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The chigger mites (Acari:Trombiculidae) of the Philippine Islands

Brown, Wayne Allen, Ph.D.

University of Hawaii, 1991
THE CHIGGER MITES (ACARI: TROMBICULIDAE)
OF THE PHILIPPINE ISLANDS.

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE
UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN ENTOMOLOGY

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ABSTRACT

Examination of chiggers (larval Trombiculidae) from the Philippine Islands in the collections of the B. P. Bishop Museum, Honolulu, and the University of Michigan Museum of Zoology has revealed the presence of 33 genera or subgenera and 60 species of which one genus and 24 species are new. Hosts include species of Rattus, which was the predominant genus, other rodents, bats, insectivores, deer, primates, birds, and reptiles. One genus, Octasternala is described as new. Twenty-four of the species are described as new: 4 in the genera Gahrliepia, Leptotrombidium, Microtrombicula; 2 in the genera Cheladonta and Myotrombicula; and 1 each in the genera Chiroptella, Diplectria, Octasternala, Rudnicula, Sasatrombicula, Schoengastia, Siseca and Trombigastia. Five previously described species; Ascoschoengastia tafia, Diplectria calva, Neoschoengastia posekanyi, Parascoshoengastia monticola, and Sasatrombicula keechongi are new records for the Philippine Islands. Four previously described species are of medical importance; Leptotrombidium deliense and L. fletcheri as vectors of scrub typhus and Eutrombicula wichmanni, and Blankaartia acuscutellaris as etiological agents of scrub itch. L. deliense, E. wichmanni, and B. acuscutellaris are widespread throughout the archipelago. New host records and distribution by island and by elevation and terrain, where available, are given. Range of the genera occurring in the Philippine Islands and a key to the genera and species is provided.
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INTRODUCTION

HISTORY. Human involvement with the Trombiculid mites began with the appearance of the genus *Homo*. Vercammen-Grandjean (1976) cites the historical pathogenies of trombiculosis and trombityphosis, recorded in old papyri, wall paintings and carvings, clay tablets, Indian "Vedas" and Chinese books, which are referred to as skin diseases, scabies and ill humors. These records antedate the Christian era.

In the modern recordings of human involvement, a description of what could be *Neotrombicula inopinata* (Oudemans, 1909) was given in 1552 in Europe, and the first description of attack on humans by the potato louse, later established as *N. autumnalis*, was reported in 1718 in America. That same potato louse, then referred as *Trombicula autumnalis* was subsequently named by Linnaeus (1758) in the tenth edition of *Systema Naturae*, along with about 35 other Acarus species.

From China, a treatise of natural history circa 1590, gives a precise account of a "red sand-louse" burrowing into the skin of man, dating back to the third century A. D. While in Japan the "akamushi" or red bug, the "kedani" or small tick, and the "tsutsugamushi" or dangerous insect have been graphically represented for two to three centuries (Vercammen-Grandjean and Langston, 1976).
Ewing (1944) proposed the family Trombiculidae for those acariform mites commonly referred to as "chiggers." These mites are parasitic only during the larval stage and this parasitic stage or "chigger" is the best known stage. While approximately 3,000 species of Trombiculidae have been described, fewer than 10% are known from post-larval stages, (Brennan and Goff 1977).

BIOLOGY. The six-legged larval trombiculid mite or chigger is the only form that parasitizes a vertebrate host (Oaks et al.1983). The post-larval stages are non-parasitic but are free living and predaceous in the soil or haunts of their hosts. The eggs are laid singly and loosely in the superficial layers of the habitat substrate. Generally, they enter a quiescent phase (prelarva) after about a week. The larva mature within the prelarva for another 5-7 days then emerge. Two days after emergence they are ready to feed, they wait for the hosts, some by crawling up on debris or vegetation, forming clusters; some by hiding in crevices or by congregating on the roofs of rodent burrows. After engorging on a meal of tissue juices or serum exudates, which may take 2-12 days depending on the species, the larvae return to the ground, where they enter another quiescent stage (protonymph) within three days. The eight-legged deutonymphs emerge after 7-10 days. They enter the final resting stage (tritonymph) within two weeks, after feeding on arthropod eggs or soft-bodied insects. Finally the adults, both males and females, emerge sexually mature in approximately two weeks. Fertilization occurs when the female picks up the stalked
spermatophore deposited by the male. Deposition of spermatophores and fertile eggs can be accomplished before feeding. Egg-laying begins in approximately two weeks, and females may deposit about 400 eggs over a 3-5 month period. The life span of the adults may be 15 months or longer.

SYSTEMATICS AND MORPHOLOGY. Classification of the Trombiculidae is based almost entirely on the parasitic larval stage since it is of medical importance and is generally the only stage for which information is available (Vercammen-Grandjean 1973).

Three subfamilies are included in the Trombiculidae: Apoloniinae, Leeuwenhoekiinae and Trombiculinae. The subfamily Apoloniinae was not found in the material examined from the Philippine Islands. Womersley (1945) and Vercammen-Grandjean (1968) have proposed the separation of the Leeuwenhoekiinae as a separate family under the name Leeuwenhoekiidae. Womersley (1945) included only the subfamily Leeuwenhoekiinae in this taxon while Vercammen-Grandjean (1968) included both the Leeuwenhoekiinae and the Apoloniinae. These proposals have not been universally accepted, and both taxa are herein treated as subfamilies of Trombiculidae.

A chigger is composed of a subspherical to ovoid body having three pairs of jointed legs and an anterior feeding apparatus or gnathosoma. The subspherical body possesses a soft, external cuticle capable of considerable expansion during feeding. Inserted on the integumental layers are setae of various lengths and forms.
Dorsally, on the anterior-median aspect is a sclerotized plate, the scutum or prodorsal shield. This scutum was recognized by the earliest pioneers of acarology as a major structure with characteristics useful in identification of chigger mites. Its form and the setae and sensillae that it bears vary considerably at both generic and specific levels, providing, along with setal arrangements and body measurements, the basis for differentiation of taxa. Many notable treatments on chigger morphology have been published. Tanaka et al. (1930) presented an excellent description of the external anatomy of Japanese trombiculids. Wharton (1946, 1948, 1952) discussed in detail the sclerotized structures and sensory setae of larvae. Vercammen-Grandjean (1968) and Vercammen Gradjean and Langston (1976) have detailed sections on chigger morphology, as do Nadchatram and Dohaney (1974) and Domrow and Lester (1985). Additionally, Goff et al. (1982) produced a glossary of chigger terminology with many illustrations of specific morphological structures.

DISEASE RELATIONSHIPS. Adults and nymphs of the Trombiculidae prey on small arthropods and are frequently encountered in soil or ground litter. Relatively few Trombiculidae species are known from postlarval stages, as nymphs and adults are hirsuit and it is difficult to associate distinguishing idiosomal characteristics with those of the larvae. Rearing of larvae in the laboratory is difficult and has had only limited success. The larvae or chigger stage has been collected from a number of different hosts,
including man, and have been extensively studied. The recognized importance of these mites in the West dates from the WWII, when the protagonists on both sides in the Asiatic-Pacific region were perplexed by unexpected outbreaks of a serious disease of unknown etiology and vectorship (Oaks et al. 1983). This disease was subsequently found to be scrub typhus or chigger borne Rickettsiosis.

Every major group of terrestrial vertebrate is attacked by larval Trombiculidae. Results often include the development of a distinctive symptomology, characterized by a weal and flare reaction at the site of chigger attachment, known as chigger caused dermatitis. The chiggers attach to hosts by inserting their barbed chelicera through the epidermis. Salivary enzymes are then injected into the dermal layer. The salivary enzymes start a process of lysis of dermal tissue, and host tissue reacts by producing necrotic tissue around the injected area. This results in the formation of an open-ended tube, or stylostome, through which the chigger extracts predigested cellular elements and serus fluid (Hase et al. 1978). Dermatitis, or trombidiosis, commonly referred to as scrub itch, occurs in man as a result of attachment of members of the genera Eutrombicula, Neotrombicula, and Schoengastia.

Symptoms of dermatitis also occur in domestic animals, rodents and birds. Many of the chigger species involved in human trombidiosis normally attack birds or reptiles rather than mammals. These species are typically characterized by a wide host range,
frequently crossing both family and ordinal lines. The intense itching reaction experienced by man, may reflect a lack of adaptation of the chigger's salivary enzymes to man as an incidental host. The itching reaction in man is relatively mild following attack by members of the disease vector genus *Leptotrombidium*, which normally infest rodents and other mammals (Hase et al. 1977).

The disease of chigger-borne rickettsiosis was termed scrub typhus during WWII, since its outbreaks were associated with exposure to terrain characterized by secondary vegetation, or scrub, occurring in the tropics, sub-tropics, and, seasonally, in more temperate regions. The etiological agent was found to be a small, obligate, intracellular, gram-negative bacterium, *Rickettsia tsutsugamushi*. The disease is contracted when man comes in contact with infected chiggers of the genus *Leptotrombidium* in scrub or other infested terrain. Following a short incubation period, the disease begins abruptly with fever, headache, malaise and anorexia. A primary lesion termed an eschar is usually present at the onset. The eschar is at the site of infected chigger attachment and commonly consists of a central tough black scab 4-8 mm wide. It is not painful and does not itch. Typhus-like symptoms with a characteristic rash persist for about three weeks. In untreated cases mortality can reach up to 90% of infected individuals, and death occurs in about the third week (Benenson et al. 1986). Death is equally attributed to circulatory failure, secondary pneumonia, or encephalitis. With the advent of antibiotics in the early 1940's,
treatment regimens became highly effective and deaths became rare in treated cases. However discomfort and temporary loss of productivity still occur in those contracting the disease (Traub and Wisseman 1974).

LITERATURE REVIEW. While mites as irritants and disease associates have been historically reported from the Orient, there are relatively few published data from the Philippines (Goff et al. 1986). Ewing (1931) described *Trombicula piercei* from *Hiposideros* bats from Sagay, Occidental, Negros. Philip et al. (1946) reviewed the experience with scrub typhus in the American armed forces during action in the Philippine Islands in 1944-45. Philip & Woodward (1946a) described 2 new species of chiggers in the genus *Neoschoengastia* and (1946b) reported on 5 species of larval mites of the genus *Trombicula* taken from field rats in various areas of the Philippines during surveys in connection with occurrence of scrub typhus in American troops. These were *T. akamushi*, *T. deliensis*, *T. wichmanni*, *T. acuscutellaris* and *T. bodensis*, of which the first 4 are known to attack man and the first 2 are demonstrated vectors. Other rat-infesting species taken consisted of 3 species of *Ascoschoengastia* and one species of *Heaslipia*. Wharton & Fuller (1952) cite 14 species in 5 genera as occurring in the Philippines. Radford (1953) added *Toritrombicula samara* from birds on Samar Island. Goff (1981) added new species of *Ascoschoengastia* and *Leptotrombidium* and a new record of *Walchiella* as occurring in the Philippines. Nadchatram & Wooster

As a result of the intense interest in chiggers, numerous studies and collections have been undertaken in the Asiatic-Pacific area. One collection, made in 1964 by workers for the B. P. Bishop Museum, Honolulu, Hawaii, and the Silliman University Natural History Museum, Negros, Republic of the Philippines, included ectoparasites from several islands in the Philippine Islands. Processing and examination of this collection was begun in 1986 and completed in 1990. In 1988, additional material was made available from collections of the University of Michigan Museum of Zoology, Ann Arbor, and examination also completed in 1990.
MATERIALS AND METHODS

This study was based on a collection of Trombiculidae collected from 24 major sites in the Philippine Islands (Figure 1) by workers for the Bernice P. Bishop Museum, Honolulu, Hawaii, and the Silliman University Natural History Museum, Negros, Republic of the Philippines and the University of Michigan Museum of Zoology, Ann Arbor. The material, consisting of approximately 11,000 chiggers from approximately 1,500 hosts, was examined. The chiggers were preserved in 70% alcohol and cleared in Evans and Browning clearing solution. Specimens were mounted on standard microscope slides in Hoyers media. Slide mounts were heat-dried at 40-50 degrees C. for 10 to 14 days and the cover slips then sealed with glyptal. A Wild M-20 phase contrast research microscope was used in identifications. Measurements, given in micrometers, were made using a calibrated ocular micrometer. Illustrations were made with the aid of the camera lucida attachment, and photomicrographs were produced with the photo-automat attachment MPS 55.

The collection was first separated by host species for convenience and later by parasite/host relationships. Generic identifications were based on diagnostic works of Nadchatram and Dohany (1974), and Vercammen-Grandjean (1968). Identification to species were made by comparison with literature or type specimens of previously described species within the various genera in the
collection of the U.S. National Museum of Natural History (chigger collection currently housed in the Acarology Laboratory, University of Hawaii at Manoa) and the B.P Bishop Museum, Honolulu, Hawaii. Description of previously unrecorded species follows the format of Goff (1977) and the terminology of Goff et al. (1982). Computerized storage, data retrieval, graphics and printing were used throughout the study, using the Apple II and MacIntosh SE systems.
Figure 1. Major collection sites of the Philippine Islands.
Asterisk * = University of Michigan Museum of Zoology collection, open circle . = Bishop Museum collection, closed circle . = previous report.
Family Trombiculidae Ewing

Trombiculinae Ewing, 1929: 22.


**Diagnosis.** Trombidiform mites with larvae parasitic on vertebrates (rarely invertebrates), nymphs and adults free-living predators. Larvae: Chelicerae 2-segmented; distal segment with fixed digit reduced, hyaline, movable digit blade-like with tricuspid cap and/or dorsal and ventral tooth rows; palps 5-segmented, with palpotibial claw forming a thumb-claw process in combination with palpotsarsi; basal lamellar process forming a pair of galealae bearing a pair of setae; single prodorsal plate (scutum) bearing a pair of sensilla; eyes 2/2, 1/1, or absent, lateral in position to scutum when present; 3 pairs of legs appearing to have 6-6-6, 7-6-6 or 7-7-7 segmentation.

**Remarks.** Three subfamilies are recognized in the Trombiculidae: Apoloniinae, Leeuwenhoekinae and Trombiculinae. Only the Leeuwenhoekinae and Trombiculinae are represented in the Philippine Island fauna. A fourth subfamily, Gahrliepiinae, was proposed by Womersley (1952). Currently this taxon is regarded as a tribe of Trombiculinae (Nadchatram and Dohany, 1974).
Subfamily Leeuwenhoekiinae Womersley


Type genus. Leeuwenhoekia Oudemans, 1911: 138.

Diagnosis. Trombiculidae larvae with paired anterior median setae (AM); palpal tarsus lacking subterminala (present in type series); sensilla flagelliform; anterior medial nase present or absent; stigmata and tracheae present or absent; leg segmentation 6-6-6 or 7-6-6. Leg I. Coxa with 2 branched setae (2B); trochanter 1B; femur 6B; genu 4B, 2 genualae (multiple genualae in Hannemania), microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus, tarsala, microtarsala, subterminala, (parasubterminala absent), pretarsala. Leg II. Coxa 1B; trochanter 1B; femur 6B; genu 4B, genuala; tibia 6B, 2 tibialae; tarsus 16B, tarsala, microtarsala, pretarsala. Leg III. Coxa 1B; trochanter 1B; femur 5B; genu 4B, genuala; tibia 6B, tibiala, tarsus, 15B. (Exceptions occur and are cited in appropriate leg data sections).

Remarks. The subfamily Leeuwenhoekiinae was proposed by Womersley (1944) to include the 7 species then in the genus Leeuwenhoekia Oudemans, 1911. Womersley (1945) proposed elevation to family level based on presence of spiracles and tracheae. These structures have subsequently been shown to have inconsistent occurrence throughout the taxon. Accordingly this
proposal was not uniformly accepted (Wharton, 1947; Wharton and Fuller, 1952; Brennan and Jones, 1959; Nadchatram and Dohany, 1974; Reed and Brennan, 1975; Brennan and Goff, 1977). In the present study Leeuwenhoekiinae is regarded as a subfamily and as a primitive group of Trombiculidae.


**Type species.** *Trombicula dentata* Ewing, 1925: 275.

**Diagnosis.** Leeuwenhoekiinae larvae possessing an anteriomedian projection or nasus. Stigmata and tracheae present. Chelicerae with dorsal and or ventral row of teeth, but lacking a modified, serrated, tricuspid cap. Galeal setae barbed. Eyes 2/2. Scutum pentagonal with anterior median nasus. Legs 6.6.6 segmented, segments long and slender. Ip average 1000. One or 2 genualae on leg I. Coxae I bisetose.

**Included species.**


**Diagnosis.** Larvae. Idiosoma. Measuring 400X258 in partially engorged specimen. Eyes 2/2 on ocular plate. 3 pair of humeral setae; 52-54 dorsal idiosomal setae, arranged in irregular rows; 1 pair of sternal setae; 36-38 preanal setae; 18-20 postanal setae; total idiosomal setae 114-120. Gnathosoma. Palpal setal formula B/B/BNN/7B; palpal claw 4-pronged; galeala N; cheliceral
blade with 5 dorsal and 4 ventral teeth. **Scutum.** Lightly punctate with straight anterior margin; without shoulders; posterior margin angulate; lateral margins straight; AM bases (2) slightly anterior to AL bases; SB slightly anterior to level of PL bases; PL>AL>AM; PW/SD=1.28-1.29; sensillae filiform branched in distal 1/3. Scutal measurements of holotype followed by means and ranges of 10 paratypes in parentheses: AW 63 (65, 63-68); PW 70 (74, 70-77); SB 22 (24, 22-25); ASB 34 (34, 33-35); PSB 21 (24, 21-27); AP 25 (27, 25-30); AM 36 (39, 36-42); AL 44 (43, 40-45); PL 56 (54, 49-57); sens. 59 (59, 56-65). **Legs.** IP = 1049-1164. Onychotriches present on claws and empodium. Leg I. 365-407; tarsus (97), tarsala (17). Leg II. 308-353; tarsus (84); tarsala (14). Leg III. 365-404; paired mastitibialae with basal barbs (54 & 52); tarsus (94), mastitarsala with basal barbs (57).

**Type data.** Holotype and 51 paratypes from Leyte I., Mahaplag ex 2 *Draco* sp., flying lizard, collected 30.VI. & 8.VII.1964

**Remarks.** The species name reflects the type host. This taxon was described from the Philippine Islands by Brown and Goff (1988a).


**Diagnosis.** Larvae. **Idiosoma.** Measuring 636X500 in partially engorged specimen. Eyes 2/2, on ocular plate. 2 pair of humeral setae; 96-100 dorsal idiosomal setae, arranged in irregular rows; 1 pair of sternal setae; 40-44 preanal setae; 60-64 postanal
setae; total idiosomal setae 204-216. **Gnathosoma.** Palpal setal formula B/B/BBB/BB; palpal claw 3-pronged; galeala B; cheliceral blade with 6 dorsal & 5 ventral teeth. **Scutum.** Lightly punctate with convex anterior margin & with a nasus; without shoulders; posterior margin tapered to a point; lateral margins with slight convexity; AM bases slightly anterior to AL bases; SB slightly anterior to level of PL bases; PL>AL>AM; PW/SD = 1.32-1.43; sensillae filiform with branches on distal 1/3. Scutal measurements of holotype followed by means and ranges of 10 paratypes in parentheses: AW 82 (80, 77-83); PW 90 (88, 86-95); SB 32 (29, 27-32); ASB 39 (38,36-40); PSB 32 (30, 24-32); AP 27 (29,25-32); AM 43 (45,40-48); AL 59 (57,54-61); PL 77 (71, 68-77); sens. 54 (55, 50-57). **Legs.** IP = 1147-1234; 6-6-6 segmented, terminating in 2 claws and a clawlike empodium. Onychotriches present on claws but absent on empodium. Leg I. 394-433; tarsus (99), tarsala (19). Leg II. 349-372; tarsus (77), tarsala (17). Leg III. 398-445; paired mastitibialae with basal barbs 54 & 52; tarsus (94), mastitarsala with basal barbs (57).

**Type data.** Holotype and 19 paratypes from Leyte I., from Mahaplag and Mt. Lobi Range ex 2 *Draco* sp. 6 birds: *Dicrurus hottentotus striatus, Halcyon winchelli, Hypsipechis philippinensis, Irena cyanogaster, Pachycephala philippinensis, Rhinotugias ruficauda samarensis* V-VIII.1964.
Additional voucher specimens. Palawan Island, collection site not recorded, 1 *Pita sordida* (1).

Remarks. The species name reflects the type locality. This taxon was previously reported from the Philippine Islands by Brown and Goff (1988a).

