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Maabella gen. nov. (Streblidae: Ascodipterinae) from Guangxi Province, China and Vietnam with notes on preservation of Ascodipterinae

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Abstract

Endoparasitic Ascodipterinae (Streblidae) were collected from bats from southeast China and northern Vietnam. Among this material, the new genus and species *Maabella stomalata* is described. The dealate females of this new taxon from China were attached over the joints of the wings of *Rhinolophus affinis* Horsfield and *Rhinolophus macrotis* Blyth. They were also removed from the wings of *Rhinolophus paradoxalophus* (Bourret) and *R. macrotis* from Vietnam. Clarification of the relationships of the streblid genera *Ascodipteron* Adensamer, 1896, *Maabella*, and *Paraascodipteron* Advani and Vazirani, 1981 is discussed. Techniques are presented for the preparation and preservation of these small obligate parasites.

Key words: *Ascodipteron*, bat flies, endoparasite, neosome, *Paraascodipteron*, *Rhinolophus*

Introduction

Ascodipterinae (Streblidae) occur only in the Old World and are parasites of bats. Currently two genera belong to this subfamily. They include *Ascodipteron* Adensamer, 1896 and *Paraascodipteron* Advani and Vazirani, 1981. The latter genus was described from one male and this specimen is currently inaccessible in the National Collections of Zoological Survey of India, Calcutta. The placement of this genus within the Ascodipterinae is disputable (see discussion). Maa (1965a) revised the African species of *Ascodipteron* and Theodor (1968) subsequently enhanced some descriptions of material from the Afrotropical Region and the Palaearctic Region (Mediterranean Subregion). Twelve species of *Ascodipteron* are currently recognized from these regions [(Afrotropical): Hutson and Oldroyd 1980, Maa 1965a, 1965b, and Theodor 1968;

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(Palaearctic): Maa 1965b, and 1971], while six have been described from the Oriental and Australian regions (Maa 1965b, 1971, 1977, and 1989). Hürka (1998), in a discussion of the classification and distribution of the family Streblidae, also suggested there are 18 species of *Ascodipteron*.

Unlike other Streblidae, females in the subfamily Ascodipterinae are endoparasitic; consequently, these females have many unique morphological characteristics. The morphological features of the female distinguish members of the Ascodipterinae from all other Streblidae. The head is greatly modified with an enormously enlarged labial theca and protrusible and retractable sets of cheliceral blades attached at the apex of the epipharynx. The female features of the head of two species of *Ascodipteron* and our new genus and species, *Maabella stomalata*, were illustrated by scanning electron microscopy by Hastriter *et al.* (2006, *M. stomalata* cited as an undescribed genus). The gena of females is enlarged to cover the lateral membranous regions of the head and both sexes are eyeless. The dorsal portion of the female head (posterior to the labial theca) has a sclerotized frons (with posterior depressions that protect the antenna comprised of two segments with apex of arista multi-branched), a pair of lateral vertices, and an occipital sclerite. Males are little known, but Maa (1971) stated, “head somewhat similar to *Raymondia* [a genus in the subfamily Nycteriboscinae], thorax is compressed bilaterally, and abdomen with seven visible segments subequal in length to one another”. Wings of both sexes of *Ascodipteron* spp. are similar with three distinct longitudinal veins and no crossveins.

Muir (1912) first described the life cycle of these pupiparous flies in his description of *A. speiserianum* from Amboina, Indonesia. Winged adults emerge from puparia. Adult females fly to a host, attach, and are enveloped by the host skin and tissues. Only the apex of the abdomen protrudes from the host’s tissue. Females lose their halteres, wings, and legs and rapidly become neosomes (adult females whose abdominal exoskeleton has been greatly enlarged by the secretion of new cuticle). Mating behavior is unknown, but must occur prior to attachment of the female to a host, or *in situ* after females attach.

Only females permanently attach and are commonly collected from bat hosts. Males are rare and have been described for only four species: *A. speiserianum* Muir, 1912, *A. africanum* Jobling (male described in Jobling 1940), *A. namrui* Maa, 1965 (male described in Theodor 1968), and *A. rhinopomatos* Jobling, 1952 (male described in Theodor and Moscona 1954)]. All were reared from pupae obtained from females in the laboratory, except for the sole male of *A. africanum* that was collected from a bat host. The new genus described in this paper is known only from dealate females. Based on morphology, host specificity, site of parasite attachment, geographic and habitat differences, our material from China and Vietnam clearly represent a new genus as suggested by Hastriter *et al.* (2006). The purpose of our paper is to describe a new genus, discuss the systematic position of P*araascodipteron*, and present techniques for the preparation and preservation of these small endoparasitic obligate parasites.

