ARE WEBSPINNERS (EMBIOPTERA) REALLY RARE IN THE PHILIPPINES?: PRELIMINARY ANSWERS FROM TAXONOMIC ACCOUNT AND REVIEW OF PREVIOUS TERRESTRIAL ARTHROPOD SURVEYS[1]

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ABSTRACT

Most entomologists in the Philippines and abroad have been taught and believe that the Embioptera commonly known as webspinners or embiids are rare. In fact, entomology teachers give higher or extra points to students who are able to collect and submit specimens of these seemingly elusive insects. Previous collections by the first author from rhizomes of some plants in Laguna and UV light trap catches in Quezon as well as collections of the second author from decaying logs and living trees around Laguna reveal that embiopterans or at least a few species belonging to this order may actually be fairly common. These recent observations are discussed vis-à-vis the aspects of commonness or rarity established in conservation biology. Initial results of attempts to culture them in captivity as well as other observations in the field and in the laboratory are summarized to gain insights on possible research needs, potentials for discovery of new forms or species, ecological/environmental significance and conservation status.

KEYWORDS: embiids, Embioptera, environmental indicators, insect conservation, rarity, terrestrial arthropod biodiversity, webspinners

INTRODUCTION

A rare species or taxonomic group has restricted geographical distribution or maybe widespread but never found in abundance (Spellerberg & Sawyer, 1999). From the perspective of biodiversity, rarity has implications to

conservation. Along this line, Primack (2010) and Molles (2010) discussed aspects of rarity and commonness in relation to the vulnerability of species to extinction. In most of these discussions, the examples provided are either vertebrates or plants and little attention is given to smaller organisms particularly insects and other arthropods. A similar observation for general biodiversity conservation has been expounded earlier, i.e. the most diverse group, the arthropods, are often neglected or excluded in discussions and actions concerning biological diversity (Lit, 2003).

Among insects, most entomologists in the Philippines and abroad have been taught and believe that the Embioptera commonly known as webspinners or embiids are rare. In fact, entomology teachers give higher or extra points to students who are able to collect and submit specimens of these seemingly elusive insects. Gapud et al. (2001) counted only two species under the Embioptera and noted 50% endemism, which meant that one of the two species he reviewed is endemic to the Philippines. However, based on previous fieldwork and recent cursory observations, embiopterans, or at least a few species belonging to this order, may actually be fairly common under certain environmental conditions in the Philippines.

This short paper aims to provide a brief taxonomic account on the species that we have encountered in Luzon and discuss their occurrence vis-à-vis aspects of rarity or commonness from the point of view of conservation as well as their probable ecological or environmental significance and possible conservation status. This signals also the kindled interest on taxonomic and ecological studies of webspinners in the Philippines where currently only the family Oligotomidae is known to occur.

MATERIALS AND METHODS

The few specimens gathered from previous fieldwork were retrieved. New specimens were collected and observed alive in the laboratory until all immatures became adults. New photographs were taken whenever possible. All specimens were preserved in vials filled with 95% ethanol and properly labeled. Records in field data notebooks, photographs on file, and compiled research reports were also reviewed.

Alcohol-preserved specimens were processed by cold overnight maceration in 10% potassium hydroxide and then washed with distilled water before mounting on slides with modified Hoyer's medium. Others were preserved as dried pinned specimens and labeled. All specimens were examined under dissecting and compound microscopes and identified using available taxonomic keys and illustrations.

For each genus and identified species, brief diagnostic notes are given following the taxonomic characters and morphological terminologies, including acronyms, of Ross (1943). These include: 9 – 9th tergite; 10L and 10R – left and right hemitergites of 10th segment; 10LP – left tergal process;

$10RP_1$ – major right tergal process; H – hypandrium (9th sternite); HP – hypandrium process; LCB and RCB – left and right cercus-basipodites; LPPT – left paraprocts; LC_1 – basal segment of left cercus. Vouchers with their corresponding accession numbers were deposited in the Entomology Section of the UPLB Museum of Natural History.