Genus *Whartonia* Ewing


Diagnosis. Leeuwenhoekiinae larvae lacking an anteriomedian projection or nasus on scutum. Stigmata and tracheae present, the latter not always discernable. PTF 7B, (rarely 6B); palpal segments usually long and slender. Claw long and slender, usually 3-pronged. Chelicera modified as a series of large recurved teeth on ventrolateral aspect; tricuspid cap bearing marginal teeth. Scutum somewhat rectangular with SB closer to posterior margin than to anterior margin. Legs 6-6-6 segmented, segments long and slender. Most of leg sensory setae very short and blunt with the exception of genualae III and tibiala III which are long and tapering. 2 genualae on leg I, rarely one.
Included species.


**Diagnosis.** Larvae. **Idiosoma.** Measuring 500X345 in partially engorged specimen. Eyes 2/2, on ocular plate. 3 pair of humeral setae; 58-62 dorsal idiosomal setae, arranged in irregular rows beginning 8.8.10.10 + 18-20; 20-26 sternal/intercoxal setae; 26 preanal setae; 28 postanal setae; total idiosomal setae 138-148. **Gnathosoma.** Palpal setal formula N/N/BNN/7B; palpal claw 2-pronged; galeala N; cheliceral blade long with large dorsal and ventral hooks, joining laterally and decreasing toward the rear. **Scutum.** Lightly punctate with nearly straight anterior margin; without shoulders; posterior margin medially concave; lateral margins nearly straight; AM bases (2) posterior to AL bases; SB slightly posterior to level of PL bases; PL>AM>AL; PW/SD = 2.3; sensillae 80-90. Scutal measurements of 7 specimens, means and ranges in parentheses: AW (143, 137-153); PW (143, 137-148); SB (47, 45-48); ASB (46, 45-50); PSB (15, 14-16); AP (31, 27-36); AM (75, 68-81); AL (63, 58-68); PL (85, 75-91); sens. (85, 80-90) **Legs.** IP = 1452, 1375-1508. Leg I. 468-536; tarsus (110X25), tarsala (22). Leg II. 428-427; tarsus (90X23), tarsala (20). Leg III. 463-531; nude mastitibiala 50; tarsus (123X21), mastitarsala 60.

**Specimens examined.** Leyte Island, Mahaplag, Mt. Kabalanti 1964 1 small bat (6). Sta Cruz 1 *Rousettus amplexicaudatis* (6).

Remarks. The specimens examined agree in size, standard measurements, and configuration to *W. maai* (Nadchatram and Wilson 1965), described from the same host from New Guinea. Holotype and 2 paratypes N.W. New Guinea, *ex Rousettus amplexicaudatus brachotis* 17.I.1962. This taxon has been previously reported from the Philippine Islands by Brown and Goff (1988a).

Subfamily Trombiculinae Ewing, 1929

Trombiculinae Ewing, 1929: 22.


Diagnosis. Larvae with scutum lacking anteriomedian nase; AM seta single or absent; sensilla flagelliform or expanded; eyes 2/2, 1/1 or absent; legs always 7-6-6 segmented. Leg I. Coxa with 1 branched seta (1B); trochanter 1B; femur 6B; genu 4B, 2 or 3 genualae, microgenuala; tibia 8B, 2 tibialae, microtibialae; tarsus 21B, tarsala, microtarsala, subterminala, parasubterminala, pretarsala. Leg II. Coxa 1B; trochanter 1B; femur 6B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus 16B, tarsala, microtarsala, pretarsala. Leg III. Coxa 1B; trochanter 1B; femur 5B; genu 3B, 1 or 2 genualae; tibia 6B, tibiala; tarsus 15B. (Exceptions occur and are cited in appropriate leg data sections).
Remarks. Ewing (1929) proposed the subfamily Trombiculinae with the genus *Trombicula* Berlese, 1905, as the type genus and *Trombicula minor* Berlese, 1905, as the type species.

Genus *Ascoschoengastia* Ewing


Type species. *Neoschoengastia malayensis* Gater, 1932: 158.

Diagnosis. PTF 6B; palpal setae weak, usually nude. Galeala N. Palpal claw 2-3 pronged. Chelicerae simple, subapical teeth varying from small to large. Eyes absent, 1/1, or 2/2, weakly sclerotized. Scutum quadrate or subquadrate, usually small, with convex or biconvex posterior margin; AL setae submarginal, AL shoulders pronounced or slight. Scutal setae generally weak, with very few short barbs, often appearing nude; AM seta anterior to AL setae; PL setae inserted on or off the scutum. Scutal punctae simple. Sensillae lanceolate to globose with distinct short or long barbs on expanded portion. Legs 7-7-7 segmented, segments short. 2-3 genualae I. Tibiala and genuala III present. Mastitarsala III present or absent, if present, short, fine and tapering. This genus is congeneric with *Microtrombicula*, i.e. in the absence of the sensillae the two genera are almost indistinguishable (Nadchatram & Dohany, 1974).
Included species.

*Ascoschoengastia krishnani* Nadchatram and Domrow, 1964: 30.

**Diagnosis.** Larvae. **Idiosoma.** Measuring 450 X 335 in partially engorged specimen. Eyes 2/2 on weak ocular plate. One pair of humeral setae; 20 dorsal idiosomal setae, arranged in 5 regular rows beginning 6-6-4-2-2; 2 pairs of sternal setae; 16 preanal setae; 6 postanal setae; total idiosomal setae 48.

**Gnathosoma.** Palpal setal formula N/N/NNN/6B; palpal claw 2-pronged; galeala N. **Scutum.** Moderately punctate with slight biconcave anterior margin; with shoulders; posterior margin slightly biconvex; lateral margins curved; AM base anterior to AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD = 1.32-1.34; sensillae capitate with fine setules. Scutal measurements of 10 specimens followed by means and ranges: AW 34, 32-36; PW 46, 43-49; SB 17, 15-18; ASB 17, 15-18; PSB 18, 16-19; AP 23, 21-24; AM 25 26, 24-29; AL 13, 11-14; PL 30, 23-32; sens. 28X10, 26-32X10. **Legs.** IP = 447-491. Leg I. 163-181; tarsus (32X13), tarsala (16-18). Leg II. 124-145; tarsus (24X14), tarsala (13-15). Leg III. 154-170; tarsus (31X14), mastitarsalae 42 and 32.

samarensis collected (no date) 1964. Mindanao Island: 1964; Bondo-An 1 Rattus evertti (1). Cotobato, Tupi Kabon, Mt Metuturn, 5000 -7000: 1 Apomys sp. (5); Hanggose, 1 R. bagobus (1). Masawan, Mt Malindang, Zamboanga del Norte: 1 Apomys insignis bardus (5); 2 R. pantarensis (3); 1 R. mindanensis (1). Mindanao Island, collection site not recorded: 3 A. bardus (8); 1 R. mindanensis (10); 2 R. evertti (9); 1 R. rabori (10). Luzon Island, Baguio: 5 R. sp. (21); 1 R. exulans (1). Negros Island: Dumaguete, 1 R. exulans (10). Cebu Island, Danao: 1 Rousetus amplexicaudatus (1); Toong, 1 R. mindanensis (10). Palawan Island, Tarumpitao, 1960 1 host not recorded (1); 1 R. exulans (1).

Remarks. Although the hosts differ the specimens examined agree in size, standard measurements, and configuration to A. krishnani Nadchatram & Domrow,1964 who described the taxon from a flying squirrel, Iomys horsefieldi from Malaya. This taxon was previously reported from the Philippine Islands by Brown and Goff (1988).

Ascoschoengastia tafia Nadchatram and Domrow, 1964: 34. Figure 2

Diagnosis. Larvae. Idiosoma. Measuring 810X675 in partially engorged specimen. Eyes 1/1. One pair of humeral setae measuring; 14-18 dorsal idiosomal setae, arranged in irregular rows beginning 2.4.2+8-12; 2 pairs of sternal setae; 10-12 preanal setae; 8-10 postanal setae; total idiosomal setae 38-46. Gnathosoma. Palpal setal formula B/N/NNN/6B; palpal claw 3 pronged; galeala
**N. Scutum.** Punctate with shallow biconcave anterior margin; posterior margin straight with slight lateral concavities; lateral margins concave; AM base anterior to AL bases; SB far anterior to level of PL bases; PL>AL>AM; PW/SD =1.16; sensillae claviform with smooth basal shaft. Scutal measurements of mean and range of voucher specimens in parentheses: AW (43, 41-44); PW (64, 63-67); SB (18, 17-19); ASB (21, 18-24); PSB (24, 23-24); AP (31, 27-36); AM (32, 30-34); AL (16, 16-16); PL (43, 40-47); sens. (57, 50-59).

**Legs.** IP = 608-634. Leg I: 217-235; tarsus (48X18), tarsala (24). Leg II: 181-191; tarsus (36X20), tarsala (15). Leg III: 199-217; tarsus (40X36), elongate special setae present as figured, 57.

**Voucher specimens examined.** Palawan Island K 114, 115, 116, 119, 1964 (10) neither the host, parisitope, or exact date were recorded, however, cartilagonous material present appears to be rodent nasal septum.

**Remarks.** The specimens examined key to *A. tafia* in the key of Nadchatram and Domrow (1964), described from *Rattus rajah* from Malaya, and agree with minor differences in standard data measurements with that taxon. Comparison with paratypes in the U. S. National Museum reveals these to be very close to *A tafia* and the minor measurement differences are considered to be regional variations. As with *A. tafia* these specimens were found associated with *Doloisia* sp and *Walchia* sp. This is a new record for the Philippine Islands.
Figure 2. *Ascoshoengastia tafia*. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Ascoschoengastia indica  (Hirst), 1915: 187.

**Diagnosis.** Dorsal setae 34, arranged 4(2).6(8).6.6.6.4.2. i. e. second from middle of second row situated forward in line with humeral setae. Mean and range of scutal measurements: AW 38, 33-43; PW 54, 48-60; SB 21, 17-25; ASB 22, 19-25; PSB 20, 9-31.

**Remarks.** Previously reported by Philip & Woodward (1946). Not found in the material studied in this investigation.

Ascoschoengastia rousetti  Goff, 1981: 70.

**Diagnosis.** Larva. Idiosoma, Measuring 640-450; 20 dorsal setae, arranged 6.6.4.2.2; total body setae 46-48. Scutum. Weakly sclerotized, lightly punctate. Scutal measurements of holotype and 8 paratypes mean and ranges in parentheses: AW 38 (35, 32-28); PW 54 (54, 52-56); SB 16 (16, 15-17); ASB 18 (19, 18-21); PSB 21 (20, 19-21); AP 27 (28, 27-30).

**Remarks.** Previously described from Mindanao ex *Rousettus amplexicaudatus*. Parasitope was thought to be internasal. The *Ascoschoengastia* of bats in this study were compared with the type specimens of this taxon, none were found in the material studied in this investigation.
Genus *Blankaartia*

*Blankaartia* Oudemans, 1911: 23.

**Type species.** *Trombidium niloticum* Tragardh, 1904: 78.

**Diagnosis.** Trombiculini of medium to very large size, SIF = 7B.S-N/B-3-3111.1000. IP = 800-1520. Scutum densely punctate, often striate, particularly on the lateral and posterior margins; pentagonal with prominent pointed posterior margin and anteriomedian shoulders; SD close to AW. SB line always between AL and PL lines, nearest to the PL line; sensilla bases well separated; sensillae long and slender, with distal halves branched. Eyes, large, 2 pairs. PL>AM>AL and AP>ASB. Gnathobase and coxae densely punctate and striate. Chelicera strong, with tricuspid cap and a dorso-apical butting tooth. Mastitarsala 3 always present, sometimes with a few basal barbs.

*Blankaartia acuscutellaris* (Walch 1923). Figure 3.

*Blankaartia acuscutellaris* (Walch 1923): 78.

**Re-description of species.** Larvae. Idiosoma. Measuring 607X472 in partially engorged specimen. Eyes 2/2, anterior 15 diam., posterior 9 diam., on ocular plate. One pair of humeral setae measuring 72-74; 24 dorsal idiosomal setae, measuring 64-70, arranged in regular rows 6.6.6.4.2; 2 pairs of sternal setae, anterior 45-49, posterior 45-47; 12 preanal setae, 40-42; 6-8 postanal setae 47-63; total idiosomal setae 48-50. **Gnathosoma.** Palpal setal formula B/B/NNB/7B.S; palpal claw 3-pronged, 18-21 long; galeala N
cheliceral blade (47), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. **Scutum.** Punctate with slightly concave anterior margin; posterior margin deeply angulate; lateral margins with shallow posterior concavity; AM base to slightly anterior AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD = 1.08-1.14; sensillae long and slender with distal halves branched. Scutal measurements of mean and range of 34 voucher specimens: AW (82, 77-86); PW (87, 80-93); SB (44, 41-49); ASB (30, 29-32); PSB (44, 41-49); AP (29, 27-32); AM (53, 50-56); AL (39, 37-41); PL (80, 76-88); sens.(74, 68-80). **Legs.** IP = 980-1030. Leg I: 313-331; tarsus (77X22), tarsala (19). Leg II: 304-325; tarsus (67X20), tarsala (14). Leg III: 362-380; tarsus (90X17); mastitarsala 77.

**Voucher specimens examined.** Mindanao: Cotabato, Lake Bulan, el. 600 m. Col. N. Wilson, 1963. Ex *Ixobrychus sinensis astrologus* (30), BPBM 2182, 2193, 2195; Ex *Pteropus vampyrus* (4) specimens, BPBM 2179.

**Remarks.** *Blankaartia acuscutellaris* a scrub itch chigger is principally a chigger of marsh birds, although it has been reported previously from marsh mammals. In this study *Ixobrychus sinensis* a marsh bird which has adapted well to rice paddy environments was found to be the host and it and the ectoparasitic *B. acuscutellaris* doubtlessly exist throughout the extensive rice
growing regions of the archipelago. It's appearance on the fruit bat
*P. vampyrus* is either incidental or unexplainable from the current
amount of data. This taxon was previously reported from the
Philippine Island by Philip & Woodward (1946).
Figure 3. *Blankaartia acuscutellaris*. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Genus *Cheladonta*


**Type species.** *Cheladonta micheneri* Lipovsky, Crossley and Loomis, 1955: 136.

**Diagnosis.** Schoengastiini of small to medium size, SIF = 4B-N/B-5/12-2110.0000. Ip = 530-830. Scutum punctate, wider than long, with posterior margin more or less biconvex. Crested sensillary area, sensillae claviform, barbed. Eyes small (1 or 2 Pair). Cheliceral blade with tricuspid cap serrate on its dorsal process. Palpotibial claw with 5 to 12 prongs. Always at least 2 pairs of humeral setae. Nude subterminala, parasternala and pretarsalae 1 and 2 always present. Epistomal pleats large.

Lakshana (1969) expanded the genus *Cheladonta* Lipovsky et al., 1955 and reduced the genus *Susa* Audy & Nadchatram, 1960 to a subgenus within *Cheladonta*. Brown & Goff (1988) follow this arrangement in describing a new species *C. (S.) palawanensis* and this arrangement is continued in this dissertation.

*Cheladonta (Susa)* N sp. A Brown, 1991. Figure 4.

**Description of species.** Larvae. *Idiosoma*. Measuring 335X235 in partially engorged specimen. Eyes 1/1 9 diam.. Two pair of humeral setae measuring 41-45, 40-41; approximately 80 dorsal idiosomal setae, measuring 36-38, arranged in irregular rows; 2 pairs of sternal setae, anterior 29, posterior 29; 32 preanal setae, 23-27; approximately 14 postanal setae 23-31; total idiosomal setae
approximately 134. **Gnathosoma.** Palpal setal formula N/N/BBN/5B; palpal claw 3-pronged, 16 long; galeala B; cheliceral blade (28), broad at base, with serrated tricuspid cap; gnathobase punctate, bearing 2 branched setae. **Scutum.** Punctate with biconcave anterior margin; posterior margin shallowly concave; lateral margins shallowly concave; AM base in line with AL bases; SB near mid-point of AP; PL>AM>AL; PW/SD = 1.97; sensillae clavate with barbs on shaft and expanded portion. Scutal measurements of holotype: AW 50; PW 61; SB 26; ASB 17; PSB 14; AP 29; AM 32; AL 20; PL 44; sens. 33X13. **Legs.** IP = 636. Leg I: 226; tarsus (43X24), tarsala (21). Leg II: 200; tarsus (33X22), tarsala (15). Leg III: 210; tarsus (42X20).

**Type data.** Holotype (BBM PI 123) from Philippine Islands, Mindanao Island Masawan area, ex *Rattus mindanensis* 1965, (parasitope, collection date, and collector not recorded).

**Remarks.** This new species is close to *C. (S.) palawanensis* Brown & Goff, 1988 in having 5B palpal tarsus and fP N/N/BBN. It differs from that species in having branched galealae, a larger scutum and a greater number of body setae (forked, AW 23, PW 38, SD 26 and 111-115 in *C. (S.) palawanensis*).
Figure 4. *Cheladonta* (Susa) n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Included species.

*Cheladonta (Susa) palawanensis* Brown & Goff, 1988b.

*Cheladonta (Susa) palawanensis* Brown & Goff 1988: 117.

**Description of species.** Larvae. **Idiosoma.** Measuring 450 X 328 in partially engorged specimen. Eyes 1/1, 6 diam., free on cuticle. 3 pair of humeral setae measuring 20-23; 52-54 dorsal idiosomal setae, measuring 11-23 arranged in 6 irregular rows beginning 10-8-12-8-12+12-14; 2 pairs of sternal setae, anterior 24-29, posterior 18-20; 32 preanal setae, 11-17; 14 postanal setae 20-22; total idiosomal setae 108-110. **Gnathosoma.** Palpal setal formula N/N/BBN; palpal claw 3-pronged, 9 long; galeala bifurcate; cheliceral blade (17) broad at base with tricuspid cap; gnathobase punctate bearing 2 branched setae. **Scutum.** Lightly punctate with biconcave anterior margin; posterior margin broadly concave; lateral margins shallowly concave; AM base slightly anterior to AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD = 1.48-1.69; sensillae globose. Scutal measurements of holotype and means and ranges of 10 paratypes in parentheses: AW 23 (23, 22-25); PW 36 (38, 34-44); SB 12 (12, 11-13); ASB 14 (14, 14-14); PSB 9 (11, 9-12); AP 21 (22, 21-23); AM 14 (14, 12-16); AL 9 (9, 9-11); PL 16 (16, 14-18); sens. 19 (20, 19-23). **Legs.** IP = 403. Leg I: 134-162; tarsus (26 X 17), tarsala (14). Leg II: 113-12. tarsus (18 X 14), tarsala (10). Leg III: 121-139; tarsus (23 X 17).
Type data. Holotype and ten paratypes, Philippine Islands, Palawan I., Tarumpitao, 1.VII.1960, 3 unknown hosts (K-114, 115 and 116-0). Chigger collections from these 3 hosts were pooled.

Remarks. Among species in the subgenus Susa, Cheladonta (Susa) palawanensis is most similar to C. (S.) traubi Nadchatram & Lakshana, 1965. It may readily be separated from this species by the palpal setation formula, N/N/BNN/ and the bifurcate galealae, (N/N/BBN and N in C. (S.) traubi). It can be further separated from this species by the consistently smaller standard data measurements, and by the presence of a distally expanded empodium of leg III. The species name is derived from the type locality Palawan Island. This taxon was previously reported from the Philippine Islands by Brown & Goff (1988b).

Genus Chiroptella Vercammen-Grandjean

Chiroptella Vercammen-Grandjean,1960: 469.

Type species. Trombicula insolli Philip and Traub, 1950: 32.

Diagnosis. PTF 7B or 7BS-N or B-3-2111. Galeala N. Palpal claw 3-pronged. Chelicerae broad, short and strongly sclerotized. Eyes 2+2 or absent. Scutum usually subquadratre with ASB/PSB ratio 3.0. Sensillae unexpanded, slender, with distal barbs. PLs significantly longer than AM or ALs. Legs 7-7-7 segmented. Leg I with 2 genualae and leg III always with 2 genualae and 1 femorala. Large species, 950-1,900 m in length.

*Chiroptella* Vercammen-Grandjean, 1960: 469


**Diagnosis.** *Chiroptella* of medium size, SIF 7B.S-N-3-2111. Ip = 640-1000. Scutum with anterolateral shoulders. Sensilla bases not far apart. Sensillae with distal halves branched. Large eyes (2 pair). Always an extra genuala 3 or mastigenuala, and one nude femorala or mastifemorala 3. Palpal setae: N/N/NNN, or B/N/NNN.

**Included species.**

*Chiroptella insolli* (Philip and Traub), 1950.


