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NEW PARASITOID (HYMENOPTERA) RECORDS FOR BAMBOO-SHOOT FLIES (TEPHRITIDAE: PHYTALMIINAE AND DACINAE)

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ABSTRACT

We provide new records of parasitoids (Hymenoptera) attacking bamboo fly (Tephritidae: Phytalmiinae, Dacinae) larvae in Malaysia. At least 7 parasitoid species from 4 families emerged from bamboo fly puparia. Most parasitoids were recovered from larvae that had bred in live shoots, although some stemmed from larvae that had developed in dead culms. Parasitoid developmental times ranged between 7 and 19 d. The braconid parasitoids of bamboo-infesting tephritids belong to the Alysiinae (Phaenocarpa Foerster) and Opiinae (Fopius Wharton, Psyttalia Walker). Hosts for some species have not been recorded previously. We also reared the alysiine Heratemis filosa Walker from puparia of cyclorrhaphous Diptera infesting bamboo shoots that had been attacked previously by the weevil Cyrtotrac hesulus sp.

Key Words: Bamboo-shoot flies, Phytalmiinae, Dacinae, Alysiinae, Opiinae

RESUMEN

Presentamos nuevos registros de parasitoides (Hymenoptera) de las moscas del bambú (Tephritidae: Phytalmiinae, Dacinae) en Malasia. Obtuvimos al menos siete especies de parasitoides (Hymenoptera) que emergieron de pupas de moscas. La mayoría de los parasitoides fueron obtenidos a partir de larvas de mosca criadas en brotes vivos, pero también se obtuvieron algunos de larvas desarrolladas en culmos muertos. El tiempo de desarrollo de los parasitoides varió entre 7 y 19 días. Los parasitoides braconídos obtenidos de los tefrítidos que infestan al bambú pertenecen a las subfamilias Alysiinae (Phaenocarpa Foerster) y Opiinae (Fopius Wharton, Psyttalia Walker). Hosts para algunas de estas especies de parasitoides no habían sido registrados previamente. Finalmente, obtuvimos al alysiino Heratemis filosa Walker de pupas de un díptero del suborden Cyclorrhapha que infesta tallos de bambú que fueron previamente atacados por el gorgojo Cyrtotrabhesulus sp.

Translation provided by the authors.

Bamboo-shoot fruit flies (Phytalmiinae: Acanthonevrini, Dacinae: Gastrozonini) are poorly known tephritid flies mainly distributed in Asia, with a few representatives of the Gastrozonini living in Africa (Hancock 1999). The Asian species breed in living or dead bamboos (Poaceae: Bambusoidea), whereas African species breed in other Poaceae (Panicum, Sorghum and Zea) (Hancock 1999; Hancock & Drew 1999). Only in a few species have specific host-plant associations fully been confirmed (Hancock & Drew 1999; Allwood et al. 1999). In the case of species such as Cyrtostola (formerly Taeniostola) limbata (Hendel) and Paraxarnuta anephelobasis Hardy females use the oviposition holes made by weevils of the genus Cyrtotrabhesulus (Curculionidae: Rhynchophori- nae) to lay their eggs (Kovac & Azaree 1994; Dohm & Kovac 2001). Here, we provide new records of parasitoids (Hymenoptera) attacking bamboo fly larvae in Malaysia. The only other known records of parasitoids attacking bamboo flies stem from tephritid host surveys carried out by Chinajariyawong and collaborators (Chinajariyawong et al. 2000) in Malaysia and Thailand under the auspices of the Australian Centre for International Agricultural Research (ACIAR). These authors were able to retrieve Diachasmimorpha longicaudata and Fopius deeralensis adults from Acroceraittis ceratitina and A. dis-incta pupae, respectively.
MATERIALS AND METHODS

Parasitoids reported here were mainly collected in the Ulu Gombak Field Studies Centre (UFSC) of the University of Malaya (West-Malaysia, Selangor Darul Ehsan), located at 3°19'32"N and 101°45'16"E (altitude of 250 m) (Kovac & Streit 1996). Clumps of Gigantochloa scortechinii Gamble and Dendrocalamus giganteus Wall ex. Munro can be found as part of the secondary vegetation that developed in the UFSC premises (or in its vicinity) after the primary forest was selectively logged in the late 1950s (Kovac & Streit 1996). Additional bamboo species (e.g., Dendrocalamus pendulus Ridley) can be found on road sides near the station. Further collections were made during short field trips in Hulu Langat (Selangor), near Labis (Johor) and near Kampung Padang and Sik (both Kedah).

