple trees at Hattula (EH) in 1904 (E. REUTER 1908 b) and near Helsinki (U) in 1914, 1919 and 1951, but caused no appreciable damage.

Beetles (*Coleoptera*). Apple flowers are sometimes injured by certain species of beetles, such as *Cantharis obscurus* L. (also plum flowers), *Corymbites pectinicornis* L., *C. aeneus* L., *Prosternon tessellatum* L., *Limonius aeruginosus* OL., *Byturus tomentosus* FABR. (also pear flower buds) and very rarely *Lochmaea capreae* L.

Rose chafers (*Cetonia aurata* L. and *Potosia cuprea* FABR.) quite often appear on the flowers of apple and plum trees, sometimes on cherry flowers, too; they damage the flowers and make them wither, and occasionally eat holes in the leaves of apple trees. In the later weeks of summer, these pests have often been seen making large holes in apples; at times they consume so much of the interior of the fruit that only the skin remains. Damage of this type is commonest in summer varieties of apples, such as Transparente blanche and Astrak.[1]) Occasionally large numbers of blossom beetles (*Meligethes aeneus* FABR.) are to be found on the flowers of apple, cherry and pear trees, but no appreciable injury has resulted.

The apple blossom weevil (*Anthonomus pomorum* L.) was first observed with certainty at Terijoki (Kk) in 1932 (VAPPULA 1933); by 1937, it had spread to the communities of Kivennapa and Uusikirkko. In the years 1936—1938 in particular, this pest was responsible for substantial destruction at Terijoki, ruining as much as 90—100 per cent of the flower buds; the apple yield was consequently very poor. During the severe, cold winters of 1939—1940 and 1940—1941, the weevil population

[1]) ELMGREN (1896) also mentions a similar instance of damage.

was practically eliminated, along with a large proportion of the apple trees. This pest has not yet been encountered in the present area of Finland.

The leaves of apple trees are sometimes injured by the summer chafer (*Rhizotrogus solstitialis* L.), which was reported in July, 1951, to be swarming in large numbers near apple trees at Pusula (V) and feeding on the leaves. Cockchafers (*Melolontha hippocastani* FABR.) are often seen on apple trees, of which they eat the leaves or flower buds. Since these pests normally occur individually, the damage they inflict is quite mild. On a few occasions, the larvae of chafers have injured young apple and pear trees by feeding on the surface of the roots. The garden chafer (*Phyllopertha horticola* L.), which was observed at Terijoki (Kk) on apple trees as early as 1920 (LAMPE 1922), has since appeared in abundance in some localities of South Savo (Luumäki in 1935 and 1949, Taipalsaari in 1949 and 1951, Savitaipale in 1949 and 1956 and Punkaharju in 1950). Their attacks on young apple trees are especially serious, as they feed on the leaves in large swarms and eat holes in the developing fruit.

Luperus flavipes L. is often to be found in profusion on the leaves of apple and plum trees in southern Finland. It makes small holes in the leaves, although no economic harm results. In some years, such as 1937 and 1939, *Agelastica alni* L. has migrated in large numbers from alders to apple trees, where it eats holes in the leaves and feeds on the petals of the flower buds. They have also been reported to have defoliated plum and cherry trees. An isolated occurrence of *Pachybrachys hieroglyphicus* LAICH. on the leaves of apple trees at Mäntyharju (ES) in 1915 was mentioned by LINNANIEMI (1920, p. 30).

On occasion, leaf weevils are found in quite large numbers on apple trees; the common leaf weevil (*Phyllobius piri* L.) is a common species in the southern and southeastern parts of Finland. It inhabits birches and other deciduous trees, but sometimes migrates in large swarms to apple trees, where it eats holes in the leaves and flower buds; it has damaged cherry trees in the same manner. However, its economic significance is relatively slight. Large numbers of the green leaf weevil (*Phyllobius maculicornis* GERM.) have appeared in some localities on apple, pear and cherry trees, as well as on other deciduous trees and bushes; it has in some instances caused severe damage by eating the leaves. Such destruction is greatest in the eastern parts of the country, where weevils are numerous on mountain ash. The silver-green leaf weevil (*Phyllobius argentatus* L.) has at times been found injuring the leaves of apple and cherry trees in south Finland. On two occasions the writer has [in the rural commune of Helsinki (U) and at Terijoki (Kk)] observed mild infestations of the brown leaf weevil (*Ph. oblongus* L.) on apple trees, but with no apparent damage as a result. It has also been seen on the leaves of cherry and bullace trees. *Polydrosus mollis* STRÖM was observed at Valkeakoski (EH) in 1945 and at Tohmajärvi (PK) in 1951—1952 to have injured the buds, young leaves and flowers of apple trees. NORDMAN (1957 a) found mines made by *Rhamphus pulicarius* HBST in the leaves of apple and pear trees in the rural commune of Porvoo (U).

Bycticus betulae L. is a common species which lives on various deciduous trees, such as birch. In the southern parts of the country, it often rolls the leaves of pear trees, but with no apparent significant injury.

The plum borer (*Rhynchites cupreus* L.) is a very harmful fruit tree pest; it lays its eggs in the upper parts of the young shoots of apple trees or in the unripe fruit, and subsequently cuts off the shoot or fruit stalk so that it falls to the ground. It may also break off the petioles. The plum borer is especially destructive in nurseries and young orchards, since it prevents the normal growth and development of the trees. Sometimes all the young shoots are injured by this pest; it has been observed to make as much as 50—100 per cent of the unripe apples fall to the ground. The fruit which remain on the trees are also damaged by the plum borer, which makes holes in them. In some orchards 50—60 per cent of the apples were so spoiled that their commercial value was greatly reduced. Damage to the shoots of plum trees is quite rare, and even rarer in respect of cherry and pear trees. One report was to the effect that 90 per cent of the unripe fruit of yellow plums had fallen to the ground following the depredations of this pest. Destruction by the plum borer was first observed in Finland in the 1880's at Mustiala (EH) (STENING 1906). In the years 1913—1914, there was damage at Kirkkonummi (U), and in 1915—1916 in many other places in south Finland. Since then, destruction has occurred in 1932—1933, 1935—1936, 1938—1939, 1944—1946 and 1950—1951. Such attacks have appeared in the southern and central parts of the country, extending as far north as Central Ostrobothnia (VAPPULA 1950).

Large numbers of apple fruit rhynchites (*Coenorrhinus aequatus* L.) were observed in some orchards at Lohja (V) in 1955. According to the observations of Kanervo and Heikinheimo, these pests injured the buds and flower buds of apple trees in the spring. Later in the summer, they damaged the ripening fruit by eating holes. There was similar damage at Perniö (V) in summer 1958. The species was not earlier known as a pest in Finland (cf. also VAPPULA 1959).

The small twigs of apple and plum trees in south Finland are sometimes injured by larvae of the plum weevil (*Magdalis ruficornis* L.), which bore tunnels under the bark, and consequently make the twigs dry. Some observations indicate that damage is confined to twigs injured by frost, or otherwise growing poorly; thus this species evidently possesses no great economic significance. These weevils sometimes appear on the leaves of apple and bullace trees, and eat small holes in them. *Strophosomus rufipes* STEPH. was found as a pest at Hartola (EH) in 1949; it fed on the bark of twigs of apple trees, on which large bare lesions appeared.

Larvae of *Saperda scalaris* L. have been observed in the trunks of apple trees (KANGAS 1942, p. 68; SAALAS 1949 a).

An especially dangerous apple tree pest is the shot-hole borer (*Xyleborus dispar* FABR.), which bores tunnels in the trunk or branches of the trees; individual branches dry, or even the entire tree. This pest appears mainly to attack trees

which are in general poor condition or which have been injured by frost; but on occasion it damages healthy-appearing apple trees. Pear, plum and cherry trees are more rarely attacked. This species was first found to be a pest in Finland at Karjalohja (V) in 1900 (SAHLBERG 1902) and at Parainen (V) in 1901 (E. REUTER 1902 b). In the reports of the State entomologists, the shot-hole borer was first mentioned in 1915—1916, when destruction was reported in four localities. In the next twenty years, only scattered reports were received, but in 1936—1938 the pest reappeared and destroyed a number of apple trees in various parts of south Finland. The most destructive epidemic was in 1950—1953, when the shot-hole borer was responsible for very great economic losses to apple orchard growers. In part, the damage continued during the two succeeding years. This species is one of the most dangerous enemies to fruit trees in Finland.[1])

The fruit bark beetle (*Scolytus rugulosus* RATZ.), which tunnels in the cambium layer under the bark, was first observed in Finland at Lohja (V) in 1917, in plum and bullace trees (HÅKAN LINDBERG 1918). Subsequently, it has been found at Karjalohja (V) in 1918 (R. FORSIUS 1920 a)[2]), at Siuntio (U) in 1940 (R. KROGERUS 1943)[3]) and at Espoo (U) in 1951. In all cases, the damage affected plum trees which had evidently been previously injured by frost.

At Jaakkima (LK) in 1922, many larvae were found damaging seeds in cherries in one orchard. The species concerned was evidently *Anthonomus rectirostris* L. (LINNANIEMI 1935, p. 42).

The nut weevil (*Curculio nucum* L.), which lives as a larva in hazel nuts, and cannot accordingly be considered as a true cultivated crop pest, has rarely been found in Ahvenanmaa, Finland Proper and Uusimaa. Its significance as a hazel pest is relatively slight.[4])

In certain instances, harmful numbers of wireworms (*Elateridae*) have been found on the roots of apple and pear trees.

Ants, sawflies, etc. (*Hymenoptera*). Ants (*Formicidae*), especially the common black ant (*Lasius niger* L.) and the mound ant (*L. flavus* FABR.) often constitute a nuisance in orchards, where they dig tunnels near the trees, and bring about the drying of the roots. They have in this manner brought about the death of young plum seedlings, as well as other fruit trees. Moreover, certain species such as the common black ant and the wood ant (*Formica rufa* L.) climb the trees in large swarms, occasionally injuring the flower buds or opened blossoms of apple and cherry trees. On one occasion (at Pöytyä (V) in 1917), leaf-cutter bees (*Megachile* sp.) were observed to have cut pieces out of apple tree leaves.

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[1]) SAVAS (1939) has written a report on the shot-hole borer and its control.

[2]) The species was also found in cherry trees at Karjalohja (SAALAS 1919, p. 195).

[3]) In the same locality, one large fruit bark beetle (*Scolytus mali* BECHST.) was also found.

[4]) A related species, *Curculio cerasorum* HBST, is also found in Finland, but no reports have been received concerning it damaging cherry seeds.

Pristiphora abbreviata HTG (*Micronematus abbreviatus* HTG) lives on pear trees; its larvae eat large holes or notches in the edges of the leaves. The species was first encountered in this country at Karjalohja (V) in 1890—1892, where it caused considerable damage (SAHLBERG 1893). Subsequently, injury has been reported from places in Finland Proper, Uusimaa and South Häme. On occasion, the larvae have almost completely defoliated young trees, but generally speaking the economic significance of this species is quite slight.

The pear slug sawfly (*Caliroa cerasi* L. = *C. limacina* RETZ.) is a rather common species, with larvae which often appear on cherry and pear, and occasionally on apple, plum, bullace and other trees. Sometimes the infestation of larvae is so extensive that in the autumn the leaves have been completely reduced to skeletons. The species was found as early as in 1878 at Parainen (V), Yläne (St) and Helsinki (U) (O. M. REUTER 1881 a)[1]), in 1897 at Tammela (EH) and Sulkava (ES) (E. REUTER 1898, p. 59—61), and at Kuopio (PS) (WESTERLUND 1898). In 1908 appreciable destruction was reported in the region of Lohja (V) (R. FORSIUS 1909). Later damage has been observed in south Finland, and to some extent also in central Finland as far as Oulu (PP). Larvae of *Pamphilius silvaticus* L. were observed in 1897 at Kuopio (PS) to have damaged the leaves of cherry trees; they twisted the leaves into rolls and later ate them wholly (WESTERLUND 1898)[2]). GRÖNBLOM (1945) mentioned that larvae of *Neurotoma iridescens* ANDRÉ (*N. sorbi* FORS.), a very rare species in this country, had been found on cherry trees.[3]) In 1955—1957 at Helsinki (U), the author found larvae of *Micronematus monogyniae* HTG in leaf edge galls on plum and bullace trees (VAPPULA 1957, 1959); the species has also been observed at Munkkiniemi in Helsinki (Lindqvist). However, it appears to have no practical economic significance.

The apple sawfly (*Hoplocampa testudinea* HTG) was first found as an apple pest in 1954—1955 at Lappee (ES). In some instances in 1957, as much as 30 per cent of the fruit was reported as damaged. Such injury has also been observed at Lauritsala (ES) (VAPPULA 1959, 1959 a). In two cases, larvae of the dock sawfly (*Ametastegia glabrata* FALL.) have been found in apples; these were at Piikkiö (V) in 1935 (VAPPULA 1936) and at Tikkurila (U) in 1952 (HEIKINHEIMO 1953). In both cases, injury was mild (cf. also VAPPULA 1959). Wasps, especially the common wasp (*Vespa vulgaris* L.), have sometimes damaged apples and cherries by eating holes in them; on occasion they have completely hollowed out the fruit, leaving only the skin intact.

In 1958, *Syntomaspis druparum* BOH. was found in the seeds of apples at Lahti (EH) and Tikkurila (U). The species was seen for the first time in Finland in 1940

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[1]) The pest of pear and cherry trees and hawthorn was given the name *Blennocampa aethiops* FABR., but evidently the species in question was actually *Caliroa cerasi* L.

[2]) The name *Lyda sylvatica* L. was used in the paper.

[3]) According to a communication of Grönblom, several groups of larvae appeared in 1944 in an orchard at Aitolahti (EH).

at Tampere (EH), where it was present in the seeds of some species of *Sorbus* (GRÖNBLOM 1940).

True flies (*Diptera*). The cherry fruit fly (*Rhagoletis cerasi* L.) is relatively scarce in Finland, and to date its larvae have not been found in cherries, although larvae of this species have occasionally been present in imported cherries (LISTO 1933).

The apple leaf midge (*Dasyneura mali* KIEFF.), whose larvae live in the rolled-up edges of young leaves, has so far appeared on young apple trees only in 1951—1952 in the region round Porvoo (U) (VAPPULA 1953 a, 1959). Similar damage to pear leaves is caused by the pear leaf midge (*Dasyneura pyri* BCHÉ), which has been found only once in this country, at Karjalohja (V) in 1924 (R. FORSIUS 1927, p. 36).

Butterflies, moths (*Lepidoptera*). Apple trees are inhabited by a large number of butterfly species, whose larvae injure the leaves, both when these are just emerging from the buds, or later in the summer when the leaves are fully-grown. Certain species also attack opening flowers.

Larvae of the black-veined white butterfly (*Aporia crataegi* L.) have often been found on apple trees, more rarely on pear or cherry trees. These pests attack the shoots and leaves of rootstocks and young apple trees, and they also favour mountain ash and bird-cherry trees. However, they do not cause great economic losses. Larvae of *Ruralis betulae* L. have been found on plum trees in Ahvenanmaa (SEPPÄNEN 1954, p. 341). In 1937, reddish lycaenid larvae were found on unripe apples at Piikkiö (V) and Valkeala (ES); they had eaten holes in the fruit. The species concerned was probably *Celastrina argiolus* L.

Larvae of the eyed hawk-moth (*Smerinthus ocellatus* L.) occasionally live on young apple trees (rarely pear trees) and are greedy eaters of the leaves of the young annual shoots. At times they have within a very short period completely defoliated seedlings or young trees. From time to time damage has been reported in south Finland, extending to the regions of Pori (St), Tampere (EH) and Heinola (EH). Larvae of *Amorpha populi* L. have twice been found feeding on the leaves of apple seedlings. Similarly, larvae of the privet hawk-moth (*Sphinx ligustri* L.) have been observed on apple trees in Ahvenanmaa (SEPPÄNEN 1954, p. 336).

Larvae of the vapourer moth (*Orgyia antiqua* L.) are often found on the leaves of apple and pear trees. Since the larvae generally appear singly, the damage they inflict is usually quite slight. In some years, however, large numbers of larvae may occur on young trees, feeding on leaves and annual shoots, and eating holes in the fruit. In the years 1946 and 1947, there was a large invasion of these larvae in some areas; they attacked other kinds of trees and shrubs, including blackberries, in addition to apple trees (cf. POHJOLA 1947). The species has been observed as far up as North Ostrobothnia.

Larvae of *Lophopteryx camelina* L. have sometimes appeared as mild pests of apple trees (LINNANIEMI 1935, p. 63; E. KIVIRIKKO 1941, p. 154; SALO and SOTAVALTA 1952, p. 101; SEPPÄNEN 1954, p. 336). Once, larvae of *Eudia pavonia* L. were observed

on an apple tree (VAPPULA 1935 d), and at Porvoo (U) in 1945 one larva of the rare species *Gastropacha quercifolia* L. was seen (SEPPÄNEN 1955). In 1934, LISTO (1934, 1935) found a larva of the lackey moth (*Malacosoma neustria* L.) at Lohja (V) feeding on the leaves of a young apple tree. The species, which had not previously been encountered in Finland, was evidently introduced into this country along with imported stock. Another pest of deciduous trees in Central Europe is *Euproctis similis* FUESSLY, found for the first time in Finland in 1923 at Huopalahti in Helsinki (U) (RUDOLPH 1923). Later, this species has appeared on many occasions, principally along the south coast; in 1936, it was stated that larvae had appeared in an old, untended orchard at Snappertuna (U) (NORDMAN 1936).

A pest relatively new to this country is the pale tussock moth (*Dasychira pudibunda* L.), first observed in 1917 at Espoo (U) (RUDOLPH 1921). Larvae of this species have since been found on various deciduous trees and bushes in south Finland. They have been reported on apple trees at Orimattila (U) in 1939 (HEINÄNEN 1947, p. 26), at Räisälä (EK), at Lemi (ES) in 1947, at Iitti (EH) (AARIO 1947), and at Mäntyharju (ES) (Peltonen). Mäntyharju had a rather large infestation in 1949; at the beginning of September, the apple trees in some spots were defoliated by the pest, and mountain ash, willow, birch and alder trees were infested with larvae (VAPPULA 1959). Larvae of *Dasychira fascelina* L. were found in an apple nursery at Janakkala (EH) by Listo in 1934.

Occasionally, larvae of *Eriogaster lanestris* L. have been seen on sour cherry trees (E. REUTER 1890). In addition, an egg group of this moth was once found on the branch of a plum tree (LINNANIEMI 1920, p. 88). In one case, larvae of *Stilpnotia salicis* L. were observed to have migrated to apple trees from poplars, of which they had completely destroyed the leaves. Larvae of the following moth species have also been found on apple trees: *Stauropus fagi* L., *Orgyia gonostigma* FABR. and *Poecilocampa populi* L. (SEPPÄNEN 1954, p. 336), *Phalera bucephala* L. and *Aglia tau* L.

One of the most important apple tree moth pests is *Eupsilia satellitia* L., whose larvae were found for the first time as pests in this country in 1924. Since then, there has frequently been rather mild damage inflicted by this species on the leaves and flowers of apple trees in many localities. Larvae have also been seen on pear and sour cherry trees (SEPPÄNEN 1954, p. 337, 341). Furthermore, larvae of the following moth species have been observed either singly or in small numbers on the leaves of fruit trees: *Moma ludifica* L., on an apple tree at Sääksmäki (EH) in 1931 (E. KIVIRIKKO 1941, p. 155); *Colocasia coryli* L., on apple trees at Sääksmäki (EH) (E. KIVIRIKKO 1941, p. 156) and in South Savo, on plum trees in South Häme (SEPPÄNEN 1954, p. 336, 341) and on hazel at Föglö (A) (NORDMAN 1943, p. 167); *Acronycta alni* L., on apple trees at Karkku (St) in 1918 (E. W. SUOMALAINEN 1920, p. 82) and at Lempäälä (EH) (SALO and SOTAVALTA 1952, p. 103) and on cherry trees in Finland Proper and Uusimaa (SEPPÄNEN 1954, p. 341); *Acronycta tridens* SCHIFF., on apple trees in Uusimaa (SEPPÄNEN, op.cit., p. 336) and near Mikkeli (ES) (Kanervo); *Acronycta psi* L., at Tikkurila (U) in 1935 (Vappula) and also

elsewhere in south Finland and in addition on pear, plum and cherry trees (SEPPÄNEN, op.cit., p. 336, 341); *Acronycta rumicis* L., on pear trees at Espoo (U) in 1900 (E. REUTER 1901 a, p. 36), on young apple trees at Lohja (V) in 1916 (LINNANIEMI 1920, p. 90—91), in an apple orchard at Hollola (EH) in 1927 (HUKKINEN et al. 1936, p. 51), and on plum and cherry trees in Finland Proper and South Häme (SEPPÄNEN 1954, p. 341); *Rhyacia augur* FABR., on apple trees at Eurajoki (St) in 1937; *Polia dissimilis* KNOCH, an egg mass on an apple tree at Kärkölä (EH) in 1933 (VAPPULA 1935 d); *Monima gracilis* FABR., on apple trees, especially on suckers, in 1939—1942 in the vicinity of Helsinki (U) and elsewhere in south Finland, also on pear and cherry trees (NORDMAN 1941 a; VAPPULA 1943; SEPPÄNEN 1954, p. 337, 341); *Lithophane socia* ROTT., on apple trees at Tuusula (U) in 1931 (VAPPULA 1935 d) and at Tyrväntö (EH) in 1934—1935 (Listo), on a plum tree (injuring the fruit) at Särkisalo (V) in 1937; *Meganephria oxyacanthae* L., on apple and plum trees at Ruissalo near Turku (V) in 1926 (CLAYHILLS 1929 a, p. 92), on common crab apple, pear and cherry trees in south and southwest Finland (SEPPÄNEN 1954, p. 337, 341); *Episema caeruleocephala* L., on apple and cherry trees in Ahvenanmaa and Uusimaa (op.cit., p. 337); *Eurois prasina* FABR., on apple trees in South Häme (op.cit.); *Amphipyra tragopogonis* L., on apple trees at Tyrväntö (EH) (Listo); *Naenia typica* L., on apple seedlings at Janakkala (EH) (Listo); *Conistra vaccinii* L., on apple trees at Kauniainen (U) and on mountain ash at Tikkurila (U) in 1934 (VAPPULA 1935 d), on apple trees at Hartola (EH) in 1949; *Phytometra gamma* L., in slight degree on apple trees in different localities in south Finland in 1946 (KANERVO 1947, p. 100).

Larvae of *Calymnia trapezina* L. have been found on apple trees (in 1935 at Turku (V) and in 1939 at Sortavala (LK); this pest is also a predator of other insect species, especially of larvae of the winter moth and green oak tortrix moth, even of its own species (CLAYHILLS 1929). Other host plants are pear, plum and cherry trees (SEPPÄNEN 1954, p. 337—342).

At Lahti (EH) in 1949, it was observed that *Agrotis clavis* HUFN. injured plums and apples which had fallen to the ground. Also at Lohja (V) in 1951, there were many larvae of *Agrotis* sp. in one orchard; they had injured about 90 per cent of the apples on the ground. Some of the apples on the trees were also damaged (Markkula). Larvae of *Triphaena pronuba* L. inflicted severe damage at Turku (V) in 1948 by feeding on the cotyledons of apple seedlings.

A very common geometrid moth species in fruit orchards in Finland is the winter moth (*Operophthera brumata* L.)[1]), whose larvae, just after emerging, penetrate the opening buds and injure the young leaf and flower primordia. In the case of older leaves, the larvae spin them together into rolls, in which they live while feeding on the leaves. The larvae injure the petals, stamens and carpels of the flowers, thus preventing the formation of fruit. In the worst cases, they may almost

[1]) VAPPULA (1926) has written a report on the winter moth as a pest.

defoliate the entire tree, with the result that the year's yield is lost. There was particularly severe destruction in orchards in 1915—1916 in many locations in south Finland, in 1926—1927 in southwest Finland, in 1932—1934 in Ahvenanmaa and elsewhere in south Finland, in 1943 near Hämeenlinna (EH) (HUKKINEN, Annual report Dept. Pest Invest. 1943), in 1951 in the vicinity of Lahti and Heinola (EH), and in 1955 in South Ostrobothnia. As a pest, it has been encountered as far north as South Ostrobothnia, North Häme and North Savo. Larvae of the mottled umber moth (*Erannis defoliaria* CL.) have also been observed on apple trees (NORDMAN 1943, p. 172) (Listo).

Another injurious apple tree pest is the green prug moth (*Chloroclystis rectangulata* L.), whose larvae often destroy flowers and flower buds, and injure young leaves and shoots. In general, damage has been mild, and when flowering is abundant the harm done is quite insignificant. Nevertheless, together with the winter moth, this species has in some cases destroyed 40—50 per cent of the flower buds and flowers of apple trees. Cherry and pear leaves and flowers are also injured. Damage has been observed mainly in south Finland, but even as far north as South Ostrobothnia the species has, according to KAISILA (1955, p. 189), appeared in large numbers in an orchard at Nurmo.

Larvae of the peppered moth (*Biston betularius* L.) often appear on terminal shoots of young apple trees, of which they eat the leaves and even leaf stalks; sometimes they also feed on the bark of the shoots. At times, there may be more than ten larvae on the same tree, and as a result most of the leaves are destroyed. However, the damage is generally not very great. Cherry and bullace trees have also been attacked. Reports of damage inflicted by the peppered moth have come from as far north as the regions of Vaasa (EP) and Kuopio (PS). In 1937 at Sääksmäki (EH), there was a heavy infestation of larvae of *Cidaria corylata* THNBG on sweet cherry trees (E. KIVIRIKKO 1941, p. 170).

Other geometrid species which have appeared as fruit tree pests include *Opisthograptis luteolata* L. on apple and especially plum trees at Pirkkala (EH) in 1913—1914 (LINNANIEMI 1915, p. 38; 1916, p. 41) and in South Savo (SEPPÄNEN 1954), and on apple trees at Tikkurila (U) in 1949; *Colotois pennaria* L. was plentiful on apple and plum trees at Ruissalo near Turku (V) in 1926 (CLAYHILLS 1929 a, p. 96) as well as on pear trees in Uusimaa (SEPPÄNEN 1954, p. 337); *Lycia hirtaria* CL. appeared on young apple saplings at Sund (A) and on apple trees at Asikkala (EH) in 1916 (LINNANIEMI 1920, p. 107) and at Lohja (V) in 1932 (VAPPULA 1935 d) and in Uusimaa (SEPPÄNEN, op.cit.); *Boarmia roboraria* SCHIFF. was seen injuring the bark of a young apple tree in a nursery at Lahti (EH) in 1946; and *Boarmia repandata* L. was found on a cherry tree at Tikkurila (U) in 1949.

In addition, according to data collected by SEPPÄNEN (1954, p. 337, 342), the following geometrid species have been found on fruit trees: *Oporinia autumnata* BKH., on plum trees in South Häme; *Hydrelia testaceata* DON. and *Eupithecia exiguata* HB., on apple trees in Uusimaa; *Bapta temerata* HB., on apple trees in Uusimaa and sour

cherry in North Carelia; *Selenia tetralunaria* HUFN., on apple trees in South Häme; *Gonodontis bidentata* CL., on apple trees in Finland Proper, Uusimaa and South Häme.

On a number of occasions, larvae of *Arctia caja* L. have been found at the beginning of autumn on apple trees, of which they have damaged the leaves. Once *Spilosoma lubricipedum* L. was reared from a larva obtained in 1934 from a young apple tree at Sortavala (LK) (Listo). At Lohja (V) in 1955, a larva of *Nola cucullatella* L. was found on an apple tree. The species has also been observed on common crab apple trees in Ahvenanmaa (SEPPÄNEN 1954, p. 337).

Many species of *Microlepidoptera* live in the larval stage on the leaves and shoots of fruit trees. As early as 1848, AF TENGSTRÖM (1848, p. 103) mentioned the discovery of larvae of *Eurhodope advenella* ZCK. (*Myelois advenella* ZCK.) on apple trees in the botanical gardens at Helsinki (U).

Many species of tortricid moths damage the buds, shoots, leaves and flowers of fruit trees. The commonest and most dangerous of these is *Argyroploce variegana* HB., often blamed for the injuries caused by other species. In the spring, its larvae cause harm to the buds of apple trees (more rarely plum and other fruit trees). At a later stage, they twist the young leaves into compact coils, including also flowers on the flowering shoots. At times, such leaf rolls are very numerous on apple trees, and consequently the growth of young trees is appreciably retarded. This species is to be found throughout the entire fruit-growing region of Finland, even being remarked as a pest as far north as Oulu (PP). A closely-related species, the plum tortrix moth (*Argyroploce pruniana* HB.), has been mentioned by SAALAS (1933, p. 500) and KANERVO (JAMALAINEN and KANERVO 1956, p. 178) as a plum tree pest. To date, no information on destruction caused by this species has been received by the Department of Pest Investigation. Nordman states that in certain years it is quite plentiful on plum trees in Ahvenanmaa, and evidently occurs there as a pest.

The European leafroller (*Cacoecia rosana* L.), a very prevalent species feeding on many different kinds of deciduous trees and bushes, has often appeared as a harmful pest on fruit trees. E. REUTER (1899 b, p. 36) mentioned finding larvae on apple trees in Ahvenanmaa and Finland Proper. Since 1913, leaves rolled by this species have been rather abundant, especially in comparatively young apple trees and in the terminal shoots of young root-stocks; in some instances, the larvae have also injured flowers and unripe fruits. The leaves of plum, bullace and pear trees have also sometimes been rolled by this pest. Damage to apple trees has been observed as far as the region of Iisalmi (PS). The closely-related species *Cacoecia lecheana* L. was reared by the author in the years 1935, 1938, 1939 and 1942 from rolled leaves and flowers of apple trees, and infested shoots of plum trees at Tikkurila (U). In 1935, larvae were found on apple trees at Tyrväntö (EH) and Kauniainen (U) (Listo). In 1955, larvae were also observed at Lohja (V) in buds at the time of their opening; the moths emerged earlier than those of other apple leaf rollers (Heikinheimo). A third species, *Cacoecia xylosteana* L., rather rare in Finland, was reared by Listo in 1934 from an infested apple tree near Turku (V).

The bud moth (*Spilonota ocellana* FABR.), reported by E. REUTER (1892) as appearing for the first time in Finland in 1890, has been mentioned several times since 1925 as an injurious pest of the leaves of plum, bullace and apple trees in south Finland. In 1939, a number of larvae were seen in and near Tikkurila (U), where they rolled both the leaves of apple trees and its flowering shoots, which as a result failed to develop. Cherry and bullace trees were also damaged by this species.

Larvae of *Exapate congelatella* CL. were found in relative abundance by AF TENGSTRÖM (1848, p. 106) on apple trees at the botanical gardens in Helsinki (U). Since then, the species has appeared as a causal agent in the rolling of apple and bullace tree leaves, at least in Uusimaa, Satakunta and South Häme. A rather heavy infestation of larvae of *Peronea reticulana* STRÖM (*P. contaminana* HB.) was observed in an orchard at Lohja (V) in 1930, according to observations made by the author; they produced rolled leaves in the young shoots of plum trees. Moreover, damage done by this species has been found on apple and bullace trees at Asikkala (EH) in 1928, at Nousiainen and Vihti (V) in 1934, at Hirvensalo (V) in 1935 and at Tikkurila (U) in 1933—1935 and 1939. The larvae injure not only leaves, but also flower buds and opening flowers. In 1936 cherry trees were also infested at Tikkurila. A larva of the rather rare species *Peronea holmiana* L. was found by the author in a rolled apple leaf at Mustiala (EH) in 1936. In 1955, this species was relatively common on apple trees at Lohja (V) (Heikinheimo) and at Tikkurila (U). On two occasions (at Mikkeli (ES) in 1935, and Helsinki (U) in 1939) *Peronea aspersana* HB. was reared from leaf rolls of apple and plum trees. E. REUTER (1911, p. 21) reported that *Acroclita naevana* HB., along with some other species, attacked apple trees at Parainen (V) in 1909. Since that time, it has been found several times as an apple-tree pest: at Asikkala (EH) in 1931, at Turku (V), Tikkurila (U), Tyrväntö (EH), Tammela (EH) and Viipuri (EK) in 1934, at Loppi (EH) and Mikkeli (ES) in 1935, at Raivola (Kk) and Kuhmalahti (EH) in 1938 and at Helsinki (U) and Tammela (EH) in 1939. The buds of cherry trees were injured by larvae of this species at Tikkurila (U) in 1926.

Larvae of *Pandemis heparana* SCHIFF. were found by E. REUTER (1899 b, p. 38) on several different kinds of trees, including apple, near Turku (V) and in Ahvenanmaa. In 1909, larvae appeared on apple trees at Parainen (V) (E. REUTER 1911, p. 21), in 1925 at Kuusankoski (EH), in 1933 at Orivesi (EH), in 1934 at Tyrväntö (EH), Lahti (EH) and Viipuri (EK), in 1935 at Tyrväntö (EH) and Mikkeli (ES), in 1936 at Elimäki (U), and in 1928 and 1935 on apple and bullace trees at Tikkurila (U). In addition, *Pandemis ribeana* HB. was responsible for leaf rolls on apple trees in southwest Finland (E. REUTER 1899, p. 36—37). Larvae were also observed on apple and bullace trees at Kuusankoski (EH) in 1925, on apple trees near Helsinki (U) in 1928, and at Tyrväntö (EH) in 1934—1935; they injured the leaves and flowers of *Malus cerasifera* at Helsinki (U) in 1942. Heikinheimo stated that the species was prevalent on apple trees at the end of summer

at Lohja (V) in 1955. A rare species is *Pandemis cinnamomeana* TR., found making leaf rolls on apple trees at Viipuri (EK) and Tyrväntö (EH) in 1934. In 1934, larvae of *Tortrix politana* HAW. were found in an apple nursery at Vaajakoski (PH) (Listo).

Cnephasia virgaureana TR. has at times slightly injured apple trees (e.g., at Loppi (EH) in 1913, Vihti (V) in 1932, Vaajakoski (PH) in 1934) and pear trees (Turku (V) in 1935). The author has observed *Capua reticulana* HB. (*Adoxophyes orana* F. R.) damaging leaves and the flower shoots of apple trees at Tikkurila (U) in 1939; in 1942, it damaged *Malus cerasifera* at Helsinki (U), and in 1945 apple trees at Helsinki commune (U). Larvae have also been encountered in apple nurseries in the regions of Turku (V), Hämeenlinna (EH) and Viipuri (EK) (Listo). Nordman reported rearing *Gypsonoma sociana* HAW. from infested apple trees near Porvoo (U).

Larvae of the apple leaf skeletonizer (*Simaethis pariana* CL.) have in some years appeared in quite destructive numbers, especially in apple nurseries and on young apple trees, as well as on the terminal shoots of older trees. At worst, the leaves are curled, and the entire tree appears brown and withered. Two generations are produced, of which the second, appearing at the end of the summer, is generally more injurious. Damage caused by this species was first observed in Finland in 1905 at Karjalohja (V) (SAHLBERG 1906; E. REUTER 1908, p. 25). Subsequently, damage has been most evident in Ahvenanmaa. Finland Proper, Uusimaa and South Carelia, although mild damage has been done in the regions of Kuopio (PS) and Oulu (PP). In 1937, particularly large numbers of larvae were observed, mainly in the areas of Helsinki (U), Porvoo (U) and Viipuri (EK), but localized damage has been done, at least in the years 1935—1936 (Tenhola, Piikkiö (V)[1]), in 1939 (Viipuri (EK)), in 1947 (Kakskerta (V)), in 1949 (Tikkurila (U)), and in 1950 (Nauvo (V)). EKHOLM (1958) mentions epidemics of this species in the years 1937—1939 and 1947—1952. In 1934—1935, Listo found larvae of *Cheimophila salicella* HB. on apple trees in a number of spots in southern Finland; these pests live within the curled leaf edges of the apple trees.

Larvae of *Recurvaria leucatella* CL., which damage young leaves by rolling them, were found by the author for the first time as an apple-tree pest at Tikkurila (U) in 1934 (VAPPULA 1935 d). Subsequently this species has been reared from apple trees at Tikkurila in the years 1936, 1938—1939 and 1945, as well as at Valkjärvi (Kk) in 1939; it was also reared from mountain ash in 1939 at Tikkurila (U) and Hausjärvi (EH). Listo found larvae on apple trees at Pohja and in the region of Turku (V).

Rolled apple-tree leaves are also caused by *Gelechia rhombella* SCHIFF., which appeared in samples sent from Terijoki (Kk) and Hyvinkää (U) in 1932 (VAPPULA 1935 d), at Tikkurila (U) and Tyrväntö (EH) in 1934, at Tammela (EH) in 1936,

[1]) NORDMAN (1936 a) mentioned that larvae proliferated in an orchard at Snappertuna (U) in 1936.

at Sippola (EK) in 1937 and at Viiala (EH) in 1949. As early as 1848, AF TENGSTRÖM (1848, p. 130) reported observing this insect on apple trees at the botanical gardens in Helsinki (U) in August. E. REUTER (1904 b, p. 15) found this species to be common on apple and pear tree trunks at Parainen (V).

The shoots of apple trees are injured by larvae of the pith moth (*Blastodacna atra* HAW. f. *putripennella* ZELL.), which in the autumn penetrate below the bark for the winter; in the following spring, they move to the interior of new leaf or flower shoots and bring about their withering. The species was first found in Finland in 1934, when it was responsible for serious damage to some orchards at Helsinki (U) (LUNDÉN 1935; VAPPULA 1936 a). In 1935, larvae were found at Tyrväntö (EH) in apple saplings imported from Sweden (Listo). In the following years, varying extents of damage were caused in the region of Helsinki, although as a result of the cold winters of 1939—1940 and 1940—1941, the infliction of injury was almost completely brought to an end. However, the species has reappeared since 1949. In 1947, a sample of injury was obtained from Sund in Ahvenanmaa, in 1948 larvae were found at Turku (V), Perniö (V) and Ylistaro (EP) (Kanervo), and in 1954—1955 localized damage was observed at Lohja (V). In certain places this species may assume considerable economic importance.

Some species of *Microlepidoptera* live in the larval stage as leaf miners on fruit trees. Of these, the commonest is the apple and plum casebearer (*Coleophora serratella* L.), whose larvae injure the opening buds in the spring; later they penetrate the interior of the leaves, feeding on the chlorophyll, and as a result causing bleached, brownish »windows». The larvae, which according to HACKMAN (1935, p. 30) live in various species of *Prunus* and *Pyrus*, are occasionally to be found in large numbers on apple trees, although they have inflicted serious injury only rarely. Injury attributable to this species has been observed from the southern parts of the country to the vicinity of Jyväskylä (PH). Larvae of *Coleophora siccifolia* STAINTON were discovered by HACKMAN (op.cit., p. 26) on *Pyrus* at Helsinki (U)[1]).

Roundish, dark brown blister mines on the upper surface of apple leaves are the work of *Leucoptera scitella* ZELL. In 1913, such mines, numbering as many as 4—5 per leaf, were plentiful at Tuusula (U), and have since been observed at Järvenpää (U), Kuhmalahti (EH), Viipuri (EK), Maaninka (PS), Kuopio (PS) and Nauvo (V). At Föglö (A), NORDMAN (1943, p. 181) found mines on common crab apple trees. He later reported (1957 a) seeing mines on pear and cherry trees. The species does not appear to have any great economic significance in Finland. Mines made by *Lithocolletis concomitella* BANKES were found in the leaves of apple trees, at least at Parikkala (LK) (v. Schantz) and those of some *Lithocolletis* species at Kymi (EK) in 1954, Kuopio (PS) (NORDMAN 1955) and Lohja (V) in 1955 (Heikinheimo). BRUUN (1951) found a mine caused by *Lithocolletis cerasicolella* H. S. on a cherry tree near Turku (V).

[1]) *Coleophora hemerobiella* SCOP., which inflicts injury on fruit trees in other countries, has been found in Ahvenanmaa on Finnish and Swedish whitebeam (NORDMAN 1947; cf. also NYLUND 1948).

The apple leaf miner (*Lyonetia clerckella* L.) is on occasion a common pest of bird-cherry trees in this country (for example, in the years 1938—1939); it produces long, narrow, winding mines in the leaves of this tree. Only rarely has it been found on fruit trees: on cherry trees at Piikkiö (V) in 1922, Tammisaari (U) in 1923, Karjalohja (V) in 1926 and Tikkurila (U) in 1938—1939. In 1939, mines were very common on bird-cherry, sour cherry and apple trees at Föglö (A) (NORDMAN 1943, p. 181). Mines of *Lyonetia prunifoliella* HB. were found on apple trees by HACKMAN (1940 a).

Incurvaria pectinea HAW., whose larvae often produce numerous roundish mines (which later become holes) in the leaves of birch trees, is at times an occasional pest on apple trees, whose leaves assume a sieve-like appearance as a result of its feeding. Damage has been observed at Karjalohja (V) in 1934 (SAALAS 1935, p. 123; 1935 a, p. 169) and at Espoo (U) and Tyrväntö (EH) in 1949.

The following species of *Nepticula* have been found as leaf miners on apple trees: *Nepticula pomella* VAUGH., Helsinki (U) in 1926 and 1927 (KANERVA 1928), Kymi (EK) in 1954 (NORDMAN 1955), and Parikkala (v. Schantz); *N. aëneella* HEIN., Satava near Turku (V) in 1938 and Tammisaari (U) (common crab apple tree) in 1939 (HACKMAN 1940), Föglö (A) (common crab apple tree) in 1939, Kymi (EK) in 1954 (NORDMAN 1943, p. 182; 1955) and Pohja (V) in 1961; *N. pulverosella* STT., on common crab apple tree at Föglö (A) in 1939 and at Kymi (EK) in 1954 (NORDMAN, op.cit.) and elsewhere in south Finland. Mines of *Nepticula malella* STT. have been observed only on common crab apple trees at Föglö (A) (NORDMAN, op.cit., p. 182).

The larvae of *Callisto denticulella* THNBG (*Ornix guttea* HAW.) first live as leaf miners in the edges of apple leaves, but later roll part of the edge into a tube, living within it and skeletonizing its inner surface. In the summer of 1917, there was substantial damage done, especially near Turku (V), but also elsewhere in southern Finland. Subsequently such rolled leaves have been observed from time to time in various places extending to the regions of Tampere (EH) and Mikkeli (ES). Nevertheless the species is not economically important.

One of the most injurious apple tree pests in Finland is the small ermine moth (*Hyponomeuta malinellus* ZELL.), whose larvae even in the early spring damage the buds and the young leaves emerging from them. At the same time, they weave a network of webbing from leaf to leaf, continuously enlarging it until it covers almost the entire tree; during this process, they devour the leaves. When the damage is severe, this moth may appreciably reduce the yield of apples, or even completely preclude it. However, heavy infestations are of but rare occurrence in Finland. This pest was mentioned as early as the 1860's in Turku (V) and Helsinki (U) (LINNANIEMI 1917, p. 5); in the early 1880's, it proliferated on the islands off southwest Finland (E. REUTER 1897, p. 38; 1904 b, p. 5—6). In 1886, it brought about substantial drops in apple yields in southern Finland (Medd. F. Fl. Fenn. 15, p. 190). After a long period of absence, the small ermine moth reappeared in epidemic

proportions during the years 1912—1917; in 1915 the epidemic reached its height, and reports were received for the first time from South Carelia, Satakunta, South Häme and South Savo. In 1926—1928, damage was prevalent in the region of Viipuri (EK). The following serious outbreak occurred in 1932—1935, when larvae were numerous on apple trees, especially in South Carelia and South Häme. Later damage has been reported in 1952 (Kouvola (EK) and Vaasa (EP)), 1955 (Helsinki (U) and Pori (St), South Ostrobothnia) and 1956 and 1958 (Finland Proper). Destruction attributable to this pest has been observed as far as the regions of Vaasa (EP), Viitasaari (PH), Kuopio (PS) and Joensuu (PK)[1]). In 1939 at Föglö (A), small groups of larvae were found on plum trees; these were probably *Hyponomeuta irrorellus* HB. (NORDMAN 1943, p. 152).

