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# OCCURRENCE AND CONTROL OF APHIDS CAUSING DAMAGE TO CEREALS IN FINLAND IN 1959

BY

MIKKO RAATIKAINEN AND AULIS TINNILÄ

AGRICULTURAL RESEARCH CENTRE
DEPARTMENT OF PEST INVESTIGATION
TIKKURILA, FINLAND

*SELOSTUS*

*KIRVOJEN VILJOISSA AIHEUTTAMAT TUHOT JA NIIDEN TORJUNTA SUOMESSA VUONNA 1959*

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## Introduction

In Finland in 1959 aphids occurred very abundantly and injuriously on spring cereals, and to some extent on winter cereals, too. To investigate the abundance of the aphids and the resultant losses in yield, the Department of Pest Investigation sent an inquiry by letter in November and December 1959 to the agricultural advisers of Maatalousseurojen Keskusliitto (The Central Association of Agricultural Societies) and of Svenska Lantbrukssällskapens i Finland Förbund (The Central Association of Swedish Agricultural Societies in Finland). To ascertain the extent of control work and yield losses the Department of Pest Investigation sent the averages calculated on the basis of this inquiry to the crop farming specialists of agricultural societies, asking for their opinions on these figures. The data presented here are based on information from all the persons mentioned above and on investigations carried out by the Department of Pest Investigation.

Some of the results of the inquiry have been published earlier (inter alia Kanervo 1960 and Vappula 1960).

## I. Aphids damaging cereals

Three aphid species damaging cereals are known in Finland at present: *Rhopalosiphum padi* (L.), *Metopolophium dirhodum* (Walk.), and *Macrosiphum (Sitobium) avenae* (F.) s. H. R. L.

*Rhopalosiphum padi* hibernates on bird-cherry *(Prunus padus)*. The secondary host plants are mainly gramineous plants and, to some extent, certain sedges *(Carex)* and *Juncus bufonius* (Ossiannilsson 1959, p. 413). According to the observations made at Laihia, some of the aphids can remain on young shoots for the summer months. *R. padi* is distributed all over Finland. The northernmost place where it has been found is at Muddusniemi, in Inl Inari (verbal statement by M. Markkula 1959).

According to the data in the archives of the Department of Pest Investigation *R. padi* occurred abundantly in Finland in the years 1926, 1947, 1954 and 1959.

The primary host plants of *Metopolophium dirhodum* are roses *(Rosa)*. The secondary host plants are gramineous plants (OSSIANNILSSON 1959, p. 487). Its distribution in Finland is incompletely known. Places of occurrence known at present are: U Tikkurila, on oats; EP Sulva, on oats; Mustasaari, on oats; and Laihia, on oats and wheat. There is no knowledge about the occurrence of the species before the year 1959. All the findings mentioned above were made in 1959 by Mr. O. Heikinheimo.

*Macrosiphum avenae* is monoecious and lives on gramineous plants and sedges *(Carex)* (OSSIANNILSSON 1959, p. 493). It is spread all over Finland. The northernmost place in which it has been found is Inl Inari.

*M. avenae* has often caused damage to cereals in Finland. According to the data in the archives of the Department of Pest Investigation, it has occurred most abundantly in the years 1915, 1917, 1920 (in North Finland), 1930, 1946—1948 and in 1952.

The damage that occurred in 1959 was almost entirely due to *R. padi*. As far as is known, *M. dirhodum* only appeared in considerable numbers in a very limited area in South Pohjanmaa (S. Ostrobothnia). It seems that *M. avenae* occurred rather abundantly, but, so far as is known, it did not inflict any considerable damage.

It has been established that all the aphid species mentioned above spread virus diseases. In Finland *R. padi* is so far the only species which has been proved with certainty to be a transmitter of *Cereal yellow dwarf virus* (IKÄHEIMO 1960). For the present there is very little information regarding the distribution and abundance of this virus disease.

## II. Migration of Rhopalosiphum padi in 1959

The spring of 1959 was, on the whole, earlier than usual. The main temperature in May—June was also higher than that of the years 1921—1950. Thus at Tikkurila the hatching of the winter eggs of *R. padi* began by about the end of April — beginning of May (KANERVO 1960).

The time of migration of *R. padi* from bird-cherries to gramineous plants was ascertained in the following way, with the help of a netting apparatus (Fig. 1). The diameter of the net was 100 cm, and its median part was 200 cm above the ground surface. The net bag, which was of nylon tulle, moved in the direction of the wind. Aphids migrating in the same direction as that in which the wind was blowing were caught in the net bag. The net was emptied between 8—9 o'clock in the evening. Only a minor number of the aphids caught in the net bag seemed to escape from it. On a windy day more air passed through the net bag, bringing a greater number of aphids

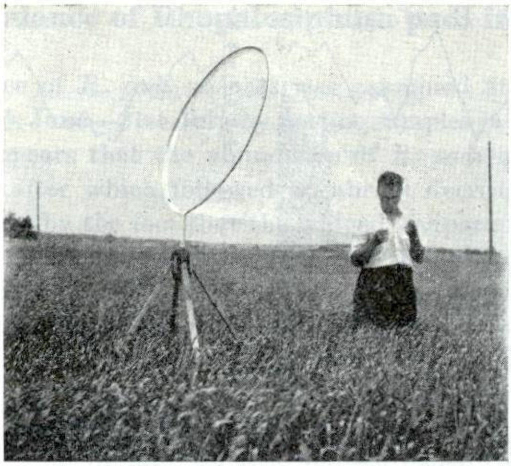

Figure 1. Netting apparatus used to investigate the migration of aphids. — Photo by O. Heikinheimo.

*Kuva 1. Haavilaite, jota käytettiin kirvojen muuton tutkimisessa. Valok. O. Heikinheimo.*

with it than in calm weather. Attempts were made to set up the nets in sufficiently open places, so that the velocity of the wind was great enough to hold them open and in the right direction.

The nets were placed on timothy leys at Pälkäne (at the Häme Agricultural Experiment Station, about 61°20'N 24°10'E), at Mustasaari (at Landmannaskolan, about 63°N, 21°40'E), at Laihia (at the field laboratory of the Department of Pest Investigation, about 63°N, 22°E) and at Ylistaro (at the South Ostrobothnia Agricultural Experiment Station, about 63°N, 22°30'E). Only the results obtained from the nets at Pälkäne and Laihia have been taken into consideration here (Figs. 2 and 3). Observations were made at Pälkäne during the period 19. V—10. VII and at Laihia from 25. V—17. VII. Samples collected from other nets were examined as random samples only, and the results obtained from them support the results presented here.

The first migrating *R. padi* aphids were observed at Pälkäne on the 31st May and at Laihia on the 5th June. During the entire period of observation the migration of *R. padi* seems to have been slightly earlier at Pälkäne than at Laihia. Aphids migrating in June moved from bird-cherries to gramineous plants and aphids migrating in July evidently moved from gramineous plants to other gramineous plants. 73 and 37 per cent of all aphids caught at Pälkäne and at Laihia respectively belonged to the species *R. padi*.

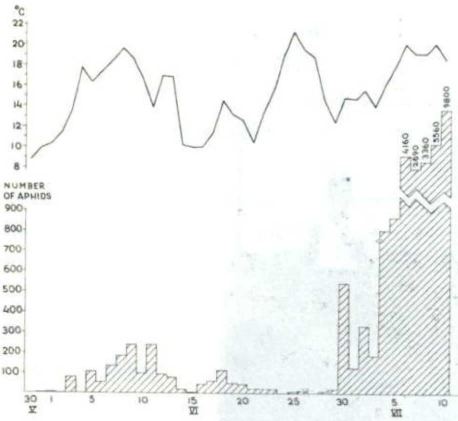

Figure 2. Migration of the daily catches of *Rhopalosiphum padi* made at Pälkäne during the period 30th May—10th July 1959. The total number of specimens is 30 200. The daily mean temperature is shown by a continuous line. — Orig.

