PROBLEMS WITH SCALE INSECTS IN VINEYARDS

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SYNTHESIS – A number of scale species can reach the status of pests in vineyards. Among them, *Parthenolecanium corni* (Bouché) (Coccidae) and *Planococcus ficus* (Signoret) (Pseudococcidae) proved to be the most important in Italy and elsewhere. Sometimes mixed populations of *P. corni* and *Neopulvinaria innumerabilis* (Rathvon) (Coccidae) are recorded in vineyards.

*Parthenolecanium corni* is a polyphagous species that completes two generations in Italian vineyards. Damage is caused by sap feeding (reduction in vigour, defoliation) associated to honeydew and sooty mould on leaves and berries. *P. corni* can transmit a number of virus, i.e. the Leafroll complex (GLRaV-1) and the Rugose wood complex (GVA). Outbreaks in Italy are recorded from the 1990s. Among factors affecting them we can mention the disruption of biological control by pesticides, and the spread of some cultural practices (e.g., mechanical pruning, irrigation and fertilization). A number of predators (Coccinellidae and Chrysopidae) and parasitoids (Encyrtidae, Aphelinidae and Pteromalidae) can affect *P. corni* populations. However, the impact of parasitoids in vineyards seems to be not significant in the short term. Moreover, knowledge of pesticide effects on scales and their antagonists is limited. In North-eastern Italy, infestation levels of *P. corni* and *N. innumerabilis* were reduced on experimental vines where access to ants was hindered. Implications of this practice for coccid control should be considered.

*Planococcus ficus* occurs throughout the Mediterranean region, South Africa, parts of Asia, Mexico, and California (since 1994). It has been misidentified with *Planococcus citri* (Risso) for a long time. In the 1950s it was the most important pest of vines in Northern Italy. Currently infestations are recorded in several regions (e.g. Veneto, Emilia-Romagna, Tuscany, Sicily and Sardinia). Damage is associated to feeding on phloem sap (reduction in plant vigour, defoliation, contamination of clusters, honeydew and sooty moulds) and the transmission of viruses such as Leafroll complex viruses (e.g. GLRaV-1, GLRaV-3, GLRaV-5 and Rugose wood complex (including “Corky bark”). In Europe, GLRaV has not been considered a serious problem. This point of view has changed after recent *P. ficus* outbreaks in the Western USA, Israel and elsewhere. Moreover, the presence of *P. ficus* in vineyards could increase the risk of ochratoxins (OTA) occurrence on grapes. It has been reported that *Aspergillus* section *Nigri* incidence and the mean OTA concentration can be significantly higher in damaged berries than in undamaged ones.

The invasion of California vineyards by *P. ficus* has promoted a large number of studies. Sex pheromone has been identified and used for monitoring the pest. The identity of *P. ficus* and its parasitoids, in particular *Anagyrus pseudococci* (Girault) has been deeply investigated. Regarding *P. ficus* various techniques (e.g., RAPD-PCR, PCR-RFLP, DNA markers) proved to be useful to discriminate this species from *P. citri*. Regarding *A. pseudococci*, cultures of different origin (e.g. Argentina, USA, Israel, Italy, Spain) were established in the laboratory. The Argentine population proved to be reproductively incompatible with and genetically different from all other populations tested. The other form, which was established in California from previous introductions, belonged to a different species (*Anagyrus* sp. near *pseudococci*) that coexists with *A. pseudococci* in some areas (e.g., Sicily). The role of the sex pheromone in the host selection by *Anagyrus* sp. near *pseudococci* has been widely investigated in Portugal, Italy and Israel. Additional effects of pheromone components have been noticed on the rate of parasitism and host location.

The influence of temperature on *Anagyrus pseudococci* development and overwintering has...
been investigated in California. Laboratory-data suggest that seven to eight *A. pseudococci* generations can occur during the vegetative season. Key biological parameters of *Anagyrus* sp. nr. *pseudococci* reared on *P. citri* have been determined in Italy. Further research showed that *P. ficus*, *P. citri* and *Pseudococcus calceolariae* (Maskell) were able to encapsulate the eggs of *Anagyrus* sp. near *pseudococci*; the rates of parasitism and encapsulation were higher in *P. citri* than in *P. ficus*. Investigations carried out in Sardinia showed that *P. ficus* is a suitable host for the parasitoid *Leptomastix dactylopii* Howard. However, this species produces less offspring when reared on *P. ficus* than on *P. citri*.

Several strategies have been explored to manage *P. ficus* populations in California: classical and augmentative biological control, mating disruption, chemical control against mealybugs and ants. At the same time studies on mealybug vector - virus type specificity and transmission efficiency are planned to understand the epidemiology of Grape Leafroll disease.

The knowledge of side-effects of pesticides on mealybug natural enemies is crucial for IPM. Studies on this topic were performed on *A. near pseudococci* and *Coccidoxenoides perminutus*. Buprofezin and spirotetramat proved to be less toxic than cypermethrin and chlorpyriphos-ethyl. Pest management strategies regarding method and timing of pesticide applications where parasitoids constitute part of the pest management program should be refined.

Antagonistic interactions between ants and *Anagyrus* sp. near *pseudococci* were assessed in the laboratory. Parasitism of vine mealybug by *Anagyrus* sp. nr. *pseudococci* was negatively affected by ants. An adequate control of ants is recommended before any release of mealybugs’ natural enemies.