**Description of species.** Larvae. **Idiosoma.** Measuring 652X382 in partially engorged specimen. Eyes 2/2, free on cuticle. 1 pair of humeral setae; 46-48 dorsal idiosomal setae, arranged in irregular rows beginning 8-8-8+22-24; 2 pairs of sternal setae; 12 preanal setae; 28-30 postanal setae; total idiosomal setae 92-96. **Gnathosoma.** Palpal setal formula N/N/NNN/7B.S; palpal claw 3-pronged, 24-29 long; galeala N. **Scutum.** Lightly punctate with shallow biconcave anterior margin; with shoulders; posterior margin shallowly biconvex; lateral margins slightly concave; AM base slightly anterior to AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD = 1.48-1.54; sensillae flagelliform with distal 2/3 branched. Scutal measurements of means and ranges of 10
specimens: AW 54, 52-56; PW 73, 68-80; SB 25, 23-27; ASB 39, 36-41; PSB 10, 10-11; AP 42, 41-44; AM 54, 50-62; AL 41, 36-45; PL 81, 73-87; sens. 60, 45-73. **Legs.** IP = 861-957.. Leg I. 302-340; tarsus (77X16), tarsala (36-40). Leg II. 280-288; tarsus (63X22), tarsala (20-24). Leg III. 280-330; tarsus (86X16).


**Remarks.** These specimens agree in size, standard measurements and configuration with *Chiroptella insolli*. It is noteworthy that while this is considered to be an ectoparasite of bats, two specimens are from *Rattus* which supports habitat specificity in chiggers rather than strict host specificity. This taxon was previously reported from the Philippine Islands by Brown & Goff (1988a).


**Diagnosis.** Scutum as long as wide, with SB in front of line of PL. PL>AL. All setae on palpal femur, genu and tibia nude. DS 38, arranged 2.8.8.8.6.4.2. Scutal measurements of holotype: AW 59; PW 82; SB 26; ASB 35; PSB 28; SD 62; AP 41; AM 55; AL 35; PL 76; sens -.
Remarks. Described and reported from Hipposideros bats from Negros by Ewing (1931). Not found in the material studied in this investigation.


Type data. Riedlinia (Neosomia) audyi Vercammen-Grandjean and Nadchatram, 1965: 317.

Diagnosis. Chiroptella of medium size, SIF 7B-N-3-2111. Ip = 640-770. Scutum trapezoidal. Eyes (2 pair). On leg 3: extra genualia or mastigenuala and mastifemorala, both nude; no mastitarsala. Palpal setation: N or B/N/NNN. Neosomy observed.

Vercammen-Grandjean and Nadchatram (1965) proposed the subgenus Neosomia in the genus Reidlinia Oudemans, 1914, for R. (N.) audyi. Nadchatram (1966) transferred the subgenus to Chiroptella Vercammen-Grandjean, 1960 retaining only C. (N.) audyi with extrascutal PL setae as the monotypic type. Vercammen-Grandjean (1967) included C. (N.) revelae with PL's on scutum as a new combination and retains this in Vercammen-Grandjean and Langston (1976). Goff (1979) described a second species with extrascutal PL's, C (N.) geikiensis. Examination of chiggers, larval Trombiculidae, from the collection of the University of Michigan Museum of Zoology, has revealed an additional species of the subgenus with PL's on the scutum from a bat host from Leyte Island.
Chiroptella (Neosomia) n. sp. A Brown. Figure 5.

Description of species. Larvae. Idiosoma. Measuring 580X326 in holotype, 588 X 335 in paratype, both partially engorged. Eyes 2/2, anterior 13 diam., posterior 10 diam., on ocular plate. One pair of humeral setae measuring 68-72; 32-34 dorsal idiosomal setae, measuring 57-63, arranged 8.8.8+8-10 in irregular rows; 2 pairs of sternal setae, anterior 49-57, posterior 41-48; 10 preanal setae, 49-54; 12-14 postanal setae 50-57; total idiosomal setae 60-64.

Gnathosoma. Palpal setal formula N/N/NNN/2N 5B; palpal claw 3-pronged, 26-28 long; galeala N; cheliceral blade (39-41), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. Scutum. Punctate with anterior margin sinuous; posterior margin straight with slight concavity; concave lateral margins; AM base slightly posterior to AL bases; SB slightly anterior to level of PL bases; PL>AL>AM; PW/SD = 1.14-1.15; sensillae filliform with branches on distal one-third. Scutal measurements of holotype followed by that of the paratype in parentheses: AW 57 (58); PW 72 (70); SB 27 (25); ASB 36(36); PSB 13 (11); AP 42 (41); AM 47 (45); AL 50 (48); PL 76 (83); sens. 68 (50, broken). Legs. IP = 791-802: Leg I: 280-307; tarsus (67X18), tarsala (26). Leg II: 231-235; tarsus (58X16), tarsala (20). Leg III: 270-280; tarsus (72X16).

Figure 5. *Chiropelta (Neosomia)* n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, femur of leg I; E, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; F, leg II as above; G, leg III as above.
Genus *Diplectria* Vercammen-Grandjean, 1968.


**Diagnoses.** Trombiculini of medium size, IP = 800-910. Nude subterminala and parasubterminala absent, 2 pretarsalae I and sometimes no pretarsala II.PL>AM>AL. Mastitarsala III rare, sometimes with basal barbs.

Vercammen-Grandjean and Nadchatram (1963) described *Trombicula reticulata* as a new species and noted the unusual paired pretarsala I, and absence of the nude subterminala and parasubterminala. Vercammen-Grandjean (1967) erected *Diplectria* as a new subgenus with *T. reticulata* as the subgenus type and Nadchatram and Dohany (1974) elevated Diplectria to generic status.

Examination of chiggers, from the collection of the University of Michigan Museum of Zoology has revealed two species of this taxon from Negros Island. One from a false vampire bat, *Megaderma spasma* (Linnaeus, 1758), which agrees in standard data measurements, size and configuration with the previously described *D. calva* (Domrow, 1962). The taxon is re-described and illustrated below. The other species from a sheath-tailed bat *Taphozous philippinensis* Waterhouse, 1845, is morphologically close to *D. taphozous* Womersley, 1952. It differs in several aspects and is described and illustrated below as a new species.
Diplectria n. sp. A Brown. Figure 6.

Description of species. Larvae. Idiosoma. Measuring 365X326 in partially engorged specimen. Eyes 2/2, anterior 16 diam., posterior 11 diam., on ocular plate. One pair of humeral setae measuring 33-38, 54-56 dorsal idiosomal setae, measuring 25-36, longer in anterior rows, arranged in irregular rows beginning 10.10.6+28-30 with some variation; 2 pairs of sternal setae, anterior 23-25, posterior 28-29; 20-22 preanal setae 23-30, 22-26; postanal setae 24-25; total idiosomal setae 102-110. Gnathosoma. Palpal setal formula variable B/B/NBB, /BNB; palpal claw 3-pronged, 11-14 long; galeala N; cheliceral blade (24-27), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. Scutum. Punctate with shallow biconcave anterior margin; posterior margin broadly convex; lateral margins straight with posterior lateral curve; AM base anterior to AL bases; SB anterior to level of PL bases; PL>AL>AM; PW/SD = 2.2 in holotype, 1.73-1.78 sensillae filliform with branches on distal 1/3. Scutal measurements of holotype followed by mean and ranges of 6 paratypes in parentheses: AW 56 (56, 52-59); PW 78 (76, 73-84); SB 16 (17, 16-19); ASB 23 (24, 23-27); PSB 13 (14, 13-15); AP 31 (31, 29-32); AM 23 (29, 27-31); AL 30 (31, 30-32); PL 41 (41, 39-46); sens. 58 (/./-). Legs. IP = 637-698. Leg I: 235-256; tarsus (52 X 18), tarsala (22), subterminala and parasubterminala absent, 2 pretarsalae. Leg II: 194-217; tarsus (45 X 16), tarsala (22), pretarsala absent. Leg III: 208-235; tarsus (59 X 18).

Remarks. Diplectria n. sp. A is close to D. taphozous as described by Womersley from Malaysia. It differs from that species in branched setation of the palpal femur and genu, in having fewer total body setae and smaller IP and standard data scutal measurements (fP starting N/N, TBS circa. 120, IP circa 845, AW 64, PW 87, SB 20, SD 48, AP 39 in D. Taphozous).
Figure 6. *Diplectria* n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, ventral aspect of pretarsa I; E, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; F, leg II as above; G, leg III as above.
Included species.

*Diplectria calva* (Domrow, 1962). Figure 7.


Re-description of species. Larvae. *Idiosoma*. Measuring 440 X 300 in partially engorged specimen. Eyes 2/2, anterior 16 diam., posterior 12 diam., on ocular plate. One pair of humeral setae measuring 33-34, 30-32 dorsal idiosomal setae, measuring 25-31, arranged in irregular rows beginning 6.6.4.6+6-8; 2 pairs of sternal setae, anterior 18-19, posterior 21-23; 10 preanal setae, 20-23; 14-16 postanal setae 24-27; total idiosomal setae 58-62. *Gnathosoma*. Palpal setal formula B/N/NNN; palpal claw 3-pronged, 12-14 long; galeala N; cheliceral blade (25), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. *Scutum*. Punctate with shallow biconcave anterior margin; posterior margin broadly convex with slight central depression; lateral margins straight with slight posterior lateral curve; AM base slightly anterior to AL bases; SB anterior to level of PL bases; PL>AL>AM; PW/SD = 1.92; sensillae filliform with basal barbs and branches on distal 1/3. Scutal measurements of holotype followed by that of two voucher specimens in parentheses: AW 54 (49-47); PW 74 (70-63); SB 18 (14-14); ASB 26 (23-1); PSB 14 (13-14); AP 29 (28-29); AL 30 (25-23); PL 39 (32-32); sens. 52 (1/1). *Legs*. IP = 601-642. Leg I: 216-226; tarsus (48 X 18), tarsala (19-22), subterminala and
parasubterminala absent, 2 pretarsalae. Leg II: 187-200; tarsus (39 X 16), tarsala (18), pretarsala absent. Leg III: 198-221; tarsus (54 X.18).

**Voucher specimens examined.** UMMZ 160332. Negros Island. 27 V 84. ex *Megaderma spasma*.

**Remarks.** The measurements of these 2 recently collected specimens vary slightly from that of the single holotype specimen of *D. calva*, however comparison with the remounted holotype reveals a configuration that is nearly identical and the variance is considered within normal range limits. The bat genus *Megaderma* ranges from India, throughout Southern Asia and into Australia. This doubtlessly represents parasite radiation along with specific or related hosts, although the site of origin can not be ascertained from this limited data. This is a new record for the Philippine Islands.
Figure 7. *Diplectria calva*. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, ventral aspect of pretarsa I; E, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; F, leg II as above; G, leg III as above.
Genus *Doloisia* Oudemans, 1910.


**Type species.** *Doloisia synoti* Oudemans, 1910: 87.

**Diagnosis.** PTF 3B or 4B. Galeala N. Palpal claw 3-pronged usually, rarely 2 pronged. Cheliceral blade with a prominent dorso-apical tooth and a larger tooth posterior to the subapical tooth. Eyes usually absent. Scutum poorly defined, lateral margins often disrupted by cuticular striae. PL setae inserted either on or off the scutum. Sensillae subglobose to globose, only rarely modified otherwise. Legs 7-7-7 segmented. Coxae II and III multisetae; coxa I unisetae or multisetae. 2 genualae I. Tibialae III absent. In replete specimens gnathosome is ventral.

The type species *D. synoti* was originally described from a single specimen and the parasitope was not known at that time. Subsequently it has been found infesting nasal cavities of rats and Fain, Yunker & Brennan (1962) found the species infesting nasal passages of bats.
Included species.


**Diagnosis.** Larvae. *Idiosoma*. Measuring 640X500 in partially engorged specimen. Eyes not discernable in this specimen. 1 pair of humeral setae; 34-36 dorsal idiosomal setae; 2 pairs of sternal setae; 18-20 preanal setae; 10-12 postanal setae; total idiosomal setae 66-72. *Gnathosoma*. Palpal setal formula B/B/NNB/4B; palpal claw 3-pronged, 18 long; galeala N; cheliceral blade with tricuspid cap and 1 dorsal tooth. *Scutum*. Lightly punctate with slight anterior projection of the AM area; without shoulders; posterior margin concave in middle, PL extrascutal; lateral margins slightly concave; AM base in line with AL bases; PL>AM>AL; sensillae pyriform with small barbs. Scutal measurements of 1 specimen; AW 18, SB 23, ASB 14, PSB 13, AM 27, AL 20, PL 45, sens. 29 12+17. **Legs.** IP = 550. Leg I: 180; tarsus (36X15), tarsala (20). Leg II: 171. tarsus (27X15), tarsala (16). Leg III: 198; no tibiala; tarsus (43X13).

Remarks. The specimens examined agree in size, standard measurements, and configuration to *D.domrowi* Audy & Nadchatram, 1957 described from *Rattus whiteheadi* and *R. alticola* from Malaysia. Coxa III setation differs in being 9-11 vice 10-12, however variation in setation of Coxa III in this genus is relatively common. This taxon was previously reported from the Philippine Islands by Brown & Goff (1988).

Genus *Eutrombicula* Ewing

*Eutrombicula* Ewing, 1938: 293.

Type species. *Microthrombidium alfreddugesi* Oudemans, 1910a: 84.

Diagnosis. PTF 7BS. Galeala N. Palpal claw 2-pronged, axial or external prong usually longer than accessory or internal prong. Chelicerae long usually with a small dorsal and ventral apical tooth. Eyes 2+2. Scutum subquadrate or quadrate, never pentagonal. Sensillae slender with distal barbs. Legs 7-7-7 segmented. 2 or 3 genualae I. A long outstanding mastitarsala III always present and mastitibiala III occasionally present.
Included species.


**Type data.** *Thrombidium wichmanni* Oudemans, 1905: 215.

Type series from North Celebes Islands, *ex: Homo sapiens.*

Oudemans, 1906.

**Diagnosis.** Larvae. **Idiosoma.** Measuring 483X374 in partially engorged specimen. Eyes 2/2, on ocular plate. 2 pair of humeral setae; 20-22 dorsal idiosomal setae, arranged in regular rows beginning 3-3-3+ 1-2; 2 pairs of sternal setae; 8-10 preanal setae; 6-8 postanal setae; total idiosomal setae 40-46. **Gnathosoma.** Palpal setal formula B/B/NNB/7B.S; palpal claw 2-pronged; galeala N.

**Scutum.** Punctate with bi-convex anterior margin; with shoulders; posterior margin rounded; AM base at same level with AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD = 1.6-1.7; sensillae filliform with distal 1/3 branched. Scutal measurements of means and ranges of 10 specimens: AW 87, 82-91; PW 101, 95-106; SB 43, 41-46; ASB 30, 27-32; PSB 31, 28-33; AP 33 28-35; AM 45 42-50; AL 54 50 45-57; PL 56 50-59; sens. 51, 50-63. **Legs.** IP = 806-909.

Leg I. 275-313; tarsus (46X20), tarsala (14-17). Leg II. 252-288; tarsus (51X19), tarsala (11-13). Leg III. 270-315; tarsus (69X16), mastitarsala 48-68.

Tambis Burauen, 2 *Rattus rattus samarensis*  5.VI.1964 (12).
Tambis Burauen, 5 *Rattus rattus* sp. 1.VI.1964. (37). Mahaplag, 1
*Rattus rattus* sp. 12.V.1964 (10). Mt.Lobi 1 *Rattus rattus* sp.
Mindanao Island. Cabadboran, Balangbalang, Mt Hilonghilong,
Agusan, el 160-330 m: 2 *R. bagobus* (6); 2 *R.* (2). Davao Prov.,
Limont Mati, Mt Mayo: 7 *R. mindanensis* (47); 7 *R.* sp. (38).
Cotobato Glan, Mt Tuduk, 1 *Pitta erythrogaster* (4). Mindanao
Island, collection site not recorded: 1 *R. bagobus* (3); 12 *R.
mindanensis* (70). Cebu Island, Danao: 1 *Dasia samaridina* (2);
Matimaw-on: 1 *R. mindanensis* (10). Mindanao Island, collection
site not recorded: 16 *R. mindanensis* (95). Camiguan Island.
Sansangan, Catarman, Mt Mabajao: 1 *Mabuya multicarina* (10).

**Remarks.** These specimens agree with the size, standard
measurements and configuration of *E.wichmanni* reported by Philip
& Woodward (1946) for chiggers taken from *R.r.mindanensis*
collected on Luzon. This species is an eitiological agent for scrub itch
in man.
Included species. Provisional.

*Eutrombicula scincoïdes* (Womersley), 1944: 84.


**Remarks.** This species shows similarities to the Eutrombiculids but differs notably in that the axial prong of the palpal claw is external rather than internal. Reported from skinks and lizards by Philip and Woodward (1946) as *Trombicula scincoïdes*, *(Neotrombicula)* of Womersley (1952), from Mindoro and Samar. Under the current diagnoses of these taxon, this taxon belongs in neither. The genus *Eutrombicula* is under current review and this taxon is placed their for purposes of this dissertation. One of three genera not found in the current study.

Genus *Gahrliepia* Oudemans, 1910.


**Type species.** *Typhlothrombidium nanus* Oudemans, 1910: 105.

**Diagnosis.** Trombiculine larvae in which the dorsal scutum is without the AM seta. Sensillae are expanded fusiform to globose. PTF 4B or 5B-N-3-2110. Cheliceral blade of normal contour, but bearing one or more subapical teeth on dorsal aspect and usually an
apical tooth on ventral aspect. Eyes, 2 pair, 1 pair, or rarely absent. Scutum very small, shield shaped to very large, tongue shaped almost covering the entire idiosome of unfed larvae; usually posterior margin extending beyond P1<sup>4</sup> proper; with 4, 6, 8 or more setae on scutum.

Subgenus *G. (Ripiaspichia).*

**Type species.** *Walchia americana* Ewing, 1942: 491.

Vercammen-Grandjean (1968) erected the subgenus *Ripiaspichia* to accommodate members of *Walchia* with 5B palpal tarsus and with rounded posterior scutal projection. Nadchatram (1974) retains *Walchia* as a subgenus of *Gahrliepia*. Brown and Goff (1988) follow Nadchatram in describing a new species from the Philippine Island, *G. (R.) serrata*, but neglect to cite the use of *Ripiaspichia* as a new combination under the genus *Gahrliepia*. This oversight is rectified below, along with an expanded diagnosis to accommodate members described since 1968.

**Re-diagnosis of subgenus.** Genus *Gahrliepia* Oudemans 1912. *Ripiaspichia* New combination. PTF 5B, galeala N, claw 3-pronged Chelicera long with tricuspid cap, a row of dorsal teeth may be present. Eyes absent. Scutum with rounded posterior margin. SB wide apart near mid-point of AP. Sensillae pyriform with barbs. Dorsal and ventral setae on prominent idiosomal plates in one species. FCx 111 or 112. No tibiala III. No mastisetae.
Gahrliepia (Ripiaspichia) n. sp. A Brown, 1990. Figure 8.


Gnathosoma. Palpal setal formula B/N/BNN; palpal claw 3-pronged, 8-10 long; galeala N, cheliceral blade (23-27), broad at base, with tricuspid cap, distal notch and dorsal teeth; gnathobase punctate, bearing 2 branched setae. Scutum. Punctate with shallow concave anterior margin; posterior margin deeply rounded; lateral margins straight; SB anterior to level of PL bases; PL>AL; PW/SD = 1.59-1.76; sensillae missing. Scutal measurements of holotype followed by the mean and ranges of 7 paratypes in parentheses: AW 58 (55, 51-58); PW 81 (80, 71-76); SB 46 (44, 41-48); ASB 14 (13, 12-14); PSB 35 (36, 33-39); AP 25 (25, 22-27); AL 29 (28, 27-29); PL 31 (33, 29-36); sens. missing. Legs. IP = 419-473. Leg I: 144-175; tarsus (28X17), tarsala (19). Leg II: 135-149; tarsus (23X15), tarsala (10). Leg III: 140-158; tarsus (25X15).

Type data. Holotype and 5 paratypes. Leyte Prov., Biliran Is. 3.5 Km. S, 5.5 Km. W Calbiran, elev 700 m. 23 July 1984. Col. L. R. Heaney 2552, ex Batomys solomonenses (Rodentia: Muridae) # HK 84-0723-1. One paratype same collection site and collector. ex Apomys microdon (Rodentia: Muridae). 27 April 1984, LPH 2533,

Remarks. Gahrliepia (Ripiaspichia) n. sp A can be separated from the majority of members of the genus by the serrations on the dorsal aspect of the cheliceral. Of those that have that characteristic it is closest to G. (R.) serrata. It can be separated from G. (R.) serrata by differences in the palpal setal formula and larger broader scutum (B/N/NNN and PW/SD= 1.19-1.24) in that species.
Figure 8. *Gahrliopia (Ripiaspichia)* n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above; G, coxa III.