*Kuva 2. Tuomikirvan (Rhopalosiphum padi) muutto 30. V—10. VII 1959 välisenä aikana Pälkäneellä. Koko yksilömäärä 30 200 kpl. Yhtenäisellä viivalla on merkitty vuorokautinen keskilämpötila.*

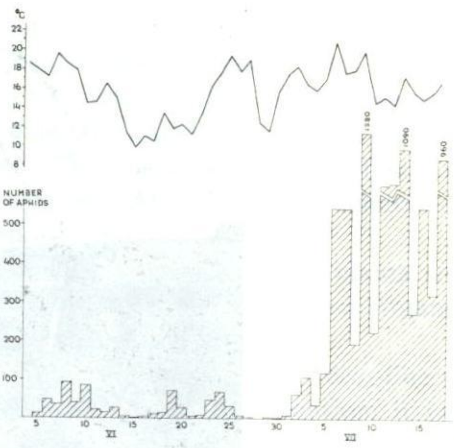

Figure 3. Migration of the daily catches of *Rhopalosiphum padi* at Laihia during the period 5th June—17th July 1959. The total number of specimens is 8 250. The daily mean temperature is shown by a continuous line. — Orig.

*Kuva 3. Tuomikirvan (Rhopalosiphum padi) muutto 5. VI—17. VII 1959 välisenä aikana Laihialla. Koko yksilömäärä 8 250 kpl. Yhtenäisellä viivalla on merkitty vuorokautinen keskilämpötila.*

By comparing the number of migrating *R. padi* and the daily temperatures with each other it can be ascertained that the warmer the weather is the more actively the *R. padi* aphids migrate. Migration was observed even when the average temperature was only 9.8°C and the maximum temperature 12.3°C. Thomas and Vevai (1940, pp. 400—401) have established migration of *R. padi* when the temperature was below 60°F (= about 16°C). The division of the migration taking place in June into two phases, and even partly into three phases at Laihia, may mainly depend on the changes in weather. It can also be partly caused by the fact that the aphids of the first and second phase of migration are, to some extent, specimens of different generations which move at different times.

According to Rogerson (1940, p. 163), in the British Isles the majority of *R. padi* have migrated to gramineous plants by the end of June. At Rothamsted, near London, Johnson and Eastop (1951, p. 19 and 21) investigated the migration of *R. padi* during the time between July—November. In their material *R. padi* appears during almost the entire period of observation, but was found least in August.

# III. The abundance of Rhopalosiphum padi in cereals in 1959

The abundance of *R. padi* on oats was examined at Laihia during the time between 12th June—31st July by netting samples (à 60 sweeps) (Fig. 4). From these it appears that the abundance of *R. padi* increased up to the middle of June, after which followed an abrupt decrease. This may have been caused chiefly by the fact that the winged viviparous females migrated away from the cereals ripened by aphids and drought (cf. Figs 3 and 5). Simultaneously the natural enemies of *R. padi*, especially *Coccinella septempunctata* L. (Fig. 4) and parasitic hymenoptera, had increased so greatly that they almost totally destroyed the aphids.

The time of occurrence of *R. padi* seems to have been rather similar everywhere in Finland. In some places the infestation had already reached its peak before the middle of July, whereas in other places the peak was reached later (cf. KANERVO 1960, p. 197).

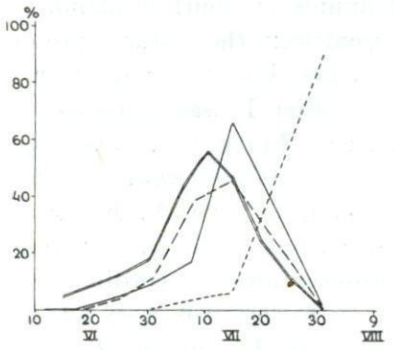


Figure 4. Weekly abundance of *Rhopalosiphum padi* (continuous line), *Metopolophium dirhodum* (broken line) and *Coccinellidae* (dotted line), based on netting samples (à 60 sweeps) in oats at Laihia in 1959. The total number of *R. padi* is 2 600, of *M. dirhodum* 12 900, and of *Coccinellidae* 67. The time of control treatment against *R. padi* is marked with a double line. — Orig.

*Kuva 4. Tuomikirvan (yhtenäinen viiva), elokirvan (katkoviiva), leppäpirkkojen (pisteviiva) viikoittainen runsaus haavintanäytteiden (à 60 haavinvetoa) perusteella kaurassa Laihialla 1959. Tuomikirvoja yhteensä 2 600, elokirvoja 12 900 ja leppäpirkkoja 67 kpl. Kaksinkertaisella viivalla on merkitty tuomikirvan torjuntakäsittelyjen ajankohta.*

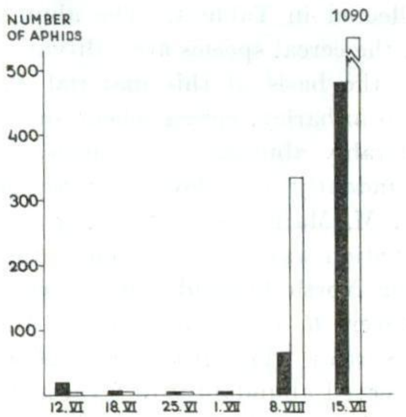


Figure 5. The abundance of winged specimens of *Rhopalosiphum padi* (black columns) and *Metopolophium dirhodum* (white columns), based on netting samples (à 60 sweeps) in oats at Laihia in 1959. — Orig.

*Kuva 5. Tuomikirvan (mustat pylväät) ja elokirvan (valkeat pylväät) siivellisten yksilöiden runsaus haavintanäytteiden (à 60 haavinvetoa) perusteella kaurassa Laihialla 1959.*

Table 1. The abundance of *Rhopalosiphum padi* on the most important cereals in 1959.

*Taulukko 1. Tuomikirvan runsaus tärkeimmissä viljalaeissamme v. 1959. Taulukko on laadittu maatalousneuvojien antamien vastausten perusteella.*

| | Oats *Kaura* | Barley *Ohra* | Spring wheat *Kevätvehnä* | Rye *Ruis* |
|---|---|---|---|---|
| Plenty of aphids — *Kirvoja runsaasti* ............ | 109 | 54 | 15 | 0 |
| Aphids rare — *Kirvoja niukasti* .................. | 36 | 81 | 77 | 27 |
| No aphids observed — *Kirvoja ei havaittu* ........ | 9 | 19 | 62 | 127 |
| Total no. of answers — *Vastauksia yhteensä kpl* ... | 154 | 154 | 154 | 154 |

The cereals on which *R. padi* was found most abundantly were ascertained by sending inquiries to the agricultural advisers. The answers are collected in Table 1. The abundance of aphids in South Finland, where all the cereal species are cultivated, is apparent from the material presented. On the basis of this material *R. padi* was found to occur most in oats, then in barley, spring wheat and rye, in that order. It was found to be considerably abundant in timothy, too. In North Finland *R. padi* occurred abundantly in barley and rarely in oats, according to observations made by Dr. M. Markkula. According to information from Prof. V. Kanervo the situation was rather similar in Central Ostrobothnia. The answers received from North Finland coincide with these observations. According to these answers *R. padi* was observed abundantly on barley in 6 cases and rarely in 8 cases, while in two cases it was not found at all. On oats *R. padi* was observed abundantly in 2 cases, rarely in 6 cases, and in 8 cases it was not found at all. In rye *R. padi* occurred more abundantly in the area in question than in South Finland, according to Dr. M. Markkula. This is also indicated by the answers received from inquiries, but the causes are for the present unclear. Is the *R. padi* of North Finland a race that prefers barley, which is cultivated rather abundantly in this region and in which the aphid reproduces better than in oats, or does the occurrence depend on some other factors, e. g., on the different sowing-time of cereals, etc?

The regional abundance of *R. padi* is presented in Figures 6—9. According to these, the aphid seems to have been most abundant in cereals in Central, South and North Ostrobothnia, in North Carelia, in North Savo, in some localities of East Nylandia, and in Central and North Häme. It was rare in many localities of Finland Proper, in West Nylandia, in the regions of Salpausselkä and Suomenselkä, and in North Finland.

