Entomologica, Bari, 45 (2014): 3-9

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Larval respiratory system analyzed for three eulophids occurring on eucalypts in Southern Italy (Hymenoptera Chalcidoidea)

ABSTRACT

Two gall-makers and one parasitic species have been studied. Absence of spiracles (= apneustic condition) does occur in both *Leptocybe invasa*, which seemingly develops through a single instar, and the first-instar larvae of the gall-maker, *Ophelimus maskelli*; it was detected also in the first-instar larvae of the parasitoid, *Closterocerus chamaeleon*. A low number of spiracles (= oligopneustic condition) was found in the full-grown larvae of *Ophelimus maskelli*, as previously reported in the literature, whereas a moderate number of spiracles (= peripneustic condition) does occur in the full-grown larvae of the above parasitoid. Altogether, results suggest the apneustic condition to be the rule in the first-instar larvae of eulophids.

Key words: *Leptocybe invasa* Fisher & La Salle, *Ophelimus maskelli* (Ashmead), *Closterocerus chamaeleon* (Girault).

INTRODUCTION

The larvae of the very common gall-maker of eucalypt leaves, *Ophelimus maskelli* (Graham), have been recently described by LAUDONIA & VIGGIANI (2004). These authors found either a low number or the absence of spiracles according to the development instar, and suppose such reduction of the respiratory system as possibly related with the gall-maker habit.

This opinion is discussed in this contribution after the a study of the respiratory system in the larvae of further two eulophids commonly occurring on eucalypts in Southern Italy.

MATERIAL AND METHODS

Larvae were obtained from leaves of *Eucalyptus camaldulensis* Dehnh. collected in Bari province (Apulia). Each of them was removed by a needle after its gall had been

engraved with a bistoury and was preliminarily examined on a slide in water. Further specimens were killed in ethanol 70% and mounted in glycerol to appreciate the minute morphological details. Specific identifications based on both the gall shape and the other features reported in the literature (LAUDONIA & VIGGIANI, 2004; MENDEL *et al.*, 2004; PROTASOV *et al.*, 2007). Terms concerning the respiratory system agree with both VIGGIANI (1994) and the dictionaries of GORDH & HEADRICK (2000) and MAGGENTI & GARDNER (2005).

RESULTS

Leptocybe invasa Fisher & La Salle – As usual, galls of this eulophid occurred in groups along both the main nerve and stems of eucalypt leaves (Fig. 1.A) and harboured a single individual. Larvae were roughly spherical and very variable in size, as diameter of their body ranged from 0,1 to 0,5 mm (n=20). The gall chamber was lined by a soft plant tissue and included a milky fluid (Fig. 1.B). Larvae did show neither a clear segmentation and nor spiracles and tracheal branches (Fig. 1.C-D). Because of the absence of distinct antennae and mandibles, their cephalic pole was uncertain to be recognized; anyhow, an internal, unpaired X-shaped sclerite (Fig. 1.E) did suggest the possible position of the mouth, whereas a small unpaired pore could be (doubtfully as well) referred to the anal orifice. Because of the lack of external sclerotized structure, the presence of different larval instars failed to be verified.

Ophelimus maskelli (Ashmead) - Larvae of this other common gall-maker were very different in size as well. Although literature does recognize three larval instars in this species, some difficulties arose in recognizing an intermediate instar. The respiratory system of larvae of major size included two pairs of spiracles and an extended tracheal net. The larvae of very small size didn't show any trace of respiratory system (Fig. 2).

Closterocerus chamaeleon (Girault) - A very rich larval presence of this parasitoid was observed in full-summer on eucalypt leaves severely damaged by *Ophelimus maskelli* (Fig. 3.A). In this season, a large rate of *Ophelimus* galls contained either one adult, or one pupa, or one free larva of the parasitoid. Each free parasitic larva was usually associated with integumentary remains of one pupa of *Ophelimus*. Further symptoms of the parasitic attack were observed in several *Ophelimus* larvae of major size, as these harboured one or more, up to five, eggs of Closterocerus at very different degrees of embryonic development (Fig. 3.B-D). In a lower rate, the parasitized *Ophelimus* larvae harboured one freshly hatched parasitic larva (Fig. 3.E). This did show neither spiracles nor traces of tracheal net; seemingly, it belongs to the first development instar of *Closterocerus*. Consequently, the second larval instar can be assigned to the full-grown