Materials and methods

Collection and extraction

During September and October 2004, 175 bats were collected 46.3 km west of the city of Xinjing, Guangxi Zhuang Autonomous Region, Jingxi County, Guangxi Diding Provincial Reserve (23°07'21"N, 105°57'49"E), 978–1,100 m, in primary forest on karst. Seven other bats were collected on the same expedition from a nearby cave (23°05'N, 105°59'E), 780 m, in an agricultural area near Nian Wei, 4.8 km SSE of the previous site in the Provincial Reserve. An additional 80 bats were collected on a second expedition in April 2005 to the Shiwandashan National Nature Preserve, Guangxi Province, China. Earlier expeditions during May 1996 and May 1997 harvested 279 bats from various locations in three provinces in northern Vietnam (Cao Bang, Tuyen Quang, and Vinh Phu) from tropical lowland forests. Access to Vietnam Ascodipterinae was provided by Douglas C. Currie, Entomology, Department of Natural History, Royal Ontario Museum (ROM), Toronto, Ontario, Canada. Bats were captured with mist nets and harp traps. Each bat was euthanized with chloroform prior to being examined for ectoparasites and embedded bat flies. All bats are deposited in the ROM. Slide mounted Ascodipterinae are deposited in ROM, the National Museum of Natural History, Washington, D.C. (NMNH), and the senior author's collection (MWH).

Neosomes were extracted by slicing through the host tissue at the base of the embedded parasites and pealing back the skin and cartilaginous layers with forceps. They were preserved in 95% ethanol. Neosomes taken *in situ* from host bats were encysted within a tough fibrous capsule of host tissue. Collectors may or may not have removed this during extraction from the host. If host tissues were present in alcohol preserved material, the entire neosome was removed from this fibrous tissue capsule with two jeweler's forceps. As a side note for future collectors: removal of the neosome with the tough fibrous capsule intact is the most field expedient method of collection and is optimal for preservation.

Laboratory specimen preparation

Once the pearl white neosome was freed from the host's tissue, the genital aperture (terminal segments bearing spiracles V–VII, cerci, anal and vaginal orifices, and circular arrangements of setae) was removed from the engorged abdomen by cross-cutting just anterior to the genital aperture with a scalpel (# 15 blade). The cut was made as close as possible to the anterior-most ring of minute spiniform setae. To prevent crushing or distorting the genital aperture, it was cut prior to clearing in potassium hydroxide (KOH). The genital aperture contains important morphological features (Hastriter *et al.* 2006) and care must be exercised to mount the associated genital aperture and head/thorax on the same slide. The head and thorax remain hidden within the neosomic abdominal sack and must be dissected from the abdomen with jeweler's forceps. There are no discernable features between the scutellum and the genital aperture that are useful for identification, thus this part of the specimen was either discarded or preserved for molecular work. Whole neosomes may be stored in vials of 70% ethanol for long periods; however, accurate identifications require clearing and mounting of specimens on microscope slides.

Jobling (1952) and Maa (1965a) only briefly described the techniques that they used for preparing specimens for examination, preparatory to mounting in Canada balsam. Jobling's technique of "boiling in potash and clearing with clove oil" was modified by clearing in KOH (using a disposable Pasteur pipette, 3 drops of a saturated solution of KOH were placed into 0.75ml distilled water) at room temperature for 6–24 hours, dehydrating in serial alcohols (70%, 80%, 95%, and absolute, 30 minutes each), rapid immersion in methyl salicylate, and one hour in xylene. Further dissection of labial thecae, vincula and laterovertices of the insects was performed in xylene. To avoid crushing and distorting the head/thorax and genital aperture, two glass shims (made with crushed No. 2 microscope cover-slips) were placed under each cover-slip. If sufficient numbers of specimens were available, mounts of dorsal, ventral and lateral views of the head and thorax were prepared. In addition, genitalia vials were used to store head/thorax and genital apertures that had been cleared in KOH. For proper orientation, lateral views were mounted with the head directed right and sternum away from technician; for dorsal and ventral views the mouth parts faced technician. When only one specimen was available, the dorsal view was the preferred orientation for maximum observation of essential characters. The genital aperture was mounted caudal portion up, spiracles five and six directed towards the technician. Genital aperture and the head/thorax were mounted under two No. 1 cover-slips on the same slide (12mm cover-slips centered one at top and one at bottom) to allow room for an identification label and a host/locality data label at each end of the slide.

A single larva/prepupa was occasionally present in the uterus of the female (apparent during dissection of the head/thorax from the abdomen). Various degrees of development were seen among larvae prematurely removed from the uterus. Early forms are tubular or elliptical shaped without apparent surface features, while a more developed larva (prepupa) may have two pair of spiracles, surface sculpturing, and an anal orifice. These stages are best studied in alcohol, since mounting larvae/prepupae generally distorts and damages specimens. Whole larvae/prepupae were preserved in genitalia vials in 70% ethanol.