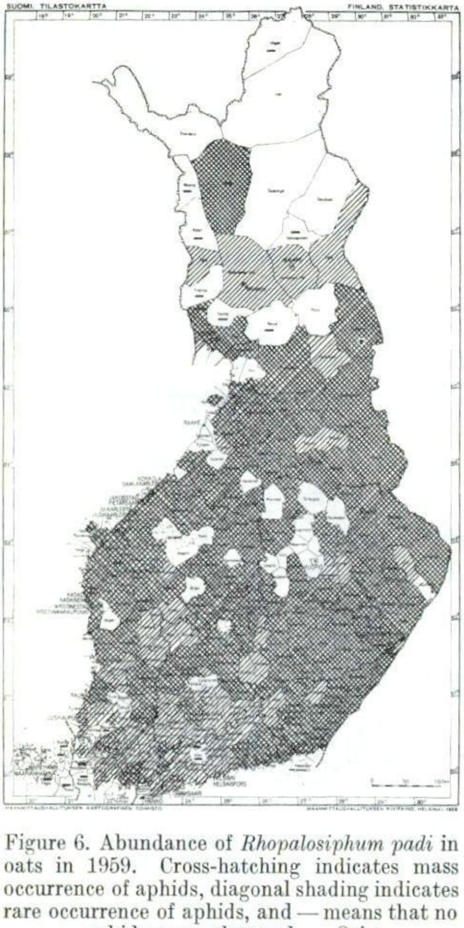


Figure 6. Abundance of *Rhopalosiphum padi* in oats in 1959. Cross-hatching indicates mass occurrence of aphids, diagonal shading indicates rare occurrence of aphids, and — means that no aphids were observed. — Orig.

*Kuva 6. Tuomikirvan runsaus kaurassa 1959. Ristiviivoituksella merkitty kirvojen runsas, vinoviivoituksella niukka esiintyminen — tarkoittaa. ettei kirvoja ole havaittu*

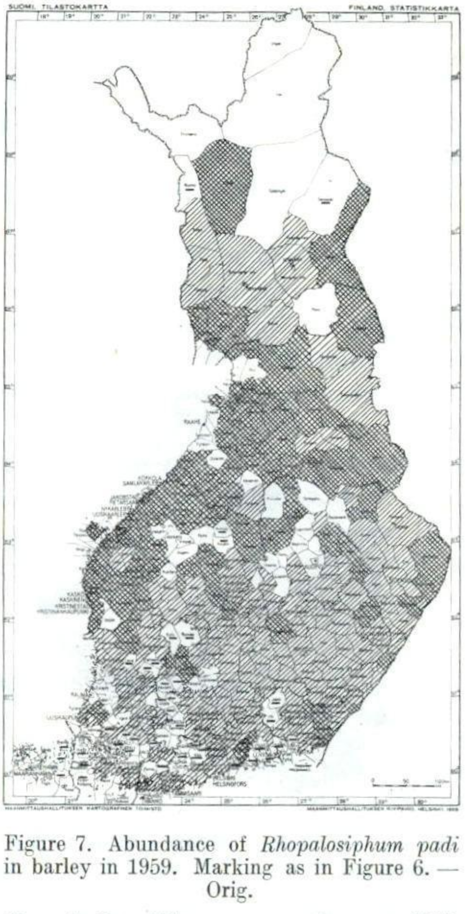


Figure 7. Abundance of *Rhopalosiphum padi* in barley in 1959. Marking as in Figure 6. — Orig.

*Kuva 7. Tuomikirvan runsaus ohrassa v. 1959. Merkkien selitykset kuvassa 6.*

On examining the maps (Figs. 6—9) it appears that *R. padi* was most abundant in fertile regions and rarest in barren regions, e. g., in watershed regions (cf. KUJALA 1951, p. 209). We know that bird-cherry appears most abundantly in fertile areas, but aphids occurred rarely in SW Finland, although this area is one of the most fertile regions of the country. However, the cultivation in this area seems to destroy many bird-cherries, while favouring valuable, broad-leaved southern trees. Such southern trees do not thrive in Central and North Finland, and the bird-cherry consequently flourishes there. It thus seems evident that the abundance of aphids can be explained by the abundance of bird-cherry. The same relationship was

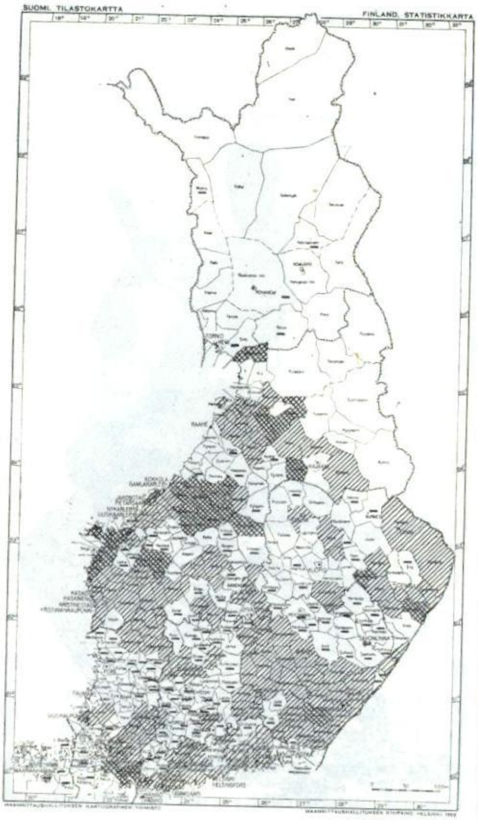


Figure 8. Abundance of *Rhopalosiphum padi* in spring wheat in 1959. Marking as in Figure 6. — Orig.

*Kuva 8. Tuomikirvan runsaus kevätvehnässä v. 1959. Merkkien selitykset kuvassa 6.*

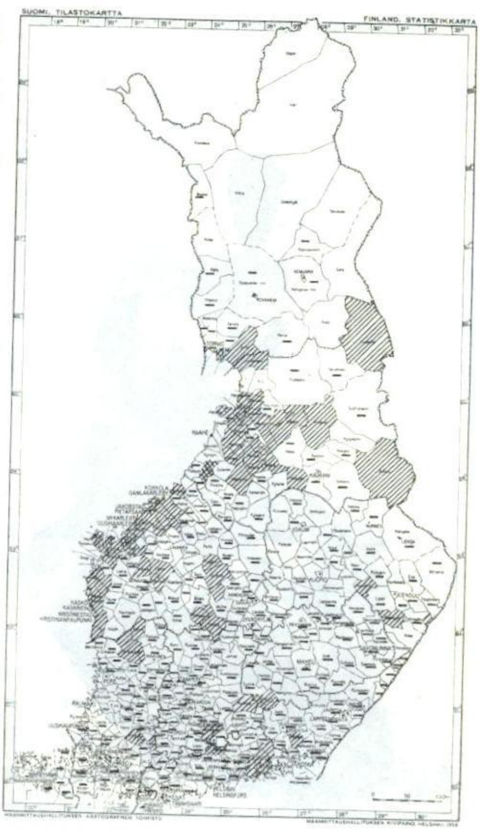


Figure 9. Abundance of *Rhopalosiphum padi* in rye in 1959. Marking as in Figure 6. — Orig.

*Kuva 9. Tuomikirvan runsaus rukiissa v. 1959. Merkkien selitykset kuvassa 6.*

established in England by ROGERSON (1947, p. 168). The ratio of the abundance of bird-cherries to the area of cereal fields does not appear to explain the abundance of *R. padi* in all cases, however. KANERVO (1960, pp. 198—199) assumes that aphids have been carried by air currents, e. g., from Baltic countries, Central Russia and Poland. This assumption is supported, inter alia, by the direction of air currents and abundant insect swarms observed by pilots, mainly at a height of 1 200 m—1 300 m, in some cases at 2 000 m—2 500 m. Unfortunately only a small sample of these insects was obtained and in this sample there were some specimens of the aphid *Euceraphis punctipennis* (Zett.) to be found.

The mass occurrence of *R. padi* was restricted to one year only. In the summer of 1960 it was very rare.

