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FIRST RECORD OF FITATSIA HYPSIPYLAE (HYMENOPTERA: ICHNEUMONIDAE: CRYPTINAE) FORM SABAH, MALAYSIA, WITH DESCRIPTION OF ANTENNAL SENSILLA

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Abstract

YOSHIDA, T., KONISHI, K. and MATSUMOTO, K., 2010. First record of *Fitatsia hypsipylae* (Hymenoptera: Ichneumonidae: Cryptinae) form Sabah, Malaysia, with description of antennal sensilla. *Ins. matsum. n. s*. 66: 1–9, 22 figs.

Fitatsia hypsipylae Kamath, 1972 is recorded from Sabah, Malaysia for the first time. The male of this species is described for the first time. This species was originally described as a parasitoid of the mahogany shoot borer, *Hypsipyla robusta* (Moore, 1886), and this host-parasitoid relationship is confirmed also in Sabah. In addition, antennal sensilla on the apex of flagellum of *F. hypsipylae* are described in detail with the aid of a scanning electron microscope, and discuss their function.

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Introduction

The Mahogany shoot borer, *Hypsipyla robusta* (Moore, 1886) (Lepidoptera: Pyralidae) is distributed in tropical Asia, Africa, and Australia, and feeds almost exclusively on timber tree species belonging to the family Meliaceae. Because Melicaceae include many high value timber trees, such as *Swietenia* spp. (Mahogany), *Toona ciliata*, and *Khaya* spp. (African mahogany), and are cultivated in plantations throughout the world tropics, effective control measures of the moth are strongly needed (Newton et al., 1993; Griffiths, 2001; Floyd et al., 2003).

Although larvae of the moth can feed on flowers, fruit, and barks, they especially prefer to bore in developing shoots and often kill the shoots (Griffiths, 2001). The loss of apical dominance resulted from the death of the apical shoot causes growth of lateral branches, and subsequently poor growth and deformation of bole. Especially young trees before reaching commercial height are more susceptible to infestation by the moth and must be protected. However, because of the overlapping generations and cryptic life style of the moth, pesticide sprayings have little effect (Cock, 1985; Lim et al., 2008; Newton et al., 1993).

Although many studies have focused on controling the moth, only a small portion of them involves discussions on their biological control, especially with parasitoids (Sands & Murphy, 2001). However, as repeatedly claimed (Sands & Hauxwell, 2001; Floyd et al., 2003), ascertaining the complex of parasitoids on the pest is essential for developing an effective pest control measures.

Rao & Bennett (1969) listed 45 hymenopterous parasitoids as natural enemy of the moth, but about half of them were not identified to the species. Taxonomic information of parasitoid wasps is still very insufficient (Sands & Murphy, 2001).

In recent years, in Malaysia, including Sabah State, there has been a growing interest in planting Meliaceous timber trees by not only the foresters from either governmental organizations or the private sector, but also estate plantation holders and farmers. Despite this situation, the establishment of the plantations in Malaysia is limited because of heavy damage caused by the moth (Ghee, 2001; Lim et al., 2008).

Here, we report an ichneumonid wasp, *Fitatsia hypsipylae* Kamath, 1972 from Sabah, Malaysia for the first time and also describe its males for the first time. The materiel was reared from *Hypsipyla robusta*, the same host as recorded in the original description from India (Kamath, 1972). We provide detailed figures for convenience for the identification of the species. We also describe the fine structure of antennal sensilla on the apex of flagellum of *F. hypsipylae* with a scanning electron microscope, and discuss their function.