Specimen imaging and measurements

An Olympus SZX12 dissecting microscope equipped with a 3CCD MTI digital camera and an Olympus BX61 compound microscope equipped with an Olympus CV12 digital camera, each equipped with an Olympus Microsuite™ B3SV multi-layer montage program were used to prepare digitized images of whole specimens and slide mounted material, respectively. Measurements were performed on digitized images with the latter equipment. A reference for measurements has never been standardized for the

Ascodipterinae. Therefore, dimensions listed in this paper adhere to the following guidelines. Measurements were applicable to mounted material only, with exception of whole, encysted females (neosomes). Body length excludes soft pleomorphic abdominal tissues that extend beyond scutellum. Length specified for the head and thorax were measured from the anterior margin of the labial theca to the most posterior point of the scutellum (dorsal view). Height and width of mounted material are subject to distortion caused by cover-slip compression and were not measured. Length of labial theca was measured from anterior margin to margin of posterior lateral lobes (dorsal view) and width of labial theca was from widest posterior lateral point on each side of labial theca (dorsal or ventral views).

Results

A total of 258 bats from China representing 12 genera were examined for ectoparasites: **Pteropodidae:** *Cynopterus* F. Cuvier (27), *Sphaerias* Miller (18), *Rousettus* Gray (16); **Rhinolophidae:** *Rhinolophus* Lacépède (82), *Hipposideros* Gray (6); and **Vespertilionidae:** *Murina* Gray (79), *Myotis* Kaup (12), *Pipistrellus* Kaup (7), *Harpiocephalus* Gray (4), *Scotomanes* Dobson (4), *Miniopterus* Bonaparte (2), *Kerivoula* Gray (1). Specimens of the new genus (Ascodipterinae) were collected from *Rhinolophus affinis* Horsfield (17 from 11 of 46 hosts examined) and from *Rhinolophus macrotis* Blyth (3 on 1 host examined).

A total of 279 bats from Vietnam representing 16 genera were examined for ectoparasites: **Emballonuridae:** *Taphozous* E. Geoffroy (1); **Pteropodidae:** *Megaerops* Peters (17), *Eonycteris* Dobson (11), *Cynopterus* (9); **Rhinolophidae:** *Rhinolophus* (76), *Hipposideros* (42), *Aselliscus* Tate (9); and **Vestpertilionidae:** *Pipistrellus* (61*), Myotis* (18), *Scotomanes* (13), *Kerivoula (6), Murina (6), Eptesicus* Rafinesque (2), *Tylonycteris* Peters (2), *Arielulus* Hill and Harrison (1), *Scotophilus* Leach (1). Among 44 Ascodipterinae collected from these bats, specimens of the new genus were recovered from *Rhinolophus paradoxalophus* (Bourret) (4 from 4 of 32 hosts examined) and *R. macrotis* (3 from 1 of 5 hosts examined).

Direct comparison with sister streblid taxa is problematic because male Ascodipterinae are poorly represented and identification of homologous characters is difficult in female Ascodipterinae because of their extreme sexual dimorphism. Theodor (1968) indicated that the male abdomen of *A. africanum* Jobling, 1939 bore similarities to that of *Raymondia* Frauenfeld, 1856 and Maa (1971) thought the male head of *Ascodipteron* was “somewhat similar to *Raymondia*”; however, molecular analyses by Dittmar *et al.* (2006) did not support a close generic affinity. Justification for erection of a new genus closely allied with Asc*odipteron* may be found in their biogeography, host specificity, site of attachment, and morphology. The genus *Ascodipteron* is found throughout the tropical and semi-tropical regions of the Old World, whereas, *Maabella* occurs only on the Southeast Asian mainland and east to the Philippine Islands and the

Lousiade Archipelago (includes a second species of *Maabella* to be described elsewhere). Species of *Maabella* parasitize *Rhinolophus* and *Hipposideros*, whereas species of *Ascodipteron* throughout their range are found on these host genera, in addition to *Miniopterus* spp. (Vespertilionidae). The evolution of streblids follows the phylogenies of their bat hosts (Wenzel et al. 1966). The occurrence of multiple species of *Ascodipteron* on a vespertilionid bat (*Miniopterus* spp.) across this bat's range with the exclusion of parasitism of this group by *Maabella* would suggest a divergence of host adaptation between the two genera. In addition, *Ascodipteron* spp. attach to different areas of the body (base of ears, urogenital region, and on the upper and forearms of the wings), whereas *Maabella* spp. are restricted to the wings over the bones or joints of the phalanges. The nature of the tissue at the attachment sites of these two genera, reflect the size and shape differences of the neosomatic cyst. The expansion of the neosomatic growth of *Ascodipteron* spp. is unrestricted in the softer thick host tissues and becomes larger and flask-shaped. Those of *Maabella* spp. associated with thin tissues of the distal portions of the wing are drastically smaller and sausage-shaped, thus minimizing their physical presence on the effect of the aerodynamics of the host's flight. The diameter of the genital aperture of *Ascodipteron* spp. is nearly twice that of *Maabella* spp. and the presence of the genital sclerite in *Maabella* is absent or vestigial in *Ascodipteron* spp. Peg-like spiniform setae are present on different sclerites of *Ascodipteron* spp. and absent in *Maabella* spp.