RESULTS AND DISCUSSION

Taxonomic accounts. Three species of webspinners were found, namely *Aposthonia borneensis* (Hagen), *Oligotoma saundersii* (Westwood) and *Oligotoma* sp. aff. *humbertiana* (Saussure). They all belong to the Family Oligotomidae, currently, the only embiopteran family recorded from the country.

Order Embioptera

Family Oligotomidae

Genus *Aposthonia* Krauss

Aposthonia Krauss, 1911: 48 (Type-Species: *Aposthonia vosseleri* Krauss 1911 (= *Oligotoma borneensis* Hagen), by original designation); resurrected by Ross, 1956: 316.

Krauss (1911) proposed this genus to accommodate his *A. vosseleri* which was later determined to be a synonym of *O. borneensis.* Hence, Enderlein (1912) considered it a synonym of *Oligotoma* Westwood. Ross (1955) recognized the group of *borneensis* to constitute a separate group within *Oligotoma* Westwood and therefore considered it a subgenus, eventually elevating it to generic status (Ross, 1956).

Diagnosis. The genus *Aposthonia* closely resembles *Oligotoma* except for the absence of the mesad lobe of the left cercus basipodite (LCB) and the simple left paraproct process (LPPT).

Distribution. Japan, Indonesia, Melanesia and Australia (Ross, 2007). Ross (2007) summarizes its distribution to Tropical Asia, Australia and east African Coast.

Remarks. *Aposthonia* is one of the largest and widely distributed embiid genera. It is probably a polyphyletic group because it serves as a "catch-all" genus for the family Oligotomidae (Ross, 2007).

Aposthonia borneensis (Hagen) (Figure 1a & b)

Oligotoma borneënsis Hagen, 1885: 146 (as *"O. saundersii* Westwood") (Lectotype male: Telang Borneo, Museum of Comparative Zoology); Davis, 1940: 371; Ross, 1943: 102.

Oligotoma masi Navás, 1923: 39 (Type: Vigan, Luzon, Philippines, Paris Museum).

Aposthonia borneensis: Ross, 1978: 5; Poolprasert, 2011: 40.

Material examined. Los Baños, on *Casuarina equisetifolia* L., 10-ii-14 (C.C. Lucañas, UPLBMNH EMB-00005♂); Pagsanjan, Laguna on *Cocos nucifera* L., 28-xii-13(CC Lucañas, UPLBMNH EMB-00007 ♂ - 00008 ♀)

Diagnosis. It is distinguished from other *Aposthonia* by a distally rounded 10LP and a narrow LPPT with a small apical hook.

Distribution. China, South East Asia and Papua New Guinea (Poolprasert, 2011)

Remarks. *Aposthonia borneensis* has been extensively described by Ross (2007) and Poolprasert (2011). This species is widely distributed (primarily due to anthropogenic causes) and was the first webspinner reported from the country by Navas (1923). He described it as *Oligotoma masi* which was later synonymized to *Aposthonia borneensis*.

Genus *Oligotoma* Westwood 1837

Oligotoma Westwood 1837: 373, as subgenus of *Embia* Latreille 1825; elevated by Burmeister, 1839: 796.

Diagnosis. Distinguished from other Oligotomid webspinners by the base of the left cercus being completely encircled by the basipodite (LCB) and projecting mesad as a lobe.

Distribution. Cosmopolitan (Ross, 1955)

Remarks. *Oligotoma*, together with *Aposthonia*, is one of the largest genera of Embioptera and are relatively common because of their rapid (anthropogenic) dispersal (Ross, 2007).

***Oligotoma saundersii* (Westwood 1873)** (Figure 1c & d)

Embia (*Oligotoma*) *saundersii* Westwood 1837:373

Oligotoma saundersii: Davis, 1942: 119; Ross, 1944: 495; Bradoo, 1971: 264; Ross 1984a: 48; Ross, 1984b: 91; Ross, 2006: 344; Poolprasert, 2012: 411.