## IV. The abundance of Metopolophium dirhodum in 1959

The occurrence of *Metopolophium dirhodum* on oats (Figures 4 and 5) seems to have been rather simultaneous with that of *R. padi.* The proportion of its winged specimens was also greatest at the beginning of June and again in July. The decrease in its numbers seemed to depend on the same factors as in the case of *R. padi.*

In 1959 *M. dirhodum* was found abundantly only in the commune of Laihia, where it occurred more frequently than *R. padi* in some oat and wheat fields. In the neighbouring communes of Sulva and Mustasaari it occurred generally but not abundantly. According to Mr. O. Heikinheimo it was not observed in Finland Proper, West Nylandia, Satakunta or in Häme, in spite of numerous searches.

There also seems to have been a similar period of mass occurrence of *M. dirhodum* in 1959, which is comparable to the occurrence of *R. padi.* For example, at Laihia the aphid was not found even once in the years 1956—1958 in the regions where it occurred abundantly in 1959.

## V. The control of Rhopalosiphum padi

### 1. *Control substances*

Of the modern control substances it is known that parathion, malathion and systemic phosphorus preparations affect adult aphids quickly and well, whereas DDT and lindane have a slower and poorer effect. Experiments were made in New Zealand in 1958 with methyldemeton, which proved to be rather effective in the control of *R. padi* (CUMBER and TODD 1959), but the results of these experiments had not yet been brought to our knowledge in 1959.

As it was established that the occurrence of *R. padi* in 1959 threatened wide areas as a mass infestation, prompt experiments were carried out by the Department of Pest Investigation to find out effective control substances and the amounts of them required. The main part of the experiments were carried out at Asikkala, in the form of field trials in experimental areas of about 10 ares each. In the experimental oat fields there were generally 10—20 aphids per plant. In some places, in rather small areas, the number increased to 500—1 000 aphids per plant. An almost 100 % effect was found after 1—2 days in the case of treatments with parathion sprays (100 g/hc and 350 g/hc 100 % parathion) and with parathion wettable powders (75 g/hc and 225 g/hc 100 % parathion), with malathion sprays (625 g/hc 100 % malathion), with malathion wettable powders (625 g/hc and 750 g/hc 100 %

malathion), with methyldemeton sprays (500 g/hc 100 % methyldemeton), with chlorthion sprays (750 g/hc 100 % chlorthion), and with malathion dusts (20 kg/hc 4 % malathion). An effect of about 90 % was obtained with chlorthion sprays (500 g/hc 100 % chlorthion), with dipterex dusts (1 200 g/hc 100 % dipterex), and with parathion dusts (20 kg/hc 1.5 % parathion). Combined parathion +DDT and malathion+ DDT dusts and DDT sprays had a rather poor effect. Dipterex dusts (20 kg/hc 5 % dipterex) and toluene sprays (24 l/hc) had no effect on aphids. The results obtained from these experiments were at once reported to the farmers through the press and radio.

### 2. *The performance of control treatments*

#### A. Time of treatment

The farmers began the treatments either as a result of their own observations or on account of warnings given to them by press or radio. The diagram in Figure 4, presenting the time of treatments, is drawn on the basis of the answers from agricultural advisers. Some farmers began the control by the end of June, but the majority of treatments were carried out at the beginning of July and the peak was reached by about the 10th July.

#### B. Control substances

On account of the great demand, retail and wholesale stocks of the most suitable control substances ran out and the producers and importers also found themselves out of supply. Since the demand for plant protection materials over the whole of Europe was greater than normal, in particular because of the mass appearence of aphids and beetflies *(Pegomyia hyoscyami* Panz.), provision of supplementary stores from abroad took its time and therefore it was necessary to use all the control substances available. The consumption figures for the various substances thus do not give a correct picture of the true order of preference.

According to statistics concerning the sale of plant protection materials in the years 1958 and 1959 (Roivainen & Tinnilä 1959, Tinnilä 1960), 274 tons of parathion dusts were used in 1959 (an increase of 153 tons compared with the year 1958), 23 tons of parathion wettable powders (an increase of 21 tons), 24 tons of parathion sprays (an increase of 10 tons), 7 tons of malathion dusts (an increase of 4 tons), 7 tons of malathion sprays (an

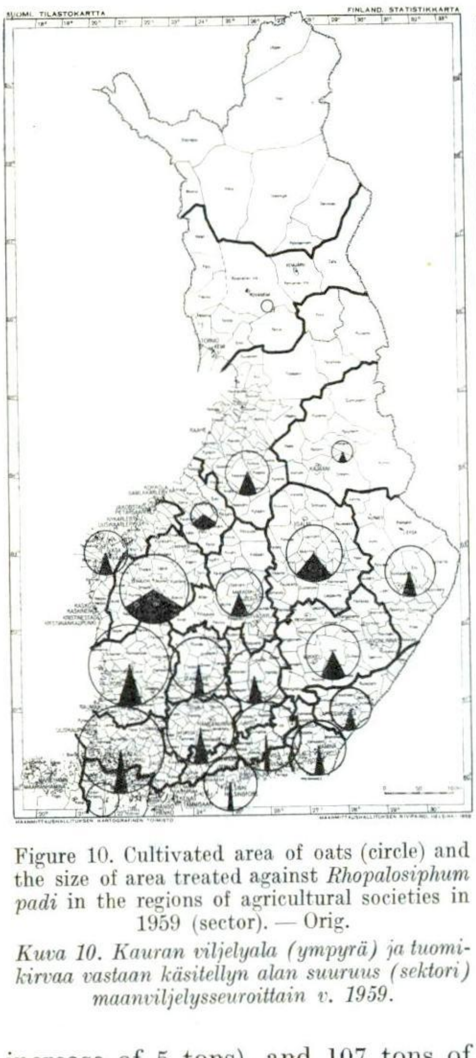


Figure 10. Cultivated area of oats (circle) and the size of area treated against *Rhopalosiphum padi* in the regions of agricultural societies in 1959 (sector). — Orig.

*Kuva 10. Kauran viljelyala (ympyrä) ja tuomikirvaa vastaan käsitellyn alan suuruus (sektori) maanviljelysseuroittain v. 1959.*

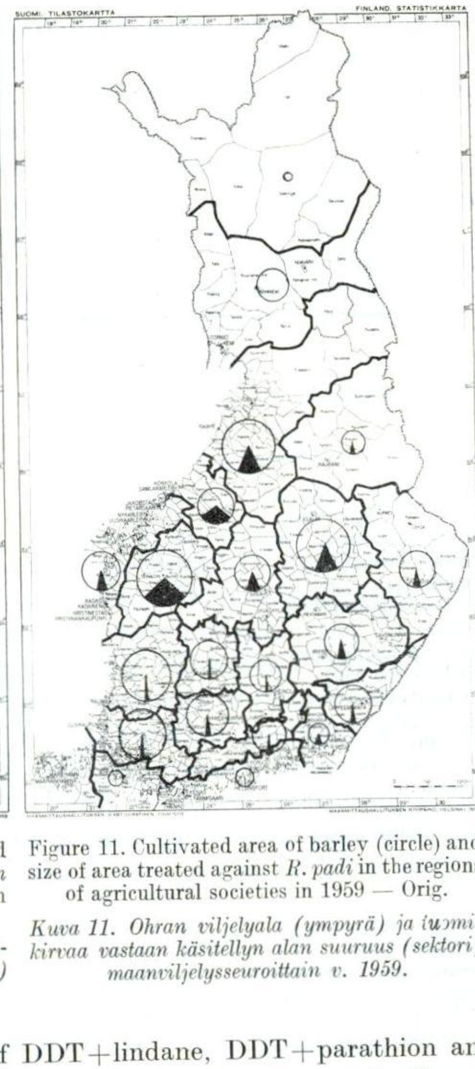


Figure 11. Cultivated area of barley (circle) and size of area treated against *R. padi* in the regions of agricultural societies in 1959 — Orig.

*Kuva 11. Ohran viljelyala (ympyrä) ja tuomikirvaa vastaan käsitellyn alan suuruus (sektori) maanviljelysseuroittain v. 1959.*

increase of 5 tons), and 107 tons of DDT+lindane, DDT+parathion and DDT+malathion dusts (an increase of 46 tons). The increase in the use of control substances in 1959 was mainly due to the mass infestation of *R. padi*, but the occurrence of *Pegomyia hyoscyami*, the bean aphid (*Aphis fabae* Scop.), and the fruit tree red spider mite (*Metatetranychus pilosus* Can. & Panz.) also caused a greater demand for plant protection materials.

