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AULACOTHRIPS DICTYOTUS (HETEROTHRIPIDAE), THE FIRST ECTOPARASITIC THRIPS (THYSANOPTERA)

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Thrips, members of the insect order Thysanoptera, are commonly regarded as flower-living, although amongst the 5000 or more described species a wide range of biologies can be found (Mound 1997). Members of the sub-order Tubulifera are particularly diverse, with different species feeding on leaves, flowers, fungal hyphae, fungal spores, mosses, and also acting as predators of other small arthropods (Mound & Marullo 1996). This communication, however, concerns a member of the Terebrantia, the sub-order that includes the basal clades of the Thysanoptera.

The plesiotypic life style of thrips is presumed to have involved fungus or detritus feeding (Mound, Heming & Palmer 1980), a habit retained in one basal clade, Merothripidae. Subsequent radiations presumably involved flower-feeding. Indeed, species of one genus of Aeolothripidae, another of the basal clades, have recently been demonstrated to breed only in the male cones of *Macrozamia* cycads, of which they are commonly the pollinators (Mound & Terry 2001; Terry 2001).

Among the more advanced Terebrantia families, the Thripidae comprises at least 1700 species worldwide and includes most pest species. These feed primarily in flowers or on leaves of higher plants including many grasses, but with some species obligate predators and a few that feed on lower plants such as mosses or ferns. The other advanced family, Heterothripidae, is restricted to the New World, comprising rather more than 70 described species in four genera (Mound & Marullo 1996). Previous field studies have indicated that heterothripids are flower-living, each largely host-specific (Del Claro et al. 1997). However, recent observations have led to the conclusion that the sole species in one of the four genera of Heterothripidae, *Aulacothrips* Hood, has a remarkably different life style.

Aulacothrips dictyotus Hood has, until now, been known only from two females, collected in Sta Catharina State, southern Brazil. The observations reported here indicate that this species has a life style unique amongst Thysanoptera, being ectoparasitic on an homopteran of the family Aethalionidae. The observations were made at Sao Jose do Rio Preto, Sao Paulo State, Brazil, and were part of a study on interactions between *Camponotus crassus* (Formicidae), *Trigona hyllinata* (Meliponidae), and *Aethalion reticulatum* on the leaves of *Bauhinia variegata* (Caesalpiniaceae). *A. dictyotus* larvae, first and second instars, also propupae and pupae, were observed living beneath the hind wings of *A. reticulatum*. Eggs have not been found, but the first instar larvae included individuals that clearly were just emerged from their eggs. Analysis of the gut contents has not been attempted, but these thrips were found in large numbers under the wings of the bugs under conditions that suggest that the life cycle is completed in this position.

Of 212 nymphal *Aethalion* examined, 52 had larval thrips beneath the wing rudiments (Fig. 1). Similarly, of 48 adult *Aethalion* examined, 13 were found with thrips under the wings. More than 10 larval thrips could be found under the wings of a single bug (Fig. 2), and even after transport in alcohol larvae were found to be firmly attached by their head region (Fig. 3). The second larval stage spins a pupal cocoon, as is known in Aeolothripidae (Lewis 1973) and also Heterothripidae, and these flat pupal cocoons were also found under the wings of the *Aethalion* (Fig. 4).

The *Aethalion* were found living gregariously in groups of 30 to 80 individuals, and were observed crawling over each other. Presumably this behaviour allows immature *Aulacothrips* to transfer between host individuals when the bugs moult. The oviposition site of the thrips has not been determined, but the hind wings of several adult bugs were deformed, and this may be due to scarring of the nymphs wing buds by ovipositing thrips. Individuals in the *Aethalion* colonies were observed to become agitated in their behaviour in the presence of these thrips.

As indicated above, several unrelated thrips species have become predatory on other small arthropods, including mites and scale insects (Palmer & Mound 1991). Many thrips species are remarkably opportunistic in their habits, changing from phytophagous to predatory depending on the available conditions (Mound & Teulon 1995; Agrawal 2000). Also, phytophagous thrips are well known to probe human skin at times, sometimes causing small lesions (Mound et al. 2002). Recent studies on other Thysanoptera have emphasized the diversity of behaviour patterns amongst these

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Figs. 1-6. *Aulacothrips dictyotus* (Heterothripidae) and *Aethalion reticulatum* (Homoptera). 1. *Aethalion* nymph with *Aulacothrips* larvae under wing bud. 2. *Aulacothrips* larvae on abdomen of *Aethalion*. 3. *Aulacothrips* larva under *Aethalion* hindwing. 4. *Aulacothrips* pupal cases on *Aethalion* tergites. 5, *Aulacothrips* antenna. 6. *Aulacothrips* tergites VII-VIII.

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small insects, including sociality (Crespi & Mound 1997), domicile construction (Mound & Morris 2001), and gall-induction (Mound & Kranz 1997). Given this wide range of feeding habits and behaviour patterns, there is no intrinsic reason to consider the ectoparasitic way of life as impossible for any particular thrips species, from either the nutritional or the behavioural aspect.

Aethalion reticulatum is recorded widely in South America, being considered a minor polyphagous pest of several crops in Venezuela, whereas *A. dictyotus* is known only from southern Brazil. The structure of the adult thrips is remarkable, with the wings held close together in a median groove on the abdomen (Mound, Heming & Palmer 1980) (Fig. 6), and the third and fourth antennal segments grossly expanded with highly convoluted sensoria (Fig. 5). The curious reduction of the antennae, and the protection of the wings, may be related to physical problems the thrips encounters when walking over colonies of agitated *Aethalion* bugs. Future studies will hopefully examine the feeding behaviour of these remarkable thrips, and their interactions with their hosts.

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Summary

All life stages of the heterothripid, *Aulacothrips dictyotus* Hood, excluding eggs but including newly hatched first instars, have been found on the abdomen of adults and nymphs of the Homopteran *Aethalion reticulatum* in southern Brazil. The thrips apparently lives as an ectoparasite under the wings of these bugs, spinning its pupal cocoon on the tergites. Other species of Heterothripidae live in flowers.

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