**Description of species.** Larvae. **Idiosoma.** Measuring 220X188 in unengorged specimen, 271X233 in partially engorged specimen. Eyes absent. One pair of humeral setae measuring 26-28; 26 dorsal idiosomal setae, measuring 22-27, arranged in regular rows beginning 6.6.6.6.2; 2 pairs of sternal setae, anterior 18-20, posterior 14-17; 10 preanal setae, 14-17; 20-22 postanal setae 18-20; total idiosomal setae 62-64. **Gnathosoma.** Palpal setal formula B/N/NNN; palpal claw 3-pronged, 13-15 long; galeala N, cheliceral blade (27-30), broad at base, with tricuspid cap, dorsal notch, and dorsal teeth; gnathobase punctate, bearing 2 branched setae. **Scutum.** Punctate with straight anterior margin; posterior margin shallowly convex; lateral margins straight; SB anterior to level of PL bases; PL>=AL; PW/SD = 1.34-1.64; sensillae pyriform with basal barbs and global setules. Scutal measurements of holotype followed by the mean and ranges of 10 paratypes in parentheses: AW 43 (47, 43-50); PW 62 (69, 62-76); SB 36 (39, 36-42); ASB 19 (19, 17-20); PSB 27 (29, 27-30); AP 28 (30, 28-32); AL 24 (24, 23-25); PL 24 (24, 23-25); sens. 32 (missing). **Legs.** IP = 491-522. Leg I: 168-193; tarsus (36X22), tarsala (13). Leg II: 146-157; tarsus (30X16), tarsala (10). Leg III: 168-185; tarsus (36X15).

**Type data.** Holotype and 1 paratype. PHILIPPINES: Leyte Prov., Leyte Is., 10.5 Km. n, 4 Km. E Baybay, elev 700 m. 18 March 1987, Col. P. D. Heideman 3164, ex *Apomys microdon* (Rodentia: Muridae). HK 87-0318-1 ear. Eight paratypes. PHILIPPINES: Leyte

**Remarks.** *G. (R.)* n. sp B can be separated from all members of the subgenus by the dorsal and ventral setal plates.
Figure 9. *Gahlrieplia (Ripiaspichia)* n. sp. B. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Figure 10. *Gahrliepia (Ripiaspichia)* n. sp. B. Brown, 1991.
Dorsal and ventral aspect of idiosoma showing epistracal plates.
Included species.

*Gahrliepia (Ripiaspichia) serrata* Brown & Goff. Figure 11.

*Gahrliepia (Ripiaspichia) serrata* Brown & Goff, 1988: 117.


**Gnathosoma.** Palpal setal formula B/N/NNN/5B; palpal claw 3-pronged, 10-12 long; galeala N; cheliceral blade (30-31) broad at base with tricuspid cap and a dorsal row of short teeth the first 2-3 behind the tricuspid cap being prominent; gnathobase punctate, bearing 2 branched setae. **Scutum.** Lightly punctate with concave anterior margin; posterior margin rounded; lateral margins convex; SB anterior to level of PL bases; PL>AL; PW/SD = 1.19-1.24; sensillae globose. Scutal measurements of holotype followed by means and ranges of 10 paratypes in parentheses: AW 33, (33, 30-35); PW 57, (58, 57-62); SB 32, (32, 31-33); ASB 18, (20, 18-22); PSB 29, (29, 28-30); AP 32, (29, 27-32); AL 27, (22, 20-28); PL 32, (29, 28-30); sens. 22, (25, 24-25). **Legs.** IP = 500-519. Leg I: 154-195; tarsus (33 X 18), tarsala (14). Leg II: 141-157; tarsus (26 X 16), tarsala (11-13). Leg III: 172-192; tarsus (33 X 14).
Type data. Holotype (B 55047) and 10 paratypes from Philippine Islands, Luzon Island, Baguio, ex 4 Rattus rattus (9) and 1 Rattus exulans (1), 1964 (parasitope, collection date, and collector not recorded).

Remarks. Among species in the subgenus Ripiaspichia, Gahrliepia (Ripiaspichia) serrata is most similar to G. (R.) sawaii (Suzuki, 1975), G. (R.) hayashii (Suzuki, 1979), and G. (R.) khanyingi (Suzuki, 1980) in having teeth or serrations on the dorsal surface of the cheliceral blade. G. (R) serrata may easily be separated from these species in having a bisetose coxa III (unisetose in the other species) and palpal setation of B/N/NNN/5B (N/N/BNN, N/N/NNN, and B/B/BNN respectively in the other species). The species name is based on the dorsal teeth on the cheliceral blade. This taxon was previously reported from the Philippine Islands by Brown & Goff (1988b).
Figure 11. *Gahrliepia (Ripiaspichia) serrata*. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.


**Type species.** *Gahrliepia (G.) insigne* Womersley, 1952.

**Diagnosis.** Gahrliepia of medium to large size, SIF = 4B or 4B.S-N-3-2110, Ip = 570-1120. Scutum often considerably elongate, or widened, with peculiar carvings (scrobiculate). Eye lenses almost always present. Leg 3 more than 10% longer than leg 1, trochanter 3 often squamous, with 1 or 2 setae.

*Gahrliepia (Scrobiculata) n. sp. A. Brown* Figure 12.

**Description of species.** Larvae.

**Idiosoma.** Measuring 344 X 226 in partially engorged specimen. Eyes not discernable. One pair of humeral setae measuring 44-46; 32 dorsal idiosomal setae measuring 42-44, arranged in regular rows 2.2.2.2.4.6.6.4.4; 2 pairs of sternal setae, anterior 27-28, posterior 27-29; 32 preanal setae, 15-17; 12 postanal setae 15-17; total idiosomal setae 80. **Gnathosoma.** Palpal setal formula B/B/NNN/4B; palpal claw 3-pronged, 16-18 long; galeala N cheliceral blade (36-40), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. **Scutum.** Elongate with puncta and scrobicula, anterior margin concave; posterior margin curved; lateral margins straight to beyond PL setal bases, then elongate and tapering inward to sharply curved posterior; SB close to level of AL bases; PL > AL; PW/SD = 0.46; sensillae clavate.

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Scutal measurements of holotype followed by mean and range of 10 paratypes in parentheses: AW 45 (43, 40-45); PW 90 (88, 85-90); SB 56 (55, 54-56); ASB 15 (15, 15-15); PSB 180 (174, 166-180); AP 42 (42, 41-43); AM 65 (65, 64-66); AL 36 (35, 34-36); PL 42 (42, 41-43); PPL 42 (41, 40-43); PPL2 42 (42, 41-43; sens. 42 (41, 40-45).
Legs. IP = 600-606. Leg I 166-190; 2 genualae; tarsus (36 X 16), tarsala (12). Leg II 181-190; tarsus (30 X 15); tarsala (12). Leg III 235-253; tarsus (38 X 16); no mastitarsala.

**Type data.** Holotype and 10 paratypes (BBM 3023) from Philippine Islands, Busuanga Island ex *Rattus panglima* 6 Km N San Nicolas, parasitope testes. collection date 24 V 62. Coll. M. Thompson.

**Remarks.** *Gahrliepia (Scrobiculata)* n. sp. A keys to *G. (S.) marshi* in Traub and Morrow, (1957) but can easily be separated from that taxon by differing standard data measurements of the scutum [AW 51, PW 81, SB 47, ASB 23, PSB 151, SD 174, AP 38 in *G. (S.) marshi*] and by having fewer NDV setae in differing configuration [ca. 100, DS 34 arranged 2.4.6.8.6.4.2.2.2, VS 2.2.32.29 in *G. (S.) marshi*]. *G. (S.)* n. sp. A also has affinity for *G. (S.) ordinata* it can be separated from that taxon by differing standard data measurements of the scutum and PW/SD ratio [ASB 26, PSB 246, PW/SD = .34 in *G. (S.) ordinata*] and by a greater number and differing configuration of NDV setae [ca. 55, DS 18-20 arranged 2.2.2.2.2.2.2+2-4, VS 2.3.28-20 in *G. (S.) ordinata*].
Figure 12. *Gahrliepia (Scrobiculata)* n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.

**Type species.** *Walchia ewingi* Fuller, 1949: 1 (= *Trombidium glabrum* Walch, 1927, preoccupied).

**Diagnosis.** Gahrliepiini of small to medium size, Ip = 320-800. Scutum moderately elongate, often pentagonal with pointed posteromargin, rarely rounded or squared; AM seta absent: sensillae clavate. Eye lenses 2/2, 1/1, or absent. Femoral, genual and tibial setae of palps often nude, fPf = N/N/NNN.

**Included species.**

*Gahrliepia* (*Walchia*) *fulleri* (Vercammen-Grandjean 1971).


**Diagnosis.** Larvae. **Idiosoma.** Measuring 315X225 in partially engorged specimen. Eyes 1/1, on ocular plate. 1 pair of humeral setae; 40-44 dorsal idiosomal setae, arranged in irregular rows beginning 3.4.+12-14; 2 pairs of sternal setae; 12-14 preanal setae; 24-26 postanal setae; total idiosomal setae 82-90. **Gnathosoma.** Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N. **Scutum.** Lightly punctate with nearly straight anterior margin; posterior margin acute; lateral margins with

Remarks. The specimens examined agree in size, standard measurements, and configuration to W. (W.) fulleri Vercammen-Grandjean 1971. Holotype and 1 paratype ex Rattus edwardsi ciliatus from Malaysia, Pahang, 25.IV.1971. One exception is the reduction to papiliform of the microtarsala, leg I which is similar to that of W. alpestris. This taxon was previously reported from the Philippine Islands by Brown & Goff (1988).

Genus Guntheria Womersley.


Type species. Neoschoengastia kallipygos Gunther, 1939: 83.

Diagnosis. Palpal tarsus 5B or 5B.S; galeala N; palpal claw 3-pronged; chelicera with tricuspid cap; legs appearing 7-segmented; 1-3 genualae I, genuala II and III; tibiala III; subterminala I, parasubterminala I present or absent; mastitarsala III absent; scutum quadrate with biconcave anterior margin and biconvex posterior margin; sensilla expanded, clavate or globose; caudal plates present or absent.
Included species.

*Guntheria philippensis* (Philip & Woodward), 1946: 158.

**Diagnosis.** Scutum with posterior margin strongly sinuate and deeply concave medially. Galeal setae nude, fPp B/B/NNB. DS 32-34, arranged 2.6.6.6.6.4(2).2. Mean and ranges of scutal measurements: AW 55, 49-51; PW 79, 72-86; SB 23, 18-28; ASB 21, 21-21; PSB 12, 8-16; AP 25, 25-25; AM 25, 21-29; AL 45, 38-52; PL 53, 46-60; sens. 29, 29-29.

**Remarks.** Described and reported by Philip and Woodward (1946) from Mindoro and by Womersley from material from Luzon. This is one of three previously reported genera that has not been found in the collection material under current study.

Genus *Heaslipia* Ewing, 1944.

*Heaslipia* Ewing, 1944: 103.

**Type species.** *Trombiculoides gateri* Womersley and Heaslip, 1943: 101.

**Diagnosis.** SIF 7B.S-N-3-3111. IP =860-1090. Chelicera blade like, subapically with a dorsal tooth and a longer ventral tooth. Eyes 2/2. Scutum with deeply rounded posterior margin; semicircular. In addition to a pair of true PL setae, scutum bears 2 or more pairs of extra PL setae which are arranged along the posteriolateral margins behind the true PL setae. Sensillae filiform with distal barbs. A long mastitarsala on leg III.
Included species.


**Diagnosis.** Larvae. Gnathosoma with fPT B/B/NNB 5-6B.S.

Scutal measurements of mean and range of 4 specimens examined by Womersley (1952): AW 89, 86-93; PW 107, 104-108; PW1 97, 95-99; PW2 74, 72-78; SB 33, 32-36; ASB 29, 29-29; PSB 39, 39-40.

**Remarks.** This was previously reported from the Philippine Islands by Philip & Woodward (1946), who report *Heaslipia gateri* from rats, Progresso, Mindoro, 1945. This is one of three previously reported genera that has not been found in the collection material under current study.

Genus *Helenicula* Audy, 1954


**Type species.** *Neoschoengastia lanius* Radford, 1946: 261.

**Diagnosis.** Trombiculinae larvae infesting mammals as primary ectoparasites, and birds as secondary ectoparasites. Eyes 2/2, rarely 1 pair. Setae on palpal femur and genu always strongly barbed. Palpal tarsus with 4 or 5 barbed setae in addition to basal tarsala; nude subterminala lacking. Claw 3 pronged; axial prong internal, the longest. Galeal seta either nude or barbed. Chelicera simple with tricuspid. Scutum rectangular to subquadrate, PW always greater than SD. Sensillary bases close together, the interspace never wider than the diameter of a SB. Sensilla expanded, its head usually globose, sparsely scattered with minute, weakly
discernible spicules, so that expanded portion of sensilla appears nude. Tarsala I always inserted on distal 1/2 of tarsus, usually in close proximity to subterminala, distal or proximal to its base.

*Helenicula* sp. Nadchatram & Traub. 1971: 562..

**Remarks.** Specimens of this taxon occurred at several collection sites, however, the material was not identifiable to the species level with the exception of *H. ungkomari* voucher specimens included below.

**Included species.**

*Helenicula kohlsi* (Philip & Woodward), 1946: 159.

**Diagnosis.** Dorsal setae circa 86. All setae on palpal tibia branched or ciliated. Mean and range of scutal measurements: AW 52, 46-58; PW 64, 58-70; SB 10, 7-13; ASB 24, 20-28; PSB 9, 6-12; SD 33, 29-37; AP 20, 17-23; AM 23, 14-29; AL 46, 41-51; PL 34, 26-42; sen. 25, 14-36.

**Remarks.** Previously reported by Philip & Woodward (1946) from Mindoro. This is one of the three previously reported taxa not found in the material studied in this investigation.
**Helenicula ungkomari** Nadchatram & Traub, 1971: 566.

**Diagnosis.** Scutum with PL corners extended; SB anterior to line of PL setae. All palpal setae barbed; galeal seta nude. DS 8.6.8.8.6.4.2.2. Coxa III unisetose. Two genualae I. Mean and range of scutal measurements: AW 52, 47-55; PW 81, 76-82; SB 14, 13-15; ASB 28, 24-30; PSB 13, 11-14; SD 41, 35-43; AP 36, 33-37; AM 36, 40-49; AL 63, 53-69; PL 76, 71-84; sens. 30 (20X20), 29 (20X20) - 33 (22X22).

**Additional voucher specimens examined.** Palawan Prov., Balabac Island, 3 *Tupaio palawanensis* (14); 3 *Tragulus nigricans* (13).

**Remarks.** This taxon was described from *Tragulus nigricans*, and other rodents from this collection from Balabac Island by the above authors in 1971.

**Genus Leptotrombidium** Nagaya et al.


**Type species.** *Trombidium akamushi* Brumpt, 1910: 506.

**Diagnosis.** Palpal tarsus with 7B or 7BS; galeala B; palpal claw 3-pronged; chelicera with tricuspid cap; sensilla filiform with branches on distal half; eyes 2+2; 2 genualae I, genuala II and III; tibiella III; no mastisetae III; legs 7-7-7 segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent.
Subgenus *Leptotrombidium* Nagayo, et al.


**Type species.** *Trombidium akamushi* Brumpt, 1919: 506.

**Diagnosis.** Palpal tarsus with 7B; palpal tibia BNN or NNN; AM seta much longer than AL setae.

*Leptotrombidium* n.sp. A Brown, 1990. Figure 13.

**Description of species.** Larvae. *Idiosoma.* Measuring 235 X 190 in partially engorged specimen. Eyes 2/2, anterior 10 diam., posterior 10 diam., on ocular plate. One pair of humeral setae measuring 58-60; 48-50 dorsal idiosomal setae, measuring 50-61, arranged in irregular rows beginning 12.10.10.6+4-6 with some variation; 2 pairs of sternal setae, anterior 38-46, posterior 39-42; 18 preanal setae, 25-37; 10-12 postanal setae 35-39; total idiosomal setae 80-84. *Gnathosoma.* Palpal setal formula N/N/BNN 7B; palpal claw 3-pronged, 21-22 long; galeala B; cheliceral blade (31-35), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. *Scutum.* Punctate with straight anterior margin; posterior margin with slight projection and shallow central concavity; lateral margins straight; AM base posterior to AL bases; SB slightly anterior to level of PL bases; AM>PL>AL; PW/SD = 1.93; PW/AP = 2.96; sensillae flagelliform with branches on distal 1/3. Scutal measurements of holotype followed by that mean and ranges of 7 paratypes in
parentheses: AW 71(73, 70-78); PW 83 (83, 75-92); SB 38 (37, 34-41); ASB 28 (28, 23-29); PSB 15 (15, 12-17); AP 28 (28, 22-30); AM 58 (60, 52-66); AL 41 (36, 34-41); PL 54 (56, 54-61); sens. 77 (73, 66-77). Legs. IP = 807-838. Leg I: 273-298; tarsus (64X18), tarsala (17). Leg II: 233-256; tarsus (44X16), tarsala (15). Leg III: 280-289; tarsus (63X18).

Type data. Holotype, PI 32 and 7 paratypes [PI 32 (3) and PI 103 (4)] from Philippine Islands, Mindanao Island ex Macaca philippinensis, 1964, parasitope, exact collection date and collector not recorded.

Remarks. Leptotrombidium n. s A keys to L. pallidum in Vercammen-Grandjean and Langston (1976). It can be separated from that species by the difference in scutal ratios PW/AP and PW/SD (3.7 and 1.81 in L. pallidum), by the different position of the SB (2-4 microns behind the PL in L. pallidum), and by the fewer number of idiosomal setae, 80-84 vice 110 in L. pallidum. The vector potential for this species is unknown.
Figure 13. *Leptotrombidium (Leptotrombidium)* n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
*Leptotrombidium* n. sp. B Brown 1990. Figure 14.

**Description of species. Larvae. Idiosoma.** Measuring 300 X 217 in partially engorged specimen. Eyes 2/2, anterior 12 diam., posterior 10 X 9, on ocular plate. One pair of humeral setae measuring 47-58; 26 dorsal idiosomal setae, measuring 48-59, arranged in regular rows beginning 8.6.6.4.2; 2 pairs of sternal setae, anterior 38-48, posterior 32-41; 10-11 preanal setae, 23-31; 10 postanal setae 36-48; total idiosomal setae 52-53. **Gnathosoma.** Palpal setal formula N/N/BNN 7B; palpal claw 3-pronged, 17-18 long: galeala B cheliceral blade (34-36), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. **Scutum.** Punctate with slightly concave anterior margin; posterior margin with slight projection and shallow central concavity; lateral margins straight; AM base posterior to AL bases; SB slightly anterior to level of PL bases; AM>PL>AL; PW/SD = 1.95; PW/AP = 2.4; sensillae flagelliform with branches on distal 1/3. Scutal measurements of holotype followed by the mean and range of 8 paratypes in parentheses: AW 62 (65, 59-72); PW 78 (78, 71-85); SB 32 (32, 28-34); ASB 25 (26, 24-28); PSB 14 (14, 14-14); AP 30 (32, 30-32); AM 57 (57, 52-62); AL 36 (34, 32-37); PL 53 (53, 50-58); sens. 81(73, 66-81). **Legs.** IP = 713-795. Leg I: 208-244; tarsus (56X22), tarsala (15). Leg II: 208-244; tarsus (45X18), tarsala (14). Leg III: 259-279; tarsus (56X18).
Type data. Holotype PI 31 and 8 paratypes [PI 31(5) & PI 32 (3)] from Philippine Islands, Mindanao Island ex Macaca philippinensis, 1964, exact collection date, parasitope, and collector not recorded.

Remarks. Leptotrombidium n. s. B keys to L fulleri Ewing 1945 in Vercammen-Grandjean & Langston (1972). It can be readily separated from that species by the difference in scutal ratio PW/AP (3.32 in L. fulleri) by the greater AP (20-23 in L. fulleri) and by the consistently longer AM>PL setation which is the usual PL>AM in the latter species.
Figure 14. *Leptotrombidium (Leptotrombidium)* n. sp. B. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
**Leptotrombidium** n. sp. C, Brown, 1990. Figure 15.

**Description of species.** Larvae. **Idiosoma.** Measuring 286 X 190 in partially engorged specimen. Eyes 2/2, anterior 13 diam., posterior 9 diam., on ocular plate. One pair of humeral setae measuring 54-56; 28-30 dorsal idiosomal setae, measuring 53-59, arranged in regular rows beginning 8.6.6.6+2-4; 2 pairs of sternal setae, anterior 56-58, posterior 42-44; 16-18 preanal setae, 32-40; 6-8 setae 48-50; total idiosomal setae 84-92. **Gnathosoma.** Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged, 20-22 long; galeala B; cheliceral blade (40), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. **Scutum.** Punctate with shallow concave anterior margin; posterior with shallowly biconvex margin; lateral margins sinuous towards posterior setae; AM base posterior to AL bases; SB slightly anterior to level of PL bases; PL>AM>AL; PW/SD = 1.87; sensillae missing.

