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*Ceranisus menes* (Walker) (Hymenoptera Eulophidae): Collection and Initial Rearing on *Frankliniella occidentalis* (Pergande) (Thysanoptera Thripidae)<sup>(1)</sup>.

I. INTRODUCTION

Until 1990, *Ceranisus menes* (Walker), a larval parasitoid of thrips, was found in several European countries. In Italy it sometimes is occurring in the southern parts on *Thrips tabaci* Lindeman (Domenichini, personal communication). Loomans and Van Lenteren (1990) reviewed the geographical distribution of *C.menes* and other thrips parasitoids and their known host associations. Further data on parasitoid species attacking thrips, their geographical distribution in Europe and their host range and the collection and first evaluation of *C.menes* as biological control agent of *Frankliniella occidentalis* (Pergande) (Loomans, 1991) indicate that parasitoids might have some potential in biological control of thrips.

*F.occidentalis* was introduced in Italy in 1987 and is harmful in protected crops (Rampinini, 1987 and 1989; Arzone *et al.*, 1989) as well as in open field crops (Del Bene and Gargani, 1989; Ciampolini *et al.*, 1990 and 1991). Many authors studied two groups of predators: amblyseiids (*Amblyseius* spp., *Neoseiulus* sp.) and anthocorids (*Orius* spp.) as biological control agents of *F.occidentalis* (Altena and Ravensberg, Bennison *et al.*, Buxton *et al.*, Gilkeson *et al.*, Lindqvist, Ramakers, van Rijn and Sabelis, Steiner and Tellier, Tellier and Steiner, 1990) but these predators are not able to keep *F.occidentalis* at sufficiently low population levels on several crops, e.g. ornamentals. The collection and rearing of an Italian strain of *C.menes* therefore could be important to plan a new or additional biological control strategy against *F.occidentalis* or other phytophagous thrips.

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## 2. MATERIALS AND METHODS

### 2.1. COLLECTION

Thrips parasitoids were collected by sampling wild vegetation in different localities in Northern and Central Italy: adults and parasitized larvae were collected by beating flowers above a white surface and by sorting out the plant material.

### 2.2. PRELIMINARY REARINGS

Newly hatched *F.occidentalis* larvae, reared by using the Murai method (Murai, 1990), were collected daily and exposed to the parasitoids. Every day, 20 first instar *F.occidentalis* were exposed to a single *C.menes* female in a petri-like dish (3.5 cm diameter) (Fig.1a), which contained a small amount of maize pollen and was closed by two layers of stretched parafilm M with a honey solution (10%) sandwiched in between; 24 hours later *C.menes* female were taken out. Then parasitoid pupae were transferred to small aired plastic cages (3.5 cm diameter, 1 cm height) with droplets of honey placed on the walls (Fig.1b). The cages were kept inside a glass jar containing a glass of water to maintain RH at saturation. Every day the development was checked and the day of emergence recorded. The field collected thrips larvae were isolated and reared using a similar method.

A back up rearing of *F.occidentalis* was set up in a plexiglass cage (40x40x40cm) (Fig.1c), on *Phaseolus vulgaris* L. plants, in a heated glasshouse.

### 2.3. PRESENT REARING

*F.occidentalis* and *C.menes* are currently reared in an incubator at 25°C, 80% RH and L:D=16:8 h photoperiod, using:

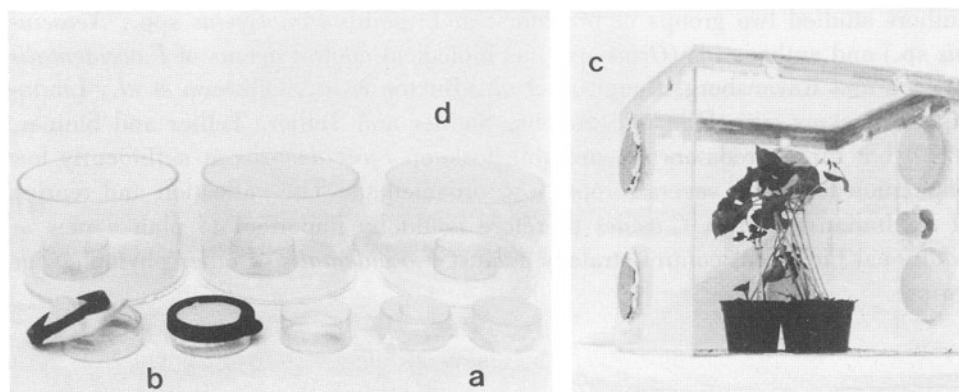


Fig. 1 - Rearing cages.