***Maabella* gen. nov.**

Diagnosis

Only dealate encysted neosomic females were available for description (males unknown). Females of the new genus share similar morphological and biological affinities with those of the genus *Ascodipteron*: 1) extreme modifications of the head, particularly the mouthparts, 2) presence of genital aperture, 3) neosomatic growth, 4) loss of halteres, wings and legs immediately after attachment to a host bat. *Maabella* differs from *Ascodipteron* by its smaller size and the shape of the labial theca, which is broad at the apex, width about equal to length (Figs. 1A–B); epipharynx (labial gutter) with lateral sclerotized expansion posterior to base of cheliceral blades (Fig. 1A); vinculum heavily sclerotized and distinctly thickened in all dimensions (Fig. 1D); genae fused ventrally (Fig. 1D), rounded along anterior margin and broadly rounded at dorsal apex, and adorned with long coarse setae (not peg-like spiniform) (Fig. 1C); scutellum posteriorly rounded (not quadrate) (Fig. 1C); anterior and posterior margin of prosternum parallel, expanded anteriorly from margin of mesosternum to forward edge of coxa (without membranous area between prosternum and ventral extensions of genae) (Figs. 1D, 2A); trochanters bearing numerous long setae (Fig. 1D, 2A); the genital plate (between anus and vaginal orifice, may represent sternum VIII) always present and exceptionally well developed (Figs. 2C–F); and in lateral view, lateral vertices nearly perpendicular to longitudinal axis of thorax (more oblique or flattened in *Ascodipteron*). The larvae are without discernable surface features, while the morphology of the prepupae of *Ascodipteron* and *Maabella* are similar. Spiracles of both genera of similar design: a dorsal and ventral pair of sealed, linear and elevated zipper-like spiracles. There were insufficient numbers of *Maabella* prepupae to evaluate the taxonomic significance of the length and position of spiracles.

Etymology

The genus is named in honor of the late Dr. Tsing C. Maa (1910–1992), (formerly of the B.P. Bishop Museum, Honolulu, Hawaii), who advanced our systematic understanding of the bat parasites Nycterobiidae and Streblidae. His contributions were particularly noteworthy regarding this most unusual and intriguing subfamily of bat parasites (Ascodipterinae) and long ago he recognized the presence of a new genus from China (Maa 1965a), but never published its description.

Maabella stomalata **sp. nov.**

Material examined

Holotype, dealate female: **Vietnam: Tuyen Quang Province,** Na Hang Nature Reserve, (22°20'N, 105°25'E), ex. *R. paradoxalophus* (ROM no. 107647), 17–19 V 1997, J. Eger, B. Lim, and L. Mitchell (ROM).

Paratypes: **China: Guangxi Province,** Jing Xin County Provincial Nature Reserve, (978 m), (23°12'N, 105°09'E), ex. *R. affinis* (ROM no.s 116035, 116084, 116085, 116089, and116092), 20 IX 2004, S. Bush (3♀ and 1 prepupa MWH; 7 ROM); same data except 3 X 2004, (ROM no.s 116141 and 116142) (2♀ ROM); same data except ex. *R. macrotis* (ROM no. 116115), 2 October 2004 (2♀ MWH, 1♀ ROM); Shiwandashan National Nature Preserve, ex. *R. affinis* (ROM no.s 116404 and 116399), 20 IV 2005, S. Bush (2♀ NMNH, 1 ROM). **Vietnam: Tuyen Quang Province,** Na Hang Nature Reserve, (22°20'N, 105°25'E), ex. *R. macrotis* (ROM no. 107635), 16 V 1997, J. Eger, B. Lim, and L. Mitchell (2 ROM).

