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V. YASNOSH , M. RTSKHILADZE, E. TABATADZE

Coccids (Hemiptera, Coccinea) and their natural enemies in the vineyards of Georgia: present situation

Abstract - Several scale insects species are recorded in Georgian vineyards. Among them the mealybug, *Planococcus ficus* (Signoret), and the cottony scale, *Neopulvinaria innumerabilis* (Rathvon), are the most prevalent and serious pests in the dry eastern regions. In the humid regions of the Black Sea coast the mealybug *Pseudococcus viburni* (Signoret) is an occasional noxious pest. Other common coccids, *Parthenolecanium corni* (Bouchè), *P. persicae* (F.), and *Pulvinaria betulae* L., are rare, minor pests in the vineyards and have no economic importance. Two hymenopterous species, *Anagyrus pseudococci* (Girault) (Chalcidoidea, Encyrtidae) and *Allotropa mecrida* (Walker) (Proctotrupoidea, Platygasteridae), are parasitoids of *P. ficus*. Some species of hyperparasitoids have also been recorded, namely *Pachyneuron muscarum* (L.), *Chartocerus subaeneus* (Forster) and *Marietta picta* (Andre). Currently, the key pest of vine in eastern Georgia is the cottony maple scale, where many outbreaks have occurred. This species of American origin (Canada, USA), spread in the Caucasus (Georgia, Armenia) and in some European countries (France, Italy) without the natural enemies that suppressed it in America. No effective natural enemies have been found in Georgia. Three chalcid parasitoids, known as parasitoids of local coccids, have been recorded on this pest: *Coccophagus maculipennis* Jasnosh (whose natural host is *Acanthopulvinaria orientalis* (Nassonov)), *C. palaeolecanii* Jasnosh, and *C. lycimnia* Walker. The larvae of *Leucopis alticeps* (Czerny) (Diptera), *Chrysopa* spp. (Neuroptera) and *Scymnus* spp. (Coleoptera, Coccinellidae) have been recorded as predators. Breeding programs were initiated more than 50 years ago for the introduced coccinellid predator, *Cryptolaemus montrouzieri* Mulsant, to control coccids. In regions with drier climates, where *C. montrouzieri* is less effective, a *C. montrouzieri* strain introduced from Israel is being tested and preliminary experiments have found it to be more effective. In conclusion, indigenous natural enemies are not capable of reducing the impact of *P. ficus* and *N. innumerabilis* populations to non-economic levels. Developing effective biocontrol of these pests will be essential.

Key words: Vineyard, scale insects, pests, natural enemies, economic importance.

INTRODUCTION

Vine cultivation is one of the important branches of Georgian Agriculture. Commercial vine-growing territories are located predominantly in the regions of Eastern Georgia with dry climate with comparatively humid regions of the Black Sea coast.

Several scale insects are constantly distributed in the vineyards (Hadzibeyli, 1960; 1983). Among them the cottony maple scale *Neopulvinaria innumerabilis* (Rathvon) (Coccidae) and the vine mealybug *Planococcus ficus* (Signoret) (Pseudococcidae) are serious pests in the dry eastern regions. In the humid regions the mealybug *Pseudococcus viburni* (Signoret) is sometimes very noxious in the vineyards. The other coccids *Parthenolecanium corni* (Bouché), *P. persicae* (F.), *Pulvinaria betulae* L. are usually present, but at low population levels, and have no economic importance. In this paper, present information on economic importance, natural enemies and their role in the number regulation of pests are given.

MATERIALS AND METHODS

Observation and collection of the material were carried out in Kakheti region, in Tbilisi and its surrounding areas. Scale density was studied by use of periodical calculation methods. The number of the cottony maple scale nymphs was counted on 10 leaves/plant on 10 plants/hectare (from different sides of vineyards) while the number of females was counted on 10 cm long trunk of the same plant.

The rearing of the parasitoids and collection of predators were conducted by generally accepted methods (Nikolskaya & Yasnosh, 1966; Tryapitzin *et al.*, 1982).

Ecology and efficiency of *C. montrouzieri* were studied according to the methods of Gaprindashvili (1977).

RESULTS AND CONCLUSION

Planococcus ficus (Signoret)

Planococcus ficus is widespread in Georgia, particularly in its eastern parts and damages vines, figs, platans. In Eastern Georgia the mealybug has 4 generations per year. The fourth is facultative. It overwinters as adult females and nymphs of all instars. In April the females begin to lay eggs. The last generation is the most dangerous because ripe grapes are injured.

The natural enemies complex comprises several species, which are mainly represented by the parasitoids *Anagyrus pseudococci* (Girault) (Chalcidoidea, Encyrtidae) and *Allotropa mecrida* (Walker) (Proctotrupoidea, Platygasteridae), the predaceous beetles *Nephus* spp. and larvae of *Leucopis alticeps* Czerny (Diptera). *P.*

ficus is the main host of *Anagyrus pseudococci*. In Georgia it is known also as a parasitoid of *Pseudococcus comstocki* (Kuwana) (Yasnosh,1962). Presently *A. pseudococci* is not effective enough in Georgia. *Allotropa mecrida* is an internal parasitoid of nymphs of all instars and of adult females of the Vine Mealybug. This parasitoid is often reared from mealybugs overwintering on *Platanus* trees in Tbilisi, but in the vineyards it is not present. In Georgia the parasitoid's number is regulated by the hyperparasitoids *Pachyneuron muscarum* (L.), *Chartocerus subaeneus* (Forster) (Signiphoridae) and *Marietta picta* (André) (Aphelinidae).