1) A modified Murai method:

As oviposition units glass tubes (8 cm diameter, 5 cm height) are used with one end closed using a cotton cloth held in place by a perforated plastic lid and the other by two layers of stretched parafilm M with distilled water sandwiched in between (Fig.1d); thrips females lay their eggs through the parafilm into the water. Inside the unit there is a petri-like dish (3.5 cm diameter) containing maize pollen. Twice a week the eggs are harvested and parafilm and pollen are renewed. Eggs are collected by filtering the water through a cloth, which serves as the basis of a second unit. Excess water is absorbed by blotting-paper, and this second cage is closed again with two layers of stretched parafilm with about 5 ml of honey solution (10%) sandwiched in between. During the experiments cages are stored in a plastic box containing a glass of water to maintain RH near saturation. After 2-4 days a small amount (0.1g) of maize pollen is put into the unit, the double-ply film changed and 2 parasitoids are added to the unit. After 3 weeks the parasitoid pupae are transferred to small aired plastic cages (3.5 cm diameter, 1 cm height) with droplets of honey placed on the walls (Fig.1b). The cages are housed in a glass jar containing a glass of water to keep RH near saturation.

2) Bean pod method:

Another, simpler rearing unit was set up for both thrips and parasitoids using green bean pods, maize pollen and honey droplets inside aired glass jars (2 dm<sup>3</sup>) (Loomans, 1991).

### 3. RESULTS AND DISCUSSION

#### 3.1. COLLECTION

About 700 thrips larvae originating from wild meadows in the hills near Bologna and Faenza (Italy) were sampled from 9 August to 15 September 1990. 343 larvae belonging to several thrip species were found in yellow flowers (*Hieracium* sp.). Adults of *Frankliniella intonsa* (Trybom), *F. pallida* (Uzel), *Taeniothrips hispanicus* (Bagnall) and *Thrips hukkineni* Priesner (Thysanoptera Thripidae) occurred regularly in these samples. 31 larvae (9%) proved to be parasitized from which 9 adults emerged (2.6%). All parasitoids collected and their progeny proved to be *C. menes* females. During the same period another 700 larvae were collected in different yet nearby hill and mountain areas, but none was found to be parasitized. Adult collection was more effective and less laborious than collection of parasitized larvae. A great number of *C. menes* adults could be collected in September, early in summer numbers were lower. The first *C. menes* adult, a female, was found on 18 August 1990 in Bologna (S. Luca) on *Hieracium* sp.

In September 1990, adults of *C. menes* were collected from *Centranthus* sp. near Pietra Ligure (Liguria, Italy) (Loomans, 1991), inhabited by *Thrips brevicornis* Priesner. Collections made on several places in Northern and Central Italy in September 1991 (table 1) show that *C. menes* has a regular distribution in Italy.

Tab. 1 - Collections of the parasitoid *Ceranisus menes* (Walker) at different localities in Italy.