Other Material Examined

China: Guangxi Province, Jing Xin County Provincial Nature Reserve, (978 m), (23°12'N, 105°09'E), ex. *R. affinis* (ROM no. 116089 and 116035), 20 IX 2004, S. Bush [1♀ DNA, 1 prepupa MWH; 1♀ mounted on stub for SEM, see Hastriter *et al.* (2006), ROM]. **Vietnam: Tuyen Quang Province,** Na Hang Nature Reserve, (22°20'N, 105°25'E), ex. *R. paradoxalophus* (ROM no.s 107647 and 107669), 17–19 V 1997, J. Eger, B. Lim, and L. Mitchell, (genital apertures of 3♀ ROM); same data except ex. *R. macrotis* (ROM no. 107635), 16 V 1997, J. Eger, B. Lim, and L. Mitchell [1♀ mounted on stub for SEM, see Hastriter *et al.* (2006), ROM].

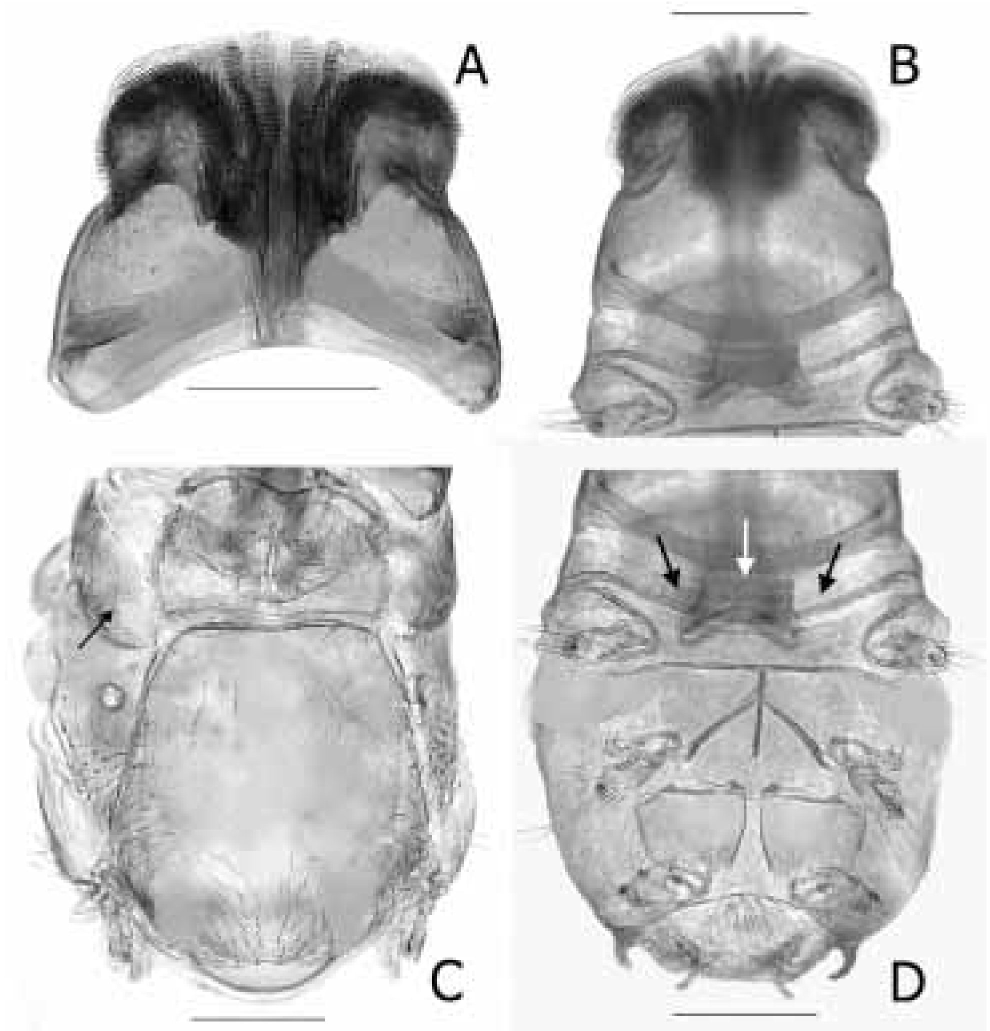

FIGURE 1. A–D. *Maabella stomalata*, gen. & sp. nov., Tuyen Quang Province, Vietnam: A. Labial theca, dorsal view (ex. *R. macrotis*); B. Labial theca, ventral view (ex. *R. paradoxalophus*); C. Thorax, dorsal (ex. *R. macrotis*); D. Thorax, ventral, white arrow illustrates vinculum; black arrows illustrates fusion of genae (ex. *R. paradoxalophus*). Scale A–D = 200μ.

Diagnosis

Setae on the gena, pleural sclerites, scutum, and lateral vertices are long and slender (longer that diameter of spiracle on mesopleuron); structures without peg-like spiniform setae. Protrochanter and mesotrochanter with a parallel tuft-like apical group of long setae. Sternites without setae.

