# Profiling Finnish Polar Hops

## Are They Native

## And How Do They Look Like?

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## HOP CASE FINLAND

61.9241° N

25.7482° E

### STONE AGE year 7100 BC/AD

Remains of hop pollen were found in the Mesolithic layers in Southern part of Finland (Alenius et al.2013)

### MIDDLE AGES 11th century - CULTIVATION

Findings of hop macrofossil seeds date to the Middle Ages and most probably cultivation of hop in Finland started at that time (Lempiäinen 2007)

### REMARKABLE COMMERCIAL VALUE

When Finland was part of Swedish Empire, during the 17th and early 18th centuries, hop inflorescences were used for paying taxes, and there were even legal obligations to cultivate hops until 1915.

### CRAZE for CRAFT BEERS

Having only a few microbreweries not more than a decade ago, the number of them raised up to over 100 in 2017 in Finland. The Finnish Parliament made a decision in 2017 that it is allowed to sell craft beers straight from breweries in 2018.

### LUKE - BLOG about HOPS –

Finnish hops are a big surprise to the rest of the world
https://www.luke.fi/blogi/hunting-finnish-hops-2/

## RESULTS - CHEMICAL ANALYSIS

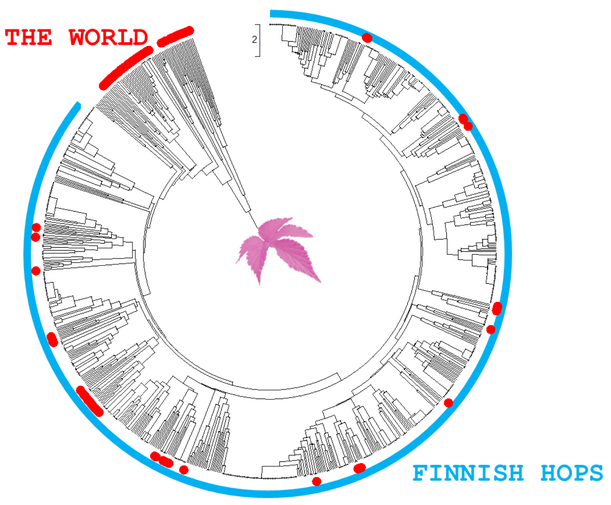
| | Desmethyl-xanthohumol g/100 g dw | Xanthohumol g/100 g dw | Sum α-acids g/100 g dw | Sum β-acids g/100 g kdw | Ratio α vs β |
|---|---|---|---|---|---|
| Samples 2016 (n=22) | | | | | |
| **Average** | **0,18** | **0,46** | **2,4** | **3,0** | **0,8** |
| maximum | 0,33 | 0,86 | 5,9 | 4,7 | 1,8 |
| minimum | 0,06 | 0,11 | 1,0 | 1,5 | 0,3 |

*Analysis of prenylflavonoids and α- and β-acids (g/100 g dw) by HPLC-DAD in methanolic extracts.*

| | myrcene peak area % | β-caryophyllene peak area % | humulene peak area % |
|---|---|---|---|
| Samples 2016 (n=22) | | | |
| **Average** | **54,3** | **5,6** | **20,7** |
| maximum | 74,2 | 9,2 | 34,2 |
| minimum | 34,3 | 1,8 | 5,7 |

*Analysis of the main volatile compounds (peak area %) by GC-MS in hexane extracts. In addition to these some samples contained up to 15.4 % α-bergamontene, and up to 12.5 % β-seline.*

