Entomologica, Bari, 33, (1999): 419-422

PANIS, A.[1]; PINET, C.
INRA, Laboratoire de Biologie des Invertébrés, Antibes, France
[1]14 Avenue Schubert, 83440 Montauroux, France

A DISCUSSION OF SOME ECOLOGICAL FACTORS AFFECTING *COCCIDENCYRTUS MALLOI* BLANCHARD (HYMENOPTERA: ENCYRTIDAE) AS A PARASITOID OF DIASPIDID SCALES UNDER GLASS IN FRANCE.

ABSTRACT

A DISCUSSION OF SOME ECOLOGICAL FACTORS AFFECTING *COCCIDENCYRTUS MALLOI* BLANCHARD (HYMENOPTERA, ENCYRTIDAE) AS A PARASITOID OF DIASPIDID SCALES UNDER GLASS IN FRANCE.

The encyrtid parasitoid *Coccidencyrtus malloi* Blanchard has been recorded in orchid glasshouses of south-eastern France where its diaspidid host, *Diaspis boisduvalii* Signoret (Hemiptera, Diaspididae), is sometimes a pest of ornamentals. In order to study its biology and potential as a biological control agent, it was cultured on a bromeliad and released into several hot temperate commercial houses. It was found to have a very restricted distribution which appeared to be determined by deep shade and very high humidities.

Key words: Argentina, Boisduval scale, parasitoid development, thelytokous parthenogenesis, *Diaspis bromeliae*, *D, coccois*, *Laeliocattleya*, *Vriesea*, *Aechmea*, *Cattleya*, *Citrullus*, *Cymbidium*, *Coccos*, *Dendrobium*, *Neodypsis*, *Hohenbergia.*

INTRODUCTION

Coccidencyrtus malloi Blanchard (Hymenoptera: Encyrtidae) had only been reported as a parasitoid of the Boisduval scale, *Diaspis boisduvalii* Signoret (Coccoidea: Diaspididae), on an undetermined orchid in Argentina (Buenos Aires Province) (De Santis, 1964). In 1970, it was found for the first time in south-eastern France (Alpes-Maritimes department) on orchids in a glasshouse. According to Noyes (1980), the species *malloi* should be correctly placed in *Coccidencyrtus*. In Argentina, both sexes are known but males appear to be completely lacking in France and so the parasitoid reproduces by thelytokous parthenogenesis. This paper considers some ecological factors affecting its distribution in glasshouses in France.

MATERIALS AND METHODS

Three species of *Diaspis* (*D. boisduvalii*, *D bromeliae* (Kerner) and *D. coccois* (Lichtenstein)) were found to be parasitised by *C. malloi*. Adult female *D. boisduvalii* and *D. bromeliae* were separated using the illustrations

in Williams & Watson (1988). *D. coccois* was validated by Miller (1996), who listed it separately from the Boisduval scale as a new record on coconut palms in Mexico.

In 1970, *Coccidencyrtus malloi* was bred from the Boisduval scale on a fairly shaded *x Laeliocattleya* plant which had recently been imported from Brazil within a hot and humid temperate glasshouse whose sides were below ground level (Glasshouse 1). From this initial collection, the parasitoid was maintained in a culture (Culture 1) of the Boisduval scale raised on uncaged and potted *Vriesea splendens* (Brongn.) (Bromeliaceae) at 15-18°C and 60-80% RH, in a small, north-facing, greenhouse against a high wall which provided shade in the afternoons for about 6 months of the year. Under these same conditions, it failed to parasitise the Boisduval scale on another bromeliad, *Aechmea fasciata* (Lindl.) which has upright leaf blades. *C. malloi* from Culture 1 was then released into two commercial orchid houses, one of which was used to grow *Cattleya x* (Glasshouse 2) and the other *Cymbidium x* (Glasshouse 3), where it successfully parasitised *D. boisduvalii.*

The second glasshouse (Glasshouse 2), which was used to grow 10 year old potted-*Cattleya x* plants, was 75m^2 and was maintained at 18°C constant temperature and 60-70% RH (except when pots were outdoors in summer) and periodically shaded between November and early April for flowering requirements. Infestations of *D. boisduvalii* on the sheathing leaf bases which enclosed the flower stem and on the pseudobulbs resulted in flower spotting, indicative of economic loss for grower, even though the level of infestation had been scored as low to medium on many plants. After high pressure sprays of petroleum white-oil had failed to control the scale, 200 *C. malloi* were released during April and May 1971, when the RH was obviously less than normal and with little shade.

C. malloi was also released in another glasshouse (Glasshouse 3) with 7 year old potted *Cymbidium x* (Orchidaceae) plants. This glasshouse was 200m^2 and, between October and late April (during flowering), it was maintained at 15-18°C and 60-65% RH but from spring to early autumn, the temperatures were maintained at 14-15°C nightly and 20-26°C daily, with an RH of 50-65%. The glasshouse was shaded according to the sky conditions from February to April. Many of the plants had a light infestation of Boisduval scale towards the base of their pseudobulbs. In November 1971, about 200 *C. malloi* were released during a rather long cloudy and rainy period (more than 65% RH was measured from time-to-time indoors). The effectiveness of the parasitoid was estimated by roughly counting the number of live scales on the same infested plants before and after release.