Description

Characters are a composite of the dealate female holotype and paratypes. **Head:** Labial theca laterally expanded at apex, both dorsal and ventral; bearing pale short, sparsely scattered spiniform setae dorsolaterally, some extending onto ventral surface (Figs. 1A–B). Ventral surface with many fine, long setae scattered on anterior half. Theca bulged ventrally at base in lateral aspect. Twelve complex cheliceral blades (four dorsal and four ventral medially fixed); two laterals (one dorsal, one ventral each side). E pipharynx (labial gutter) with laterally expanded sclerotizations posterior to cheliceral blades (Figs. 1A–B). Clypeus horseshoe-shaped; vinculum heavily sclerotized, C-shaped plate (Fig. 1D). Frons expanded laterally; anterior margin gently convex, posterior margin darkly sclerotized (Figs. 1C, 2B). Antenna of two segments; arista multi-branched apically, arising from globular second segment. Lateral vertex wider than long, 9–12 long setae directed anteriorly on anterior half (Fig. 2B). Gena broadly rounded dorsally, with 9–10 slender setae on dorsal half (Figs. 1C, 2A); genae fused at ventor (Fig. 1D). **Thorax:** Scutum with many slender lateral and posterior setae, central area devoid of setae. Scutellum rounded from dorsal aspect, without setae (Fig. 1C). Mesopleuron devoid of setae anterior to round spiracle; 24–25 slender setae posteriorly. Hypopleuron and sternopleuron each without setae. Pteropleuron covered with about 20 long slender setae (Fig. 2A). Procoxa with 3–4 long setae, mesocoxa with 1–2 long setae, metacoxa broad, with long setae scattered along margins. Protrochanter and mesotrochanter each with apical group of 7–8 setae whose lengths exceed that of the trochanter; metatrochanter with two basal patches of minute setae and several longer setae towards apex. Prosternum, mesosternum, and metasternum without setae; latter two divided by medial suture (Fig. 1D). **Genital Aperture:** Fifth and sixth terminal pairs of spiracles dorsad to pair of cerci. Cercus with two long lateral setae and 8–9 shorter setae (variable between specimens). Seventh pair of spiracles ventrolateral to vaginal opening (Fig. 2C). Genital plate (possibly representing sternum VIII) bearing 3–5 stout setae; positioned between the anal and vaginal openings (Figs. 2C–F). Seven to eight slender setae between pair of seventh spiracles; two setae lateral to each cerca. Lateral to all spiracles are three roughly concentric rows of setae; each seta short and stout, but not arising from sclerotized plate. Vaginal orifice small and slit-like or enlarged (dependent on parity). **Larva/prepupa:** Larva without apparent features; tubular to elliptical. More developed larvae (or prepupae) have surface sculpturing (Fig. 3D), a sclerotized conical anus (Fig. 3D), ventral pair of spiracles less than half the length of dorsal pair, each with longitudinal raphe (Fig. 3B). General shape of prepupa flattened ventrally, dorsally convex, oval shaped (Fig. 3A). Prepupa: Length: 1.66 mm, height: 1.11 mm, width: 1.25 mm (n = 1).

Dimensions

Whole neosomes are highly pleomorphic but length, height, and width of mature females averaged 2185µ, 1550µ, and 1550µ (n = 4, range: 2080–2220µ; 1520–1660µ; 1520–1660µ), respectively. Head and thorax, average length: 1091µ (n = 5, range: 1035–1142µ). Labial theca, average length: 413µ (n =6, range: 389–442µ); average width: 483µ (n = 5, range: 462–515µ).