Material examined. Mt. Makiling, Laguna on rotten *Spondias purpurea* L. log 17-xi-73 (VP Gapud UPLBMNH EMB-00001 – 00003 ♀); Cassamata Nursery, Bangued, Abra on *Gliricidia sepium* (Jacq.) Kunth ex Walp. 23-x-76 (J Sotto, R Garcia UPLBMNH EMB-0004♂)

Diagnosis. Distinguished from other males by the sickle shape LPPT.

Distribution. Cosmopolitan (Ross, 1955); Indian; Type locality: Sri Lanka

Remarks. This species was originally described from Sri Lanka. It is considered as introduced, probably via Manila-Acapulco Galleon trade (Ross, 1955). The species was first recorded in the country when Dr. Leopoldo B. Uichanco, former Dean of the U.P. College of Agriculture collected it in 1934 on the roots of an orchid (Baltazar and Salazar, 1979).

***Oligotoma* sp.aff. *humbertiana* (Saussure 1896)(**Figure 1e & f)

Material examined. Polillo Island, Quezon on *Cocos nucifera* L.30-v-13 (CC Lucañas, UPLBMNH EMB-00034 ♂ - 00035 ♀); Pollilo Island, Quezon on wall 21-x-13 (CCLucañas, UPLBMNH EMB-00036 ♀); Pagsanjan, Laguna inside *Nepenthes ventricosa* Blanco, 15- ix-14 (CC Lucañas, UPLBMNH EMB-00037 ♂); Pagsanjan, Laguna on wall 15-i-14 (CC Lucañas, UPLBMNH EMB-00038 ♂); Pagsanjan, Laguna on rotten *Azadirachta indica* A. Juss. 10-xii-13 (CC Lucañas, UPLBMNH EMB-00039 ♀)

Remarks. The specimens at hand key out to *Oligotoma humbertiana* (Saussure), a species also originally described from Sri Lanka and distributed in the Indian subcontinent. It is also considered a "weed" species and has been introduced to other countries such as Mexico (Ross, 1984), China, Indonesia (Ross, 2000b), Hong Kong, Mariana Islands, Taiwan and Thailand (Poolprasert, 2012).

O. humbertiana differs from other *Oligotoma* species by the small apical process on the narrow curved 10LP. Detailed descriptions were provided by Ross (1940) and Poolprasert (2012). However, our specimens differ in the following characters: HP not tapering, rather emarginate or blunt; LPPT complex, sclerotized; markings on the 8th abdominal sternite of females unpigmented posteriorly, with two circular patterns medially and hence, we place them in the meantime as just near *humbertiana* pending further studies and collection of more specimens.

Aspects of Commonness or Rarity. Molles (2010) enumerated aspects of commonness or rarity in relation to the vulnerability of a species to extinction. These are: (1) geographic range, which can be either extensive or restricted; (2) habitat tolerance, which can be broad or narrow; and (3) population size, which vary from large to small. Varying combinations of these aspects or characteristics present a continuum of states from cosmopolitan and widespread to extremely rare species. Considering these aspects or criteria, we present below a preliminary reconsideration of the common notion that embiopterans, at least in the Philippines, are rare.

Geographic range. As a group, the order Embioptera is considered by some authors as rare (e.g. Baltazar and Salazar, 1979) whereas others safely state that they are little-known (e.g. Wootton, 1993). Within the order, the family Oligotomidae is known to occur in Mediterranean, Middle East, India, Southeast Asia and Australia. *Aposthonia borneensis* and *Oligotoma*