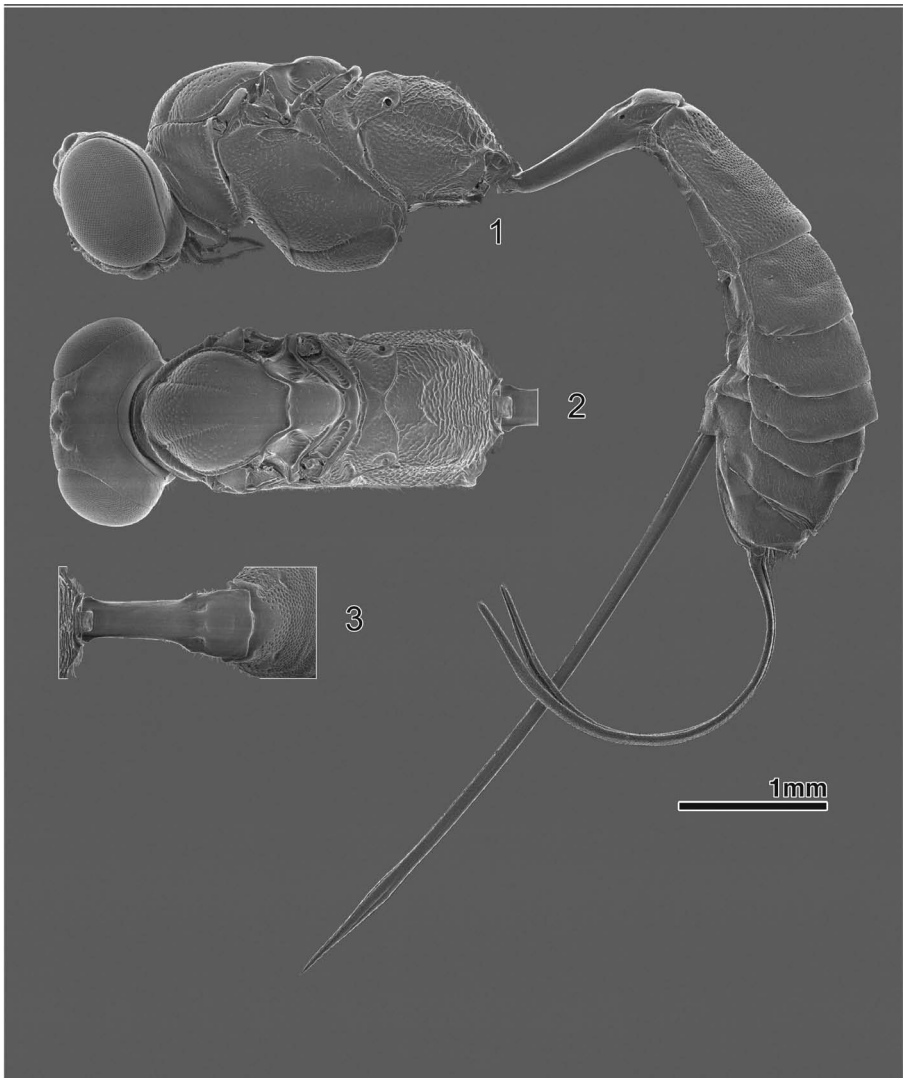
Material and methods

The specimens were reared from pupae of *Hypsipyla robusta* collected in Sabah, Malaysia by the third author and will be deposited in the Forest Insect Museum, Forest Research Centre, Sabah Forestry Department, Sandakan (FRC).