Neopulvinaria innumerabilis (Rathvon)

This American species was found in Georgia in 1952 and described by Hadzibeyli (1955) as *N. imeretina*. Later, *N. imeretina* was synonymized with *N. innumerabilis* (Rathvon, 1854) (Danzig & Matile-Ferrero,1990). This pest is recorded in Armenia, France and Italy (Pellizzari Scaltriti,1977). Presently *N. innumerabilis* is widespread in many eastern regions (Kacheti, Tbilisi, Mchxeta) and some western regions of Georgia. Nowadays it is a key pest of vine in Georgia, although sometimes it could be recorded on some other plants, especially apple trees.

The cottony maple scale has one generation/year. Fertilised females overwinter on the branches and trunk of the vine. After winter, the development continues in April. Each female lays from 300 to 800 eggs. Eggs hatch in June-July . The crawlers crawl over plants and settle on both sides of leaves, mainly on the upper side. The nymphs produce abundant honeydew which pollutes leaves and grapes. Saprophytic fungi will develop in this environment and will blacken green parts of plants and grapes: quality will be reduced greatly.

In 1996, the average number of ovipositing females on 10cm long trunk was 4.5 in Kakheti region. In 1999, the number of females in the same plots increased to 7-8. The number of females was lower (5-6) during the same period in Tbilisi. Oviposition is completed in Kakheti by June 10 and earlier in Tbilisi. The average number of nymphs per leaf in Kakheti is higher than in Tbilisi and varies between 33.8 and 52.2 with a maximum of 160 nymphs per leaf (Rtskhiladze, 2000). Presently the cottony maple scale has no specific natural enemies in Georgia. Three species of generic parasitoids (Chalcidoidea, Aphelinidae) were reared from cottony maple scale in Georgia. They are: *Coccophagus maculipennis* (Jasnosh), *C. palaeolecanii* (Jasnosh) and *Coccophagus lycimnia* Walker. *C. maculipennis* was detected for the first time as a parasitoid of *Neopulvinaria innumerabilis*; its natural host is *Acanthopulvinaria orientalis* (Nassonov). *C. palaeolecanii* was known as parasitoid of *Palaeolecanium bituberculatum* (Signoret) and *Lichtensia viburni* Signoret. *Coccophagus lycimnia* is a common parasitoid of many species of coccids in Georgia. The level of parasitization of all the above mentioned species varies from 4 to14.1%. The eggs of the Cottony Maple Scale are preyed upon by larvae of *Leucopis alticeps* (Czerny) (Diptera: Chamaemyiidae) and lacewings *Chrysopa* sp. (Neuroptera ,Chrysopidae). Predators are rare in the colonies of this species.

Biological control

The coccinellid *Cryptolaemus montrouzieri* Mulsant is successfully used in Georgia to control mealybugs and cottony scales. *C. montrouzieri*, introduced more than 50 years ago, has been established in some regions of the Black Sea coast. Unfortunately, because of the small number of the overwintering specimens, its economic importance is not high during the first half of summer. Therefore the beetles are reared in the laboratory and released in the groves.

In the Eastern Georgia *C. montrouzieri* is less effective due to high temperature and low humidity, in contrast with the western Georgia's subtropical regions. Tests conducted in Kakheti region revealed that *C. montrouzieri* can be more effective at smaller individual lots, where, among plots, one-year crops such as soybeans, beans, or sunflowers are sowed. This creates somewhat optimum microclimate for development of *C. montrouzieri* and therefore, its efficiency has been increased (Tabatadze *et al.*,1999).

For experiment, a strain of *C. montrouzieri* was imported from Israel. It differs in having a stronger resistance to low humidity. In laboratory trials, Israel beetles fed on all stages of Vine Mealybug and nymphs of all instars of the Cottony Maple Scale. The latter was a new host for *C. montrouzieri.* Under laboratory conditions (temperature 26-29°C, humidity 60-68 %) one beetle consumed 43-64 second-instar nymphs of the Cottony Maple Scale in a day. Under the same conditions the "Georgian" *C. montrouzieri* consumed only 40, rarely 50, scales.

A strain of *C. montrouzieri* from Israel was released against the Cottony Maple Scale in August 1999 in two plots at Kakheti (Tsinandali), with 5 beetles per one metre of vineyard. The number of the Cottony Maple Scale on August 6, at the beginning of the experiments, varied from 33.8 to 44.4 nymphs/leaf. At the end of the trial, on September 24, only 15.7-24.4 nymphs/leaf were found. Therefore the number of nymphs/leaf was reduced by 48.3-53.6 %.

CONCLUSION

Populations of coccids pests in the Georgian vineyards are not regulated sufficiently by the natural enemies. Therefore, introduction of more effective natural enemies will continue. Until now *N. innumerabilis* had no specific natural enemies among the Georgian fauna. The import of its parasitoids, which suppress the pest in America, is necessary.

The coccinellid *C. montrouzieri* is used to regulate the coccids number in vineyards. The beetles are reared in the laboratory. In the drier climate of Eastern Georgia its effectiveness proved to be low. To enhance the control *N. innumerabilis*, a strain of *C. montrouzieri* introduced from Israel was tested in the laboratory and then released in the vineyards. First trials demonstrated a higher efficiency of the *C. montrouzieri* strain from Israel with respect to the Georgian strain.

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PROF. VALENTINA YASNOSH - Department of Biological Control, Kanchaveli L. Research Institute of Plant Protection, Chavchavadze Av.82, 380062,Tbilisi, Georgia. E-mail: giorgij70@hotmail.com.

MARIA RTSKHILADZE - Department of Biological Control, Kanchaveli L. Research Institute of Plant Protection, Chavchavadze Av.82, 380062,Tbilisi, Georgia.

DR. EKATERINE TABATADZE - Department of Biological Control, Kanchaveli L. Research Institute of Plant Protection, Chavchavadze Av.82, 380062,Tbilisi, Georgia.