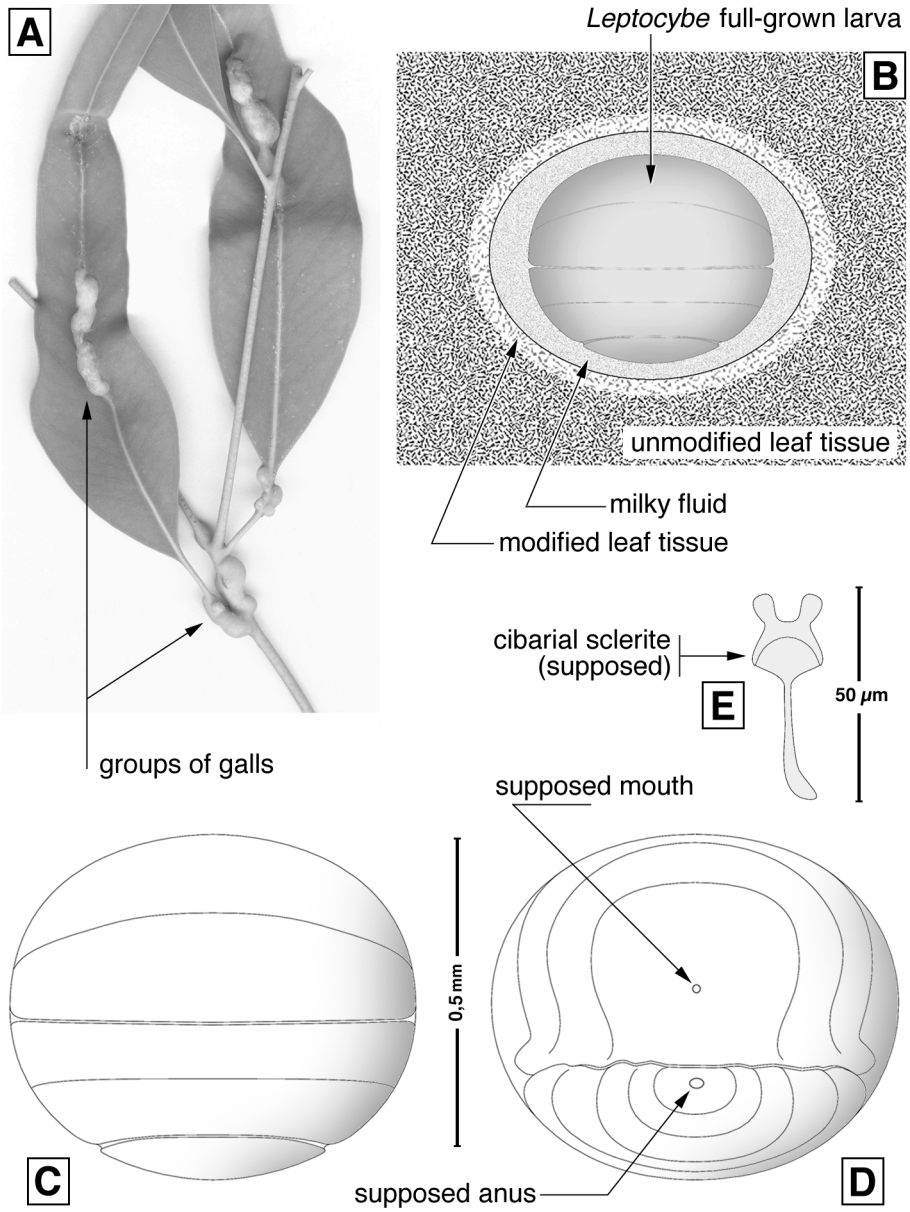

Fig. 1 - *Leptocybe invasa* Fisher & La Salle: A, gall groups on leaves of *Eucalyptus camaldulensis* Dehnh.; B, scheme of a single gall; C-D, apneustic full-grown larva seen from two opposite sides; E, sclerite occurring at the supposed mouth orifice.

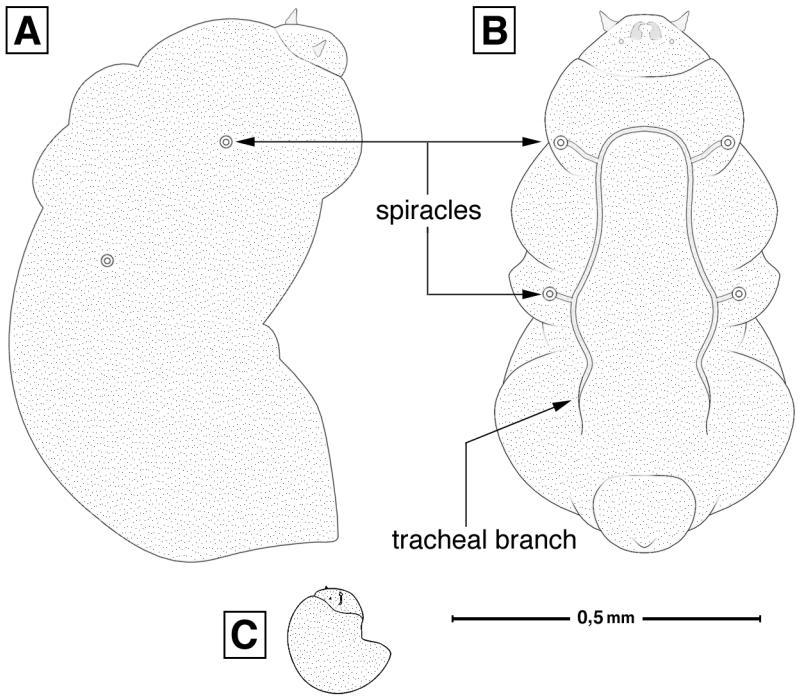

Fig. 2 - *Ophelimus maskelli* (Ashmead): A-B, lateral and ventral sides of a full-grown larva; C, first-instar larva in lateral view.