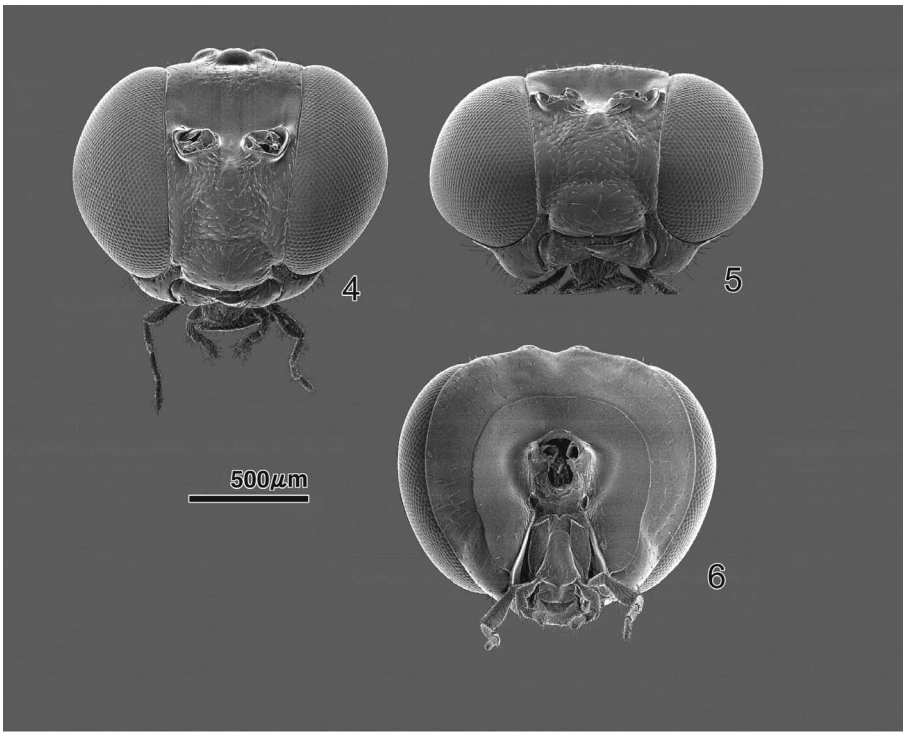
Two of three paratypes of *Fitatsia hypsipylae* were also examined. One is from the National Bureau of Agriculturally Important Insects, Bangalore (NBAII) (formerly in the Commonwealth Institute of Biological Control, Bangalore: CIBC) and the other is from the Museum of Entomology, Florida State Collection of Arthropods, Gainesville (FSCA).

The holotype, which should be in NBAII (formerly in CIBC) could not be found (Dr. Poorani Janakiraman, personal communication). The paratype which should be in the Forest Research Institute, Dehra Dun (FRID) could also not be found (Dr. Neena Chauhan, personal communication).

Observations were made with the aid of a stereomicroscope (Nikon SMZ-10), a light-microscope (Olympus BX40), and a field-emission scanning electron microscope (SEM, JEOL JSM-6301F). Digital images were edited using Adobe Photoshop® 7.0. Terminology mainly followed Gauld (1991). OOL and POL refer to ocello-ocular line and postocellar line, respectively.



Figs 1–3, *Fitatsia hypsipylae*, female. 1, Profile. 2, Head and mesosoma, dorsal view. 3, First metasomal segment, dorsal view.



Figs 4–6, Head of *Fitatsia hypsipylae*, female. 4, Anterior view, perpendicular to the plane containing median ocellus and mandible. 5, Anterior view, perpendicular to face. 6, Posterior view.

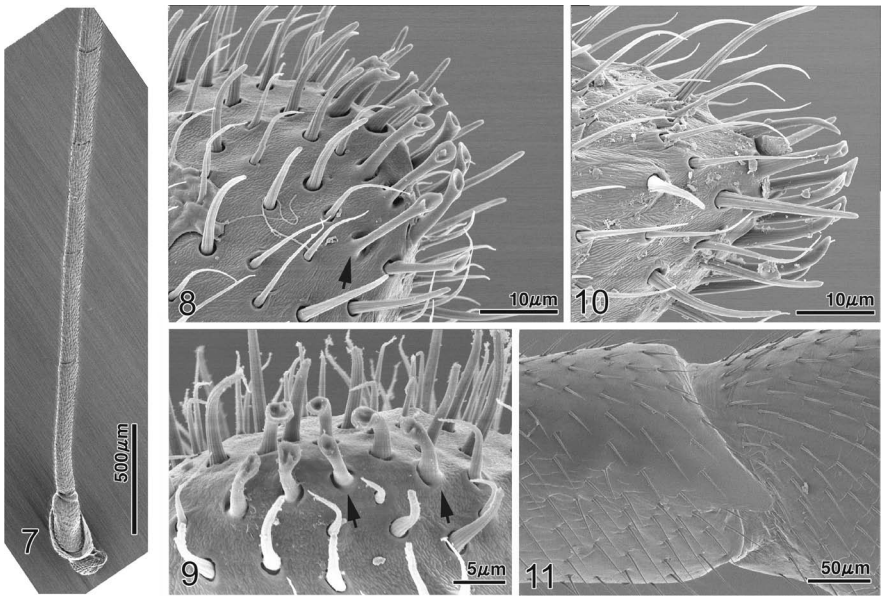
Record and identification of the species

