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**FIRST INTERCEPTION OF *ANATRICHUS PYGMAEUS*
(LAMB, 1918) (DIPTERA: CHLOROPIDAE,
ELACHIPTERINI) IN THE UNITED KINGDOM**

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First interception of *Anatrichus pygmaeus* (Lamb, 1918) (Diptera: Chloropidae, Elachipterini) in the United Kingdom.

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ABSTRACT

Anatrichus pygmaeus (Lamb, 1918) (Diptera: Chloropidae) was intercepted in the United Kingdom (UK) for the first time on imported water spinach (*Ipomoea aquatica* Forsskål (Fam: Convolvulaceae)) from Thailand. The structure, functional biology and the known ecology of this species and the genus *Anatrichus* Loew, 1860 is reviewed and discussed.

Keywords: *Anatrichus*, Chloropidae, Diptera, *Ipomoea aquatica*, functional morphology, ecofunctional traits

INTRODUCTION

To ensure compliance with UK biosecurity legislation, the entomology diagnostics team based at Fera Science Limited provides insect identification services for the Plant Health and Seed Inspectorate (PHSI) of the Animal and Plant Health Agency. Each year PHSI inspectors intercept thousands of specimens on imported plant material entering the UK. One of the more curious findings was a single dead adult male specimen of *Anatrichus pygmaeus* Lamb, 1918 (Diptera: Chloropidae), Fera ref. 2026008152 (Fig. 1) that was intercepted at London Heathrow Airport on 2 April 2026 in a consignment of freshwater spinach (*Ipomoea aquatica* Forsskål) imported from Thailand. The identity of the specimen was confirmed morphologically to genus using (Ismay *et al.* 2021 and Mlynarek & Wheeler 2018) and then to species using (Sabrosky 1961 & Deeming & Al-Dhafer 2012).

Anatrichus Loew, 1860 is a small genus of the family Chloropidae distributed across the Old-World tropics with representatives recorded from the Afrotropical, Oriental, Palaearctic, and Australian regions (Mlynarek 2009). The genus currently contains 5 valid species, namely *A. erinaceus* Loew, 1860, *A. hystrix* (Kertész, 1914), *A. pygmaeus* Lamb, 1918, *A. taprobane* (Andersson, 1977) and *A. bimaculatus* Kubík & Barták, 2010, however, the true diversity of the genus is likely to be underestimated. Barcode of Life Data System (BOLD) records indicate 11 Barcode Index Numbers (BINs) attributed to *Anatrichus*, suggesting the presence of additional, undescribed species, and this is supported by Mlynarek (2009) who examined numerous specimens during her MSc research that could not be confidently assigned to any known species.

Adult *Anatrichus* spp. may be macropterous/fully winged (Figs. 1 & 2), brachypterous (reduced wings) or apterous (wingless) and are readily identifiable by several distinctive morphological traits (Ismay *et al.* 2021). The scutum and scutellum typically bear long, straight, spinescent macrosetae, giving the genus a striking appearance reminiscent of a

porcupine or hedgehog (Figs.1, Fig. 2, Fig. 3). This has led some taxonomists, such as Nikita Vikhrev to informally refer to members of this genus in a post on Diptera.info, as porcupine or hedgehog flies (Vikhrev 2007). It should be noted that these common names are not unique to this genus as they have also been used to describe members of the Tachinidae because of their conspicuous bristling and well-developed chaetotaxy. Many species of chloropids (mainly in the Oscinellinae and particularly genera in the tribes Elachipterini, Rhodesiellini, Acanthopelstatini and Botanobiini) bear scutellar armature of some form whether macrosetae atop tuberculate scutellar processes or modified macrosetae only. *Anatrichus* bears macrosetae on both scutum and scutellum of a similar form with the genus *Togeciphus* Nishijima, 1954 (Liu & Yang 2012) now a junior synonym of *Elachiptera* Macquart, 1835 (Mlynarek & Wheeler 2018) being the closest genus in form to *Anatrichus*. As well as the spiny appearance, the abdominal tergites 1–3 of *Anatrichus* spp. are fused into a prominent, pear-shaped sclerotised plate (Kubík & Barták 2010), often with fine reticulated surface sculpturing.

LIFE HISTORY AND BIOLOGY

The family Chloropidae (Diptera), sometimes referred to as frit flies or grass flies, comprises a diverse group of more than 2,000 described species with a wide range of life-history strategies (Nartshuk 2014; Evenhuis 2023). Many chloropids are phytophagous, with larvae feeding within grasses and other monocotyledonous plants. Some species are of considerable economic importance; for example, the frit fly *Oscinella frit* (Linnaeus, 1758) is a recognized pest of cereal crops, whose larvae damage developing shoots and stems of oats, barley, wheat and other grasses (Leather *et al.* 1987; Cook *et al.* 2021). Other chloropid genera, including *Liohippелates* Duda, 1929, *Hippelates* Loew, 1863 and *Siphunculina* Rondani, 1856, contain species commonly known as eye gnats or eye flies. The larvae of these flies typically develop in decaying organic matter such as dung, or other nutrient-rich substrates, whereas adults feed on lachrymal secretions, perspiration, wounds and other bodily exudates of vertebrates. As a result of this behaviour, some species are of medical and veterinary importance and have been implicated in the mechanical transmission of pathogens (Klepzig *et al.* 2022; Sabrosky 1987).