The most dangerous cherry-tree pest in Finland is *Argyresthia pruniella* L. In the early spring, its larvae penetrate the buds and destroy them; later they injure the unfolding flower buds, and feed on the flowers. They also damage young leaves and developing fruit. Sometimes the injury is so severe that the yield is partially or completely lost. On rare occasions, damage has been inflicted on plum and bullace trees. Rather limited data indicates that serious damage has occurred in the years 1913, 1915, 1924, 1926—1928, 1937, 1951, 1953 and 1957—1960 (especially in the region of Lohja (V)), but that appreciable localized damage has also been done by this pest in the intermediate years. The majority of reports have been recieved from Finland Proper, Uusimaa and South Häme; the area of occurrence of this species extends to the regions of Pori (St), Tampere (EH), Mikkeli (ES) and Joroinen (PS).

The opening buds and young leaves of apple trees are injured by larvae of *Argyresthia cornella* FABR. This species was first found in Finland in 1898 by FEDERLEY (1901), but it did not occur as a pest until 1924 at Malmi (U) (VAPPULA 1935 d; HUKKINEN and VAPPULA 1935, p. 63), where it was quite abundant, together with other moth species. Since then, it has been observed several times on apple trees, e.g., 1928 and 1934 at Tikkurila (U), 1935 at Savitaipale (ES), 1939 at Helsinki commune (U) and Sortavala (LK), 1949 at Hartola (EH) and 1955 at Sysmä (EH).

Cerostoma parenthesellum L. has been found four times on apple trees (Järvenpää (U) in 1931, Isokyrö (EP) in 1933, Kuopio (PS) in 1934 and Vihti (V) in 1935). NORDMAN (1943, p. 181) mentions seeing larvae of *Cerostoma scabrellum* L. on apple trees at Föglö (A). The author once found a larva of *Cerostoma asperellum* L. injuring a plum fruit at Tikkurila (U) in 1935. Larvae have also appeared on apple trees in 1934 at Lohja (V), Hämeenlinna (EH) and Tyrväntö (EH) (Listo).

The trunks of apple trees are damaged by the larvae of the goat moth (*Cossus cossus* L.), which initially live under the bark at the base of the tree, but later penetrate the interior of the trunk. Trees badly attacked by the larvae often die. As a rule, damage appears as single cases in various places in the southern parts of the

[1]) According to JUNNIKKALA (1960) the species has been found in Central and North Ostrobothnia as far as Oulu (PP).

country, and the injury inflicted has generally been rather slight. Larvae of *Laspeyresia woeberiana* SCHIFF., which make tunnels in the bark or superficial wood layers of fruit tree trunk, were found by NORDMAN (1943, p. 177) in the bark of cherry trees at Föglö (A). The species is quite common, but its damage is not easily detectable.

Two injurious fruit pests appear in Finland, the codling moth and the apple fruit moth. The codling moth (*Laspeyresia pomonella* L.) was known as a pest in Finland as early as the middle of last century. AF TENGSTRÖM (1848, p. 82) mentioned that it was very common in southern Finland in some years. From 1895, information is available in the annual reports of the State entomologists and in the archives of the Department of Pest Investigation on the injuries caused by this pest; in certain cases the damage has often been serious, with as much as 20—50 per cent or even more of the fruit having been destroyed. Damage has been reported almost every year, but in view of the scantiness of data it is difficult to obtain a definite picture of the annual fluctuations in abundance of this species. However, it appears that damage attributable to the codling moth was particularly severe and common in the following years: 1897, 1914—1915, 1925—1926, 1932—1933, 1936—1937, 1940, 1945—1946, 1948, 1950—1951, 1954—1955, 1957, and 1959—1960 (cf. also KANERVO 1960 a). The codling moth often appears together with the apple fruit moth. At times, pear trees are also harmed by this pest. The greatest damage done by the codling moth is in south Finland, but it has been found as far north as the regions of Kokkola (KP), Kuopio (PS) and Joensuu (PK).

Another destructive fruit pest of apples is the apple fruit moth (*Argyresthia conjugella* ZELL.), which is often even more injurious than the codling moth, since it riddles the fruit with its tunnels and spoils them completely. In epidemic years, it proliferates over wide areas, and is capable of destroying as much as 50—100 per cent of the apple yield. As the larvae normally live also in the berries of mountain ash, severe damage to apples generally occurs when a large yield of mountain ash berries is followed by a year with a small one. Destruction to apples usually lasts for no more than one year, but sometimes 2—3 years. Larvae of the apple fruit moth have at times also been observed in the fruit of Siberian crab (*Pyrus baccata* and *P. prunifolia*) and hawthorn. This species was first found as a pest in Finland in 1898, when larvae suddenly appeared in great numbers over wide areas (E. REUTER 1899, p. 55—60; 1899 a; 1904 b, p. 7). Years of extensive destruction have been 1901, 1905, 1907, 1916, 1918—1919, 1924, 1929, 1931—1932, 1935, 1937, 1943, 1945, 1949, 1951—1953, 1955, 1957, and 1960. Thus during a period of 60 years there have been 20 years of heavy destruction. Injury attributable to the apple fruit moth has been encountered as far as the regions of Oulu (PP) and Iisalmi (PS).

Plums are damaged by larvae of *Laspeyresia funebrana* TR. which live in the interior of the fruit. Injury was established for the first time in 1936, on the basis of a larval specimen from Rymättylä (V). Later, NORDMAN (1950) found larvae of this species in plums at Eckerö (A) and Nauvo (V). At the latter location, about 20 per cent of

the fruit were injured on some of the trees in an orchard. Slight damage has also been observed at Lohja (V) in 1940, at Tikkurila (U) in 1945 and 1947, and at Salo (V) in 1949 (Kanervo). Evidently this species appears at certain times as a significant plum orchard pest in south Finland.

Mites (*Acarina*). The fruit tree red spider mite (*Metatetranychus ulmi* KOCH) is one of the most destructive pests of fruit trees in this country, injuring apple, plum and bullace trees, and sometimes also pear and cherry trees. The species was first observed in Finland in 1901, when according to E. REUTER (1902, p. 68) it brought about severe injury to plum trees at Parainen (V). In 1917, these mites were plentiful on apple trees at Porvoo (U) and in 1922 on plum trees at Naantali (V) (LINNANIEMI 1935, p. 132). Since 1924, reports of damage by this species have been received annually from various parts of the country and at times the damage has been very great in extent. In 1934 and 1935, it was found as far as Oulu (PP), and in 1954 Heikinheimo saw moderate numbers of mites in an orchard at Simo (PP), apparently the most northerly location in Finland where the fruit tree red spider mite has been found. As most commercial nurseries are infested with mites, this pest has been able to spread to many parts of the country. The mites live in large numbers on the lower surface of the leaves, feeding on them; the result is that the leaves often become brownish-grey, and even fall off prematurely. During the course of the summer, 3—5 generations are produced, dependent on the weather conditions (LISTO et al. 1939, p. 38). Particularly heavy infestations of mites were recorded in the years 1931, 1933, 1934, 1936—1937, 1939 (locally), 1947—1948 (locally), 1952, 1955, 1957 and 1959 (cf. KANERVO 1960 a). In 1955 in particular, the reproduction of mites was profuse; by the autumn, the leaves of apple trees in many orchards had become prematurely brown, thus hindering their photosynthetic activity. Since the 1930's, attention has been paid to control of the fruit tree red spider mite (LISTO 1935 a, 1935 b; LISTO and LISTO 1937; HEIKINHEIMO 1956; KANERVO 1956 a).

The apple gall mite (*Eriophyes malinus* NAL.) is a common pest on apple trees, and produces white or reddish felted galls (which later turn brown) on the undersurface of the leaves. The species, first observed as a pest in this country at Tikkurila (U) in 1911[1]), occurs in southern Finland as far as the regions of Laukaa (PH) and Suonenjoki (PS). Its most severe attacks are directed against old trees, but in general it does not inflict serious damage. *Eriophyes mali* NAL. was found as a pest on the leaves of apple trees at Nauvo (V) in 1952.

Injuries brought about by the leaf and bud mite (*Phyllocoptes schlechtendali* NAL.) were first observed in 1926 at Hyvinkää (U), and two years later at Sortavala (LK) (LISTO 1933 a, 1934 a). Subsequently, it has been found in several communities, the northernmost being Revonlahti (KP). The species lives freely on the leaves of apple trees, and when it appears in large numbers may cause the leaves to turn yellow and dry during the summer, thus hindering the growth of the trees. This

[1]) According to LINDROTH (LIRO) (1899, p. 18) it was found earlier at Hammarland (A), Suursaari (EK), and Kaukola (LK).

mite is readily transmitted from place to place through the agency of infested saplings. It has also been found on pear trees (H. ROIVAINEN 1947, p. 26; LIRO and ROIVAINEN 1951, p. 197), Siberian crab, *Pyrus Sieboldi* (LIRO and ROIVAINEN, l.c.), and common crab apple (H. ROIVAINEN 1951, p. 31).

The pear leaf blister mite (*Eriophyes pyri* NAL.) lives within the leaves of pear trees, making pale-green blisters which later turn dark brown. As the numbers of mites on infested trees increase from year to year, the trees suffer, and the fruit yield may decrease considerably. Sometimes the mites also attack unripe fruit, which become wrinkled and readily fall to the ground (E. REUTER 1906). The species was first encountered as a pest in 1897 at Siuntio (U) (E. REUTER 1898, p. 61). Damage has since been observed in different areas of south Finland, extending to the regions of Tampere (EH), Jyväskylä (PH) and Joensuu (PK). This pest has spread mainly by means of infested saplings bought from nurseries. *Epitrimerus pyri* NAL., which lives freely on the lower surface of pear leaves, and causes their withering, has been found only once in Finland, in the commune of Helsinki (U) (H. ROIVAINEN 1947, p. 33; LIRO and ROIVAINEN 1951, p. 234).

An important pest of plum and bullace trees is the plum leaf-gall mite (*Eriophyes similis* NAL.), the cause of pouch-shaped galls in the leaves, and unevenness in the surface of the fruit. When the attack is severe, the leaves become wrinkled, the fruit stop growing, and the yield is resultantly very low. Damage was first observed in 1899 at Turku (V) (E. REUTER 1901, p. 39)[1]). In 1903 Lindroth (Liro) saw mites at Pornainen (U). It has since appeared in many localities in the south and south-western coastal areas, and on the islands of Ahvenanmaa. *Phyllocoptes fockeui* NAL. & TROUESSART lives freely on the lower surface of plum leaves, and causes them to turn brown. It has been found in south Finland on sour and sweet cherry, bullace and plum trees (LIRO and ROIVAINEN 1951, p. 182).

The buds of hazel bushes are at times destroyed by the nut gall mite (*Phytoptus avellanae* NAL.), which appears throughout the entire region of growth of this plant (LIRO and ROIVAINEN 1951, p. 163). It was first found in 1928 (LIRO 1928 a; cf. also LIRO 1928). It brought about particularly severe damage to transplanted hazel bushes at Hattula (EH) in 1924 (HUKKINEN and VAPPULA 1935, p. 86).

M o l l u s c s (*M o l l u s c a*). Grey field slugs (*Deroceras agreste* L.) have at times appeared on fruit trees; they often feed on fruit, especially plums, which have fallen to the ground, and have also been seen to climb apple trees to eat the fruit. In 1955, *Fruticicola hispida* L. was reported on apple trees at Lappeenranta (ES).

B i r d s (*A v e s*). Certain species of birds damage orchards either by feeding on the buds in winter or by eating the fruit in summer. S. L. and P. NUORTEVA (1952) reported that nutcrackers (*Nucifraga caryocatactes* L.) appreciably damaged apple trees at Korppoo (V) by feeding on their winter buds. Similarly, the bullfinch (*Pyrrhula pyrrhula* L.) has been seen eating the buds of apple trees during the

[1]) As early as 1897, it was found on *Prunus spinosa* at Jomala (A), and in 1899 on the same host plant at Eckerö (A) (LINDROTH (LIRO) 1899, p. 19; 1902 a, p. 7).

winter (HILLI 1927, p. 127; 1929, p. 41). In some cases, the hazel grouse (*Tetrastes bonasia* L.) has done much harm by eating the flowering buds of apple trees; at Tuusula (U) in 1952, about 90 per cent of the buds on 200 apple trees were injured, and at Nuijamaa (EK) in 1951 60 per cent of the buds on 350 trees were destroyed. The black grouse (*Lyrurus tetrix* L.) has also eaten apple tree buds, e.g., at Harviala (EH) in 1952—1954 (Kanervo). House sparrows (*Passer domesticus* L.) have been seen to eat the buds of plum trees, perhaps in order to consume the aphid eggs on them.

The hooded crow (*Corvus corone* L.) and continental jay (*Garrulus glandarius* L.) have on occasion been seen feeding on apples (HILLI 1927, p. 122, 124; 1929, p. 35, 38). In 1925, the northern great spotted woodpecker (*Dendrocopos major* L.) destroyed a large number of apples at Viitasaari (PH) (HILLI 1927, p. 128; 1929, p. 42). It was responsible for similar damage at Kirkkonummi (U), Lohja (V) and Hauho (EH) in 1930 (EKMAN et al. 1931). In some instances, the magpie (*Pica pica* L.) has been reported as feeding on apples and cherries (HILLI 1927, p. 124; 1929, p. 37).

The most serious bird pest in fruit orchards is the fieldfare (*Turdus pilaris* L.), which at times makes holes in the apples upon the trees. These birds inflict more damage when they fly in large flocks from one orchard to the next, eating all the cherries on cherry trees. As an example of their destructiveness, in 1925 they destroyed one third of the cherry and currant crop in an orchard at Mikkeli (ES) (HILLI 1927, p. 125; 1928; 1929, p. 39). Fieldfares have perpetrated their most severe damage in the southwestern parts of the country (SIIVONEN 1940). The blackbird (*Turdus merula* L.) has also been seen to injure apples. Other birds which have been observed feeding on cherries are the jackdaw (*Corvus monedula* L.), starling (*Sturnus vulgaris* L.) and house sparrow (*Passer domesticus* L.) (HILLI 1927, p. 124, 126; 1929, p. 38, 41).

M a m m a l s (*M a m m a l i a*). Hares are often responsible for very severe damage to fruit orchards. Especially towards the end of the winter, when their food supply is meagre, hares invade orchards, mainly attacking young trees. They inflict injury by eating the buds, chewing off the ends of the twigs, and gnawing at the bark of the trunks and branches. The injury can be of a very serious nature to young trees, when the bark encircling the base of the trunk has been eaten away.

Of the two species of hare in Finland, the European hare (*Lepus europaeus* PALL.) is the one responsible for most injury. It is currently distributed throughout south and central Finland as far as to the regions of Oulu (PP), Iisalmi (PS) and Nurmes (PK). Information on the damage brought about by hares has been published since 1926, when appreciable destruction was caused in at least Satakunta and South Häme.[1]) During the 1930's (especially 1936—1938) hares were a nuisance in many orchards and nurseries; since 1948 damage attributable to them has been of frequent occurrence, attaining a peak in 1951, when destruction was greater than

[1]) According to K. E. KIVIRIKKO (MELA—KIVIRIKKO, Suomen luurankoiset 1909, p. 53) hares had already spread to the commune of Helsinki (U), where they caused much harm by feeding on apple trees.

ever before. On the basis of replies to questionnaires, the damage caused by hares was estimated at 5.5—6 million marks in 1950, 50—60 million marks in 1951 and 35—40 million marks in 1952 (KANERVO 1952, 1953). In the years 1953, 1955 and 1956 again, the extent of damage was appreciable, especially in the south of the country. The Department of Pest Investigation, on conducting an examination of 214 orchards, showed that in the winter of 1954—1955 hares injured about 1.2 per cent of the apple saplings, 0.3 per cent of the rootstocks, and 5.5 per cent of the older apple trees (KANERVO 1956, p. 137). Hares also damage pear trees and occasionally plum, bullace and cherry trees (BRANDER 1955). Only rarely has the mountain hare (*Lepus timidus* L.) been observed to cause injury to fruit trees.

Not only hares, but also voles (*Arvicolidae*) are harmful fruit tree pests. The commonest of these pests is the field vole (*Microtus agrestis* L.), which appears throughout the entire country. In the winter, it severely damages trees by gnawing at the bark under the snow, and young trees are often killed. Damage brought about by voles was first mentioned in the State entomologist's report of 1915 (LINNANIEMI 1920, p. 223), and ever since then reports have been received every year on destruction by this pest. In 1941, voles were responsible for inflicting serious injury in at least some nurseries in the regions of Lohja (V) and Hämeenlinna (EH); in 1950—1951, apple trees were damaged in many places in southwest Finland; in 1952—1953, destruction was above normal in south and central Finland, and in the following two winters severe damage was caused to apple trees. As an example, in the winter of 1953—1954, voles damaged 6.4 per cent of apple trees and 5.4 per cent of saplings and rootstocks in the areas investigated. In the winter of 1957—1958 destruction was again very heavy. As much as 18.1 per cent of apple trees and 20.8 per cent of saplings and rootstocks were injured by voles (MYLLYMÄKI 1959, p. 76—77). On occasion, plum and bullace trees are also attacked, and only rarely pear and cherry trees. In the years 1954—1959, most of the damage (91 per cent of apple trees and 94 per cent of saplings) consisted of bark injury inflicted mainly by field voles.

A related species, the continental vole (*Microtus arvalis* PALL.), has rapidly increased during the past ten years (SIIVONEN 1951) and has now been found as far north as central Finland. The continental vole inflicts the same kind of damage as the field vole, and may also injure the roots of fruit trees. Its share of the total damage to trees is obviously less than that of the field vole. In orchards located near forests, damage to buds and bark may be attributable to the bank vole (*Clethrionomys glareolus* SCHREB.) (MYLLYMÄKI 1956; 1958, p. 67; 1959, p. 82). The yellow-necked field mouse (*Apodemus flavicollis* MELCH.) can also apparently injure fruit trees, and K. E. KIVIRIKKO (1940, p. 61) mentions it as feeding also on sweet apples in an orchard.

An injurious pest of fruit tree roots is the water vole (*Arvicola terrestris* L.), common almost everywhere in Finland. It often digs tunnels in orchard soil and severs the roots of the trees below ground level, with the result that even old trees may be killed. The rather limited data available indicates that 8.8 per cent of the vole damage to apple trees in 1954—1959 and 5.9 per cent of that to saplings was inflicted on the

roots, evidently caused almost exclusively by the water vole. The annual losses to fruit and ornamental trees for which voles are responsible are estimated at 100—200 million marks; in exceptional epidemic years such losses may be substantially greater (MYLLYMÄKI 1959).

It has been stated that the red squirrel (*Sciurus vulgaris* L.) carries off apples, pears and other fruits in order to eat their seeds (KORVENKONTIO 1926; RIKALA 1937). In addition, it has been seen feeding on the bark of apple trees, and eating nuts (VARTIO 1946, p. 67, 69). In one case, squirrels were suspected of removing all the buds from the branches of an apple tree (PEKKOLA 1938).

In some instances, elks (*Alces alces* L.) have visited fruit orchards, eating the terminal shoots of the twigs, and breaking branches and even the trunks of the trees (Metsästys ja Kalastus 1950, p. 110; COLLAN 1951). In 1951 at Parainen (V), elks destroyed several thousand marketable fruit tree saplings in a nursery, as well as rootstocks, resulting in damage to the extent of over 2 million marks (COLLAN, op.cit.).

17. Berry bushes

Springtails (*Collembola*). In 1924, springtails, evidently *Sminthurus viridis* LUBB. var. *nigromaculata* TULLB., appeared in large numbers on strawberry leaves in a garden at Tikkurila (U), causing curling of the leaves (HUKKINEN and VAPPULA 1935, p. 14).

Earwigs (*Dermaptera*). At times, rather large numbers of earwigs (*Forficula auricularia* L.) have been found on currant bushes; on one occasion it was stated that they had attacked ripe fruit.

Plant bugs, aphids, etc. (*Hemiptera*). Capsid bugs often infest berry bushes, particularly currants, but also gooseberries, raspberries and strawberries. At the beginning of summer, they feed on growing shoots, of which the young leaves subsequently become brown and dry. Older leaves become wrinkled and discoloured. In the worst cases, the bushes dry almost entirely, and the berries fall to the ground before they have ripened. On occasion, damage has been especially great in North Ostrobothnia, e.g., in 1919 at Oulu, 1930 at Tornio, 1933 at Alatornio and Ylitornio, 1944 at Kemi, 1951 at Tervola and Alatornio, 1954 at Oulu, Tornio, Ylitornio and Rõvaniemi, and 1956 at Tornio. The species mentioned in literature as inflicting damage is usually the tarnished plant bug (*Lygus pratensis* L.), but in fact the principal causes of damage to berry bushes are the common green capsid (*Lygus pabulinus* L.) and the apple capsid (*Plesiocoris rugicollis* FALL.). The former was found as early as in 1918—1919 as a pest at Raahe (KP) (LINNANIEMI 1935, p. 111), and the latter on currant bushes in 1931 at Kauhajoki (EP), in 1933 at Alatornio and Ylitornio (PP) (VAPPULA 1935 c) and in 1935 in Helsinki (U) (Vappula)[1]).

[1]) Currants were further infested with *Calocoris biclavatus* H.S., but this species was evidently less injurious than the apple capsid.

At Raahe (KP) *Calocoris ?fulvomaculatus* DeG. was observed in addition to the other species (LINNANIEMI, op.cit.). Capsid bugs damage both the leaves and the unripe fruit of strawberries, which as a result become shrivelled and deformed.

Occasionally large numbers of sloe bugs (*Dolycoris baccarum* L.) infest currant, gooseberry and raspberry bushes; they feed on and cause the desiccation of the young leaves, flower buds, flowers and developing fruits. In the worst cases, the berries fall before they have ripened. The bugs also spoil currants and strawberries with their odour. Damage has been inflicted in south and central Finland. *Coreus marginatus* L. has at times been found on raspberry bushes and strawberry plants, where they inflict mild injury (LINNANIEMI 1916, p. 59).

A frequent pest on strawberries, and a very injurious one is the common froghopper (*Philaenus spumarius* L.), whose larvae live within a saliva-like froth on leaves and stems. They feed on the plant, causing the leaves to become twisted and wrinkled; in severe cases the flowers wither, with a consequent reduction in strawberry yield. Varying degrees of damage have been inflicted in different parts of the country, extending as far as the district of Kemi (PP). *Macropsis fuscula* ZETT. and *Orolix cruentatus* PANZ. have been found on raspberries at Hattula (EH) (P. NUORTEVA 1952 a, p. 22, 25).

Aleurodes fragariae WALK. was first observed in this country at Hattula (EH) in 1917, when it was present in great numbers on the undersides of strawberry leaves (LINNANIEMI 1935, p. 117). It has since appeared at Sipoo (U) in 1937 and 1951, Järvenpää (U) in 1951, Helsinki (U) in 1957, Sammatti (V) and Helsinki commune (U) in 1959. However, it has not caused any appreciable damage.

According to the investigations of HEIKINHEIMO (1951, 1952), about 10 species of aphids have been found on currants and gooseberries in this country. Some of these injure the young shoots, making the leaves curl, while others produce reddish or yellowish blisters in the leaves. Furthermore, there are species which live freely on the leaves, woody stems or on the surface of the roots in the ground.

One of the commonest and most injurious aphids on berry bushes is the gooseberry aphid (*Aphis grossulariae* KALT.), which brings about deformation of the tips of the shoots on red and black currants and gooseberry. It has spread as far as Inari Lapland, and often seriously hinders the growth of the bushes. For instance, the yearly growth of black currant shoots may be reduced by 30 per cent of the normal as a result of aphid attacks, with a corresponding diminution in the fruit yield the following year (HEIKINHEIMO 1952, p. 103). *Aphis schneideri* C. B., which causes the shoots of red and black currants to curl, is apparently rarer than the former species. In some localities, it has been found in relatively large numbers, for example, as far as Central Ostrobothnia in 1959 (cf. KANERVO 1960 a).

The red currant blister aphid (*Cryptomyzus ribis* L.) produces reddish blisters on the leaves of red currant, rarely black currant; within these blisters, the aphids live on the undersides of the leaves. In the worst cases, most of the leaves may be deformed and twisted, and the yield of currants very low. The aphids may also

attack the fruit clusters, injuring them to such an extent that fruit wither and fall. According to observations made by Hukkinen, the falling of unripe fruit which prevailed in the region of Hämeenlinna (EH) in 1943 was due to the red currant blister aphid. In one case, losses amounted to 68 per cent (HUKKINEN 1943 a). The species is found throughout the whole country as far as Kemi Lapland, and its leaf blisters appear every year in varying degrees on red currant bushes. The black currant aphid (*Cryptomyzus galeopsidis* KALT.) lives freely on the lower surface of the leaves of red and black currant, but without the production of any blisters or discoloration in them. This aphid has been found in various parts of the country as far as Utsjoki in Inari Lapland (Vappula). In the middle and later part of the summer, the aphids, remigrating to the bushes, may foul the ripening berries with their excrement (Heikinheimo).

Black currant is the principal host plant of the currant-lettuce aphid (*Hyperomyzus lactucae* L.), although in exceptional cases it may move to nearby red currant and gooseberry bushes. It causes leaf galls at the tips of the young shoots, in which the leaf edges are turned downwards, and the leaf-veins become yellowish; badly injured leaves fall prematurely. This species has sometimes been reported as proliferating on currants, but has evidently been confused with other species of aphid. In the report of the State entomologist 1915—1916 (LINNANIEMI 1920, p. 192—201), as well as in some later communications, the currant-lettuce aphid was reported mainly to have infested red and white currants, and more rarely black currants. However, HEIKINHEIMO (1951, p. 464) believes that the damage in question was due to *Hyperomyzus rhinanthi* SCHOUT. and to the black currant aphid. The former species lives on red currant, whose leaves become intensely curled. It is evident that in certain years the three species mentioned have a considerable significance as currant pests. They are found in nearly the whole of the country, extending as far as Lapland. *Hyperomyzus pallidus* H. R. L. produces the same kind of leaf galls on gooseberry bushes as the currant lettuce-aphid on black currant. The species has been found in moderate numbers in certain spots in south and central Finland.

The lettuce aphid (*Nasonovia ribisnigri* MOSL.) lives on both currant and gooseberry bushes, whose terminal leaves become curled. It has been found on gooseberry bushes in places in south Finland, in some cases quite abundantly.

In 1946 at Perniö (V), remigrating adults of the mealy plum aphid (*Hyalopterus pruni* GEOFFR.) along with their young nymphs, were found on gooseberry leaves. The nymphs were incapable of developing into adults (Heikinheimo).

There are two species of aphids in Finland which do not live on currant leaves. *Rhopalosiphoninus ribesinus* V. D. GOOT lives in clusters on the underside of the woody shoots or 1—2 year branches of currant bushes. It was found on red currant at Tikkurila (U) in 1950 (Heikinheimo). The intermediate host plants of the elm aphid (*Schizoneura ulmi* L.) are currants and gooseberries, on whose roots they sometimes live in such large numbers that the surrounding soil is covered with their wax secretion. This species has on several occasions been found on gooseberry (Helsinki

(U) in 1929) and black and red currant (Kauhajoki (EP) in 1931 and 1934, Mäntyharju (ES) in 1947, Vanaja (EH) in 1951).

Raspberry bushes are often infested by aphids which twist the terminal leaves of the shoots into deformed curls. The causal agent is the raspberry aphid (*Aphis idaei* v.d. Goot), which has been found as far as Maaninka in North Savo (Heikinheimo), as well as on wild raspberry as far as Kuusamo (Ks) (Vappula). In south Finland, the rubus aphid (*Amphorophora rubi* Kalt. = *Nectarosiphon idaei* C. B.) is also quite common. Both of these species transmit virus diseases of raspberry (Heikinheimo 1959).

The leaves and shoots of blueberries have been injured by aphids of the genus *Doralis* (Hårdh 1959, p. 139)[1]).

The willow scale (*Chionaspis salicis* L.) often appears in large numbers on the stems of currant bushes; at times, the bush is so severely injured that individual branches or even the whole plant may die. In severe cases, the berries also are infested. The species was found as early as 1881 on mountain ash at Parainen (V), and in 1892 at Ilmajoki (EP)[2]) (O. M. Reuter 1883, 1893). It also appears in profusion on bilberry and cowberry (e.g., E. Reuter 1896). The willow scale is found at least as far as South Ostrobothnia, North Häme and North Carelia. Another species, the brown scale (*Eulecanium corni* Bché), sometimes infests black and red currant as well as gooseberry bushes, the branches of which are on occasion covered with these pests. As a result of the injury, the fruit yield is reduced, and in cases of serious damage the entire plant may die. Injury is most extensive in Finland Proper and Uusimaa, but has been found as far as Central Ostrobothnia (Veteli) and North Savo (Lapinlahti).

Beetles (*Coleoptera*). *Harpalus pubescens* Müll. was seen damaging strawberries by eating their interior at Somero (EH) in 1954. Similarly, *Carabus nemoralis* Müll. hollowed out strawberries, especially sweet varieties, at Iisalmi (PS) in 1955.[3]) In 1928 at Kuusankoski (EH), *Pterostichus vulgaris* L. made holes in ripe strawberries, and sometimes ate its way into the interior of the berries; it continued its destructive work later during storage (Listo).

At Kangasala (EH) in 1952, *Cantharis obscurus* L. so heavily infested the flowers of red currant that the flowers fell off. *Cantharis fuscus* L. destroyed unripe fruit of black and red currant at Elimäki (U) in 1953.

Wireworms (*Elateridae*) have occasionally been responsible for considerable damage to strawberry gardens, attacking young plants in particular. In one case, they were reported to have destroyed 20 per cent of the plants. *Agriotes obscurus* L. was once found damaging berries. In 1953 at Elimäki (U), *Corymbites pectinicornis* L. and *Prosternon tessellatum* L., together with cantharids, injured the unripe fruit of black and red currant.

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[1]) The species was possibly *Aphis vaccinii* C.B. (Heikinheimo).

[2]) The sample from Ilmajoki was determined by J. W. Douglas to be a new species with the name *Chionaspis sorbi*, but according to Lindinger it was the same as *Ch. salicis* L.

[3]) *Carabus glabratus* Payk. has been observed to injure ripe raspberries (Nordman 1944).

The worst raspberry pest is the raspberry beetle (*Byturus tomentosus* FABR.), which appears in the spring or early summer, makes its way into the flower buds, and eats their interiors. It also injures the generative organs of opened flowers. Strawberries are damaged in a similar manner. The larvae of this species are especially injurious; very often 25—50 per cent of the fruit are infested, and sometimes every single berry contains larvae. Larvae are found in equal abundance in wild raspberries. The species was first mentioned as a pest in this country at Helsinki (U)[1]) in 1897; since 1913, almost every year has brought reports of damage of varying degrees of intensity. This pest was particularly common at least in the years 1915, 1935 (in Central and North Ostrobothnia), 1945 (in South Häme), 1952—1955, 1957 and 1959—1960. Damage has been reported from as far as North Ostrobothnia and Kemi Lapland (Pelkosenniemi). Blossom beetles (*Meligethes aeneus* FABR.) proliferate at times on strawberry flowers, but cause no noteworthy damage.

From time to time, larvae of the cockchafer (*Melolontha hippocastani* FABR.) have been found on strawberry patches, where they have in some instances inflicted injury by feeding on the roots. They also damage raspberry seedlings and cuttings of berry bushes. In 1951 at Taipalsaari (ES), large numbers of the garden chafer (*Phyllopertha horticola* L.) appeared on raspberries. The rose chafer (*Cetonia aurata* L.) and *Potosia cuprea* FABR. sometimes injure the flowers of the black currant by tearing them open and eating their inner organs. They have also been known to feed on gooseberries, and make large notches in the leaves of berry bushes.

Large numbers of *Lagria hirta* L. were found in 1952 in a strawberry field at Nauvo (V), where they ate small holes in the surface of the fruit. About 60 per cent of the ripe berries were injured (ÅBERG 1952). Damage also occurred at Tikkurila (U). The species had not previously been observed as a strawberry pest in Finland.

The strawberry leaf beetle (*Galerucella tenella* L.) has at times substantially injured strawberry; both the adult and the larva feed on the leaves and flowers. Once damage was observed in raspberry leaves, which became full of small holes. At Espoo (U), strawberry fruits were found to be damaged by this pest. Injury attributable to this species has taken place since 1915, principally in the southern parts of the country as far as North Häme (Multia) and North Savo (Suonenjoki). Similar damage to strawberry is the work of a related species, the water lily beetle (*Galerucella nymphaeae* L.), which has been found twice as a pest, at Kuopio (PS) in 1954 (Heikinheimo) and at Vanaja (EH) in 1958.

Occasionally, raspberry flea beetles (*Glyptina rubi* PAYK.) are observable in great abundance on the leaves of strawberry and raspberry. In general, the injuries inflicted are rather mild, but sometimes the attack is severe, with the result that the leaves of young strawberry plants or raspberry shoots become brown. Damage

[1]) HARALD LINDBERG (1894) reported finding larvae in raspberries at Lohja (V) in 1893; he used the name *Byturus aestivus*.

of this type was first seen in this country at Espoo (U) in 1900, and has since 1914 been remarked at many places in the south of the country, extending as far as South Ostrobothnia and North Häme. On one rare occasion, mangold flea beetles (*Chaetocnema concinna* MARSH.) were observed on the tender leaves of young currant and gooseberry plants; they ate small holes in the upper surface of the leaves (LINNANIEMI 1920, p. 36).

Larvae of the strawberry root weevil (*Otiorrhynchus ovatus* L.) have several times (at Vehkalahti (EK) in 1925, at Nastola (EH) in 1956 and 1960, and at Suonenjoki and Maaninka (PS) in 1960) been observed to cause the desiccation of strawberry plants by eating the epidermal layer of the roots. In addition, a few reports have been received of adult weevils being seen on the leaves, flowers and fruits of strawberry, although the extent of injury was not mentioned. According to observations made by NORDMAN (1957 a) larvae of the clay-coloured weevil (*Otiorrhynchus singularis* L.) damaged the roots of strawberry at Maarianhamina (A) in 1947.

Certain species of leaf weevils are occasionally found on berry bushes, but the injury they inflict is generally rather small. The common leaf weevil (*Phyllobius piri* L.) has at times in early summer appeared in large numbers on the leaves of currant, gooseberry and raspberry, and have in some cases been reported as having defoliated raspberry bushes. Damage has taken place in South Häme and North Carelia. The green leaf weevil (*Phyllobius maculicornis* GERM.) has on a few occasions been a mild pest of currants, raspberry and strawberry in east Finland. The silver-green leaf weevil (*Phyllobius argentatus* L.) was found on strawberries near Helsinki (U) in 1932 and 1949; *Phyllobius urticae* DEG. proliferated on strawberry at Helsinki in 1924[1]), and at Ruskeala (LK) in 1932 on various garden plants, especially raspberry and strawberry. These two species, however, are not reported to have caused any noteworthy damage. In 1909 at Juva (ES), *Phyllobius viridicollis* FABR. was so numerous on strawberry leaves that there were as many as 50 weevils on each plant. Large numbers of *Sciaphilus asperatus* BONSD. (= *muricatus* FABR.) appeared on raspberry and strawberry at Kirkkonummi (U) in 1914, but no information was received on the damage caused.

One of the most harmful strawberry pests is the strawberry blossom weevil (*Anthonomus rubi* HBST), which appears in the springtime, lays its eggs in the flower buds, and partially severs the flower stalk. As a result, the bud droops, becomes dry and usually falls to the ground. Similar damage is also brought about by the weevil to wild and cultivated raspberries. Reports of the State entomologists state that the species was first mentioned in 1900, when a light infestation on strawberry occurred at Espoo (U). It has since been an especially injurious strawberry pest, often destroying 10—30 per cent of the flower buds, but even as much as 50—90 per cent of the crop may be lost. Damage to raspberries is generally milder. According to the scanty data available, the years of greatest damage included 1915—1916,

[1]) In this case the species was marked as uncertain.

1936, 1945, 1952 and 1960. Destruction caused by this pest has been observed as far as the regions of Raahe (KP) and Kajaani (Kn).

The shot-hole borer (*Xyleborus dispar* FABR.) injured red and white currant bushes at Valkeala (ES) in 1934 by boring tunnels in the stems of the plants.

Sawflies, ants, etc. (*Hymenoptera*). Strawberries are infested by *Allantus* (*Emphytus*) *truncatus* KL., whose larvae eat large holes in the leaves at the end of the summer; in severe cases the plants may be completely defoliated. Damage by this pest, which first appeared in 1915, has occurred from time to time in various parts of the country, farthest north at Rovaniemi (PP). This species, which according to R. FORSIUS (1920, p. 110) lives in the larval stage also on *Spiraea ulmaria*, is not as yeat a serious pest in Finland. *Blennocampa confusa* KNW = *geniculata* STEPH. has been mentioned (SAALAS 1933, p. 386—387; HUKKINEN 1933, p. 191; JAMALAINEN and KANERVO 1956, p. 217) as a pest of strawberry, but so far no information is available on the injuries it inflicts in Finland. Raspberry leaves are mildly damaged by larvae of *Arge gracilicornis* KL. (*A. coerulescens* GEOFFR.), found at Kuopio (PS) in 1916 (LINNANIEMI 1920, p. 73) and at Munkkiniemi, Helsinki (U), in 1936—1937 (LINDQVIST 1937)[1]).

Gooseberry sawflies are among the most important pests of gooseberry and currant bushes. The gooseberry sawflies (*Pteronidea ribesii* SCOP. and *Pristiphora pallipes* LEP.) are both very common on gooseberry and red currant bushes (rarely black currant) everywhere in the country as far north as Kemi Lapland. Larvae of these species appear every year, feeding on the leaves of berry bushes, and sometimes defoliating them completely. The damage is augmented by 2—3 generations of larvae being produced during the summer. According to observations made by SAARINEN (1949, p. 167), the small gooseberry sawfly particularly directs its attacks at gooseberry bushes with small berries and thin leaves, allowing large-berried, thick-leaved varieties to remain unharmed. In the State entomologists' reports, the common gooseberry sawfly was first mentioned in 1895—1896, and the small gooseberry sawfly in 1913. Although only scanty information is available on damage caused by these species, it is apparent that the worst years of destruction have been 1916—1917, 1920, 1924—1925, 1929—1930, 1933, 1935—1936, 1943, 1950—1951, 1953—1954 and 1958. Exceptionally great damage was inflicted in 1959 (KANERVO 1960 a). The pale spotted gooseberry sawfly (*Pteronidea leucotrocha* HTG) was reported at Janakkala (EH) in 1919 as being of abundant occurrence on red currant and gooseberry bushes. According to R. FORSIUS (1919, p. 16), the species is quite common in the region of Lohja (V). Larvae of *Pteronidea approximata* FÖRST. (= *cognata* LINDQ.) were found by Lindqvist on wild black currant at Helsinki (U) (KONTUNIEMI 1960, p. 52). A species new to science, *Pteronidea ribesicola* LQV., was reared from a larva found on a gooseberry bush at Turku (V) (LINDQVIST 1949, p. 72—73).

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[1]) This paper gives a correcting description of the larva of this species.

Currant bushes are inhabited by larvae of *Eriocampa dorpatica* KNW, found for the first time as black currant pests near Porvoo (U) in 1946.[1]) Larvae have since been seen at Tikkurila (U) in 1949 (Heikinheimo), in 1951 and 1952 at Luvia (St), 1952 at Janakkala (EH) and 1956 at Pälkäne (EH). The species appeared at many places at Reposaari (St) in 1949—1952, causing slight injury to black, red and white currants (LAURO 1953). Larvae have also been seen at Rantasalmi (ES) (MIKKOLA 1954) and Lammi (EH) (Kontuniemi).

One of the worst enemies of black currants is the black currant sawfly (*Pachynematus pumilio* KNW), whose larvae live in the fruit and completely spoil their interior; the berry swells and becomes a deformed, angular gall-fruit. The larvae also live in wild black currants. This species was first found as a pest in 1917 at Kuhmoinen (EH) (HUKKINEN 1921, 1922 c). It is widely distributed throughout the country, and has been found as far north as Pello (PP) (VAPPULA 1935 c). The black currant sawfly inflicts severe damage, often destroying 40—50 per cent of the berries, and in the worst event bringing about almost a total loss of yield.

Ants (*Formicidae*) are occasionally a nuisance in berry gardens, where they make their nests near strawberry plants and at the bases of berry bushes, thus causing the young plants to dry and wither. In addition, they inflict direct damage by climbing the plants and injuring the flowers. For example, wood ants (*Formica rufa* L.) were mentioned as having caused in two consecutive years a complete loss of red and black currants in a garden (PARVELA 1916). In another instance, ants completely devoured within one day all of the flowers on the black currant bushes. Both the common wasp (*Vespa vulgaris* L.) and the Norway wasp (*Vespa norvegica* FABR. var. *saxonica* FABR.) have sometimes in large swarms attacked ripe strawberries; in one case they damaged nearly three-fourths of the yield on a two-are strawberry field. Wasps have also been observed to injure raspberries.

Stem galls on raspberry are caused by *Diastrophus rubi* HTG, found in small numbers in Helsinki (U) (1922) and Kuhmoinen (EH) (1922 and 1927).

True flies (*Diptera*). The young shoots of raspberry are damaged by *Pegomyia dentiens* PAND., whose larvae bore tunnels in them; as a result, the upper part of the shoot withers and dies. On occasion this pest has brought about the destruction of as many as 50—100 per cent of the young shoots. It has been found in Uusimaa (Espoo, Helsinki commune, Kerava, Porvoo, Elimäki), South Häme (Tammela, Hämeenlinna, Hattula, Sysmä), South Carelia (Vehkalahti), South Savo (Kerimäki), Ladoga Carelia (Kurkijoki, Sortavala), and North Carelia (Joensuu).

Larvae of crane flies (*Tipula* sp.) have been observed feeding on the nethermost leaves of strawberry plants close to the ground; at times they have severed the petioles.

The flowers of black currant are damaged by larvae of the black currant flower midge (*Dasyneura ribis* BARNES); following attack by this pest, the flowers fail to open and instead swell into globular galls. This species, which has not been found

[1]) The species was first encountered in this country in 1914 at Karkku (St) and in 1927 at Terijoki (Kk) by HELLÉN (1933).

elsewhere in the world, was described as a new species by BARNES (1940) on the basis of samples sent from Finland.[1]) It was first observed at Kuhmoinen (EH) in 1919—1920 on both cultivated and wild black currant bushes; about 5—10 per cent of the flowers were infested with galls. According to later observations, the species has spread throughout many parts of the country, and appears as far north as Pello in North Ostrobothnia (VAPPULA 1935 c; 1941). It usually appears singly on berry bushes, but sometimes in large numbers, and in such cases this pest may play a considerable economic rôle. Larvae of the black currant leaf midge (*Dasyneura tetensi* RÜBS.) live on the upper leaf surfaces of black currant shoots. As a result of the infestation, the leaves exhibit intense twisting and often turn brown. When larvae are numerous, they greatly hinder the growth of young shoots. Damage attributable to this species was first observed in Finland at Järvenpää (EH) in 1930—1931 (VAPPULA 1941). Since then, substantial destruction has been reported from Ahvenanmaa, Finland Proper, Uusimaa, South Häme, North Savo, and North Ostrobothnia.

The raspberry stem gall midge (*Lasioptera rubi* HEEG.) produces galls in the stems of raspberry plants; as a result, the stem may dry and break. Since 1914, light infestations have been found on both wild and cultivated raspberry in certain areas of south Finland. At Piikkiö (V) in 1952, larvae of the raspberry cane midge (*Thomasiniana theobaldi* BARNES) appeared under the bark of raspberry stems (VAPPULA 1935 b). When many larvae are present, they may loosen the bark from the stem.