Fitatsia hypsipylae Kamath, 1972
(Figs 1–22)

Specimens examined. 4 ♂ 2 ♀ , Luasong, Sabah, Malaysia, collected on 9.ii.1996, emerged on 22.ii.1996, K. Matsumoto; 2 ♂ 4 ♀ , same data except "collected on 8.ii.1996, emerged on 24.ii.1996". These specimens are emerged from pupae of *Hypsipyla robusta* (Moore) (Lepidoptera: Pyralidae) boring in the shoot of *Swietenia macrophylla* King (Big-leaf mahogany) in Sabah, Malaysia.

This species was originally described based on three females from India and one female from Myanmar. Two of the Indian specimens were reared from pupae of *Hypsipyla robusta* on Cedrela *Toona* (= *Toona ciliata* Roem.) and was reported as *Gotra* sp. in Rao & Bennett (1969). This species is solitary endoparasitoid.

The genus *Fitatsia* can be distinguished from the other genera of the tribe Cryptini by the combination of the following character states (Kamath, 1972; Townes, 1970): frons without high carina or horn; temple very short; apical margin of clypeus simple, without median irregularity; lower tooth of mandible about half as long as upper tooth; prepectus without vertical carina below lower corner of pronotum; upper margin



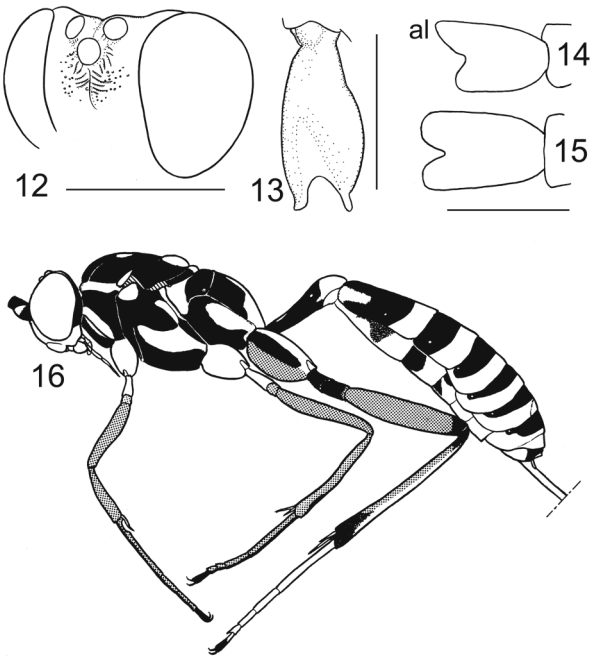
Figs 7–11, *Fitatsia hypsipylae*. 7, 8, 9 and 11, female. 10, male. 7, Basal segments of antenna. 8, 9 and 10, Apex of flagellum. 11, Anterior face of hind trochantellus. Arrows indicate bridges between the seta and the wall of flagellomere.