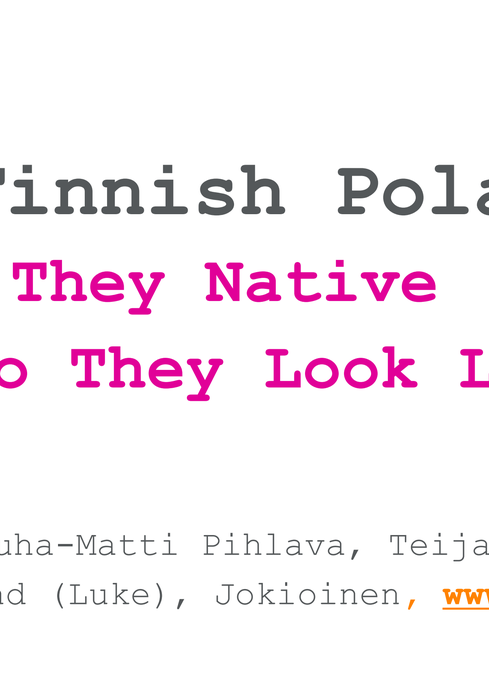
## RESULTS - GENETIC ANALYSIS




Software GenAlEx 6.503 was used for calculation of genetic distance matrix based on dissimilarity coefficient from allelic data. The dendrogram was constructed by software MEGA 7.0.26 using UPGMA method. Software DARwin 6 was used to resample the data for bootstrap analysis with 500 replicates.

### CALLING BREWERIES FOR HOP AROMA TESTINGS

We aim overall to collect 1000 hops from all over Finland, with the goal of giving image to the «polar hop aroma»
& establish solid base for IMPROVEMENT OF LOCAL HOPS.
At the moment, we have about 20 stakeholders to take part in sensory testings but more participants from breweries would be beneficial for the work.

## CALL FOR HOPS

1st June – 31st July 2017,
continued until 30th September 2017

- Older than 50 years
- Healthy plants
- Use (e.g. brewing)
- Bearing cones regularly
- Male plants

*The call was published in number of media from Finland.*

*The call was implemented trough electronic system for plant genetic resources in Luke (Kasvinpolku database: www.luke.fi/ilmoitakasvi).*

*30th September 2017 >*
*1225 hops notified*

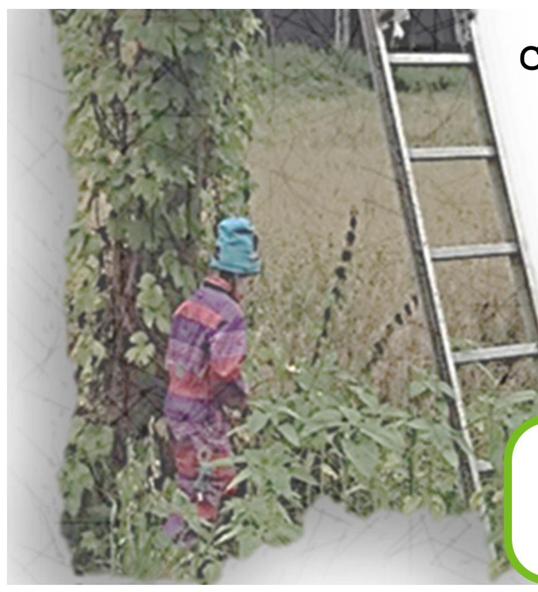
## COLLECTING HOPS

1st June – 31st December 2017

[1] 6 LEAVES
[2] 100 CONES
[3] Knowledge

[a] Notifiers of hops from all over the Finland were asked to send leaf materials and cones to Luke.

[b] Traditional knowledge and important information on each plant was registered into Luke database.



## CHEMICAL ANALYSIS

n = 22, year 2016

- alpha- and beta-acids
- prenylated flavonoids
- terpenoids
- volatile oils

## GENETIC ANALYSIS

n = 1000*, year 2017

- 25 microsatellite markers
- Identity analysis
- Relationships
- Genetic structuring
- Diversity analysis

Photo: Jussi Kangas (Finland – 2016)
**including landraces and bred cultivars from Europe and world wide for inter-comparative assessment*

Maataloustieteen päivät 10.-11.1.2018, Viikki, Helsinki

*References:*

*Lempiäinen Terttu (2007) Archaeobotanical evidence of plants from the medieval period to early modern times in Finland. In: Medieval food traditions in Northern Europe. Edited by: Sabine Karg*

*Alenius et al. (2013), Geoarcheology: An International Journal 28:1-24*

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