When applied according to the instructions the amount of control substances used in 1959 was sufficient to treat an area 70 000 hectares greater than the area treated in 1958. According to the opinion of the authors, 50 000—70 000 hectares of this additional area are attributable to *R. padi* (cf. Table 3).

Table 2. Summary of results of inquiries sent to agricultural advisers (I) and crop farming specialists (II). The values within parentheses were presented by the informer as probably correct values. + = less than 1 % (not taken into consideration in averages). A = Treated area as percentage of cultivated area. B = Yield losses.

*Taulukko 2. Tiivistelmä maatalousneuvojille (I) ja maanviljelysagronomeille (II) lähetetyn tiedustelun tuloksista. Suluissa olevat arvot on ilmoittaja esittänyt todennäköisinä oikeina arvoina. + = alle 1 % (ei ole otettu huomioon keskiarvossa). A = Käsitelty ala % viljelyalasta. B = Satotappio %.*

| Agricultural society *Maanviljelysseura* | Answers to inquiries *Kyselyyn saatuja vastauksia kpl* | Oats — *Kaura* | | | | Barley — *Ohra* | | | | Spring wheat — *Kevätvehnä* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | | B | | A | | B | | A | | B | |
| | | I | II | I | II | I | II | I | II | I | II | I | II |
| Uudenmaan läänin mvs. | 9 | 1 | (1) | 1 | (1) | 1 | (1) | 1 | (1) | + | (+) | 1 | (+) |
| Nylands svenska lbsk. . . | 4 | 3 | | 1 | | — | | + | | — | | + | |
| Varsinais-Suomen mvs. | 18 | 6 | 2 | 6 | 5 | 3 | 1 | 3 | 3 | 1 | (+) | 2 | 1 |
| Finska hushållningss. . . | 4 | — | | 5 | | — | | + | | — | | 3 | |
| Satakunnan mvs. ..... | 8 | 10 | 2 | 8 | | 2 | 0.5 | 1 | | 1 | 0.1 | + | |
| Hämeen-Satakunnan mvs. ............... | 7 | 4 | | 21 | | 1 | | 7 | | — | | 1 | |
| Hämeen läänin mvs. .. | 8 | 5 | (5) | 3 | (3) | 1 | (1) | 1 | (1) | + | (+) | 1 | (1) |
| Itä-Hämeen mvs. ..... | 7 | 9 | | 9 | | + | | 1 | | — | | 1 | |
| Kymenlaakson mvs. ... | 4 | 5 | | 11 | | 8 | | 3 | | + | | 2 | |
| Länsi-Karjalan mvs. .. | 11 | 9 | (9) | 11 | (11) | 3 | | 8 | | 1 | | 1 | |
| Mikkelin läänin mvs. .. | 16 | 16 | (16) | 28 | (28) | 8 | | 9 | | 2 | | 2 | |
| Kuopion mvs. ........ | 11 | 21 | 15 | 21 | 15 | 12 | 5 | 9 | 5 | — | | 1 | |
| Pohjois-Karjalan mvs... | 11 | 9 | | 21 | | 5 | | 9 | | 3 | | 3 | |
| Keski-Suomen mvs. ... | 12 | 10 | 5.5 | 21 | (21) | 10 | 4 | 11 | (11) | 6 | | 6 | |
| Etelä-Pohjanmaan mvs. | 9 | 35 | 22 | 13 | 10 | 31 | 14 | 13 | 6 | 9 | 7 | 2 | 2 |
| Österbottens svenska lbsk. ............... | 4 | 8 | 17 | 18 | 18 | 10 | 17 | 17 | 17 | 2 | | 12 | |
| Keski-Pohjanmaan mvs. | 6 | 33 | 11 | 23 | 11 | 29 | 7 | 16 | 6 | + | | — | |
| Oulun l. Talousseura .. | 25 | 14 | 10 | 19 | 15 | 15 | | 19 | 10 | 9 | | 9 | 10 |
| Kajaanin mvs. ....... | 12 | 10 | | 14 | | 5 | | 10 | | — | | — | |
| Peräpohjolan mvs. .... | 14 | — | | 4 | | — | | 9 | | — | | — | |
| Lapin Maatalousseura .. | 6 | — | | 1 | | — | | 1 | | — | | — | |
| Total — *Yhteensä* | 206 | | | | | | | | | | | | |
| Mean — *Keskim.* | | 11.6 | | 12.3 | | 9.0 | | 7.8 | | 3.8 | | 3.1 | |

## C. The extent of control treatments on different cereal species and in various parts of the country.

The data on the extent of control treatments are based on material obtained from agricultural advisers. The results of the inquiry have been assembled by agricultural societies and the size of the treated areas is compared with the cultivated area of the corresponding cereal species. The results in regard to oats and barley are to be seen in the charts (Figs. 10—11). The numerical values obtained from the inquiry are presented in Tables 2—3.

Table 3. The cultivated areas of oats, barley and spring wheat in 1959, and the areas of control treatments and yield losses in the entire country as compiled from agricultural statistics and from figures received from agricultural advisers.

*Taulukko 3. Yhdistelmä, josta ilmenee kauran, ohran ja kevätvehnän viljelyalat v. 1959, torjuntakäsittelyjen suorittamisalat ja satotappiot koko maassa maataloustilaston ja maatalousneuvojilta saadun tilaston mukaan.*

| Cereal species *Viljalaji* | Cultivated area ha *Viljelyala ha* | Area of control treatments hectares *Torjuntakäsittelyn ala ha* | Percentages area of control *Torjuntakäsittelyn ala %* | Percentage Yield losses *Satotappio %* |
|---|---|---|---|---|
| Oats — *Kaura* | 460 895 | 39 732 | 11.6 | 12.3 |
| Barley — *Ohra* | 232 869 | 25 874 | 9.0 | 7.8 |
| Spring wheat — *Kevätvehnä* | 119 341 | 3 141 | 3.8 | 3.1 |
| Total — *Yhteensä* | | 68 747 | | |

According to the opinion of agricultural advisers, about 12 % of the cultivated area of oats, 9 % of the cultivated area of barley and 4 % of the cultivated area of wheat were treated. Most treatments were undertaken in the areas belonging to the agricultural societies of South and Central Ostrobothnia, Kuopio and Oulu. There were no control treatments in the area belonging to the Polar Circle and Lapland Agricultural Societies, and none in regard to barley and wheat in the region of Nylands svenska lantbrukssällskap (Agricultural Society of Uusimaa). The areas of control treatments as determined from inquiries do not always agree with the estimates given by the crop farming specialists of agricultural societies, as is to be seen in Table 2.

In many localities, the performance of control measures was hindered by the lack of effective control equipment. According to agricultural advisers, there was sufficient equipment in Finland Proper, in South Satakunta and in Nylandia. Where control measures were carried out by tractor sprays the tractor-wheels caused partial damage to the cereals, whereas knapsack combined motor-sprays and dusts proved to be very useful, even in long cereals.

## D. Results obtained by control

Aphids could be almost totally destroyed in cereals by treatments carried out at the beginning of July. It was only in some cases that new treatments were necessary to ensure an effective result. Many agricultural advisers reported that attempts at control with nicotine sprays failed.

The increase of yield obtained by control varied greatly according to the abundance of aphids and time of treatment. In one experiment of the Department of Pest Investigation where aphids occurred very abundantly a 1 000 kg/hectare yield was obtained with one treatment, whereas no yield was obtained from the untreated area. In places where aphids occurred rather rarely, e. g., in the experimental area of North Ostrobothnia, the control gave an increase in yield of about 10 %. The control costs generally amounted to about 1 500—2 500 mk per hectare, which corresponds to an increase of yield of about 100 kg. Control treatments on this basis must generally be regarded as profitable.

Oats damaged by *R. padi* did not always recover, and in such cases they were evidently suffering from virus disease spread by aphids (Ikäheimo 1960). The number of such cases seemed, however, to be small.

