

Parasitoids of *Pseudococcus comstocki* in Italy. *Clausenia purpurea* and *Chrysoplatycerus splendens*: first records from Europe

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Abstract

The occurrence of *Clausenia purpurea* Ishii and *Chrysoplatycerus splendens* (Howard) (Hymenoptera Encyrtidae) in Europe (Italy) is here reported for the first time. These species were reared from females of the Comstock mealybug, *Pseudococcus comstocki* (Kuwana) (Hemiptera Pseudococcidae), a species accidentally introduced into Italy. The complex of *P. comstocki* antagonists in Italy includes two other encyrtid species, already reported from Italy, namely *Acerophagus maculipennis* (Mercet) and *Anagyrus* sp. near *pseudococci* (Girault).

Key words: Chalcidoidea, Encyrtidae, *Acerophagus maculipennis*, *Anagyrus* sp. near *pseudococci*, biological control, peach, Pseudococcidae.

Introduction

The Comstock mealybug, *Pseudococcus comstocki* (Kuwana) (of Asiatic origin), was collected for the first time in northern Italy (Veneto region) in 2004, on mulberry (Pellizzari, 2005). Since then, the species has spread, attacking several species of ornamental plants. *P. comstocki* is a known pest of ornamentals and fruit trees (apples, pears and peaches), particularly in countries where it was introduced accidentally (USA, Canada, and Argentina) (Agnello *et al.*, 1992; Phillips, 1960). Early August 2007, heavy infestations were recorded in a nectarine and peach orchard near Verona (Visigalli *et al.*, 2008). The district of Verona is an economically important area for peach cultivation in Italy and the Regional Quarantine Service funded a research programme for studying the biology and the distribution of *P. comstocki* in north eastern Italy. Preliminary data indicated that *P. comstocki* has three generations per year and overwinters at the egg stage. Adult females appear in late June (1st generation), from the end of July to the first half of August (2nd generation), and from mid September to November (3rd generation) (Pellizzari *et al.*, 2008).

Along with biological observations, a preliminary survey on the natural enemies of *P. comstocki* was carried out during summer 2007 and 2008. Parasitized adult

adult females of the 2nd and 3rd generations were collected from peach trees and ornamentals in two different districts and were kept at room temperature until the emergence of parasitoid adults for their identification (table 1).

The most interesting result of the survey on the parasitoid complex of *P. comstocki* was the presence of two encyrtid species new for the European fauna. Two other encyrtid species already reported from Italy, *Acerophagus maculipennis* (Mercet) and *Anagyrus* sp. near *pseudococci* (Girault) (Tranfaglia, 1973) were also collected. This communication aims at providing information about these parasitoids, their hosts and their distribution in the perspective of a sustainable control of the mealybug pest.

Clausenia purpurea Ishii 1923

This Asiatic species (described by Ishii, 1923) was re-described and illustrated by Tachikawa (1963). It is an endoparasitoid of a few mealybug species [*Crisicoccus azaleae* (Tinsley), *Planococcus citri* (Risso), *Pseudococcus* sp., *Pseudococcus cryptus* Hempel, *Pseudococcus kenyae* (Le Pelley)] including *P. comstocki* (Noyes and Hayat, 1994). Females of this species can be confused with those of *Clausenia josephi* Rosen (Rosen, 1965) and *Clausenia senex* Noyes (Noyes, 2000) but can be separated from these two by the almost complete notaular lines (hardly visible in front of mesoscutum in *C. josephi* and *C. senex*). So far, with the exclusion of an accidental introduction of this parasitoid with its host from the Orient into the eastern states of the USA (Haeussler and Clancy, 1944), *C. purpurea* has been used in classical biological control introductions to control *P. comstocki* infestations. For example, it has been imported into California from Japan and released in apple orchards (Bartlett and Clancy, 1972; Meyerdirk and Newell, 1979). In the 1940s it was imported into Israel

Table 1. Data on *P. comstocki* collections.

