

## **NOTE**

# **NATURAL ENEMIES OF CYPRESS TREE MEALYBUG, *PLANOCOCCUS VOVAE* (NASONOV), AND THEIR PARASITIDS IN SHIRAZ, IRAN**

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## **ABSTRACT**

In a survey conducted in 1998, 15 species of natural enemies attacking cypress tree mealybug, *Planococcus vovae* (Nasonov) were found in Shiraz, Iran. These included two parasitoids, *Anagyrus pseudococci* (Girault) and *Dusmetia fascipennis* (Noys & Hayat). The most common predators included *Exochomus* spp., *Hyperaspis polita* Weise, *Nephus bipunctatus* Fursch, *Chrysoperla carnea* (Stephens), *Suarius fedtschenkoi* (McLachlan), *Dicrodiplosis manihoti* Harris and *Geocoris quercicola* Linnavuori. The effectiveness of these natural enemies was reduced by the hyperparasitoids, *Marietta picta* (Andre) and *Chartocerus* spp., by the parasite *Homalotylus ephippium* Ruschka attacking coccinellids, and by the parasites *Cheiloneurus ceroplastis* Ishii, *Ooencyrtus kuvanae* (Howard), *Isodromus atriventris* Ashmead, *I. aff. vinulus*, *Catolaccus crassiceps* (Masi) and *Pachyneuron concolor* (Forster) attacking chrysopids.

**Key words:** Cypress pests, Mealybug enemies, Natural enemies, Parasitoids, Planococcus.

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1. Former Graduate Student and Professor (deceased), respectively.

## تحقیقات کشاورزی ایران

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### دشمنان طبیعی شپشک آرد آلود سرو *Planococcus vovae* (Nasanov) و پارازیتوئید های آن ها در شیراز، ایران

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#### چکیده

در بررسی به عمل آمده در سال ۱۳۷۷ در شیراز، ۱۵ گونه از دشمنان طبیعی شپشک آرد آلود سرو *Planococcus vovae* (Nasanov) جمع آوری شد که شامل دو گونه پارازیتوئید *Dusmetia fascipennis* (Noys & Hayat) و *Anagyrus pseudococci* (Girault) بودند. مهمترین شکارگرهایی که در این بررسی عمومیت داشتند عبارت بودند از: *Exochomus* spp., *Hyperaspis polita* Weise, *Nephus bipunctatus* Fursch, *Chrysoperla carnea* (Stephens), *Suarius fedtschenkoi* (McLachlan), *Dicrodiplosis manihoti* Harris و *Geocoris quercicola* Linnavuori. کارایی این دشمنان طبیعی به وسیله پارازیت های ثانویه شامل *Marietta picta* (Andre) و *Chartocerus* sp. کاهش یافت و کفشدوزک ها توسط زنبور پارازیت *Homalotylus ephippium* Ruschka و بالتوری ها توسط زنبور پارازیت های: *Cheiloneurus ceroplastis* Ishii, *Ooencyrtus kuvanae* (Howard), *Isodromu atriventris* و *Ashmead, I. aff. vinulus* و *Catolaccus crassiceps* (Masi) *Pachyneuron concolor* (Forster)

مورد حمله قرار گرفتند.

## INTRODUCTION

The cypress tree mealybug, *Planococcus vovae* (Nasonov) (Homoptera: Pseudococcidae) is one of the most serious pests of cypress trees (particularly *Cupressus sempervirens* var. *fastigiata*) in Iran. This mealybug is widespread in Fars province and some other areas of Iran (M. Moghaddam, personal communication), and in other regions of Asia and Europe (2). Nymphs and adults of the pest cause direct damage by sucking the sap of cypress trees. Also dust is collected and sooty mold develops on the honeydew excreted by the mealybug.

A large number of parasitoids and predators has been reported attacking Pseudococcidae in other parts of the world (2, 7, 9, 11, 12, 16). However, there is no information on natural enemies of cypress tree mealybug. This study was conducted to determine natural enemies of cypress tree mealybug in Shiraz and surrounding.

## MATERIALS AND METHODS

Periodical surveys were conducted weekly from April to December 1998 in several locations in Shiraz and surrounding (Fars province of Iran), where cypress tree is widely grown.

Adult and immature stages of predators were collected from infested and unsprayed trees by shaking the branches or cutting some of them as samples for laboratory studies. The immature stages were reared to adult on infested branches bearing different stages of *Planococcus vovae* (Nasonov) incubated in petri-dishes (8.5×8.5×1.5cm). One 2.5 cm and one 1 cm holes were made 3-cm apart in the top lid of the petri-dish. The larger hole was covered with fine mesh for aeration. The smaller hole was used to insert a glass vial containing tap water and plugged with cotton wool downwards to provide moisture. Collected predators were offered mealybug in the laboratory. Those which were fed on the mealybug were considered as the mealybug predators. Coccinellids were identified using keys by Gordon (4) and Yazdani (24).