Scutal measurements of holotype followed by the mean and range of 5 paratypes in parentheses: AW 74 (70, 68-74); PW 76 (73, 72-76); SB 34 (33, 32-34); ASB 23(24, 23-25); PSB 14 (15, 14-16); AP 22 (22, 21-23); AM 49 (51, 49-53); AL 46 (49, 46-54); PL 52 (55, 52-59); sens. missing. **Legs.** IP = 710-796. Leg I: 232-262; tarsus (55 X 21), tarsala (17). Leg II: 222-244; tarsus (52 X 20), tarsala (15). Leg III: 244-290; tarsus (66 X 18).

**Type data.** Holotype and 5 paratypes (BBM 1881) from Philippine Islands, Mindanao Island ex *Urogale*, 1964 parasitope, collection date and collector not recorded.
Remarks. *Leptotrombidium* n. sp. C keys to the *L. langati*, Audy & Womersley, 1957 complex in Vercammen-Grandjean & Langston (1972). It can be readily separated from members of that complex by the smaller standard data measurements (ASB 30-33, SD 43-46, AP 30-33, PW/SD = 2.44 in *L. langati*).
Figure 15. *Leptotrombidium (Leptotrombidium)* n. sp. C.
Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Included species.

*Leptotrombidium deliense* (Walch), 1922


**Description of species. Larvae. Idiosoma.** Measuring 453X326 in partially engorged specimen. Eyes 2/2, on ocular plate. 1 pair of humeral setae; 26 dorsal idiosomal setae, arranged in regular rows 8.6.6.4.2; 2 pairs of sternal setae; 14 preanal setae; 6 postanal setae; total idiosomal setae 52. **Gnathosoma.** Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B. **Scutum.** Lightly punctate with biconcave anterior margin; without shoulders; posterior margin biconvex; lateral margins slightly curved; AM base posterior to AL bases; SB anterior to level of PL bases; PL>AL>AM; PW/SD = 1.9; sensillae filliform. Scutal measurements of means and ranges of 10 specimens: AW 71, 66-77; PW 82, 77-89; SB 31, 30-33; ASB 28, 25-31; PSB 14, 14-14; AP 32, 29-34; AM 63, 59-67; AL 45, 41-50; PL 83, 76-90; sens. 66, 54-72. **Legs.** IP = 761-820,. Leg I: 253-286; tarsus (55X20). Leg II: 223-252; tarsus (42X20), tarsala (13). Leg III: 266-290; tarsus (58X18).

**Voucher specimens examined.** Billiran Island: 2 *Apomys microdon* (6); 2 *Rattus evertti* (10); 1 *R. exulans* (4). Bohol Island: 1 *Hipposideros diadema* (3). Leyte Island: Baybay, 1 *Batomys salomonseni* (2); 1 *Bullimus bagobus* (7); 1 *Crocidura beatus* (6); 2 *R. evertti* (11); 1 *Sundasciurus samarensis* (1). Mindanao Island: 5.V-5 VI.1964. Tambis Burauen 29 *Rattus rattus mindanensis*
(142). Buri 9 R. r. mindanensis (44) 12 R. r. mindanensis (62). Mt. Lobi; 4 R. r. mindanensis (7). Sta Cruz 11 R. r. (94). Tambis Burauen 4 R. r. (31). Buri 6 R. r. (44). Mt. Lobi 2 R.r. (20). Sta Cruz 2 R. r. (20). Mahaplag; 6 R. r. samarensis (40). Tambis Burauen 1 R. r. sp. (10). Mahaplag 4 R.r. sp. (20). Tambis Burauen 1 R.r. sp. (7). Mt. Lobi 5 Callosciurus sp. (26). Mt. Lobi 1 Halcyon (1). Mt. Lobi 2 Ptilochichila (3). Leyte Prov., Maripipi Island: 1 Bullimus bagobus (10); 1 Crocidura beatus (10); 2 R. evertti (2). Mindanao Island. Cotobato, Tupi Kabon, Mt. Metuturn, 1 Apomys sp. (5); Masawan, Mt Malindang, Zamboanga del Norte: 1R. exulans todayensis (1);12 R. mindanensis (45); 2R. rabori (3); 1R. sp. (6); 1 Trichoglossus johnstoniae (6). Mt. Kataglad: 2 Podogymnura truei (18) 1 R. (3). Dapitan Peak: 2 Calliosiurus mindanensis (10); 2 R. rabori (6); 2 R. mindanensis (11); 4 host not recorded (17). Davao Prov., Limont Mati, Mt Mayo: 47 R. mindanensis (326); 2 R. (12); 10 R. sp. (42); 1 Callosciurus sp. (10); 1 Caorimulous macrurus delacorti (6); 1 host not recorded (10). Sibahay, Lanuza, Surigao del Sur: 1 R. exulans (1), Mindanao Island: 1 Apomys insignis bardus (1); 2 Callosiurus mindanensis (18); 1 R. bagobus (1); 1 R. (6); 69 R. mindanensis (428); 1 R. sp. (4). Luzon Island, Baguio: 19 R. sp. (76); 2 R. mindanensis (6). Cebu Island, Danao: 1 Dasia samaridina (2). Palawan Island Island 1962 1 host not recorded (1); 1 R. tyranos (1); 1 R. mulleri (5); 1 R. panglima (10); 2 Tupaio palawanensis (7); 1 Tragulus nigricans (5); 2 Crocidura palawanensis (20), 1 Tupaia mollendorfii (9). Negros Island:
Dumaguete: 1 *R. rattus* (6); 2 *Suncus murinus* (18); Lake Balinsasayao. 1 *Apomys littoralis* (3); 1 *A. microdon* (3); 1 *Crocidura nigrina* (4); 4 *Haplonycteris fisheri* (21); 2 *Ptenochiurus jagori* (11); 3 *R. rattus* (30); 2 *Suncus murinus* (19). Negros Island: 1 *R. rattus* (10).

**Remarks.** These specimens agree in standard data measurements and configurations with *L.(L.) deliense*. This species has been proven to be a principal vector of Chigger borne rickettsiosis.

*L. fletcheri* Ewing 1945.

*L. fletcheri* Ewing 1945:

**Diagnosis.** Mean and range of scutal measurements: AM 65, 62-27; PW 76, 73-81; SB 31, 28-34; ASB 26, 20-28; PSB 14, 12-17; SD 40, 24-44; AP 27, 25-30; AM 52, 48-57; AL 39, 33-42; PL 50, 47-57; sen. 70, 62-78. Ip 665, 646-703. S. S. = 40 arranged 10.8.8.6.4.2, with variations. VS ca. 26. NDV ca. 66.

**Voucher specimens examined.** Mindanao Island: 1964; Balang Cabadbaran 1 *R. bagobus* (1); Bondo-an 1 *Rattus bagobus* (1). Cotobato, Tupi Kabon, Mt. Metuturn, 3,700 7,900, Host not recorded: 1, (10); 1 *Nannosciuris* sp. (5); *Apomys insignis bardus* (8). Hanggose; 1 *R. bagobus* (1). Dapitan Peak: 1 *R. rabori* (4); 4 *Apomys insignis bardus* (32); 2 *Callosiurus mindanensis* (8). Davao Prov., Mt Mayo: 2 *R. mindanensis* (2). Masawan, Mt Malindang, Zamboanga del Norte: 2 *R. mindanensis* (2); 4 *Apomys*
insignis bardus (14); 2 Callosciurus mindanensis (16)
1Haplonecteris (8). Mt. Kataglad: 1 R. evertti (2). Siwan: 1
Apomys sp. (2). Mindanao Island, collection site not recorded: 2 A.
bardus (7). 2 R. evertti (5); R. mindanensis (1); R. torquatus
sandfordi (6); 1 Urogale evertti (7). Luzon Island, Baguio: 6 R. sp.
(30); 1 R. exulans (3). Cebu Island, Matimaw-on: 1 R. sp. (10); 1 R.
mindanensis ((10).

Remarks. Philip and Woodward (1946) report both L.
akamushi and L. fletcheri as occurring in the Philippine Islands.
Vercammen-Grandjean (1976) states that L. deliense and L.
akamushi do not co-exist and relegates the specimens of L.
akamushi to L. fletcheri luzonensis. In this dissertation L. fletcheri is used for those variants with 9, 10, 11 dorsal setae in the first post
humeral row that are obviously not L. deliense.


Diagnosis. Dorsal setae circa 30, arranged 10(11).8.6.4.2.
Palpal setation N/N/BNN/7B. Scutal measurements, mean and
range: AM 68, 63-71; PM 82, 72-86; SB 32, 29-35; ASB 29, 27-31;
PSB 16, 14-17; AP 30, 28-32; AM 64, 61-66; AL 50, 45-55; PL 69,
64-75; sens. 72, 68-78.

Remarks. A previously described species from Mindanao, ex
Rallus torquatus sandfordi. No additional specimens of this taxon
where found in this study.


Diagnosis. *Leptotrombidium* of small to medium size, Ip - 580-760. SIF 7B-B-3-2111.0000. Scutum subrectangular with projection of posterior margin. SB on or behind the PL line. Sensilla bases relatively far apart. PL modified, more or less foliate. Idiosomal setae foliate. Sensillae slender, branched on distal halves.

The genus *Trombiculindus* was proposed by Radford (1948) to accommodate the new species *T. squamosus* collected by Kalra from rat ear specimens in India. Domrow (1960) and Vercammen-Grandjean (1960) demonstrated its relationship to *Leptotrombidium* and established *Trombiculindus* as a subgenus of that taxon.

*Trombiculindus* n. sp. A, Brown. Figure 16.

Description of species. Larvae. Idiosoma. Measuring 262X190 in partially engorged specimen. Eyes 2/2, anterior 9 diam., posterior 9 diam., on ocular plate. One pair of humeral setae measuring 35-37; 36-38 dorsal idiosomal setae, measuring 32-34, arranged in regular rows beginning 10.10.8+6-8; 2 pairs of sternal setae, anterior 38-41, posterior 35-37; 12 preanal setae, 25-27; 8-10 postanal setae 31-33; total idiosomal setae 62-66. Gnathosoma. Palpal setal formula N/N/NNN 7B; palpal claw 3-pronged, 26-28 long; galeala B cheliceral blade (25-27), broad at base, with tricuspid...
cap; gnathobase punctate, bearing 2 branched setae. **Scutum.**
Punctate with concave anterior margin; posterior margin broadly convex; lateral margins straight; AM base posterior to AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD 1.31=1.38; sensillae missing. Scutal measurements of holotype followed by that of one paratypes in parentheses: AW 54 (58); PW 72 (76); SB 32 (32); ASB 23(23); PSB 16 (14); AP 30 (28); AM 45 (49); AL 25 (-); PL 40 (40); sens. missing. **Legs.** IP = 608-680. Leg I: 212-232; tarsus (41X418), tarsala (15). Leg II: 186-208; tarsus (41X17), tarsala (14). Leg III: 210-240; tarsus (43X18).

**Type data.** Holotype and paratype (BBM PI 591) from Philippine Islands, Mindanao, Mt Katanglad, 1963, (parasitope, collection date, and collector not recorded), ex *Rattus*.

**Remarks.** *Trombiculindus* n. sp. A is similar to *T. traubi* and *T. fordi*. It can be separated from those species by its shorter anterior width (greater than 64 in *T. traubi* and *T. fordi*) by it's shorter scutal depth (greater than 42 in *T. traubi* and *T. fordi*) and by its longer AP (less than 25 in the other two species). Additionally the NDV is less in this species (106 in *T. traubi* and 84 in *T. fordi*) and the scutal bases remain anterior to the PL bases while pronounced protrusion of the posterior scutal margin bring the SB's of the other two posterior to the PL bases.
Figure 16. *Leptotrombidium (Trombiculindus)* n. sp. A.
Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, sternal seta; E, ventral seta; F, posterior ventral seta; G, dorsal seta; H, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; I, leg II as above; J, leg III as above.


Diagnosis. SIF 6B-N-2-3111. Ip = 420-900. Palpal setae weak. Chelicerae normal with a dorsal subapical tooth or with 2 apical teeth forming a tricuspid cap. Eyes 1 or 2 pairs. Scutum small, pentagonal or quadrate; posterior margin slightly or deeply U shaped. AL setae usually submarginal, sometimes marginal. 2 or 3 genualae on leg I, usually 3. Leg setae short and appear nude. A short, fine mastitarsala III usually present.

This genus is congeneric with *Ascoschoengastia*, i.e. in the absence of the sensillae the two genera are almost impossible to distinguish.

Subgenus *Eltonella*


Diagnosis. Microtrombicula larvae having 6 setae on palpal tarsus (combination N & B); palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; legs all 7-segmented; 3 genualae I, genuala II and III; tibiala III; tarsala I, tarsala II; subterminala and parasubterminala I; scutum pentagonal with acute posterior
margm; sensilla flagelliform, thick, with basal barbs, branched distally; eyes 2/2, reduced, unapparent in old material, anterior larger.

*Eltonella* was proposed as a subgenus of *Eutrombicula* Ewing by Audy, (1956). Vercammen-Grandjean (1960) elevated *Eltonella* to the generic status. Nadchatram and Dohany (1974) placed *Eltonella* as a subgenus of *Microtrombicula*. Goff (1979) followed this placement and re-described the taxon. This placement is followed in the descriptions of these new taxa.

*M. (Eltonella) n. sp. A Brown. Figure 17.

Description of species. Larvae. Idiosoma. Measuring 326X272 in partially engorged specimen. Eyes 2/2, anterior 9 diam., posterior 9 diam., on ocular plate. One pair of humeral setae measuring 24-27; 20-22 dorsal idiosomal setae, measuring 22-27, arranged in irregular rows beginning 6.6.4+4-6; 2 pairs of sternal setae, anterior 10-12, posterior 12-14; 8 preanal setae, 15-21; 6-8 postanal setae 21-23; total idiosomal setae 40-44. Gnathosoma. Palpal setal formula N/N/NNN/6B; palpal claw 3-pronged, 12-14 long; galeala N, cheliceral blade (21-23), broad at base, with tricuspid cap and an elongate dorsal tooth; gnathobase punctate, bearing 2 branched setae. Scutum. Punctate with straight anterior margin; posterior margin broadly rounded; lateral margins straight; AM base posterior to AL bases; SB anterior to level of PL bases;
PL>AL>AM; PW/SD = 1.66; sensillae flagelliform with distal branches.

Scutal measurements of holotype followed by mean and range of 13 paratypes, in parentheses: AW 52 (50, 46-53); PW 67 (68, 63-77); SB 21 (20, 17-28) ASB 23 (21, 17-25); PSB 23 (20, 17-24); AP 24 (25, 23-28); AM 23 (21, 20-23); AL 19 (17, 15-19); PL 24 (23, 21-25); sens. 58 (41, 36-58). Legs. IP = 500-556. Leg I: 181-196; tarsus (41X18), tarsala (17-19). Leg II: 163-177; tarsus (32X16), tarsala (16-17). Leg III: 156-196; tarsus (39X15).

Type data. Holotype and 3 paratypes (BBM 126894) from Philippine Islands, Leyte Province, Camotes Island, Poro. Ex Dasia smaragdina, 1968 (parasitope, collection date, and collector not recorded).

Remarks. Microtrombicula (Eltonella) n. sp. A is similar to M.(Eltonella) fieldi in having a somewhat rounded posterior scutal margin. It can readily be separated from that species by its smaller IP, idiosomal and scutal measurements (664, 370-420X250-300, AW 66, PW 74, SB 29, SD 44, AP 21 in M. (E.) fieldi). Additionally it has a 3-pronged palpal-tarsal claw and lacks a mastitarsala III (2-pronged and present in the latter species).
Figure 17. *Microtrombicula (Eltonella)* n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Microtrombicula (Eltonella) n. sp. B Brown. Figure 18.

Description of species. Larvae. Idiosoma. Measuring 335X264 in partially engorged specimen. Eyes 2/2, anterior 9 diam., posterior weak 9X13, on ocular plate. One pair of humeral setae measuring 24-27; 18-20 dorsal idiosomal setae, measuring 20-24, arranged in irregular rows beginning 6-6-4+2-4; 2 pairs of sternal setae, anterior 13-14, posterior 10-12; 8-10 preanal setae, 12-14-; 6-8 postanal setae 20-22; total idiosomal setae 38-44. Gnathosoma. Palpal setal formula N/N/NNN/6B; palpal claw 3-pronged, 8-10 long; galeala N cheliceral blade (23-25), broad at base, with tricuspid cap and an elongate dorsal tooth; gnathobase punctate, bearing 2 branched setae. Scutum. Punctate with straight anterior margin; posterior margin acutely V shaped; lateral margins straight; AM base in line with AL bases; SB anterior to level of PL bases; PL>AL>AM; PW/SD = 1.54-1.58; sensillae flagelliform, with distal branches. Scutal measurements of holotype followed by the mean and ranges of 8 paratypes, in parentheses: AW (45, 43-48); PW (62 (57-68); SB (19, 15-21); ASB (19, 17-22); PSB (21, 19-22)); AP (23, 19-29); AL (18, 15-20); PL (25, 21-28); sens. (37, 34-43) Legs. IP = 477-552. Leg I: 165-195; tarsus (40 X 17), tarsala (19-20). Leg II: 147-168; tarsus (29 X 14), tarsala (18). Leg III: 165-191; tarsus (35 X 13)
Type data. Holotype and 3 paratypes (BPBM 126963) from Philippine Islands, Panay Prov., Guimayas Island ex *Lepidactylus christiana*, 1968. Col. R. B. Gonzales (parasite, collection date, not recorded)

Remarks. *M. (Eltonella) n. sp. B*, is morphologically similar to *M. (E.) frittsi* as re-described by Goff (1979). It can be separated from that species by lacking subapical claws, mastitarsala III and basal barbs on the sensillae.
Figure 18. *Microtrombicula (Eltonella)* n. sp. B. Brown, 1991.

A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Subgenus *Microtrombicula* Ewing.


**Subgenus type.** *Microthrombidium minutissimum* Oudemans 1910: 104.

**Diagnosis.** SIF 6B-N-2-3111. Ip = 420-900. Scutum quadrate or pentagonal with concavity of posterior margin rounded. AL setae always submarginal so that AL shoulders are present. PW less than 1.3X that of AW. Shape of area between AL and PL setae more square than rectangular. Sensillae very slender to thick.

*Microtrombicula* (*Microtrombicula*) n. sp. A Brown. Figure 19.

**Description of species.** Larvae. **Idiosoma.** Measuring 347 X 185 in partially engorged specimen. Eyes 2/2, anterior 13 diam., posterior 9 diam., on ocular plate. 1 pair of humeral setae measuring 25-29; 20-22 dorsal idiosomal setae, measuring 21-23, arranged in regular rows beginning 6-6-2+4; 2 pairs of sternal setae, anterior 16-17, posterior 17-18; 12 preanal setae, 18-20; 4-6 postanal setae, 19-22; total idiosomal setae 56-62. **Gnathosoma.** Palpal setal formula N/B/NNN/6B; palpal claw 2-pronged with axial prong internal, 11-13 long; galeala N cheliceral blade (27), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. **Scutum.** Lightly punctate, porous with biconcave anterior margin and with prominent shoulders; posterior margin shallowly convex; lateral margins straight; AM base anterior to AL bases; SB at median line; PL>AM>AL; PW/SD = 1.33; sensillae missing in all.
specimens. Scutal measurements of holotype followed by means and ranges of 4 paratypes in parentheses: AW 39 (40, 39-41); PW 52 (52, 50-53); SB 15 (15, 15-16); ASB 18 (19, 18-20); PSB 18 (20, 19-22); AP 25 (26, 26-29); AM 23 (23, 22-25) AL 14 (14, 12-15); PL 28 (28, 27-29); shoulders 9 (8, 7-8); sens. missing. **Legs.** IP = 525 Leg I: 195-199; tarsus (39 X 15), tarsala (15). Leg II: 156-159; tarsus (32 X 14), tarsala (12-13). Leg III: 168-172; tarsus (38 X 16); 2 mastitarsalae (22).

**Type data.** Holotype (HK 87-0321-2) and 4 paratypes from Philippine Islands, ex *Megaderma spasma*, 21 March 1987 from ears and wing, 10.5 Km N, 4 Km E Baybay, Leyte Prov. Leyte Is., Col. P. D. Heideman.

**Remarks.** *Microtrombicula* n. s. A is in the *M. minutissima* group of Vercammen-Grandjean (1968) and is close to both *M. audyi* Vercammen-Grandjean, 1965 and in *M. batui* (Philip & Traub, 1950). It can be readily separated from both by having a smaller number of idiosomal setae (84 in *M. audyi*, 78 in *M. batui*) and by differing palpal setation (B/B/BNN in *M. audyi* and *M. batui*). Additionally the scutal surface is lightly punctate with minute pores in *M.* n. sp. A while the scutal surface of both of the other species is markedly punctate with large pores.
Figure 19. *Microtrombicula (Microtrombicula)* n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, intercoxal area; E, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; F, leg II as above; G, leg III as above.
Microtrombicula (Microtrombicula) n. sp. B Brown, 1989. Figure 20.