Butterflies, moths (*Lepidoptera*)[2]). Larvae of *Polygonia c-album* L. usually occur singly on berry bushes, but in some cases in south and central Finland large numbers of them have appeared and defoliated red currant and gooseberry bushes. They have also been found on black currant. Larvae of another species, *Celastrina argiolus* L., have on a few occasions been responsible for mild injury by making holes in the fruit of gooseberry, red currant and black currant. Damage has been observed as far north as Oulu (PP) (HUKKINEN 1926). On occasion, larvae of the privet hawk moth (*Sphinx ligustri* L.) have been found on raspberry.

Larvae of the vapourer moth (*Orgyia antiqua* L.) occasionally appear on currant, gooseberry, raspberry, strawberry and blueberry; although they feed on the leaves they do not do much damage. Larvae of *Malacosoma castrensis* L. were found at Kumlinge (A) in 1916 to cause mild injury to leaves of red currant, and larvae of *Phalera bucephala* L. damaged black currant leaves at Nousiainen (V) in 1926. In South Häme larvae of *Lasiocampa quercus* L. were found on red currant (SEPPÄNEN 1954, p. 329). Sometimes larvae of *Eudia pavonia* L. have been observed on raspberry (SALO and SOTAVALTA 1952, p. 101) and strawberry (SEPPÄNEN 1954, p. 333).

[1]) Until 1940, the name *Contarinia ribis* DE MEIJ. was used in Finnish entomological literature.

[2]) This description concerns species appearing on gooseberry, currant, strawberry and cultivated raspberry plants. Many other species have been found on raspberry (cf. SEPPÄNEN 1954, p. 333—335), but since in most cases their host plant has apparently been wild raspberry, they are not mentioned here.

Larvae of many different species of noctuid moths have been found as pests of berry bushes. In 1933, red currant was infested with *Acronycta psi* L. at Uskela (V) (Kanervo); *Eupsilia satellitia* L. appeared on red currant at Tikkurila (U) in 1928 (Listo), *Monima gothica* L. on black currant at Pello (PP) in 1933 (VAPPULA 1935 c), *Polia dissimilis* KNOCH at Nummi (V) in 1936 (Kanervo), and small numbers of *Xylina exoleta* L. on gooseberry at Perniö (V) in 1945 (Heikinheimo). In 1946 very light injury was caused by *Phytometra gamma* L. to currants (KANERVO 1947, p. 100); larvae were plentiful on berry bushes in Ahvenanmaa (HELLÉN 1947). In 1916 several adults of *Scoliopteryx libatrix* L. were found sucking the fruit of black currant in a garden at Raahe (KP).

In addition, larvae of the following moth species have been found on berry bushes: *Chloantha solidaginis* HB. and *Euplexia lucipara* L. on gooseberry; *Xylina vetusta* HB. and *Antitype chi* L. on black currant; *Amphipyra tragopogonis* L. on red currant; *Polia pisi* L. on gooseberry and black currant; *Rhyacia augur* FABR., *Eurois prasina* FABR., and *Eurois occulta* L. on *Ribes* bushes (SEPPÄNEN 1954, p. 330).

In the years 1939—1942, *Monima gracilis* FABR. constituted an injurious pest of raspberry plants at Tikkurila (U) and elsewhere in the region of Helsinki. The larvae twisted the young terminal leaves together into clumps, or in the case of older leaves, into deformed curls (VAPPULA 1943). Red and black currant bushes have also been infested with larvae (SEPPÄNEN 1954, p. 330). The species was first found in 1919 among specimens collected in South Finland prior to 1901 (R. FORSIUS 1920 a, p. 220). Since then, it has become more common and has spread as far as the region of Kuopio (PS) (H. KROGERUS 1946, p. 39—40).

Larvae of *Acronycta auricoma* FABR. have at times been observed on leaves of raspberry, strawberry, bilberry and red currant. In 1916, larvae of *Acronycta alni* L. were found on strawberry plants at Helsinki (U). Strawberry is also one of the host plants of *Acronycta rumicis* L. (SEPPÄNEN 1954, p. 333). During the years 1939—1942 and 1945—1946, *Polia persicariae* L. was quite abundant in the region of Lahti (EH), where it infested raspberry plants (HEINÄNEN 1947, p. 32). Larvae have also been found on red currant (SEPPÄNEN 1954, p. 330).

Raspberry is also a host plant of *Thyatira batis* L., whose larvae eat large holes in the leaves, although they cause little real damage. It appeared in 1916 at Tuusula (U) and 1917 at Tikkurila (U) (LINNANIEMI 1920, p. 102; 1935, p. 73). In addition, larvae have been observed on raspberry at Sääksmäki (EH) (E. KIVIRIKKO 1941, p. 165), Lempäälä (EH) (SALO and SOTAVALTA 1952, p. 103) and Kangasniemi (ES) (Kanervo).

Cutworms (*Agrotis* sp.) have at times inflicted moderate damage on strawberry fields by severing petioles or entire plants at ground level. In 1934, a larval sample obtained from Viipuri (EK), was reared into a moth of the species *Euxoa obelisca* HB. In North Carelia, larvae of *Agrotis exclamationis* L. have been found on strawberry (SEPPÄNEN 1954, p. 333). Larvae of the rosy rustic moth (*Hydroecia micacea* ESP.) are occasionally a nuisance on strawberry fields; they live inside the stems

or sometimes feed on the bases of the leaves, causing the plant to wither. Only rarely have larvae been found in the fruit, and in general damage by this species has been quite slight. For instance, at Mustiala (EH), where larvae have been present for about 30 years (1890—1920), injury has been inflicted on only 0.5—1 per cent of the plants (LINNANIEMI 1935, p. 71). Once larvae of this species were observed in the stem of raspberry.

The currant webworm (*Semiothisa wauaria* L.) is an important pest of berry bushes; damage attributable to this species has been noted since 1914 in various parts of the country, as far north as Pello and Rovaniemi (PP). These larvae feed in early summer on the leaves of red and black currant and gooseberry, sometimes defoliating entire plants. One observation was that larvae attack most severely those gooseberry plants which are susceptible to American gooseberry mildew, whereas resistant varieties to a great extent escape injury. In certain locations, this species may be economically significant.

Larvae of the magpie moth (*Abraxas grossulariata* L.) mainly inflict injury on gooseberry plants, but may sometimes also feed on the leaves of currant. The species was first mentioned in the State entomologist's report for 1913, at which time large numbers of larvae appeared on gooseberries at Kirkkonummi (U). Since then, damage has taken place in the southern and central parts of the country as far north as Kuopio (PS). The most northern locality where larvae of this species were found was Oulainen (KP) in 1935 (Kanervo). In scattered cases, the magpie moth has inflicted appreciable destruction on berry bushes. A report from Karhula (EK) in 1946 mentioned that larvae fed on the leaves of black currant bushes, but did not touch those of red currant nor gooseberry.

Larvae of *Lygris prunata* L. have been found on currant and gooseberry bushes throughout the entire country, but the damage they cause is generally quite slight. Only in one instance (1917 at Bromarv (V)) were they quite abundant on the leaves of red currant bushes. In 1955, larvae destroyed almost the entire yield of currants at Utsjoki (InL) by severing the fruit cluster stalks (EURANTO et al. 1957, p. 127). Larvae of *Lygris mellinata* FABR. were found by the writer at Tikkurila (U) in 1934 on young shoots of black currants, which they injured slightly by making holes in the leaves. Larvae have also been found on red currant and gooseberry (SEPPÄNEN 1954, p. 330). *Lygris pyropata* HB. appeared on currant bushes in 1933 at Terijoki (Kk) (LAHTIVIRTA 1939, p. 135) and *Eupithecia exiguata* HB. on red currant at Sääksmäki (EH) (E. KIVIRIKKO 1941, p. 171). In 1944 the author observed small numbers of *Cidaria hastata* L. larvae on the shoots of red currant bushes at Tyrväntö (EH); they had twisted the leaves into loose cones and fed on their upper surfaces. Similar injury has also been seen in Uusimaa and South Savo (SEPPÄNEN 1954, p. 330) as well as on red and black currant bushes at Rovaniemi (PP) in 1953 (Varis). Larvae of the peppered moth (*Biston betularius* L.) have sometimes inflicted mild damage on the leaves of red currant and raspberry. On only one occasion (at Jääski (EK) in 1917) was the infestation so severe that all the currant and

gooseberry bushes (about 60) in a garden were defoliated (K. J. VALLE 1917). Similarly, larvae of the winter moth (*Operophthera brumata* L.) have in some cases rather severely injured the leaves of currant and gooseberry; even strawberry plants have been mildly attacked. *Cidaria truncata* HUFN. was found on strawberry at Raahe (KP) in 1918, *Lycia hirtaria* CL. on raspberry at Sund (A) in 1916, and on gooseberry in Uusimaa (LINNANIEMI 1920, 1935; SEPPÄNEN 1954, p. 330).

According to information collected by SEPPÄNEN (op.cit.), larvae of the following geometrid species have also been observed on berry bushes: *Hemithea aestivaria* HB., *Lygris populata* L., *Cidaria bicolorata* HUFN., *Cidaria quadrifasciata* CL., *Eupithecia satyrata* HB., *Selenia bilunaria* ESP., *Angerona prunaria* L., and *Boarmia bistortata* GOEZE, on red currant; *Eupithecia assimilata* DBLD., *Gonodontis bidentata* CL., and *Opisthograptis luteolata* L., on black currant; *Crocallis elinguaria* L. and *Erannis defoliaria* CL., on red and black currant; *Boarmia repandata* L., on *Ribes* bushes.

Larvae of *Arctia caja* L. appeared singly as pests of gooseberry leaves at Kirkkonummi (V) in 1917. They have also been observed on currant and strawberry plants (SEPPÄNEN 1954). *Spilarctia lutea* HUFN. has been found on black currant in Uusimaa (op.cit.).

The raspberry clearwing (*Bembecia hylaeiformis* LASP.) often brings about considerable damage to raspberry plantings. Its larvae live first in the subterranean parts of the stems, and make their way upward into the second-year fruit-bearing shoots, which as a result of the injury dry and readily break at ground surface. About 10—15 per cent of the shoots may thus be destroyed, but in some cases all of the shoots are lost. The species, first mentioned in the State entomologist's report of 1915—1916, has appeared as a pest in south Finland, extending as far as the regions of Vaasa (EP) (LINGONBLAD 1944, p. 165) and Nurmo (KAISILA 1955, p. 189). All kinds of currant bushes are often attacked by the currant clearwing (*Synanthedon tipuliformis* CL.), whose larvae penetrate the terminal parts of the branches and gradually make their way toward the base of the stem, eating a black-coloured tunnel through the interior of the branches. As a result, the leaves wither and the branches dry. The pest was noticed for the first time at Tikkurila (U) in 1924—1925. It has since been observed several times in the southern half of Finland, its northernmost location being Kempele (PP). Gooseberry bushes were also infested by this species on one occasion.

One of the worst pests of gooseberry and currant bushes is the gooseberry fruitworm (*Zophodia convolutella* HB.), whose larvae seriously damage the fruit. The species was first mentioned in Finland by SAHLBERG (1892) in 1889, when he reported finding larvae several years previously on gooseberry and currant bushes at Karjalohja (V). Injuries had increased from year to year, and in 1889 10 per cent of the berries in one garden had been destroyed. In the succeeding years, only scattered reports were received of this pest. In 1915—1917, however, the gooseberry fruitworm had become quite common in many places in the southern parts of the country. Destruction was again severe in 1920—1921, and after that not until 1942 (especially

in Uusimaa), 1947, 1948—1949 (especially in South Häme and South Savo), 1950 (especially in South Savo and South Carelia), 1952, 1954, 1955 and 1958—1959. Most of the destruction has taken place in south Finland as far as the regions of Vaasa (EP) and Kuopio (PS), but a few instances have been reported from Central and North Ostrobothnia, and once (1921) from as far as Sodankylä (LKem). This last report, however, should be considered as uncertain. When infestation is severe, 30—70 per cent of the gooseberries or currants may be lost, but sometimes the entire yield is destroyed. It appears that black currant is most often attacked, gooseberry next, and red currant third. In 1934, the author reared *Pyrausta prunalis* SCHIFF. from a larva found on a black currant bush at Tikkurila (U).

Larvae of tortricids are occasionally quite injurious pests of berry bushes; they feed on the leaves and twist them into curls. Damage was especially marked in south Finland in 1930—1932, and in places in 1953—1954. The most important species on gooseberry and currant bushes is the European leaf roller (*Cacoecia rosana* L.), widespread in Finland. E. REUTER (1899 b, p. 36) mentioned finding larvae of this species on gooseberry plants in Ahvenanmaa and in the region of Turku (V). Since 1913, destruction has been quite heavy in some localities. In the worst cases, entire plantings of berry bushes are full of twisted and riddled leaves, and no yield of berries is obtained. Sometimes raspberry plants are also infested.

Another common pest of currant and gooseberry bushes is *Exapate congelatella* CL. Damage attributable to this species was first observed at Parainen (V) in 1925—1926, when larvae inflicted substantial injury on currant bushes (VAPPULA 1933 b). Damage has later occurred — sometimes quite severely — on both red and black currant and gooseberry bushes, particularly in Uusimaa and South Häme. *Pandemis ribeana* HB. was found by E. REUTER (1899 b, p. 36—37) on gooseberry and currant in Ahvenanmaa and Finland Proper, but it is a rare pest of berry bushes in this country, being recorded only once among all the material compiled in south Finland. The author has reared *Argyroploce urticana* HB. from a rolled leaf of black currant at Tikkurila (U) and *Tortrix ministrana* L. from black currant collected at Kuusamo (Ks).

A very harmful pest of strawberry plants at times is *Cnephasia virgaureana* TR., whose larvae live in the inflorescences, roll the leaves and flowers together, and feed on them. Damage caused by this species was first observed in 1913 at Helsinki (U), Tuusula (U) and Loppi (EH), where in some plantations they destroyed flowers and fed on leaves of strawberry plants. Localized cases of injury have been most numerous, especially in the years 1928, 1933—1934, and 1953—1954; at Koivulahti (EP) in 1953 there was the complete destruction of 3 000 plants on one field, and in the following year, nearly all the plantings of strawberries in the same area were severely damaged, with a resultant very poor yield. This species has been reared also from raspberry, and AF TENGSTRÖM (1848) mentioned finding larvae on red currant. Injury to the leaves and flowers of strawberry is also caused by *Peronea aspersana* HB.; small numbers of this pest have been found at Tuusula (U) in 1915, Siilinjärvi (PS) in 1916, Helsinki (U) in 1931, Kemi (PP) in 1944, and Sippola (EK) in 1956.

Larvae of *Peronea variegana* SCHIFF. were found by NORDMAN (1943, p. 175) on strawberry and raspberry at Föglö (A). The author has reared the same species from infested raspberry at Tikkurila (U) in 1931. *Peronea ferrugana* TR. was once stated (at Loppi (EH) in 1913) to have injured strawberry (LINNANIEMI 1915, p. 40)[1]). Raspberry plants were damaged by larvae of *Notocelia roborana* TR. in the region of Hämeenlinna (EH) in 1943 together with *Incurvaria rubiella* and *Argolamprotes micella* (HUKKINEN 1943).

One of the most dangerous currant pests in this country is the currant shoot borer (*Incurvaria capitella* CL.). Its larvae overwinter on the bushes, and in the early spring injure the opening buds, usually so completely that no leaves or flowers develop. Larvae of the new generation later damage the ripening fruit, which drop off prematurely. Nevertheless, injury to the fruit is generally neither very serious nor visible. As early as the middle of the past century, AF TENGSTRÖM (1848, p. 107) reported that the currant shoot borer was a common moth on *Ribes* species in the region of Helsinki (U) at the end of June. According to E. REUTER (1904 b, p. 58), this species was quite common on berry bushes at the turn of the century in southwest Finland. In the reports of the State entomologists, the species was first mentioned in 1914, and has since then been responsible for increasing damage to currants, both in individual gardens and on larger plantings. In many cases, the injury has been so extensive that in the spring the bushes have been bare and the year's fruit yield completely lost as a result. In some places gooseberry bushes have also been mildly injured. The currant shoot borer is found mainly in south and central Finland, but has inflicted damage as far north as Kemi Lapland (Pelkosenniemi, Kittilä). Years of exceptionally severe destruction were 1928, 1935, 1942—1943, 1945, 1948, 1950, 1952—1953, 1955, 1957 and 1959—1960 (cf. KANERVO 1960 a), but localized instances of major damage have also occurred in other years.

In August 1951, the writer found holes and dark-coloured lesions in the leaves of red currant bushes in a garden at Alatornio (PP); the causal agent was *Incurvaria trimaculella* H. S. subsp. *quadrimaculella* HÖFN. This species, first found at Salla (Ks) by BRANDT (1937), was later observed by GRÖNBLOM (1941) near Tampere (EH). KAISILA (1946) also found many mines made by the species on red currant (*Ribes schlechtendalii*) at Hyrynsalmi (Kn). Larvae of *Nordmaniana* (*Zelleria*) *ribesiella* JOANN., which initially live as miners and later freely on leaf surfaces, were found by NORDMAN (1925) on mountain currant, black currant and gooseberry bushes at Parainen (V). In 1931, the author reared this species from a sample taken from black currant at Helsinki (U).

The young shoots of raspberry are injured by larvae of the raspberry moth (*Incurvaria rubiella* BJERK.), which first live in the receptacle without giving rise to any visible damage to the flowers or fruit. After wintering on the lower parts of the canes, or on the ground, they penetrate the buds in the following spring and destroy

[1]) This report is somewhat uncertain, since the collection of the Department of Pest Investigation contains one specimen of *Peronea aspersana* reared from material collected at Loppi.

the developing shoots completely. The species is rather common in Finland, but damage was first noted in 1934, when it was extensive in gardens at Kumpula in Helsinki (U) (VAPPULA 1935 e). Since then, serious damage has occurred several times in south Finland, including the region of Tampere (EH). In 1943, this species, together with *Argolamprotes micella* and *Notocelia roborana*, destroyed 40—60 per cent of the raspberry buds and shoots at Hämeenlinna (EH), with the berry yield thereby being reduced by 30—40 per cent (HUKKINEN 1943). Similar cases of destruction were reported in 1938 at Sipoo (U), in 1945 at Uusikaupunki (V), in 1946 at Kotka (EK), in 1948 at Sauvo (V), and in 1952 at Tampere (EH). The buds of raspberry plants, and the shoots emerging from them, are also injured by *Argolamprotes micella* SCHIFF., found as a pest in 1925 at Tikkurila (U) (VAPPULA 1926 b) and in 1943 at Hämeenlinna (EH) (HUKKINEN 1943).

Myriapods (*Myriopoda*). Myriapods have at times inflicted considerable damage on ripe strawberries by eating holes in them. In two cases (at Kirkkonummi (U) and Tyrväntö (EH) in 1915—1916), slight injury was caused by flattened millipedes (*Polydesmus complanatus* L.) (LINNANIEMI 1920, p. 218—219).

Mites (*Acarina*). A pest especially injurious to berry bushes is the gooseberry red spider mite (*Bryobia praetiosa* KOCH), which feeds on the leaves, causing their discoloration, withering, yellowing, and curling of the edges. The berries are smaller than usual, and fall prematurely. Damage is mainly confined to gooseberry bushes, but is sometimes extended to currant. The gooseberry red spider mite was first observed in this country in 1920 at Tammela (EH), infesting black currant, and has since been found from time to time in the southern and central parts of the country as far as the regions of Vaasa (EP) and Jyväskylä (PH). The hop red spider mite (*Tetranychus urticae* KOCH) has also appeared occasionally as a harmful pest, particularly on the leaves of black currant. However, it usually attacks strawberry and raspberry plants, whose leaves subsequently become yellow and twisted. Such damage has been reported from as far north as North Ostrobothnia.

The most destructive pest of cultivated strawberry is the strawberry mite (*Tarsonemus pallidus* BKS), which mainly lives on young, unexpanded leaves, causing them to become stunted, twisted and brownish in colour. The flowers wither, the fruit is small, and in the worst cases the plants die. The strawberry mite was first found at Parainen (V) in 1902 (E. REUTER 1903, p. 18; 1906 a). In 1904 and 1911 it was encountered at Helsinki (U), and after 1914 many reports told of its appearance in different localities. During the 1940's and 1950's in particular it became commoner, inflicting substantial damage on strawberry plantings.[1]) In some cases, it has completely destroyed the entire field. Damage was particularly severe in 1959—1960. In the main the mite has spread through the agency of infested commercial plants. This pest is found in south and central Finland, and has been observed as far north as the region of Tornio (PP).

[1]) A detailed description of the strawberry mite and its control has been given by HEIKINHEIMO (1953 a, 1953 b).

Black currant bushes are often infested by the black currant gall mite (*Eriophyes ribis* NAL.), which produces swollen galls in the buds. The first observation of this species was made by LINDROTH (LIRO) (1899, p. 17) at Mäntsälä (U) in 1898; he also found galls on mountain currant at Lammi (EH) in 1903 (LINDROTH 1904, p. 11—12). The species was first mentioned in the state entomologist's report of 1911 as appearing on black currant at Tikkurila (U). Subsequently it has spread throughout nearly the whole country (HUKKINEN 1923 a), and has been found as far north as Lapland. The black currant gall mite is transmitted from place to place through the agency of infested plants; this pest is particularly dangerous because of its steady propagation on infested bushes; it can finally destroy an entire field. In many places, it is very injurious, and substantially reduces the production of black currants. Certain varieties, such as Brödtorp and Lepaan musta, appear more resistant than others. Occasionally red and white currant are also injured, but only seldom is gooseberry affected. *Anthocoptes ribis* MASSEE, which lives freely on the leaves of black currant and causes them to turn reddish, has been found at Siuntio (U), Karkku (St) and Epilä (EH) (LIRO and ROIVAINEN 1951, p. 250—251).

The raspberry leaf and bud mite (*Eriophyes gracilis* NAL.), presented as a new species in Finland by LINDROTH (LIRO) (1902 a), lives freely on the lower surface of raspberry leaves, producing in them yellowish spots and sometimes wrinkling of the leaves. On occasion, severe injury results in a low fruit yield. LIRO and ROIVAINEN (1951, p. 145) state that the species is common throughout the country, but is a pest mainly in south Finland. In trials, HÅRDH (1956) found both the raspberry leaf and bud mite and the hop red spider mite to be abundant on the varieties Marlboro, Harzjuvel and Herbert, whereas Preussen and Pynes Royal were resistant to the mites.

M o l l u s c s (*M o l l u s c a*) Grey field slugs (*Deroceras agreste* L., etc.) sometimes inflict damage by eating ripe strawberries; at times almost the entire crop has been lost. On occasion, they have also eaten fruit or annual shoots of raspberries, or fed on the bark of currant and gooseberry cuttings. At Alahärmä (KP) in 1946, *Arion circumscriptus* JOHNST. was seen to eat strawberries along with other kinds of garden berries on the lower-hanging branches. In 1954, large numbers of *Arianta arbustorum* L. appeared at Helsinki (U) and fed on strawberries and the leaves of black currant bushes. *Fruticicola hispida* L. was reported to have appeared on berry bushes at Lappeenranta (ES) in 1955.

W o r m s (*V e r m e s*). The strawberry eelworm (*Aphelenchoides fragariae* RITZ. BOS) has on only a few occasions been found in Finland: in 1952 at Nurmijärvi (U) and Tyrväntö (EH), and in 1955 at Eura (St) and Nivala (KP). To date, the species has no practical economic significance in this country.

B i r d s (*A v e s*). The hooded crow (*Corvus corone* L.) has at times been seen eating strawberries and raspberries. Similarly, the jackdaw (*Corvus monedula* L.) and continental jay (*Garrulus glandarius* L.) often eat cultivated berries, such as strawberries and currants. The magpie (*Pica pica* L.) inflicts the same kind of damage

as the crow but on a smaller scale, feeding on strawberries and currants (HILLI 1927, p. 122—124; 1929, p. 37).

Starlings (*Sturnus vulgaris* L.) were said to have eaten red currants at Orivesi (EH) in 1926 (H. PALMGREN 1927). Sometimes they also feed on strawberries (HILLI 1927, p. 127). The bullfinch (*Pyrrhula pyrrhula* L.) has been observed to utilize the buds of currant bushes as part of its food supply (HILLI, op.cit.).

House sparrows (*Passer domesticus* L.) are often unwelcome guests in gardens. In the winter, they feed on the buds of currant and gooseberry bushes, with the result that the plants suffer and remain stunted. In the spring, they have been seen to eat even young leaves. The greatest damage they inflict is in the late summer, when large flocks of them attack strawberry and raspberry plantings, causing appreciable reductions in yield. Damage attributable to sparrows has been observed as far north as Rovaniemi (PP). According to observations made by S. and L. SIIVONEN (1940) at Pieksämäki (PS), certain species of small birds may be responsible for damage by feeding on berries, or causing them to fall to the ground. Such species include the white-throat (*Sylvia communis* LATH.), lesser white-throat (*Sylvia curruca* L.), garden warbler (*Sylvia borin* BODD.), willow warbler (*Phylloscopus trochilus* L.), feeding on raspberries, and redstart (*Phoenicurus phoenicurus* L.), feeding on red currants.

The bird which inflicts most damage on cultivated berries is the fieldfare (*Turdus pilaris* L.), the cause of great economic loss by eating berries. When the crop begins to ripen, these birds fly in large flocks from one garden to another, sometimes destroying the entire crop. Their attacks are mainly directed at strawberries, but they also feed on the fruit and flowers of currants, particularly the red and white varieties. More rarely, they attack raspberry or gooseberry bushes. As an example of the destruction for which fieldfares are responsible, HILLI (1927, p. 125; 1928; 1929, p. 39) mentions that in one large nursery at Viipuri (EK), it was estimated that these birds damaged 10 per cent of the berry crop every year. According to SIIVONEN (1940), damage attributable to fieldfares is concentrated in the southwestern part of the country, where the species has moved from its natural habitat to become a pest of garden berries. Observations made by BRANDER (1955 a, p. 69) at Urjala (EH) have shown that other pests of cultivated berries include the mavis (*Turdus ericetorum* TURTON), redwing (*Turdus musicus* L.) and blackbird (*Turdus merula* L.).

M a m m a l s (*M a m m a l i a*). Occasionally, it has been reported that the common mole (*Talpa europaea* L.) has damaged strawberry fields by digging tunnels in the ground and making mounds of soil. On one occasion the hedgehog (*Erinaceus europaeus* L.) was seen eating strawberries at Kumlinge (A) in 1957.

The European hare (*Lepus europaeus* PALL.) often damages gardens by breaking raspberry stems (K. E. KIVIRIKKO 1940, p. 56). It may attack other berry bushes, as does the mountain hare (*Lepus timidus* L.) (BRANDER 1960). Voles, particularly the field vole (*Microtus agrestis* L.), can also be harmful; they prefer gooseberry and raspberry bushes (rarely currant), feeding on the bark at the base of the stems up to a height of 10—25 cm from the ground. Strawberry fields are likewise damaged

by voles, most by the water vole (*Arvicola terrestris* L.) and continental vole (*Microtus arvalis* PALL.), which dig tunnels in the soil and feed on the roots of the plants. During the winter of 1957—1958, water voles killed many blueberry bushes at Piikkiö (V) (HÅRDH 1959, p. 139). VÄLIKANGAS (1942) reported that the bank vole (*Clethrionomys glareolus* SCHREB.) appeared as a garden pest at Sipoo (U), injuring strawberries and other plants. However, the damage inflicted by voles on cultivated berries is not as great as their depredations in orchards.

18. Ornamental flowers grown out of doors

Earwigs (*Dermaptera*). In 1953, the author found that earwigs (*Forficula auricularia* L.) had damaged the flowers and leaves of dahlias at Kuhmalahti (EH), and had caused injury to indoor plants such as *Thunbergia alata*. In 1952, this species was mentioned as a pest of both outdoor and indoor ornamentals at Rääkkylä (PK), and in 1960 it fed on the leaves of ornamental plants at Korppoo (V).

Thrips (*Thysanoptera*). The chrysanthemum thrips (*Thrips nigropilosus* Uz.) was first observed in Finland at Hyvinkää (U) in 1926, where it severely damaged cornflower (*Centaurea montana*) leaves (HUKKINEN 1927; 1936 a, p. 130). It was assumed that the species had entered the country through the agency of imported plants. Cornflowers were similarly found by HUKKINEN (op.cit.) at Hyvinkää to be infested by cabbage thrips (*Thrips angusticeps* Uz.).

Plant bugs, aphids, etc. (*Hemiptera*). Plant bugs (*Lygus* spp.) sometimes harm ornamentals, in particular chrysanthemums, dahlias, and China asters, by feeding on their shoots. These pests are particularly noxious on chrysanthemums grown outdoors. They feed on the flower buds, with the result that the flower heads are either lacking or defective and the shoots are malformed. In some cases, entire plantings have been lost in this manner. On one occasion, hollyhocks (*Althaea rosea*) were injured in the same way by plant bugs. During the spring of some years, sloe bugs (*Dolycoris baccarum* L.) have attacked and badly damaged annual and perennial ornamentals, such as the nasturtium, *Nemesia*, squill, phlox, doronicum, China aster, *Onopordum*, spiraea, fern and stock. *Coreus marginatus* L. has also been observed on perennials. O. M. REUTER (1880, p. 161; 1881) mentioned the cabbage shield bug (*Eurydema oleraceum* L.) as having completely destroyed newly-set seedlings of stock at many places at Uskela (V) in 1877. Since 1914 in particular, it has on many occasions caused severe damage to stocks, sometimes also to queen stocks, nasturtiums and alpine rockcress, and at times to sweet peas and mignonette.

At times, perennials suffer large infestations of the common froghopper (*Philaenus spumarius* L.), resulting in curling of the leaves and withering of the flower buds. Chrysanthemums and phlox are on occasion severely damaged, with milder injury being inflicted upon the coneflower, solidago, poppy, violet and annual daisy (*Chrysanthemum coronarium* and *Chr. carinatum*).

In 1940, SAALAS (1942) found large numbers of *Aleurodes campanulae* SAALAS on bellflower (*Campanula grandis*) at Karjalohja (V); the leaves of the plants were partly withered as a consequence of the infestation.

Bean aphids (*Aphis fabae* SCOP.) have at times (i.e., in Helsinki (U) in 1949) been abundant on dahlias. *Aphis sedi* KALT. appeared on stonecrop (*Sedum spurium*, *S. telephium*) at Helsinki in 1944 (Heikinheimo). *Aphis thalictri* KOCH was found on meadowrue (*Thalictrum dipterocarpum*, *Th. crenatum* and *Th.* sp.) at Helsinki (U) in 1946 and at Janakkala (EH) in 1949 and 1961 (Heikinheimo and Kanervo). In 1960, *Brachycaudus napelli* SCHRK was observed on monkshood (*Aconitum napellus*) at Helsinki (THUNEBERG 1962). According to HEIKINHEIMO (1944, p. 4), the peach-potato aphid (*Myzus persicae* SULZ.) was found at Helsinki (U) on mallow (*Malva* sp.) and tobacco (*Nicotiana* sp.). In 1937, large numbers of *Aulacorthum solani* KALT. (*Macrosiphum pelargonii* KALT.) appeared on horned violet (*Viola cornuta*) in the rural commune of Mikkeli (ES) (HEIKINHEIMO 1945). The pea aphid (*Acyrthosiphon pisum* HARR.) proliferated on the leaves of scarlet runner beans at Hattula (EH) in 1915 (LINNANIEMI 1920, p. 205), and on sweet peas near Mikkeli (ES) (Kanervo). *Capitophorus vandergooti* H.R.L. was found on *Inula helenium* in 1946 and 1947 at Helsinki (U), and *Nasonovia pilosellae* C.B. on orange hawkweed (*Hieracium aurantiacum*) at Perniö (V) in 1947 (Heikinheimo).

B e e t l e s (*C o l e o p t e r a*). During epidemic years in north Finland, the beet carrion beetle (*Aclypea opaca* L.) has inflicted severe damage on various ornamentals, especially pot marigold, stock, sunflower, prince's feather and tulip. In 1894, it was reported that stock plants at Pudasjärvi (PP) were destroyed as soon as their leaves began to appear (E. REUTER 1895, p. 40).

Wireworms (*Elateridae*) have often appeared as harmful ornamental plant pests throughout the country. They have damaged violets, China asters and pinks in particular, but in some instances injury has also been inflicted on snapdragon, African marigold (*Tagetes erecta*), zinnia, pot marigold, chrysanthemum, lily-of-the-valley, phlox, monkshood, and peony. Moreover, wireworms have sometimes penetrated both the bulbs of tulip and narcissus and the tubers of begonia, and thus retarded the growth of the plants. As a rule, the species responsible for the damage has been *Agriotes obscurus* L.

In 1960, *Dasytes niger* L. was observed injuring the petals of poppy at Bromarv (V) (P. NUORTEVA 1961).

Observations made by S. Roivainen show that blossom beetles (*Meligethes aeneus* FABR.) substantially damaged stock flower buds at Paimio (V) in 1953.

Subcoccinella 24-punctata L. has only once (at Kuhmoinen (EH) in 1951) been found as a pest on Chabaud carnations; it appeared in profusion on the leaves, and made yellowish, grooved streaks in them.

Larvae of the cockchafer (*Melolontha hippocastani* FABR.) have sometimes inflicted injury in flower beds by severing the roots of begonia, lobelia and peony. On a few occasions, rose chafers (*Cetonia aurata* L. and *Potosia cuprea* FABR.) have appeared

on perennials, e.g., *Chrysanthemum maximum* and *Eryngium planum*, with a consequent rapid withering of the flowers. These chafers have also been seen to damage the flowers of tulip.

Lilioceris lilii SCOP. was first found in this country at Kirkkonummi (U) in 1944, where the pest severely injured Martagon lily (*Lilium martagon*). They had appeared at least three years earlier, evidently owing their introduction into this country with imported plants (R. KROGERUS 1945). Injury has subsequently occurred at Kirkkonummi in 1948 (R. KROGERUS 1949), at Espoo (U) in 1950, at Vihti (V) in 1951, at Kerava (U) in 1957 and at Helsinki (U) in 1958. Other species of lilies other than the Martagon lily have also been damaged and one case was reported of injury to foxglove and tulip. *Lilioceris merdigera* L. attacked lily-of-the-valley at Perniö (V) in 1945, making notches in the leaves (Heikinheimo); it has also been found on iris (Kanervo).

When they appear in large numbers, mustard beetles (*Phaedon cochleariae* FABR.) have injured stock and mignonette. The barley leaf beetle (*Phyllotreta vittula* REDTB.) was found on the leaves of stock by LINNANIEMI (1935, p. 34). *Longitarsus succineus* FOUDR. lightly infested chrysanthemums in a garden at Tuusula (U) in 1916; small brownish spots were made in the upper surfaces of the leaves (LINNANIEMI 1920, p. 40). *Longitarsus rubiginosus* FOUDR. was found by SAALAS (1936 a) at Helsinki (U) in 1935; the species had severely damaged morning glory (*Convolvulus sepium*) by feeding on the leaves, and there was slight damage to *Convolvulus undulatus* and *C. arvensis* growing nearby. In 1954, the author found beetles of the genus *Longitarsus* on forget-me-not (*Myosotis* sp.) growing in a garden at Helsinki (U). The false cabbage flea beetle (*Haltica oleracea* L.) abounded on *Clarkia* at Suonenjoki (PS) in 1927, and on evening primrose (*Oenothera fraseri* and *Oe. yungii*) at Tyrväntö (EH) in 1932; in both cases the beetles had eaten notches in the leaves.

In 1917 at Kurkijoki (LK), the beet tortoise beetle (*Cassida nebulosa* L.) injured the leaves of stock growing outdoors. *Cassida viridis* L. damaged peppermint (*Mentha piperita crispa*) at Järvenpää (U) in 1937, and bee-balm (*Monarda didyma*) at Helsinki (U) in 1942; the leaves of these plants were partially riddled with holes as a result of the infestation.

Green leaf weevils (*Phyllobius maculicornis* GERM.) were reported in 1931 to have been abundant on the leaves of flower plants at Impilahti (LK), and were in 1957 found on coneflower (*Rudbeckia laciniata*) at Kaavi (PK). In addition, a number of common leaf weevils (*Phyllobius piri* L.) were also present. Silver-green leaf weevils (*Phyllobius argentatus* L.) have similarly been found on flower plants (at Tuusula (U) in 1933), and on the leaves and flowers of globe-flower (at Hämeenlinna (EH) in 1951), although the injury was obviously very slight.

Three cases have been reported (Espoo (U) in 1900, Helsinki (U) in 1916, Helsinki commune (U) in 1944) of the pea and bean weevil (*Sitona lineatus* L.) as having moderately harmed the leaves of sweet pea. In 1916 *Sitona decipiens* LINDB. rather severely injured leaves of lupin (*Lupinus polyphyllus*) at Tuusula (U)[1].

[1]) LINNANIEMI (1920, p. 47) believed the causal species to be *Sitona crinitus* Ol., but according to Markkula it was apparently *Sitona decipiens*.

Larvae of the knot-grass weevil (*Phytonomus arator* L.) have infested outdoor carnations, particularly the variety Chabaud, on the following occasions: 1914—1915 at Nokia (EH), 1939 at Viipuri (EK) and Pori (St), 1943 at Janakkala (EH), 1945 at Helsinki (U), 1951 near Helsinki. They injured the young terminal leaves, brought about the suppression of flowering, and also ate holes or notches in the older leaves and flower buds. At times, cabbage stem weevils (*Ceuthorrhynchus quadridens* PANZ.) and cabbage seed weevils (*C. assimilis* PAYK.) damage stock flowers.

Sawflies, ants (*Hymenoptera*). In 1927, larvae of the Solomon's seal sawfly (*Phymatocera aterrima* KL.) defoliated the plants of lily-of-the-valley near Viipuri (EK). The author's own observations made at the Helsinki University Botanical Gardens in 1935, 1937 and 1942 showed that the larvae attacked the genus *Polygonatum* in particular (*P. officinale, P. verticillatum, P. giganteum*), but did not injure *Convallaria majalis*.

In 1955, larvae of the iris sawfly (*Rhadinoceraea micans* KL.) damaged the leaves of yellow iris at Anjala (U). Larvae have also been found at Lammi (EH) (Kaisila). The columbine sawfly (*Pristiphora alnivora* HTG) has been a pest of columbine at Helsinki (U), at least as regards the years 1930, 1934—35 and 1956—57, and at Korso (U) in 1955. The species has also been observed at Särkisalo (V) (Kontuniemi). In some cases, damage has been quite severe, with the larvae completely destroying all the leaves of the plants within a few days.

Ants (*Formicidae*) are often noxious when they build their nests in flower beds and cause the roots to dry. They have at times attacked peonies, with the result that the flower buds withered without opening.

True flies (*Diptera*). The large narcissus fly (*Lampetia equestris* FABR.) was first found in this country in 1910 at Huopalahti in Helsinki (U) (JOHANSSON 1912) and again at Lohja (V) in 1933 (P. SUOMALAINEN 1934). It has since appeared as a pest of narcissus bulbs at Sortavala (LK) in 1939, at Kymi (EK) in 1943 and at Lahti (EH) since the year 1945 (KANERVO 1945, 1950 a). It was also present in bulbs of *Hippeastrum* at Helsinki (U) (HÄYRYNEN 1947; KANGAS 1950), and in imported narcissus bulbs at Helsinki in 1953. The species has evidently entered the country from abroad, but observations indicate that it can live here on outdoor plantings. At Sortavala, only 1 per cent and at Kymi 5 per cent of the narcissus bulbs grown outdoors were damaged by larvae of this species.

Several species of flies appear as leaf-miners in ornamental plants. Larvae of *Trypeta artemisiae* FABR. produce blister mines in the leaves of chrysanthemum plants grown in outdoor pots. Such damage has been observed in 1912 at Helsinki (U) (LINNANIEMI 1913, p. 78), in 1915 at Turku (V), in 1929 at Tyrväntö (EH), in 1936 at Jokioinen (EH) and in 1942 at Piikkiö (V). In some cases the injury was quite severe, with 20—30 per cent of the leaves of some plants being mined. According to one observation, this species favours thick-leafed varieties of vigorous growth. Leaf mines have also been found in some species of mugwort (*Artemisia dracunculus, A. discolor, A. selengensis* and *A. gnaphaliodes*) grown in the Botanical Garden at Helsinki.

Tunnel mines are produced in daisy leaves (*Bellis perennis*) by *Liriomyza fasciola* MEIG. (FREY 1937, p. 89), which has been observed both near Helsinki (U) (LINNANIEMI 1913, p. 96) and in a few places in South Häme. The leaves of columbine are injured by the columbine leaf miner (*Phytomyza aquilegiae* HARDY), whose blister mines were very numerous in 1914 at Lohja (V), in 1939 at Tikkurila (U), in 1951 at Alatornio (PP), in 1960 at Helsinki (U), and in the region of Viipuri (EK) in 1922 (FREY 1937, p. 92). In 1934, stock leaves near Helsinki (U) had blister mines made by *Scaptomyza flaveola* MEIG.

The larvae of the chrysanthemum leaf miner (*Phytomyza atricornis* MEIG. = *Ph. geniculata* MACQ.) attack many plants. At times, large numbers of its tunnel mines have been found in the leaves of chrysanthemum[1]), marguerite chrysanthemum (*Chrysanthemum frutescens*) and nasturtium. In addition, LINNANIEMI (1913, p. 102, 104) found mines in cornflower (*Centaurea montana*) and *Alfredia stenolepis*, and FREY (1937, p. 92) observed them in many plants, including poppy (*Papaver somniferum* and *P. bracteatum*), nasturtium, fleabane (*Erigeron speciosum*) and dahlia. Apparently, the species has spread throughout most of the country, at least as far as Rovaniemi (PP). FREY (1937, p. 91) remarked that mines made by *Phytomyza aconitella* HEND. were found in larkspur near Viipuri (EK) in 1922. THUNEBERG (1956, 1958) found mines of *Phytomyza sedicola* HER. in stonecrop (*Sedum spurium* and S. *purpureum*) at Vehkalahti (EK) in 1954, and those of *Phytomyza krügeri* HER. in columbine seeds at Joutseno (ES) in 1952, and at Virolahti (EK) in 1961.

In 1915, the larvae of crane flies (*Tipulidae*) damaged the roots of lupin (*Lupinus angustifolius*) at Tikkurila (U). At times they have invaded flower beds, and destroyed snapdragon plants (at Liminka (PP) in 1950).

In 1942, horned violets (*Viola cornuta*) at Espoo (U) were infested with many shoot and leaf galls, the causal agent probably being *Dasyneura violae* F. LW (VAPPULA 1943 a)[2]). The larvae live in the terminal parts of the shoots, making the flower buds wither, and bleaching and thickening the sepals and petals. Furthermore, the uppermost leaves on the shoots have pale, upward-turned edges. Damage to violets was first observed in 1939. Subsequent observations of serious injury have been made at Kauniainen and Espoo (U) in 1947 and 1949, at Tammelund in Helsinki (U) in 1952, at Sipoo (U) in 1954 and at Lahti (EH) in 1960.

Butterflies, moths (*Lepidoptera*). The larvae of *Papilio machaon* L. have been seen feeding on the leaves and young fruit of *Dictamnus albus* on the following occasions: at Sortavala (LK) in 1934, Sääksmäki (EH) (E. KIVIRIKKO 1941, p. 149), Parainen (V) (E. REUTER 1946), Lempäälä (EH) (SALO and SOTA-

[1]) LINNANIEMI (1920, p. 170) mentioned that *Phytomyza affinis* FALL. had caused leaf mines in chrysanthemum growing in a garden, but most likely the actual species was *Ph. atricornis* (SAALAS 1933, p. 456).