Infested shoot samples were placed in plastic bags and transferred to the laboratory where they were placed in plastic containers (11×11×10 cm) for rearing parasitoids. Each container had four 3-cm aeration holes covered with fine mesh and a 2-cm hole for collecting adult parasitoids. The containers were covered with black plastic.

Rearing containers were maintained under laboratory conditions at  $25 \pm 2$  °C,  $60 \pm 10\%$  RH and 12:12 (L:D) photoperiod. Collected adult parasitoids were preserved in 70% alcohol. Parasitoids were identified using keys by Hayat (5, 6), Peck *et al.* (15), Trypitsin (18, 19), Trypitsin and Gordh (20) and Yasnosh (21, 22, 23). Identifying of some species was later confirmed by specialists. The microscopic study of pupal remains of wasps assists the identification of parasitoids and hyperparasitoids.

Studies on activity periods of natural enemies and their parasitoids were carried out on 50 randomly sampled infested branches of cypress trees (collectively 36 times) in this region.

## RESULTS AND DISCUSSION

The cypress tree mealybug is attacked by the common guild of predators and parasitoids of mealybugs. A total of 13 species of predators and two species of endoparasitoids were identified as natural enemies of cypress tree mealybug in Shiraz and surrounding (Table 1).

The most common natural enemies on the pest were coccinellids. Among these, *Exochomus* spp., *Hyperaspis polita* Weise and *Nephus bipunctatus* Fursch were more abundant.

*E. quadripustulatus* (L.) was abundant mostly during spring in Shiraz, but with the rising temperature the overall effectiveness diminished during summer, because of adult obligatory estival diapause. It remained inactive until autumn. This species was recorded on *Phenacoccus aceris* from Caspian Sea area by Khiriuchin in 1947 (as cited in 16). It appears to be intermediate between aphidophagous and coccidophagous species because of its predaceous behavior observed on some aphids (e.g. *Hyalopterus pruni* Geoffroy) and some of Coccidoidea.

Table 1. Natural enemies of *Planococcus vovae* in Shiraz and surrounding.

| Natural enemy                              | Activity periods              |
|--|-------------------------------|
| <b>COLEOPTERA</b>                          |                               |
| <b>Coccinellidae:</b>                      |                               |
| <i>Exochomus undulatus</i> Weise           | July-November                 |
| <i>E. quadripustulatus</i> (L.)            | March-July & October-December |
| <i>E. nigromaculatus</i> (Goeze)           | May- August                   |
| <i>E. nigripennis</i> Erichson             | May- July                     |
| <i>Chilocorus bipustulatus</i> (L.)        | June-October                  |
| <i>Hyperaspis polita</i> Weise             | June-December                 |
| <i>Nephus bipunctatus</i> (Kugelann)       | May-August & October-December |
| <i>Scymnus araraticus</i> Khnzorian        | May-June                      |
| <i>Oenopia conglobata</i> (L.)             | July-November                 |
| <b>NEUROPTERA</b>                          |                               |
| <b>Chrysopidae:</b>                        |                               |
| <i>Chrysoperla carnea</i> (Stephens)       | July- October                 |
| <i>Suarius fedtschenkoi</i> (McLachlan)    | July-October                  |
| <b>HEMIPTERA</b>                           |                               |
| <b>Lygaeidae:</b>                          |                               |
| <i>Geocoris quercicola</i> Linnavuori      | June-November                 |
| <b>DIPTERA</b>                             |                               |
| <b>Cecidomyiidae:</b>                      |                               |
| <i>Dicrodiplosis manihoti</i> Harris       | July-September                |
| <b>HYMENOPTERA</b>                         |                               |
| <b>Encyrtidae:</b>                         |                               |
| <i>Anagyrus pseudococci</i> (Girault)      | May - October                 |
| <i>Dusmetia fascipennis</i> (Noys & Hayat) | July-September                |

This study showed that, *Hyperaspis polita* Weise and *Nephus bipunctatus* Fursch could have an important role in reducing the number of the mealybug during summer, but their potential decreased because of parasitization of their larvae. Some predaceous coccinellids were parasitized by an encyrtid wasp as *Homalotylus ephippium* Ruschka, (Table 2). *Homalotylus* is a common genus that contains several species of endoparasitoids of the larvae and pupae of Coccinellidae (8). In Turkmenia,

*H. ephippium* is parasite of the larvae of *Coccinella septempunctata* L., *Hippodamia variegata* (Goeze), *Exochomus quadripustulatus* (L.) and *Chilocorus bipustulatus* (L.) (13).