of pronotum weakly swollen; hind rim of metanotum without angular or tooth-like widening just laterad of each side of postscutellum; inner hind tarsal claw of male with a right angle bend, its outer claw with a simple, even curve (hind tarsal claws in female evenly curved); areolet small and transverse, receiving the 2m-cu at center, and it outer side open; base of petiole of first metasomal segment with lateral tooth; first metasomal sternite not separated from tergite by sutures. This species is superficially similar to *Gotra* species in having small areolet and colouration (yellow with black spots), and indeed was misidentified as *Gotra* by Rao & Bennett (1969), but these two genera are easily distinguishable by the relative length of upper and lower teeth (equal length in *Gotra* species but upper one is distinctly longer in Fitatisa species). The genus *Fitatsia* is known from six species from the Oriental Region and Madagascar and is divided into two species groups, the *ampingensis* group and the *desperator* group (Kamath, 1972). *Fitatsia hypsipylae* was placed in the *ampingensis* group with *F. ampingensis* (Uchida, 1932), because these two species possess an acute tooth on anterior distal margin of middle and hind trochantelli. To our knowledge, this character state is unique to these two species in the tribe Cryptini. *F. ampingensis* has been known from only two males, whereas *F. hypsipylae* from four females. The key to species by Kamath (1972) is based on such unpaired material. By comparing the characters of the males of *F. hypsipylae* with *F. ampingensis*, it is confirmed that they can be identified easily by the key of Kamath (1972).

The following additional description is based on the Malaysian specimens. Kamath's measurements are provided in parentheses in case that they are different from ours.

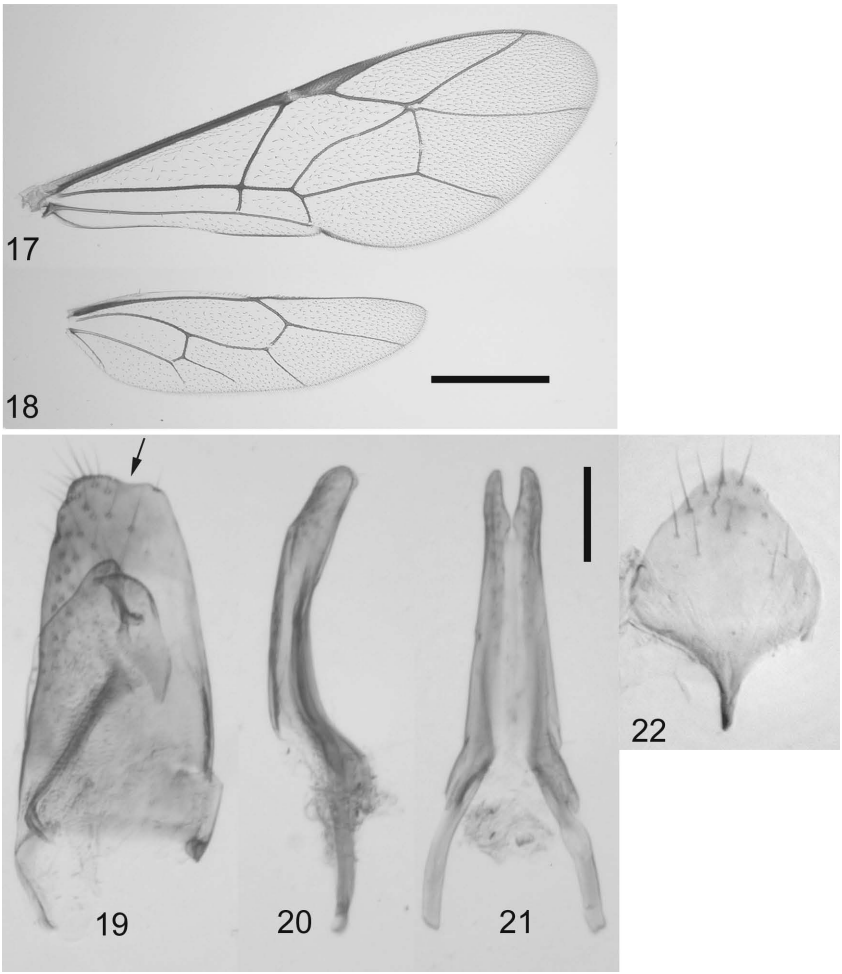
Female. Frons with antennal scrobe deeply concave and smooth, and occasionally with weak median vertical ridge just below median ocellus, and laterally with short transverse rugae and punctures either side of ridge (Fig. 12) (sculptures very weak in small individuals as in Fig. 4). Sensilla on apex of flagellum widened apically and depression on its apical end (Figs 8–10). Malar space short, 0.2–0.4 (0.4–0.6) times as long as basal mandibular width. Flagellum with 24–28 segments. First flagellar segment 5.8–7.0 (6.6–8.4) times as long as apical width. Hind femur 4.7–4.8 (5.0-6.0) times as long as median width. Hind tibia 9.0–11.1 times as long as apical width. Posterior spur of hind tibia 1.8–1.9 times as long as anterior one and 0.5 times as long as hind first tarsal segment. Ovipositor sheath 1.5–1.7 (1.4–1.5) times as long as hind tibia. Forewing 4.5–7.1 mm (6.5–8.0).