Although phytophagy predominates within the family, Chloropidae also includes species with predatory, parasitoid and kleptoparasitic lifestyles. Predatory larvae are known in genera such as *Thaumatomyia* Zenker, 1833, whose larvae prey on root aphids, while larvae of some *Pseudogaurax* Malloch, 1915 are predators of spider egg sacs and other arthropod eggs (Nartshuk 2014; Sabrosky 1987). True kleptoparasitism has evolved in several chloropid lineages. Genera including *Anomoeoceros* Lamb, 1918, *Aphanotrigonum* Duda, 1932, *Gaurax* Loew, 1863, *Olcella* Enderlein, 1911, *Speccafrons* Sabrosky, 1980 and *Trachysiphonella* Enderlein, 1936 have been associated with spider webs, where larvae exploit trapped prey remains, prey fragments or other organic resources accumulated by spiders. These species do not normally attack the spider itself but instead derive nutrition from resources collected by the host, representing a specialised form of kleptoparasitic behaviour (Nartshuk 2014; Sabrosky 1987). The life history of *Anatrichus* spp. and most other chloropid genera are poorly known. As with many species in the tribe Elachipterini, they are often associated with riparian habitats, but without more data we can only hypothesize what their likely life histories may be.



Figure 1. *Anatrichus pygmaeus* (Lamb, 1918) adult © National Museum Cardiff.



Figure 2. *Anatrichus erinaceus* Loew, 1860 adult © National Museum Cardiff.



Figure 3. *Anatrichus pygmaeus* (Lamb, 1918) adult. Detailed view of spinescent macrosetae on both the scutum and scutellum © National Museum Cardiff.

The biology of *Anatrichus* species, particularly species such as *A. erinaceus* (Fig. 2), have been the subject of considerable confusion. Some early reports suggested that the larvae attack crops such as sorghum (*Sorghum bicolor* (L.) Moench) and maize (*Zea mays* L.) in Africa (Matthee & Oberholzer 1958 & Deeming & Al-Dhafer 2012 respectively), while Gautam *et al.* (2009) reported damage to rice (*Oryza sativa* L.) in India, including “dead heart” symptoms typically associated with stem-boring pests.

Other interpretations challenge the view, however, that *Anatrichus* as a primary plant pest. Wongsiri *et al.* (1974) and Shiraki (1917) considered the species predatory, while Sabrosky (1961) proposed that larvae are scavengers feeding on dead stem-borer caterpillars rather than acting as true predators or parasitoids. This interpretation has gained broader acceptance. Observations by Nartshuk (2014) suggested that the larvae are strictly saprophagous. Wheeler (2013) described *Anatrichus* species as secondary invaders that exploit feeding galleries created by moths or other insects, where they scavenge or possibly prey opportunistically. Evidence from field studies supports this view. For example, Sherwill *et al.* (1999) found that in sorghum crops, the primary pest *Atherigona soccata* Rondani, 1871 (Diptera: Anthomyiidae) was abundant, while *A. erinaceus* was comparatively rare. It has been reared from kenaf (*Hibiscus cannabinus* L.). (Malvaceae), in Nigeria following damage by the weevil *Alcidodes* Marshall, 1939 sp. (Coleoptera: Curculionidae) (J.C. Deeming, unpubl.). Both these examples suggest that *Anatrichus* species are secondarily associated with, rather than being a direct cause of crop damage. In Europe, a similar ecological pattern is observed in another member of the Elachipterini. The larvae of *Elachiptera cornuta* (Fallén, 1820), one of the most widespread and frequently encountered species in the tribe, are saprophytophagous secondary invaders that develop in decaying plant tissues, including those of various Poaceae and other monocotyledonous and dicotyledonous plants (Vilkova, 1962).

The type material for *Anatrichus pygmaeus*, was collected in Sri Lanka and at the time was published as *Anatrichus erinaceus* var. *pygmaea* (Lamb, 1918). The two species *A. erinaceus* and *A. pygmaeus* are, however, now recognised as separate yet morphologically similar species. Although they are sympatric in India, *Anatrichus pygmaeus* is recorded primarily from the middle east through Asia, including Afghanistan, China, India, Palestine, the Philippines, Taiwan, Thailand, Vietnam, Japan and Indonesia, and has since been reported from Saudi Arabia and has been introduced into northern Australia (Nartshuk 1984, 2010; Dawah *et al.* 2020; Paramonov 1961); whereas *Anatrichus erinaceus* is recorded mainly from Africa, including Benin, Cameroon, Egypt, Ghana, Namibia, South Africa, Uganda,