[2]) As yet, the exact species has not been positively determined. Similar injury is also inflicted by *Dasyneura affinis* KIEFF., but this name is possibly a synonym for *D. violae* F.LW (BARNES 1948, p. 115).

VALTA 1952, p. 93) and at Hirvensalmi (ES) in 1954. Larvae have also been found on Martagon lily (SEPPÄNEN 1954, p. 279).

Larvae of the large white butterfly (*Pieris brassicae* L.) have on occasion damaged the leaves of nasturtium and stock. SEPPÄNEN (op.cit., p. 326, 370, 381) gives further host plants of this species in Finland as hesperis, mignonette, Virginia tobacco and pot marigold. Exceptionally large numbers of larvae of the small white butterfly (*Pieris rapae* L.) have been found on mignonette (E. KIVIRIKKO 1941, p. 150), and lesser numbers on hesperis, golden-tuft (*Alyssum saxatile*), alpine rockcress (*Arabis alpina*), nasturtium and Virginia tobacco (SEPPÄNEN 1954, p. 325, 354, 370). Larvae of the green-veined white butterfly (*Pieris napi* L.) have appeared on stock, hesperis and mignonette (E. KIVIRIKKO, l.c.), and on alpine rockcress, nasturtium and pot marigold (SEPPÄNEN, op.cit., p. 325, 355, 381).

The following species of butterflies have also been found on ornamental plants: *Parnassius apollo* L. on roseroot (*Rhodiola rosea*) and stonecrop (*Sedum album, S. telephium*); *Scolitantides orion* PALL. on *Sedum ewersii* and *S. telephium; Glaucopsyche alexis* PODA on Siberian sweetvetch (*Hedysarum sibiricum*) (SEPPÄNEN 1954).

Larvae of *Celerio galii* ROTT. were observed on *Clarkia* at Kannus (KP) in 1938, and on *Godetia* and *Circaea alpina* (SEPPÄNEN, op.cit., p. 348, 349). Larvae of *Pergesa elpenor* L. were seen feeding on the leaves of fuchsia at Ruovesi (EH) in 1916, and at Viipuri (EK) and Punkaharju (ES) in 1927.

Heartleaf bergenia (*Bergenia cordifolia*) has been injured by larvae of the vapourer moth (*Orgyia antiqua* L.) (SEPPÄNEN, op.cit., p. 329), a species which also damaged the leaves of gladiolus near Helsinki (U) in 1932. Larvae of the rare species *Euproctis similis* FUESSLY were found once on monkshood (*Aconitum napellus*) near Porvoo (U) in 1936 (NYLUND 1936).

Cutworms occasionally severely damage outdoor ornamental flowers by severing their stems at soil level. Injury has been inflicted on China aster, chrysanthemum, stock, violet, ornamental tobacco, stonecrop (*Sedum telephium*), sweet pea, lupin, hemerocallis, phlox, lily-of-the-valley and begonia. In 1951, they were reported to have destroyed several thousand gladiolus plants during two summers at Oulunkylä in Helsinki (U). The common dart moth (*Agrotis segetum* SCHIFF.) is often mentioned as the species inflicting most damage, but other species obviously contribute to the destruction. Larvae of *Euxoa obelisca* SCHIFF. were seen to injure violets, poppies and dahlias near Viipuri (EK) in 1934, and those of *Euxoa tritici* L. damaged phlox and peony at Hyvinkää (U) in 1949, and China aster and peony at Rauma (St) in 1952. Larvae of the large yellow underwing moth (*Triphaena pronuba* L.) have been found on dahlia and pot marigold in the province of Uusimaa (SEPPÄNEN 1954, p. 378, 381).

Larvae of *Polia thalassina* ROTT. and *Polia contigua* SCHIFF. have appeared abundantly on the inflorescences of larkspur (*Delphinium*) at Sääksmäki (EH) (E. KIVIRIKKO 1941, p. 158); the latter species has also been found on golden columbine (*Aquilegia chrysantha*), stonecrop (*Sedum spurium*) and pot marigold

(SEPPÄNEN, op.cit., p. 320, 328, 381). Larvae of *Polia persicariae* L. have been observed on the inflorescences of larkspur and coneflower (*Rudbeckia*) (E. KIVIRIKKO 1941, p. 158; HEINÄNEN 1947, p. 32), as well as on nasturtium, alpine polygonum (*Polygonum undulatum* var. *alpinum*), petunia and African marigold (SEPPÄNEN 1954, p. 311, 355, 370, 379). *Polia pisi* L. has been seen on pot marigold (op.cit., p. 381), on monkshood at Janakkala (EH) in 1916 and on outdoor grown geranium at Rovaniemi (PP) in 1932. Larvae of *Barathra brassicae* L. were observed to damage coneflower and pot marigold (op.cit., p. 378, 381), and in 1913 they inflicted injury on *Lychnis chalcedonica*, *Melandrium album*, and in particular on columbine at Pirkkala (EH). In 1936, this species proliferated on dahlias in the rural commune of Helsinki (U), with consequent substantial damage to the leaves, and particularly the buds of the plants. Larvae of *Polia oleracea* L. have injured begonia, geranium, nasturtium, balsam, dahlia and pot marigold (op.cit., p. 327, 354, 355, 356, 378, 381); in addition, they have infested iris at Särkisalo (V) and stock at Tampere (EH).

In 1933, a larva of *Parastichtis obscura* HAW. was observed to eat holes in gladiolus flowers at Tikkurila (U) (Vappula). In 1946, *Phytometra gamma* L. severely damaged pot marigold, inflicted moderate damage on lupin, and no more than slight injury on sunflower (KANERVO 1947, p. 99). As early as 1922, this species inflicted injury on ornamentals, especially pot marigold.

Besides the above species, SEPPÄNEN (1954) lists the following species of noctuid moths, whose larvae have been found infesting ornamental flowers: *Acronycta auricoma* FABR. on alpine polygonum; *Acronycta rumicis* L. on hemerocallis, iris, gladiolus, polygonum and heartleaf bergenia; *Naenia typica* L. on pot marigold; *Hadena reticulata* VILL. on garden pink (*Dianthus plumosus*) and soapwort (*Saponaria officinalis*); *Monima gracilis* FABR. on meadowrue (*Thalictrum aquilegiifolium*); *Dasypolia templi* THNBG on cowparsnip (*Heracleum laciniatum*); *Xylina exoleta* L. on poppy, *Sempervivum* and phlox; *Eumichtis bathensis* LUTZ. on monkshood; *Antitype polymita* L. on soapwort; *Antitype chi* L. on *Lychnis chalcedonica; Amathes litura* L. on yellow fumitory (*Corydalis nobilis*); *Cosmia icteritia* HUFN. on cinquefoil (*Potentilla atrosanguinea*); *Amphipyra tragopogonis* L. on monkshood; *Euplexia lucipara* L. on morning glory (*Convolvulus sepium*); *Pyrrhia umbra* HUFN. on genista (*Genista tinctoria*), toadflax (*Linaria bipartita*), snapdragon, *Pentstemon barbatus* and pot marigold.

A common host plant of *Harmodia rivularis* FABR., according to observations made in the region of Lahti, is *Lychnis chalcedonica;* the larvae inhabit the flowers and fruits, and also infest the leaves as they mature (HEINÄNEN 1947, p. 33). At Lempäälä (EH), larvae have also been seen on *Dianthus barbatus* (SALO and SOTAVALTA 1952, p. 107), and various carnations (SEPPÄNEN 1954, p. 317). Another pest of outdoor carnations is *Harmodia compta* SCHIFF. (K. J. VALLE 1940, p. 169; SEPPÄNEN 1954, p. 318). In 1939, there was a severe infestation of *Harmodia* larvae (the species was not determined) at Kangasala (EH) on *Lychnis chalcedonica*, following which all the flowers and young leaves were destroyed. In 1923, larvae of *Xanthoecia*

flavago SCHIFF. were observed to hollow out the stems of sunflower (*Helianthus annuus*).

The rosy rustic moth (*Hydroecia micacea* ESP.) was a serious gladiolus pest at Kuopio (PS) in 1931, and at Helsinki (U) in 1951; it also caused injury to other ornamentals, such as *Incarvillea* and cultivated polygonum at Kokemäki (St) in 1957.

Larvae of the golden plusia (*Polychrysia moneta* FABR.) are often noxious pests of monkshood and larkspur. In early summer, they invade the top foliage, roll the leaves and damage the flower buds of these plants. Injury has also inflicted on globeflower (LINGONBLAD 1944, p. 144; SEPPÄNEN 1954, p. 321). The species has brought about damage as far north as South Ostrobothnia (EP) and North Carelia (PK).

On a number of occasions, large numbers of larvae of *Larentia clavaria* HAW. have been found on mallow plants, e.g., in 1922 on *Malva alcea* at Hammarland (A) (KANERVA 1923), in 1943 on mallow at Helsinki (U) (Vappula), and on hollyhock (*Althaea*) at Lahti (EH) (HEINÄNEN 1947, p. 46), since 1942 on *Malope* at Lempäälä (EH) (SALO and SOTAVALTA 1952, p. 117), and in 1955 on *Malva alcea* at Naantali (V). At the last-mentioned spot, larvae ate nearly all the leaves on 110 plants (Tiensuu). This species has also been found on *Lavatera thuringiaca* (SEPPÄNEN 1954, p. 353). Larvae of *Cidaria fluctuata* L. have at times damaged the leaves of nasturtium (NORDMAN 1943, p. 171; SEPPÄNEN 1954, p. 355).

In addition, larvae of the following geometrid species have been observed infesting ornamental plants: *Eupithecia satyrata* HB. on monkshood; *Eupithecia absinthiata* CL. on Canadian golden-rod (*Solidago canadensis*); *Cidaria sagittata* FABR. on *Thalictrum aquilegiifolium; Biston betularius* L. on *Lupinus angustifolius* and *Aster tripolium* cult.; *Boarmia bistortata* GOEZE on monkshood (SEPPÄNEN 1954).

Large numbers of *Pyrausta sambucalis* SCHIFF. appeared in 1933 at Värtsilä (PK), where during the previous summer the larvae had fed on leaves of morning glory (*Convolvulus*).

As early as the middle of the last century, AF TENGSTRÖM (1848, p. 83) reported finding larvae of *Cnephasia virgaureana* TR. on cornflower (*Centaurea macrocephala*) in the University of Helsinki Botanical Gardens. Injury attributable to this species has occasionally been quite severe with respect to various ornamentals, such as lupin, monkshood, larkspur, anemone, China aster, coneflower, zinnia, stock, *Dianthus barbatus*, stonecrop, and campanula. The larvae infest the flowers and leaves of these plants, spinning them together; they have also been found in the flower buds of *Papaver bracteatum*. In 1938, the author found a larva of *Tortrix paleana* HB. feeding on the leaves of white narcissus at Tikkurila (U).

In 1940—1941, there was a moderate infestation of *Plutella porrectella* L. on hesperis in the Botanical Gardens at Helsinki (U) (NORDMAN 1942), and in 1943 they were found on this plant at Korso (U). The larvae inhabited the terminal foliage, injuring and rolling the leaves together. At times, larvae of the diamond-back moth (*Plutella maculipennis* CURT.) attack ornamental crucifers, especially stock. Once nasturtium was reported to have been damaged by this pest.

Myriapods (*Myriopoda*). In 1939, large numbers of myriapods (species undetermined) appeared in partially-decayed tulip bulbs set outdoors at Helsinki (U). They had made holes in the bulbs, and damaged the healthy tissues of the plants.

Mites (*Acarina*). The hop red spider mite (*Tetranychus urticae* KOCH) is occasionally responsible for considerable damage to outdoor ornamentals, resulting in discoloration of the leaves. Severe or moderate injury has been observed on scarlet runner bean, sweet pea, hollyhock, mallow, *Aristolochia clematidis*, hydrangea, dahlia, *Centaurea montana*, coneflower, campanula, lupin, larkspur, columbine, *Astilbe arendsi*, violet, *Physalis alkekengi* and *Cephalaria tatarica*. Mild injury has been remarked as regards poppy (*Papaver nudicaule* and *P. orientale*), snapdragon, morning glory, *Omphalodes verna*, phlox, *Lychnis chalcedonica*, sunflower and daisy. In 1916, *Uropoda* (*Urosternella*) *obnoxia* E. REUT. damaged a large number of sweet pea plants growing in frames at Turku (V) by severing their stems at ground level (LINNANIEMI 1920, p. 210). On at least one occasion (at Anjala (U) in 1953) bulb mites (*Rhizoglyphus echinopus* FUM.& ROB.) have injured tulip bulbs in outdoor beds.

Phyllocoptes violae NAL., which produces leaf edge galls in violets, was first observed in this country in 1927 at Helsinki (U) (LIRO 1927; 1940, p. 41). It destroyed entire frames of horned violet (*Viola cornuta*), and also damaged ordinary garden violets (*Viola tricolor maxima*) in the rural commune of Helsinki. This pest has also been found at Kauniainen (U) (H. ROIVAINEN 1947, p. 27) and at Espoo (U) in 1949.

Molluscs (*Mollusca*). In some years, when slugs, especially grey field slugs (*Deroceras agreste* L.), are very numerous, they may inflict severe damage on ornamental plants by feeding on their leaves. In particular, they have injured dahlia, gladiolus, *Hosta*, salvia, nasturtium and *Chrysanthemum carinatum;* on occasion, they have destroyed young seedlings even in the cotyledon stage. In 1954, *Arianta arbustorum* L. injured some flower plants at Helsinki (U).

Worms (*Vermes*). In 1946, the author found steam and bulb eelworms (*Ditylenchus dipsaci* KÜHN) in phlox growing in a Helsinki (U) park. The stems of the infested plants were swollen, the leaves had become narrow strips, and the lowermost leaves had turned brown. Such injury was apparent in red-flowered varieties, while white-flowered varieties grown in the same group appeared to be quite healthy. In 1950, a plant sample displaying similar damage was received from Turku (V).

In 1932, enchytraeids (*Enchytraeidae*) were observed in the decayed lower part of primrose (*Primula obconica*) plants growing in frames at Tyrväntö (EH), and in the soil nearby. These worms were either the primary or at least the secondary cause of the damage (Hukkinen).

Mammals (*Mammalia*). Common moles (*Talpa europaea* L.) have sometimes been (e.g., at Loppi (EH) in 1917) noxious pests in flower beds, where they dig tunnels just under the ground surface, resulting in the collapse and desiccation of the plants. They may also be harmful in plantings where flower bulbs are produced (V. SIIVONEN 1957).

Voles, especially the water vole (*Arvicola terrestris* L.), field vole (*Microtus agrestis* L.) and continental vole (*Microtus arvalis* PALL.), occasionally damage outdoor ornamental plants; they feed on flower bulbs and the roots of perennials, and destroy young seedlings on their emergence from the soil. The water vole and continental vole are particularly voracious eaters of flower bulbs. In 1938, scores of lily bulbs were found in the storage chambers of water voles at Sääksmäki (EH) (K. E. KIVIRIKKO 1940, p. 81). In 1950, water voles destroyed at Korso (U) a great number of tulip and narcissus bulbs which had been buried in the ground; losses amounted to 100 000—150 000 marks (Puutarha-Uutiset 1950, No. 50). At Urjala (EH), field voles were seen to take sown sunflower (*Helianthus annuus*) seeds, along with leaves and shoots of stonecrop (*Sedum ewersii*), from the fields and carry them away (BRANDER 1955 a, p. 66). At Hattula (EH) in 1941 this same pest ate germinating sweet pea seeds in a frame, which meant that sowing had to be repeated four times.

Vole damage has also been observed in chickweed (*Cerastium*), chrysanthemum, bleeding heart (*Dicentra*), *Gypsophila*, iris, primrose, poppy, phlox and violet (MYLLYMÄKI 1959, p. 78).

19. Ornamental shrubs

Thrips (*Thysanoptera*). At Janakkala (EH) in 1945, flower thrips (*Frankliniella intonsa* TRYB.) were present on the flowers of Persian yellow rose and Valamo rose, although no damage was inflicted. In 1934, some thrips species appeared in large numbers on the terminal buds and young leaves of hawthorn at Nurmijärvi (U); as a result considerable withering of these parts of the plants occurred.

Plant bugs, aphids, etc. (*Hemiptera*). Capsids have at times been found as pests of ornamental shrubs. In 1918—1919, the common green capsid (*Lygus pabulinus* L.) appeared together with *Calocoris ?fulvomaculatus* DEG. at Raahe (KP); much damage was done to rose bushes, of which the young leaves withered as a result of the injury, and the older leaves became full of feeding-holes. The tarnished plant bug (*Lygus pratensis* L.) was also partly responsible for the damage inflicted. Capsids have also been seen to injure young shoots of Virginian creeper. *Calocoris biclavatus* H. S. was found by O. M. REUTER (1880, p. 168) on spiraea at Vestanfjärd (V). On one occasion, *Coreus marginatus* L. was observed to injure the leaves of lilac.

In 1935 *Stephanitis oberti* KOL. was found by SAALAS (1936) to be an injurious rhododendron pest at Karjalohja (V). The species, quite common on wild dwarf shrubs in Finland, was in this instance introduced from Germany along with imported rhododendron plants. The damage mainly affected *Rhododendron catawbiense*, of which the leaves had become discoloured, or had completely lost their green colour. The species had not previously been observed with certainty as a pest in

Finland.[1]) In 1936, a great deal of damage was caused by this species at Tainionkoski (ES) and Kauniainen (U) (SAALAS 1937). The rhododendron bug (*Stephanitis rhododendri* HORV.) was found by SAALAS (1938 a) at Elimäki (U) on rhododendron plants imported the previous year from Holland.

During the period of its swarming time, at the beginning of summer, the sloe bug (*Dolycoris baccarum* L.) often attacks lilac bushes. The insects collect in large swarms on the bushes, giving rise to browning of the inflorescenses, and withering of the young shoots. They have also been observed to injure other ornamental shrubs, such as pea-tree and spiraea. As early as in 1897, damage to lilac was observed at Espoo (U) and Lohja (V); the years of exceptionally severe injury were 1915, 1937—1938 and 1948—1949. Damage has been noted as far north as Central Ostrobothnia (KP), North Häme (PH) and North Carelia (PK).

Small numbers of the common froghopper (*Philaenus spumarius* L.) have at times appeared on rose bushes. Rose leaves are on occasion injured by some species of leafhopper (*Typhlocyba* spp.), which live on the lower surface of the leaves and make them become pale and discoloured. Damage has been observed as far as the region of Raahe (KP). The most important species involved have been *Typhlocyba rosae* L., found for the first time in abundance at the University Botanical Gardens in Helsinki (U) in 1949, and *Typhlocyba sociabilis* Oss., which also appeared in great numbers at the same place (P. NUORTEVA 1955). According to P. Nuorteva, *Allygus mixtus* FABR. and *Orolix cruentatus* PANZ. were found on lilac in 1950 at Hattula (EH), and *Empoasca flavescens* FABR. at Hattula and Helsinki (U) (cf. also P. NUORTEVA 1952 a, p. 24, 25, 28), but no great damage resulted.

Hawthorn bushes are infested by larvae of *Psylla peregrina* FÖRST.[2]), which live on the young leaves in the early part of the summer. The species has appeared in Ahvenanmaa (A), Salo (V), Helsinki (U), Kirkkonummi (U), Hämeenlinna (EH) and Tyrväntö (EH).

In 1938, large numbers of rhododendron white flies (*Dialeurodes chittendeni* LAING) were observed swarming on rhododendron bushes growing in a park at Elimäki (U) (SAALAS 1942 a). The species, not previously found in Finland, was evidently introduced into the country from Germany or Holland.

Aphids are common pests of ornamental shrubs. The rose aphid (*Macrosiphum rosae* L.) often infests rose bushes in large numbers, injuring the young shoots, flower buds and flower stalks. This species is very prevalent on Scotch rose (*Rosa pimpinellifolia*) and Japanese rose (*R. rugosa*). It is found in most of the country, as far north as Pello (PP)[3]). Rose leaves are infested by another aphid species as

[1]) In 1921, a specimen of injured rhododendron leaves was obtained from Hämeenlinna (EH), but it was not certain whether the causal agent was *Stephanitis oberti* or *St. rhododendri* (LINNANIEMI 1935, p. 110).

[2]) This species has earlier been considered a variety of the apple sucker; LINNAVUORI (1951) believes it to be a separate species.

[3]) According to HEIKINHEIMO (1959, p. 25), the species has also been observed in north Lapland.

well, *Myzaphis rosarum* KALT., found at Perniö (V) (HEIKINHEIMO 1944), at Helsinki (U) in 1945, and at Maaninka (PS) in 1949. In 1952, *Longicaudus trirhodus* WALK. appeared on rose bushes at Saltvik (A) (Vappula).

The bean aphid (*Aphis fabae* SCOP.) has on occasion been found in large numbers on spindle-tree (*Euonymus europaeus*), mock orange (*Philadelphus* sp.) and guelder rose (*Viburnum opulus*). As a result of the infestation, the terminal parts of the foliage become twisted and withered. To date, the species has been observed mainly in south Finland. *Ceruraphis eriophori* WALK. has been remarked on *Viburnum lantana* and *V. opulus* in Finland Proper, Uusimaa and South Häme (Heikinheimo).

The following aphid species have been found on hawthorn (*Crataegus* spp.): oat-apple aphid (*Rhopalosiphum insertum* WALK.) in southern and central Finland (also found on *Cotoneaster integerrimus*) (Heikinheimo); green apple aphid (*Aphis pomi* DEG.) on *Crataegus sanguinea* at Kuopio (PS) in 1954[1]); *Ovatus crataegarius* WALK. at Hämeenlinna (EH) (Heikinheimo); *Stagona crataegi* TULLGR. in 1947 at Helsinki (U) and Mikkeli (ES), and in 1947 and 1949 at Kuopio (PS). The commonest and most injurious pests are different species of *Dysaphis*, of which at least *Dysaphis ranunculi* KALT. has been found in Finland (on *Crataegus Lambertiana* in Helsinki (U) in 1947). These pests give rise to reddish or yellowish leaf galls, which can at times be so numerous that hawthorn hedges have partially withered. Damage attributable to *Dysaphis* has been reported at Hanko (U) in 1917, at Oulu (PP) in 1919, Loppi (EH) in 1939, and Helsinki (U) in 1937 on *Crataegus Lambertiana* and 1959 on *Cr. oxyacantha Paulii.*

Brachycaudus spiraeae OESTL. was found on spiraea at Turku (V) and Piikkiö (V) in 1951. This species was possibly present on *Spiraea hypericifolia* at Kauniainen (U) in 1950; the young leaves were curled by the aphid damage, and the lower parts of the shoots twisted and deformed. The thistle aphid (*Brachycaudus cardui* L.) sometimes also infests sloe.

The pest most injurious to honeysuckle is *Stagona xylostei* DEG., responsible for severe twisting and curling of the young leaves. It was reported by HINTIKKA (1913, p. 65) in Ahvenanmaa. Later infestations on *Lonicera tatarica* and other cultivated honeysuckle species have occurred in Finland Proper, Uusimaa, South Carelia and South Häme. Other species found on honeysuckle (*Lonicera tatarica* and *L.* x*ylosteum*) comprise *Rhopalomyzus lonicerae* SIEB. in Finland Proper, Uusimaa, South Häme and South Savo, and *Hyadaphis foeniculi* PASS. at Mikkeli (ES) in 1937 (Kanervo), Helsinki (U) in 1945 and 1946, Perniö (V) in 1948 and Kuopio (PS) in 1949 (Heikinheimo).

The young branches of red-berried elders are infested by the elder aphid (*Aphis sambuci* L.), found in south and central Finland.

Dogwood bushes are attacked by the dogwood aphid (*Anoecia corni* FABR.), which may bring about wrinkling and curling of the leaves. Up till 1913, the

[1]) The green apple aphid was also observed on cotoneaster at Lappeenranta (ES) (THUNEBERG (1960) and at Piikkiö (V) (Heikinheimo).

species had been observed in Uusimaa and South Savo (HINTIKKA 1914, p. 65, 68) and at Helsinki (U) in 1913 (LINNANIEMI 1915, p. 62). It has subsequently been seen at Mäntyharju (ES) in 1915, Hämeenlinna (EH) in 1919, Viipuri (EK) in 1920 and according to TIENSUU (1936, p. 168) at Naantali (V) in 1935. In addition, *Aphis corniella* H. R. L. was found on white-berried dogwood at Masku (V) in 1960 (THUNEBERG 1962).

The caragana aphid (*Acyrthosiphon caraganae* CHOL.), which twists the young leaves of pea-tree, has been remarked in injurious numbers in the southern and central parts of the country. The artichoke aphid (*Capitophorus elaeagni* DEL GU.) appears on elaeagnus bushes in south and central Finland (HEIKINHEIMO 1959, p. 25). Golden currant shrubs are at times infested by the lettuce aphid (*Nasonovia ribisnigri* MOSL.), and barberry bushes by the barberry aphid (*Liosomaphis berberidis* KALT.)

The brown scale (*Eulecanium corni* BCHÉ) is a common ornamental shrub pest, sometimes appearing in profusion on pea-tree, *Cotoneaster adpressus*, mock orange, spiraea, sweet honeysuckle and rose. Damage may be severe, and on occasion result in the death of the plants. Injury has been observed in Finland Proper, Uusimaa and South Häme. The author has found willow scale (*Chionaspis salicis* L.) on willow and other ornamental shrubs in Helsinki parks (U).

Beetles (*Coleoptera*). On three occasions (Luumäki (ES) in 1935, Lammi (EH) in 1949, Savitaipale (ES) in 1956) large numbers of garden chafers (*Phyllopertha horticola* L.) have appeared on rose bushes, *Rosa pimpinellifolia* in particular, and inflicted rather severe damage on the leaves and flowers. Lilac flowers and pea-tree leaves were also subjected to injury. Occasionally, rose chafers (*Cetonia aurata* L.) attack the flowers of lilac and rose in early summer, causing them to turn brown. Observations (e.g., BACKLUND 1933), have indicated that this pest favours large, complex lilac flowers to single ones, and similarly white-flowered to blue. Of the roses, the Scotch rose is the one most severely attacked; the chafers sometimes penetrate the opening flower buds and destroy them. The rose chafer also injures the flowers of spiraea and other ornamental shrubs. Similar damage to these plants is also caused by *Potosia cuprea* FABR.

The brassy willow beetle (*Phyllodecta vitellinae* L.) sometimes injures cultivated willow bushes; the larvae feed on the lower surface of the leaves. The author has found such damage on purple willow (*Salix purpurea*) at least.

The elm tree beetle (*Galerucella lineola* FABR.) has at times appeared on willows growing as hedges. Similarly, the poplar leaf beetle (*Melasoma populi* L.) has been observed as a pest of some willow species in a nursery. Viburnum is infested by *Pyrrhalta viburni* PAYK., whose larvae sometimes completely defoliate entire bushes. When the leaves are finally gone, this pest has been seen feeding on the young, green shoots. Damage has been noted in Ahvenanmaa, Uusimaa, South Häme and South Savo (cf. also M. NUORTEVA 1960). The alder leaf beetle (*Agelastica alni* L.) is an occasional leaf-pest of hawthorn hedges (at Sortavala (LK) in 1939).

In 1953, mines were found in the leaves of *Crataegus coccinea* at Helsinki (U); TIENSUU (1955) stated that the beetles emerging from them were of a new species to Finland, *Rhamphus oxyacanthae* MARSH. Similar mines were found by NORDMAN (1957 b) in the vicinity of Helsinki in 1943 in *Crataegus oxyacantha* and in 1955 also in *Cr. coccinea*. He considered the causal species to be *Rhamphus pulicarius* HBST. Everts believes that *Rh. oxyacanthae* MARSH. is not a distinct species, but no more than a race of *Rh. pulicarius* living on *Pomaceae* plants.

In 1923—1924, brown leaf weevils (*Phyllobius oblongus* L.) inflicted considerable damage on hawthorn plants at Viipuri (EK) by feeding on the buds and young leaves. In 1924, this pest destroyed about 700 young hawthorn seedlings within a short time; the species had not previously been encountered as a pest in this country. It has since appeared on june-berry (SAALAS 1949, p. 305) and pear trees (*Pyrus ussuriensis*). Rose leaves are on occasion injured by the green leaf weevil (*Phyllobius maculicornis* GERM.), the silver-green leaf weevil (*Phyllobius argentatus* L.) and *Phyllobius urticae* DEG. In 1954, *Strophosomus rufipes* STEPH. was reported to have injured the leaves of a hawthorn hedge at Kuusamo (Ks).

Roses are sometimes appreciably damaged by the strawberry blossom weevil (*Anthonomus rubi* HBST), which severs the stalks of the flower buds and brings about their desiccation. At times, it has destroyed 25—50 per cent of the buds, and in some cases even more. The main target of attack seems to be Scotch rose, but other rose species (*Rosa foetida, R. rugosa*) are also harmed. Damage has taken place in south and central Finland, extending to the region of Iisalmi (PS). In 1939, larvae of the alder weevil (*Cryptorrhynchidius lapathi* L.) inflicted some injury on the branches of *Salix lanata*. On a few occasions, the shot-hole borer (*Xyleborus dispar* FABR.) has injured lilac, and once a hedge of pea-tree.

Sawflies, etc. (*Hymenoptera*). Two species of pamphilids have been found on hawthorn bushes. In 1915, larvae observed at Ruovesi (EH) were presumed by LINNANIEMI (1920, p. 73) to be either *Neurotoma flaviventris* RETZ. or the closely-related *Neurotoma iridescens* ANDRÉ (*sorbi* FORS.). According to Grönblom, the species in question was the latter, of which the food plant is usually the young mountain ash (cf. also HELLÉN 1935, p. 16). WESTERLUND (1898) reported that *Pamphilius silvaticus* L. substantially damaged a hawthorn hedge at Joroinen (PS) in 1897; the pest fed on the foliage starting from the terminal parts, and progressing downward to the base of the plants. In 1949—1950, numerous larvae were seen on a hawthorn hedge at Rovaniemi (PP), and for many years a slight infestation has occurred at Tampere (EH) (Grönblom).

Fifteen species of sawflies have been established as rose pests. The commonest and most injurious species to attack the leaves is the rose sawfly (*Arge rosae* DEG.), whose larvae may sometimes defoliate small bushes. Moreover, the females inflict damage by making short, oblique grooves in the shoots, and depositing one egg in each groove; the injured shoot becomes twisted, often blackened and dried. As early as last century, damage inflicted by the species took place at Karjalohja (V)

(SAHLBERG 1895)[1]). The reports of the State entomologist first mentioned the species in 1913; since then, it has been observed in many parts of the country, most abundantly in Finland Proper, Uusimaa and South Häme, and is found on both wild and cultivated roses. In the region of Lohja (V), it is a common and harmful species (R. FORSIUS 1919, p. 20).

Rose bushes are commonly infested with sawflies of the genus *Allantus* (*Emphytus*), but in most cases it has not been possible to determine the species on the basis of larval specimens alone. SAHLBERG (1895), gives the most common of these as the banded rose sawfly (*Allantus* (*Emphytus*) *cinctus* L.), whose larvae eat larger or smaller portions of the leaves. A rarer species is *Allantus* (*Emphytus*) *rufocinctus* RETZ., which has occurred as pest at least in Uusimaa and South Häme. A third related species, *Apethymus serotinus* MÜLL. (*filiformis* KL.), first found at Helsinki (U) in 1894 (SAHLBERG 1895), has been found as a rose pest in 1921 and 1928 at Tikkurila (U) (Vappula) and in 1949 at Perniö (V) (KONTUNIEMI 1950). R. FORSIUS (1933, p. 7) believes it is carried by roses from abroad. Larvae of the rose leaf-rolling sawfly (*Blennocampa pusilla* KL.) live protected within the tightly rolled leaves. According to SAALAS (1933, p. 387), the species is a pest in some places in south Finland. The first observation of the Department of Pest Investigation dates from 1952, when many larvae appeared on roses at Saltvik (A). Larvae have also been found on cultivated roses at Espoo (U), and on wild roses at Särkisalo (V) (Kontuniemi). Larvae of the rose slug sawfly (*Endelomyia aethiops* FABR.) reduces the leaves of rose bushes to a skeleton. The species is very prevalent in this country, bringing about considerable injury, especially to smooth-leaved roses. The rose slug sawfly was first reported by SAHLBERG (1907), but has according to R. FORSIUS (1907) been found earlier in a number of places in southwest Finland. Reports received by the Department of Pest Investigation indicate that this species appears throughout the country as far north as the region of Oulu (PP), and at times completely defoliates rose bushes. The pear slug sawfly (*Caliroa cerasi* L.) was reported by SAHLBERG (1895) to have injured roses at Karjalohja (V). Similarly, E. REUTER (1898, p. 59; 1910, p. 14) and R. FORSIUS (1909 a) also mention it as a rose pest. In 1906—1908, larvae of *Cladius difformis* PANZ. (= *Cl. crassicornis* STEPH.)[2]) appeared together with larvae of the rose bud sawfly at Helsinki (U), and completely destroyed the first flower crop in a glasshouse (E. REUTER 1912, p. 18—20). The larvae inhabited the young shoots, eating holes in the leaves, and injuring also the flower buds. Adults of the former species have been remarked by R. FORSIUS (1907 a, p. 96) on rose bushes in Ahvenanmaa (A). NORDMAN (1943, p. 151) has found larvae of *Cladius pectinicornis* GEOFFR., sometimes in large numbers, on rose bushes at Föglö (A). The species has also been seen on cultivated roses at Helsinki (U) (Kontuniemi). In 1933, larvae of *Pristiphora punctifrons* THOMS. appeared on Scotch rose bushes at Nivala (KP), defoliating

[1]) He used the name *Hylotoma rosarum* L.

[2]) According to KONTUNIEMI (1951), *Cladius difformis* PANZ., which has been eliminated from Finnish lists and combined with *Cl. pectinicornis* GEOFFR., should be considered as a distinct species.

several branches. Furthermore a statement (with a question mark) points to the fact that the species lives on roses (SAHLBERG 1907).

Larvae of the rose bud sawfly (*Monardis plana* KL.) injure the young leaves and particularly the flower buds of rose bushes by making holes in them and ultimately hollowing out the buds. The species was first mentioned in this country by SAHLBERG (1907) from Karjalohja (V), but it had evidently appeared earlier, according to an observation made by E. REUTER (1897, p. 47) at Parainen (V) in 1895—1896 (cf. also R. FORSIUS 1907). Damage has since been inflicted on a number of occasions in the southern parts of the country (in V, U, EK, EH and once in PK).

Rose bush shoots are injured by the rose stem sawfly (*Ardis brunniventris* HTG), whose larvae penetrate the terminal parts of the stems and bore downwards, causing the shoot tops to become blackened and twisted. The species was first found in Finland at Karjalohja (V) in 1892 (SAHLBERG 1895), and again at the same place in 1906 (SAHLBERG 1907). Since 1935, this pest has been observed in various parts of the country as far north as Kainuu, inflicting damage on different species of roses.

A new rose pest is *Pamphilius balteatus* FALL., which appeared in large numbers at Lammi (EH) in 1955; injury to roses has also taken place at Pälkäne (EH) (Kontuniemi). Grönblom found *P. inanitus* VILL. to have infested Scotch rose and other smooth-leaved rose species near Tampere (EH) in 1941—1944 (KONTUNIEMI 1960, p. 64)[1]). *Sterictiphora geminata* GMEL. was also established as a rose pest at Helsinki (U) in 1958 (Ranin).

Pseudomacrophya punctum-album L., first found in this country in 1906 at Finström (A) (R. FORSIUS 1907 a, p. 98), appeared in large numbers in 1945 at Malmi (U) in Helsinki, on privet shrubs (*Ligustrum vulgare*). The adults gnawed the upper surface of the leaves, with the result that only the lower epidermis remained; consequently, the leaves contained irregular light patches or holes. Larvae of this species have also been found on privet at Helsinki (U) (Saarinen). On several occasions, larvae of *Zaraea fasciata* L. have been observed on honeysuckle and snowberry, e.g., at Sääksmäki (EH) and Tampere (EH) (cf. KONTUNIEMI 1960, p. 62).

The pear slug sawfly (*Caliroa cerasi* L.) is a frequent and harmful pest of hawthorn in south and central Finland; it feeds on the leaf tissues of this plant so thoroughly that only the veins and lower epidermis remain intact. In some cases injury has also been inflicted on cotoneaster, and Grönblom reports damage to almond bushes (*Amygdalus nana*) at Tampere (EH).

In 1961, large blister mines were apparent in the leaves of *Rubus odoratus* at Savonlinna (ES); they were apparently the work of *Metallus pumilus* KL. (Vappula).

Purple willows grown as ornamental shrubs have sometimes been infested with elongated leaf-galls caused by *Pontania vesicator* BREMI (cf. also SAARINEN 1945).

Leaf-cutter bees (*Megachile* sp.) have on occasion been responsible for minor damage by cutting round pieces from the leaves of lilac and rose bushes, which

[1]) Adults of this species were found in 1906 at Finström (A) and Hammarland (A), together with *P. balteatus* (R. FORSIUS 1907 a).

they utilize in building their nests. Injury has been noted as far north as Oulu (PP). In 1916 at Janakkala (EH), *Megachile centuncularis* L. so severely injured rose leaves that the bushes appeared riddled with holes (LINNANIEMI 1920, p. 76).

Rose bushes are sometimes infested with galls caused by certain *Rhodites* species, of which the commonest is *Rhodites rosae* L. The galls contain one or several chambers, can be as large as a fist, and are covered with dense green or red hairs. Both wild roses (*Rosa glauca, R. coriifolia, R. cinnamomea*) and cultivated roses (e.g., *Rosa eglanteria magnifica*) are infested. This species of pest was first observed near Tammisaari (U) in 1909—1911 (LINNANIEMI 1916, p. 26); galls have since been found in the southwestern parts of the country (A, V, U and St). Another species, *Rhodites mayri* SCHLECHT., produces roundish galls in the leaves, calyx and fruits of roses. These galls are green or red in colour, one- or many-chambered, long-spined, and may be in clusters. The species was first reported in Finland by HIETIKKO (1926; cf. also R. FORSIUS 1925 b, p. 68) from Kaarina (V). Galls have later been found at various places in southern Finland (A, V, U, St, EH and LK), both on wild roses such as *Rosa cinnamomea*, and also at times on cultivated roses. The galls produced by *Rhodites eglanteriae* HTG are small, round, one-chambered, smooth-surfaced, green or red in colour, and attached to only one place, most often on the under-surface of the leaves. In 1912—1920 R. FORSIUS (1925 a) found galls at Lohja (V), Karjalohja (V) and Helsinki (U), while HIETIKKO (1926) found them in the region of Turku (V).They have also been remarked, mainly on wild roses, at Janakkala (EH), Föglö (A) and Honkilahti (St). *Rhodites centifoliae* HTG produces galls similar to those of the previous species, but their surface is covered with short, stiff protuberances. The species was quite injurious to rose bushes in the region of Pietarsaari (KP) (SAHLBERG 1881), and has also appeared at Haapavesi (KP). *Rhodites spinosissimae* GIR., whose galls are roundish, reddish, usually smooth, and grow through the entire leaf section, have been observed at Kauniainen (U) (R. FORSIUS 1925 b, p. 66) and Turku (V) (HIETIKKO 1926). Galls of *Rhodites rosarum* GIR. were reported by LIRO (LINDROTH) (1902) at Tammela (EH), and R. FORSIUS (1925 a) found them at Kauniainen (U) in 1919.

True flies (*Diptera*). *Rhagoletis alternata* FALL. was first seen in this country at Terijoki (Kk) in 1938 (TIENSUU 1941). In 1941, larvae of this species proliferated in the fruits of two small-leafed rose bushes at Helsinki (U) (NORDMAN 1943 a). Similar damage was observed on a large scale on Japanese roses at Tikkurila (U) in 1954—1955.

Small numbers of leaf mines made by *Agromyza spiraeae* KALT. have on occasion been remarked on *Spiraea salicifolia* and *Sp. chamaedryfolia* (LINNANIEMI 1935, p. 94; FREY 1937, p. 87). This species appears as far north as Kemi Lapland. *Phytagromyza xylostei* ROB.-DESV. (= *Phytomyza lonicerae* BRISCHKE) is responsible for narrow, brownish, meandering tunnel mines in honeysuckle leaves; they appear in both wild and cultivated honeysuckle plants. Damage is also inflicted on snowberry (*Symphoricarpos*) bushes (LINNANIEMI 1913, p. 120—121, 123—127; 1915, p. 51).

The species has spread as far as North Ostrobothnia. At Helsinki (U), FREY (1946, p. 51) found a variant form of this species in cultivated honeysuckle, and gave it the name *Phytagromyza xylostei* ROB.-DESV. var. *lonicerarum* FREY. In 1912, LINNANIEMI (1913, p. 121) discovered many leaf-mines made by *Phytomyza* (*Napomyza*) *xylostei* KALT. in garden honeysuckle at Korso (U).

THUNEBERG (1959) reports discovering mines of *Liriomyza amoena* MEIG. in elder leaves at Joutseno (ES) in 1947.

Willows (*Salix purpurea, S. purpurea nana, S. viminalis, S. longifolia*) grown as ornamental bushes have at times been found infested with stem galls made by *Rhabdophaga salicis* SCHRK. Damage has been inflicted both in the region of Helsinki (U) and at Vanaja (EH) and Mikkeli (ES).

Butterflies, moths (*Lepidoptera*). Larvae of the black-veined white butterfly (*Aporia crataegi* L.) have at times injured the leaves of hawthorn and sloe. SEPPÄNEN (1954, p. 357, 375) has stated that larvae of *Gonepteryx rhamni* L. and *Celastrina argiolus* L. have appeared on buckthorn (*Rhamnus cathartica*), and larvae of *Melitaea maturna* L. on viburnum and honeysuckle. Larvae of the privet hawk-moth (*Sphinx ligustri* L.) are occasionally very noxious to ornamental shrubs, especially spiraea (*Spiraea salicifolia, Sp. chamaedryfolia, Sp. Vanhouttei, Sp. arguta*), false-spiraea (*Sorbaria sorbifolia*), lilac and viburnum (*Viburnum opulus, V. opulus sterile*), but more rarely honeysuckle (*Lonicera tatarica*), snowberry and golden currant (*Ribes aureum*). In some cases, they have defoliated small bushes. Damage attributable to this species has been reported from as far as the regions of Lavia (St) and Mikkeli (ES). Larvae of *Haemorrhagia fuciformis* L. have been observed on honeysuckle and snowberry (E. KIVIRIKKO 1941, p. 153; SALO and SOTAVALTA 1952, p. 99; SEPPÄNEN 1954, p. 375). Larvae of *Haemorrhagia tityus* L. damaged the leaves of tatarian honeysuckle at Tuusula (U) (LINNANIEMI 1920, p. 86), and those of snowberry in South Häme (SEPPÄNEN, op.cit.). Larvae of the eyed hawk-moth (*Smerinthus ocellatus* L.) were found on *Salix viminalis* and *Viburnum opulus* in south Finland (SEPPÄNEN, op. cit., p. 301, 375).

Larvae of *Lophopteryx camelina* L. appeared on hawthorn at Sääksmäki (EH) (E. KIVIRIKKO 1941, p. 154) and on rose at Lempäälä (EH) (SALO and SOTAVALTA 1952, p. 101). At the former place, KIVIRIKKO (op.cit., p. 155) also found larvae of *Trichiura crataegi* L. f. geogr. *ariae* HB. on hawthorn, and larvae of *Lasiocampa quercus* L.f. *callunae* PALM on lilac and spiraea. He further found *Orgyia antiqua* L. on rose bushes; this species has also been observed on *Crataegus coccinea* and *Syringa vulgaris* (SEPPÄNEN 1954, p. 340, 366). At Terijoki (Kk), larvae of *Dasychira pudibunda* L. were discovered on Japanese rose (LAHTIVIRTA 1939, p. 129). Other larvae found on ornamental shrubs include the following species: *Eudia pavonia* L. on cotoneaster at Föglö (A) (NORDMAN 1943, p. 167) and on rose (SEPPÄNEN 1954, p. 331), *Pheosia tremula* CL. and *Earias chlorana* L. on purple willow and *Eriogaster lanestris* L. on hawthorn and cotoneaster (SEPPÄNEN 1954, p. 301, 304, 339, 340) as well as on viburnum.