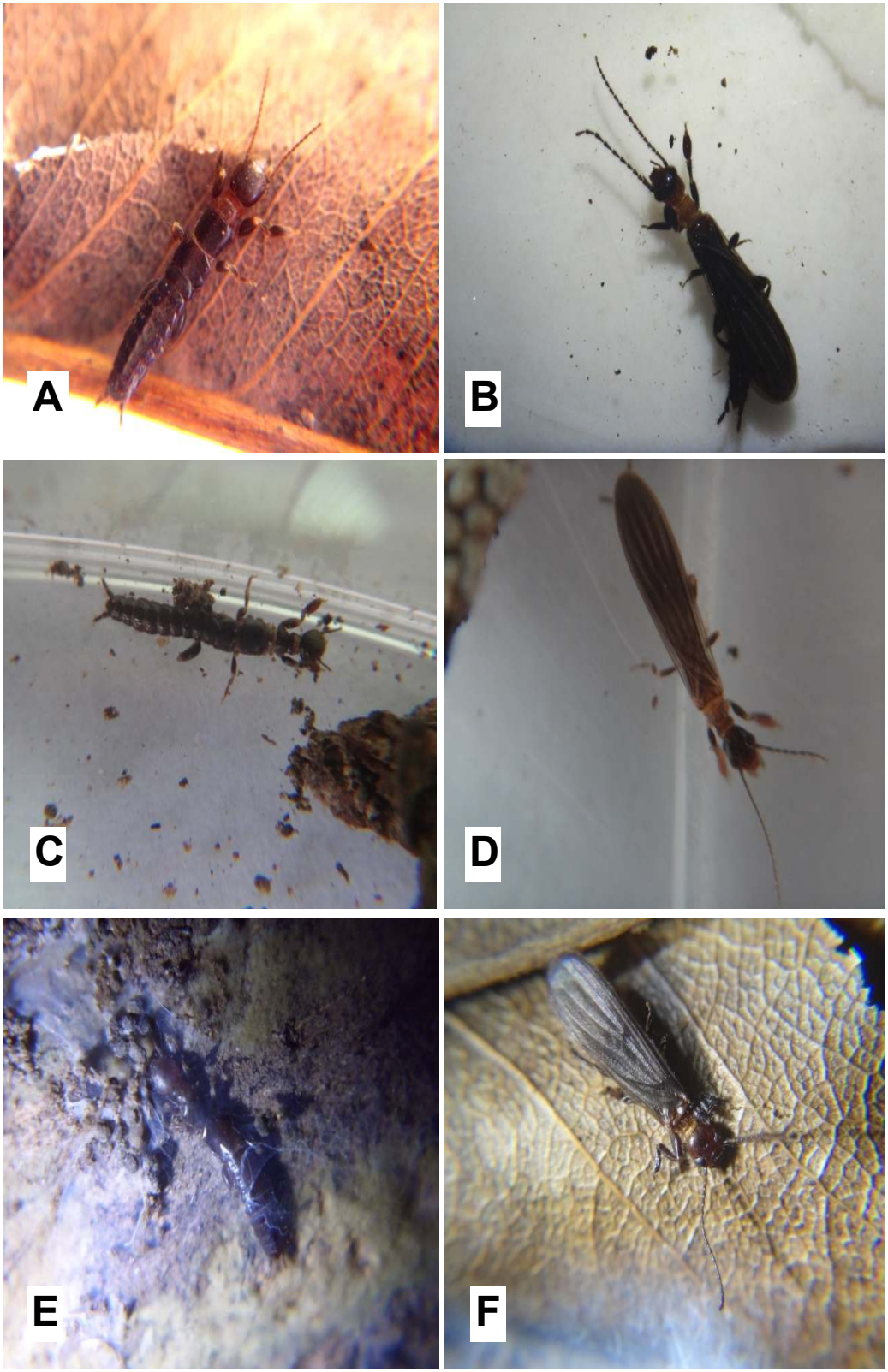

Figure1. Habitus of webspinners collected from the Philippines. Female (A) and Male (B) *Aposthonia borneensis* (Hagen); Female (C) and Male (D) *Oligotoma saundersii* (Westwood); Female (E) and Male (F) *Oligotoma* sp.aff. *humbertiana* (Saussure).

Table 1. Incidence of webspinners (Embioptera) among accumulated catches of terrestrial arthropods during biodiversity surveys from 1998-2013.

