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Taxonomy of fungus gnats allied to *Neoempheria ferruginea* (Brunetti, 1912) (Diptera: Mycetophilidae), with descriptions of 11 new species from Japan and adjacent areas

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Abstract

Specimens of *Neoempheria* previously considered to be *N. ferruginea* (Brunetti, 1912) are studied and revised. Eleven new species are described from Japan, Nepal, Philippines, and Thailand; *N. biceltisuta* **sp. n.**, *N. bifurcata* **sp. n.**, *N. bisecuriata* **sp. n.**, *N. brevispathulata* **sp. n.**, *N. carinata* **sp. n.**, *N. cuneata* **sp. n.**, *N. dilatata* **sp. n.**, *N. denticulata* **sp. n.**, *N. forficulata* **sp. n.**, *N. latisternata* **sp. n.**, and *N. muticata* **sp. n.** *Neoempheria sakhalinensis* Zaitzev, 2001, is recorded from Japan for the first time. Male genitalia of these 12 species are illustrated. A key to the species is provided. A lectotype of *Mycomya ferruginea* Brunetti, 1912 is designated (deposited in the Zoological Survey of India, Kolkata) and the species redescribed. Morphological similarities and differences among *N. ferruginea* and allied species are discussed. The usefulness of the male gonocoxite and associated structures, and the gonapophysis of the female 8th and 9th abdominal sternites for taxonomy are discussed.

Key words: Asia, fungi, *Lentinula edodes*, mushroom pest, Mycomyinae

Introduction

The fungus gnat, *Neoempheria ferruginea* (Brunetti, 1912) (Diptera: Mycetophilidae), was originally described in the genus *Mycomya* Rondani, 1856, based on three syntype specimens (two males and one female) from Darjeeling and Kolkata, India. It has characteristic dark marks on the body: five dark brown stripes on the scutum; single black median stripe, enlarged on the posterior margin, on each abdominal tergite; wing tinged with yellow on anterior margin, with gray at apex and along apical half of cell cua_2, and with dark brown marks on veins Rs and R_4. It also has wing cell r_1 at least two times as long as wide. Some of these characters are used for distinguishing it from congeners (Okada 1938; Sasakawa 1961, 1979; Zaitzev 1999; Wu *et al*. 2001) though male and female genital structures have not yet been examined in detail. Since the original description, it has been recorded from India, Sri Lanka, China, and Japan (Senior-White 1922; Okada 1938, 1939, 1940; Sasakawa & Tamu 1961; Sasakawa 1964, 2005).

Neoempheria ferruginea is a known pest of the edible Shiitake mushroom, *Lentinula edodes* (Berk.) Sing., in Japan (Yasuda 2006; Okabe 2006). The Shiitake mushroom has mainly been cultivated with sawdust-based artificial media in indoor facilities over the last two decades. The amount of the mushrooms cultivated by this method represents more than 80% of the total Japanese production. The larvae of the fly inhabit the surface of the media and the fruit bodies of the mushrooms, thus causing damage to the mushroom production. The infestation by larvae was first reported in 1997 (Ohya & Goto 1997), and has since spread to indoor facilities in different prefectures in the subsequent 10 years (Kitajima *et al*. 2011). This mushroom is also produced in other East Asian countries, especially, China and Korea.

A collection of *Neoempheria* from various parts of Japan and the adjacent countries resembled *N. ferruginea* in the general appearance of the dark marks on the body and wings, but showed morphological variation in male and female genital structures. This indicates that the published records and identifications of *N. ferruginea* need a

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