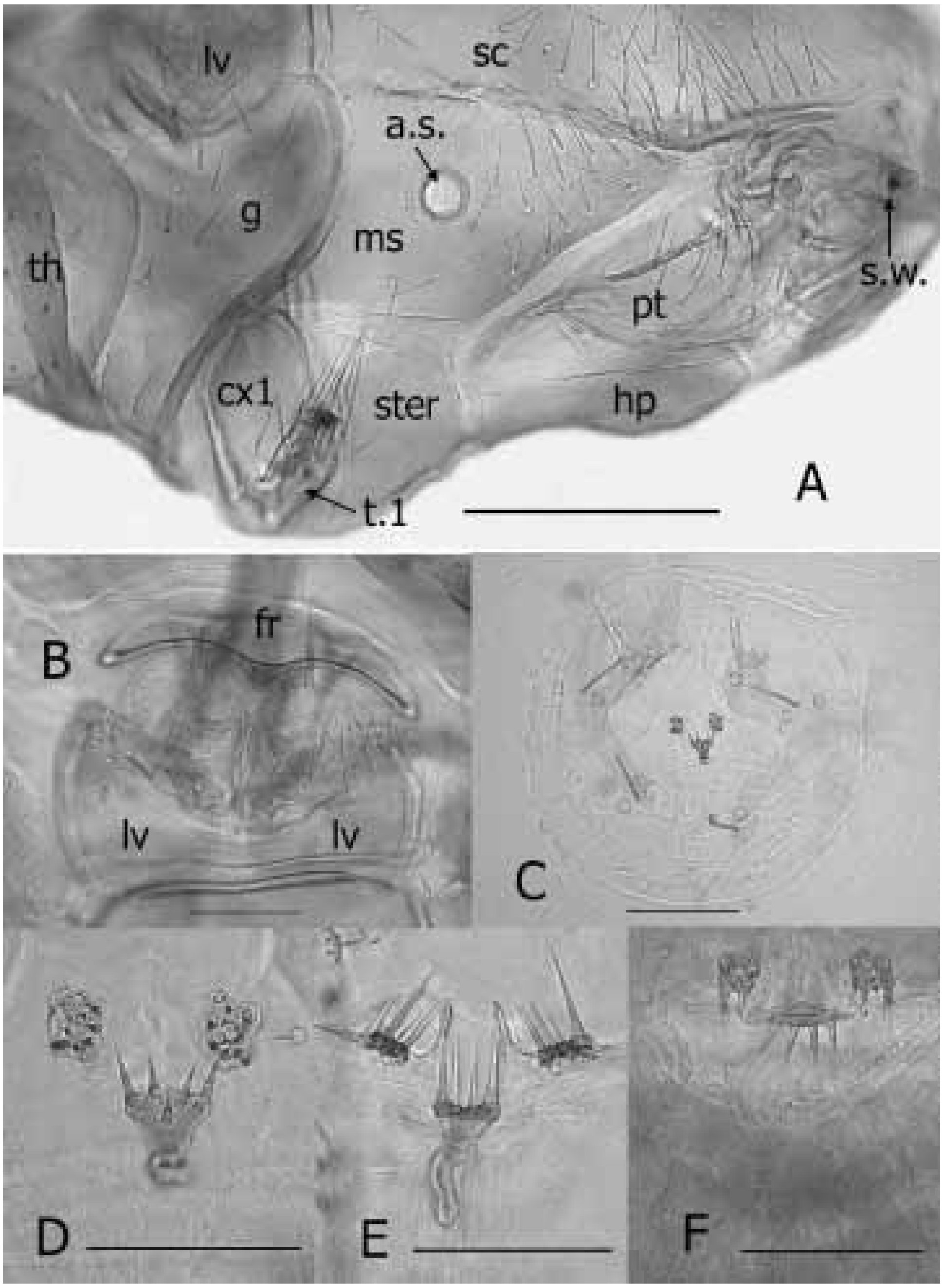

FIGURE 2. A–F. *Maabella stomalata*, gen. & sp. nov. A. Head, posterior and thorax (ex. *R. affinis*); B. Frons and lateral vertex, ex. *R. macrotis*; C. Genital aperture (ex. *R. macrotis*); D–F. Cerci and genital plates; D–E. Guangxi Province, China (ex. *R. macrotis* and *R. affinis*, respectively); F. Tuyen Quasng Province, Vietnam (ex. *R. affinis*). Abbreviations: a.s., anterior thoracic spiracle; cx1, coxa 1; fr, frons; g, gena; hp, hypopleuron; lv, lateral vertex; ms, mesopleuron; pt, pteropleuron; s.w., stump of wing; sc, scutum; ster, sternopleuron; t.1, trochanter 1; and th, labial theca. Scale A–C = 200μ, D–F = 100μ.