Area/Locality	Inclusive Dates	Approximate Accumulated Catches	No. of individual webspinners	Collecting techniques used	Remarks
Mt Pulag, Benguet	April 1998	400	0	Malaise trap, light trap, sweep net, opportunistic	
Mt Banahao de Lucban, Quezon	1998-1999	900	1	light trap, sweep net, opportunistic	male caught by white light trap
Pinaglubayan, Polillo, Quezon	2003-2004	900	1	light trap, sweep net, pitfall, opportunistic	male caught by white light trap
Pagbilao-Atimonan, Quezon	2005-2008	3,000	6	light trap, sweep net, opportunistic	males caught by UV light trap
Greater Sipit, Mt Makiling, Batangas-Laguna	2008	1,000	0	light trap, sweep net, pitfall opportunistic	
Polillo & Burdeos, Quezon	2012-2013	1,200	11	light trap, sweep net, pitfall, habitat search/ opportunistic	females etc. caught by habitat search

saundersii are distributed in several countries. Although there is a possibility that these may be indigenous, albeit not endemic to the Philippines, their presently disjunct distribution in countries or areas that are not biogeographically related suggests periodic introductions via human agencies. Whereas there are probably Philippine endemic species that await discovery, the fact remains that as a group, their geographic range is wider than previously thought or perceived.

Habitat tolerance. Despite the seemingly widespread distribution of embiids, including the species known to occur in the Philippines, they do not occur in all places and habitats. We have collected individuals in semi-urban centers but usually we have encountered them mainly in cleaner or less polluted environments. We collected them from trees covered with lichens and mosses and on moss-covered concrete walls, decaying logs, canal walls. We have not found them in abundance in polluted urban centers, especially in highly disturbed areas or busy streets. Therefore, these observations suggest that their habitat tolerance is indeed narrow. Only a few species may, if at all, tolerate pollution. As such, they may also be good candidates for biological indicators of environmental health.

Population size.This aspect of commonness or rarity is presently the most difficult to assess or evaluate. Webspinners build silken domiciles (or galleries as they were called in Gullan and Cranston, 2000) which protect them and facilitate their foraging activities. At present, there is no non-destructive way or opportunity to conduct population assessments. Detection of domiciles which are often concealed by debris, fecal and other materials also need to be improved. Upon review of our collection records and field notebooks for previous biodiversity surveys (Table 1), their occurrence among terrestrial arthropods caught in light traps, pitfalls, sweep nets and other sampling/collecting techniques, is relatively less common. Our previous collections are limited to a few males attracted to UV and white light traps like the few collected near the Pagbilao Power Plant and in the Quezon National Forest Park area of Atimonan, both in Quezon, Province. These observations coupled with their relatively narrow habitat tolerance suggest that compared to most insects, their populations may not be large. However, this needs to be supported by empirical data based on well-planned sampling, especially because the trapping or collection techniques used may not have been appropriate to detect or catch webspinners and generally do not take into consideration their cryptic habits. It should be noted that only in the last two years, when we have been more familiar with the habits of webspinners that we collected a few females.

CONCLUSION AND RECOMMENDATIONS

Based on results of our preliminary surveys and on a review of our field and museum records, embiids may not be as rare as presumed or perceived and

at least two or three species may occur in a wider geographic range as long as the local environment is relatively less polluted. Dennis et al. (2007) in discussing rarity and flagship species in the context of species conservation and landscape management wrote that "rare species can become common with environmental changes much as common species can become rare," and Lewis and Basset (2007) reminded "that taxa can be both widespread and rare." Our initial observations of the non-occurrence or low rate of incidence of webspinners in highly polluted areas indicate that they are affected by negative anthropogenic environmental changes and that future rarity may indeed be inevitable.

In view of our results, we recommend further studies aimed at discovering possible new faunal records or even new species should be conducted along with detailed studies focusing on abundance, population assessment and the ecology of their domiciles.

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