In South and Southeast Asia, *A. pygmaeus* is often associated with grassland and rice-associated habitats but has also been reared from a variety of other hosts and substrates. Nartshuk (2010) reported its emergence from the shoots of Burgu millet (*Echinochloa stagnina* (Retz.) P. Beauv.) and young rice plants (*Oryzae* sp.) in India and the Philippines. It is also reported as a predator of the mealybug species *Brevennia rehi* (Lindinger, 1943) (Hemiptera: Pseudococcidae) on rice in India (Pathak & Khan 1994), and of as a predator of rice stem-borer larvae such as *Schoenobius incertulas* Walker, 1863 (Lepidoptera: Crambidae) in Taiwan. Additional records indicate associations with other lepidopteran stem borers in Vietnam, including *Chilo polychrysus* (Meyrick, 1932), *Chilo suppressalis* (Walker, 1863) (Crambidae), and *Chilodes* Herrich-Schäffer, 1849 sp. (Noctuidae). Other reported associations are less clear. For example, it has been suggested to parasitise the so-called “Kody fly” (likely *Siphunculina* spp.) and to be linked with *Pelopidas thrax* (Hübner, 1821) (Lepidoptera: HesperIIDae) (Hendawy *et al.* 2022). Multiple authors have listed this genus among parasitoids and predators (Koffi *et al.* 2020; Hassan & Tajuddin 1997).

DISCUSSION

Current evidence suggests that *Anatrichus* spp. are primarily necrophagous or opportunistic predators, feeding on dead or dying insects within plant tissues (Ferrar 1987). Their role may therefore involve exploiting existing pest infestations rather than directly attacking primary pests. *Ipomoea aquatica* is widely cultivated in Thailand in wet, lowland conditions like rice paddies. It remains unclear whether the intercepted specimen of *A. pygmaeus* was purely adventive or was perhaps associated with an overlooked insect host present amongst the *Ipomoea* at the time of harvest. From a UK plant health and biosecurity perspective the genus *Anatrichus* is not considered to be of any concern.

More research is required to better understand the biology and unique anatomy of *Anatrichus* amongst the Chloropidae and Diptera as a whole and to what extent they feed directly on other invertebrates. Relative to other congeners, *Anatrichus pygmaeus* appears highly adapted to dense, vegetation rich and wet environments (Fig. 4). Their morphology is probably best interpreted as specialized and has evolved directly in response to such unique ecological niches. The macrosetae thus serve multiple roles: firstly, an obvious role is defence. It could be speculated that the macrosetae increase the apparent body size and may prevent predation by small arthropod predators such as rove beetles (Staphylinidae), ants, and spiders inhabiting the same grassland and rice-field margins. Liang Wang (pers. com) has collected numerous Staphylinidae (Fig. 5) aside predatory ephydriids like *Ochthera* Latreille, 1802 spp. around rice-fields in Jinghong, Yunnan Province, China



Figure 4. A rice field in Jinghong, Yunnan Province illustrating the complexity of the typical habitat of *Anatrichus pygmaeus* (Lamb, 1918) ©Liang Wang.

Combined with the genus' robust and heavily sclerotised abdominal make-up, these macrosetae may reduce handling success by predators operating within dense vegetation. Although direct evidence is lacking, the repeated occurrence of pronounced armature in *Anatrichus* and related elachipterine genera suggests that these structures have been maintained by strong selective pressures associated with dense and complex vegetative habitat filled with diverse predatory pressure.

Together with the fused abdominal plates, fine pilosity, fused abdomen and cuticular surface sculpturing, may contribute to the formation of a plastron-like boundary layer of air over the body surface, facilitating gas exchange under saturated conditions in a manner analogous to that observed in many aquatic and semi-aquatic insects. Similar to *Anatrichus*, *Elachiptera longiventris* (Johannsen, 1924) in eastern North America occupies a similar wet environment, is thought to be a secondary invader of cattail (*Typha* L. spp.) and has fused abdominal

tergites but is missing the same prominent macrosetae. The macrosetae likely have a mechanosensory function unique to *Anatrichus* and may provide tactile feedback during adult eclosion and when locating oviposition sites within confined plant tissues (A. Korycińska, pers. comm.).

In addition, melanisation is well known to contribute to cuticle hardening and sclerotization in insects (Andersen 1980; Sugumaran & Barek 2016; Matsuoka & Monteiro 2018). The strong melanisation of the macrosetal apices in *Anatrichus* may therefore increase stiffness and resistance to abrasion through mechanisms analogous to those underlying cuticular melanisation and sclerotization elsewhere in insects. Collectively, these features suggest that the distinctive chaetotaxy of *Anatrichus* is not merely taxonomically diagnostic but represents a suite of functional adaptations associated with life in persistently wet and structurally complex habitats. Future work should seek to understand the developmental and evolutionary mechanisms underlying scutal and scutellar elaboration in *Anatrichus* and other Oscinellinae, and investigate why the Chloropinae have largely retained a more conservative thoracic morphology.



Figure 5. Paederine staphylinidae collected using a sweep net around a rice field margin in Jinghong, Yunnan Province ©Liang Wang.

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