Description of species. Larvae. Idiosoma. Measuring 326 X 232 in partially engorged specimen. Eyes absent. One pair of humeral setae measuring 50; 100 dorsal idiosomal setae, measuring 20-29, arranged in irregular rows; 2 pairs of sternal setae, anterior 35, posterior 32; 48 preanal setae, 24-27; 4 setae 23-25; 4 bilateral intercoxal setae between coxa II & III; total idiosomal setae 166. Gnathosoma. Palpal setal formula N/N/NNN; palpal claw 2-pronged, axial prong internal, 11 long; galeala N cheliceral blade (24), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. Scutum. Pentagonal, moderately punctate with concave anterior margin and prominent shoulders; posterior margin with slight pointed projection; lateral margins convex; AM base anterior to AL bases; SB anterior to level of PL bases; PL>AL=AM; PW/SD = 1.46; sensillae simple, unbranched. Scutal measurements of holotype: AW 35; PW 57; SB 15; ASB 21; PSB 18; AP 20; Shoulders 12; AL 23; PL 33; sens. 36. Legs. IP = 543. Leg I: 195; tarsus (41 X 18), tarsala (18). Leg II: 163; tarsus (32 X 16), tarsala (18). Leg III: 185; tarsus (45 X 14).
**Type data.** Holotype from Philippine Islands, Negros Oriental Prov., Negros Is., Dumaguete 9°18' N 123°18' E, 750 m. 23 August 1982. Col. P. D. Heideman, ex. *Rousetus amplexicaudatus*, (Geoffroy, 1810), (Chiroptera Pteropodidae) female, ear. UMMZ Ann Arbor 161504. Mite # HK 86-0425-1.

**Remarks.** *Microtrombicula* n. sp. B can be separated from all known members of the genus by the presence of four pair of prominent lateral setae between coxa II and coxa III.
Figure 20. *Microtrombicula (Microtrombicula)* n. sp. B. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Genus *Myotrombicula* Womersley and Heaslip, 1943.


**Type species. Myotrombicula vespertilionis** Womersley and Heaslip, 1943: 99.

**Diagnosis.** SIF 7B,S-N-3-2111. Ip = 640-1000. Chelicera blade-like with one dorsal and one ventral subapical tooth. Eyes 1 or 2 pairs. Scutum subquadrate or quadrate with simple or coarse punctae, but not reticulate. AL setae submarginal so that AL shoulders are present. SB inserted halfway between AL and PL setae. Sensillae filiform, nude or barbed. Mastitarsala III absent.

The genus *Myotrombicula* was created by Womersley and Heaslip, (1943) to accommodate a unique specimen found in association with bats of South Australia. Vercammen-Grandjean, (1968) revised the genus to include four subgenera, redescribed the type species and adds new combinations and 2 new species.

Examination of chiggers, larval Trombiculidae, from the University of Michigan Museum of Zoology has revealed two additional new species which are described below.
Myotrombicula n. sp. A. Figures 21 and 22.

Description of species. Larvae. Idiosoma. Measuring 217X154 in partially engorged specimen. Eyes 2/2, anterior 12X10, posterior 6X6, on ocular plate. One pair of humeral setae measuring 40-42; 42-44 dorsal idiosomal setae, measuring 27-32, arranged in irregular rows beginning 12.8.2.8+12-14; 2 pairs of sternal setae, anterior 33-37, posterior 22-24; 22 preanal setae, 18-22; 10-12 postanal setae 26-27; total idiosomal setae 82-86. Gnathosoma. palpal setal formula B/B/NBB/7BS; palpal claw 3-pronged, 16-18 long; galeala B; cheliceral blade (24-26), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. Scutum. Punctate with anterior margin slightly bi-concave; posterior margin bi-convex; lateral margins straight with shoulders; AM base in line with AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD = 1.51-1.61; sensillae flagelliform with branches on distal one third. Scutal measurements of holotype followed by the mean and range of 3 paratypes in parentheses: AW 57 (56, 54-57); PW 66 (66, 63-68); SB 21 (21, 20-21); ASB 27 (24, 23-27); PSB 18 (18, 16-18); AP 24 (23, 21-25); AM 33 (33, 30-32); AL 32 (31, 30-32); PL 39 (36, 32-39); sens. 50 (50, /-). Legs. IP = 603-624 Leg I: 217-223; tarsus (45X18), tarsala (20). Leg II: 183-190; tarsus (33X16), tarsala (14). Leg III: 199-217; tarsus (45X14).
**Type data.** Holotype and 3 paratypes (HK 84-0806-5) from Philippine Islands, Negros Island, 3 Km N, 14 Km W Dumaguete, Lake Balinsasayao, el 850 M ex *Rhinolophus nonarcuatus* (Chiroptera: Rhinolophidae) male, August 6, 1984. Coll. P. D. Heideman.

**Remarks.** *Myotrombicula* n. sp. A is similar to *M. womersleyi* in having idiosomal plates at the bases of dorsal and ventral setae. It differs from that species in number and configuration of body setae (NDV 122, DS 2.8-4.i.2.10.10.8.6.4.4 in *M. womersleyi*), in larger scutal measurements (AW 49, PW 59, SB 18, ASB 21, PSB 14, SD 35, AP 19 in *M. womersleyi*) and in larger IP (564 in *M. womersleyi*).
Figure 21. *Myotrombicula* n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Figure 22. *Myotrombicula* n. sp. A. Brown, 1991. Dorsal and ventral aspect of idiosoma showing epistral plates.
Myotrombicula n. sp. B Brown 1990. Figure 23.


**Gnathosoma.** Palpal setal formula B/B/NNNnB; palpal claw 3-pronged, 16 long; galeala B, cheliceral blade (18), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae.

**Scutum.** With large puncta, anterior margin straight; posterior margin broadly convex; lateral margins straight; AM base slightly anterior to AL bases; SB anterior to level of PL bases; AM>PL>AL; PW/SD = 1.56; sensillae filiform with smooth basal shaft and branched on distal one-third.

Scutal measurements of holotype: AW 54; PW 64; SB 23; ASB 18; PSB 16; AP 23; AM 33; AL 24; PL 25; sens. 45. **Legs.** IP = 540. Leg I: 190; tarsus (52 X 15), tarsala (21). Leg II: 168; tarsus (37 X 14), tarsala (18). Leg III: 181; tarsus (52 X 14).

**Type data.** Holotype (HK 84-0621-5), Philippine Islands, Negros Island 4 Km N Manjuyod el 50 M ex *Taphozous philippinensis* (Chiroptera: Emballonuridae) female. June 21, 1984 collector P. D. Heideman.
Remarks. *Myotrombicula* n. sp. B is closest to *M. vercammeni* but differs from that species in number and configuration of body setae (NDV 204, DS 2.12.10.8.10.12.16.14.10.8.4 in *M. vercammeni*), in smaller scutal measurements (AM 49, PW 59, SB 18, ASB 21, PSB 14, SD 35, AP 19 in *M. vercammeni*) and in a smaller IP (735 in *M. vercammeni*).
Figure 23. *Myotrombicula* n. sp. B. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palp palp tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.


**Type species.** *Schoengastia americana* Hirst, 1921: 37.

**Diagnosis.** PTF 7B, 7BS or rarely 6B. Galeala N or B. Palpal claw 3-pronged. Chelicera normal with usual tricuspid cap. Eyes 2+2, well developed. Scutum overlapped by cuticular striae, usually on the posterior half. Scutal setae strongly barbed, AM is plumeose or strongly bipectinate. AL and PI setae usually of equal length, if not, AL setae are usually longest. AL setae usually submarginally inserted. Sensillae often globose, rarely clavate. Legs 7-7-7 segmented; segments usually long and slender. Usually 3 genualae on leg I. Nude parasubterminala on leg I is often replaced by a short distinctly barbed seta.

**Included species.**

*Neoschoengastia posekanyi* Wharton & Hardcastle, 1946. Figure 24.


long; galeala N cheliceral blade (40), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. Scutum. Punctate with concave anterior margin; posterior margin with shallow central concavity; lateral margins shallowly concave; AM base slightly posterior to AL bases; SB anterior to mid-point of AL & PL bases; AL>PL>AM; PW/SD = 1.33; sensillae pyraform with setules. Scutal measurements of voucher specimens, mean and range in parentheses: AW (70, 68-71); PW (77, 73-81); SB (44, 42-45); ASB (25, 23-28); PSB (33, 32-34); AP (33, 29-36); AM (50, 47-54); AL (78, 72-81); PL (52, 50-54); sens. (36, 33-38). Legs. IP = 972-999. Leg I: 344-348; tarsus (72 X 23), tarsala (18). Leg II: 290-304; tarsus (63 X 21), tarsala (17). Leg III: 334-362; coxa 1 B; tarsus (75 X 20).

Voucher specimens examined. Mindanao: Kibawalan Malaglag: 3 Mimizuku gurney (14); Limot Davao Prov. Mt. Mayo 1 Macronus striatus, (4). Mindanao Island, site not recorded: 1 Centropus melanops (2), 3 Macronus striaticeps mindanensis (22), 1 Otus bakkamoeana evertti (5), 1 Pitta sordida (8), 1 Prionochilus olivaceus (1), 1 Rhinomyias ruficauda samarensis (2), Negros Island Oriental. 1 Dicaeum hyploeucum (1). Panay Island, Iloilo 1 Muscicapa rufigaster. (1); Palawan Island, site not recorded, 1 host not recorded (1); 1 Muscicapa rufigaster (1).

Remarks. These specimens agree in size, standard measurements and configuration with N. posekanyi. This is a new record for the Philippine Islands.
Figure 24. *Neoschoengastia posekanyi*. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
*Neoschoengastia thomasi*  Radford 1946: 262.

**Diagnosis.** Larvae. **Idiosoma.** Measuring 200X190 in partially engorged specimen. Eyes 2/2, on ocular plate. One pair of humeral setae; 18-20 dorsal idiosomal setae, arranged in irregular rows beginning 4-6+8-10; 2 pairs of sternal setae; 12-14 preanal setae; 6-8 postanal setae; total idiosomal setae 42-48. **Gnathosoma.** Palpal setal formula B/B/BBB/7BS; palpal claw 3-pronged; galeala B. **Scutum.** Lightly punctate with biconcave anterior margin; with shoulders; posterior margin deeply concave; lateral margins concave; AM base slightly anterior to AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD = 1.4; sensillae missing. **Scutal measurements of 1 specimen;** AW 52, PW 72, SB 32, ASB 23, PSB 24, AP 30, AM 36, AL 45, PL 48, sens. missing. **Legs.** IP = 1068. Leg I: 362; tarsus (72X22), tarsala (15), branched subterminala. Leg II: 308; tarsus (63X16), tarsala (16). Leg III: 398; coxa 3B; tarsus (115X12).


**Remarks.** This specimen agrees in size, standard measurements, and configuration with *N.thomasi*  Radford 1946. This taxon was previously reported from the Philippine Islands by Brown and Goff (1988).


**Type species.** *Octasternala taphozousa* Brown, 1990: 115.

**Diagnosis.** Legs all 7-segmented terminating in a pair of claws and a claw like empodium, onychotriches absent. Three genualae I aligned near proximal articulation, genuala II and III; tibiala III absent; subterminala I located near mid-point of tarsal segment, parasubterminala absent; no mastisetae III. Palpal tarsus 4B; palpal claw 3-pronged. Cheliceral blade elongate with tricuspid cap. Eyes 2/2. Scutum punctate with extrascutal posterior lateral setae; sensillae flagelliform, with smooth basal shaft, branched on distal one-third. Eight sternal setae, arranged 2-4-2.


**Remarks.** *Octasternala* n. gen. is similar to the genus *Rudnicula* Vercammen-Grandjean as re-described by Brown, et al., (1988) in having 4B palpal tarsus, 3 pronged palpotibial claw and lacking scutal shoulders. It can be separated from that genus by the proximally displaced subterminala, by the loss of the parasubterminala and tibiala III, and by the lack of striations at the
margins of the scutum. Additionally the sensillae of this taxon are flagelliform with a smooth basal shaft, while those of a range from flagelliform with basal barbs and distal branches to broadly expanded, fanlike with 2 major branches becoming dendritic distally. The genus name indicates the distinct morphology of the taxon.

*Octasternala taphozousa* Brown, 1989 Figure 25.

**Description of species.** Larvae. **Idiosoma.** Measuring 420 x 280 in partially engorged specimen, 260 x 186 in unengorged specimen. Eyes 2/2, anterior 14 diam., posterior 17 x 12., on ocular plate. One pair of humeral setae measuring 40-46; 64-68 dorsal idiosomal setae, measuring 32-37, arranged in irregular rows beginning 6-6-14-12-10+16-20; 8 sternal setae, arranged 2-4-2, anterior 22-23, medium 29-35 posterior 23-29; 46 preanal setae, 22-23 arranged in irregular rows 12-12-10-12; 18-22 postanal setae 16-12+18-22; total idiosomal setae 138-146. **Gnathosoma.** Palpal setal formula B/B/NBB, 4B; palpal claw 3-pronged, 28-30 long; galeala B; cheliceral blade (30), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. **Scutum.** Punctate with straight anterior margin; posterior margin convex; lateral margins straight; AM base slightly anterior to AL bases; PL setae extrascutal; PL>AL>AM; sensillae flagelliform, basal 2/3 smooth, branched on distal one-third. Scutal measurements of holotype followed by those of 2 paratypes in parentheses: AW 58
(56, 60); SB 43 (44, 44); ASB 37 (35, 36); PSB 17 (17, 19); AM 36 (33, 35); AL 38 (41, 46); PL 45 (43, 44); sens. 75 (73, 75). **Legs.** IP = 925-979. Leg I: 315-349; tarsus (90 x 17), tarsala (27), subterminala displaced proximally from usual terminal position, parasubterminala absent. Leg II: 284-326; tarsus (70 x 14), tarsala (27). Leg III: 326-338; tarsus (93 x 12).

**Type data.** Same as for genus cited above.

**Remarks.** The species name reflects the type host. This taxon was previously reported from the Philippine Islands by Brown 1990.
Figure 25. *Octasternala taphozousa*. Brown, 1990. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, sternum; E, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; F, leg II as above; G, leg III as above.
Genus *Parascoschoengastia* Vercammen-Grandjean

*Parascoschoengastia* Vercammen-Grandjean, 1960: 469.

**Type species.** *Neoschoengastia nunezi* Hoffmann, 1944: 221.

**Diagnosis.** Schoengastiini of medium size, scutum punctate, wider than long, with anterolateral shoulders and prominent, convex or biconvex, posterior margin, AP small. Sensilla bases far apart, sensillae fusiform. Eyes, 2/2. PL and AM considerably longer than AL, PL>AM>AL. Nude subterminala, branched parasubterminala, pretarsalae 1 and 2 present.

**Included species.**

*Parascoschoengastia monticola*, (Wharton & Hardcastle, 1946).

Figure 26.

*Parascoschoengastia monticola*, (Wharton & Hardcastle, 1946): 301.

**Re-description of species.** Larvae. *Idiosoma*. Measuring 450 X 360 in partially engorged specimen. Eyes 2/2, anterior 14 diam., posterior 11 diam., on ocular plate. One pair of humeral setae measuring 54-59; 30 dorsal idiosomal setae, measuring 59-69, arranged in regular rows beginning 8.6.6.6+4; 2 pairs of sternal setae, anterior 32-34, posterior 34-38; 30 preanal setae, 27-31; 6-8 postanal setae 35-41; total idiosomal setae 72-74. *Gnathosoma*. Palpal setal formula B/B/NNB/7B.S; palpal claw 2-pronged, 28-30 long; galeala N; cheliceral blade (30-32), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae.
Scutum. Punctate with straight anterior margin; posterior margin broadly convex; lateral margins shallowly concave; AM base slightly anterior to AL bases; SB anterior to level of PL bases; PL>A>LAM; PW/SD = 1.66; sensillae slightly expanded with setae. Scutal measurements of voucher specimens, mean and range in parentheses: AW (57, 53-61); PW (90, 80-96); SB (34, 31-37); ASB (27, 25-27); PSB (27, 25-27); AP (29, 23-32); AM (49, 45-55): AL (33, 31-36); PL (88, 81-90); sens. (68, 64-74). Legs. IP = 760-817 Leg I: 261-286; tarsus (54 x 20), tarsala (36). Leg II: 226-250; tarsus (47 x 17), tarsala (19). Leg III: 272-295; tarsus (68 x 18).

Voucher specimens examined. SU BBM 36 (12) Philippine Islands, Mindanao Island, Davao Province, Kibawalan Malaglag, ex 2 Mimizuku gurney (Tweeddale, 1878), giant scope owl. 04.XI.63 & 03.I.64, parisitope and collector not recorded.

Remarks. Wharton and Hardcastle (1946) described this taxon as Neoschoengastia monticola from birds, Monticola solitarius a rock thrush on Okinawa. Vercammen-Grandjean (1960) transferred it to Ornithacarus, in (1966) to Herpetacarus and in (1966) as a new combination Parascoschoengastia monticola. Wharton and Hardcastle in their original description observed that this species was apparently confined to the rock thrush Monticola solitarius in the vicinity of Okinawa. It has subsequently been reported from Japan, again on M. solitarius from Miyoke and Hachijo Islands by Sasa and Jameson (1954).
The specimens examined key to *P. monticola* and agree with minor differences in standard measurements with that taxon. Comparison with type material reveal these to be virtually identical to *P. monticola* and the minor measurement differences are considered to be regional variations.

This represents a new host and distribution record for this taxon.
Figure 26. *Parascoschoengastia monticola*. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Genus *Rudnicula*  Vercammen-Grandjean


Vercammen-Grandjean (1964) proposed *Rudnicula* as a subgenus of *Trombicula* to accommodate a species of bat-infesting chigger. In 1965, he elevated *Rudnicula* to generic status and replaced the name *T. (R.) tibbettsi* with *T. (R.) tibbi*, having found *T. (R.) tibbettsi* to be a primary homonym of *Trombicula tibbettsi* Brennan and White, 1960. The name of the type species of the genus *Rudnicula* thus became *R. tibbi*. Nadchatram (1968) described *R. becki* and provided a key and additional notes on the genus, which then contained four species. Brown, Goff, and Nadchatram (1988) described a new species *R. leytensis* from pteropine fruit bats on Leyte Island, reassigned three species from other genera and provided a re-diagnosis of the genus.

**Diagnosis.** Bat-infesting Trombiculinae larvae having palpal tarsus 4B; palpal claw 3-pronged; cheliceral blade broad at base, short, with tricuspid cap. Legs all 7-segmented; 3 genualae I, single genuala II & III; tibiala III; subterminala and parasubterminala I; pretarsala I & II; no mastisetae III. Scutum quadrate; sensillae ranging from flagelliform with basal barbs and distal branches to broadly expanded, fanlike with 2 main branches becoming dendritic distally.
Rudnicula n. sp. A, Brown. Figure 27.

Description of species. Larvae. Idiosoma. Measuring 433X365 in partially engorged specimen. Eyes 2/2, anterior 14 diam., posterior 10 diam., on ocular plate. One pair of humeral setae measuring 41-42; 42-44 dorsal idiosomal setae, measuring 40-42, arranged in irregular rows beginning 10-10-8-8+6-8; 3 pairs of sternal setae, anterior 26-28, median 26-28, posterior 26-28; 18 preanal setae, 23-28; 24-26 postanal setae 25-35; total idiosomal setae 82-84. Gnathosoma. Palpal setal formula B/B/NNB/4B; palpal claw 3-pronged, 15-17 long; galeala bifurcate; cheliceral blade (26-218), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. Scutum. Punctate with shallow biconcave anterior margin; posterior margin shallowly convex; lateral margins with overlying striae; AM base even with AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD = 1.71-1.75; sensillae with basal barbs, and tripartite distal branches with secondary dendrites. Scutal measurements of holotype followed by the mean and range of 2 paratypes in parentheses: AW 53 (52, 50-53); PW 72 (74, 72-77); SB 25 (25, 24-26); ASB 27 (29, 27-30); PSB 15 (15, 15-16); AP 36 (39, 36-40); AM 37 (36, 33-39); AL 32 (32, 32-33); PL 56 (59, 56-72); sens. 62(missing). Legs. IP = 708-743. Leg I: 253-278; tarsus (64X19), tarsala (29). Leg II: 214-226; tarsus (52X17), tarsala (28). Leg III: 237-253; tarsus (66X14).
**Type data.** Holotype (HK 84-0622-2) and 2 paratypes (HK 84-0622-1 from Philippine Islands, Leyte Island, 4 Km Sm 1 Km E Inopacan elev. 50 M. ex *Emballonura alecto*, (Chiroptera: Emballonuridae) Col. P. D. Heideman, wing. 22 June 1984.