Table 2. Parasitoids of natural enemies of *Planococcus voyae* in Shiraz and surrounding.

| Parasitoid                            | Host                                      |
|---------------------------------------|---|
| <b>Aphelinidae:</b>                   |   |
| <i>Marietta picta</i> (Ander)         | <i>A. pseudococci</i> (Girault)           |
| <b>Signiphoridae:</b>                 |   |
| <i>Chortocerus</i> sp.                | <i>A. pseudococci</i> (Girault)           |
| <b>Encyridae:</b>                     |   |
| <i>Homalotylus ephippium</i> Ruschka  | <i>H. polita</i> & <i>N. bipunctatus</i>  |
| <i>Ooencyrtus kuvanae</i> (Howard)    | <i>C. carnea</i> & <i>S. fedtschenkoi</i> |
| <i>Cheiloneurus ceroplastis</i> Ishii | <i>C. carnea</i> & <i>S. fedtschenkoi</i> |
| <i>Isodromus</i> aff. <i>Vinulus</i>  | <i>C. carnea</i> & <i>S. fedtschenkoi</i> |
| <i>I. atriventris</i> Ashmead         | <i>C. carnea</i> & <i>S. fedtschenkoi</i> |
| <b>Pteromalidae:</b>                  |   |
| <i>Catolaccus crassiceps</i> (Masi)   | <i>C. carnea</i> & <i>S. fedtschenkoi</i> |
| <i>Pachyneuron concolor</i> (Forster) | <i>C. carnea</i> & <i>S. fedtschenkoi</i> |

*H. ephippium* Ruschka was collected from *H. polita* in groups of 2-4 wasps and on *N. bipunctatus*, as a solitary parasitoid. In *H. polita*, individual parasite larvae pupate in chambers separated from each other by remnants of dry host tissues. Each adult makes its own opening, through which it leaves the host. *H. flaminus* Dalm. has been reported as a solitary parasitoid on Scymnini (8). In this study parasitization by *H. polita* and *N. bipunctatus* was about 80% and 75%, respectively. Therefore, this parasitoid may be considered as a very significant mortality factor for these ladybirds specially in summer. Parasitization by *Homalotylus* spp. may be as high as 90-95% on *C. bipustulatus* and 100% on *Rodalia cardinalis* in India (see 8).

Two neuropterous species were found preying on the eggs and nymphal stages of the mealybug (Table 1). This is a new record of *Suarius fedtschenkoi* (McLachlan) from Fars province. Although these predators reach a high number in summer, their effectiveness is reduced due to parasitization of their larvae and cocoons by some parasitoids (Table 2).

Preying of *Geocoris* (*Piocoris*) *quercicola* Linnavuori (Hem: Lygaeidae) on the mealybug is a new record for Iran. This species was previously known

from Iraq and Israel on *Quercus* spp. (10). It is a polyphagous predator that feeds on adult and nymphal stages of cypress tree mealybug and phytophagous mirid bugs.

Three species of Diptera have been previously collected on mealybugs (2). In this study, larvae of *Dicrodiplosis manihoti* Harris, were found feeding on egg masses or ovisacs of cypress tree mealybug. This predaceous gall midge is a new record for Iran.

*Anagyrus pseudococci* (Girault) acted as a solitary endoparasitoid of adult and nymphal stages of the mealybug. This parasitoid has been already reported from Fars province on *Pseudococcus filamentosus* Ckll (9). It seems that this parasitoid may act as an effective agent in controlling this pest in Shiraz. However, its effectiveness is reduced due to parasitization by two hyperparasitoids (Table 2).

*Marietta picta* (Andre) has been recorded as a secondary parasite of Coccoidea (3, 12, 21, 22), but it was also recorded as a primary parasitoid on *Parthenolecanium corni* (Hom.: Coccidae) in Kazakhstan (21). *Chartocerus* (*Signiphorina*) sp. was found in low density, on the mealybug. In California *C. elongatus* (Gir.) greatly reduced the useful activity of three parasitoids on *P. maritimus* (Ehrh.) (Hom.: Pseudococcidae).

*Ooencyrtus kuvanae* (Howard) emerged from cocoons of *Chrysoperla carnea* (Stephens) and *Suarius fedtschenkoi* (McLachlan). Parasitism of this gregarious wasp was high, specially in summer months. This genus mostly parasitizes eggs of Lepidoptera (14, 18) and Hemiptera (18).

*Chiloneurus ceroplastis* Ishii was reared from cocoons of *C. carnea* (Stephens) and *S. fedtschenkoi* (McLachlan). Alrouechdi *et al.* (1) believed that these wasps parasitize their host in cocoon, and they are hyperparasitoids of Chrysopidae.

*Isodromus* spp. are gregarious parasitoids. They attack larval stages of chrysopids and pupate within the host larvae. Presence of pupal remains inside the host larval skin appears largely characteristic for this genus amongst chrysopid chalcidoid parasitoids. Gregarious adults leave the host cocoon through a single hole. All samples investigated, were sexually female, as previously reported by Alrouechdi *et al.* (1).

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