Locality	date	plant species	numbers
<b>Bologna</b>			
S. Luca	09.08.1990	<i>Hieracium</i> sp.	3 <sup>1</sup> 2y,1b
	18.08.1990	<i>Hieracium</i> sp.	1 y
	13.09.1990 <sup>a</sup>	<i>Hieracium</i> sp.	14 <sup>1</sup> y
		<i>Trifolium repens</i>	1 b
	15.09.1990	<i>Hieracium</i> sp.	6 <sup>1</sup> 2y,1b,3-
	28.09.1990	—	1 y
	04.10.1990	<i>Dittrichia viscosa</i>	5 3y,1b,1-
		<i>Solidago virgaurea</i>	
	07.08.1991	—	3 —
	20.08.1991	—	21 —
	28.09.1991	<i>Dittrichia viscosa</i>	61 51y,7b,3-
		<i>Solidago virgaurea</i>	
<b>Savona</b>			
Pietra Ligure	16.09.1990 <sup>a</sup>	<i>Centranthus ruber</i>	16 b
<b>Faenza</b>			
Pietramora	02.10.1990	—	3 1y,2b
<b>Pistoia</b>			
Pescia	25.09.1991	<i>Dittrichia viscosa</i>	21 y
Ponte di Serravalle	25.09.1991	<i>Picris hieracioides</i>	2 1y,1b
<b>Forlì</b>			
Borello-Ranchio	26.09.1991	<i>Dittrichia viscosa</i>	10 5y,5b
Piavola	26.09.1991	<i>Polygonum auberti</i>	1 y
Cesena	04.10.1991	<i>Polygonum auberti</i>	6 y
<b>Padova</b>			
Torreglia	27.09.1991	<i>Leontodon</i> sp.	2 1y, 1b

— = unknown; y = yellow colour of abdomen; b = brown colour of abdomen; <sup>1</sup> = reared from sampled larvae;

<sup>a</sup>: Loomans(1991)

### 3.2. PRELIMINARY REARING EXPERIMENTS

In June 1990 we received a sample of pupae of *C.menes* from a laboratory rearing (Murai, Shimane Expt. Station, Japan): some adults emerged but within few generations on *F.occidentalis* they became extinct, nevertheless we can state that *F.occidentalis* is a suitable host for *C.menes*.

Later on, a laboratory rearing was set up using 19 *C.menes* females collected in Bologna. Only 5 *C.menes*, 3 collected as adults and 2 as parasitized thrips larvae, parasitized *F.occidentalis*: of the 60 subsequent pupae, 30 adults emerged (no males) and 7 females were used later in preliminary rearing trials.

The resulting data (Fig.II) show that, at 25°C, 78% of *C.menes* females emerged 28 to 34 days after parasitization (37% after 29 days) and 22% 46 to 64 days (N=56). Murai (1990) also recorded a marked variation in the development duration of *C.menes* (on other thrip species) i.e. 27-80 days. Explanations about these differences in developmental time are hard to define.

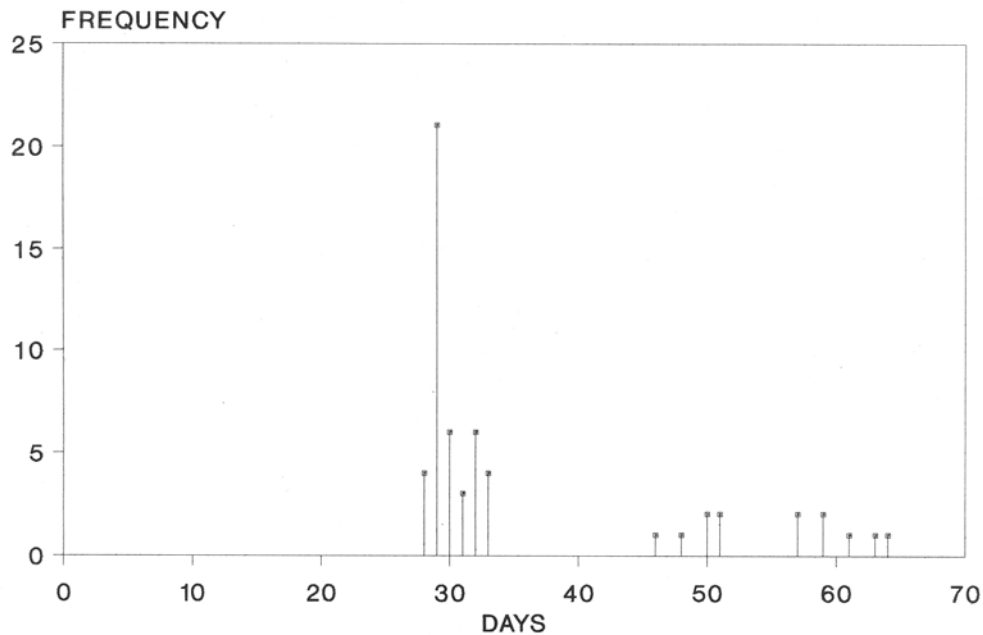


Fig. II - Developmental time of *Ceranisis menes* (Walker) females at 25°C (N=56) on *Frankliniella occidentalis* (Pergande).