**Remarks.** *Rudnicula* n. sp. A is near to *R. dimolinae* in having 3 pair of sternal setae. It differs in fPp, standard measurements of the scutum and in number of dorsal idiosomal setae (B\B\NBB; AW 45, PW 64, SB 18, ASB 25, PSB 16, SD 41, AP 34, and 44-60 in *R. dimolinae*).
Figure 27. *Rudnicula* n. sp. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, sternum; E, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; F, leg II as above; G, leg III as above.
Included species.


Gnathosoma. Palpal setal formula B/B/NBB/4B; palpal claw 3-pronged; galeala N or with minute distal branches. Scutum. Lightly punctate with biconcave anterior margin; without shoulders; posterior margin shallowly biconvex; lateral margins with overlapping cuticular striations; AM base in line with AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD = 1.68-1.70; sensillae with coarse basal barbs, divided fanlike distally into 2 main branches, becoming dendritic distally. Scutal measurements of holotype followed by means and ranges of 10 paratypes in parentheses: AW 75 (72, 68-75) PW 77 (83, 75-91) SB 28 (29,28-33) ASB 27 (30, 27-33) PSB 19 (19, 17-21) AP 39 (40, 36-43) AM 46 (49, 46-53) AL 41 (44, 44-50) PL 59 (59, 56-63) sens. 67 (65, 63-67) Legs. IP = 757-916. Leg I: 272-330; tarsus (67X23), tarsala (27-30). Leg II: 221-226; tarsus (52X21), tarsala (24-25). Leg III: 251-333; tarsus (62X16).


Remarks. The species name reflects the type locale. This taxon was previously reported from the Philippine Islands by Brown et al. (1988).

Genus *Sasatrombicula* Vercammen-Grandjean.

*Sasatrombicula* Vercammen-Grandjean 1960: 469.


Vercammen-Grandjean (1960) created the subgenus *Sasatrombicula* with *Trombicula koomori* Sasa and Jameson, 1954 from Japan as the subgenus type. Nadchatram and Mitchel (1965) re-diagnosed the subgenus and included 8 species and Nadchatram and Wilson (1965) added an additional species. Vercammen-Grandjean and Langston (1968) recognized the taxon at the generic level. Examination of chiggers, larval Trombiculidae from the collection of the University of Michigan Museum of Zoology has revealed a new species, *Sasatrombicula* n. sp. A from horseshoe-nosed and fruit eating bat hosts in the Philippine Islands and the presence of Nadchatram and Wilson's *Sasatrombicula keechongi* a previously described species from the Solomon Islands.
**Diagnosis.** PTF 5B. Setae on palpal femur and genu always barbed. Galeala N. Palpal claw 3-pronged. Eyes 2/2, well developed. Scutum subquadrate or quadrate, bearing simple punctae. Sensillae filiform; proximal shaft either smooth or serrated. Scutal setae ciliated. ALs and PLs marginal. Legs 7.7.7 segmented. Leg I with 3, occasionally 2 genualae. Leg III with 2 genualae and a tibia. No femorala or other mastisetae.

_Sasatrombicula_ n. sp. A, Brown Figure 28.

**Description of species.** Larvae. **Idiosoma.** Measuring 440 X 300 in partially engorged specimen. Eyes 2/2, anterior 16 diam., posterior 14 diam., on ocular plate. One pair of humeral setae measuring 51-65; 34-36 dorsal idiosomal setae, measuring 45-58, arranged in irregular rows beginning 6.6.6.6+4-6; 2 pairs of sternal setae, anterior 32-34, posterior 36-43; 30 preanal setae, 27-29; 30-32 postanal setae 36-43; total idiosomal setae 100-104.

**Gnathosoma.** Palpal setal formula B/B/NBB/5B; palpal claw 3-pronged, 20-22 long; galeala N cheliceral blade (36-38), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. **Scutum.** Punctate with bi-convex anterior margin; posterior margin with projection; lateral margins concave; AM base even with AL bases; SB anterior to level of PL bases, near mid-point; PL>AM>AL; PW/SD =1.34-1.36; sensillae filiform with branches on distal 1/3. Scutal measurements of holotype followed by the mean and range of 3 paratypes in parentheses: AW 59 (63, 59-67); PW
68 (70, 66-76); SB 22 (24, 22-27); ASB 25 (29, 25-30); PSB 22 (23, 21-25); AP 38(36, 33-38); AM 63 (59, 54-63); AL 43(42, 40-43); PL 57 (62, 56-72); sens. 50 (-, -). **Legs.** IP = 795-904 Leg I: 299-326; tarsus (81X20), tarsala (27). Leg II: 235-262; tarsus (65X18), tarsala (21). Leg III: 271-316; tarsus (64X18).


**Remarks.** *S. n. sp. A* is close to *S. quatei* described by Nadchatram et. al 1946, from Hipposideros bats from New Guinea. It differs from that species by the lesser number and arrangement of dorsal idiosomal setae (2.8-12.8.6.2.2 in *S. quatei*), by the longer PSB and smaller PW/SD ratio (18-20 and 1.65 - 1.69 in *S. quatei*).
Figure 28. *Sasatrombicula* n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Included species.


**Description of species.** Larvae. *Idiosoma.* Measuring X in partially engorged specimen. Eyes 2/2, anterior 15 diam., posterior 12 diam., on ocular plate. One pair of humeral setae measuring 49-52; 34-38 dorsal idiosomal setae, measuring 45-47, arranged in regular rows beginning 6.6.6.6+8-12; 2 pairs of sternal setae, anterior 32-36, posterior 34-36; 18 preanal setae, 27-33; 20 postanal setae 34-36; total idiosomal setae 78-82. *Gnathosoma.* Palpal setal formula B/B/NBB/7B; palpal claw 3-pronged, 27-30 long; galeala N cheliceral blade (33), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. *Scutum.* Punctate with biconcave anterior margin; posterior margin acute; lateral margins sinuous near base of posteriollaterals; AM base even with AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD = 1.16-1.18; sensillae missing. Scutal measurements of voucher specimen, mean and range in parentheses: AW (54, 51-58); PW (60, 57-63); SB (18, 17-23); ASB (27, 26-28); PSB (23, 23-25); AP (38, 36-40); AM (50, 50-50); AL (38, 36-41); PL (54, 51-58); sens.(missing).**Legs.** IP = 734 =-802. Leg I: 272-311; tarsus (68X21), tarsala (32). Leg II: 225-232; tarsus (52X18); tarsala (23). Leg III: 253-271; tarsus 967X18).

**Voucher specimens examined.** BMOC 83-1600-092.

Remarks. These specimens agree in standard data measurements, configuration and morphology with the previously described *Sasatrombicula keecho* Nadchatram and Wilson, 196 from the Solomon Islands. This represents a new record for the Philippine Islands.

Genus *Schoengastia* Oudemans, 1910.

*Schoengastia* Oudemans, 1910: 86.

**Type species.** *Thrombidium vandersande* Oudemans, 1905: 216.

The genus *Schoengastia*, comprising 25 species in the Asiatic Pacific region, was reviewed by Nadchatram et al. (1980). Subsequently, 5 additional species from New Guinea (Goff, 1981a, 1982a, 1982b) and one species from Australia (Goff, 1981b) were added. Notes on the public health importance of these scrub-itch chiggers and their potential role as vectors of scrub typhus including their ecology are summarized in Nadchatram et al. (op. cit).

Nadchatram and Wooster (1985) described a new species from metropolitan Manila and Brown and Goff described a new species of this taxon from Baguio (1988), expanding the Asiatic species number to 32.
**Diagnosis.** Schoengastiini of medium to large size, Ip = 600-144-. Scutum punctate, sometimes striate on posterior half, or on margins; posterior margin convex, no anterior lateral shoulders. SB line close to that of PL's, sometimes behind them. Sensilla bases not far apart, often close to each other. AL's always longer than PL's, or as long. Sensillae globose, with tiny barbs. Galeala always nude. Chela long and serrate. Palpal claws with two or three prongs. Generally 3 sometimes 2 genualae on leg I. Nude subterminala, parasubterminala, pretarsalae 1 & 2 present. Eyes 2/2. Mastitarsalae often present.

**Included species.**

*Schoengastia baguioensis* Brown & Goff, 1988. Figure 29.


**Type data.** Holotype and 2 paratypes (B 55049) from Philippine Islands, Luzon Island, Baguio, ex Rattus sp., 1964 (parasitope, collection date, and collector not recorded).

**Description of species.** Larvae. Idiosoma. Measuring 384 X 295 in partially engorged specimen. Eyes 2/2, anterior 11 diam., posterior 7 diam., on ocular plate. 1 pair of humeral setae measuring 45-52; 38-40 dorsal idiosomal setae, measuring 41-50, arranged in irregular rows beginning 8-8-8-8+6-10; 2 pairs of sternal setae, anterior 40-41, posterior 30-31; 24 preanal setae, 23-29; 10 postanal setae 27-30; total idiosomal setae 78-80.
**Gnathosoma.** Palpal setal formula B/B/NNB/7BS; palpal claw 3-pronged, 25-29 long; galeala N; cheliceral blade (64), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. **Scutum.** Lightly punctate with shallowly biconcave anterior margin; posterior margin convex; lateral margins shallowly concave; AM base slightly posterior to AL bases; SB posterior to level of PL bases; PL>AL>AM; PW/SD = 1.4-1.5; sensillae globose with numerous minute spicules. Scutal measurements of holotype and the 2 paratypes in parentheses: AW 63 (-, 62); PW 83 (79, 77); SB 23 (22, 24); ASB 27 (27, 27); PSB 28 (27, 28); AP 17 (18, 19); AM 32 (32, 31); AL 58 (61, 63); PL 63 (63, 60); sens. 30 (32, missing). **Legs.** IP = 765. Leg I: 258; tarsus (50 X 20), tarsala (14). Leg II: 233; tarsus (41 X 18), tarsala (13). Leg III: 271; tarsus (54 X 16).

**Remarks.** *Schoengastia baguioensis* can be separated from the majority of members of the genus by the presence of a bifurcate palpal claw (palpal claw simple or trifurcate in most other members). Among species having a bifurcate palpal claw, *S. baguioensis* keys to the couplets for *S. whartoni* Womersley, 1952, *S. roselli* Goff, 1980, and *S. schuffneri* (Walch, 1923) in the key given by Goff (1982). *S. baguioensis* can be readily separated from these three species by the scutal configuration, PW/SD 1.4-1.5 (<1.4
in the other three). It can be further separated from these species by dorsal and ventral body setation, 38-40 dorsal, 24 preanal, and 10 postanal (34 dorsal and 24 ventral in S. whartoni, 28 preanal and 16 postanal in S. roselli, and 16 preanal and 6-8 postanal in S. schuffneri). The species name is derived from the type locality Baguio. This taxon was previously described from the Philippine Islands by Brown and Goff (1988).
Figure 29. *Schoengastia baguiensis*. Brown, 1988. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.

**Diagnosis.** Palpal formula N/N/NBB/7BS; claw 3-pronged; nude galeal seta; flexed cheliceral blade of moderate length (28-31) with 5 to 7 distal teeth. Scutum wider than long with deeply convex posterior margin. DS 32 in number. IP 675-690. Coxae unisetose. Without mastitarsala III. An outstanding feature of this species is the short brush-like AM seta.

**Remarks.** A species of scrub itch chigger, described by Nadchatram and Wooster (1985) collected on black plates at Metro Manila.

Genus Schoengastiella, Hirst


**Type species.** *Schoengastiella bengalensis* Hirst, 1915: 188.

**Diagnosis.** Gahrliepiini of small to medium size. Scutum rather elongate with 2 pairs of lateral setae plus one pair of usurped dorsal setae; sensillae clavate. Eyes present or absent. PSF N/N/NNN/4B, 4BS or 5B, galeala N. Palpal claw 2 or 3-pronged. Genualae 2-1-1 or 1-0-0.
Included species


**Diagnosis. Larvae.** **Idiosoma.** Measuring 272X208 in partially engorged specimen. Eyes 1 pair, on cuticle. One pair of humeral seta; 22-24 dorsal idiosomal setae, arranged in regular rows 4-6-6-4-2; 2 pairs of sternal setae; 12-14 preanal setae; 8-10 postanal setae; total idiosomal setae 46-52. Anal plate present measuring 50X27. **Gnathosoma.** Palpal setal formula B/B/BNN; palpal claw 3-pronged; galeala N. **Scutum.** Lightly punctate with nearly straight anterior margin; without shoulders; posterior margin convex; lateral margins curved; SB anterior to level of PL bases; PW/SD = 0.84; sensillae missing. Scutal measurements of holotype: AW 42, PW1 65, PW2 37, SB 37, ASB 14, PSB 63, AP 27, PPL 50, PPP-1 41, PPP-2 16, AL 22, PPL1 25, PPL-2 21, sens. (missing). **Legs.** IP = 482. Leg I. 174; tarsus (36X18), tarsala (15). Leg II. 145; tarsus (28X16), tarsala (13). Leg III. Tibiala missing; tarsus (36X14).

**Type data.** Holotype from Leyte I., Tambis *Rattus rattus mindanensis* 3.VI.1964.

**Remarks.** The species name is derived from the fact that this is the only species in the *birella* group that has bisetose coxa III. This taxon was previously reported from the Philippine Islands by Brown and Goff (1988).

**Diagnosis.** Larvae. **Idiosoma.** Measuring 326X253 in partially engorged specimen. Eyes unapparent in single available specimen. 1 pair of humeral; 30-32 dorsal idiosomal setae, arranged in regular rows beginning 4, 6; 2 pairs of sternal setae; 30-32 preanal setae; 10-12 postanal setae; total idiosomal setae 76-82. **Gnathosoma.** Palpal setal formula B/N/NNN/4B; palpal claw deeply trifurcate; galeala N; cheliceral blade with a prominent distal notch and a row of 4-5 short teeth. **Scutum.** Lightly punctate with biconcave anterior margin; without shoulders; posterior margin broadly pointed; lateral margins broadly curved; AM not present; SB far anterior to level of PL-1 bases; scutal setae subequal; sensillae missing; PW/SD = 0.96. Scutal measurements of holotype: AW 50, PW1 72, PW2 32, SB 45, ASB 12, PSB 63, AP 31, PPL 61, PPP-1 41, PPP-2 18, AL 23, PPL1 27, PPL-2 25, sens. (missing). **Legs.** IP = 543. Leg I: 199; tarsus (41X19), tarsala (16), papiliform microtarsala. Leg II: 163; tarsus (32X18), tarsala (11). Leg III: 181; tarsus (38X14).

**Type data.** Holotype from Leyte I., Mt Lobi Range from Rattus rattus samarensis collected (no date), 1964. This taxon was previously reported from the Philippine Islands by Brown & Goff (1988a).

**Remarks.** The species name is derived from the dentition of the cheliceral blade. This taxon was previously reported from the Philippine Island by Brown and Goff (1988a).
Genus *Siseca* (Womersley and Audy)

*Siseca* (Womersley and Audy), 1957: 268.

**Type species.** *Trombicula rara* Walch, 1923: 593.

**Rediagnoses of Genus.** Genus: *Siseca* Audy, 1956. Genus type: *Trombicula rara* (Walch, 1923). PTF 7B or 7BS, galeala N. Claw 2-pronged, external claw shorter than internal prong. Chelicerae long with dorsal and ventral subapical tooth. Eyes 2/2. Scutum large and quadrate, with or without slight projection of posterior margin; densely punctate. SB wide apart and inserted close to anterior margin. Sensillae filliform with distal branches. Total body setae less than 45. Legs all 7 segmented, 3 genualae I, an elongate mastitarsala often present.

**Siseca** n. sp. A. Brown. Figure 30.

**Description of species. Larvae. Idiosoma.** Measuring 450X380 in partially engorged specimen. Eyes 2/2, anterior 10 diam., posterior 9 diam., on ocular plate. One pair of humeral setae measuring 65-69; 22 dorsal idiosomal setae, measuring 49-57, arranged in regular rows 6-6-4-2-2; 2 pairs of sternal setae, anterior 36-37, posterior 35-36; 10 preanal setae, 33-36; 4 postanal setae 51-63; total idiosomal setae 42. **Gnathosoma.** Palpal setal formula B/N/NNN/7B; palpal claw 2-pronged, 18-20 long; galeala N, cheliceral blade (49-52), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. **Scutum.** Punctate with biconcave anterior margin; posterior margin broadly rounded with shallow central concavity; lateral margins with slight concavities; AM base posterior to AL bases; SB far anterior to level of PL bases; PL>AM>AL; PW/SD = 1.24-1.25; sensillae flagelliform with branches on distal 2/3. Scutal measurements of holotype followed by the means and ranges of 10 paratypes in parentheses: AW 105 (107, 104-108); PW 108 (111, 108-115); SB 75 (76, 74-78); ASB 31 (30, 29-31); PSB 54 (54, 54-56); AP 41 (43, 41-45); AL 39 (41, 39-45); PL 57 (58, 57-61); sens. 75 (74, 68-85). **Legs.** IP = 923-1050. Leg I: 353-371; tarsus (90 X 21), tarsala (44). Leg II: 280-326; tarsus (70 X 21), tarsala (27). Leg III: 330-371; tarsus (90 X 18).
Type data. Holotype and 9 paratypes (126660) from Philippine Islands, Mindanao District, Camiguin Island, Mt Mambajao, 5-6 K NE Sangsangan, Catorman ex *Brachymales schandenbergi*, 20 May 1967, (parasitope and collector not recorded).

Remarks. *Siseca* n. sp. A can be separated from all other members of the genus by the larger standard data measurements, by the elongation of tarsala I, and II, and by the lack of mastatarsala III. The proposed species name, *S. megarara* reflects the relative size of this taxon. Womersley (1952) remarked that a single specimen collected on boots at Noemfoor Is., Dutch New Guinea had significantly larger scutal standard data than the many others he had studied. He regarded this as belonging to a distinct race or population.
Figure 30. *Siseca* n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Included species.

*Siseca rara* (Womersley and Audy), 1957: 268.


Diagnosis. Larvae. *Idiosoma*. Measuring 410X315 in partially engorged specimen. Eyes 2/2, on ocular plate. One pair of humeral setae measuring; 20 dorsal idiosomal setae, arranged in 5 rows 6-2-4-4-2; 2 pairs of sternal setae; 10 preanal setae; 4 postanal setae; total idiosomal setae 38. *Gnathosoma*. Palpal setal formula B/N/NNN/7B; palpal claw deeply bifurcate; galeala N. *Scutum*. Lightly punctate with biconcave anterior margin; with shoulders; posterior margin convex; lateral margins straight; AM base even with AL bases; SB far anterior to level of PL bases; PL>AM>AL; PW/SD = 0.8-1.0; sensillae filliform, branched in distal one-third. Scutal measurements of means and ranges of 10 specimens: AW 72, 70-76; PW 86,83-92; SB 47,45-49; ASB 15, 13-18; PSB 48, 44-52; AP 32, 29-38; AM 37, 32-40; AL 29, 27-34; PL 40, 37,43; sens. 47, 39-54. *Legs*. IP = 702-752. Leg I: 230-266; tarsus (50X22), tarsala (14-16). Leg II: 222-241; tarsus (40X18), tarsala (11-13). Leg III: 216-219; tarsus (51X16), mastitarsala 42.
Voucher specimens examined. Leyte Island, Mahaplag 1

Remarks. The specimens examined agree in size, standard data and scutal configuration to *Siseca rara* (Womersley and Audy), 1957. This taxon has been previously reported from the Philippine Islands by Philip & Woodward (1946) and by Brown & Goff (1988a).

Genus *Toritrombicula* Sasa


Type species. *Trombicula hasegawai* Sasa et al.,1953: 15.

Diagnosis. PTF 7B or 7B.S. Galea. N. Palpal claw 3-pronged. Chelicera blade-like, broad at base with a simple dorsal tooth. Eyes 2/2, anterior eye very conspicuous, at least 3X greater than posterior eye, strongly sclerotized and dark brown. Scutum rectangular, punctae sparse to fairly dense and very prominent. Sensillae filiform with barbs. Legs 7-7-7 segmented, segments long. 2 genualae on leg I, one genuala each on leg II and III. Nude parasubterminala on leg I replaced by a barbed seta.
Included species.