Location	Host plants 2007	Host plants 2008
Treviso district	<i>Viburnum tinus</i>	<i>Prunus laurocerasus</i>
		<i>Viburnum tinus</i>
		<i>Eleagnus</i> sp.
		<i>Morus nigra</i>
Verona district	<i>Hypericum</i> sp.	<i>Prunus laurocerasus</i>
	<i>Prunus persica</i>	<i>Prunus persica</i>
		<i>Viburnum tinus</i>

to control *P. cryptus* (at that time misidentified as *P. comstocki*) infesting citrus groves (Blumberg *et al.*, 1999). More recently Syria was included in the distribution area of *C. purpurea* (Al-Khateeb and Louai-Assan, 2004).

Material examined

Italy, Veneto: Dossobuono (VR), 4♀♀, 9.X.2007, ex *P. comstocki* on *Prunus persica* (L.); Castelnuovo del Garda (VR), 2♀♀, 9.X.2007, ex *P. comstocki* on *Hyperricum* sp.; Lugagnano (VR), 1♀, 21.VIII.2008, ex *P. comstocki* on *Morus nigra* L.; Buttapietra (VR), 1♀, 7.VIII.2008, ex *P. comstocki* on *M. nigra*; Verona (VR), 1♀, 27.VI.2008, ex *P. comstocki* on *M. nigra*; 4♀♀, 29.IX.2008, ex *P. comstocki* on *P. persica*. All material collected by G. Pellizzari.

Comments

This species has not been recorded in Europe before. The potential of this parasitoid as a biocontrol agent of *P. comstocki* became evident in summer 2008 when it was introduced accidentally into the rearing screenhouse of the mealybug at the “Dipartimento di Agronomia Ambientale e Produzioni Vegetali - Entomologia, Università di Padova”. In a couple of months *C. purpurea* parasitized nearly all the adult females of *P. comstocki* of the 2nd generation.

***Chrysoplatycerus splendens* (Howard 1888)**

This remarkable Neotropical species was described by Howard (1888) and redescribed and illustrated by Noyes (2000). It has been reported from a number of mealybugs [*Dysmicoccus brevipes* (Cockerell), *Dysmicoccus ryani* (Coquillett), *Ferrisia virgata* (Cockerell), *Formicococcus njalensis* (Laing), *Planococcus ficus* (Signoret), *P. citri*, *Pseudococcus* sp., *Pseudococcus calceolariae* (Maskell), *Pseudococcus longispinus* (Targioni Tozzetti), *Pseudococcus maritimus* (Ehrhorn), *Pseudococcus viburni* (Signoret) (= *obscurus* Essig; = *affinis* Maskell), including *P. comstocki* (Noyes and Hayat, 1994). It was introduced into California and Texas for the biological control of *P. citri* in protected crops (Hall, 1974; Summy *et al.*, 1986), and also into Canada, Ghana, South Africa and Hawaii against different mealybug pests (Baird, 1940; McLeod, 1962; Greathead, 1971; Prinsloo, 1981). The distribution of this species includes Mexico, Trinidad and Tobago, Costa Rica and Panama (Noyes, 2000).

Material examined

Italy, Veneto: Treviso, 1♀, 16.X.2007, ex *P. comstocki* on *Viburnum tinus* L. (G. Pellizzari).

Comments

This is the first record of this species for Europe although only one female was collected during the 2 years of the survey. Further field collections of parasitized mealybugs will be undertaken to assess the present distribution/occurrence of this species in Italy.

***Acerophagus maculipennis* (Mercet 1923)**

A. maculipennis is a gregarious endoparasitoid of *P. viburni*, a mealybug largely distributed in Italy on ornamentals. Other hosts include *Pseudococcus* sp. and *P. maritimus* (Noyes and Hayat, 1994). It was described (as *Pseudaphycus maculipennis*) from specimens collected in the Canary Islands but its native area is still uncertain, even though Charles (2001) regarded it as a southern European/Mediterranean species. This species can be recognised by a combination of characters as stated by Mercet (1923), mainly by the presence of 2 distinct brown bands on the fore wing. *A. maculipennis* was recorded for the first time in southern France in 1971 and released as biocontrol agent against *P. viburni* both in greenhouses and open field (Panis and Brun, 1971; Panis, 1986); in 1973 it was recorded in southern Italy (Tranfaglia, 1973). So far, its distribution in the Palaearctic, other than France and Italy, includes Portugal, Spain and Georgia (Noyes, 2009). It has been successfully introduced into Australia and New Zealand against *P. viburni* infestations in pip fruit orchards (Charles *et al.*, 2004).