In March 1991, a second "wild" population of *C. malloi* was discovered in a small orchid collector's glasshouse (Glasshouse 4) which backed onto a northern wall, fairly humid and hot temperate, and somewhat shaded during the morning and evening between mid-autumn and early spring. The parasitoid was probably introduced in parasitised *D. boisduvalii* on the flower stem of a *Cattleya* plant imported from Brazil; it was also found on the pseudobulb of a *Dendrobium sp.* imported from Thailand. The parasitoid was collected and maintained in culture on caged water-melon fruit, *Citrullus lanatus* (Thunb.), previously contaminated with Boisduval scale, in a rearing chamber at 25°C, 60-70% RH and artificial overhead lighting (L:D 16:8 h) (Culture 2). Parasitoids from this second culture were not subsequently used experimentally under glass.

In 1996-1997, yet more *C. malloi* of undetermined origin were found in a large, 2.3 hectare, wet-tropical house with a special plastic roof (Glasshouse 5). The tallest vegetation was about 6m tall, while the understorey provided a wide variety of conditions, some of which were permanently shaded throughout the day. Gradients of temperature (22-28°C) and RH (60-85%) were present depending on the situation and vegetational strata in the glasshouse. Control of the temperature and RH (misted water from above the top vegetation) was automatic, so that the temperature above the vegetation was 17°C at night and 20-25°C daily from October to late in March and 20°C at night and (at most) 25°C during the day from April to September. The RH above the canopy was controlled at 75-80% between February and October and at 70% between November and January. Three species of *Diaspis* were present: *D. boisduvalii* was widespread on various tropical plant-species, either scattered on both leaf surfaces or on the sheathing leaf bases which enclosed the stem; it also formed mixed infestations with *D. coccois* on two palms (*Coccos nucifera* L. and *Neodypsis decaryi* Baill.). In addition, *D. bromeliae* was present on both leaf surfaces of three bromeliads: *Hohenbergia stellata* Schult., *Vriesea hieroglyphica* (Carr.) and *V. spendens*, but only in very small groups.

RESULTS AND DISCUSSION

The development of the *C. malloi* under the conditions of Culture 2 lasted 20-25 days, with the eggs being laid in the 2nd-instar nymphs and young adult females only. Parasitoid emergence was from young female scales prior to ovarian maturation. Adult parasitoids were mainly found beneath the water melons and were never found to lay their eggs in scales on the upper

surface. Similarly, in the first culture (Culture 1) which had been raised on *V. splendens*, the parasitoid rarely emerged from scales on the upper leaf surface, preferring to remain beneath the leaves. All the populations introduced into glasshouses (Glasshouses 1, 3, 4 and 5) preferred to rest and oviposit in fairly to very shady situations.

In the case of Glasshouse 2, it is considered that the failure of the parasitoid to establish was due to too low a humidity. Glasshouse 3 had a much higher RH and the pseudobulbs were very shaded and it is considered that these conditions were suitable for biological control on *Cymbidium,* which remained undamaged up to October 1972 when observations ceased. Again, in Glasshouse 5, *C. malloi* was restricted to *D. bromeliae* infesting two bromeliad plants: *H. stellata* (0.7m high) and *V. hieroglyphica* (0.5m high) growing on the margin of a small pond in deep shade in a nearly water-saturated atmosphere. About 2m away from these two bromeliads, in fairly shady situations but with sunny areas at times and with 70-80% RH, were three plants of *Vriesea splendens* (0.4m tall) infested with *D. bromeliae* and a plant of *Vriesea imperialis* Carr. (1.25m tall) infested with *D. boisduvalii*. These plants grew under brighter light conditions and lower RH and were not attacked by *C. malloi*; nor was a mixed colony of *D. boisduvalii* and *D. coccois* on the two palm species. It is concluded that *Coccidencyrtus malloi* requires high humidity and deep shade for it to become established in glasshouses in France.

REFERENCES

De Santis, L., 1964 - Encirtidos de la Republica Argentina (Hymenoptera: Chalcidoidea). *Anales de la Comision de Investigacion Cientifica*, 4: 9-392.

Miller, D.R., 1996 - Checklist of the scale insects (Coccoidea: Homoptera) of Mexico. *Proceedings of the Entomological Society of Washington*, 98: 68-86.

Noyes, J.S., 1980 - A review of the genera of Neotropical Encyrtidae (Hymenoptera: Chalcidoidea). *Bulletin of the British Museum (Natural History), Entomology Series*, 41: 107-253.

Williams, D.J., Watson, G.W., 1988 - The Scale Insects of the Tropical South Pacific Region. Part 1. The Armoured Scales (Diaspididae). CAB International Institute of Entomology, Wallingford. 290pp.