

## BIOLOGICAL OBSERVATIONS ON SOME SCALE INSECTS (HOMOPTERA: COCCOIDEA) IN SICILY

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### ABSTRACT

Observations are presented on the biology and ethology of three scale insect species, namely the mealybugs (Pseudococcidae) *Phenacoccus madeirensis* Green, *Phenacoccus silvanae* Longo and Russo and the soft scale insect (Coccidae) *Scythia aetnensis* Russo and Longo, occurring in Sicily, Italy.

KEY WORDS: Coccoidea, Pseudococcidae, Coccidae, biology, ethology, Italy, Sicily.

### INTRODUCTION

Comprehensive studies on scale insects are generally focused, in Italy as well as in other countries, on species that are of agricultural and sylvan importance, whereas others are generally known only from a taxonomic and faunistic point of view: for example, there are numerous studies on *Aspidiotus nerii* (Bouche) as compared to those on *Aspidiotus hedericola* Lindinger.

In this paper we present data on the biology of two mealybug species, namely *Phenacoccus silvanae* Longo and Russo and *Phenacoccus madeirensis* Green, and of the soft scale *Scythia aetnensis* Russo and Longo in Sicily.

*Ph. silvanae* and *S. aetnensis* have been described recently (Longo et al., 1989; Russo and Longo, 1990) and are known so far only from Sicily. *Ph. madeirensis*, on the other hand, is a cosmopolitan species. It was recorded for the first time in 1990 in Sicily (Longo and Russo, 1990). Since then it has become a serious pest of ornamental plants. Therefore it was necessary to broaden the knowledge on its biology, in order to apply integrated control strategies.

### MATERIALS AND METHODS

The observations on *Ph. madeirensis* were carried out from 1992 to 1994 at Catania in the field, at 50 m above sea level (a.s.l.) and in laboratory conditions (Institute of Agricultural Entomology). The observations on *Ph. silvanae* and *S. aetnensis* were performed on Mount Etna from 1991 to 1993 at one locality at 1230 m a.s.l. and from 1991 to 1994 on Mount Etna at two localities (1300 and 1500 m a.s.l.).

*Ph. madeirensis* was reared in the open on plants of *Lantana camara* L. placed in isolated cages. In the laboratory (25° C and 60–70% RH) it was reared on bleached potato sprouts and on cucumber fruits in polythene boxes. Every ten days, 10 infested *L. camara* leaves were removed and the mealybug population was counted and examined according to the various instars, and classified as live, dead and parasitized. In September 1992 the number of eggs in 25 ovisacs was counted. More or less daily laboratory observations provided data on the duration of male and female preimaginal stages, number of eggs laid and percentage of hatching of the eggs.

Biological observations on *Ph. silvanae* and *S. aetnensis* were carried out at fortnightly intervals on populations living on *Pyracantha coccinea* Roemer and *Festuca circummediterranea* Patzke, respectively. Samples were collected to determine the composition of the population and to count the number of eggs produced.

For each of the three species, specimens showing to be actively parasitized were isolated in test tubes, in order to identify the parasitoids.

#### RESULTS AND DISCUSSION

In Italy *Ph. madeirensis* has several, sometimes overlapping, annual generations, as also observed by Marotta (1990). In the field, the first generation develops in February/March from eggs laid at the beginning of winter or from those produced subsequently, in spring, by overwintering females. From June to August, at approximately monthly intervals, three further generations are produced, followed in September by a fifth generation that continues until November. The last generation is bred in December and ends with the oviposition of overwintering eggs or the appearance of young adult females, that move to sheltered parts of the plants (Fig. 1a). Each female produces an average of  $601.6 \pm 32.1$  eggs, enclosed in a compact ovisac that covers the body almost entirely. The ovipositing females may form small groups but, more commonly, they are found isolated along the leaf midribs. The colonies develop on the trunk, twigs, leaves and fruits of the host plants, preferably infesting the lower leaf surfaces, the small branches and the buds. Males are always present.

During the study, the mealybug was preyed upon by the predators *Cryptolaemus montrouzieri* Mulsant and *Sympherobius* sp. Second-instar nymphs were parasitized by an undetermined Encyrtid.

Under laboratory conditions, the mealybug breeds a generation in 30–40 days. Upon oviposition, the eggs have a light yellow color that turns darker later. Close to hatching, the eyes of the crawlers are visible in the developing egg. The hatching crawlers are inactive for a short time; then they quickly disperse on the host plant. The body of the 2nd-instar nymphs is covered with a thin layer of powdery wax through which the color of the hemolymph (yellow in females and pink in males) is discernible. Male 2nd-instar nymphs form a soft wax cocoon, inside which they will moult three times before the adult male appears. The average duration of development was calculated to be 10 days (1st instar), 10 days (2nd instar), 6 days (3rd-instar female) and 11 days for the female until the beginning of egg laying. In the male, the average duration of the stages of prepupa, pupa and adults is of 2.36, 4.95 and 6 days, respectively. Under the laboratory conditions detailed above, a female laid  $375.4 \pm 64.7$  eggs, and the rate of hatching was 95.2%.