The control should evidently have been carried out by the end of June, when the migration of *R. padi* from bird-cherries to gramineous plants had almost entirely ceased. During this time there were no winged generations on grasses. By the time the winged individuals had appeared and had moved from the grasses in July, the cereals had had time to grow so long that the aphids that migrated there were unable to inflict great damage. In addition, the natural enemies of *R. padi*, especially the *Coccinellidae*, had then increased in number and were able to restrict considerably the increase of the aphid populations.

## VI. Yield losses caused by aphids

The estimation of yield losses carried out by agricultural advisers was also very difficult, because damage was not only caused by *R. padi*, but also by drought (especially in Finland Proper and Satakunta) and by frost (especially in South and Central Ostrobothnia and in the Oulu region). In some localities all these factors reduced the yields. Yields losses determined on the basis of inquiry are presented in Table 3, and with them are the estimates given by the crop farming specialists of the agricultural societies.

According to the agricultural advisers the average yield loss in oats was about 12 %; in barley it was about 8 % and in wheat about 3 %. The worst damage (Fig. 12) occurred in the area belonging to the Mikkeli Province Agricultural Society (28 %). The yield losses were over 20 % in the regions of the agricultural societies of Häme—Satakunta, Kuopio, North Carelia, Central Finland and Central Ostrobothnia. The yield losses of barley were over 10 % in the South and Central Ostrobothnia, Kuopio and Oulu regions. No yield losses caused by aphids were observed in rye.

The estimates given by crop farming specialists regarding the order of the areas according to the extent of damage coincided with the facts given above, whereas the percentages of yield losses varied noticeably. The percentage of

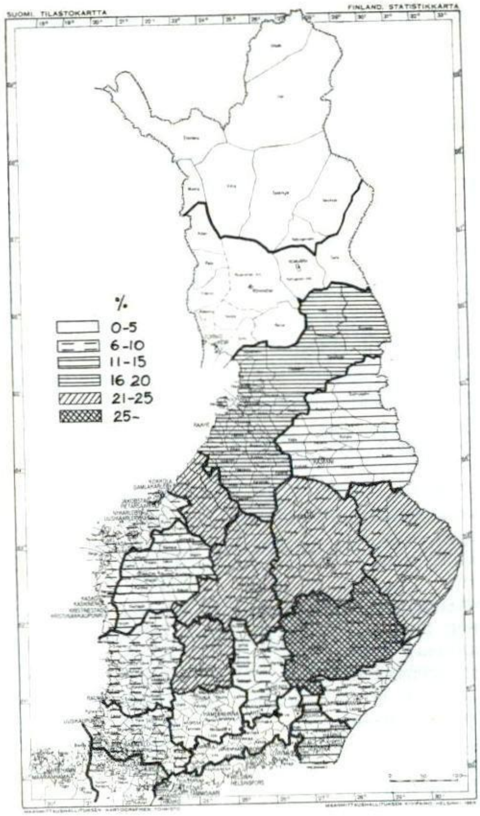


Figure 12. The size of yield losses caused by *Rhopalosiphum padi* in oats in the regions of agricultural societies in 1959. — Orig.

*Kuva 12. Tuomikirvan aiheuttaman satotappion suuruus kaurassa maanviljelysseuroittain v. 1959.*

yield losses for the area belonging to the Mikkeli Province Agricultural Society was regarded as fairly correct, whereas similar percentages for other areas were considered too great, because of the inclusion of yield losses caused by other factors. The percentages of yield losses obtained with the aid of inquiries may thus be somewhat greater than the true values.

The economic value of the yield lost has been calculated (Table 4) for the cases where *R. padi* is assumed to have caused the yield losses presented in Table 3. The estimation shows that *R. padi* caused a yield loss of about 87 000 tons in oats, and about 27 000 tons in barley, which, at a price of 25 marks per kilo for oats and 30 marks per kilo for barley, means a yield loss amounting to 3 milliard Finnish marks.

Table 4. Theoretical yield loss estimated on the assumption that the 1959 yield losses reported by agricultural advisers and presented in Table 2 were caused by *Rhopalosiphum padi*.

*Taulukko 4. Teoreettinen satotappio olettaen, että tuomikirvat aiheuttivat taulukossa 2 mainitut maatalousneuvojien ilmoittamat satotappiot v. 1959 saatuihin satoihin.*

| Agricultural Society *Maanviljelysseura* | Yield loss in tons *Satotappio tn* | |
|---|---|---|
| | Oats *Kaura* | Barley *Ohra* |
| Uudenmaan läänin mvs. | 762 | 199 |
| Nylands svenska lbsk. | 405 | 5 |
| Varsinais-Suomen mvs. | 5 873 | 1 066 |
| Finska Hushållningssällskapet | 571 | 3 |
| Satakunnan mvs. | 7 444 | 381 |
| Hämeen-Satakunnan mvs. | 7 681 | 938 |
| Hämeen läänin mvs. | 2 140 | 264 |
| Itä-Hämeen mvs. | 3 647 | 156 |
| Kymenlaakson mvs. | 3 960 | 165 |
| Länsi-Karjalan mvs. | 2 192 | 1 004 |
| Mikkelin läänin mvs. | 12 620 | 1 415 |
| Kuopion mvs. | 9 751 | 3 479 |
| Pohjois-Karjalan mvs. | 6 562 | 1 655 |
| Keski-Suomen mvs. | 7 080 | 1 924 |
| Etelä-Pohjanmaan mvs. | 6 728 | 3 545 |
| Österbottens svenska lbsk. | 3 292 | 2 550 |
| Keski-Pohjanmaan mvs. | 1 602 | 1 446 |
| Oulun läänin Talousseura | 3 925 | 5 343 |
| Kajaanin mvs. | 675 | 738 |
| Peräpohjolan mvs. | 25 | 762 |
| Lapin Maatalousseura | 2 | 6 |
| Total tons — *Yhteensä tonnia* | 86 937 | 27 044 |
| Price/kg — *Kilohinta mk* | 25 | 30 |
| Approx. total in milliard mks *Yhteensä miljardeja mk n.* | 2.2 | 0.8 |

## VII. Summary

*Rhopalosiphum padi* was controlled very extensively in Finland. The area of treated fields was about 50 000—70 000 hectares and all the available aphid control substances were used. The best effect was obtained with organic phosphorus preparations, whereas control with nicotine failed in some places. The control treatments were not generally undertaken before the aphids had occurred very abundantly in the plants for some time. Treatment was given to about 12 % of the total oat-growing area over the whole country, to about 9 % of the barley-growing area and to about 4 % of the wheat-growing area. The aphids were generally destroyed effectively by the control measures, but in some cases they had already damaged the cereals or had caused very considerable yield losses on account of the virus disease which they transmitted.

The highest yield losses caused by *R. padi* are about 12 % for oats, about 8 % for barley, and about 3 % for wheat. Conservatively estimated these losses amount to a total yield loss of about 3 milliard marks.

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During printing there has appeared a publication called:

D. HILLE RIS LAMBERS 1960: The Identity and Name of a Vector of Barley Yellow Dwarf virus. Virology 12,3; 487—488, in which it is stated that *Rhopalosiphum prunifoliae* (Fitch) is identical with *Rhopalosiphum padi* (L).

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## Selostus

# Kirvojen viljoissa aiheuttamat tuhot ja niiden torjunta Suomessa v. 1959

MIKKO RAATIKAINEN ja AULIS TINNILÄ

Maatalouden tutkimuskeskus, Tuhoeläintutkimuslaitos
Tikkurila

Kirvat esiintyivät vuonna 1959 Suomessa kevät- ja osittain myös syysviljoissa erittäin runsaina ja tuhoisina. Kirvojen runsauden, torjunnan ja niiden aiheuttamien satotappioiden selvittämiseksi lähetettiin Tuhoeläintutkimuslaitoksesta marras- ja joulukuussa 1959 Maatalousseurojen Keskusliiton ja Svenska Lantbrukssällskapen i Finland Förbundin maatalousneuvojille kirjeellinen tiedustelu. Torjunnan ja satotappioiden laajuuden selvittämiseksi lähetettiin tämän tiedustelun perusteella maanviljelysseuroittain lasketut keskiarvot vielä maanviljelysseurojen maanviljelysagronomeille ja tiedusteltiin heidän mielipidettään saaduista keskiarvoista. Tässä esitettävät tiedot perustuvat kaikkien kyseessä olevien henkilöiden antamiin tietoihin sekä Tuhoeläintutkimuslaitoksella suoritettuihin tutkimuksiin.