Roses have been infested by larvae of *Acronycta alni* L. at Lohja (V) (LINNANIEMI 1916, p. 31), and hawthorn by the same species at Lempäälä (EH) (SALO and SOTAVALTA 1952, p. 103). *Acronycta psi* L. has attacked rose bushes at Sääksmäki and Lempäälä (EH) (E. KIVIRIKKO 1941, p. 256; SALO and SOTAVALTA 1952, p. 104). This last-mentioned species also infests spiraea, hawthorn and june-berry (SEPPÄNEN 1954, p. 336, 340). Larvae of *Acronycta euphorbiae* SCHIFF. were discovered on sweet honeysuckle (*Lonicera caprifolium*) at Sääksmäki (EH) (E. KIVIRIKKO 1941, p. 156), and on spiraea and snowberry in Uusimaa (U) (SEPPÄNEN op.cit., p. 336, 376). The leaves and flowers of rose and viburnum bushes have been damaged by larvae of *Polia pisi* L. Larvae of *Lithophane socia* ROTT. were found to feed on the flower buds and opening flowers of *Rosa foetida* at Tikkurila (U) in 1946 (Vappula); they have also appeared on lilac and viburnum (SEPPÄNEN 1954, p. 366, 375). At Korso (U), *Monima incerta* HUFN. was found on rose bushes. KANERVO (1947, p. 100) reports that pea-tree was mildly injured by larvae of *Phytometra gamma* L. On one occasion, larvae of *Scoliopteryx libatrix* L. were noted on spiraea at Lempäälä (EH) (SALO and SOTAVALTA 1952, p. 115).

Apart from the above pests, larvae of the following species have been found on ornamental shrubs: *Colocasia coryli* L. on hawthorn and june-berry; *Acronycta auricoma* FABR. on hawthorn and viburnum; *Acronycta rumicis* L. on hawthorn, ampelopsis and sweet honeysuckle; *Rhyacia augur* FABR. on lilac; *Rhyacia baja* FABR. on rose; *Agrotis ypsilon* ROTT. on hawthorn; *Aplecta nebulosa* HUFN. on viburnum; *Polia persicariae* L. on elder; *Polia thalassina* ROTT. on barberry; *Episema caeruleocephala* L. on sloe; *Antitype chi* L. on viburnum; *Meganephria oxyacanthae* L. on hawthorn, june-berry and sloe; *Euplexia lucipara* L. on black-berried dogwood and viburnum; *Naenia typica* L. on elaeagnus and ampelopsis; *Xanthoecia flavago* SCHIFF. on elder; *Monima gracilis* FABR. on cotoneaster; *Calymnia trapezina* L. on hawthorn, sloe and buckthorn; *Amathes helvola* L. on barberry; *Eupsilia satellitia* L. on hawthorn, viburnum and honeysuckle (SEPPÄNEN 1954).

Larvae of the winter moth (*Operophthera brumata* L.) have on occasion been responsible for quite severe damage to hawthorn, rose and june-berry, and milder injury to Hungarian lilac, honeysuckle, cotoneaster and buckthorn. In 1943, a number of larvae of *Calocalpe cervinalis* SCOP. were observed on barberry bushes at Lahti (EH) (HEINÄNEN 1947, p. 47). They have also been found on the same plant elsewhere in south Finland (SEPPÄNEN 1954, p. 321). Rose bushes have been infested with *Cidaria derivata* SCHIFF. at Lempäälä (EH) (SALO and SOTAVALTA 1952, p. 119) and Ahvenanmaa (SEPPÄNEN, op.cit., p. 331), and with *Abraxas grossulariata* L. at Kirkkonummi (U) (LINNANIEMI 1920, p. 106). At Porvoo commune (U) and Eckerö (A), larvae of *Phalaena syringaria* L. have been found on lilac (NYLUND 1941; NORDMAN 1951). Larvae of the mottled umber moth (*Erannis defoliaria* CL.) appeared on leaves of sloe at Föglö (A) (NORDMAN 1943, p. 172), and on june-berry and cotoneaster in Uusimaa.

In addition, larvae of the following species have been found on ornamental

bushes: *Nothopteryx polycommata* SCHIFF. on honeysuckle and snowberry; *Triphosa dubitata* L., *Philereme vetulata* SCHIFF. and *Philereme transversata* HUFN. on buckthorn; *Calocalpe undulata* L. on barberry and spiraea; *Lygris prunata* L. on golden currant; *Cidaria fulvata* FÖRST. on Scotch rose; *Cidaria miata* L. on june-berry; *Eupithecia exiguata* HB. on barberry and tatarian honeysuckle; *Selenia tetralunaria* HUFN. on sloe; *Angerona prunaria* L. on elder; *Opisthograptis luteolata* L. on hawthorn and june-berry; *Phigalia pedaria* FABR. on buckthorn; *Lycia hirtaria* CL. on barberry and hawthorn; *Biston betularius* L. on spiraea, june-berry and European euonymus; *Siona lineata* SCOP. on viburnum (SEPPÄNEN 1954).

Larvae of *Arctia caja* L. have appeared on spiraea and hawthorn, those of *Nola cucullatella* L. on cotoneaster and those of *Sterrhopteryx standfussi* WOCKE on mock orange (SEPPÄNEN 1954, p. 329, 336, 340).

AF TENGSTRÖM (1848, p. 103) mentioned finding larvae of *Eurhodope advenella* ZCK., mainly on hawthorn at Helsinki (U). In the region of Turku (V), larvae of *Eucnemidophorus rhododactylus* FABR. (*Platyptilia rhododactyla* FABR.) were noted on Japanese rose bushes (NORDMAN 1943, p. 150).

The tortricids include many injurious pests of ornamental shrubs. Rose bushes are often attacked by larvae of Bergman's button (*Tortrix bergmanniana* L.), which sometimes roll the leaves and injure all of them, deforming the appearance of the bushes. The species is common in the southern parts of Finland, but damage has been observed as far north as the rural commune of Kemi in North Ostrobothnia. Larvae of the currant fruit moth (*Notocelia roborana* TR.) also harm rose bushes by spinning together the terminal leaves and flower buds; damage appears on both wild and cultivated roses. AF TENGSTRÖM (1848, p. 70) first mentioned finding larvae in the vicinity of Helsinki (U); subsequently, they have appeared several times as rose pests, especially in Uusimaa and South Häme. For instance, this pest was very common in 1943 in the region of Hämeenlinna (EH) (HUKKINEN 1943). Larvae of *Eucosma cynosbatella* L. = *Epiblema tripunctana* FABR. injure the buds and young emerging leaves of rose bushes, so that in the early summer the branches remain without leaves. There were severe infestations of this species in 1935 at Oulainen (KP) (Kanervo), in 1938 at Vahviala (EK) and in 1943 at Korso (U). A leaf sample from the last-mentioned location was also infested with *Pandemis ribeana* HB. The related species *Pandemis corylana* FABR., not previously positively observed in Finland, was reared in 1933 from a larva collected from Scotch rose at Tvärminne (U) (NORDMAN 1934). In 1931, larvae of *Peronea schalleriana* L. were found on Japanese rose near Helsinki (U).

The European leaf-roller (*Cacoecia rosana* L.) has on occasion proved to be a noxious pest, particularly with respect to hawthorn hedges and rose bushes, but has also been observed to injure many other ornamental shrubs, such as *Ligustrum vulgare, L. ovalifolium, Viburnum lantana, Elaeagnus argentea, Syringa josikaea, Lonicera caprifolium, Philadelphus* sp., *Berberis* sp. and *Salix purpurea.* Larvae of *Exapate congelatella* CL. attack various ornamental bushes, especially pea-tree and spiraea (cf. also AF

TENGSTRÖM 1948, p. 106). Injury has also been noted on honeysuckle (*Lonicera periclymenum, L. caprifolium*), viburnum (*Viburnum opulus pygmaeum*), lilac (*Syringa josikaea*), rose, privet, snowberry, cotoneaster and hawthorn. The species appears as far north as the region of Oulu (PP) (VAPPULA 1933 b). *Argyroploce siderana* TR. was found in 1960 to be a pest of spiraea at Hamina (EK) (TIENSUU 1961). Larvae of *Peronea holmiana* L. were seen on cotoneaster at Föglö (A) (NORDMAN 1943, p. 175). Larvae of *Cnephasia virgaureana* TR. were once remarked on rose, and once on common osier and hawthorn.

NORDMAN (1943, p. 179) reported the discovery of larvae of *Taygete mouffetella* SCHIFF. on honeysuckle at both Föglö (A) and Helsinki (U). The larvae live inside tubular leaf-rolls. Leaf-mines made by larvae of the apple and plum casebearer (*Coleophora serratella* L.) have been found at Helsinki (U) on cotoneaster and *Peraphyllum* (KANERVA 1925), and in profusion on *Forsythia* in 1925—1927 (HACKMAN 1945, p. 30), as well as on hawthorn at Jyväskylä (PH) in 1951.

The most damaging lilac pest is the lilac leaf-miner (*Caloptilia syringella* FABR.), whose larvae make large blister mines in the leaves and thereby disfigure the appearance of the bushes. In some years, the injury is so extensive that the bushes appear completely brown. The lilac leaf-miner, which produces two larval generations during the summer, is common in south and central Finland; to date, damage has occurred as far north as South Ostrobothnia and North Savo. The round, brown leaf-mines made by *Leucoptera scitella* ZELL. abound on cotoneaster, but are less numerous on hawthorn and june-berry (NORDMAN 1957 b). Larvae of *Hyponomeuta cognatellus* HB. inflicted considerable damage to *Euonymus* in 1919 at Turku (V) and in 1920, 1925 and 1928 at Helsinki (U). Small numbers of larvae of *Hyponomeuta irrorellus* HB. were found on sloe at Föglö (A) (NORDMAN 1943, p. 152). A heavy infestation of *Swammerdamia lutarea* HAW. occurred in 1945 on a hawthorn hedge at Maarianhamina (A); the leaves of the young shoots were so badly injured, that from a distance the hedge appeared grey in colour (NORDMAN 1946). Larvae of *Cerostoma xylostellum* L., which roll the leaves of honeysuckle, abounded on *Lonicera xylosteum, L. caprifolium* and *L.* sp. in 1934 and 1942 at Helsinki (U), and in 1945 at Tikkurila (U). *Nepticula oxyacanthella* STT., first found in Finland by KANERVA (1928) at Helsinki (U), produces tunnel mines in the leaves of hawthorn. Such mines were very numerous at Kymi (EK) in 1954 (NORDMAN 1955).

Mites (*Acarina*). The hop red spider mite (*Tetranychus urticae* KOCH) has brought about severe damage to the following ornamental shrubs in south Finland: *Hydrangea paniculata*, laburnum, roses, shrubby cinquefoil, *Celastrus orbiculata, Actinidia*, spiraea, buckthorn (*Rhamnus frangula, Rh. alpina*), ampelopsis, dogwood, elder, viburnum and honeysuckle. The fruit tree red spider mite (*Metatetranychus ulmi* KOCH) has at times appeared in large numbers on hawthorn, and in small numbers on cotoneaster and june-berry (LISTO et al. 1939, p. 16). *Eriophyes goniothorax* NAL., which causes erineum in the rolled leaf edges of hawthorn,

has been observed in Ahvenanmaa and Finland Proper (LINDROTH) (LIRO) 1899, p. 18; LIRO and ROIVAINEN 1951, p. 144) and in Hyvinkää commune (U) (Vappula).

Eriophyes aroniae CAN. gives rise to galls in the leaf tissue of cotoneaster; initially, these are yellowish-green, later becoming reddish, and finally dark brown; they appear as small swellings on the upper and lower surfaces of the leaves. The species has been remarked in south Finland as far as South Häme and Ladoga Carelia (LIRO and ROIVAINEN 1951, p. 82). Sloe bushes are infested by *Eriophyes similis* NAL. var. *pruni-spinosae* NAL., which produces bag-shaped galls in the leaves. This pest is common in Ahvenanmaa (op.cit., p. 155).

Molluscs (*Mollusca*). Slugs (*Deroceras agreste* L., etc.) have on occasion eaten the leaves and green shoots of broom (*Cytisus alpinus*) seedlings; they have also injured rose bushes. In 1923, *Fruticicola hispida* L. appeared in large numbers on mock orange at Helsinki (U) (LINNANIEMI 1935, p. 138).

Birds (*Aves*). The bullfinch (*Pyrrhula pyrrhula* L.) has been seen to damage the leaf and flower buds of lilac, hawthorn, june-berry and mock orange in winter, thus retarding the subsequent development of leaves and flowers (SIMBERG 1953; Puutarha 1953, p. 296).

Mammals (*Mammalia*). Field voles (*Microtus agrestis* L.) often damage ornamental shrubs during the winter by gnawing the bark of the stem under the cover of snow up to a height of 10—25 cm from the ground. They attack hawthorn bushes in particular, occasionally destroying hedges for many tens of metres. Voles also injure rose bushes in a similar fashion, and do not even hesitate to feed on prickly-stemmed bushes. Damage attributable to voles has been seen on lilac, dogwood, mock orange, spiraea and elaeagnus. Moreover, MYLLYMÄKI (1959, p. 78) lists 16 species of ornamental shrubs injured by voles in Finland; such injury has occurred in the south and central parts of the country. Other voles, such as the continental vole (*Microtus arvalis* PALL.) and the water vole (*Arvicola terrestris* L.), have contributed to the damage. Furthermore, hares (*Lepus timidus* L. and *L. europaeus* PALL.) may sometimes be harmful to ornamental shrubs (BRANDER 1960).

20. Ornamental trees

Thrips (*Thysanoptera*). *Thrips calcaratus* Uz. lives on linden leaves, making them brown and curled. The species was first observed at Tuusula (U) in 1915—1916, when it was an injurious pest of park lindens (LINNANIEMI 1920, p. 4—6). In 1932 it appeared profusely at Kuhmoinen (EH) and again in 1936 at Tuusula (U) (HUKKINEN 1936 a, p. 129). Substantial injury to linden seedlings attributable to thrips was found in a nursery at Janakkala (EH) in 1939 (HUKKINEN, Ann. Report Dept. of Pest Invest. 1939), and at Viipuri (EK) (Vappula).

Plant bugs, aphids, etc. (*Hemiptera*). Occasionally, large numbers of sloe bugs (*Dolycoris baccarum* L.) have been observable on young

deciduous trees such as linden and oak, causing injury to shoots and young leaves. In some instances, similar damage has been inflicted on young linden trees by plant bugs (*Lygus* spp.).

Some species of leafhoppers are at times present in large numbers on deciduous park trees; they cause bleaching or discoloration of the leaves. A common and polyphage species is *Empoasca flavescens* FABR., found on linden and oak (P. NUORTEVA 1952 a, p. 28). In 1933 *Cicadella concinna* GERM. so severely infested 20-year old oak trees near Pori (St) that the leaves turned greyish. *Cicadella stellulata* BURM. is very common on lindens at Hattula (EH) toward the end of the summer; it gives rise to light-coloured spots in the leaves (P. NUORTEVA, op.cit.). On occasion, large numbers of *Typhlocyba ulmi* L. appear on elm trees. In autumn 1914, this species damaged elms at Lahti (EH), with the result that the leaves were pale and curled (LINNANIEMI 1916, p. 61). Damage has also been remarked in the regions of Helsinki (U) and Hämeenlinna (EH). Lindens are commonly infested with large numbers of *Erythroneura alneti* DAHLB., which makes pale-coloured feeding spots in the leaves (P. NUORTEVA 1955). On rare occasions, linden trees at Hattula (EH) were found to be infested with the leafhopper species *Erythroneura ordinaria* RIB., *Typhlocyba sexpunctata* FALL., and *T. decempunctata* FALL. (P. NUORTEVA 1952, p. 30, 31, 32).

Rhinocola aceris L. lives on maple leaves, but it has also been found on oak and elm (O. M. REUTER 1876, p. 72). *Psyllopsis fraxini* L. causes irregular curling or twisting in the leaflets of ash; damage is sometimes extremely prevalent in the region of Helsinki (U). The species is common in Ahvenanmaa (A) and has also been found in Finland Proper, the Carelian isthmus and South Häme (O. M. REUTER 1876, p. 71; 1880, p. 232; R. FORSIUS 1929; HÅK. LINDBERG 1960). The leaves of ash are injured also by two other species, *Psyllopsis fraxinicola* FÖRST. and *Ps. discrepans* FLOR (O. M. REUTER 1880, p. 231, 232; HÅK. LINDBERG 1960). *Psylla ulmi* FÖRST. has on occasion proved to be a harmful pest of the smooth-leaved elm, leaves and shoots being injured. The species has been observed in the region of Turku (V), in Uusimaa and in South Häme. Old elms suffered severe injury at Hattula (EH) in 1929 (SAALAS 1949, p. 167). LINNANIEMI (1922) found *Aleurochiton aceris* GEOFFR. = *A. complanatum* BAER to be a new species in Finland, appearing on maple at Salo (V). It was also found in profusion in 1934 on *Acer campestre* at Lohja (V) (R. FORSIUS 1934), and in 1936 on young wild maples near Helsinki (U) (VAPPULA 1937 a).

Plant lice often constitute harmful pests of ornamental trees. *Lachnus roboris* L., which lives on the young branches of oaks, was first found in this country at Uusikaupunki (V) in 1916 (HELLÉN 1927) and has since been remarked at Lohja (V) (HÅK. LINDBERG 1935), at Föglö (A) (NORDMAN 1943, p. 164), and in 1948 at Perniö (V) (Heikinheimo). Oak leaves are infested with *Tuberculoides annulatus* HTG, first found at Lohja (V) (HÅK. LINDBERG 1935). The species abounded at Lahti (EH) in 1954, and at Kauniainen (U) in 1959. *Thelaxes dryophilus* SCHRK

injures the young shoots and leaves of oak trees. In Finland, it has appeared in Ahvenanmaa and Finland Proper (HINTIKKA 1913; NORDMAN 1943, p. 164) as well as in Uusimaa (Heikinheimo). In addition, *Phylloxera* sp. was found on oak leaves at Viipuri commune (EK) in 1922 (LINNANIEMI 1926)[1]), where it brought about quite severe damage to the foliage of a few trees; the species also appeared in 1959 at Kauniainen (U) and Janakkala (EH).

Maple trees are at times inhabited by large numbers of the Norway-maple aphid (*Periphyllus aceris aceris* L.). The species has been noted in south and central Finland. *Periphyllus lyropictus* KESSLER was found in 1960 on maple at Joutseno (ES) (THUNEBERG 1962).

A common linden pest is the brasswood aphid (*Eucallipterus tiliae* L.), which lives in large numbers on the lower surface of the leaves, soiling them with its sticky excretion. At times, the liquid drips on to benches and plants below the trees, covering them with a glistening, sticky layer. This aphid has been found throughout the country as far north as Oulu (PP).

The leaves of smooth-leaved elm trees are inhabited by *Tinocallis platani* KALT., which has been found in Uusimaa and South Häme (Heikinheimo). The elm aphid (*Schizoneura ulmi* L.) causes the leaves of wych elm to become curled and bleached in early summer. This species was reported by O. M. REUTER (1883 a) as very abundant in 1882 on the islands off Turku (V). Later, numerous reports have been received, indicating that this species is common, and occurs at least as far north as the regions of Kokkola (KP) and Kuopio (PS). At times, the injury inflicted on elms is so severe that nearly all of the leaves are twisted, and the trees visibly suffer. The elm gall aphid (*Tetraneura ulmi* L.) produces galls — at first green, later becoming reddish and finally dark-coloured — on the upper surface of wych elm leaves. The species is prevalent in south Finland, and has been found as far north as Savonlinna (ES). *Colopha compressa* KOCH lives mainly on smooth-leaved elm, making pouchlike galls in the upper surface of the leaves. It was remarked at Karjaa (V) in 1910 on *Ulmus campestris* (HEIKINHEIMO 1944, p. 6), at Elimäki (U) and Pälkäne (EH) in 1954 on smooth-leaved elm (Heikinheimo) and at Joroinen (PS) (SAALAS 1949, p. 174).

Fundatrices of *Thecabius affinis* KALT. make folds in the leaf-edges of poplars; the nymphs subsequently move from these to the young leaves, and roll them into pocket-like curls. The species was found at Helsinki (U) on *Populus nigra* and *P. berolinensis* (HINTIKKA 1913), and at Tyrväntö (EH) in 1937 on the latter species of poplar. The lettuce root aphid (*Pemphigus bursarius* L.) gives rise to irregular purselike galls in the petioles of poplars. The damage is extremely widespread on occasion. It has been observed at Sortavala (KL) in 1910 and 1922 (HINTIKKA 1913; LINNANIEMI 1935, p. 127), in 1937 at Tyrväntö (EH) (on *Populus berolinensis*), in 1938 at Espoo (U) and in 1953 at Naantali (V). *Pemphigus borealis* TULLGR.

[1]) Linnaniemi believed it to be a new species in Finland, *Phylloxera quercus* B.D.F., but as this species is found only in south Europe, the report evidently concerned some other species of *Phylloxera*.

makes large, peanut-sized galls in the shoots of poplars; they were first found at Sippola (EK) in 1937 (VAPPULA 1937 c) on balsam poplar (*Populus balsamifera*), which was severely infested by such galls. In 1940, many galls appeared on *Populus laurifolia* at Hyvinkää (U); in 1952 a sample was obtained from Lavia (St), and in 1958 from Harjavalta (St). Moreover, galls have also been observed at Helsinki (U) in a number of years. Reports on the occurrence of *Pemphigus filaginis* B. D. F. in Finland have been obtained as regards its secondary host plant, *Gnaphalium uliginosum* (HINTIKKA 1913, p. 67).

Cavariella theobaldi GILL. & BR. was found on white willow in 1954 at Janakkala (EH) and Kuopio (PS) (Heikinheimo).

Ornamental and park coniferous trees are also sometimes infested very heavily by aphids. *Cinara abieticola* CHOL. lives in large numbers on the trunk and branches of the Siberian fir (*Abies sibirica*), which become covered with its sticky secretion. Reports of this species were received in 1913 from Kesälahti (KP) (LINNANIEMI 1915, p. 61), in 1949 from Karjalohja (V), and in 1957 from Hyvinkää commune (U). This species was particularly prevalent in 1959, when many reports of its appearance were received from Finland Proper, Uusimaa, Satakunta and North Savo. *Cinara laricis* WALK. has at times been found in small amounts on larch, at least in Uusimaa and North Savo. The balsam twig aphid (*Mindarus abietinus* KOCH), which gives rise to twisting of the needles of young shoots, has been found mildly infesting Siberian fir in 1951 at Tyrväntö (EH) and Ylistaro (EP), and in 1952 at Tikkurila (U). *Mindarus obliquus* CHOL. was noted on white spruce at Maaninka (PS) in 1952 (Heikinheimo).

Pineus cembrae CHOL. lives on first- and second-year needles of the cembran pine. It was found at Helsinki and Helsinki commune (U) in 1943 and 1954 (Heikinheimo). During the course of decades, there have accumulated a large number of reports of damage inflicted on the needles of Siberian fir and other fir species by gall-lice (*Adelgidae*) in different parts of the country. Often the injury has been so extensive that especially on small trees the shoots are curled up, the needles are completely brown and fall to the ground, and the tree may finally dry up. However, the species has not been established with certainty. In the reports of the State entomologists, the causal agent was held to be *Dreyfusia nordmannianae* ECKST. = *nüsslini* C.B. Later studies have indicated that this species mainly inhabits *Abies nordmanniana*, *A. pectinata*, and at times other species of *Abies*. It is probable that in most cases, particularly as regards the Siberian fir, the causal agent has been *Aphrastasia pectinatae* CHOL., first reported in Finland at Elimäki (U) in 1947—1948 (KANGAS 1948). There, it injured Siberian and balsam fir seedlings; the latter were partially or nearly completely withered as a result of the damage inflicted. The species has since been found on Siberian fir in many localities in south and central Finland.

Larch trees have frequently been infested with aphids which — covered with their cotton-like waxy secretions — live on the needles. The damage may be so

severe that most of the needles fall off. Injury has been observed throughout the country as far north as Pello (PP). In the State entomologist's reports (LINNANIEMI 1920, p. 205—207; 1935, p. 129) the causal agent was assumed to be *Adelges laricis* VALL. (= *Cnaphalodes strobilobius* KALT.), but other species may have been involved. In any event, it is certain that the eastern spruce gall aphid (*Sacchiphantes abietis* L. = *viridis* RATZ.) was found on Siberian larch at Joutseno (ES) (THUNEBERG 1962)[1]). The gall aphids of conifer trees in Finland require more detailed studies.

The willow scale (*Chionaspis salicis* L.) is common in south Finland, sometimes appearing so profusely on mountain ash, linden and willows that the trunks are entirely covered with the insects. It has also been found on poplar and Finnish whitebeam. Young trees in particular may be subjected to disturbances in growth, although serious damage is of relatively rare occurrence. The brown scale (*Eulecanium corni* BCHÉ) has at times been observed on elm and oak. The rare species *Kermes quercus* L. has also been found on oak at Turku (V) and Lohja (V) (HELLÉN 1923; HÅK. LINDBERG 1935).

Beetles (*Coleoptera*). *Agrilus sulcicollis* LAC. was reared from infested oak branches taken at Ruissalo (V) (R. ELFVING 1943). Larvae of the cockchafer (*Melolontha hippocastani* FABR.) have on occasion destroyed ornamental coniferous tree seedlings, such as larch, Siberian fir, balsam fir and jack pine (*Pinus banksiana*) (SAALAS 1939, p. 44; 1949, p. 204), and have also been known to injure poplar roots. The garden chafer (*Phyllopertha horticola* L.) was reported eating the leaves of maple and alder in South Savo in 1949 (SAALAS 1949, p. 211). Large numbers of larval tunnels made by *Plagionotus arcuatus* L. were discovered in oak trunks at Ruissalo (V) (SAALAS 1949, p. 274). In 1932, larvae of the poplar borer (*Saperda carcharias* L.) were found in the trunks of young, poorly-growing poplar trees, which readily broke off at ground level as a result of the injury they had suffered. Even large trees were damaged in a similar manner. Larvae of *Saperda scalaris* L. have been found in oak trees at Ruissalo (V) (R. ELFVING 1943).

One report stated that poplar leaf beetles (*Melasoma populi* L.) had appeared in abundance on the young shoots of poplar (LINNANIEMI 1916, p. 14). The brassy willow beetle (*Phyllodecta vitellinae* L.), common throughout the entire country, has also on a few occasions been observed injuring the leaves of poplars, and once of white willow. In 1920, 1921 and 1923 *Chalcoides aurata* MARSH. was remarked in a poplar nursery (*Populus ? rasumowskiana*) at Viipuri commune (EK), where it ate pits and notches in the leaves of the plants (LINNANIEMI 1935, p. 31). Damage to first-year needles attributable to *Luperus pinicola* DUFT. has been observed on mountain pines and to some extent on Siberian larches and Murray pines (SAALAS 1949, p. 294).

Leaves rolled by *Byctiscus populi* L. have once been found on poplar trees (*Populus rasumowskiana* and *P. candicans*) (LINNANIEMI 1916, p. 15; 1920, p. 42). The common

[1]) JULIN (1959) reports finding *Sacchiphantes abietis* L. s.l. on Norway spruce in provinces A, V, U and PP and *Adelges laricis* VALL. s.l. in provinces EP, PH, Kn, PP and KemL.

leaf weevil (*Phyllobius piri* L.) has at times appeared in very large numbers, both on wild trees (birch, bird-cherry, alder) and on ornamental trees, such as maple, linden, balsam poplar and white willow. In 1935, these weevils were so numerous at Renko (EH) that in a day a pailful of them could be collected merely by shaking the trees. The species has been found as a pest as far north as the region of Pieksämäki (PS). Similar damage is brought about by the green leaf weevil (*Phyllobius maculicornis* GERM.) particularly in the eastern parts of the country. It injures the leaves of maple, linden and poplar, as well as those of forest trees. It has been found on mountain ash as far north as Sotkamo (Kn). In 1937 the brown leaf weevil (*Phyllobius oblongus* L.) has been seen eating leaves of linden seedlings near Helsinki (U). The alder weevil (*Cryptorrhynchidius lapathi* L.), whose larvae bore tunnels in the trunks of alder and willow trees, has twice been observed as a cultivated willow pest on *Salix lanata* in 1939 at Hyvinkää (U) and on white willow in 1952 at Kauniainen (U). — Large, round leaf-mines on poplars are the work of larvae of *Rhynchaenus populi* FABR., which were seen on balsam poplars at Parainen (V) (E. REUTER 1897, p. 46) as well as elsewhere in southern Finland (V, U, St and EH) since. In 1939, exceptionally large numbers of leaf-mines were made by *Rhynchaenus quercus* L. on oak trees at Föglö (A) (NORDMAN 1943, p. 164).

One of the commonest and most destructive weevils on coniferous trees is the pine weevil (*Hylobius abietis* L.), which attacks pine, spruce, and at times also larch and Murray pine seedlings (KANGAS 1937, p. 68); the adult weevils eat bare irregular lesions in the bark of the plants. In 1935 and 1938 they severely damaged cembran pine seedlings at Kannus (KP). Larvae of the lesser banded pine weevil (*Pissodes notatus* FABR.) have inflicted damage on various kinds of coniferous seedlings, e.g., larch, Jack pine, and Murray pine; adults have injured Murray pine and mountain pine by gnawing holes in the bark (SAALAS 1949, p. 315—316). In 1939, large numbers of the larger pine sapwood weevil (*Magdalis frontalis* GYLL.) appeared, particularly on the young shoots, stems and branches of mountain pine at Muolaa (Kk) (SAALAS, op.cit., p. 323).

The oak sapwood borer (*Scolytus intricatus* RATZ.) makes its feeding tunnels in the trunk or branches of oak trees. This pest has been found inter alia at Föglö (A), where the insects injured shoots, giving rise to their desiccation (NORDMAN 1943, p. 164). They also appeared at Ruissalo near Turku (V) (SAALAS 1919, p. 193; R. ELFVING 1943).

Ash trees were damaged by *Hylesinus crenatus* FABR. at Suomenlinna (U) (SAALAS 1919, p. 198; 1949, p. 348). Tunnels made by *Xyloterus signatus* FABR. and *Xyleborus dispar* FABR. have also been found in deciduous trees, such as linden.

Coniferous trees are infested by a large number of bark beetle species, of which some have been found on cultivated ornamental trees. The European spruce bark beetle (*Dendroctonus micans* KUG.) was observed in 1932 at Karjalohja (V) in Engelmann spruce (SAALAS 1949, p. 351) and in 1951 at Punkaharju (ES) in blue spruce (JUUTINEN 1953). In 1937, it was reported that the large shoot-boring pine beetle (*Blasto-*

phagus piniperda L.) had inflicted appreciable damage on pine trees (*Pinus montana, P. silvestris, P. cembra, P. strobus*) growing in the parks of Tampere (EH). Other bark beetles found in Finland include *Pityophthorus micrographus* L. and *Ips typographus* L., found in Engelmann spruce (SAALAS 1949, p. 380, 386); *Pityogenes chalcographus* L. in Engelmann spruce, Siberian fir, European and Siberian larch, and *Pityogenes bidentatus* HBST in Murray pine, mountain pine, Douglas fir, and white spruce (SAALAS, op. cit., pp. 381, 383).

Sawflies, etc. (*Hymenoptera*). Larvae of *Apethymus autumnalis* FORS. appeared in large numbers on oak leaves at Janakkala (EH) in 1949—1950 and 1953; also at Tampere (EH) they were found in 1960—1961 (Grönblom). This species was first described by R. FORSIUS (1933, p. 7) who discovered it on oak trees at Turku (V) in 1923. This pest evidently destroyed oak leaves at the end of last century at Mietoinen (V) and Ruissalo (V) (E. REUTER 1897, p. 45), and at Hattula (EH) in 1936—1938. Adults have also been found at Hämeenlinna (EH) and Helsinki (U) (KONTUNIEMI 1950). Oak leaves are injured by *Mesoneura opaca* FABR., which has appeared at Lemland (A) and at Tammisaari (U) (KONTUNIEMI 1960, p. 31). Larvae of *Caliroa varipes* KL., which skeletonize the leaves from the lower surface, have been seen on oak at Helsinki (U) (Lindqvist). *Profenusa pygmaea* KL. lives as a miner in oak leaves; in 1939 it appeared in large numbers at Föglö (A), and to a minor extent at Kymi (EK) (NORDMAN 1943, p. 164; 1955) and Porvoo (U) (Grönblom), as well as in 1929 at Hartola (EH) and 1934 at Huittinen (St). Damage has also been remarked at Lammi (EH) (Kontuniemi) and Parikkala (LK) (Tiensuu).

Larvae of *Caliroa annulipes* KL. injure linden leaves by feeding on their upper or lower surfaces. Severe damage was observed in 1936 at Kulosaari in Helsinki (U). The leaf-miner *Parna tenella* KL. appeared in linden (*Tilia cordata*) leaves at least at Lammi (EH) (Kontuniemi) and Tikkurila (U) and *Fenusa ulmi* SUND. in elm leaves at Helsinki (U) (Saarinen) and at Piikkiö (V). In 1957 poplars at Helsinki (U) were infested by larvae of *Pteronidea melanaspis* HTG, with consequent rather severe damage to the leaves. Larvae of *Trichiocampus viminalis* FALL. have been observed on poplar leaves at Helsinki (U) (Lindqvist). At times, large numbers of *Pteronidea salicis* L. larvae have appeared on crack willow; the pest fed on the leaves so thoroughly that within a short time no more than the midrib remained. *Salix elegantissima* has also been attacked. Damage has been reported in Uusimaa, South Carelia (LINNANIEMI 1935, p. 53) and South Häme. *Cimbex lutea* L. appeared on white willow at Helsinki (U) (KONTUNIEMI 1960, p. 60). In 1950 at Kauniainen (U), and in 1959 at Pietarsaari (KP), the leaves of white willow were infested with oblong blister-like galls, evidently originating in some species of *Pontania*. In 1951, some larvae of the genus *Euura* were found in white willow at Kauniainen (U); they were living inside the stem without causing any appreciable swelling. Young trees in particular were injured by the infestation. In 1961, galls originating in *Euura testaceipes* BRISCHKE were found on crack willow leaves at Järvenpää (U).

Numerous pamphilid larvae made an appearance on cembran pines at Tornio (PP) in 1926; they fed on the needles of the previous year's shoots. The causal species was presumed to be *Acantholyda nemoralis* THOMS. = *A. stellata* CHRIST. (HUKKINEN et al. 1936, p. 78). Similar injury occurred in 1927 at Oulu (PP). In 1942—1943, it was stated that *Diprion similis* HTG. had damaged several large cembran pines at Kangasala (EH) (SAALAS 1949, p. 413). As early as 1902, larvae of this species were found by K. O. ELFVING (1904 c) on cembran pine at Helsinki (U). Larvae of the red pine sawfly (*Diprion sertifer* GEOFFR.) were noted on mountain pine at Tuusula (U) in 1950.

The worst pest of larch is the large larch sawfly (*Pristiphora* (*Nematus*) *erichsoni* HTG), whose larvae have often defoliated entire trees. Damage has been inflicted on both Siberian and European larch. Injury was first noted in 1897 at Lammi (EH) (K. O. ELFVING 1904)[1]), but the species was first reared and announced as new to the country in 1903 (K. O. ELFVING 1904 a). In later years, destruction has been reported from various parts of the country as far north as Pello (PP) and Kuusamo (Ks). In 1915 and 1917, damage attributed to *Pristiphora* (*Lygaeonematus*) *laricis* HTG was apparent on larch in Helsinki commune (U), Tuusula (U) and Sääksmäki (EH), although the species was not identified with certainty (SAALAS 1949, p. 423). *Pristiphora* (*Lygaeonematus*) *wesmaeli* TISCHB., first found in 1903 at Muolaa (Kk) (K. O. ELFVING 1904 b), has since been established as inflicting quite severe damage on larch at Lohja (V) (R. FORSIUS 1919, p. 15), at Ruovesi (EH) and in 1943 at Helsinki (U) (KANGAS 1944). Larvae of *Anoplonyx destructor* BENS. were collected from Siberian larch in 1949 at Tampere (EH). This species was not previously known in Finland (KONTUNIEMI 1953). Larvae of the spruce sawfly (*Pristiphora abietina* CHRIST. = *Lygaeonematus abietum* HTG) have at times injured spruce hedges in south Finland by feeding on the needles of the young shoots. In 1938, similar damage was caused by *Pristiphora subarctica* FORSSL. (*Lygaeonematus subarcticus* FORSSL.) at Kuusamo (Ks) (SAALAS 1949, p. 425). On occasion, larvae of the giant wood wasp (*Urocerus gigas* L.) are found in the felled trunks of Siberian fir (SAALAS, op.cit., p. 431).

Various different species of gall wasps live on oak trees; they make galls in the leaves or other parts of the plant, but have no great economic significance. The commonest of these in Finland is probably *Andricus inflator* HTG, found several times in Ahvenanmaa, Finland Proper, Uusimaa, South Carelia and South Häme. *Andricus curvator* HTG is rather common in south Finland, and sometimes appears in very great numbers. Galls made by the following species have also been observed in Finland: *Andricus fecundator* HTG, Ahvenanmaa, Finland Proper, Uusimaa; *A. quercus-ramuli* L., Ahvenanmaa, Finland Proper; *A. quercus-radicis* FABR., Föglö (A), Parainen (V), Ruissalo (V); *A. marginalis* SCHLECHT., Föglö (A), Terijoki (Kk); *A. callidoma* HTG, Kaarina (V) (in 1946); *Neuroterus quercus-baccarum* L., Ahvenan-

[1]) It is probable that damage attributable to this species was inflicted as early as in 1896 at Siuntio (U) (E. REUTER 1908 a).

maa, Finland Proper; *Neuroterus tricolor* HTG, Föglö (A); *Diplolepis quercus-folii* L., Ahvenanmaa, Parainen (V); *Diplolepis longiventris* HTG, Ahvenanmaa, Finland Proper, Uusimaa, Carelian isthmus; *Diplolepis divisa* HTG, Föglö (A), Parainen (V), Lohja (V); *Biorrhiza pallida* OL., South Carelia (Viipuri and vicinity).

Larvae of *Syntomaspis druparum* BOH. were found to be common seed pests of white mountain ash (*Sorbus aria*) at Tampere, and have also been found in Finnish whitebeam and European mountain ash (GRÖNBLOM 1940). In the summer of 1945, very large numbers of larvae of *Megastigmus grönblomi* KANG. appeared in Siberian fir at Tampere (EH); they ate the seeds, and thus brought about substantial damage (KANGAS 1945; SAALAS 1949, p. 448). As early as 1915—1916 reports were received of injury inflicted by *Megastigmus* in the seeds of fir, but the species was not determined (LINNANIEMI 1920, p. 74—75).

True flies (*Diptera*). Larch seeds are injured by the larvae of *Hylemyia laricicola* KARL, first found in Finland at Punkaharju (ES) in Siberian larch in 1940 (LOVÁSZY 1942).

Larvae of the bat-willow gall midge (*Rhabdophaga terminalis* H. LW) cause twisted galls in the shoots of certain species of willow; they were abundant on white willow in 1951 at Vanaja (EH), in 1952 at Kauniainen (U), in 1953 at Kempele (PP), and in 1954 at Kuopio (PS).

Linden leaves are inhabited by *Dasyneura tiliamvolvens* RÜBS.; damage attributable to them has been found in Finland Proper and Uusimaa (I. FORSIUS 1922, p. 54), and in South Häme. The young leaves of linden trees are also injured by *Dasyneura thomasiana* KIEFF., which has been observed only once, at Helsinki (U) in 1947 (HACKMAN 1948). Galls made by *Contarinia tiliarum* KIEFF. in the leaves, leaf stalks and veins, flowers and flower stalks of linden have been found in Finland Proper, Uusimaa and South Häme.

Two species of gall midge have been found on ash trees in Ahvenanmaa: *Dasyneura fraxini* KIEFF. and *Dasyneura fraxinea* KIEFF. (FREY 1925; R. FORSIUS 1929).

Contarinia quercina RÜBS. causes crinkling and twisting of young oak leaves emerging from the buds; this pest has been observed only at Föglö (A) in 1927—1928 (R. FORSIUS 1929). Galls made by *Macrodiplosis dryobia* F. LW have been found at Turku (V), Espoo (U) and Viipuri (EK) (R. FORSIUS 1922; FREY 1925). In addition, rolled leaves caused by *Macrodiplosis volvens* KIEFF. were found at Ruissalo near Turku (V) (R. FORSIUS, op.cit.) in 1922.

Butterflies, moths (*Lepidoptera*). Ornamental trees are inhabited by many different species of *Lepidoptera*, but relatively few of them have any appreciable economic significance.

Larvae of the black-veined white butterfly (*Aporia crataegi* L.) have sometimes appeared on mountain ash and on Finnish and Swedish whitebeam, *Limenitis populi* L. has been found on poplars (*Populus balsamifera, P. nigra*) (LAHTIVIRTA 1939, p. 127; E. KIVIRIKKO 1941, p. 150), *Vanessa antiopa* L. and *Amorpha populi* L. on poplar (LINNANIEMI 1915, p. 26; E. KIVIRIKKO 1941, p. 154; SALO and SOTAVALTA 1952,

p. 99), the last-named being found also on crack and white willow (SEPPÄNEN 1954, p. 301), *Sphinx ligustri* L. on ash, e.g., at Lempäälä (EH) (SALO and SOTAVALTA 1952, p. 98) and Asikkala (EH), *Mimas tiliae* L. on linden, e.g., at Terijoki (Kk) (LAHTIVIRTA 1939, p. 128), Lahti (EH) (HEINÄNEN 1947, p. 17), Lempäälä (EH) (SALO and SOTAVALTA 1952, p. 99), and Tikkurila (U). In addition, the following species have been found on ornamental trees: *Polygonia c-album* L. on elm, *Melitaea maturna* L. on ash, *Ruralis quercus* L. on oak, *Smerinthus ocellatus* L. on crack willow, white willow, and balsam poplar, *Sphinx pinastri* L. on cembran and white pines and Siberian larch (SEPPÄNEN 1954).

Large numbers of larvae of the buff-tip moth (*Phalera bucephala* L.) have frequently been found injuring the leaves of birch, linden, oak, poplar, and sometimes elm and maple; young trees have suffered in particular. Damage has been reported mainly from Uusimaa, Satakunta, South Häme and South Savo. Larvae of the vapourer moth (*Orgyia antiqua* L.) have at times been abundant on linden, poplar and oak. In 1925, they defoliated large linden trees at Hyvinkää (U), with the result that the trees died in the following year (HUKKINEN and VAPPULA 1935, p. 47). Larvae of *Lophopteryx camelina* L. have been found on linden, oak, white willow, elm and poplar; those of *Poecilocampa populi* L. on poplar (E. KIVIRIKKO 1941, p. 154, 155; SALO and SOTAVALTA 1952, p. 101, 102; LAHTIVIRTA 1961, p. 11) and ash (NORDMAN 1943, p. 167), as well as on oak, white willow, linden and elm (SEPPÄNEN 1954). Larvae of *Eriogaster lanestris* L. have appeared on linden and oak (heavy infestation on linden at Jyväskylä (PH); HELLE 1916), *Aglia tau* L. likewise on linden and oak (SALO and SOTAVALTA 1952, p. 101; SEPPÄNEN 1954), *Dasychira pudibunda* L. on linden and maple (LAHTIVIRTA 1939, p. 129; SEPPÄNEN, op.cit.), *Eudia pavonia* L. on oak (NORDMAN 1943, p. 167; SEPPÄNEN, op.cit.), and *Trichiura crataegi* L. on oak (Kanervo). Larvae of *Dicranura vinula* L. have at times damaged poplars (*Populus laurifolia, P. balsamifera, P. ? pyramidalis*) by defoliating shoots of young trees. Damage has been inflicted in Uusimaa, South Carelia, Satakunta and South Häme. Larvae have also appeared on crack and white willows (SEPPÄNEN, op.cit., p. 301).