*Ph. silvanae* generally lives isolated on twigs, among buds, and along midribs on the lower leaf surface of *P. coccinea*. It overwinters as 2nd- or 3rd-instar female nymph and male prepupa,

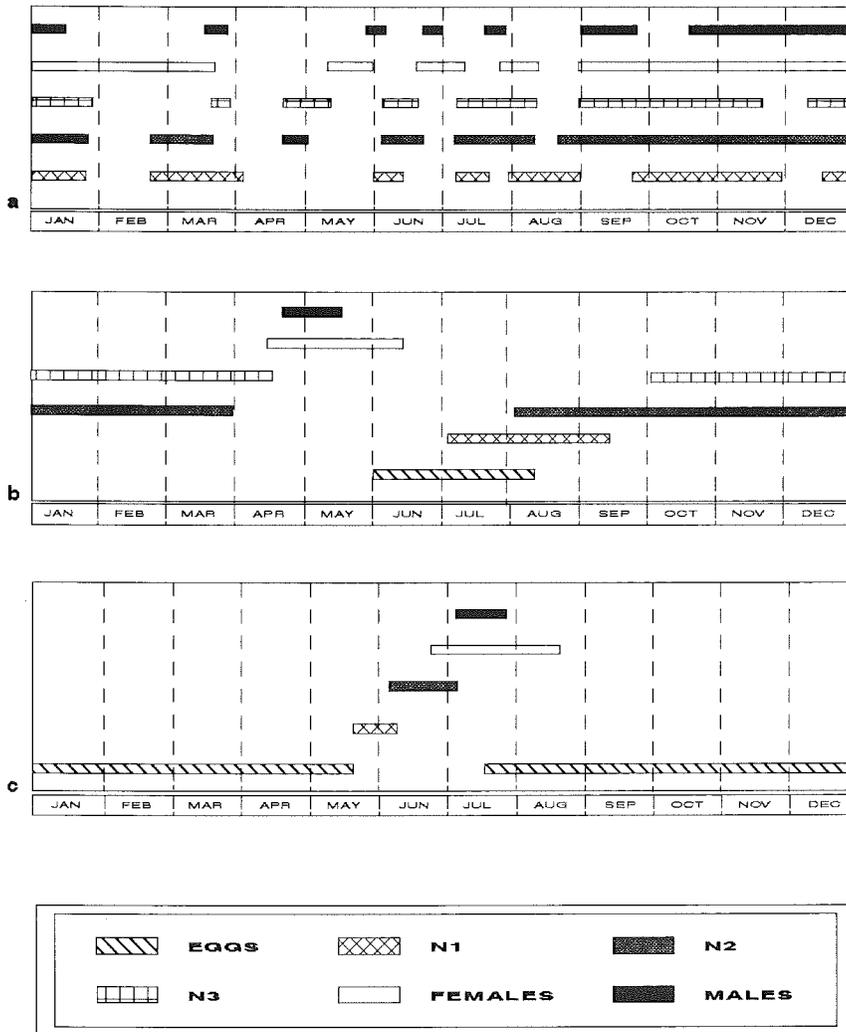


Fig. 1. Phenology of *Phenacoccus madeirensis* (a) (Catania, in a field on *Lantana camara*); *Phenacoccus silvanae* (b) (Mount Etna, on *Pyracantha coccinea*); and *Scythia aetnensis* (c) (Mount Etna, on *Festuca circummediterranea*) in Sicily.

within bark cracks. They leave these shelters in March, completing their development in mid-April. Males were present until May and females until June.

Mated females begin to lay eggs at the beginning of June, forming elongate or slightly bent ovisacs that contain an average of  $840.8 \pm 127.1$  eggs.

The hatching of eggs begins at the end of June and ends in August. The first instars develop until September, and 2nd-instar nymphs are present from August to October. Second- and third-instar nymphs, as well as prepupae, are present from October until March of the following year.

*Ph. silvanae* has a monovoltine cycle (Fig. 1b). In this aspect and in the ovisac shape, the species resembles *Phenacoccus aceris* (Signoret), from which it differs, however, in distinct morphological characters (Longo et al., 1989; Longo and Russo, 1990).

*Scythia aetnensis* overwinters in the egg stage, within the ovisac. Egg hatching begins in the second half of May, approximately a month after the vegetative renewal of the host plant, *F. circummediterranea*. The crawlers have a gregarious behaviour and tend to settle at a short distance from the maternal ovisac, close to each other along the leaves, where they begin to secrete a wax covering. Within 4–6 weeks, depending on the temperature, and after two nymphal stages, adult females appear. Males appear two weeks later. After mating, the female starts to lay eggs, from the third decade of July until the end of August. As the eggs fill the distal end of the ovisac, the body of the female begins to protrude at the opposite end, until it detaches itself from the ovisac as soon as egg laying is complete. The number of eggs produced by a female was  $118.8 \pm 12.1$  in 1991 and  $136.5 \pm 16.4$  in 1993.

This soft scale develops one annual generation (Fig. 1c), thus resembling other species of *Scythia* (Kosztarab and Kozár, 1988). Our observations indicate that its phenology is synchronized with that of the host-plant cycle.

During the study we have found that *S. aetnensis* was parasitized by the primary parasitoid *Baeocharis pascuorum* Mayr (Hymenoptera: Encyrtidae) and the secondary parasitoid *Marietta picta* André (Hymenoptera: Aphelinidae).

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