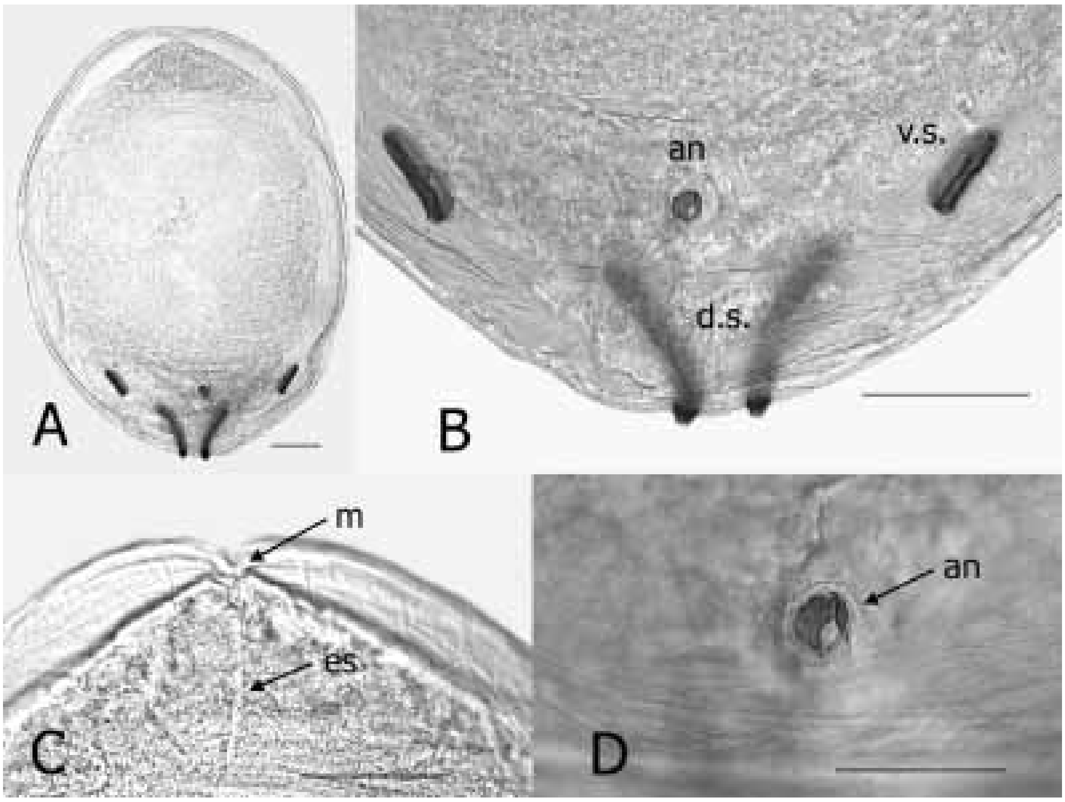

FIGURE 3. A–D. *Maabella stomalata*, gen. & sp. nov., Prepupae, Guangxi Province, China (ex. *R. affinis*). A. Dorsal view; B. Spiracles, posterior; C. Anterior mouth; D. Anus. Abbreviations: an, anus; d.s., dorsal spiracle; es, esophagus; m, mouth; and v.s., ventral spiracle. Scale A–C = 200µ, D = 100µ.

Discussion

The majority of *M. stomalata* from China (17) were collected from 11 of 46 *R. affinis* individuals; however, three specimens were collected from the only specimen of *R. macrotis* examined. *Rhinolophus macrotis* from Vietnam also yielded three specimens. Although 21 genera of bats from five families were examined, the new genus was restricted to *Rhinolophus* (Rhinolophidae). Chinese specimens were embedded near the anterior edge of the wing and at the joints on the dorsal surface of the wings. Site of attachment for specimens from Vietnam (*Ascodipteron* spp., as well as *Maabella stomalata*) were removed from the wings and the urogenital area (Judith Eger, Department of Mammalogy, ROM, pers. comm.). Many additional specimens of *Maabella* collected from *Rhinolophus* spp. were recently acquired from countries from Southeast Asia to Papua New Guinea (manuscript in preparation). Interestingly, these specimens were almost exclusively found on the dorsal portion of the wing and many were directly over the joints, while specimens of *Ascodipteron* occasionally collected from the same host were removed from the urogenital area.

With exception of the single male *Paraascodipteron*, the taxonomy of Ascodipterinae relies solely on female characteristics. Advani and Vazirani (1981) based their diagnosis of the genus *Paraascodipteron* solely on wing venation. The male of *P. scotophilus* is not available for study and comparison; however, based on the illustrations of Advani and Vazirani (1981) morphological characters suggest that *Paraascodipteron* does not belong in the subfamily Ascodipterinae. In particular, the males of *Ascodipteron* (Ascodipterinae) have the following morphological characteristics: 1) segmentation of the abdomen is obscure or poorly defined (Muir 1912 and Maa 1971), 2) three longitudinal wing veins (R_1, R_{4+5}, and M_4+Cu_1) are present without crossveins (Theodor 1968), 3) absence of alula (Maa 1971), and 4) terminalia are external, a feature shared only by *Ascodipteron* spp. and New World species of *Nycterophilia* Ferris, 1916 (Wenzel *et al.* 1966). Thus, the illustrations and the sketchy description of *P. scotophilus* provided by Advani and Vazirani (1981) do not adhere to these major subfamily characteristics. One would conclude that the genus *Paraascodipteron* should be assigned to another subfamily of Streblidae (Hastriter *et al.* 2006), which is beyond the scope of our paper. The morphological characters of *Maabella* distinguish this new genus from *Ascodipteron*, while both clearly belong within the subfamily Ascodipterinae.

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