

Phlaeothripidae



Australian fauna

There are 140 genera and 630 species of Phlaeothripidae listed from Australia, although many undescribed species, and genera, are known to exist. Many genera are endemic to this continent, particularly those associated with the plant genera *Acacia* and *Casuarina*.

Link to **Idolothripinae** taxa [25 genera and 102 species];
 Link to **Phlaeothripinae** taxa [116 genera and 531 species].

Biology

Species of Phlaeothripidae are particularly diverse in their biologies. Idolothripinae are all considered to feed on fungal spores, and members of *Elaphrothrips* and related genera have a specialised spore-crushing device in the foregut (Tree *et al.*, 2010). In the Phlaeothripinae, members of the "*Phlaeothrips* lineage" are essentially fungus feeders, presumably on fungal hyphae. Fungus feeding species often exhibit considerable sexual dimorphism, such that males are larger than females, moreover one or other of the sexes commonly exhibits structural polyphenism that is sometimes associated with allometry in various structures (Mound, 2005). Males have been shown to indulge in male/male combat, and to compete for resources and the attention of females (Crespi, 1988). Species in the "*Liothrips* lineage" are leaf-feeding, and many of these are involved in the induction of galls on leaves. In such species, males are commonly smaller than females, and in some species females exhibit allometry. Some gall-inducing species on *Acacia* trees in Australia have been demonstrated to have a life-cycle in which the first generation develops into adults that are flightless and that function as soldiers to defend the gall whilst the original female continues to raise a further brood of winged adults (Crespi *et al.*, 2004). In the Asian tropics and also eastern Australia there are thrips galls on many different plants, and these galls are sometimes invaded by predatory thrips species. Flower-living is relatively unusual among Phlaeothripidae, although the Haplothripini include many species that are probably host specific in the flowers of species of Asteraceae, Poaceae and Cyperaceae (Mound & Minaei, 2007). Some Phlaeothripidae are associated with mosses, and yet others are predatory on mites or on coccids (Mound, 2004). In Australia there is a rich Phlaeothripid fauna at ground level living in leaf litter (Wang *et al.*, 2019). The eggs of Phlaeothripidae are deposited superficially, and the pupal stages are found in association with the adults and larvae. The life-cycle involves two active larval stages, followed by three inactive stages, (propupa, pupa I, pupa II) before the adult emerges. In their unusual life cycle, Thysanoptera are thus effectively exopterygote holometabola.

Geographic distribution

The Phlaeothripidae is particularly species-rich in tropical and



Gynaikothrips ficorum, male



Lichanothrips pasta, female



Priesneriella citricauda, female
microptera & macroptera



Triadothrips briga, female & large
male



Warithrips aridum, male & female



Stephanothrips occidentalis,
antenna



Strepterothrips tuberculatus,
antenna



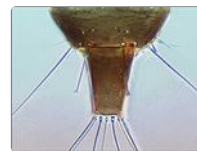
Liothrips vaneckeii, antenna



Haplothrips leucanthemi, wings



Liothrips vaneckeii, wings



Allothrips stannardi, female
abdominal segments IX-X



Dactylothrips bos, female abdomen



Baenothrips moundi, female
abdominal segments IX-X

subtropical lowland areas. No species in this Family appears to be resident at high altitudes on mountains, or in the subarctic and subantarctic regions. Very few Idolothripinae occur outside of the tropics and subtropics, and this is also true of the large genus *Liothrips*. Available measures of the greater richness of tropical thrips faunas are: in Europe 85 genera of Thripidae but only 51 genera of Phlaeothripidae (Fauna Europea, 2017); in Central and South America 73 genera of Thripidae and 135 genera of Phlaeothripidae (Mound & Marullo, 1996); in Australia 84 genera of Thripidae and 140 genera of Phlaeothripidae (Australian Faunal Directory, 2019).

Recognition

Members of the Phlaeothripidae are highly diverse in general appearance, but are remarkably conservative in structural details. The last abdominal segment, segment X, is tubular with the anus at the apex and the genital opening at the base, although this tube is developed into a variety of shapes in the species of several genera. The ovipositor is an eversible chute-like structure. The fore wings are characteristic in having no surface microtrichia, no distinct longitudinal veins, and the marginal cilia immersed into the wing membrane rather than arising from normal setal bases. The antennae are 8-segmented, with reduction to five segments in a very few species, and the sensoria on segments III and IV are simple emergent thin-walled sense cones.

Genus and species diversity

The family Phlaeothripidae is currently interpreted as comprising almost 3800 described species. These are arranged into two subfamilies, the Phlaeothripinae with 2990 species in 370 genera, and the Idolothripinae with 740 species in 83 genera (ThripsWiki, 2020). About 45% of the genera include only one species, but in six genera more than 100 species are listed: *Hoplandrothrips* 117; *Hoplothrips* 130; *Elaphrothrips* 140; *Holothrips* 140; *Haplothrips* 240; *Liothrips* 280. Species in the first four of these genera are fungus-feeders, with many of them exhibiting remarkable polymorphisms associated with sex, wing length, and body size that often confound species recognition. The last two of the six genera involve leaf-feeding species, many of which remain known only from single populations or even single individuals (Mound, 2005). As a result, concepts of intra-specific structural variation, and hence species identity, are not secure amongst many Phlaeothripidae genera. Within the Idolothripinae two Tribes are distinguished, and within the Phlaeothripinae three informal "lineages" are recognised (Mound & Marullo, 1996). One of these is now accepted as the Tribe Haplothripini (Mound & Minaei, 2007), but the "*Liothrips* lineage" of leaf-feeding species, and the "*Phlaeothrips* lineage" of fungus-feeding species, are both presumably polyphyletic.

Family relationships

The Phlaeothripidae is the only family of living species recognised in the Thysanoptera suborder Tubulifera (Okajima, 2006), with a second family, Rohrthripidae, known only from Cretaceous fossils. The sub-order Tubulifera is probably sister-group to the sub-order Terebrantia (Buckman *et al.*, 2013). Phlaeothripidae species are usually classified into two subfamilies, the Idolothripinae and the Phlaeothripinae, of which the Idolothripinae is possibly monophyletic, but is likely to have evolved from within the Phlaeothripinae. Bhatti (1994, 1998) has proposed an alternative classification that involves recognition of the Tubulifera as an independent Order of Insects. Within this Order, Bhatti recognised 11 families, for a total of 106 species in 28 genera, but with eight of the 11 families each including only a single genus, and the remaining 3000 species in 400 genera retained within the Phlaeothripidae. This classification does not reflect evolutionary relationships.

Thysanoptera systematics

The classification adopted here is a compromise between practicality and the ideal of a classification based on phylogenetic relationships. The two sub-orders, Terebrantia and Tubulifera, are probably sister-groups (Buckman *et al.*, 2013), but relationships among the eight families of Terebrantia remain far from clear (and there are also five families based on fossils - see ThripsWiki 2020). A radically different classification was proposed by Bhatti (1994, 1998, 2006) that recognised two Orders, 10 superfamilies and 40 families. This classification is based on autapomorphies rather than synapomorphies, and thus is essentially phenetic rather than phylogenetic.

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