In addition, the following spinner moths have been found to injure ornamental trees: *Cerura furcula* L., crack and white willow and poplar; *Cerura bifida* HB., poplar; *Stauropus fagi* L., linden; *Gluphisia crenata* ESP., *Pheosia tremula* CL., *Notodonta phoebe* SIEB., *N. tritophus* ESP., and *Pterostoma palpinum* L., poplar; *Notodonta ziczac* L. and *Pygaera curtula* L., crack and white willow and poplar; *Pygaera pigra* HUFN., white willow and poplar; *Pygaera anachoreta* FABR., poplar; *Lasiocampa quercus* L., Siberian fir; *Dendrolimus pini* L., cembran pine, fir, and Siberian larch; *Dasychira selenitica* ESP., oak; *Dasychira abietis* SCHIFF., Siberian fir; *Stilpnotia salicis* L., crack willow and poplar, e.g. at Lohja (V), where many old poplar trees were defoliated; *Lymantria monacha* L. and *Drepana falcataria* L., oak; *Palimpsestis flavicornis* AURIV. (*Cymatophora or* FABR.) and *P. duplaris* L., balsam poplar (LAHTIVIRTA 1939, p. 128, 129; E. KIVIRIKKO 1941, p. 154, 155, 165; NORDMAN 1943, p. 167; SALO and SOTAVALTA 1952, p. 100, 101; SEPPÄNEN 1954).

Many species of noctuid moths have been observed on ornamental trees, but in general they are not serious as pests, and some of them are extremely rare: *Panthea coenobita* Esp., on cembran pine; *Diphthera alpium* Osbeck, on oak; *Colocasia coryli* L., on European hornbeam, oak, linden, and maple; *Acronycta leporina* L., on crack and white willow and poplar; *Acronycta aceris* L., on oak, linden, maple, and horse-chestnut; *Acronycta megacephala* Fabr., on crack and white willow and poplar; *Acronycta alni* L., on balsam poplar, elm, linden, and maple; *Acronycta psi* L., on oak, poplar (*Populus suaveolens*), elm, Finnish and Swedish whitebeam, and linden; *Acronycta auricoma* Fabr. and *A. euphorbiae* Schiff., on oak; *Acronycta rumicis* L., on Siberian larch, balsam poplar, maple, and ash; *Craniophora ligustri* Fabr., on ash; *Rhyacia augur* Fabr., *Eurois prasina* Fabr., and *Polia contigua* Schiff., on balsam poplar; *Episema caeruleocephala* L., on Finnish and Swedish whitebeam; *Brachionycha nubeculosa* Esp., on linden and maple; *Griposia aprilina* L. and *Dryobotodes protea* Bkh., on oak; *Monima gothica* L., on oak and linden; *Monima incerta* Hufn., *M. stabilis* View., and *M. pulverulenta* Esp., on oak; *Panolis flammea* Schiff., on cembran pine; *Calymnia trapezina* L., on oak, elm, linden, and maple; *Amathes circellaris* Hufn., on elm; *Amathes helvola* L. and *Cosmia citrago* L., on linden; *Conistra vaccinii* L. and *Amphipyra pyramidea* L., on oak; *Eupsilia satellitia* L., on oak, elm, chokecherry, linden, maple, and ash; *Lithophane socia* Rott., on linden; *Lithophane ornithopus* Rott., on oak; *Xylina vetusta* Hb., on linden and maple; *Scoliopteryx libatrix* L., on crack and white willow and poplar (*Populus suaveolens*); *Sarothripus degeneranus* Hb., *S. revayanus* Scop., *Hylophilina bicolorana* Fuessly, *Hylophila prasinana* L., *Herminia derivalis* Hb., *Pechipogo barbalis* Cl., *Mormonia sponsa* L., and *Catocala promissa* Esp., on oak; *Catocala fraxini* L., on ash (Clayhills 1929 a, p. 93; Linnaniemi 1920, p. 91; 1935, p. 66; Lahtivirta 1939, p. 129; E. Kivirikko 1941, p. 156; Nordman 1943, p. 167, 169; Salo and Sotavalta 1952, p. 103; Seppänen 1954).

One of the most destructive pests of ornamental trees is definitely the winter moth (*Operophthera brumata* L.), whose larvae often appear in profusion in the spring, feeding on the opening buds, and later on the young leaves. In the worst cases, even large trees have been completely defoliated. Damage has been inflicted on maple, linden, elm, oak, ash, poplar, Finnish and Swedish whitebeam, chokecherry, hornbeam, and to a minor extent horse-chestnut. Destruction was exceptionally severe in the years 1915—1916, 1922—1924 (especially at Ruissalo (V) near Turku) (Clayhills 1929 a, p. 95), 1926—1927 and 1934 (particularly in the region of Helsinki (U)).

Furthermore, ornamental trees have sometimes been infested with small numbers of larvae of the following geometrid species: *Jodis lactearia* L. and *Cosymbia punctaria* L., on oak and linden; *Operophthera fagata* Scharffenb., on linden; *Triphosa dubitata* L., on ash; *Cidaria variata* Schiff., on European silver fir and Siberian fir; *Cidaria siterata* Hufn., on oak, linden, maple, and ash; *Cidaria corylata* Thnbg and *Oporinia autumnata* Bkh., on linden; *Oporinia christyi* Prout., on Finnish and Swedish white-

beam; *Oporinia dilutata* SCHIFF., on oak; *Eupithecia tantillaria* BSD., on fir; *Eupithecia indigata* HB., on European larch; *Eupithecia lariciata* FRR., on larch; *Eupithecia orphnata* BHTSCH. and *E. dodoneata* GN., on oak; *Eupithecia inturbata* HB., on maple; *Chloroclystis chloërata* MAB., on chokecherry; *Lomaspilis marginata* L., on poplar (*Populus suaveolens*); *Ennomos autumnaria* WERNEB. and *E. erosaria* SCHIFF., on oak; *Ennomos fuscantaria* STEPH., on ash; *Selenia bilunaria* ESP., on linden and maple; *Selenia lunaria* SCHIFF., on oak; *Selenia tetralunaria* HUFN., on ash; *Gonodontis bidentata* CL., on oak, poplar, linden, and ash; *Colotois pennaria* L., on oak and maple; *Crocallis elinguaria* L., on linden; *Plagodis dolabraria* L., on oak and linden; *Erannis aurantiaria* ESP., on oak; *Erannis defoliaria* CL., on oak, elm, Finnish and Swedish whitebeam, linden, and maple; *Phigalia pedaria* FABR., on oak; *Lycia hirtaria* CL., on oak, poplar (*Populus suaveolens*), elm, and linden; *Biston stratarius* HUFN., on oak; *Biston betularius* L., on European and Siberian larch, oak, white willow, poplar (*Populus suaveolens*), elm, and linden; *Boarmia repandata* L. and *B. punctinalis* SCOP., on linden (E. REUTER 1897, p. 45; CLAYHILLS 1929 a, p. 96; E. KIVIRIKKO 1941, p. 165, 170, 172; NORDMAN 1943, p. 171, 172, 173; SALO and SOTAVALTA 1952, p. 122; SEPPÄNEN 1954).

Larvae of *Arctia caja* L., *Roeselia strigula* SCHIFF., and *Celama confusalis* H. S. have been found on oak trees and those of *Nola cucullatella* L. on Finnish and Swedish whitebeam (NORDMAN 1943, p. 173; SEPPÄNEN 1954, p. 300, 339).

The poplar hornet clearwing (*Aegeria apiformis* CL.) whose larvae make tunnels in the base of the trunk and even in the roots, occasioned great damage to poplars (*Populus rasymowskiana*) at Vanaja (EH) in 1934. Damage has also been observed at Sääksmäki (EH) (E. KIVIRIKKO 1941, p. 175), in southwestern Häme (EH) (ANTHONI 1956), and elsewhere in the southern parts of the country (cf. SEPPÄNEN 1954, p. 309). The branches and trunk of poplars are inhabited by larvae of *Paranthrene tabaniformis* ROTT.; these were abundant on white poplar at Pirkkala (EH) in 1913, where they were responsible for considerable damage (LINNANIEMI 1915, p. 42; cf. also SEPPÄNEN, op.cit.). In 1957, larvae appeared in profusion at Harjavalta (St), where they injured many young triploid poplars (Ekbom). Larvae of the goat moth (*Cossus cossus* L.) bore wide tunnels in the trunks of deciduous trees, with consequent frequent desiccation of the trees. At times, damage has been observed in the southern and central parts of the country in trees such as poplar, linden, ash, oak, crack willow and Swedish whitebeam.

In 1939, the two species *Acrobasis consociella* HB. and *Nephopteryx similella* ZCK. appeared as oak pests at Föglö (A). In places, the former species was abundant on the shoots of the trees, while the latter, with larvae living between two leaves spun together, was present only in minor numbers (NORDMAN 1943, p. 162—163). — Larvae of the pine cone moth (*Dioryctria abietella* SCHIFF.) were remarked at Loppi (EH) in 1926; there they injured large numbers of larch cones. In 1939, this species was reported to have damaged all the cones of two spruce trees (*Picea excelsa* var. *claubrasiliana*) at Tyrväntö (EH). In 1937—1938, the shoots of cembran pines were injured by larvae of the genus *Dioryctria*, although the species was not determined.

An important ornamental tree pest is the oak leaf-roller moth (*Tortrix viridana* L.), whose larvae may in fact defoliate even large trees when the infestation is severe. This species, common in the region of oak trees, has often inflicted severe damage on oaks, particularly in the area near Turku (V). As early as 1886, destruction was mentioned in respect to Ruissalo and other islands near Turku (SAELAN and E. REUTER 1888—1889). Since then, the years of most injury have included 1901, 1909, 1916—1917, 1925—1926, 1932 and 1939. In exceptional cases, larvae have also been found on linden trees (E. REUTER 1899 b, p. 40). Other tortricid species found to damage oak leaves are *Peronia fissurana* PIERCE in the region of Turku (V) (KANERVA 1935), *Cacoecia xylosteana* L., and *Ancylis mitterbacheriana* SCHIFF., similarly near Turku (SALMIKIVI 1932), *Tortrix loeflingiana* L., plentiful in some spots at Föglö (A) in 1939 (NORDMAN 1943, p. 175), and at Helsinki (U) in 1934, *Exapate congelatella* CL. in very large numbers at Helsinki (U) (AF TENGSTRÖM 1848, p. 106) and *Eucosma stroemiana* THNBG (*corticana* HB.) at Föglö (A) in 1939 (NORDMAN 1943, p. 164) and at Helsinki (U) in 1934. Larvae of *Pammene gallicolana* ZELL. were found in galls caused by *Diplolepis longiventris* on oaks at Parainen (V) and Föglö (A); later, they fed on the leaf tissues near the galls (NORDMAN, op.cit., p. 177—178). Other oak pests are *Cacoecia lecheana* L. in the region of Turku (V) and at Föglö (A) (SALMIKIVI 1932; NORDMAN 1943, p. 164) and *Pandemis heparana* SCHIFF. in southwest Finland (E. REUTER 1899 b, p. 38); larvae of both these species have been found on linden (E. REUTER, op.cit.). *Pandemis ribeana* HB. has been particularly prevalent on oak and linden, and also on maple; *Cacoecia rosana* L. on ash (E. REUTER, op.cit., p. 36) and linden. Maple is the only host plant of *Tortrix forskaleana* L., which was responsible for many rolled leaves on young maples at Tikkurila (U) in 1939. Tunnels made by larvae of *Laspeyresia woeberiana* SCHIFF. were found in the bark of the Finnish whitebeam at Föglö (A) in 1939. In the same area, acorns were observed to be injured by *Pammene iuliana* CURT. (NORDMAN 1943, p. 164, 177). In 1948, considerable damage caused by the apple leaf skeletonizer (*Simaethis pariana* CL.) was apparent on Finnish whitebeam in Ahvenanmaa.

Oak shoots are injured by *Stenolechia gemmella* L., whose larvae make tunnels in the shoots; they turn black, and the terminal leaves wither. The species, first found in Finland in 1923 at Ispoinen near Turku (V) (KANERVA 1924), appeared in large numbers at Parainen (V) in 1925 (SAALAS 1949, p. 516). Damage has since been noted in Ahvenanmaa, Finland Proper, Uusimaa, and South Häme. Oak leaves are injured by *Cerostoma radiatellum* DON. and *C. lucellum* FABR., of which the former species was particularly abundant at Föglö (A) in 1939 (NORDMAN 1943, p. 164, 181).

Many species of *Microlepidoptera* are leaf-miners on oak trees; the most important of these is *Tischeria ekebladella* BJERK. (*complanella* HB.). Often, the leaves are full of light-coloured blister mines, and at times even 80—90 per cent of the leaves on a tree may be injured. The species is common in south Finland, and has been

found as far as Kokemäki (St), Kuhmalahti (EH), Hartola (EH) and Tohmajärvi (PK). The related species *Tischeria dodonea* STT. was reared from oak leaf mines found at Ruissalo (V) and Ahvenanmaa (NORDMAN 1950 a; BRUUN 1952 b). In addition, the following species have been observed as leaf-miners on oak: *Lithocolletis nicellii* STT. at Turku (V) (BRUUN 1952), *L. cramerella* FABR., *L. quercifoliella* ZELL., *Nepticula atricapitella* HAW., and *N. subbimaculella* HAW. in 1939 at Föglö (A) (NORDMAN 1943, p. 180, 181, 182), *Heliozela sericiella* HAW. at Eckerö (A) (BRUUN 1952) and *Eriocrania subpurpurella* HAW. var. *fastuosella* ZELL. in the region of Turku (V) and at Föglö (A) (SALMIKIVI 1932; NORDMAN 1943, p. 183).

Maple leaves are injured by *Caloptilia (Gracilaria) semifascia* HAW., whose larvae roll the edges of the leaves downwards into loose curls. Such damage was very apparent and abundant at Aulanko near Hämeenlinna (EH) in 1936 and 1939. The species was first reported as new to Finland at Sortavala (LK) in 1938 (KANERVA 1939). — Ash is sometimes infested with *Prays fraxinellus* BJERK., a rather rare species in this country, although it occasioned severe damage at Föglö (A) in 1939 (NORDMAN 1943, p. 140, 181). At times small numbers of mines made by the lilac leaf-miner (*Caloptilia syringella* FABR.) have been observed in ash leaves.

The following species have also been found as leaf-miners on ornamental trees in Finland: *Coleophora hemerobiella* SCOP., on Finnish and Swedish whitebeam in Ahvenanmaa (A) (NORDMAN 1947); *Nepticula marginicolella* STT., on elm at Helsinki (U) (JÄPPINEN 1941; NORDMAN 1950 a), *N. ulmivora* FOL., on smooth-leaved elm at Hattula (EH) in 1952 (TIENSUU 1956); *N. ulmicola* HER., on linden (?) at Eckerö (A) (BRUUN 1952 a); *Phyllocnistis suffusella* ZELL., on balsam poplar at Parainen (V) and Turku (V) (E. REUTER 1904 b, p. 44; KANERVA 1924); *Leucoptera scitella* ZELL., on Finnish and Swedish whitebeam (NORDMAN 1943, p. 181; 1957 a). — *Cerostoma scabrellum* L. has been observed to injure the leaves of Finnish whitebeam (NORDMAN 1943, p. 181).

The larch casebearer moth (*Coleophora laricella* HB.) is a larch pest; its larvae penetrate the needles, and feed on their internal tissues. The injury may continue in the same tree for several years; on occasion, the damage is very severe, and the trees appear to be like injured by frost. The first reports of extensive appearances of this pest date from 1894, when it damaged larches at Helsinki (U) (E. REUTER 1895 b). It reappeared in the same locality in 1914—1915, and injured various species of larch (*Larix sibirica, europaea, dahurica, kurilensis, ochotica*, etc.) (LINNANIEMI 1916, p. 46; 1920, p. 122). Subsequent occasions of severe damage have been reported from Tampere (EH) in 1919, Turku (V) in 1925, Tampere and Kangasala (EH) in 1943, many places in west Finland in 1947 (SAALAS 1949, p. 514) and Tikkurila (U) in 1953—1954. The species is found as far north as North Savo and North Carelia (SAALAS, op.cit.).

M i t e s (*A c a r i n a*). One of the most injurious linden pests is *Eotetranychus tiliarium* HERMANN, which infests the lower surface of the leaves, often together with the brasswood aphid. Following the injury, the leaves become brownish at the end

of the summer, and may partially wither. Park lindens suffer particularly from mite infestations in dry and warm summers. The species has been found in south and central Finland as far north as North Häme and North Savo. The fruit tree red spider mite (*Metatetranychus ulmi* KOCH) has been noted on the following species of park trees: Finnish whitebeam (quite abundantly), Swedish whitebeam (moderately), *Sorbus hastii*, *S. chrysophylla*, *S. aria* and *S. conradina* (small numbers), *Pyrus malus prunifolia hyvingiensis* (abundantly) and elm, mainly wych elm, (moderately) (LISTO et al. 1939, p. 15—16). In 1928 eggs of *Paratetranychus ununguis* JAC. were found on larch at Tikkurila (U); in 1959, the species infested 3—4-year old spruce trees in a nursery at Parainen (V).

Ornamental trees are often injured by certain gall mites, which live mainly on the leaves of the trees. The commonest species on linden is *Eriophyes leiosoma* NAL.; which causes erineum — initially white, yellowish or reddish but finally changing to dark brown — in the leaf surfaces and sometimes in the petioles and inflorescences. The mites live for many years on the same trees, sometimes inflicting visible damage on them. The species is found throughout the whole country as far north as Tornio (PP). *Eriophyes tiliae-nervalis* NAL. makes white, yellowish or reddish erineum along the veins in the upper surface of linden leaves. It has been noted in south Finland on the lower branches and stump sprouts of wild linden trees (LIRO and ROIVAINEN 1951, p. 139). The erineum spots attributable to *Eriophyes exilis* NAL. are located at the vein junctions in the lower surface of the leaves. They have been seen on wild linden at Säkylä (St) (LIRO and ROIVAINEN 1951, p. 143), on park linden at Helsinki (U) in 1943 and Järvenpää (U) in 1959. *Eriophyes lateannulatus* SCHULZE, which makes reddish hornlike galls in the upper surface of the leaves, is quite common in south and central Finland as far north as North Häme and North Savo. *Phytoptus tetratrichus* NAL. lives in the edges of the leaves, which as a result become curled and bleached. The species has been noted at Lammi (EH) and at Kajaani (Kn) in 1958.

Eriophyes platanoideus NAL. produces erineum in the lower leaf surfaces of maple; at times it is very plentiful, and young trees in particular are retarded by the infestation. It is obviously quite common, at least in south Finland. *Eriophyes multistriatus* NAL. lives in pouch-like galls — initially green, later brown — in the upper surface of elm leaves.[1]) They have been found in south Finland as far as the regions of Mouhijärvi (St) and Pirkkala (EH) (LINDROTH (LIRO) 1899, p. 14). — *Eriophyes fraxinivorus* NAL. infests the inflorescences of ash, changing them into large, sometimes fist-sized galls, which are initially green but become dark brown and woody at the end of the summer. These galls were first observed in 1907 at Loviisa (U) (E. REUTER 1908 d). During the period 1914—1927, damage was inflicted in many localities in southeastern Finland; in 1927, nearly all of the ash trees growing in the parks of Loviisa (U) were infested (RAINIO 1928). The species

[1]) Another species, *Eriophyes brevipunctatus* NAL., has also been found in the galls of the smooth-leaved elm; it is possibly a free-living species (LIRO and ROIVAINEN 1951, p. 87).

is also prevalent in Ahvenanmaa, particularly at Kökar, where natural stands of ash are in danger of extermination because of the depredations of this pest (ROIVAINEN 1951, p. 8). Mites were also observed in erineum galls on the lower surfaces of ash leaves at Sund (A) in 1897 and at Kökar (A) (LIRO 1912; KARI 1936, p. 22). In 1939, *Oxypleurites carinatus* NAL. was found on horse-chestnut leaves at Munkkiniemi in Helsinki (U) (Vappula).

M a m m a l s (*M a m m a l i a*). The European hare (*Lepus europaeus* PALL.) has at times inflicted damage by injuring young deciduous trees, especially in nurseries and replanted forest areas. Observations made by E. Kangas in 1935 showed that hares damaged seedlings of oak (*Quercus rubra*) and elm (*Ulmus effusa*) very severely — up to 100 per cent — and inflicted substantial injuries on maples and lindens in a nursery near Punkaharju (ES). The hares cut the tops of branches, eating both the buds and some of the previous year's shoots. They also damaged 95 per cent of the oak seedlings in a reforested area, along with lesser quantities of maple and elm (SAALAS 1949, p. 652). Hares have also been known to sever the stems of larch seedlings. Reports were made of mountain hares (*Lepus timidus* L.) injuring 30-year old oak trees at Urjala (EH); they ate the shoots, buds, young branches and bark of the trees, with the result that some of them died. Maples and lindens were also damaged, but to a lesser extent (BRANDER 1955, p. 61).

At times, voles have been harmful, especially in nurseries. The field vole (*Microtus agrestis* L.) has been a particularly destructive pest; according to E. Kangas, in 1935 these voles destroyed at least 5 000 maple seedlings (*Acer platanoides*, *A. triflorum* and *A. saccharinum*) in a nursery at Punkaharju (ES). They also destroyed 75 per cent of the maple seedlings in a 1.5-hectare reforested area, along with about 20 per cent of the oak seedlings and all of the pine (*Pinus peuce*) seedlings (SAALAS 1949, p. 643—644). Similar injury was inflicted in 1941 near Hämeenlinna (EH) to maple (*Acer platanoides*, *A. negundo* and *A. tataricum*) and to *Taxus cuspidata*. In 1943, voles stripped the bark from large maples and elms at Korkeasaari in Helsinki (U). On occasion, young spruce hedges are reported to have been the victims of voles. At Bromarv (V), water voles (*Arvicola terrestris* L.) have been observed to kill newly-planted ash seedlings by severing their roots (SAALAS 1949, p. 645). Damage attributable to voles has also been noted in horse-chestnut, poplar, oak, white willow, mountain ash, linden, fir, larch and arbor-vitae (MYLLYMÄKI 1959, p. 78).

Red squirrels (*Sciurus vulgaris* L.), whose main food supply consists of spruce seeds, have been seen to eat the seeds of larch and cembran pine. In years when there are no conifer seeds, they may feed in winter on the male inflorescence buds of firs, and on the bark and young branches of larch, linden and oak. Observations made in and near Helsinki (U) have indicated that squirrels eat the bark of oak only from the lower surface of the branches, in the worst cases uninterruptedly from the trunk to the tip of the branch, consuming the fungus *Vuilleminia*, which constitutes a parasite on oak branches and gradually causes the bark to loosen. Squirrels have also been observed to feed on acorns and maple seeds (VARTIO 1946).

21. Greenhouse plants

A. Tomatoes

Springtails (*Collembola*). Springtails have at times been reported to destroy tomato seedlings by completely devouring their cotyledons during the germination stage.

Plant bugs, aphids, etc. (*Hemiptera*). The greenhouse white fly (*Trialeurodes vaporariorum* WESTW.) often appears as a very damaging greenhouse pest, injuring tomatoes, cucumbers and different pot plants. It was first found in 1919 on myrtle, grown indoors at Helsinki (U) (LINNANIEMI 1921). In the same year, it was apparent on greenhouse tomatoes and pelargonium at Vanaja and Janakkala (EH) (LINNANIEMI 1935, p. 116—117). Since then, the greenhouse white fly has rapidly become prevalent in greenhouses throughout the country, as far as Rovaniemi (PP), often inflicting quite substantial damage on plants. It is readily spread from place to place through the agency of infested plant stock. In summer small numbers of this pest have at times been found on tomatoes growing outdoors in the vicinity of greenhouses. — Lily aphids (*Aulacorthum circumflexum* BUCKT.) and solanum aphids (*Aulacorthum solani* KALT.), which live on the underside of tomato leaves, have been found in this country. Both species were noted at Malmi in Helsinki (U) in 1953. Mealybugs (*Pseudococcus* sp.) have also inflicted slight injury on greenhouse tomatoes, for example at Tyrväntö (EH) in 1932, and at Sammatti (V) in 1960.

Beetles (*Coleoptera*). Wireworms (*Elateridae*), principally *Agriotes obscurus* L. and *Agriotes lineatus* L., are often injurious pests of tomatoes in greenhouses, into which they are carried with infested soil from outside. After planting, the larvae sever the young seedlings just below the soil surface, thus bringing about the death of the plants. They also penetrate the main root or stem of older plants — sometimes even those which have begun to bear fruit — and both retard the growth of the plant and prevent the formation of fruit. On occasion all the plants have died.

Ants (*Hymenoptera, Formicidae*). At times, ants have been observed building nests at the roots of tomato plants in the greenhouse, with withering and even death of the plants as a consequence.

True flies (*Diptera*). The leaves of greenhouse tomatoes are sometimes infested with numerous tunnel mines, which were in at least one case (at Kirkkonummi (U) in 1946) caused by the chrysanthemum leaf-miner (*Phytomyza atricornis* MEIG.). At the same place, small numbers of mines, possibly the work of the same species, were remarked in cucumber leaves.

Moths (*Lepidoptera*). Larvae of the tomato moth (*Polia oleracea* L.) have on a number of occasions inflicted considerable damage on tomatoes by feeding on the leaves, boring holes in the stems, and later attacking the fruit. Since 1940, injury has been noted in Finland Proper, Uusimaa, Satakunta and South Häme. Larvae of *Euxoa tritici* L. damaged tomatoes at Yläne (St) in 1943 by feeding on the stems at night, with the result that they broke (VAPPULA 1945). In 1961, larvae

of the rosy rustic moth (*Hydroecia micacea* ESP.) appeared in tomato plants at Varkaus (PS).

Mites (*Acarina*). On at least one occasion, a heavy infestation of the hop red spider mite (*Tetranychus urticae* KOCH) has been found on the surface of the unripe fruit of greenhouse tomatoes.

Crustaceans (*Crustacea*). In 1948, large numbers of *Armadillidium vulgare* LATR. appeared in a greenhouse at Hanko (U), and inflicted substantial damage on tomato plants. The species had evidently been introduced to the country along with flower bulbs imported from Belgium or Holland (PALMÉN 1950, p. 102).

Worms (*Vermes*). The root knot eelworm (*Meloidogyne* sp.) was first observed in Finland at Tyrväntö (EH) in 1932 in the roots of greenhouse tomatoes at the Lepaa horticultural school (VAPPULA 1933 c). Since then, it has spread increasingly and become an injurious greenhouse pest throughout south Finland, extending to the regions of Tampere (EH), Mikkeli (ES) and Savonlinna (ES). Enchytraeids (*Enchytraeidae*) have at times been plentiful in the soil of greenhouses. The growers have claimed that they induce wilting of tomato plants, although it is probable that other factors have contributed to this condition.

Mammals (*Mammalia*). Norway rats (*Rattus norvegicus* ERXL.) were once observed feeding on the leaves of tomato seedlings in a greenhouse, where they had eaten all the leaves and even the terminal shoot from one of the plants.

B. Cucumbers

Springtails (*Collembola*). Reports from growers state that springtails have often injured cucumber seedlings during the process of germination by eating the cotyledons before they have completely emerged from the seed. Furthermore, these insects have damaged the fruit and stems of cucumber plants in the greenhouse.

Thrips (*Thysanoptera*). Greenhouse cucumbers are often infested by thrips, which live on the lower surface of the leaves, producing pale, translucent spots in them and in the fruit. At times, the damage has been very serious. The commonest species is probably the onion thrips (*Thrips tabaci* LIND.), found in Uusimaa, South Häme and South Savo. The chrysanthemum thrips (*Thrips nigropilosus* Uz.), first remarked in this country at Hyvinkää (U) in 1926 (cf. p. 141), inflicted considerable damage on greenhouse cucumbers at Jääski (EK) and Tyrväntö (EH) in 1930 (HUKKINEN 1932).

Plant bugs, aphids, etc. (*Hemiptera*). In 1931, *Halticus apterus* L. injured cucumber leaves in a greenhouse at Tyrväntö (EH).

At times, the greenhouse white fly (*Trialeurodes vaporariorum* WESTW.) (see p. 163) is a very damaging cucumber pest in greenhouses or frames; it injures the leaves, soiling them and the fruit with its sticky secretion. In severe cases, it completely destroys the plants.

In some instances, aphids attack greenhouse cucumbers, making the leaves curl and wither, and the shoots are deformed. The causal species is evidently the melon aphid (*Aphis gossypii* GLOV.)[1]. Damage by aphids has occurred in Uusimaa, South Carelia, South Häme and Central Ostrobothnia. Melons are also occasionally infested by this species. The aphids which attack cucumbers have been established as vectors of the mosaic virus disease of cucumber (RAINIO 1941, p. 18).

Beetles (*Coleoptera*). Wireworms (*Elateridae*) are on occasion destructive pests, particularly as regards young cucumber seedlings; they injure the roots, and at times penetrate the interior of the stem, making the plant wither. In some instances, they have been observed to hollow out the seeds of cucumber. — A species of *Cercyon* was found in the soil of indoor cucumbers at Siuntio (U) in 1939 and near Iisalmi (PS) in 1948. In the first case, the beetle, together with *Uropoda obnoxia*, appeared at the junction between the stem and root, where gummosis was observed, although it is uncertain whether the injury could be ascribed to the insects.

Ants (*Hymenoptera, Formicidae*). Ants have at times been reported as harming cucumbers, with consequent drying of the plants.

Myriapods (*Myriopoda*). Several species of myriapods appear in greenhouses; some of them may be so numerous that they injure the plants. The most important pest is perhaps *Orthomorpha* (*Oxidus*) *gracilis* C. L. KOCH, first found in Finland in 1900, and subsequently so widespread that today it may well be the commonest myriapod in Finnish greenhouses (PALMÉN 1949, p. 15—16). To date, it has been reported as far north as Haapavesi (KP) and Kuhmo (Kn). Myriapods have been observed to feed on the root collar and even on the fruits, with the result that the plant grows poorly, and the crop is low. In 1949, large numbers of *Cylindroiulus frisius* VERH. and *Pachymerium ferrugineum* C. L. KOCH were found on the roots of melons grown in a greenhouse at Kirkkonummi (U); it was assumed that they were responsible for the wilting of the plants.

Mites (*Acarina*). Undoubtedly the most destructive pest of greenhouse cucumbers is the hop red spider mite (*Tetranychus urticae* KOCH), found throughout the whole country in varying degrees of intensity. In some cases, the leaves become brownish or wither completely; on severe infestation, the crop may be almost entirely lost. *Uropoda* (*Urosternella*) *obnoxia* E. REUT. (cf. p. 79) often damages the stem base of cucumber plants; young seedlings in particular suffer from their attack. In 1958 at Kaarina (V), *Scheloribates laevigatus* C. L. KOCH (*Oribata lucasi* NIC.) (cf. p. 79) was found injuring the leaves of greenhouse cucumber.

Crustaceans (*Crustacea*). Very large numbers of woodlice appear on occasion in greenhouses, where they feed on the leaves and unripe fruit of cucumbers in particular. They are most destructive to young plants, which they sever at ground level, but old fruit-bearing plants may also be damaged. Reports of injury inflicted by woodlice have been received from Uusimaa, South Carelia,

[1]) HEIKINHEIMO (1959, p. 35) believes it possible that *Aphis* (*Aphidula*) *nasturtii* KALT., or some other related species, may have contributed to the damage inflicted on cucumber.

the Carelian isthmus, Satakunta and South Häme since 1929. The species responsible have been *Porcellio scaber* LATR. and *Oniscus asellus* L. The former species may live outdoors, but evidently the latter is dependent upon man-made conditions of environment (PALMÉN 1946, p. 19, 24). It has been established that the latter species transmits the mosaic virus disease of cucumber (RAINIO 1941, p. 17—19).

Molluscs (*Mollusca*). Slugs (*Deroceras agreste* L.) have at times inflicted harm upon greenhouse cucumbers.

Worms (*Vermes*). Since 1932, root knot eelworms (*Meloidogyne* sp.) (cf. p. 164) have on a number of occasions been responsible for substantial damage to cucumbers, which wilt and in severe cases wither completely.

Mammals (*Mammalia*). The Norway rat (*Rattus norvegicus* ERXL.) has sometimes been observed to eat cucumbers in greenhouses.

C. Other vegetables

Springtails (*Collembola*). In one instance, springtails were reported as having completely devoured the cotyledons of lettuce seedlings.

Aphids (*Hemiptera, Aphidoidea*). The peach-potato aphid (*Myzus persicae* SULZ.) has at times been found on parsley and potatoes grown indoors (HEIKINHEIMO 1944, p. 4). In 1937, *Aulacorthum solani* KALT. appeared on potato, horse-radish and beans grown in a greenhouse at Mikkeli (ES) (HEIKINHEIMO 1945).

Beetles (*Coleoptera*). Wireworms (*Elateridae*) have at times injured greenhouse lettuce.

Myriapods (*Myriopoda*). *Cylindroiulus frisius* VERH. was observed in profusion in a greenhouse at Kuopio (PS) in 1951, where it damaged the roots of some plants, such as parsley.

Crustaceans (*Crustacea*). In 1948, *Armadillidium vulgare* LATR. (cf. p. 164) appeared on cauliflower grown in a greenhouse at Hanko (U) and almost completely destroyed the crop. In the following year, control measures kept them to a minimum, but in 1950 they were again numerous without, however, damaging the plants (PALMÉN 1950, p. 102).

Molluscs (*Mollusca*). In 1954, slugs (*Deroceras agreste* L.) injured cauliflower growing in a greenhouse at Kauhava (KP) and threatened the ruin of the entire crop.

D. Ornamental plants

(in greenhouses and dwellings)

Springtails (*Collembola*). Springtails are often very plentiful in greenhouse soil and in flower pots; their source of food is mainly decaying organic matter. As a rule, they do not appreciably damage mature plants, but they have

at times been reported to have caused injury to young ornamentals, such as cyclamen, cineraria and *Zantedeschia* by feeding on their roots and other underground parts or by gnawing small holes in young leaves of chrysanthemums. Many species of springtails have been found in greenhouses (cf. O. M. REUTER 1890), although to date their significance as pests in Finland has not been established.

Crickets (*Orthoptera*). The greenhouse stone cricket (*Tachycines asynamorus* ADEL.) was first found in Finland in 1916 at Lauttasaari in Helsinki (U); it had completely destroyed several flats of seedlings growing in a greenhouse. It was assumed that the species had been introduced into this country along with lily bulbs imported from Holland (LINNANIEMI 1917 a, p. 2; cf. also FREY 1918). The pest has since been noted in 1932 in several greenhouses in south Finland (SAALAS 1933, p. 215), 1933 at Helsinki (U) (AHLQVIST 1933), 1934 at Tampere (EH), 1948 at Lielahti (EH) near Tampere, 1952 at Espoo (U) and Tampere (EH), 1955 at Nokia (EH) and 1959 at Helsinki (U). In some instances it was stated to have damaged seedlings, such as those of cyclamen, as well as cactus plants.

Thrips (*Thysanoptera*). Many species of thrips in Finland injure the leaves or flowers of ornamental plants grown in greenhouses and homes. The greenhouse thrips (*Heliothrips haemorrhoidalis* BCHÉ) has been observed to damage roses, palm (*Phoenix*), myrtle, *Cissus* and *Ficus elastica*. The species was first noted on house plants at Helsinki (U) during the 1880's; in 1890, it was a greenhouse pest at Inkoo (U) and at Helsinki (U) (O. M. REUTER 1891). It has since appeared in 1904 (E. REUTER 1905, p. 25), in 1921 at Virolahti (EK), 1936 at Jämsä (EH), 1950 at Lahti (EH) and 1951 at Helsinki (U). Appreciable damage attributable to this species was discovered on azaleas imported from Belgium in 1937 (Ann. report Dept. of Pest Invest. 1937). In 1883, the banded greenhouse thrips (*Heliothrips femoralis* REUT.) was first established as a new species; it was found on *Crinum* and *Arum* in a Helsinki (U) house. In 1890, this species was plentiful on some greenhouse plants, such as *Dracaena*, *Ficus elastica* and *Pandanus* (O. M. REUTER 1891). In 1949, there were heavy infestations of this pest on plants in the greenhouses of the University of Helsinki botanical gardens (e.g., *Crinum*, *Cestrum Nevellii*, *Aspidistra*, *Ampelopsis* sp.). — Dracaena thrips (*Parthenothrips dracaenae* HEEG.) has been known in Finland since 1880, when it was noted on rose and *Dracaena* at Helsinki (U); in 1890, it reappeared on *Dracaena*, *Ficus* and *Pandanus* at Helsinki (O. M. REUTER 1881 b; 1891). Subsequently this species has appeared on a number of occasions in Finland Proper, Uusimaa, South Häme, South Savo, North Savo and South Ostrobothnia, being found on the plants mentioned above and on *Kentia*, *Phoenix*, *Ruscus*, *Azalea*, *Araucaria*, *Fatshedera*, *Hedera*, *Cissus*, *Hibiscus*, *Fatsia*, *Zantedeschia*, *Gloxinia*, *Hippeastrum* and *Begonia*. As a result of thrips infestation, pale spots appear on the leaves; in the most severe cases the foliage may become grey in colour, and the plant may lose its vigour. The begonia thrips (*Scirtothrips longipennis* BAGN.) was first found in Finland in 1931 at Vanaja (EH), where it inflicted severe damage

on *Cyclamen persicum*, *Begonia hybrida* and *B. semperflorens* (HUKKINEN 1932 a). Injury to these plant species was also noted in the region of Helsinki (U), at Tyrväntö (EH) (HUKKINEN 1935, p. 93) and in 1945 at Lahti (EH). Thrips injury appears on the leaves of the plants, which become filled with brown streaks or spots. In the case of cyclamen, the petals of the flowers are also affected, becoming white- or dark-spotted. In 1937, *Anaphothrips orchidii* MOULT. was found together with the first-mentioned species on begonia at Vanaja (EH) (HUKKINEN and SYRJÄNEN 1937). *Leucothrips nigripennis* REUT. has similarly been found only once in this country, in 1904 at Helsinki (U), where it appeared as a pest on ferns (*Pteris serrulata*, *Pt. cretica major*, *Pt. Vincetti*) growing in a house (O. M. REUTER 1904). Mention has often been made of *Taeniothrips atratus* HAL., which appears in greenhouses and injures carnations in particular (SAALAS 1933, p. 226). This species is common in Finland, and has been found even in North Ostrobothnia (HUKKINEN 1936, p. 31). Rose thrips (*Thrips fuscipennis* HAL.), prevalent throughout the entire country as far as Lapland, has sometimes inflicted considerable damage on greenhouse roses and carnations in the region of Helsinki (U) and at Vanaja (EH). At Vanaja, it destroyed nearly half of the greenhouse roses in 1931 (HUKKINEN 1932 b; 1936 a, p. 128). In 1946, this pest appeared at Valkeakoski (EH), where it produced brown feeding spots on cyclamen flowers. In 1930, the chrysanthemum thrips (*Thrips nigropilosus* Uz.) was a noxious pest of chrysanthemums at Jääski (EK) and Tyrväntö (EH) (HUKKINEN 1932; 1936 a, p. 130). The leaves of the plants had become mottled as a result of the infestation; carnations and China asters were also injured. The onion thrips (*Thrips tabaci* LIND.), which inhabits various wild plants, has at times appreciably damaged ornamental greenhouse plants. In 1930 and following years, it injured *Asparagus sprengeri* and *A. plumosus* at Kirkkonummi (U), and in 1932 it inflicted severe damage on rose plantings at Huopalahti (U) in Helsinki (HUKKINEN 1932 b; 1936 a, p. 131). The species has since appeared as a pest of asparagus and carnation at Salo (V), Hyvinkää (U), Vanaja (EH), Tyrväntö (EH) and Kuusankoski (EH). In 1943, the onion thrips appeared in profusion on cyclamen in some greenhouses at Helsinki (U); most of the flowers had been injured even at the bud stage, and their petals were mottled with light spots. The damage was appreciable, and only by careful selection was it possible to obtain marketable flowers.

Plant bugs, aphids, etc. (*Hemiptera*). In 1916—1917, *Trioza alacris* FLOR infested laurel in a Helsinki (U) greenhouse, but the injury was slight (LINNANIEMI 1935, p. 116).

The greenhouse white fly (*Trialeurodes vaporariorum* WESTW.) (cf. p. 163) is a common pest in greenhouses and dwellings. It particularly directs its attacks at geranium and fuchsia, from which it readily moves to other house plants. This pest has been found on the following plant genera: *Pelargonium*, *Fuchsia*, *Myrtus*, *Calceolaria*, *Salvia*, *Primula*, *Pentstemon*, *Laurus*, *Cissus*, *Buxus*, *Azalea*, *Nerium*, *Carica*, *Impatiens*, *Begonia*, *Hydrangea*, *Medeola*, *Chrysanthemum* and *Asparagus*.

Many aphid species have been established as indoor ornamental plant pests. The peach-potato aphid (*Myzus persicae* SULZ.) has in some localities been very abundant on chrysanthemum, hibiscus, tulip and rose (HEIKINHEIMO 1944), as well as on *Cordyline terminalis* and *Sanchezia nobilis* (THUNEBERG 1962). It has also been found on cactus, asparagus, *Chlorophytum* sp., cineraria and violet (*Viola tricolor hortensis*). The aphids injure the terminal shoots, leaves, flower buds and flowers of these plants. This species, noted as early as 1912 at Helsinki (U), has been found as far north as Ylitornio (PP) (HEIKINHEIMO 1959, p. 28).

The leaf-curling plum aphid (*Brachycaudus helichrysi* KALT.) is a common greenhouse pest; the injury it inflicts is principally to chrysanthemum shoots and flowers (HEIKINHEIMO 1944). It begins its damaging attack on seedlings in frames and in open ground; later it is transferred with the plants to greenhouses. It has been found since 1932 in various parts of the country as far north as Rovaniemi (PP) (HEIKINHEIMO 1959, p. 28).

In 1942, the lily aphid (*Aulacorthum circumflexum* BUCKT.) was abundant on cyclamen at Perniö (V), and subsequently spread to ivy (*Hedera helix*), rose and amaryllis (HEIKINHEIMO 1944). This species is also a pest of *Streptocarpus*, tulip, *Cyclamen hederifolium* (THUNEBERG 1962), chrysanthemum, *Chlorophytum*, begonia, cineraria and *Lilium candidum*. It has been found in Finland Proper, Uusimaa, South Häme, South Savo and Central Ostrobothnia (at Kaarlela).

The violet aphid (*Myzus ornatus* LAING) was found on daisies at Perniö (V) in 1944. It has since been noted, at times abundantly, on various greenhouse plants in southern Finland (V, U, EH) and at Kaarlela (KP), such as chrysanthemum, cineraria, dahlia, violet (*Viola tricolor maxima*), hydrangea, rose, hibiscus and grape (*Vitis* sp.) (Heikinheimo). In 1960, this aphid appeared on fuchsia at Joutseno (ES) (THUNEBERG 1962).

Further to the above, according to Heikinheimo, the following species have been found on chrysanthemum: green chrysanthemum aphid (*Coloradoa rufomaculata* WILS.) 1946 at Helsinki (U) and 1947 at Kylmäkoski (EH); *Macrosiphoniella oblonga* MORDW. 1947 at Tyrväntö (EH); *Macrosiphoniella tanacetaria* KALT. 1947 at Hämeenlinna (EH) and Tyrväntö (EH); chrysanthemum aphid (*Macrosiphoniella sanborni* GILL.) 1932 at Helsinki (U) (HEIKINHEIMO 1944) and 1947 at Kylmäkoski (EH); *Macrosiphum euphorbiae* THOS 1947 at Kylmäkoski (EH). In 1952, the latter species was common on cineraria in a Helsinki (U) greenhouse.