parasitic larvae. These were equipped with both 7 pairs of spiracles and an extended tracheal net (Fig. 4).

CONCLUDING REMARKS

The respiratory system exhibits a consistent diversity even within a single species, including the three conditions already assigned by VIGGIANI (l.c.) to both Eulophidae and Hymenoptera as a whole: (I) the "apneustic condition" (= absence of spiracles) does occur in the larvae of *Leptocybe*, which belong to the "sack-like type" and seemingly do develop in a single instar; it was found also in both the young larvae of *Ophelimus* and the endophagous, first-instar larvae, of *Closterocerus*; (II) the "oligopneustic condition" (= spiracles in a low number) was already reported for the full-grown larvae of *Ophelimus*; (III) the "peripneustic condition" (= moderate number

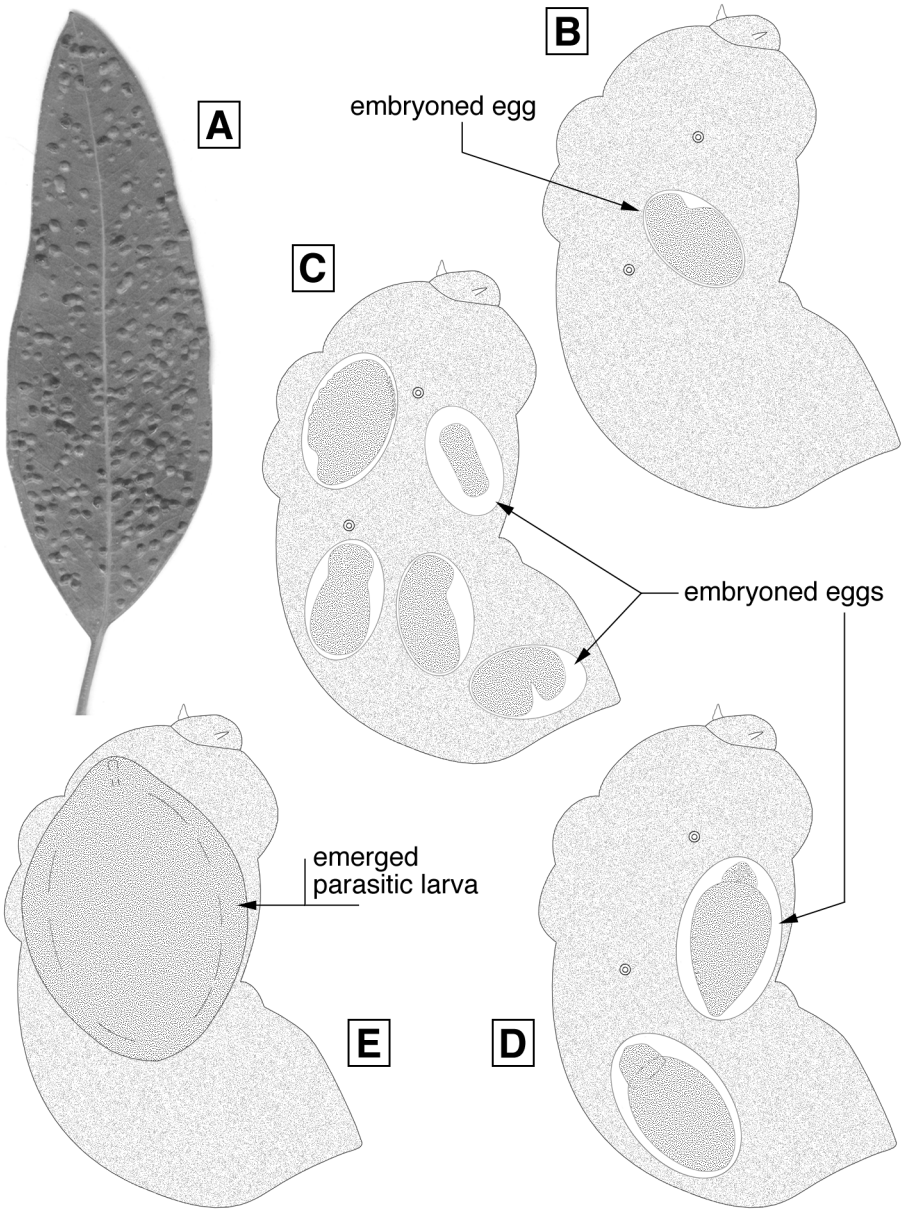

Fig. 3 – *Ophelimus maskelli* (Ashmead): a severely damaged leaf of *Eucalyptus camaldulensis* Dehnh. and different features of its full-grown larvae parasitized by *Closterocerus chamaeleon* (Girault).