Larvae of bamboo tephritids were obtained from living young and mature bamboo shoots, dead bamboo shoots and culms, and from shoots showing signs of attack by Cyrtotrachelus sp. (Curculionidae: Rhynchophoridae) (Kovac & Azaree 1994; Dohm & Kovac 2001). In the case of the young shoots, we cut them and then artificially created suitable crevices by making cuts in the bamboo sheaths with a Machete, further details in Table 1 and Dohm et al. (unpublished data). Shoots were then left in the field up to 2 weeks to allow complete development of the larvae.

Most infested bamboo material was dissected to retrieve larvae, which were placed in plastic containers (18 × 12.5 × 6.5 cm) with pupating medium (moistened tissue paper). Some shoots were placed in plastic fish tanks (40 × 20 × 30 cm) covered with fine-meshed gauze to preclude ants or other insects from reaching the larvae or to impede them from escaping (the larvae of several species are able to jump). Larvae leaving the bamboo tissue to pupate were transferred to plastic containers (18 × 12.5 × 6.5 cm) with moistened tissue paper as pupating medium. Some larvae pupated directly in the bamboo internodes. All puparia were collected and transferred into small vials closed with fine-meshed gauze until all adult flies or parasitoids emerged. Vials were stored in take-away food boxes, which were placed in a plastic box or fish tanks that had ca. 2 cm layer of water on the floor to create a humid environment that prevented desiccation of the pupae. Vials were checked daily for eclosed adult flies and parasitoids, which were killed with ethyl acetate and preserved in 70 or 100% alcohol together with the puparia. In the case of flies we waited until the adults had hardened and developed full wing coloration before killing them.

Voucher specimens of all parasitoid species mentioned here were deposited in the TAMU insect collection (Texas A & M University, College Station, Texas) curated by R. A. W. Vouchers of all fly species are able to jump. Larvae leaving the bamboo tissue to pupate were transferred to plastic containers (18 × 12.5 × 6.5 cm) with moistened tissue paper as pupating medium. Some larvae pupated directly in the bamboo internodes. All puparia were collected and transferred into small vials closed with fine-meshed gauze until all adult flies or parasitoids emerged. Vials were stored in take-away food boxes, which were placed in a plastic box or fish tanks that had ca. 2 cm layer of water on the floor to create a humid environment that prevented desiccation of the pupae. Vials were checked daily for eclosed adult flies and parasitoids, which were killed with ethyl acetate and preserved in 70 or 100% alcohol together with the puparia. In the case of flies we waited until the adults had hardened and developed full wing coloration before killing them.