The solanum aphid (*Aulacorthum solani* KALT. = *Macrosiphum pelargonii* KALT.) has been found on the following ornamental plants: dahlia, amaranth and nasturtium at Mikkeli (ES) in 1937 (HEIKINHEIMO 1945), gloxinia (*Sinningia*) at Helsinki (U) in 1948, calceolaria at Tikkurila (U) in 1957, as well as *Anemone coronaria*, *Zantedeschia* and *Pelargonium peltatum*. *Masonaphis azaleae* MASON was found in 1953 at Tikkurila (U) on azalea (*Rhododendron simsii*) which had been imported from Germany and Belgium (Heikinheimo). The shallot aphid (*Myzus ascalonicus* DONC.) was observed for the first time in Finland in 1956 at Tikkurila (U); it appeared on

tulip leaves, from which it spread to other plants, such as *Zantedeschia*, chrysanthemum, potato and stored onion bulbs. A greenhouse orchid (*Dendrobium* sp.) was attacked by *Cerataphis ?orchidearum* WESTW. in 1954 at Tikkurila (U) (Heikinheimo).

Mealybugs (*Pseudococcus*) are very prevalent pests in dwellings and greenhouses; they often inflict heavy injury on plants and may even kill them. In particular, they attack cactus (e.g., *Epiphyllum truncatum*, *Opuntia microdasys*, *Phyllocactus grandiflora*, *Cereus peruvianus*), and frequently *Fuchsia*, *Hoya*, *Zantedeschia*, begonia and geranium. Damage has also been inflicted on myrtle, Amazon lily (*Eucharis*), amaryllis, *Streptocarpus*, *Clivia*, papyrus, *Cissus*, *Crassula*, *Rhododendron catawbiense* and *Sedum* sp. Injury attributable to this pest is greatest in southern and central Finland, but mealybugs were common on house plants as far north as Oulu (PP) in 1958. Two species are known in Finland: the citrus mealybug (*Pseudococcus citri* RISSO), which has been observed since 1915 (LINNANIEMI 1920, p. 209), and the long-tailed mealybug (*Ps. adonidum* L.), first found in 1922 at Helsinki (U) (HELLÉN 1925), and which appears to be more common than the former.

The commonest species belonging to the family *Lecaniidae* is perhaps the soft scale (*Coccus hesperidum* L.), which has often appeared in profusion on ivy, myrtle, oleander, amaryllis, *Zantedeschia*, *Eucharis*, orange, laurel, palms, cactuses, agave, sage, rose and chrysanthemum. When injured by this pest, the leaves become yellow; in the case of palms, their leaf tips become brown and dry. Brown scale (*Eulecanium corni* BCHÉ) was once found (in 1947 at Turku (V)) on *Nephrolepis*, amaryllis and oleander. Hemispherical scale (*Saissetia coffeae* WALK. = *Lecanium hemisphaericum* TARG.) was first observed in Finland at Helsinki (U) in 1915, where it infested fern leaves (*Pteris ? serrulata*) (LINNANIEMI 1920, p. 209). It has since been found in south and central Finland on plants other than ferns: *Jacobinia pulchra*, *Ficus religiosa*, *Hoya carnosa*, ivy, palm, *Zantedeschia* and oleander. *Saissetia oleae* BERN. has only once been observed in Finland, on asparagus grown in a dwelling at Vihti (V) (HELLÉN 1925). In addition, euonymus (*Euonymus japonica*), speedwell (*Veronica* sp.) and *Chlorophytum* sp. have been infested by pests in this group of scales, although the species was not determined.

The most important species belonging to the family *Diaspididae* is the oleander scale (*Aspidiotus hederae* VALL.), first reported in 1915 at Paimio (V), where it was observed on a house plant, possibly *Aucuba japonica* (LINNANIEMI 1920, p. 209). The species has since been seen to have retarded the growth of palms, ivy and oleander in particular, but on occasion other plants as well, such as *Fatsia*, *Ficus*, *Laurus* and cactuses. The most northerly localities where this pest has been found are Vaasa (EP) and Juankoski (PS). Only once has the fig scale (*Lepidosaphes conchiformis* GMEL.) been observed in Finland, at Helsinki (U) in 1914 on the leaves of *Anona squamosa*. In 1916, plants other than the above-mentioned were infested with scale: *Kentia*, *Phoenix*, *Chamaedorea* and *Ficus populnea* (LINNANIEMI 1916, p. 68). On two occasions, (1946 at Hanko (U) and 1947 at Helsinki (U)) the fern scale (*Pinnaspis aspidistrae* SIGN.) was found on the leaves of *Nephrolepis* sp.

Beetles (*Coleoptera*). In some instances, wireworms (*Elateridae*) have injured greenhouse chrysanthemums and Chabaud carnations, severing the latter at the soil surface. Damage brought about by the knot-grass weevil (*Phytonomus arator* L.) has at times been inflicted on greenhouse carnations, for example near Helsinki (U) in 1946 and 1955 (cf. p. 129). In 1957, the vine weevil (*Otiorrhynchus sulcatus* FABR.) appeared in a winter garden at Espoo (U), but no damage was observed. In 1960, this pest inflicted at Tampere (EH) quite severe injury on the roots of *Echeveria* and *Rhoicissus rhomboidea* (Grönblom).

Sawflies, ants (*Hymenoptera*). Certain species of sawflies which ordinarily live on outdoor roses have at times appeared as greenhouse rose pests. In 1925, larvae of *Allantus* (*Emphytus*) *rufocinctus* RETZ. injured the leaves of greenhouse roses, and in 1946, *Ardis brunniventris* HTG was observed on roses at Tampere (EH). In 1927, larvae of the rose bud sawfly (*Monardis plana* KL.) destroyed most of the young shoots and flower buds of rose plants at Loppi (EH).

In 1949, larvae of *Ametastegia equiseti* FALL. ab. *coxalis* KL. were observed on leaves of *Begonia hybrida* at Lahti (EH). The larvae were feeding on the leaves from their lower surface, making round holes in them. Similar injury was done at Elimäki (U) in 1954. A report made as early as 1924, concerned with larvae feeding on begonia at Tampere (HUKKINEN and VAPPULA 1935, p. 82), evidently referred to this species.

In some instances, ants (*Formicidae*) have constituted a nuisance by establishing their nests in the root balls of camelia plants, and infesting the stems and foliage of these plants (E. REUTER 1912, p. 27—29), or by invading flower pots in dwellings. They have furthermore been reported as injuring the flower buds of greenhouse roses.

True flies (*Diptera*). Larvae of the large narcissus fly (*Lampetia equestris* FABR.) have on occasion been found in the bulbs of narcissus and amaryllis (*Hippeastrum*) (cf. p. 129).

Large numbers of leaf mines made by the larvae of *Trypeta artemisiae* FABR. have at times been apparent in both outdoor and in greenhouse chrysanthemums (cf. p. 129). This plant is also attacked by another pest, the chrysanthemum leaf-miner (*Phytomyza atricornis* MEIG.), whose meandering tunnel mines in the leaves are sometimes so plentiful that the leaves are variegated in colour. Such damage was first observed in Finland in 1904 at Helsinki (U) (E. REUTER 1905, p. 25), and since 1928 reports have been received from various parts of Finland, as far north as the region of Oulu (PP). In some cases, a number of such mines have also been seen in cineraria leaves.

A pest which inflicts a great deal of damage on chrysanthemum is the chrysanthemum gall midge (*Diarthronomyia chrysanthemi* AHLB.), first found at Kirkkonummi (U) and near Helsinki (U) (KANERVO 1936 a, 1936 b) in 1936. It produces small cone-shaped galls in the leaves, shoots and flowers, which may at times be so numerous — especially in the terminal portions of the plant — that flower development is completely suppressed. The species has since been noted in 1937 at Oulun-

kylä (U) and Helsinki (U), 1941 at Pohja (V), 1950 at Parikkala (LK) and Kaarlela (KP), 1953 at Korso (U), 1955 at Kontiolahti (PK), 1957 at Iitti (EH), 1958 at Simpele (LK) and Ruovesi (EH) and in 1959 near Helsinki (U). In some cases, the damage has been extremely severe, with the consequent loss of the entire flower yield.

Larvae of *Bibio* sp. have at times appeared in greenhouses, for instance in the soil surrounding chrysanthemum plants; it has been assumed that they cause injury to the plants.

Moths (*Lepidoptera*). In 1954, larvae of *Pergesa elpenor* L. were observed singly in a Pori (St) greenhouse in which grape vines and fuchsia were growing.

In many locations the tomato moth (*Polia oleracea* L.) appeared as an injurous pest in greenhouses throughout south Finland in 1934—1936, for example on cyclamen, and in 1939 larvae were found on begonia and balsam (*Impatiens balsamina*) in a house at Kökar (A) (NORDMAN 1943, p. 145). In 1945, larvae destroyed about 1 500 greenhouse rose plants at Tampere (EH) by injuring the leaves and making deep holes in the flower buds. Larvae of *Naenia typica* L. were found on cyclamen at Tampere (EH) (GRÖNBLOM 1942), and those of *Euplexia lucipara* L. on the same plant at Tikkurila (U) in 1932 (Vappula). *Polia dissimilis* KNOCH injured the top leaves of carnations in an Espoo (U) greenhouse in 1961.

In 1931, larvae of *Cacoecia podana* SCOP. and var. *sauberiana* SORH. were seen on laburnum growing in a home at Helsinki (U) (E. SUOMALAINEN 1932). The same species of plant was infested with larvae of *Cacoecia rosana* L. in a Helsinki greenhouse in 1933; the larvae had rolled the leaflets into tubes. Large numbers of larvae of *Notocelia rosaecolana* DBLD. were observed on greenhouse roses at Loppi (EH) in 1925; they damaged the unopened leaf and flower buds, and also fed on the young leaves. The larvae, which had evidently been introduced into this country along with infested foreign rose plants, brought about considerable damage, as in 1925 at least 40 per cent and in 1926 60—70 per cent of the flowers were destroyed (HUKKINEN 1927 a). In 1927, injury was still prevalent, but no reports of the species have been received since then.

The azalea leaf-miner (*Caloptilia azaleella* BRANDTS), first found at Helsinki (U) in 1927 (P. SUOMALAINEN 1927), has at times constituted an injurious pest of azaleas imported from Belgium (cf. Ann. Report Dept. of Pest Invest. 1937). The leaves of laburnum are on occasion infested with mines made by *Leucoptera laburnella* STT., first found in Finland at Helsinki (U) in 1931 (E. SUOMALAINEN 1932).

Myriapods (*Myriopoda*). Myriapods have on occasion been quite abundant in the soil of greenhouses and flower pots, where they have apparently injured the roots of cineraria or the tubers of cyclamen plants, and have otherwise hindered the growth of house plants such as oleander and palm. When they appear in large numbers, they may actually be injurious to the plants. The following reports have been received: in 1958, *Orthomorpha* (*Oxidus*) *gracilis* C. L. KOCH damaged African violet (*Saintpaulia ionantha*) at Espoo (U), and in 1959 it injured various plants at Kuhmo (Kn); *Cylindroiulus frisius* VERH. appeared in profusion on the roots

of forget-me-not and daisy growing in a greenhouse at Espoo (U), and in 1951 it infested greenhouses at Kuopio (PS), destroying many tulip bulbs; *Cylindroiulus britannicus* VERH. was abundant on the roots of chrysanthemum at Helsinki (U) in 1949, and in the soil of various greenhouse plants at Mikkeli (ES), where it brought about severe damage to the roots of fairy primrose (*Primula malacoides*). In addition, *Nopoiulus venustus* MEINERT was found in greenhouse soil at Hyvinkää (U) in 1949, although no mention was made of possible injury.

Mites (*Acarina*). One of the most harmful indoor ornamental plant pests is the hop red spider mite (*Tetranychus urticae* KOCH), which infests many different kinds of plants. During the early stages of mite infestation, the leaves become slightly chlorotic, but when the attack is severe, the leaves turn yellow or brown, become covered with webs produced by the mites, and finally wither and die. This pest is most prevalent and injurious as regards roses, but it has also been seen on the following plants: hydrangea, carnation, fuchsia, ivy, *Fatsia*, palms, amaryllis (*Hippeastrum*), laurel (*Laurus*), Japanese euonymus (*Euonymus japonica*), orchids, gardenia, *Zantedeschia*, medeola, passionflower, common fig (*Ficus carica*), Indian rubber fig (*Ficus elastica*), orange (*Citrus*), *Cissus*, Japanese aucuba, hibiscus (*Hibiscus manihot*), *Fatshedera*, asparagus (*Asparagus plumosus nanus*), chrysanthemum, *Mitella diphylla*, *Nelumbo* sp. and *Acalypha hispida*. The hop red spider mite is a common pest on house plants throughout southern and central Finland, and has been found as far north as Alatornio (PP). There are two different colour types in this country, one red, and the other yellowish-green with black spots (HEIKINHEIMO 1956).

Tenuipalpus (*Brevipalpus*) *cactorum* OUD. has only once been observed in this country, in 1953 at Kuopio (PS), where it caused brownish spots in cactus plant. Mites evidently belonging to the same genus were observed at Helsinki (U) in 1955; it had made pale blemishes in the leaves of an orchid plant (*Odontoglossum grande*). In 1956, the leaves of anthurium at Joutseno (ES) were injured in a similar fashion.

In 1904, the strawberry mite (*Tarsonemus pallidus* BANKS = *fragariae* ZIMM.) appeared on begonia plants growing in a greenhouse at Helsinki (U). As a consequence of the infestation, many of the shoots had stopped growing even at the bud stage (E. REUTER 1905, p. 23—24, 25; 1906 b, p. 138). In 1952, strawberry mites damaged the top shoots of *Kalanchoë blossfeldiana* and pentstemon at Tyrväntö (EH); the leaves had become brown and twisted (cf. also HEIKINHEIMO 1953 a). On two occasions (at Helsinki (U) in 1953 and 1960) mites of the genus *Tarsonemus* — probably *T. laticeps* HALBERT — were observed in narcissus bulbs. *Uropoda* (*Urosternella*) *obnoxia* E. REUT. was once found on seedlings of gloxinia (*Sinningia*).

The bulb mite (*Rhizoglyphus echinopus* FUM. & ROB.) has appeared as a flower bulb pest since 1924, when it was noted in amaryllis bulbs at Tyrväntö (EH) (HUKKINEN 1924, 1926 b). The mites had either attacked the basal, interior part of the stalk, causing it to remain stunted in its growth, or the leaf primordia, preventing the development of the leaves. In this year, and in the two succeeding years, hyacinth, tulip and narcissus bulbs imported from Holland were generally of poor quality,

and in many cases infested with bulb mites, which meant that the growers suffered great losses. In 1926, for example, as many as 50—100 per cent of the tulip bulbs imported in the preceding autumn, and 30—75 per cent of the hyacinth bulbs were damaged by mites. Other flower bulbs later infested by mites included crocus, eucharis and *Lilium auratum*, and on one occasion the tubers of gladiolus and iris. In many cases, mites have been observed in bulbs infected with bacteria or fungi, but frequently they have attacked healthy tissues, thus constituting the primary causal agent of the damage to the bulbs.

Gall mites have appeared on greenhouse ornamental plants as follows: *Eriophyes saalasii* LIRO, which lives freely on the lower surface of lilac leaves, was first found by SAALAS in 1932 (LIRO 1940, p. 20—21). So far, the species is known only as regards greenhouses near Helsinki (U) (LIRO and ROIVAINEN 1951, p. 128). The top leaves of carnations were infested with *Eriophyes dianthi* LINDROTH (LIRO) at Maaria (V) and at Helsinki (U) in 1960; at the former place, considerable damage resulted. In 1949, *Vasates magnolivora* KEIFER was found on magnolia leaves at Kirkkonummi (U) (cf. ROIVAINEN 1951, p. 28), but the extent of injury was not certain; the plants had been imported from France. In 1952, *Nalepella triceras* C. B. appeared on European silver fir (*Abies pectinata*) seedlings growing in pots in an insectary at Tikkurila (U). The species, not previously observed in Finland, was living on the lower surface of the needles, and caused them to become pale in colour.

M o l l u s c s (*M o l l u s c a*). Slugs (*Deroceras* sp.) have on occasion invaded greenhouses and injured various plants, such as gladiolus and *Dracaena*, by eating holes or streaks in the leaves. *Oxychilus alliarius* MILLER has been found in greenhouses in the regions of Lohja (V), Helsinki (U) and Jyväskylä (PH) (VALOVIRTA 1953) and in the soil at the base of a large palm tree at Ikaalinen (St) in 1956. The species was evidently introduced into this country along with foreign plant stock.[1]) In 1958, mild injury to *Saintpaulia ionantha* at Espoo (U) was inflicted by some small snails (*Oxychilus* sp., *? Retinella* sp.), whose species was not determined.

W o r m s (*V e r m e s*). Two species of leaf eelworms have been found in Finland. The chrysanthemum eelworm (*Aphelenchoides ritzemabosi* SCHW.) was first seen in 1932 in many south Finnish greenhouses (SAALAS 1933, p. 603; VALKAMA 1934). Injury to chrysanthemums has subsequently been quite frequent, e.g., at Lahti (EH), Helsinki (U), Hanko (U) and Imatra (ES). The strawberry eelworm (*Aphelenchoides fragariae* RITZ. BOS)[2]) was first found in 1932, when it damaged the leaves of begonia, gloxinia (*Sinningia*) and ferns in greenhouses in different parts of the country (SAALAS, op.cit.; VALKAMA, l.c.). In 1949, this species appeared on begonia cuttings at Helsinki (U), inflicting injury on 80 per cent of them. In the same year, begonia leaves at Nastola (EH) were badly damaged by this pest.

[1]) The related species *Oxychilus draparnaldi* BECK was found only in a greenhouse at Porvoo (U) in 1947 (SUNDMAN 1948).

[2]) The species had originally been given the name fern eelworm (*Aphelenchoides olesistus* RITZ. BOS), which at the present time is considered a synonym of *A. fragariae*.

In 1937, root galls made by the root knot eelworm (*Meloidogyne* sp.) were observed in coleus plants growing at Tyrväntö (EH). Cyclamen plants were severely damaged by this pest at Nastola (EH) in 1943, at Lahti (EH) in 1948 and at Hämeenlinna (EH) in 1949.

Mammals (*Mammalia*). At Rauma (St) in 1957, voles (*Arvicolidae*) injured roses growing in a greenhouse. Norway rats (*Rattus norvegicus* ERXL.) and house mice (*Mus musculus* L.) damage flower bulbs in storage, and at times during the period of their forcing in greenhouses (V. SIIVONEN 1957). In 1956, common moles (*Talpa europaea* L.) invaded a greenhouse at Kirkkonummi (U), occasioning slight damage to ornamental flowers by digging in the soil near their roots (Myllymäki).

E. Grape and peach

Thrips (*Thysanoptera*). In 1924, rose thrips (*Thrips fuscipennis* HAL). appeared on peach trees at Vanaja (EH), with consequent desiccation and twisting of the leaves (HUKKINEN 1932 b; HUKKINEN and VAPPULA 1935, p. 16).

Aphids, etc. (*Hemiptera*). The peach-potato aphid (*Myzus persicae* SULZ.) was found on peach trees at Piikkiö (V) and Kuopio (PS) (HEIKINHEIMO 1959, p. 26).

The citrus mealybug (*Pseudococcus citri* RISSO) has on two occasions (at Dragsfjärd (V) in 1944 and at Elimäki (U) in 1945) appeared abundantly on grape vines; it hindered the growth of the plants, and soiled the fruit. In 1948, a severe infestation of mussel scale (*Lepidosaphes ulmi* L.) and brown scale (*Eulecanium corni* BCHÉ) occurred on the branches of peach trees at Karjalohja (V). Large numbers of the latter species were also observed on peach trees at Järvenpää (U) in 1949.

Myriapods (*Myriopoda*). In 1912, the roots of grape vines at Köyliö (St) were affected by injury possibly attributable to myriapods (E. REUTER 1914 a, p. 12).

Mites (*Acarina*). The hop red spider mite (*Tetranychus urticae* KOCH) has on many occasions been an injurious pest on both peach trees and grape vines; the leaves of these plants become discoloured as a result of the infestation. Damage has been observed in greenhouses in south Finland extending as far north as the regions of Noormarkku (St), Ruovesi (EH) and Mikkeli (ES).

22. Mushrooms

True flies (*Diptera*). In 1957, large numbers of larvae of *Lycoriella* sp. appeared on cultivated mushrooms at Janakkala (EH). They infested the mycelia of the mushrooms, and brought about so much injury that the yield was reduced by about one-third (Ekbom).

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APPENDIX

List of cultivated-plant pests and the distribution of injuries caused by them in the biogeographical provinces of Finland (see map, p. 226)

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Collembola																						
Onychiurus armatus Tullb.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Bourletiella pruinosa Tullb.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
?Sminthurus viridis L. var. *nigromaculata* Tullb.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Collembola spp.	—	×	×	—	—	×	×	×	—	—	×	—	×	—	—	×	—	—	—	—	—	*
Orthoptera																						
Tettigonia viridissima L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Tachycines asynamorus Adel.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Dermaptera																						
Forficula auricularia L.	—	×	—	—	—	—	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	*
Thysanoptera																						
Heliothrips haemorrhoidalis Bché	—	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *femoralis* Reut.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Parthenothrips dracaenae Heeg.	—	×	×	—	—	—	×	×	—	×	—	×	—	—	—	—	—	—	—	—	—	* *
Chirothrips hamatus Tryb.	—	×	×	×	—	×	×	×	×	×	×	×	×	×	—	×	—	—	—	—	—	* * *
,, *manicatus* Hal.	—	×	×	—	—	×	×	—	—	×	—	—	—	—	—	×	—	—	—	—	—	* *
Limothrips denticornis Hal.	×	×	×	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	—	—	—	* * *
Aptinothrips rufus Gmel.	—	×	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	*
,, *stylifer* Tryb.	—	×	×	×	—	×	×	×	×	×	×	×	—	×	×	×	—	—	—	—	—	* * *
Scirtothrips longipennis Bagn.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Anaphothrips obscurus Müll.	—	×	×	—	—	—	×	—	—	×	—	—	—	—	—	×	—	—	—	—	—	*
,, *orchidii* Moult.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Kakothrips robustus Uz.	—	×	×	—	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* * *
Frankliniella tenuicornis Uz.	—	×	×	—	—	—	×	×	—	×	×	×	×	×	—	×	×	—	—	?	—	* * *
,, *intonsa* Tryb.	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Leucothrips nigripennis Reut.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Taeniothrips atratus Hal.	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Thrips fuscipennis Hal.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *major* Uz.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *calcaratus* Uz.	—	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *angusticeps* Uz.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *nigropilosus* Uz.	—	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *tabaci* Lind.	—	×	×	—	—	—	×	×	—	—	×	—	—	×	—	—	—	—	—	—	—	* * *
Bolacothrips jordani Uz.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Haplothrips aculeatus Fabr.	—	×	×	×	—	×	×	×	×	×	—	×	×	—	—	—	—	—	—	—	—	* * *
,, *niger* Osb.	×	×	×	×	—	×	×	×	×	×	×	×	×	×	—	×	×	×	—	—	—	* *

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Hemiptera																						
Calocoris ?fulvomaculatus DeG.	—	—	—	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	*
,, *biclavatus* H.S.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Lygus pabulinus L.	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	×	—	—	—	—	—	* *
,, *pratensis* L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *punctatus* Zett.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *rugulipennis* Popp.	—	×	×	×	—	×	×	×	—	×	×	×	×	×	×	×	—	—	—	—	—	* * *
,, *kalmi* L.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, spp.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	
Plesiocoris rugicollis Fall.	—	×	×	—	—	—	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	* *
Leptopterna dolabrata L.	—	×	×	—	—	—	×	—	—	×	—	×	—	×	—	×	—	—	—	—	—	* *
Halticus apterus L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Coreus marginatus L.	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	*
Piesma capitata Wolff	—	—	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Stephanitis oberti Kol.	—	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *rhododendri* Horv.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Dolycoris baccarum L.	—	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	—	—	—	—	* *
Eurydema oleraceum L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	—	—	—	—	* * *
Philaenus spumarius L.	—	×	×	×	—	×	×	×	×	×	—	×	×	×	—	×	—	—	—	—	—	* *
Centrotus cornutus L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Euacanthus interruptus L.	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	(*)
Tettigella viridis L.	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	*
Macropsis fuscula Zett.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Psammotettix sp.	—	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Allygus mixtus Fabr.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Orolix cruentatus Panz.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Hypospadianus torneellus Zett.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Empoasca flavescens Fabr.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *kontkaneni* Oss.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Cicadella concinna Germ.	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *stellulata* Burm.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Typhlocyba sociabilis Oss.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *ulmi* L.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *rosae* L.	×	×	×	—	—	×	×	—	—	—	—	—	—	—	×	—	—	—	—	—	—	* *
,, *sexpunctata* Fall.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *decempunctata* Fall.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Erythroneura alneti Dahlb.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Erythroneura ordinaria Rib.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Helicoptera lapponica Zett.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Calligypona pellucida Fabr.	—	×	×	×	—	×	×	×	—	×	×	×	×	×	—	—	—	—	—	—	—	* * *
,, *obscurella* Boh.	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	*
Rhinocola aceris L.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Psyllopsis fraxinicola Först.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *fraxini* L.	×	×	×	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *discrepans* Flor	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Psylla pyri L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *costalis* Flor	—	×	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *pyrisuga* Först.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *mali* Schmidbg.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	—	—	—	—	* * *
,, *peregrina* Först.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *ulmi* Först.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Trioza apicalis Först.	×	×	×	×	—	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	—	* * *
,, *alacris* Flor	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Aleurochiton aceris Geoffr.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Aleurodes fragariae Walk.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *campanulae* Saalas	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Trialeurodes vaporariorum Westw.	—	×	×	×	—	×	×	×	×	—	×	×	×	×	—	×	—	—	—	—	—	* * *
Dialeurodes chittendeni Laing	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Cinara abieticola Chol.	—	×	×	—	—	×	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	* *
,, *laricis* Walk.	—	—	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Lachnus roboris L.	×	×	?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Periphyllus aceris aceris L.	—	×	×	—	×	×	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	* *
,, *lyropictus* Kessler	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Eucallipterus tiliae L.	—	×	×	—	—	—	×	×	×	×	—	×	—	—	×	×	—	—	—	—	—	* * *
Myzocallis coryli Goeze	—	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Tuberculoides annulatus Htg	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Tinocallis platani Kalt.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Triphyllaphis luteola C.B.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Hyalopterus pruni Geoffr.	×	×	×	×	×	×	×	×	×	×	—	×	×	—	—	—	—	—	—	—	—	* * *
Rhopalosiphum nymphaeae L.	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
,, *padi* L.	—	×	×	×	—	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	* * *
,, *insertum* Walk.	—	×	×	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Schizaphis sp.	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	*
Aphis fabae Scop.	×	×	×	×	—	×	×	×	×	×	×	×	×	×	—	×	—	—	—	—	—	* *
,, *sambuci* L. s.lat.	—	—	×	×	—	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	*
,, *?vaccinii* C.B.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Aphis grossulariae Kalt.	—	×	×	×	×	×	×	×	—	×	×	×	—	×	—	×	—	—	—	×	—	* * *
,, *idaei* v.d. Goot	—	×	×	×	—	—	—	×	—	—	—	×	—	—	—	—	×	—	—	—	—	* *
,, *pomi* DeG.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	* * *
,, *schneideri* C.B.	—	×	×	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	*
,, *sedi* Kalt.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *thalictri* Koch	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *corniella* H.R.L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Anuraphis farfarae Koch	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Ceruraphis eriophori Walk.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Dysaphis plantaginea Pass.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *anthrisci* C.B.	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	* * *
,, *ranunculi* Kalt.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, sp. (apple tree)	×	×	×	×	×	×	×	×	—	×	×	×	—	—	—	—	—	—	—	—	—	
,, sp. (hawthorn)	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	
Brachycaudus cardui L.	?	×	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* * *
,, *helichrysi* Kalt.	—	—	×	—	—	—	×	—	—	—	—	×	—	×	—	×	—	—	—	—	—	* *
,, *spiraeae* Oestl.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *napelli* Schrk	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Brachycolus mühlei C.B.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Brevicoryne brassicae L.	×	×	×	×	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Lipaphis erysimi Kalt.	—	—	×	—	—	—	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	*
Hyadaphis foeniculi Pass.	—	×	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Coloradoa rufomaculata Wils.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Longicaudus trirhodus Walk.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Myzaphis rosarum Kalt.	—	×	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Liosomaphis berberidis Kalt.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Cavariella aegopodii Scop.	—	×	×	—	—	—	×	×	—	×	—	×	—	×	—	×	—	—	—	—	—	* *
,, *theobaldi* Gill.& Br.	—	—	—	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Ovatus crataegarius Walk.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Phorodon humuli Schrk	×	×	×	—	—	×	×	×	—	×	—	×	—	—	—	—	—	—	—	—	—	* * *
Rhopalomyzus lonicerae Sieb.	—	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Myzus cerasi Fabr.	×	×	×	×	×	—	×	×	×	×	—	×	—	—	—	—	—	—	—	—	—	* * *
,, *ornatus* Laing	—	×	×	—	—	—	×	×	—	—	—	—	—	×	—	—	—	—	—	—	—	* *
,, *ascalonicus* Donc.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *persicae* Sulz.	—	×	×	—	—	—	×	×	—	—	—	×	—	—	—	×	—	—	—	—	—	*
Capitophorus elaeagni Del Gu.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *vandergooti* H.R.L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Cryptomyzus galeopsidis Kalt.	—	—	×	—	—	—	×	×	—	×	—	×	—	×	—	×	—	—	—	×	—	*
,, *ribis* L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	×	×	—	—	—	* * *

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps) L	Class
Nasonovia pilosellae C.B.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *ribisnigri* Mosl.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Hyperomyzus lactucae L.	—	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	* * *
,, *pallidus* H.R.L.	—	—	×	—	—	—	×	×	—	×	—	×	—	×	—	—	—	—	—	—	—	* *
,, *rhinanthi* Schout.	—	×	×	—	—	×	×	×	—	×	—	×	—	×	—	×	—	×	—	×	—	* *
Rhopalosiphoninus ribesinus v. d. Goot	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Aulacorthum circumflexum Buckt.	—	×	×	—	—	—	×	×	—	—	—	—	—	×	—	—	—	—	—	—	—	* *
,, *solani* Kalt. s. lat.	—	—	×	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	*
Acyrthosiphon caraganae Chol.	—	×	×	—	—	—	×	×	—	×	—	—	×	—	—	—	—	—	—	—	—	* * *
,, *pisum* Harr.	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	—	—	—	* *
Metopolophium dirhodum Walk.	—	—	×	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	* *
Corylobium avellanae Schrk	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Macrosiphum euphorbiae Thos	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *rosae* L.	—	×	×	×	—	×	×	×	×	×	—	×	—	×	×	×	—	—	—	—	—	* * *
,, *avenae* Fabr.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	×	×	—	×	—	* * *
Macrosiphoniella oblonga Mordw.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *sanborni* Gill.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *tanacetaria* Kalt.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Masonaphis azaleae Mason	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Amphorophora rubi Kalt.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Anoecia corni Fabr.	—	×	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Thelaxes dryophilus Schrk	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Mindarus abietinus Koch	—	—	×	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	*
,, *obliquus* Chol.	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Cerataphis ?orchidearum Westw.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Schizoneura ulmi L.	×	×	×	×	—	×	×	×	×	×	—	×	—	×	—	—	—	—	—	—	—	* * *
Colopha compressa Koch	—	×	×	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	* *
Tetraneura ulmi L.	×	×	×	×	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* * *
Stagona crataegi Tullgr.	—	—	×	—	—	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	*
,, *xylostei* DeG.	×	×	×	×	—	—	×	—	—	—	—	—	—	—	×	—	—	—	—	—	—	* * *
Thecabius affinis Kalt.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pemphigus borealis Tullgr.	—	—	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *bursarius* L.	—	×	×	—	—	—	×	—	×	—	—	×	—	—	—	—	—	—	—	—	—	*
Pineus cembrae Chol.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Aphrastasia pectinatae Chol.	—	×	×	—	—	—	×	—	—	×	—	×	—	—	×	—	—	—	—	—	—	* *
Sacchiphantes viridis Ratz.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Adelgidae	—	×	×	×	—	×	×	×	—	×	—	×	×	×	—	×	—	—	—	—	—	
Phylloxera sp. (oak)	—	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Phenacoccus aceris Sign.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *hordei* Lindem.	—	×	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	(*)
Pseudococcus adonidum L.	—	×	×	?	—	×	×	×	?	×	×	—	×	—	—	?	—	—	—	—	—	* * *
,, *citri* Risso	—	×	×	?	—	×	×	?	?	×	—	—	—	—	—	?	—	—	—	—	—	* * *
Aspidiotus hederae Vall.	—	×	×	—	—	×	×	×	—	×	—	×	—	—	—	—	—	—	—	—	—	* *
Chionaspis salicis L.	—	×	×	×	—	—	×	×	×	—	×	×	×	—	—	—	—	—	—	—	—	* * *
Lepidosaphes conchiformis Gmel.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *ulmi* L.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pinnaspis aspidistrae Sign.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Kermes quercus L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Eulecanium corni Bché	—	×	×	×	×	×	×	—	—	—	—	×	—	×	—	×	—	—	—	—	—	* *
Coccus hesperidum L.	—	×	×	—	—	×	×	×	—	—	—	—	—	—	—	×	—	—	—	—	—	* *
Saissetia coffeae Walk.	—	—	×	×	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *oleae* Bern.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Coleoptera																						
Bembidion lampros Hbst	—	×	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *rupestre* L.	—	×	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	(*)
,, *quadrimaculatum* L.	—	×	—	×	—	—	×	×	—	—	×	—	—	×	—	—	—	—	—	—	—	*
Carabus nemoralis Müll.	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	(*)
Harpalus pubescens Müll.	—	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Amara plebeja Gyll.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *eurynota* Panz.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	*
Pterostichus vulgaris L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Cercyon analis Payk.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Aclypea opaca L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	* * *
,, *undata* Müll.	—	—	×	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Anthobium minutum Fabr.	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	(*)
Trogophloeus pusillus Grav.	—	×	×	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	* *
Cantharis obscurus L.	×	—	×	—	—	×	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	*
,, *fuscus* L.	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Dasytes niger L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Elateridae	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	
Limonius aeruginosus Ol.	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Corymbites pectinicornis L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	* *
,, *cupreus* Fabr. subsp. *aeruginosus* Fabr.	—	—	—	—	—	—	—	—	—	—	—	?	?	—	×	—	×	—	—	—	—	* *
,, *melancholicus* Fabr.	—	—	—	—	—	—	—	—	—	—	—	—	—	?	×	—	—	—	—	—	—	* *
,, *aeneus* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Prosternon tessellatum L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Agriotes lineatus L.	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* * *
„ *obscurus* L.	×	×	×	—	×	—	—	—	—	×	—	—	—	—	×	×	—	×	—	—	—	* * *
Agrilus sulcicollis Lac.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Byturus tomentosus Fabr.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	—	—	* * *
Meligethes aeneus Fabr.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	* * *
Atomaria linearis Steph.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Subcoccinella 24-punctata L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Geotrupes sp.	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	(*)
Aphodius fimetarius L.	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	(*)
Rhizotrogus solstitialis L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Melolontha hippocastani Fabr.	×	×	×	×	×	×	×	×	×	—	×	×	×	×	×	—	—	—	—	—	—	* *
Anomala dubia Scop. v. *aenea* DeG.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Phyllopertha horticola L.	—	—	—	—	×	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Cetonia aurata L.	×	?	×	×	?	—	×	×	?	?	×	×	?	—	—	—	—	—	—	—	—	*
Potosia cuprea Fabr.	?	×	×	×	×	×	×	×	?	×	×	×	?	—	—	×	—	—	—	—	—	*
Lagria hirta L.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Plagionotus arcuatus L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
?Saperda carcharias L.	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	*
„ *scalaris* L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Lema melanopa L.	—	—	×	—	—	—	×	×	—	×	—	—	—	—	—	?	—	—	—	—	—	*
Lilioceris lilii Scop.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
„ *merdigera* L.	×	×	×	—	—	×	×	—	×	—	—	—	—	×	×	—	—	—	—	—	—	*
Pachybrachys hieroglyphicus Laich.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Chrysomela polita L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Gastroidea polygoni L.	—	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
„ *viridula* DeG.	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Phaedon cochleariae Fabr.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	* * *
„ *armoraciae* L.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Melasoma populi L.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Phyllodecta vitellinae L.	—	—	×	—	—	—	×	—	×	—	—	—	—	×	—	—	—	—	—	—	—	* *
Galerucella tenella L.	—	—	×	×	—	×	×	×	—	×	×	×	—	—	—	—	—	—	—	—	—	* *
„ *lineola* Fabr.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
„ *nymphaeae* L.	—	—	—	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Pyrrhalta viburni Payk.	×	—	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Galeruca tanaceti L.	×	×	—	×	—	—	—	—	—	?	—	—	—	—	—	—	—	—	—	—	—	(*)
Lochmaea capreae L.	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Luperus flavipes L.	—	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
„ *pinicola* Duft.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Agelastica alni L.	—	—	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps) (L)	Class
Phyllotreta vittula Redtb.	—	×	×	×	—	×	×	×	—	×	×	×	×	×	?	—	—	—	—	—	—	* * *
,, *armoraciae* Koch	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *nemorum* L.	×	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *undulata* Kutsch.	×	×	×	—	—	×	×	—	—	—	—	—	—	×	—	×	—	—	—	—	—	* * *
,, *flexuosa* Ill.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	*
,, *vittata* Fabr.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *atra* Fabr.	—	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* * *
Phyllotretae	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	
Aphthona euphorbiae Schrk	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Longitarsus succineus Foudr.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *luridus* Scop.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *parvulus* Payk.	—	×	×	×	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *rubiginosus* Foudr.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Haltica oleracea L.	—	—	×	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Glyptina rubi Payk.	—	×	×	×	—	×	×	×	×	—	×	—	—	—	—	—	—	—	—	—	—	* * *
Chalcoides aurata Marsh.	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Chaetocnema concinna Marsh.	×	×	×	×	—	×	×	×	×	×	×	×	×	×	—	?	—	—	—	—	—	* * *
,, *aridula* Gyll.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *mannerheimi* Gyll.	—	×	×	—	—	—	×	—	—	—	—	×	×	—	—	—	—	—	—	—	—	*
,, *hortensis* Geoffr.	—	—	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Halticinae (bean)	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Cassida viridis L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *nebulosa* L.	×	×	×	—	—	×	×	—	×	×	—	—	×	×	—	×	—	—	—	—	—	* *
Coenorrhinus aequatus L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Rhynchites cupreus L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	—	—	—	—	* * *
Byctiscus betulae L.	×	×	×	×	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *populi* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Apion seniculus Kirby	×	×	×	×	—	×	×	×	×	×	×	×	×	—	—	—	—	—	—	—	—	*
,, *virens* Hbst	—	×	×	—	—	×	×	×	—	×	—	×	×	×	—	—	—	—	—	—	—	* *
,, *flavipes* Payk.	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	* *
,, *trifolii* L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* * *
,, *apricans* Hbst	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	* * *
,, *assimile* Kirby	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	* * *
Otiorrhynchus dubius Ström	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	*
,, *ovatus* L.	—	—	×	×	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	* *
,, *singularis* L.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *sulcatus* Fabr.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Phyllobius viridicollis Fabr.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *oblongus* L.	—	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	Ën L	In L	(Ps L)	Class
Phyllobius piri L.	—	×	×	×	×	—	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	* *
,, *maculicornis* Germ.	—	—	×	—	×	—	—	×	×	—	—	—	×	—	×	—	—	—	—	—	—	* *
,, *argentatus* L.	×	—	×	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	*
,, *urticae* DeG.	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	*
Polydrosus mollis Ström	—	—	—	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	*
Sciaphilus asperatus Bonsd.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Strophosomus rufipes Steph.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	×	—	—	—	—	*
Sitona lineatus L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	* * *
,, *suturalis* Steph.	×	×	×	—	—	×	×	×	—	×	—	×	×	—	—	×	—	—	—	—	—	*
,, *sulcifrons* Thnbg	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×	×	—	×	—	—	—	* *
,, *flavescens* Marsh.	×	×	×	—	—	×	×	×	×	×	×	×	×	×	—	×	×	—	—	—	—	* *
,, *decipiens* Lindb.	—	×	×	—	—	×	×	×	—	×	×	×	×	×	×	×	—	—	—	—	—	* *
,, *hispidulus* Fabr.	×	×	×	—	—	×	×	×	—	—	—	×	—	—	—	×	—	—	—	—	—	*
Miccotrogus picirostris Fabr.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Anthonomus rubi Hbst	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	* * *
,, *pomorum* L.	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(* *)
,, *rectirostris* L.	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Curculio nucum L.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pissodes notatus Fabr.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Magdalis ruficornis L.	—	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *frontalis* Gyll.	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Hylobius abietis L.	—	—	×	—	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	*
Phytonomus rumicis L.	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	*
,, *meles* Fabr.	×	×	×	—	—	—	—	×	×	×	×	×	×	×	×	×	×	×	—	—	—	*
,, *nigrirostris* Fabr.	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	* * *
,, *arator* L.	—	—	×	×	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Cryptorrhynchidius lapathi L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Ceuthorrhynchus pleurostigma Marsh.	—	×	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Ceuthorrhynchus roberti Gyll.	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	*
,, *rapae* Gyll.	—	—	×	—	—	—	×	—	—	?	—	—	—	—	—	—	—	—	—	—	—	*
,, *assimilis* Payk.	×	×	×	—	—	×	×	×	—	×	×	—	—	—	—	—	—	—	—	—	—	* * *
,, *quadridens* Panz.	×	×	×	×	×	×	×	×	×	×	×	×	—	?	—	—	—	—	—	—	—	* * *
Rhinoncus pericarpius L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	*
Rhynchaenus quercus L.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *populi* Fabr.	—	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Rhamphus oxyacanthae Marsh.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *pulicarius* Hbst	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Scolytus rugulosus Ratz.	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Scolytus intricatus Ratz.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Hylesinus crenatus Fabr.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Dendroctonus micans Kug.	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Blastophagus piniperda L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Pityophthorus micrographus L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Xyloterus signatus Fabr.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pityogenes chalcographus L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *bidentatus* Hbst	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Ips typographus L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Xyleborus dispar Fabr.	×	×	×	×	×	×	×	×	×	—	×	—	×	—	—	—	—	—	—	—	—	* * *
Hymenoptera																						
Diprion sertifer Geoffr.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *similis* Htg	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Dolerus sp.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pseudomacrophya punctum-album L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Athalia colibri Christ.	×	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	—	—	—	—	—	* * *
Ametastegia equiseti Fall. ab. *coxalis* Htg	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Ametastegia glabrata Fall.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Allantus cinctus L.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	?	—	—	—	—	—	* *
,, *rufocinctus* Retz.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *truncatus* Kl.	—	×	×	—	—	—	×	—	×	×	—	×	—	×	—	×	—	—	—	—	—	* *
Apethymus autumnalis Fors.	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *serotinus* Müll.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Eriocampa dorpatica Knw	—	—	×	—	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Caliroa annulipes Kl.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *cerasi* L.	×	×	×	×	×	×	×	×	×	×	—	—	—	×	—	×	—	—	—	—	—	* *
,, *varipes* Kl.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Endelomyia aethiops Fabr.	×	×	×	—	—	—	×	—	×	—	—	—	—	×	—	×	—	—	—	—	—	* *
Phymatocera aterrima Kl.	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Rhadinoceraea micans Kl.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Ardis brunniventris Htg	—	—	×	×	—	—	×	×	×	—	—	×	×	×	×	?	—	—	—	—	—	*
Monardis plana Kl.	—	×	×	×	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	* *
Blennocampa pusilla Kl.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Parna tenella Kl.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Metallus pumilus Kl.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Profenusa pygmaea Kl.	×	—	—	×	—	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Fenusa ulmi Sund.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Cladius difformis Panz.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *pectinicornis* Geoffr.	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Trichiocampus viminalis Fall.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Anoplonyx destructor Bens.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Mesoneura opaca Fabr.	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pontania vesicator Bremi	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, sp.	—	—	×	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	*
Euura testaceipes Brischke	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, sp.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Hoplocampa testudinea Kl.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Pristiphora abietina Christ.	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *abbreviata* Htg	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *alnivora* Htg	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *erichsonii* Htg	—	×	×	—	×	—	×	×	—	—	—	×	×	—	—	×	×	—	—	—	—	* *
,, *laricis* Htg	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *pallipes* Lep.	—	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	* * *
,, *punctifrons* Thoms.	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	(*)
,, *subarctica* Forssl.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	*
,, *wesmaeli* Tischb.	—	×	×	—	?	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Micronematus monogyniae Htg	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pachynematus pumilio Knw	—	×	×	×	×	×	×	×	—	×	×	×	×	×	—	×	—	—	—	—	—	* * *
Pteronidea approximata Först. (*cognata* Lqv.)	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Pteronidea leucotrocha Htg	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *melanaspis* Htg	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *ribesicola* Lqv.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *ribesii* Scop.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	* * *
,, *salicis* L.	—	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Arge gracilicornis Kl.	—	—	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
,, *rosae* L.	×	×	×	—	—	—	×	—	×	×	—	×	—	—	—	×	—	—	—	—	—	* * *
Sterictiphora geminata Gmel.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Cimbex lutea L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Zaraea fasciata L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Neurotoma iridescens André	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pamphilius balteatus Fall.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *inanitus* Vill.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *silvaticus* L.	—	—	—	—	—	—	×	×	—	—	—	×	—	—	—	×	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Acantholyda sp. (*?nemoralis* Thoms.)	—	—	—	—	—	—	—	—	—	?	—	—	—	—	—	×	—	—	—	—	—	(*)
Cephus sp.	—	×	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	(*)
Urocerus gigas L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Formicidae	×	×	×	×	—	×	×	×	—	×	—	—	—	×	—	—	—	—	—	—	—	* *
Formica rufa L.	—	—	×	—	×	×	×	—	×	—	×	—	—	×	—	—	—	—	—	—	—	* *
Vespa vulgaris L.	—	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *norvegica* Fabr. var. *saxonica* L.	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Megachile centuncularis L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Megachile sp.	×	×	×	×	—	—	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	*
Andricus callidoma Htg	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *curvator* Htg (and f. ag. *collaris* Htg)	×	×	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *fecundator* Htg (and f. sex. *pilosus* Adl.)	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *inflator* Htg (and f. ag. *globuli* Htg)	×	×	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *marginalis* Schlecht. f. ag.	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *quercus-radicis* Fabr. f. sex. and ag.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *quercus-ramuli* L. (and f. ag. *autumnalis* Htg)	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Neuroterus quercus-baccarum L. (and f. ag. *lenticularis* Ol.)	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Neuroterus tricolor Htg	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Rhodites centifoliae Htg	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	(*)
,, *mayri* Schlecht.	×	×	×	—	—	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *rosae* L.	×	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *spinosissimae* Gir.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *eglanteriae* Htg	×	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *rosarum* Gir.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Biorrhiza pallida Ol. f. ag.	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Diplolepis divisa Htg f. ag.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *longiventris* Htg (and f. sex. *similis* Adl.)	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *quercus-folii* L. f. ag.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Diastrophus rubi Bché	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Syntomaspis druparum Boh.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Megastigmus grönblomi Kang.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Eurytoma suecica Rosen	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	*
Mesopolobus graminum Hårdh	—	—	—	—	—	×	—	—	—	×	×	×	—	×	—	—	—	—	—	—	—	*
Diptera																						
Stratiomyiidae	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	*
Thereva sp.....	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Chilosia illustrata Harr.....	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Lampetia equestris Fabr.....	—	?	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	*
Eumerus tuberculatus Rond.	—	×	×	×	×	×	×	×	—	×	×	×	×	×	—	×	—	—	—	—	—	* * *
,, *strigatus* Fall.	—	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	×	×	—	—	—	* * *
Rhagoletis cerasi L.....	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *alternata* Fall.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Trypeta artemisiae Fabr.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Philophylla heraclei L.....	—	×	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	*
Agromyza spiraeae Kalt.....	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	*
,, *nana* Meig.	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *flaviceps* Fall.....	—	×	×	?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *igniceps* Hend.	×	—	—	×	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	* *
,, sp.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Liriomyza fasciola Meig.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *amoena* Meig.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *solani* Macq.....	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *obliqua* Hend.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *strigata* Meig.	—	×	?	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Phytagromyza xylostei R.-D. (var. *lonicerarum* Frey)	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Phytomyza xylostei Kalt.....	—	—	×	×	×	—	×	—	—	—	×	×	—	×	—	×	—	—	—	—	—	*
,, *rufipes* Meig.....	—	×	×	—	×	×	×	×	—	×	—	×	×	×	×	×	—	—	—	—	—	* *
,, *aquilegiae* Hardy	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	*
,, *atricornis* Meig.....	—	—	×	×	—	—	×	×	—	—	—	—	—	×	—	×	—	—	—	—	—	* *
,, *krügeri* Her.	—	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *aconitella* Hend.	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *sedicola* Her.....	—	×	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *nigra* Meig.	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
,, *pastinacae* Hend.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *brischkei* Hend.....	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *fuscula* Zett. (*avenae* de Meij.)	—	—	—	—	—	×	×	—	—	×	×	×	×	×	—	—	?	—	—	?	—	* *