Material examined

Italy, Veneto: Dossobuono (VR), 2♀♀, 1♂, 13.VII.2007, ex *P. comstocki* on *P. persica*; Treviso, 4♀♀, 1♂, 25.VII.2007 ex *P. comstocki* on *V. tinus*; 2♀♀, 16.X.2007 ex *P. comstocki* on *V. tinus*; 1♀, 16.X.2008, ex *P. comstocki* on *V. tinus*. All material collected by G. Pellizzari.

Comments

P. comstocki is a new host record for *Acerophagus maculipennis*. In 2007 it was the most abundant species reared from parasitized Comstock mealybugs in Veneto. Apparently, in 2008 its place was overtaken by *Anagyrus* sp. near *pseudococci*.

***Anagyrus* sp. near *pseudococci* (Girault 1915)**

This species appears to be extremely common in the Mediterranean and has been frequently misidentified with the similar *Anagyrus pseudococci* (Girault) (Triapitsyn *et al.*, 2007). The females of the two species can be readily separated by the colour of the first funicular segment that is entirely brown in *A. sp. near pseudococci* and partially white in the true *A. pseudococci*. According to Triapitsyn *et al.* (2007), *A. pseudococci* is only known from Sicily (Palermo), Argentina and Cyprus whereas the close related *A. sp. near pseudococci* is more widely distributed. *A. sp. near pseudococci* may be the same as *Anagyrus dactylopii* (Howard), but this needs to be investigated. Nonetheless the record is noteworthy because *A. sp. near pseudococci* is usually recorded from *Planococcus* spp. and *A. dactylopii* from *Nipaecoccus* spp. This poses questions about the real identity of the species used under the name *A. pseudococci* all over the world in biocontrol programmes against mealybugs. A multidisciplinary characterization of this species complex is needed in the perspective of using them as biocontrol agents of mealybug pests.

Material examined

Italy, Veneto: Dossobuono (VR), 1♀, 1♂, 9.X.2007, ex *P. comstocki* on *P. persica*; 1♀, 27.VIII.2008, ex *P. comstocki* on *P. persica*; 1♀, Bine (VR), 13.VIII.2008, ex *P. comstocki* on *M. nigra*; Treviso, 1♀, 16.VII.2008, ex *P. comstocki* on *Eleagnus* sp.; 2♀♀, 16.VII.2008, ex *P. comstocki* on *Prunus laurocerasus* L.; 2♀♀, 20.VIII.2008, ex *P. comstocki* on *P. laurocerasus*; 2♀♀, 26.IX.2008 ex *P. comstocki* on *V. tinus*. All material collected by G. Pellizzari.

Comments

This species appears to be dominant in the District of Treviso in Veneto, representing the only one species collected in the 70% of samples.

Conclusions

The parasitoid complex of *Pseudococcus comstocki* in Italy currently consists of four encyrtid wasps, namely *Clausenia purpurea*, *Anagyrus* sp. near *pseudococci*, *Acerophagus maculipennis* and *Chrysoplatcerus splendens*. *Clausenia purpurea* has been recorded from several locations but only in the Verona District, where *Pseudococcus comstocki* infestations on peach already cause an economic damage. In the same area, the parasitoid complex is completed by the presence of *Anagyrus* sp. near *pseudococci* and, to a lesser extent, *Acerophagus maculipennis*. Our survey also shows that ornamental plants infested by *Pseudococcus comstocki* can play the role of parasitoid reservoir in an area where pesticides are regularly employed on peach cultivation. This is more evident in Treviso District where there is a predominant presence of *Anagyrus* sp. near *pseudococci* together with *Acerophagus maculipennis* on infested ornamentals. The presence of *Chrysoplatcerus splendens* should be regarded as occasional, if not confirmed by further records.

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