Osa tiedustelun tuloksista on julkaistu jo aikaisemmin (mm. KANERVO 1960 ja VAPPULA 1960).

## I. Viljoissa tuhoa aiheuttavat kirvat

Suomesta tunnetaan nykyisin kolme viljoissa tuhoa aiheuttavaa kirvalajia: tuomikirva, *Rhopalosiphum padi* (L.), elokirva, *Metopolophium dirhodum* (Walk.) ja viljakirva, *Macrosiphum (Sitobium) avenae* (F.) s. H. R. L.

Tuomikirva talvehtii tuomessa. Väliravintokasveina ovat etupäässä heinäkasvit, etenkin viljat. Elokirvan pääravintokasveja ovat ruusut. Väliravintokasveja ovat heinäkasvit. Viljakirva on yksikotinen ja elää lähes yksinomaan heinäkasveissa.

Vuonna 1959 sattuneet tuhot olivat yksinomaan tuomikirvan aiheuttamia. Elokirvaa esiintyi tiettävästi huomattavassa määrin vain hyvin suppealla alalla Etelä-Pohjanmaalla. Viljakirvaa näyttää esiintyneen melkoisesti, muttei tiettävästi missään mainittavaa tuhoa aikaansaaneena.

Kaikkien edellä mainittujen kirvalajien on todettu levittävän virustauteja. Suomessa on toistaiseksi todettu varmasti vain tuomikirvan levittävän Cereal yellow dwarf-virusta.

## II. Tuomikirvan muutto v. 1959

Tuomikirvan muuttoaikaa selvitettiin haavilaitteilla (kuva 1). Nailontyllinen haavipussi kääntyy tuulen suuntaan ja kirvat, joiden muuttosuunta on sama kuin tuulen suunta, joutuvat haavipussiin. Haavi tyhjennettiin iltaisin klo 20.00:n ja 21.00:n välillä.

Haavit oli sijoitettu timoteinnurmiin Pälkäneellä 19. V—10. VII ja Laihialla 25. V—17. VII välisiksi ajoiksi.

Tarkkailuaikana näyttää tuomikirvojen muutto olleen Pälkäneellä (kuva 2) hieman aikaisempaa kuin Laihialla (kuva 3). Kesäkuussa muuttaneet kirvat siirtyivät tuomista heinäkasveihin ja heinäkuussa muuttaneet taas ilmeisesti heinäkasveista toisiin heinäkasveihin. Tuomikirvat muuttavat sitä vilkkaammin, mitä lämpimämpi sää on. Kesäkuussa tapahtuvan muuton jakautuminen kahteen, Laihialla osittain kolmeen, muuttojaksoon johtunee pääasiassa säässä tapahtuneesta muutoksesta. Osittain siihen saattaa olla syynä sekin, että ensimmäisen ja toisen muuttojakson kirvat ovat eri sukupolvien yksilöitä, jotka muuttavat eri aikoina.

## III. Tuomikirvan runsaus viljoissa v. 1959

Laihialla selvitettiin tuomikirvojen esiintymisrunsautta kaurassa viikoittain otetuilla haavintanäytteillä (kuva 4). Niistä ilmenee tuomikirvan runsauden kasvu heinäkuun puoliväliin saakka, jonka jälkeen seurasi jyrkkä lasku, mikä lienee johtunut etupäässä seuraavista syistä. Kesäkuun alussa tuomista muuttaneista siivellisestä kirvoista oli kaurassa ehtinyt tähän mennessä kehittyä siivellisiä neitseitä, jotka muuttivat pois kirvojen ja kuivuuden tuleennuttamasta viljasta (vrt. kuvia 3 ja 5). Samanaikaisesti kirvojen luontaiset viholliset, etenkin seitsenpistepirkko (kuva 4) ja loispistiäiset olivat lisääntyneet siinä määrin, että ne tuhosivat suureksi osaksi tuomikirvat.

Kaikkialla Suomessa tuomikirvan esiintymisaika näyttää olleen jokseenkin samanlainen. Paikoin runsaimman esiintymisen huippu oli saavutettu jo ennen heinäkuun puoliväliä, paikoin taas myöhemmin.

Maamme eteläpuoliskossa tuomikirvoja oli runsaimmin kaurassa, sitten ohrassa, kevätvehnässä ja rukiissa (taulukko 1). Pohjoisosassa maata niitä oli ohrassa runsaammin kuin kaurassa. Rukiissa niitä oli myös kyseessä olevalla alueella suhteellisesti runsaammin kuin maan eteläosassa.

Karttojen (kuvat 6 ja 9) tarkastelusta ilmenee kirvojen suurin runsaus viljavilla maa-aloilla ja niukin esiintyminen karuilla, esimerkiksi vedenjakaja-alueilla. Tuomen tiedämme esiintyvän samoin runsainpana viljavilla alueilla. Täten näyttää siltä, että osaksi kirvojen runsaus on selitettävissä tuomen runsauden perusteella. Saman yhtäläisyyden on ROGERSON (1947) todennut Englannista. Kaikkialla tuomen runsauden suhde viljapeltojen alaan ei kuitenkaan näytä selittävän tuomikirvan runsasta esiintymistä. KANERVO (1960) olettaakin niitä kulkeutuneen ilmavirtojen mukana esim. Baltian maista, Keski-Venäjältä ja Puolasta.

Tuomikirvan massaesiintyminen rajoittui vain vuoteen 1959. Kesällä 1960 niitä oli enää erittäin vähän.

## IV. Elokirvan runsaus v. 1959

Elokirvan kaurassa esiintymisenaika (kuvat 4 ja 5) näyttää olleen jokseenkin sama kuin tuomikirvankin.

Elokirvaa tavattiin runsaana v. 1959 ainoastaan Laihian kunnassa. Siellä sitä esiintyi eräissä kaura- ja vehnäpelloissa runsaampana kuin tuomikirvaa. Läheisissä Sulvan ja Mustasaaren kunnissa sitä oli yleisesti, muttei runsaasti.

## V. Kirvojen torjunta

1. Torjunta-aineet. Kun tuomikirvan esiintyminen kesällä 1959 todettiin laajoja alueita uhkaavaksi massaesiintymäksi, suoritettiin Tuhoeläintutkimuslaitoksella kiireellisesti kokeita tehokkaiden torjunta-aineiden ja -ainemäärien selvittämiseksi. Pääosa kokeista suoritettiin kenttäkokeina n. 10 aarin koealoilla Asikkalassa. Koemaina käytetyissä kauramaissa oli yleensä 10—20 kirvaa kasvia kohti. Paikoin kohosi määrä pienehköillä alueilla 500—1 000 kirvaan kasvia kohti. 1—2 vuorokauden kuluttua suoritetuista käsittelyistä todettiin saadun lähes 100 %:n teho parationiruiskutteilla, (tehoainetta 100 g/ha ja 350 g/ha) ja -ruiskutejauheilla (tehoainetta 75 g/ha ja 225 g/ha), malationiruiskutteilla (tehoainetta 625 g/ha), -ruiskutejauheilla (tehoainetta 625 g/ha ja 750 g/ha), metyylidemetonilla (tehoainetta 500 g/ha) klortioniruiskutteella (tehoainetta 750 g/ha) ja malationipölytteellä (4 %:sta malationia 20 kg/ha). N. 90 %:n teho saatiin klortioniruiskutteella (tehoainetta 500 g/ha), diptereksiruiskutejauheella (tehoainetta 1 200 g/ha) ja parationipölytteellä (1.5-%:sta parationia 20 kg/ha). Melko huonosti tehosivat yhdistetyt parationi+DDT- ja malationi+DDT-pölytteet sekä DDT-ruiskute. Dipteroksipölytteellä (5-%:sta tehoainetta 20 kg/ha) ja tolueeniruiskutteella (24 l/ha) ei ollut lainkaan tehoa kirvoihin. Kokeissa saadut tulokset annettiin heti viljelijäin käyttöön.