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<table>
<thead>
<tr>
<th>Parasitoid species</th>
<th>Family/Subfamily</th>
<th>Host (fly) species (subfamily in parenthesis)</th>
<th>Bamboo species in which host larvae developed</th>
<th>Plant part in which host larvae developed</th>
<th>Parasitoid developmental time days (mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fopius</strong> (marangenis species group)</td>
<td>Braconidae/Opiinae</td>
<td><em>Acroceratitis bilineata</em> (Dacinae)</td>
<td><em>Gigantochloa scortechinii</em></td>
<td>Cut shoot</td>
<td>13.7 ± 0.94</td>
</tr>
<tr>
<td><strong>Psyttalia</strong> sp.</td>
<td>Braconidae/Opiinae</td>
<td><em>Acroceratitis bilineata</em> (Dacinae)</td>
<td><em>Gigantochloa scortechinii</em></td>
<td>Cut shoot</td>
<td>11.0 ± 0.81</td>
</tr>
<tr>
<td><strong>Heratemis filosa</strong> Walker</td>
<td>Braconidae/Alysiinae</td>
<td>Emerged from puparia of cyclorrhaphous Diptera</td>
<td><em>Gigantochloa scortechinii</em></td>
<td>Shoot</td>
<td>10.1 ± 1.59</td>
</tr>
<tr>
<td><strong>Fopius</strong> (marangenis species group)</td>
<td>Braconidae/Opiinae</td>
<td><em>Enicoptera gigantea</em> (Dacinae)</td>
<td><em>Gigantochloa scortechinii</em></td>
<td>Dead tip of a shoot</td>
<td>21.0 ± 2.82</td>
</tr>
<tr>
<td><strong>Phaenocarpa cameroni</strong> Papp</td>
<td>Braconidae/Alysiinae</td>
<td><em>Gastrozona fasciventris</em> (Dacinae)</td>
<td><em>Gigantochloa scortechinii</em></td>
<td>Cut shoot</td>
<td>20.5 ± 2.12</td>
</tr>
<tr>
<td><strong>Phaenocarpa cameroni</strong> Papp</td>
<td>Braconidae/Alysiinae</td>
<td><em>Gastrozona fasciventris</em> or <em>Chaetellipsis maculosa</em> (Dacinae)</td>
<td><em>Gigantochloa scortechinii</em></td>
<td>Cut shoot</td>
<td>13.8 ± 4.6</td>
</tr>
<tr>
<td>Undescribed Eulophidae</td>
<td></td>
<td><em>Gastrozona fasciventris</em> (Dacinae)</td>
<td><em>Gigantochloa scortechinii</em></td>
<td>Cut shoot</td>
<td>16.0 ± 2.64</td>
</tr>
<tr>
<td>Undescribed Eulophidae</td>
<td></td>
<td><em>Langatia setinerva</em> or <em>Ptilona cf. confinis</em> (Phytalmiinae)</td>
<td><em>Gigantochloa scortechinii</em></td>
<td>Water-containing internodes of older cut-down shoot</td>
<td>N.D.</td>
</tr>
<tr>
<td>Undescribed Eulophidae</td>
<td></td>
<td><em>Gastrozona fasciventris</em> (Dacinae)</td>
<td><em>Gigantochloa scortechinii</em></td>
<td>Cut shoot</td>
<td>9.5 ± 0.7</td>
</tr>
<tr>
<td>Undescribed Eulophidae</td>
<td></td>
<td><em>Felderimyia gombakensis</em> (Phytalmiinae)</td>
<td><em>Gigantochloa sp.</em></td>
<td>Water-containing internodes of an older shoot</td>
<td>13.5 ± 2.25</td>
</tr>
<tr>
<td>Undescribed Eulophidae</td>
<td></td>
<td><em>Gastrozona fasciventris</em> (Dacinae)</td>
<td><em>Gigantochloa scortechinii</em></td>
<td>Cut shoot</td>
<td>15.0 ± 0.81</td>
</tr>
<tr>
<td>Undescribed Encyrtidae</td>
<td></td>
<td><em>Felderimyia gombakensis</em> (Phytalmiinae)</td>
<td><em>Gigantochloa sp.</em></td>
<td>Water-containing internodes of an older shoot</td>
<td>N.D.</td>
</tr>
<tr>
<td>Undescribed Encyrtidae</td>
<td></td>
<td><em>Gastrozona fasciventris</em> (Dacinae)</td>
<td><em>Schizostachyum cf. grande</em></td>
<td>Cut shoot</td>
<td>12.5 ± 4.94</td>
</tr>
<tr>
<td><strong>Spalangia</strong> sp.</td>
<td>Pteromalidae</td>
<td><em>Rixoptilona vaga</em> (Phytalmiinae) or <em>Acroceratitis hardyi</em> (Dacinae)</td>
<td><em>Dendrocalamus pendulus</em></td>
<td>Cut shoot</td>
<td>13.0</td>
</tr>
</tbody>
</table>
fortunately, *D. thailandica* is known only from the male, and the question of whether it is identical to our material will require more detailed study. The apparently undescribed species of *Psyttalia* reared from bamboo flies is interesting in several respects. Morphologically, it belongs to the large concolor species group as segregated by Wharton (2009), and except for the much darker coloration, it is similar to *P. walkeri* Muesebeck. The species attacking bamboo shoot flies thus belongs to the group of *Psyttalia* that attack fruit-infesting tephritids rather than those that attack gall-making and flower head-infesting tephritids. We also reared the alysiine *Heratemis filosa* Walker from puparia of cyclorrhaphous Diptera infesting bamboo shoots that had previously been attacked by the weevil *Cyrtotrichelus* sp. There are no confirmed host records for any species of *Heratemis* Walker. Although 1 specimen of the widely distributed *H. filosa* has a label suggesting that the host is a cucurbit-infesting tephritid, this record is suspect (Wharton 2002; Yaakop et al. 2009). Similarly, although we reared several individuals, all from the same host (based on morphology of the puparium), we were unable to rear any flies from these puparia and hence the host remains unknown.

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