

***Cacopsylla melanoneura* (Foerster): aestivation and overwintering habitats in Northwest Italy**

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Abstract

Cacopsylla melanoneura (Foerster) is considered one of the most important vectors of 'Candidatus Phytoplasma mali', the phytoplasma associated with apple proliferation disease. In the last years several studies concerning the biology, the infectivity and the transmission activity of this psyllid highlighted the crucial role of the overwintered adults in the epidemiology of the disease. However very few information on the overwintering sites are available. The aestivation and overwintering habitats of *C. melanoneura* in Northwest Italy were studied. Samplings were carried out in conifer forests, chosen by following the direction of warm ascending currents. The altitudinal distribution of the psyllid as well as the shelter plants were investigated. Adults of *C. melanoneura* were collected on *Abies alba* (Miller), *Picea abies* (L.), *Pinus sylvestris* (L.) and *Larix decidua* (Miller) predominantly at an altitude range between 1,350 and 1,650 m a.s.l. It was possible in this way for the first time to follow the whole life cycle of *C. melanoneura* throughout the year.

Key words: *Cacopsylla melanoneura*, shelter plants, conifers, aestivation, overwintering, apple proliferation.

Introduction

The psyllid *Cacopsylla melanoneura* (Foerster) (Hemiptera: Psylloidea) is considered one of the most important vectors of 'Candidatus Phytoplasma mali', the prokaryote associated with the apple proliferation (AP) disease, (Tedeschi *et al.*, 2002). Studies on the epidemiology of AP and on the infectivity of the vector showed evidence of the crucial role of overwintered adults of *C. melanoneura* in transmitting 'Ca. P. mali' (Tedeschi *et al.*, 2002, 2003, Tedeschi and Alma, 2004; Pedrazzoli *et al.*, 2007) when they reach, often already infected, apple and hawthorn plants at the end of the winter. On the contrary fairly little is known about newly emerged *C. melanoneura* behaviour after the migration to shelter plants. For this reason, new surveys were carried out to identify some aestivation and overwintering sites of *C. melanoneura* in Northwest Italy. In the present work we studied the altitudinal distribution of *C. melanoneura* and the suitability of different conifer species as shelter plants during aestivation and overwintering periods.

Materials and methods

The area of study (Aosta Valley and Piedmont, Northwest Italy) was chosen according to the incidence of AP disease and to the abundance of *C. melanoneura* specimens recorded in the last years.

Coniferous forests, potentially reachable by the psyllids, were spotted, as suggested by Čermák and Lauterer (2008), following the direction of warm ascending currents. These flows rise from apple orchards located in lowlands up to the mountains and promote psyllid movements. Samplings were carried out once a week from June to December at different altitudes by means

of a sweep net with a 5 m telescopic handle enabling to reach the highest parts of the plants. Samples were collected at different altitudes between 800 and 2,077 m a.s.l. on different species of conifers: *Abies alba* (Miller), *Picea abies* (L.), *Pinus sylvestris* (L.), *Larix decidua* (Miller) and *Pinus cembra* (L.). Once the most suitable shelter plants were localized, newly emerged adults of *C. melanoneura* were collected from apple and hawthorn plants and caged on branches of different species of conifers between 1,442 and 1,636 m a.s.l. to follow the entire cycle of the insects until the re-immigration period into apple orchards or on hawthorn plants. A total of 1,405 specimens were isolated in 74 net cages until the end of January when normally the first remigrants appear on apple and hawthorn plants. Then the cages were brought to the laboratory and alive psyllids counted.

Results

Forty-nine samplings were carried out at different altitudes between 800 m. and 2,077 m. a.s.l. A total number of 266 *C. melanoneura* specimens were collected during aestivation and overwintering periods on conifers. *C. melanoneura* was found on Norway spruce, European silver-fir, Scots pine, larch, but not on Swiss stone-pine. The highest psyllid density was recorded on Norway spruce followed by European silver-fir, larch and Scot's pine. Norway spruce was the dominant conifer species in the forests under investigation, followed by larch while the other species were sporadic.

For this reason the altitude distribution was in depth analysed only in relation to *P. abies* and the results are shown in figure 1. *C. melanoneura* was more common at the altitude ranging between 1,350 and 1,650 m a.s.l..

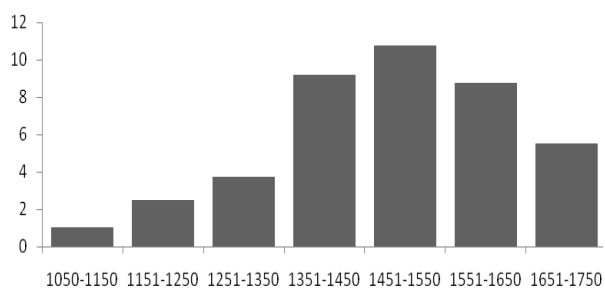


Figure 1. Altitudinal distribution of *Cacopsylla melanoneura* (Foerster) captured on *Picea abies* (L.).

In January living specimens were found in the net cages placed on European silver-fir, Norway spruce, Swiss stone-pine and Scots pine. All the psyllids isolated on juniper died. *C. melanoneura* alive specimens were observed on larch only until November, before the needle fall. On January all the psyllids isolated on larch were dead. Among the 1,405 individuals isolated on different species of conifers only 19.2% survived. *A. alba* revealed to be the best shelter plant with 36.5% of survivals, followed by *P. cembra* (20.4%), *P. abies* (19.9%) and *P. sylvestris* (3.1%).

Discussion

The present work allowed to localize for the first time the habitats of *C. melanoneura* in Northwest Italy during the aestivation and overwintering period. As proposed by Čermák and Lauterer (2008) the warm ascending currents should be fundamental for psyllid movements, allowing quite long migrations. In our case the distance between the shelter plants and the closest apple orchard was around 2 km, but we cannot exclude longer migration distances considering the location of the other orchards. The samplings by means of the telescopic sweep net enabled to identify the shelter plant species colonized by *C. melanoneura* and to determine the altitudinal distribution of the psyllid. Almost all the conifers analyzed seem suitable as shelter plants. No specimens were found on *P. cembra*, but very few plants of this species were analysed. Anyhow the experiments with the net cages revealed that *P. cembra* is a suitable shelter plants. In the case of larch, all the specimens isolated in the net cages died before January. We have to consider that larch is the only deciduous conifer in our regions and probably this is the reason why all the psyllids died. Considering also that we were able to collect *C. melanoneura* on larch until needle fall, the results obtained make us suppose that *C. melanoneura* has some feeding activity on conifers, as proposed also by Jackson *et al.* (1990), and maybe also some movement activity between different shelter plants.

In the present work it was not possible to define some preference towards the different conifers. Most of the psyllids were collected on Norway spruce, but this is the predominant species in the investigated area. So there is a higher probability for *C. melanoneura* to reach this species rather than the others.

The study on the altitudinal distribution revealed that *C. melanoneura* finds the best climate conditions for aestivation and overwintering between 1,350 and 1,650 m a.s.l.. It will be interesting to analyse if during the period June-January some vertical migration occur within the same forest according to changes of climatic conditions. So further studies are required to deepen this aspect. The finding of the sites colonised by *C. melanoneura* during a quite long period of the year, after the migration from apple and hawthorn plants opens new perspectives on the study of the phytoplasma-vector relationships during the season and thus of the epidemiology of AP. Moreover these information could provide new indications for prompt control strategies, for instance exactly forecasting the migration to apple orchards in relation to the climatic conditions in the overwintering sites.

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