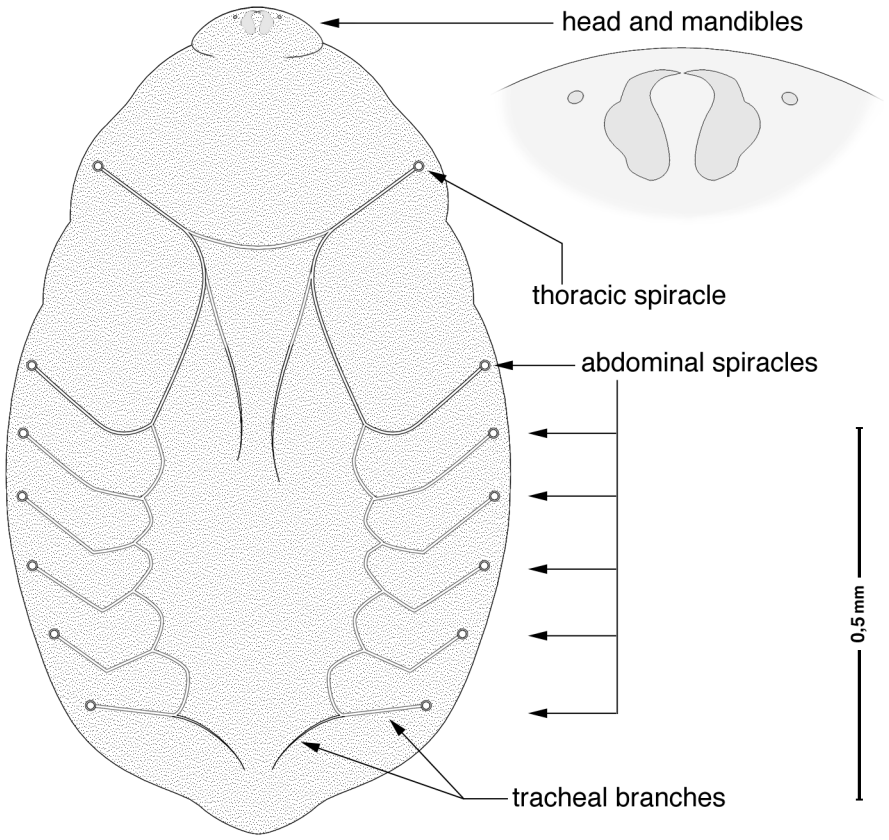

Fig. 4 – *Closterocerus chamaeleon* (Girault): peripneustic full-grown larva with a detail of its head.

of spiracles) has been found in the full-grown larvae of *Closterocerus*, which seemingly belong to the second instar.

According to LAUDONIA & VIGGIANI (l.c.), the reduction of the respiratory system in *Ophelimus* is depending upon its endophytic environment. The extreme reduction of the respiratory system in the very specialized gall-maker, *Leptocybe invasa*, does actually support this view. Anyhow, results of the present study suggest that the apneustic condition is the rule for the first-instar larvae of the eulophids, including both endophytic and endophagous species.

RIASSUNTO

ANALISI DEL SISTEMA RESPIRATORIO LARVALE IN TRE EULOFIDI INFEUDATI AGLI EUCALIPTI IN SUD ITALIA (HYMENOPTERA CHALCIDOIDEA)

È stato effettuato uno studio morfologico delle larve di tre eulofidi comuni sull'eucalipto in Sud Italia, in merito ad assenza, presenza e numero degli stigmi respiratori. Questi ultimi risultano mancanti (= condizione apneustica) sia nel galligeno *Leptocybe invasa* Fisher & La Salle, che verosimilmente si sviluppa in una singola età, sia nelle larve di prima età dell'altro comune galligeno dell'eucalipto, *Ophelimus maskelli* (Ashmead); essi mancano anche nelle larve neosgusciate del parassitoide *Closterocerus chamaeleon* (Girault). Le larve mature presentano un numero ridotto di stigmi nel caso dell'*Ophelimus*, mentre sono nella condizione peripneustica con 7 coppie di stigmi. Nell'insieme, i risultati suggeriscono la condizione apneustica come regola generale nelle larve di prima età degli eulofidi, sia nei fitofagi sia nei parassitoidi.

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