2. Torjuntakäsittelyjen suoritus. A. *Ajankohta.* Viljelijät aloittivat kirvojen torjunnan joko itse tekemiensä havaintojen perusteella tai radion ja lehtien välityksellä annettujen ohjeiden hälyttäminä. Kuvassa 4 on torjuntakäsittelyjen ajankohtaa kuvaava käyrä piirretty neuvojilta saatujen torjunta-ajan pituutta selvittävien vastauksien perusteella. B. *Torjunta-aineet.* Vilkkaan kysynnän takia soveliaimmat torjunta-aineet loppuivat vähittäis- ja tukkukauppojen varastoista sekä myös valmistajilta ja maahantuottajilta. Torjunnassa jouduttiin käyttämään kaikkia saatavana olevia aineita, eikä eri aineiden kulutus anna oikeaa kuvaa niiden suosituimmuudesta.

Kasvinsuojeluaineiden myynnistä vuosina 1958 ja 1959 laadittujen tilastojen mukaan käytettiin v. 1959 parationipölytteitä 274 tn (lisäys vuoteen 1958 153 tn), parationiruiskutejauheita 23 tn (lisäys 21 tn), parationiruiskutteita 24 tn (lisäys 10 tn), malationipölytteitä 7 tn (lisäys 4 tn), -ruiskutteita 7 tn (lisäys 5 tn) sekä DDT+lindaani-, DDT+parationi- ja DDT+malationi-pölytteitä 107 tn (lisäys 46 tn). V. 1959 tapahtunut torjunta-aineiden käytön lisääntyminen johtui ensi sijassa tuomikirvan massaesiintymisestä, mutta myös juurikaskärpänen ja -kirva sekä hedelmäpuupunkki aiheuttivat esiintymisellään torjuntatarpeen lisääntymistä.

Käyttöohjeiden mukaisesti levitettynä riitti v:n 1959 torjunta-ainemäärä n. 70 000 hehtaaria suuremman alan käsittelyyn kuin v:n 1958 määrä. Lisäalasta tulee kirjoittajien käsityksen mukaan 50 000—70 000 ha tuomikirvan osalle. C. *Torjuntakäsittelyjen laajuus.* Torjuntakäsittelyjen laajuudesta esitettävät tiedot perustuvat neuvojilta saatuun aineistoon. Tulokset käyvät selville kartakkeista (kuvat 10—11) kauran ja ohran osalta. Tiedustelun numerolliset arvot esitetään taulukossa 2 ja 3. Neuvojien arvion mukaan käsiteltiin koko maassa noin 12 % kauran, 9 % ohran ja 4 % vehnän viljelysalasta. Tiedustelun perusteella arvioidut torjuntakäsittelyjen suoritusalat eivät aina käy yksiin maanviljelysseurojen maanviljelysagronomien arvioiden kanssa, kuten taulukosta 2 voi todeta. D. *Torjunnalla saadut tulokset.* Heinäkuun alkupuolella suoritetulla käsittelyllä saatiin kirvat yleensä lähes kokonaan häviämään viljakasveista. Vain eräissä tapauksissa jouduttiin suorittamaan uusia käsittelyjä tehon varmentamiseksi. Useat neuvojat ilmoittivat nikotiiniruiskutteilla suoritetun torjunnan epäonnistuneen.

Torjunnalla saadut sadon parannukset vaihtelivat paljon kirvojen runsauden ja torjunta-ajan mukaan. Eräässä Tuhoeläintutkimuslaitoksen kokeessa, jossa kirvaa oli erittäin runsaasti saatiin kertakäsittelyllä 1 000 kg/hehtaarisato, kun käsittelemättömästä alasta ei saatu satoa lainkaan. Sielläkin, missä kirvaa esiintyi melko vähän, saatiin torjunnalla noin 10 %:n sadonparannuksia. Torjuntakustannukset muodostuivat yleensä noin 1 500—2 500 mk:ksi hehtaaria kohti, joka summa vastaa noin 100 kg:n sadonlisäystä.

Aina ei kirvojen turmelema kaura toipunut, vaikka kirvat hävitettiin. Näissä tapauksissa oli todennäköisesti kysymyksessä kirvojen levittämä virustauti (IKÄHEIMO 1960), joka aiheutti viljan tuhoutumisen virusvektoreina toimineiden kirvojen torjumisesta huolimatta. Tällaisia paikkoja ei kuitenkaan näyttänyt olevan paljon.

Torjunta olisi pitänyt ilmeisesti suorittaa jo kesäkuun loppupuolella, jolloin tuomikirvan muutto tuomista heinäkasveihin oli jokseenkin kokonaan päättynyt. Tänä aikana ei ollut vielä heinäkasveissa siivellisiä sukupolvia. Siivellisten ilmaantuessa ja muuttaessa niistä heinäkuussa viljat olivat jo ehtineet kasvaa niin pitkälle, etteivät niihin muuttaneet kirvat enää ehtineet aiheuttaa suurtuhoa. Tähän aikaan olivat myös kirvojen luontaiset viholliset, etenkin leppäpirkot, lisääntyneet siinä määrin, että ne kykenivät huomattavasti rajoittamaan kirvapopulaatioiden kasvua.

## VI. Kirvojen aiheuttamat satotappiot

Maanviljelysneuvojien suorittama satotappioiden arviointi oli erittäin vaikeaa, koska kirvojen aiheuttamaan tuhoon liittyi lisäksi kuivuuden ja hallan aiheuttamat tuhot. Eräissä paikoissa esiintyi näitä kaikkia tekijöitä satoja vähentämässä. Taulukossa 3 esitetään tiivistelmänä tiedustelun perusteella lasketut satotappiot sekä näiden rinnalla maanviljelysseurojen viljelysagronomien arvioinnit.

Neuvojien mukaan saatiin kauran keskimääräiseksi satotappioksi n. 12 % (kuva 12), ohran n. 8 %, ja vehnän n. 3 %. Rukiissa ei havaittu kirvojen aiheuttamia satotappioita.

Tiedustelujen avulla saadut tappioprosentit lienevät jonkin verran todellisia arvoja suuremmat.

Menetetyn sadon taloudellisen arvon määrittämiseksi on suoritettu laskelma (taulukko 4), jossa on oletettu, että tuomikirva aiheutti taulukossa 2 esitetyt tappiot v. 1959 saatuihin satoihin.

## VII. Tiivistelmä

Tuomikirvan torjuntaa suoritettiin maassamme varsin runsaasti. Erilaisilla torjunta-aineilla käsitelty pinta-ala oli noin 50 000—70 000 hehtaaria ja torjunnassa käytettiin kaikkia saatavissa olevia kirvantorjunta-aineita. Paras teho saatiin orgaanisilla fosforivalmisteilla. Nikotiinilla suoritettu torjunta sen sijaan epäonnistui paikka paikoin. Torjuntakäsittelyt suoritettiin yleensä vasta silloin, kun kirvaa oli jo jonkin aikaa ollut kasveissa erittäin runsaasti. Koko maassa käsiteltiin kaurapinta-alasta enintään noin 12 %, ohrasta noin 9 % ja vehnästä noin 4 %. Torjuntakäsittelyillä onnistuttiin kirvat yleensä hävittämään tehokkaasti, mutta eräissä tapauksissa ne olivat jo aiheuttaneet joko imennällään tai levittämänsä virustaudin vaikutuksesta varsin tuntuvia sadonmenetyksiä.

Kirvan aiheuttamien satotappioiden enimmäismääriksi saadaan kauran osalle n. 12 %, ohran osalle 8 % ja vehnän osalle 3 %. Varovaisesti laskien nämä edustavat yhteensä noin 3 miljardin markan sadonmenetystä.

Työssä ovat avustaneet prof. V. KANERVO, toht. M. MARKKULA ja maist. O. HEIKINHEIMO. Maatalousseurojen Keskusliiton ja Svenska Lantbrukssällskapen i Finland Förbundin maatalousneuvojat ja maanviljelysagronomit ovat antaneet tietoja tuomikirvan runsaudesta ja torjunnasta. Kaikille edellä mainituille lausumme parhaat kiitoksemme.