Emergence percentage from pupae was 56% (N=219). Thrips larvae were observed feeding on both parasitized and unparasitized larvae. Host feeding by *C.menes* females (Loomans, 1991), was confirmed. Studies of *C.menes* behaviour are currently under way (Loomans *et al.*, 1992).

### 3.3. REARING METHODS

*C.menes* was reared for at least 20 generations on *F.occidentalis*. Green bean pods rearing method was effective. The Murai method was used to rear isolated thrip larvae in little cages but it was less effective to rear several larvae or adults together because of the parafilm quality: in few hours water drips into the cage from oviposition or feeding holes.

Our modified method was effective and less laborious for thrips egg laying and hatching but there was a high mortality during the larval development, perhaps because of the mould growing, larval cannibalism or the incorrect RH regulation.

### SUMMARY

In 1990, 19 individuals of *Ceranisis menes* (Walker) (Hymenoptera Eulophidae) were collected in a wild meadow in the hills near Bologna and Faenza (Italy). A *C.menes* laboratory rearing was

set up using these 19 parasitoids, all of which proved to be females. Only 5 *C.menes* females, 3 collected as adults and 2 as parasitized thrips larvae, parasitized *Frankliniella occidentalis* (Pergande) (Thysanoptera Thripidae).

Of the 60 subsequent pupae, 30 females emerged and 7 were used later in preliminary rearing trials at 25°C: 78% of *C.menes* females emerged 28 to 34 days after parasitization (37% after 29 days) and 22% 46 to 64 days (N=56); emergence percentage from pupae was 56% (N=219). Thrips larvae were observed feeding on both parasitized and unparasitized larvae. Two rearing methods were used: 1) a modified Murai method and 2) on green bean pods. *C.menes* was reared for at least 20 generations on *F.occidentalis*. Later collections from flowers of wild vegetation proved that *C.menes* is a regularly occurring parasitoid of thrips in Northern and Central Italy.

*Ceranisus menes* (Walker) (Hymenoptera Eulophidae): raccolta in Italia e primo allevamento su *Frankliniella occidentalis* (Pergande) (Thysanoptera Thripidae).

#### RIASSUNTO

Nel 1990, 19 individui di *Ceranisus menes* (Walker) (Hymenoptera Eulophidae) sono stati raccolti su vegetazione spontanea sulle colline vicino a Bologna e a Faenza. È stato avviato un allevamento di *C.menes* in laboratorio usando questi 19 parassitoidi, che erano tutte femmine. Solo 5 femmine di *C.menes*, 3 raccolte come adulti e 2 sfarfallate dall'ospite, hanno parassitizzato *Frankliniella occidentalis* (Pergande) (Thysanoptera Thripidae). Dalle 60 pupe ottenute sono sfarfallati 30 adulti (nessun maschio) e in seguito 7 femmine sono state utilizzate in prove preliminari a 25°C: il 78% delle femmine di *C.menes* è sfarfallato da 28 a 34 giorni dopo la parassitizzazione (il 37% dopo 29 giorni) e il 22% da 46 a 64 giorni (N=56); la percentuale di sfarfallamento dalle pupe è stata del 56% (N=219). Sono state osservate neanidi di tripidi alimentarsi sia su neanidi parassitizzate che indenni. Sono stati utilizzati due metodi di allevamento: 1) un metodo di Murai modificato e 2) su baccelli di fagiolino. *C.menes* è stato mantenuto su *F.occidentalis* per almeno 20 generazioni. Raccolte successive su fiori di erbe spontanee hanno provato che *C.menes* è un parassitoide di tripidi generalmente presente nel Nord e Centro Italia.

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