Male. Sensilla on apex of flagellum widened apically with depression on its apical end (Fig. 9) as in female. Similar to female except as follows. Face 0.8–0.9 times as long as wide. OOL/POL=0.5–0.7. Flagellum 24–27-segmented, with tyloids on 5–7 segments form 13th to 19th segment. First flagellar segment 5.5–6.7 times as long as apical width. Hind femur 4.9–5.6 times as long as median width. Anterior spur of hind tibia 2.1–2.2 times as long as posterior one and 0.5–0.6 times as long as hind first tarsal segment. Inner hind tarsal claw with a right angle bend, its outer claw with a simple, even curve (hind tarsal claws in female evenly curved). First metasomal tergite 1.8–2.6 times as long as apical width. Apex of gonosquama weakly concave (arrow in Fig. 19). Apex of aedeagus deeply incised (Figs 20, 21). Subgenital plate narrow, slightly longer than wide (Fig. 22). Yellow areas on petiole larger than female. Forewing 5.5–6.7 mm.



Figs 12–16, *Fitatsia hypsipylae*, female. 12, dorso-lateral view of head. 13, left hind coxa, dorsal view. 14, Fourth segment of fore tarsus (al=anterior lobe). 15, Fourth segment of hind tarsus. 16, Profile, showing colour pattern. Scale lines: 1 mm for 12 and 13; 0.2 mm for 14 and 15.

The function of a sensillum can often be assumed by its gross external morphology (Frazier, 1985; Chapman, 1998) though knowing it exactly requires electrophysiological studies and histological observations (Isidoro et al., 1996; Quicke, 1997). A hair-like sensillum with a socket is generally considered to have mechanoreceptive function. The hair is movable in the socket, and displacement of the hair in the socket generates neural stimulation. There are no pores in the cuticle of mechanoreceptor hairs. On the other hand, chemoreceptive hairs (olfactory or contact receptor) usually arise from the cuticle without any specialized socket, and have a terminal pore or numerous small pores which permit the entry of chemicals. Multiporous hairs are assumed to be olfactory receptors and uniporous ones to be contact chemoreceptors.



Figs 17–22, *Fitatsia hypsipylae*. 17 and 18, female. 19–22, male. 17, Fore wing. 18, Hind wing. 19, Gonosquama. An arrow indicates the apical concavity. 20, Aedeagus, lateral view. 21, Aedeagus ventral view. 22, Subgenital plate. Scale lines: 1 mm for 17 and 18; 0.1 mm for 19–22.

In *Fitatsia hypsipylae*, the apex of flagellum has special sensilla (Figs 8–10). These sensilla are apically widened and each has a depression on the apical end. The specialized sensillum arises from a socket as in normal hair-like or trichoid sensillum, but the socket is always largely interrupted by a bridge between the seta and wall of the flagellomere (indicated by arrows in Figs 8, 9). This bridge must prevent the free movement of the seta. This may suggest that the sensilla do not work as mechanoreceptor, but may do rather as chemoreceptor. It is also possible that the apical depressions lead to neural system interiorly and play as an entrance of chemical substances. Because both sexes have this type of sensillum, it probably does not involve sex specific roles, such as host searching exclusively done by female. Roles in food location or in habitat selection are likely.

Acknowledgements

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