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps) L	Class
Psila rosae Fabr.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	* * *
Opomyza florum Fabr.	—	—	×	—	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	*
Scaptomyza flaveola Meig.	—	—	×	—	—	—	×	—	—	—	—	—	—	×	—	×	—	—	—	—	—	*
Hydrellia griseola Fall.	—	×	×	×	—	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	* * *
Elachiptera cornuta Fall.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Aphanotrigonum trilineatum Meig.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Conioscinella albipalpis Meig.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Oscinella frit L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	* * *
Meromyza saltatrix L.	—	×	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	*
Lasiosina cinctipes Meig.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Chlorops pumilionis Bjerk.	×	×	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	×	—	—	—	* * *
Amaurosoma flavipes Fall.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	×	* * *
,, *armillatum* Zett.																						
Hylemyia radicum L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *coarctata* Fall.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *platura* Meig.	—	—	×	—	—	—	—	—	—	—	—	×	—	×	×	×	—	—	—	×	—	* *
,, *antiqua* Meig.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	?	* * *
,, *liturata* Meig.	—	×	×	—	—	—	—	—	—	—	—	×	—	×	—	×	—	—	—	×	—	* *
,, *pilifemur* Ringd.	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
,, *floralis* Fall.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	* * *
,, *brassicae* Bché	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	?	* * *
,, *laricicola* Karl	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pegomyia hyoscyami Panz.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	* * *
,, *dentiens* Pand.	—	—	×	×	—	—	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	*
,, *albimargo* Pand.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Muscina assimilis Fall.	—	×	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	*
Tipula oleracea L.	—	×	×	×	×	×	×	×	—	×	×	×	×	×	×	×	—	×	—	—	—	* * *
,, *paludosa* Meig.																						*
Pachyrrhina maculata Meig.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *pratensis* L.																						o
Lasioptera rubi Heeg.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	o
Diarthronomyia chrysanthemi Ahlb.	—	×	×	—	—	—	×	—	×	—	—	—	×	×	—	—	—	—	—	—	—	* *
Mayetiola destructor Say	—	×	×	×	×	×	×	—	—	×	—	?	—	×	—	?	—	—	—	—	—	* *
,, *joannisi* Kieff.	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *avenae* Marsh.	—	—	—	—	—	—	—	—	—	—	—	—	?	—	—	—	—	—	—	—	—	(*)
Rhabdophaga salicis Schrk	—	—	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *terminalis* H. Lw	—	—	×	—	—	—	×	—	—	—	—	×	—	—	—	×	—	—	—	—	—	*
,, *dubiosa* Kieff.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Rhabdophaga ma ginemtorquens Bremi	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Dasyneura brassicae Winn.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,, *alopecuri* E. Reut.	—	×	×	—	—	—	×	—	×	×	—	—	—	×	—	×	—	—	—	—	—	
,, *leguminicola* Lintn.	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	
,, *violae* F. Lw	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,, *ribis* Barnes	—	×	×	—	×	—	×	×	—	—	×	—	—	—	—	×	—	—	—	—	—	
,, *tetensi* Rübs.	×	×	×	—	—	—	×	—	—	—	—	×	—	×	—	×	—	—	—	—	—	
,, *tiliamvolvens* Rübs.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,, *fraxini* Kieff.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *fraxinea* Kieff.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *mali* Kieff.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *piri* Bché	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *thomasiana* Kieff.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *gentneri* Pritsch.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	
Kiefferia pimpinellae F. Lw	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Gephyraulus raphanistri Kieff.	—	—	×	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	
Stenodiplosis geniculati E. Reut.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Contarinia pisi Winn.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,, *quercina* Rübs.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *tiliarum* Kieff.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,, *merceri* Barnes	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,, *tritici* Kirby	—	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,, *kanervoi* Barnes	—	—	—	—	—	×	—	—	—	×	×	—	—	×	×	—	—	—	—	—	—	
Sitodiplosis mosellana Géh.	—	×	×	—	—	—	—	×	—	—	—	?	—	—	—	—	—	—	—	—	—	
Macrodiplosis dryobia F. Lw	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *volvens* Kieff.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Thomasiniana theobaldi Barnes	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Lycoriella sp.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Bibio sp.	—	—	×	—	—	—	×	—	—	×	—	—	×	—	—	—	—	—	—	—	—	
Lepidoptera																						
Papilio machaon L.	×	×	×	×	—	—	×	×	×	—	—	—	—	×	—	—	—	—	—	—	—	
Parnassius apollo L.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Aporia crataegi L.	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	—	—	—	—	—	
Pieris brassicae L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	
,, *rapae* L.	—	×	×	×	×	×	×	—	—	×	—	×	—	—	—	—	—	—	—	—	—	
,, *napi* L.	—	×	×	×	—	×	×	×	—	×	—	×	×	×	—	×	—	×	—	×	—	
Gonepteryx rhammi L.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Limenitis populi L.	—	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✲
Vanessa antiopa L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✲
,, *urticae* L.	—	—	—	—	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	✲
Polygonia c-album L.	×	×	×	—	—	—	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	✲
Pyrameis atalanta L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Melitaea maturna L.	—	—	×	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	(✲)
Brenthis ino Rott.	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	(✲)
Aphantopus hyperantus L.	—	—	×	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	(✲)
Epinephele jurtina L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Coenonympha pamphilus L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
,, *tullia* Müll. f. *isis* Thnbg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Pararge hiera Fabr. f. *ominata* Krul.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
,, *maera* L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Ruralis quercus L.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
,, *betulae* L.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Plebejus idas L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Polyommatus icarus Rott.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
,, sp. (*?semiargus* Rott.)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✲
Scolitantides orion Pall.	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Glaucopsyche alexis Poda	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Celastrina argiolus L.	×	×	×	—	—	×	×	×	—	—	—	—	—	—	—	×	—	—	—	—	—	✲
Sphinx ligustri L.	×	×	×	×	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	✲
,, *pinastri* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Mimas tiliae L.	×	×	×	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Smerinthus ocellatus L.	×	×	×	×	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✲
Amorpha populi L.	—	×	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✲
Haemorrhagia tityus L.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✲
,, *fuciformis* L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	✲
Celerio galii Rott.	—	—	×	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	✲
Pergesa elpenor L.	—	—	×	×	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	✲
Cerura furcula Cl. f. geogr. *borealis* Boh.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Cerura bifida Hb.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Dicranura vinula L.	—	×	×	×	—	×	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	✲
Stauropus fagi L.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Gluphisia crenata Esp.	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)
Pheosia tremula Cl.	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(✲)

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps) L	Class
Notodonta ziczac L.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
„ *phoebe* Sieb. f. geogr. *tiefi* Bart.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
„ *tritophus* Esp.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Lophopteryx camelina L.	×	×	×	—	—	—	×	—	—	—	—	×	×	—	—	—	—	—	—	—	—	*
Pterostoma palpinum L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Phalera bucephala L.	×	×	×	—	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pygaera curtula L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
„ *anachoreta* Fabr.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
„ *pigra* Hufn.	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Eudia pavonia L.	×	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Aglia tau L.	×	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Malacosoma neustria L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
„ *castrensis* L.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Trichiura crataegi L. f. geogr. *ariae* Hb.	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Poecilocampa populi L.	×	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Eriogaster lanestris L.	×	—	×	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	*
Lasiocampa quercus L. f. geogr. *callunae* Palmer	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Macrothylacia rubi L.	—	—	×	—	—	—	×	—	—	—	—	—	×	×	—	—	—	—	—	—	—	*
Cosmotriche potatoria L.	—	—	×	—	—	—	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	(*)
Gastropacha quercifolia L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Dendrolimus pini L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Orgyia gonostigma Fabr.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
„ *antiqua* L.	×	×	×	×	×	×	×	×	—	—	×	—	×	×	—	×	—	—	—	—	—	* *
Dasychira selenitica Esp.	—	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
„ *fascelina* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
„ *abietis* Schiff.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
„ *pudibunda* L.	—	—	×	×	×	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Stilpnotia salicis L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Lymantria monacha L.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Euproctis similis Fuessly	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Drepana falcataria L.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Thyatira batis L.	—	—	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Palimpsestis flavicornis L.	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
„ *duplaris* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Episema caeruleocephala L.	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Panthea coenobita Esp.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Moma ludifica L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Colocasia coryli L.	×	×	×	—	—	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	(*)
Diphthera alpium Osb.	×	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Arsilonche albovenosa Goeze	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Acronycta leporina L.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *aceris* L.	—	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *megacephala* Fabr.	×	×	×	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	(*)
,, *alni* L.	—	×	×	—	×	×	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	(*)
,, *tridens* Schiff.	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *psi* L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *auricoma* Fabr.	×	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *euphorbiae* Schiff. and f. geogr. *obscura* Ström	×	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *rumicis* L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Craniophora ligustri Fabr.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Euxoa obelisca Hb.	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *nigricans* L. and ab. *rubricans* Esp.	×	×	×	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	*
,, *tritici* L.	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Agrotis ypsilon Rott.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *segetum* Schiff.	?	×	×	×	—	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	* *
,, *clavis* Hufn.	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *exclamationis* L.	—	×	×	—	—	—	×	—	—	×	—	—	×	—	—	—	—	—	—	—	—	* *
,, sp.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Rhyacia baja Fabr.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *augur* Fabr.	—	—	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Eurois prasina Fabr.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *occulta* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Naenia typica L.	×	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Triphaena pronuba L.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Barathra brassicae L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	—	—	—	—	* * *
Scotogramma trifolii Rott.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Polia contigua Schiff.	—	—	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *thalassina* Rott.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *dissimilis* Knoch	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *persicariae* L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *oleracea* L.	×	×	×	—	—	×	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	*
,, *pisi* L.	×	×	×	—	×	×	×	—	—	×	×	×	×	×	—	×	—	—	—	—	—	*
Harmodia rivularis Fabr.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps) (L)	Class
Harmodia compta Schiff.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Aplecta nebulosa Hufn.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Hadena reticulata Vill.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Tholera popularis Fabr.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Monima gothica L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	(*)
,, *stabilis* View.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *pulverulenta* Esp.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *incerta* Hufn.	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *opima* Hb.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *gracilis* Fabr.	×	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Cerapteryx graminis L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	* * *
Cucullia lactucae Schiff.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Brachionycha nubeculosa Esp.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Dasypolia templi Thnbg	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Chloantha solidaginis Hb.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Lithophane socia Rott.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *ornithopus* Rott.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Xylina vetusta Hb.	—	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *exoleta* L.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Eumichtis satura Schiff.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *bathensis* Lutz.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Griposia aprilina L.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Dryobotodes protea Bkh.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Antitype polymita L.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *chi* L.	—	—	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Eupsilia satellitia L.	×	×	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Conistra vaccinii L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Amathes circellaris Hufn.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *helvola* L.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *litura* L.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Cosmia icteritia Hufn.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *citrago* L.	×	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Amphipyra pyramidea L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *tragopogonis* L.	—	—	×	—	—	—	×	×	—	—	—	—	—	×	—	—	—	—	—	—	—	*
Parastichtis monoglypha Hufn.	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *rurea* Fabr.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *lateritia* Hufn.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *obscura* Haw.	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *basilinea* Schiff.	×	×	×	×	×	×	×	×	—	×	×	×	×			—	—	—	—	—	—	* *

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Parastichtis secalis L.	—	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	—	—	* *
Procus strigilis L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *latrunculus* Schiff.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Euplexia lucipara L.	—	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Hoplodrina alsines Brahm	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Xanthoecia flavago Schiff.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Hydroecia micacea Esp.	—	×	×	×	—	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	* *
Calymnia trapezina L.	×	×	×	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Pyrrhia umbra Hufn.	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Panolis flammea Schiff.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Sarothripus revayanus Scop.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *degeneranus* Hb.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Earias chlorana L.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Hylophilina bicolorana Fuessly	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Hylophila prasinana L.	×	—	×	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	(*)
Mormonia sponsa L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Catocala promissa Esp.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *fraxini* L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Gonospileia glyphica L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Phytometra gamma L.	×	×	×	×	—	×	×	×	—	×	×	×	—	×	×	×	—	—	×	—	—	* * *
Polychrysia moneta Fabr.	—	×	×	×	—	—	×	—	—	×	—	—	×	—	—	—	—	—	—	—	—	* *
Scoliopteryx libatrix L.	—	—	—	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	(*)
Herminia derivalis Hb.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Pechipogo barbalis Cl.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Hypena rostralis L.	×	×	×	—	—	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	*
Hemithea aestivaria Hb.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Jodis lactearia L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Cosymbia punctaria L.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Larentia clavaria Hb.	×	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Nothopteryx polycommata Schiff.	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Operophthera fagata Scharffenb.	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *brumata* L.	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	—	—	—	* * *
Oporinia dilutata Schiff.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *christyi* Prt	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *autumnata* Bkh.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Triphosa dubitata L.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Calocalpe cervinalis Sc.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *undulata* L.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Philereme vetulata Schiff.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *transversata* Hufn.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Lygris prunata L.	×	×	×	—	—	—	×	×	—	×	—	—	×	—	—	×	—	—	—	×	—	*
,, *populata* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *mellinata* Fabr.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *pyropata* Hb.	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Cidaria fulvata Forst.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *bicolarata* Hufn.	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	(*)
,, *variata* Schiff.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *truncata* Hufn.	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	(*)
,, *siterata* Hufn.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *miata* L.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *fluctuata* L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *designata* Hufn.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *quadrifasciata* Cl.	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *derivata* Schiff.	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *sagittata* Fabr.	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *corylata* Thnbg	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *hastata* L.	—	—	×	—	—	—	×	×	—	—	—	—	—	—	—	×	—	—	—	—	—	*
Hydrelia testaceata Don.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Eupithecia inturbata Hb.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *exiguata* Hb.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *centaureata* Schiff.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *trisignaria* H.S.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *satyrata* Hb.	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *absinthiata* Cl.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *assimilata* Dbl.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *orphnata* Bohatsch	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *indigata* Hb.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *dodoneata* Gn.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *lariciata* Frr.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *tantillaria* Bsd.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Chloroclystis chloërata Mab.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *rectangulata* L.	×	×	×	×	—	—	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	* *
Abraxas grossulariata L.	×	×	×	×	—	—	×	×	—	—	—	×	—	×	—	—	—	—	—	—	—	*
Lomaspilis marginata L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Bapta temerata Schiff.	—	—	×	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	(*)
Plagodis dolabraria L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Ennomos autumnaria Werneb.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps) (L)	Class
Ennomos fuscantaria Stph.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *erosaria* Schiff.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Selenia bilunaria Esp.	—	—	×	—	—	—	×	—	—	×	—	—	×	—	—	—	—	—	—	—	—	(*)
,, *lunaria* Schiff.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *tetralunaria* Hufn.	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Phalaena syringaria L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Gonodontis bidentata Cl.	×	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Crocallis elinguaria L.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Angerona prunaria L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Opisthograptis luteolata L.	×	—	×	—	×	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Colotois pennaria L.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Semiothisa clathrata L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *wauaria* L.	—	×	×	—	—	—	×	×	×	×	—	×	×	×	×	×	—	—	—	—	—	* *
Erannis aurantiaria Hb.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *defoliaria* Cl.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Phigalia pedaria Fabr.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Lycia hirtaria Cl.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Biston stratarius Hufn.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *betularius* L.	×	×	×	×	—	×	×	×	×	×	×	×	—	—	—	—	—	—	—	—	—	*
Boarmia repandata L.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *roboraria* Schiff.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *punctinalis* Scop.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *bistortata* Goeze	—	—	—	—	—	—	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	(*)
Ematurga atomaria L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Siona lineata Scop.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Nola cucullatella L.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Roeselia strigula Schiff.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Celama confusalis H.S.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Diaphora mendica Cl.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Spilarctia lutea Hufn.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Spilosoma lubricipedum L.	—	×	×	—	—	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Phragmatobia fuliginosa L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Rhyparia purpurata L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*()
Diacrisia sannio L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Arctia caja L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Anthrocera meliloti Esp.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *lonicerae* Schev.	—	×	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Sterrhopteryx standfussi Wocke	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Aegeria apiformis L.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* * *

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Paranthrene tabaniformis Rott.	—	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Bembecia hylaeiformis Lasp.	×	×	×	×	—	×	×	—	—	×	—	—	—	—	—	×	—	—	—	—	—	* * *
Synanthedon tipuliformis Cl.	×	×	×	×	—	×	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	* *
Cossus cossus L.	×	×	×	×	—	×	×	×	—	×	—	×	—	—	—	—	—	—	—	—	—	* *
Hepiolus fusconebulosus DeG.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	*
Crambus tristellus Schiff.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *hortuellus* Hb.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *culmellus* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *pratellus* L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *pascuellus* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Zophodia convolutella Hb.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	×	—	—	—	* * *
Nephopteryx similella Zck.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Dioryctria abietella Schiff.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, sp.	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Acrobasis consociella Hb.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Eurhodope advenella Zck.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Euergestis extimalis Scop.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Mesographe forficalis L.	×	×	×	×	—	×	×	×	×	×	—	×	×	×	×	×	—	—	—	—	—	* *
Pyrausta sambucalis Schiff.	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	(*)
,, *prunalis* Schiff.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Eucnemidophorus rhododactylus Fabr.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Peronea variegana Schiff.	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *aspersana* Hb.	—	—	×	×	—	—	—	×	—	—	—	×	—	—	—	×	—	—	—	—	—	*
,, *ferrugana* Tr.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *fissurana* Pierce	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *holmiana* L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *reticulana* Ström	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *schalleriana* L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Capua reticulana Hb.	—	×	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Cacoecia podana Scop. and var. *sauberiana* Sorh.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Cacoecia xylosteana L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *rosana* L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	—	* * *
,, *lecheana* L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pandemis cinnamomeana Tr.	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *heparana* Schiff.	×	×	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* *

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Pandemis ribeana Hb.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *corylana* Fabr.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Tortrix viridana L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *paleana* Hb.	—	×	×	—	—	—	×	×	—	×	×	×	—	—	—	—	—	—	—	—	—	* *
,, *loeflingiana* L. and f. *ectypana* Hb.	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *forskaleana* L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *bergmanniana* L.	—	×	×	×	—	×	×	×	×	—	×	—	—	×	—	×	—	—	—	—	—	* * *
,, *ministrana* L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	*
,, *politana* Haw.	—	—	×	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	(*)
Cnephasia virgaureana Tr.	—	×	×	×	—	×	×	×	—	×	×	—	—	×	—	?	—	—	—	—	—	* * *
Exapate congelatella Cl.	×	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Spilonota ocellana Fabr.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Acroclita naevana Hb.	—	×	×	×	×	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Ancylis mitterbacheriana Schiff.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Gypsonoma sociana Haw	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Notocelia rosaecolana Dbld.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *roborana* Tr.	×	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Eucosma stroemiana Thnbg	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *cynosbatella* L.	—	—	×	×	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	* *
Argyroploce pruniana Hb.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *variegana* Hb.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	—	—	—	—	* * *
,, *siderana* Tr.	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *urticana* Hb.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Laspeyresia pomonella L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	* * *
,, *woeberiana* Schiff.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *funebrana* Tr.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *nigricana* Fabr.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	* * *
Pammene gallicolana Zell.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *juliana* Curt.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Simaethis pariana Cl.	×	×	×	×	×	×	×	×	—	—	—	—	—	—	—	×	—	—	—	—	—	* *
Cheimophila salicella Hb.	—	×	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Depressaria heracliana DeG.	×	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Argolamprotes micella Schiff.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Stenolechia gemmella L.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Recurvaria leucatella Cl.	—	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Taygete mouffetella Schiff.	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Gelechia rhombella Schiff.	—	—	×	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Blastodacna atra Haw. f. *putripennella* Zell.	×	×	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	* *
Coleophora laricella Hb.	—	×	×	—	×	—	×	—	×	—	×	—	×	—	—	—	—	—	—	—	—	* * *
,, *deauratella* Zell.	×	×	×	×	—	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	* *
,, *siccifolia* Stt.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *serratella* L.	×	×	×	×	×	—	×	—	×	—	×	—	—	—	—	—	—	—	—	—	—	* *
,, *hemerobiella* Scop.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Caloptilia azaleella Brandts	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *semifascia* Haw.	—	—	—	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *syringella* Fabr.	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	—	—	—	* * *
Callisto denticulella Thnbg	—	×	×	×	—	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	* *
Lithocolletis cramerella Fabr.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *quercifoliella* Zell.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *cerasicolella* H.S.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *concomitella* Bankes	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, sp.	—	×	—	×	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	(*)
Phyllocnistis suffusella Zell.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Leucoptera laburnella Stt.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *scitella* Zell.	×	×	×	×	—	—	×	—	—	×	—	×	—	—	—	—	—	—	—	—	—	*
Lyonetia clerckella L.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *prunifoliella* Hb.	—	?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Tischeria ekebladella Bjerk.	×	×	×	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—	* *
,, *dodonea* Stt.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Epermenia chaerophyllella Goeze.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Prays fraxinellus Bjerk.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Hyponomeuta irrorellus Hb.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *malinellus* Zell.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	—	* * *
,, *cognatellus* Hb.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Swammerdamia lutarea Haw.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Nordmaniana ribesiella Joann.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Argyresthia conjugella Zell.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	* * *
,, *pruniella* L.	×	×	×	×	—	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	* * *
,, *cornella* Fabr.	—	—	×	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Cerostoma radiatellum Don.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *parenthesellum* L.	—	×	×	—	—	—	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	(*)
,, *lucellum* Fabr.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *asperellum* L.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *scabrellum* L.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *xylostellum* L.	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *

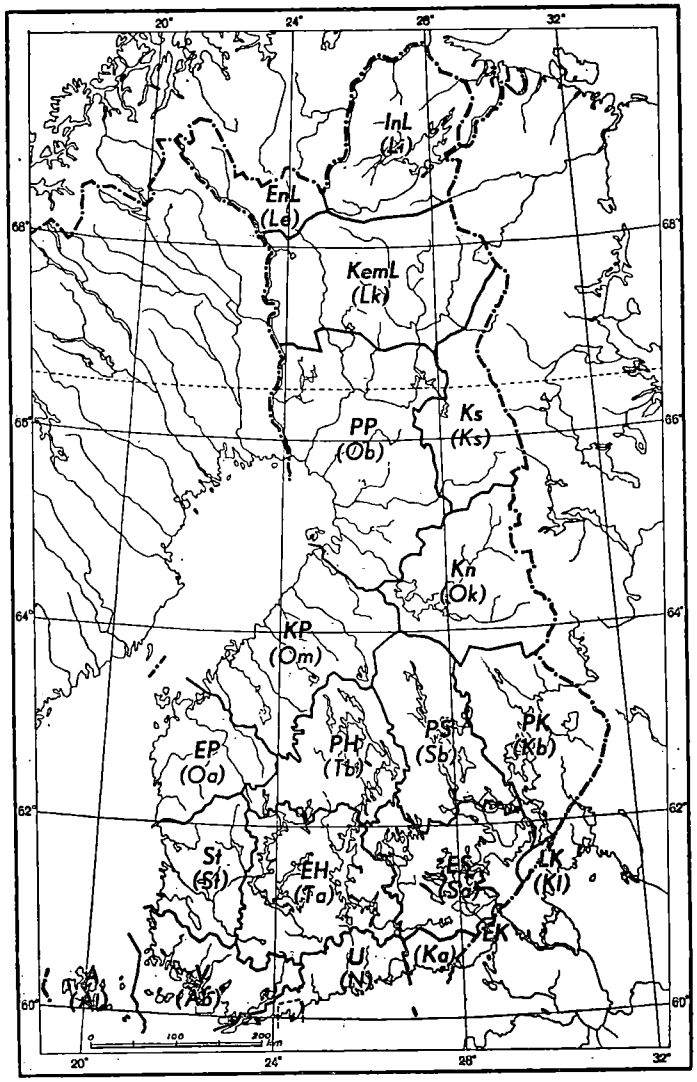
	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Plutella porrectella L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *maculipennis* Curt.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	* * *
,, *annulatella* Curt.	—	—	×	—	—	—	×	—	—	—	—	—	—	?	—	?	—	—	—	—	—	*
Ochsenheimeria taurella Schiff.	—	×	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	(*)
Incurvaria trimaculella H.S. subsp. *quadrimaculella* Höfn.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	*
Incurvaria rubiella Bjerk.	—	×	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *capitella* Cl.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	* * *
,, *pectinea* Haw.	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Heliozela sericiella Haw.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Nepticula pomella Vaugh.	—	—	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *aëneella* Hein.	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *atricapitella* Haw.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *oxyacanthella* Stt.	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *ulmivora* Fol.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *ulmicola* Her.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *marginicolella* Stt.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *subbimaculella* Haw.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *pulverosella* Stt.	—	—	×	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Eriocrania subpurpurella Haw. subsp. *fastuosella* Zell.	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Myriopoda																						
Polydesmus complanatus L.	—	—	×	—	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	*
Orthomorpha gracilis C. L. Koch	—	—	×	—	—	×	—	—	—	—	×	—	—	×	×	—	—	—	—	—	—	* *
Nopoiulus venustus Meinert	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Cylindroiulus frisius Verh.	—	—	×	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	* *
,, *britannicus* Verh.	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
?Pachymerium ferrugineum C. L. Koch	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Myriopoda	—	—	×	—	—	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	
Arachnoidea																						
Bryobia praetiosa Koch	—	×	×	×	—	—	×	×	—	×	×	—	—	×	×	×	—	—	—	—	—	* *
Tetranychus urticae Koch	—	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	?	—	—	—	* * *
Eotetranychus tiliarium Hermann	×	—	×	×	—	—	×	×	—	×	×	×	—	—	—	—	—	—	—	—	—	* * *
Paratetranychus ununguis Jac.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Metatetranychus ulmi Koch	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	—	—	—	—	* * *
Tenuipalpus cactorum Oud.	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	(*)

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Tenuipalpus sp.	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Tarsonemus culmicola E. Reut.	—	×	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	* * *
,, *pallidus* Banks	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	* * *
,, *laticeps* Halbert	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Siteroptes graminum E. Reut.	—	×	×	—	—	—	×	—	—	×	—	×	—	—	?	—	—	—	—	—	—	* * *
Scheloribates laevigatus C. L. Koch	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Uropoda obnoxia E. Reut.	—	×	×	×	×	—	×	×	—	×	—	—	×	—	×	—	—	—	—	—	—	*
Rhizoglyphus echinopus Fum.& Rob.	×	×	×	×	—	×	×	×	×	×	×	×	—	×	—	×	—	—	—	—	—	* * *
Eriophyes aroniae Can.	×	×	—	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *dianthi* Lindroth (Liro)	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *fraxinivorus* Nal.	×	—	×	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *lateannulatus* Schulze	×	×	×	×	×	×	×	×	×	—	×	×	—	—	—	—	—	—	—	—	—	*
,, *mali* Nal.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *multistriatus* Nal.	—	×	×	×	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *platanoideus* Nal.	×	×	×	×	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *saalasii* Liro	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *tenuis* Nal.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *tiliae-nervalis* Nal.	×	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *tulipae* Keifer	—	—	×	—	—	×	×	—	—	—	×	×	—	×	×	×	—	—	—	—	—	*
,, *exilis* Nal.	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *goniothorax* Nal.	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *gracilis* Nal.	×	×	×	—	—	×	×	—	—	—	—	?	—	—	—	—	—	—	—	—	—	* *
,, *leiosoma* Nal.	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	×	—	—	—	—	—	* *
,, *malinus* Nal.	×	×	×	×	—	×	×	×	×	?	×	×	—	—	—	—	—	—	—	—	—	* *
,, *pyri* Pgst.	×	×	×	×	×	×	×	×	—	—	×	—	×	—	—	—	—	—	—	—	—	* * *
,, *similis* Nal.	×	×	×	×	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	* * *
,, *similis* Nal. var. *prunispinosae* Nal.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *ribis* Nal.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	×	—	—	—	* * *
Phytoptus avellanae Nal.	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *tetratrichus* Nal.	×	×	×	×	×	×	×	—	—	—	—	—	—	—	×	—	—	—	—	—	—	*
Phyllocoptes fockeui Nal.& Trouessart	×	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Phyllocoptes magnolivora Keifer	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
,, *schlechtendali* Nal.	×	×	×	×	×	×	×	×	×	×	×	—	—	×	—	×	—	—	—	—	—	* *
,, *violae* Nal.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Epitrimerus pyri Nal.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Anthocoptes ribis Massee	—	—	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Oxypleurites carinatus Nal.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Nalepella triceras C.B.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Crustacea																						
Oniscus asellus L.	—	—	×	—	—	?	×	?	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Porcellio scaber Latr.	—	—	×	×	×	?	×	?	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Armadillidium vulgare Latr.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Mollusca																						
Deroceras agreste L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	* * *
,, *reticulatum* Müll.																						* * *
Limax laevis Müll.	—	—	×	—	—	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	* *
Arion circumscriptus Johnst.	—	×	—	—	—	—	×	—	—	×	—	—	—	×	—	—	—	—	—	—	—	* * *
Fruticicola hispida L.	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Succinea putris L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Arianta arbustorum L.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Oxychilus alliarius Müll., *O.* sp.	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
?Retinella sp.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Vermes																						
Ditylenchus radicicola Greeff	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	×	—	—	—	* * *
,, *dipsaci* Kühn	×	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Aphelenchoides fragariae Ritz. Bos	—	—	×	—	—	×	×	—	—	—	—	—	—	×	—	—	—	—	—	—	—	* *
,, *ritzemabosi* Schw.	—	—	×	—	—	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	* *
Heterodera rostochiensis Woll.	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *schachtii* Schm.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Meloidogyne sp.	—	×	×	×	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Enchytraeidae	—	?	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Aves																						
Corvus corone L.	—	×	×	×	—	×	×	×	×	×	—	—	×	×	—	×	—	—	—	—	—	* *
,, *frugilegus* L.	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
,, *monedula* L.	—	×	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pica pica L.	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	*
Nucifraga caryocatactes L.	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Garrulus glandarius L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Sturnus vulgaris L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Chloris chloris L.	—	×	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Carduelis cannabina L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Carduelis carduelis L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *spinus* L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Pyrrhula pyrrhula L.	—	—	—	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Fringilla coelebs L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Passer domesticus L.	—	×	×	—	—	×	×	—	—	—	×	—	—	×	—	×	—	—	—	—	—	* * *
Emberiza citrinella L.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Phylloscopus trochilus L.	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Sylvia borin Bodd.	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
,, *communis* Lath.	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
,, *curruca* L.	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Turdus pilaris L.	—	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	* * *
,, *ericetorum* Turton	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *musicus* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *merula* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Phoenicurus phoenicurus L.	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	*
Dendrocopos major L.	—	×	×	—	—	—	×	—	—	—	×	—	—	—	—	—	—	—	—	—	—	*
Anas platyrhynchos L.	—	—	—	—	×	×	—	—	—	×	—	—	—	×	—	×	—	—	—	—	—	*
Columba palumbus L.	—	—	×	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	* *
,, *oenas* L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
,, *livia* Gm.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Grus grus L.	—	—	—	—	—	—	×	—	—	×	—	—	—	×	—	—	—	—	—	—	—	*
Lyrurus tetrix L.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Tetrastes bonasia L.	—	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Mammalia																						
Talpa europaea L.	—	—	×	?	?	×	×	×	×	—	—	—	—	—	—	—	—	—	—	—	—	* *
Erinaceus europaeus L.	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Meles meles L.	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	(*)
Lepus timidus L.	×	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	—	—	—	—	—	*
,, *europaeus* Pall.																						* * *
Rattus norvegicus Erxl.	—	×	×	—	—	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	*
Mus musculus L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* *
Micromys minutus Pall.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	×	—	—	—	—	—	* *
Apodemus flavicollis Melch.	—	—	×	—	—	×	—	—	—	×	×	—	—	×	—	—	—	—	—	—	—	*
,, *agrarius* Pall.	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Lemmus lemmus L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	×	×	—	—	*
Clethrionomys glareolus Schreb.	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	*
,, *rutilus* Pall.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	*
,, *rufocanus* Sund.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	*

	A	V	U	EK	(Kk)	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	Kem L	En L	In L	(Ps L)	Class
Microtus agrestis L.	×	×	×	×	×	×	×	×	×	×	×	×	×	—	—	×	—	×	×	?	—	* * *
,, *arvalis* Pall.	—	—	×	—	×	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	* * *
,, *ratticeps* Keys.& Blas.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*
Arvicola terrestris L.	—	×	×	×	—	×	×	×	×	×	—	—	×	×	—	?	—	—	×	—	—	* * *
Ondatra zibethica L.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	*
Sciurus vulgaris L.	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Alces alces L.	—	×	×	×	—	×	×	×	—	×	×	×	×	×	—	×	×	—	—	—	—	* * *
Odocoileus virginianus Bodd.	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(*)
Ursus arctos L.	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	(*)



Biogeographical provinces of Finland

(Finnish Zoological-Botanical Society 'Vanamo')

A	Ahvenanmaa	LK	Ladoga Carelia	PP	North Ostrobothnia
V	Finland Proper	EP	South Ostrobothnia	Ks	Kuusamo
U	Uusimaa	PH	North Häme	KemL	Kemi Lapland
EK	South Carelia	PS	North Savo	EnL	Enontekiö Lapland
St	Satakunta	PK	North Carelia	InL	Inari Lapland
EH	South Häme	KP	Central Ostrobothnia		
ES	South Savo	Kn	Kainuu		

SUOMEN VILJELYKASVIEN TUHOELÄINLAJISTO

Selostus

Julkaisu on ilmestynyt suomenkielisenä Maatalouden tutkimuskeskuksen aikakauskirjan (Annales Agriculturae Fenniae) vol. 1, 1962, lisävihkona (Supplementum 1).

ADDITIONS

CEREALS

Leafhoppers (*Hemiptera*). *Calligypona sordidula* STÅL and *Dicranotropis hamata* BOH., as virus vectors on oats, barley and wheat, as well as on many grasses (P. NUORTEVA, Ann. Zool. Soc. 'Vanamo' 23, 4: 19—20; IKÄHEIMO and RAATIKAINEN, Ann. Agric. Fenn. 2: 153—158; RAATIKAINEN and VASARAINEN, Ann. Agric. Fenn. 3: 311—323).

FRUIT TREES

Moths (*Lepidoptera*). *Lithocolletis cydoniella* FREY, on apple trees at Tikkurila (U) in 1963 (Vappula).

Worms (*Vermes*). *Pratylenchus penetrans* COBB, considerable damage in an apple tree nursery at Tenhola (V) in 1962 (O. Roivainen).

BERRY BUSHES

Sawflies (*Hymenoptera*). *Priophorus tristis* ZADD., on raspberry at Tikkurila (U) in 1964 (Rautapää).

Mites (*Acarina*). *Phyllocoptes masseei* NAL., on currants in south and central Finland (LIRO and ROIVAINEN, Animalia Fennica 6: 189).

ORNAMENTAL SHRUBS

Moths (*Lepidoptera*). *Nepticula gratiosella* STT., on hawthorn at Maarianhamina and Jomala (A) in 1945—1946 (NORDMAN, Not. Ent. 26: 120).

Worms (*Vermes*). *Pratylenchus penetrans* COBB, considerable damage on hawthorn at Vanaja (EH) in 1963 (O. Roivainen).

ORNAMENTAL TREES

Aphids (*Hemiptera*). *Periphyllus villosus* HTG, on *Acer platanoides* at Masku (V) in 1962 (THUNEBERG, Ann. Ent. Fenn. 29: 131); *Pterocomma steinheili* MORDW., on *Salix alba* at Janakkala (EH) (HEIKINHEIMO, Ann. Ent. Fenn. 29: 186); *Liosomaphis abietina* WALK., on *Picea obovata* and *P. glauca* at Elimäki (U) in 1963 (HEIKINHEIMO, Ann. Ent. Fenn. 29: 285).

Sawflies (*Hymenoptera*). *Pontania leucaspis* TISCHB., on *Salix fragilis*, and *P. proxima* LEP., on *Salix alba* and *S. fragilis* at Hamina (EK) (TIENSUU, Kymenlaakson Luonto 4: 25); *Platycampus duplex* LEP., adults found in larch stands at Raivola (Kk), Punkaharju (ES) and Parainen (V) (KANGAS, Ann. Ent. Fenn. 8: 221—223); *Pristiphora pallidula* KNW, on larch at Pälkäne (EH) (KONTUNIEMI, Ann. Ent. Fenn. 29: 70).

True flies (*Diptera*). *Didymomyia reaumuriana* F. Lw (*Oligotrophus reaumurianus* F. Lw), galls on linden at Lohja (V) in 1923 (FREY, Not. Ent. 3: 127—128).

Moths (*Lepidoptera*). *Crobylophora inquinatana* HB., in maple fruits at Ruissalo (V) in 1950 (BRUUN, Not. Ent. 31: 128); *Lithocolletis tristrigella* Haw., on elm at Jomala (A) (NORDMAN, Not. Ent. 29: 62); *L. joannisi* LE MARCH, on maple at Urjala (EH) (VIRAMO, Lounais-Hämeen Luonto 15: 54); *Nepticula samiatella* H. S., on oak at Eckerö (A) (WASELIUS, Not. Ent. 26: 119; 27: 22); *N. ?quercifoliae* TOLL, on oak at Ruissalo (V) (BRUUN, Ann. Ent. Fenn. 18: 54); *Acrocercops brogniardella* FABR., on oak at Ruissalo (V) (BRUUN, Ann. Ent. Fenn. 16: 138).

GREENHOUSE PLANTS

Aphids (*Hemiptera*). *Acyrthosiphon malvae* MOSL. subsp. *rogersii* THEOB., on strawberry (*Fragaria hybrida*, cult.) grown in a glasshouse at Tikkurila (U) in 1962 (HEIKINHEIMO, Ann. Ent. Fenn. 29: 188).

Moths (*Lepidoptera*). *Agonopteryx costosa* Haw., possibly on *Cytisus laburnum*, grown as a house plant (E. SUOMALAINEN, Luonnon Ystävä 39: 132).

Worms (*Vermes*). *Paratylenchus* sp., in carnations at Hyvinkää (U) in 1963 (O. Roivainen).

INDEX