

HAFL Master's Thesis Abstract

Year: 2018
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English Title: ***Phyllocoptes gracilis*, the eriophyoid mite: its intraplant distribution on *Rubus idaeus* and testing of potential fungal biocontrol agents in the laboratory**

English Summary: *Phyllocoptes gracilis* Nalepa (Acari: Eriophyidae) is an important pest of raspberry plantation in Switzerland, which may produce significant crop damage and economic loss. Due to *P. gracilis* small size and hiding lifestyle, it is very difficult for growers to detect its presence on crops before the development of symptoms and crop damage. In recent years, the number of problems linked to *P. gracilis* increased in several European countries. In 2017, the situation reached a critical point in Switzerland with severe infestations affecting particularly organic raspberry growers who lack control methods. This situation highlighted the urgent need to develop efficient tools for early detection and monitoring of *P. gracilis* as well as effective solutions for the control of the mite for the organic production.

The first objective of this thesis was to characterize the intraplant distribution of *P. gracilis* on raspberry crops to adapt the sampling design and monitoring of the pest. The second objective was to test the pathogenicity of several strains of entomopathogenic fungi to *P. gracilis* to identify potential candidates for biological control. Both objectives would contribute to the promotion of a more sustainable production of raspberries by optimizing integrated pest management programs based on a better knowledge of the pest and its interaction with the host plant.

Inspections of overwintering canes of raspberry by the extraction method confirmed the presence of *P. gracilis* among planting material. The presence of eriophyoid mites on planting material represents a primary source of infestation and a mean for long distance spread of *P. gracilis* highlighting the need for growers to perform winter controls on planting material. Those controls would allow growers to adapt their pest management strategy if presence of mites is confirmed.

The comparison of two methods for the detection of eriophyoid mites in overwintering buds of raspberry canes showed a greater detection rate for the extraction method than the sticky tape method. Although the results were not optimal, the sticky tape method still represents an interesting tool for growers as it is rapid, economical and easy to perform while the extraction method requires expensive equipment. Further tests are therefore necessary to refine the protocol and evaluate the reliability of the sticky tape method, especially in situations where the population density is low.



The distribution of *P. gracilis* in dormant buds along infested overwintering canes of raspberry was characterized by extracting mites from their overwintering sites. The results showed a prevalence of eriophyoid mites on the upper part of the cane with the greatest number found in buds located between 100 and 120 centimeter above collar level. Those results should be used to improve sampling design for the winter controls on planting material.

The distribution of *P. gracilis* within its host was studied over eight months by sampling specific organ types at three height categories along infested raspberry canes. Although the presence of *P. gracilis* was observed among all organ types and all height categories on all sampling dates, there were significant differences in the distribution of the mites. It appeared that the populations of *P. gracilis* were actively influenced by morphological changes of their host. The mite populations presented an aggregated distribution along the cane illustrated by a prevalence of mites on the two upper third of the canes. Those results should be used to improve monitoring of *P. gracilis* by sampling specific organ types according to crop development between 60 and 180 centimeter above collar level. The age of plant tissue is the principle factor suspected to influence the distribution of *P. gracilis* within its host. Hypotheses regarding potential factors affecting the distribution need to be tested experimentally.

Finally, three strains of entomopathogenic fungi were tested against *P. gracilis* under laboratory conditions. The application of fungal solutions with strains *Beauveria bassiana* 1.1 and *Metarhizium anisopliae* 10.1 to mites provoked mortality of respectively 65% and 70% at seven days after treatment which differed significantly from the control. Further experiments are needed to optimize the rearing of *P. gracilis* and to confirm the pathogenicity of the fungal strains. The identification of efficient biological control agents represents great interest as there is an urgent need to find solutions for the control of *P. gracilis* in organic production in Switzerland.

Keywords: *Phyllocoptes gracilis*, raspberries, intraplant distribution, entomopathogenic fungi

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