**Diagnosis.** Larvae. **Idiosoma.** Measuring 863X690 in partially engorged specimen. Eyes 2/2 large and prominent, on ocular plate. One pair of humeral; 42-44 dorsal idiosomal setae, arranged in in irregular rows; 2 pairs of sternal setae; 18-20 preanal setae; 6-8 postanal setae; total idiosomal setae 72-78. **Gnathosoma.** Palpal setal formula B/B/NNB; palpal claw 3-pronged; galeala B. **Scutum.** Lightly punctate and with numerous pore like structures, with nearly straight anterior margin; with shallow shoulders; posterior margin shallowly biconvex; lateral margins curved posteriorly; AM base slightly posterior to AL bases; SB slightly anterior to level of PL bases; PL > AL > AM; PW/SD = 1.66-1.67; sensillae filliform, branched on distal 1/2. Scutal measurements of means and ranges of 10 specimens: AW 66, 61-71; PW 77, 70-83; SB 24, 23-26; ASB 33, 30-35; PSB 14, 12-15; AP 33, 30-36; AM 41, 38-44; AL 42, 38-48 PL 51, 47-58 sens. 52, 48-54. **Legs.** IP = 886-961. Leg I: 300-335; tarsus (69), tarsala (33). Leg II: 250-293; tarsus (56) tarsala (22). Leg III: 313-362; tarsus (72).

**Voucher specimens examined.** Leyte Island: 2 *Centropus* sp. (13) 2.V.1964 and 16.VI Mt. Lobi Range; 2 *Oriolus* sp. (2) 3.V and 14.VI.1964; 1 Chrysocalyptis sp. (1) 13.V.1964 Mt. Lobi Range; 1 *Halcyon* sp. (11)(no date) Mt. Lobi Range; 1 *Irena* sp. (3) 2.V.1964 Mt. Lobi Range; 1 *Irena* sp. (3) collected 2.V.1964 Mt. Lobi Range. Mindanao Island: Cotobat Glan, Mt Tuduk 1 *Centropus melanops*
(2); Cotobato, Tupi Kablon, Mt Matutum: 1 *Pachycephala philippinensis apoensis* (4); Davao Prov. Limont Mati, Mt Mayo: 1 *Halcyon hombroni* (2); 1 *Rhinomyias ruficauda* (7); Kibawalan Malaglag. *Mimizuku gurney* (5); Masawan: 1 *Halcyon hombroni* (1); Mt Kataglad 1 *Musicarpa panayensis nigraloris* (10), 1 *Pachycephala philippinensis apoensis* (10); Mindanao Island, site not recorded: 1 *Centropus melanops* (8), 1 *Lanis validirostrus quartus* (2), 1 *Macronus stiatricps mindanensis* (3), 1 *Otus bakkamoeana evertti* (4). Palawan Island, collection site not recorded, 1 *Pita sordida* (3); 1 *Centropus singuois* (1); 1 *Muscicapa rufigaster* (1).

**Remarks.** The specimens examined agree in size, standard data and scutal configuration to *T. samara* Radford 1953. It differs only in the galeala being branched rather than nude. Type series from Samara Island, also previously reported from Leyte Island by Brown & Goff (1988a).

**Genus Trombicula** Berlese, 1905.

*Trombicula* Berlese, 1905: 155.

**Type species.** *Trombicula minor* Berlese, 1905: 155.

**Diagnosis.** PTF 5 or 6B-B/N-3/2111. Chelicera with a dorsal and a ventral subapical tooth. Eyes 2 + 2. Scutum usually subquadrate with evenly convex posterior margin; rarely rectangular, if so PL corners slightly extended behind line of posterior margin of scutum. AL setae marginal. Scutal punctae
coarse or big so that the pattern produces a verrucose or reticulate effect. Sensillae filiform, with barbs. 2 genualae on leg I, one each on leg II and III. Tibiala III present, without mastitarsala III. A single pretarsala and subterminala.

*Trombicula* sp. Berlese 1905a: 105.

*Specimens examined.* Bohol Island. HK 87-0619-2. ex.

*Hipposiderosis pygmaeus* (1).

*Remarks.* Specimen not identifiably to species. The genus *Trombicula* is the type for the family Trombiculidae.


*Diagnosis.* PTF 7B-N-3-3111. Chelicerae of normal length and width, with ordinary subapical, dorsal and/or ventral tooth. Eyes 2/2. Scutum broadly trapezoidal. PW/SD 1.4. All scutal setae marginal. Sensillae not filiform, but thick to lanceolate, sometimes sensillary stem bifurcate. Two sclerotized bars on tarsus I. Tarsala I approximately 2X as long as tarsala II. No outstanding nude setae on legs and no femorala III.
Vercammen-Grandjean and Brennan (1957) proposed the genus *Trombigastia* to accommodate a group of bat-infesting chiggers having narrowly expanded sensillae that appeared intermediate between Schoengastiiini and Trombiculini. Subsequently, Vercammen-Grandjean (1964) revised the genus *Trombigastia*, and proposed the synonymy of *Trombigastia* with *Riedlinia* Oudemans, 1914. This synonymy was not widely accepted and *Trombigastia* was retained at the generic status by Nadchatram and Dohany (1974). This status is followed in this dissertation.

*Trombigastia* n. sp. A Brown. Figure 31.

Description of species. Larvae. Idiosoma. Measuring 372X245 in partially engorged specimen. Eyes 2/2, anterior 21X17, posterior 15X15, on ocular plate. One pair of humeral setae measuring 46-51; 32-34 dorsal idiosomal setae, measuring 35-41, arranged in regular rows 6.6.6.6.2-4; 2 pairs of sternal setae, anterior 28-34, posterior 26-28; 14 preanal setae, 22-24; 10-12 postanal setae 23-29; total idiosomal setae 62-66. Gnathosoma. Palpal setal formula B/B/BBB/7B; palpal claw 3-pronged, 23-26 long; galeala N, cheliceral blade (37), broad at base, with tricuspid cap; gnathobase punctate, bearing 2 branched setae. Scutum. Punctate with biconcave anterior margin; posterior margin slightly convex; lateral margins shallowly concave; AM base even with AL bases; SB anterior to level of PL bases; PL>AM>AL; PW/SD = 1.35; sensillae narrowly expanded. Scutal measurements of holotype followed by
that of the paratype in parentheses: AW 45 (50); PW 60 (63); SB 21 (22); ASB 25 (24); PSB 24 (24); AP 45 (43); AM 35 (38): AL 30 (31); PL 43 (44); sens. 59 (missing). **Legs.** IP = 746-748. Leg I: 270-270; tarsus (66 X 20), tarsala (27). Leg II: 217-224; tarsus (51 X 18), tarsala (14). Leg III: 254-259; tarsus (65 X 18).

**Type data.** Holotype and 1 paratype (HK 87-0611-2) from Philippine Islands, Negros Island, Dumaguete, elev 10 M, ex *Eonycteris spelaea* (Chiroptera: Pteropodidae), female. Col. J. S. H Klonpen.

**Remarks.** *Trombigastia* n. sp. A is close to both *T. bishopi* and *T. harrisoni*. It differs from both in having smaller scutal measurements (AW 50, PW 72, AP 40 in *T. bishopi* and AW 48, PW 62, AP 38 in *T. harrisoni*), configuration (PSB 16 and 14 in *T. bishopi* and *T. harrisoni*) and in having mastitarsala and mastitibiala III which are not reported in the other two species.
Figure 31. *Trombigastia* n. sp. A. Brown, 1991. A, scutum; B, dorsal aspect of gnathosoma; C, ventral aspect of palpal tibia and tarsus; D, leg I showing specialized setae (measurements in micrometers) and bases of branched setae; E, leg II as above; F, leg III as above.
Genus *Walchiella* Fuller

*Walchiella* Fuller, 1952: 95.

**Type species.** *Trombicula oudemansi* Walch, 1922: 35.

**Type data.** *Trombicula oudemansi* Walch, 1922: 35. Type series from Dutch East Indies ex "rat". Walch, 1923; Fletcher et al., 1928; Hirst, 1929; Mehta, 1937; Gunther, 1941; Radford, 1946.

**Diagnosis.** PTF 7B.S. Galeala N. Palpal claw 2 or 3-pronged. Chelicera with a tricuspid cap. In one species, *W. oudemansi* anterior dorsal portion sometimes with 2 to 4 short teeth. Eyes 2+2, weakly sclerotized in most species. Scuta quadrate, characterized by having PL setae shortest. AL setae marginal. SB widely separated, closer to lateral margins than to each other. Sensillae lanceolate to clavate; strongly barbed. Legs 7.7.7 or 7.6.6 segmented. (On the basis of leg segments, the genus may be separated into two groups - *lacunosa* group which have long segmented legs, and *oudemansi* group which have short segmented legs.) 3 genualae I. Mastitarsala absent.
Included species.

Walchiella oudemansi Walch, 1922: 35.

**Diagnosis.** Larvae. **Idiosoma.** Measuring 340X270 in partially engorged specimen. Eyes 2/2, on ocular plate. One pair of humeral setae; 26-28 dorsal idiosomal setae, arranged in regular rows beginning 3-3-3+3-4; 2 pairs of sternal setae; 28-30 preanal setae; 8-10 postanal setae; total idiosomal setae 68-74.

**Gnathosoma.** Palpal setal formula N/N/NBB; palpal claw 2-pronged; galeala N; cheliceral blade with 3-4 short dorsal teeth. **Scutum.** Lightly punctate with shallow biconcave anterior margin; without shoulders; posterior margin shallowly biconvex; lateral margins straight; AM base slightly posterior to AL bases; SB anterior to level of PL bases; AM>AL>PL; PW/SD = 1.13-1.15; sensillae fusiform covered with prominent barbs. Scutal measurements of means and ranges of 10 specimens: AW 55, 53-57; PW 66, 62-68; SB 32, 31-34; ASB 24, 23-26; PSB 22, 22-23; AP 34, 32-36; AM 35, 31-38; AL 26, 25-28; PL 18, 17-19; sens. on 1 specimen only 41X10. **Legs.** IP =576-608. Leg I: 194-216; tarsus (41X18), tarsala (17-19). Leg II: 171-189; tarsus (34X18), tarsala (12-13). Leg III: 198-243; tarsus (45X14).


Mindanao Island: Masawan, Mt Malindang, Zamboanga del Norte: 7
Apomys insignis bardus (46); 6 Callosciurus mindanensis (34) 20; 1 Nannosciurus surrutilus (10); R. mindanensis (71); 8 R. rabori (49); 2 Urogale evertti (20). Bondo-an: 1 R. (9); 2 R. bagobus (7).

Cabadboran, Balangbalang, Mt Hilotanglong, Agusan, el 160-330 m:
4R. sp. (33); 4R. bagobus (18). Car-can Mad-lan, 14 R. mindanensis (135); 1 R. (6); 3 host not recorded (24). Mt Kataglad: 1 Nannosciurus surrutilus (8); 1 Podogymnura truei (10); 5 R. (31).

Sibahay, 16R. sp. (87); 1 R. exulans (1); 14 R. bagobus (85); 4R. mindanensis (26); 1 R. rabori (7). Dapitan Peak: 1 Apomys insignis bardus (1); 14 Callosciurus mindanensis (107); 2 Nannosciurus surrutilus (14); 12 R. rabori (46); 4 R. mindanensis (9); 5 R. sp. (24); 1 Urogale evertti (10). Hanggose: 2 R. bagobus (3). Siwad: 1 Croccidura sp. (6). Mindanao, collection site not recorded: 1 Dicrurus hottentotus striatus (10); 6 R. (58); 4 R. rabori (25); 13 R. bagobus (86); 17 R. mindanensis (153); 1 R. sp. (10). Siwad: 2 Apomys sp. (4).

Remarks. The specimens examined agree in size, standard data, scutal configuration and cheliceral teeth to W.oudemansi Walch, 1922. This taxon has been previously reported from the Philippine Islands by Brown & Goff (1988a).

Walchiella impar (Gunther) 1939: 85.

Diagnosis. Larvae. Idiosoma. Measuring 295X200 in partially engorged specimen. Eyes 2/2, on ocular plate. One pair of humeral setae; 26-28 dorsal idiosomal setae, arranged in regular
rows beginning 3-2-2+ 3-2, second dorsal seta of row one almost twice as long as other dorsal setae; 2 pairs of sternal setae; 28-30 preanal setae; 8-10 postanal setae; total idiosomal setae 68-74.

**Gnathosoma.** Palpal setal formula N/N/NNN/7B.S; palpal claw 2-pronged; galeala N; cheliceral blade, without teeth. **Scutum.** Lightly punctate with shallow biconvex anterior margin; without shoulders; posterior margin shallowly biconcave; lateral margins straight; AM base even with AL bases; SB anterior to level of PL bases; AL>PL AM all missing; PW/SD = 1.15-1.19; sensillae fusiform covered by distinct barbs. Scutal measurements of means and ranges of 10 specimens: AW 50, 48-51; PW 71, 68-75; SB 33, 32-34; ASB 27, 27-29; PSB 22, 22-23; AP 34, 32-35; AM missing; AL 23, 22-26; PL 14, 13-15; sens. 37X14, only 1 present in this series. **Legs.** IP = 572-639. Leg I: 180-216; tarsus (45X20), tarsala (18-20). Leg II: 176-200; tarsus (35X19), tarsala (18-19). Leg III: 212-225; tarsus (43X18).

Remarks. The specimens examined agree with the description of *W. impar* in having the chelicerae without teeth, dorsal setae not on plates, in having 28-30 dorsal setae with the second and fifth in the first dorsal row being longer than the remaining setae. It differs from *W. impar* as illustrated by Domrow 1962 in having microtarsala I papiliform as well as located proximally and in the palpal setation formula of N/N/NNB vice N/b/BBB. These are considered to be regional variations and that these are *W. impar* (Gunther). This taxon was previously reported from the Philippine Islands by Brown & Goff (1988a).


Diagnosis. Larvae. Idiosoma. Measuring 270X210 in partially engorged specimen. Eyes 2/2, on ocular plate. One pair of humeral setae; 22-24 dorsal idiosomal setae, arranged in regular rows beginning 3-3-3+2-3; 2 pairs of sternal setae; 28-30 preanal setae; 10-12 postanal setae; total idiosomal setae 66-72.

Gnathosoma. Palpal setal formula N/N/BNN/7B.S; palpal claw 3-pronged; galeala N. Scutum. Lightly punctate with shallow biconcave anterior margin; without shoulders; posterior margin shallowly biconvex; lateral margins straight; AM base slightly posterior AL bases; SB anterior to level of PL bases; AM>PL>AL; PW/SD = 1.36-1.43; sensillae fusiform covered with prominent barbs. Scutal measurements of holotype and 10 paratypes, means and ranges in parentheses: AW 58 (55, 52-59); PW 62 (65, 63-69);

Type data. Holotype and 50 paratypes from Leyte I., Mt. Lobi Range ex 5 R.r.mindanensis & 3 R.r.evertti collected V-VI.1964.

Additional voucher specimens. Mindanao Island, Cabadboran, Balangbalang, Mt Hilonghilong, Agusan, el 160-330 m.: 1 R.evertti (10).

Remarks. The species name reflects the type locality. This taxon was previously reported from the Philippine Islands by Brown & Goff (1988a).
PARASITE DISTRIBUTION MAPS AND TABLES
Figure 32. Collection sites, elevations and genera found on Luzon Island, Mindoro Island and Busuanga Island.
Isabela
el 2500 m

Baguio
el 2934 m

LUZON ISLAND
Odontacarus
Ascogyraengastia
Blankaartia
Chiroptella
Gahrlejia (Ripiaspichia)
Leptotrombidium
Schoengasastia

Quezon
el 10 m
Manila
el 10 m

MINDORO

Progresso
el 15 m

BUSUANGA
el 5 m

Gahrlejia (Scrobiculata)

Eutrombicula
Heaslipia
Leptotrombidium
Siseca
Figure 33. Collection sites, elevations and genera found on Negros Island, Cebu Island and Bohol Island.
Whartonia
Diplectria
Leptotrombidium
Microtrombicula
Myotrombicula
Octasternala
Rudnicula
Sasatrombicula
Toritrombicula
Trombigastia

NEGROS
Lake Balinsasayo
el 10 m

CEBU
Mactan
el 25 m

BOHOL

Chiroptella
Trombicula
Rudnicula

Walchia
Leptotrombidium
Microtrombicula

195
Figure 34. Collection sites, elevations and genera found on Samar Island, Biliran Island and Leyte Island.
Figure 35. Collection sites, elevations and genera found on Palawan and Balabac Island.
PALAWAN
Odontacarus
Ascoschoengastia
Cheladonta
Doloisia
Helenicula
Laurentella
Leptotrombidium
Siseca
Toritrombicula
Walchia
Walchiella

Brooke's Point
el 10 m

• Balabac
el 35 m

Hoax
el 100 m
Figure 36. Collection sites, elevations and genera found on Mindanao Island.
### Table 1  Legend.

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TABLE 1 (Cont.) Parasite Distribution by Major Islands  (X = this study, * = previous report)

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TABLE 1 (Cont.) Parasite Distribution by Major Islands  

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Table 2  Legend

\[ R = \textit{Rattus} \text{ sp.} \quad P = \text{Primate} \]
\[ \text{OR} = \text{Other Rodent} \quad S = \text{Sauriana} \]
\[ I = \text{Insectivore} \quad A = \text{Aves} \]
\[ A = \text{Artiodactyla} \quad F = \text{Free living or unknown} \]
\[ C = \text{Chiroptera} \]
### Table 2 Parasite Host Relationships
*(X = this study, * = previous report)*

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Table 2 (Cont.) Parasite Host Relationships

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KEY TO LARVAL TROMBICULIDAE OF THE PHILIPPINE ISLANDS
(GENERA, SUBGENERA & SPECIES)

1. Scutum with 2 anterior median setae; all legs 6 segmented (Leeuwenhoekinae) .................................................. 2

2. Scutum with 1 anterior median seta or none; legs 7-7-7 or 7-6-6 (Trombiculidae) .................................................. 4

3. Scutum with nasus ........................................................................ Odontacarus 3
   Scutum without nasus ................................................................ Whartonia maai

4. Scutum with 4, 6 or 8 setae, anterior median seta always absent .................................................. Tribe: Gahrliepini 5
   Scutum with 3 or 5 setae, anterior median seta always present .................................................. 11

5. With 4 scutal setae, scutum relatively short .................................. 6
   With 6 or 8 scutal setae, scutum elongate ........................................ 9

213
6. Posterior margin of scutum angulate,
inner tarsal claw filiform ........................................... *Walchia fulleri*
Posterior margin of scutum broadly rounded ...... *Ripiaspichia*

7. Cheliceral blade with teeth, no dorsal or
ventral setal plates ...................................................... 8
Cheliceral blade without teeth, dorsal and
ventral setae on expanded plates ................................. *R. n. sp. B*

8. Palpal setation formula B/N/NNN;
   PW/SD = 1.19 - 1.24 .................................................. *R. serrata*
   Palpal setation formual B/N/BNN ;
   PW/SD = 1.59 - 1.72 .................................................. *R. n. sp. A*

9. With 6 scutal setae, scutum punctate .......... *Schoengastiella* 10
   With 8 scutal setae, scutum scorbiculate
   ............................................................................ *G. (Scrobiculata) n. sp. A.*

10. Anal plate sclerotized, cheliceral blade
    without teeth ............................................................ *S. birellasetosa*
    Anal plate not sclerotized, cheliceral blade
    with prominent ventral teeth .................................... *S. dentata*
11. Sensillae expanded (lanceolate to globose) Tribe:
   Schoengastiini ..............................................................................................................12
   Sensillae unexpanded, attenuated, filamentous
   or occasionally distally thickened. Tribe:
   Trombiculini ......................................................................................................................29

12. Coxa I and II always bear a single seta ......................................................... 13
   Coxa II always, and coxa I sometimes multisetose;
   PL seta off scutum ............................................................................................................ Doloisia domrowi

13. Sensillary bases (SB) wide apart, their distance
   separated by at least 1.5X the diameter of a SB.
   Tarsala I inserted approximately halfway between
   base and tip of tarsus ........................................................................................................14
   SB close together, their distance separated by less
   than the diameter of a SB. Tarsala I inserted on distal
   tarsus adjacent to subterminala ........................................................................ Helenicula

14. A portion of scutum, usually posterior half,
   overlapped by cuticular striations.
   Subterminala barbed .......................................................................................................15
   Scutum not overlapped by cuticular striation.
   Parasubterminala nude ...................................................................................................17
15. Scutum posteromargin concave in center, sensillae globose ................................................................. *Neoschoengastia* 16
Scutum with pronounced rounded posterior projection, sensillae fusiform ....... *Parascoshoengastia monticola*

16. Coxa III 1B; Mastitarsala III present ....................... *N. posekanyi*
Coxa III 3 B; Mastitarsala III absent ......................... *N. thomasi*

17. Chelicerae sword-like or blade-like,
always with a row of prominent teeth
on their dorsal aspect .................................................. *Schoengastia* 18
Cheliceral blade without a row of teeth on dorsal aspect, but a dorsal and ventral subapical tooth
often present ........................................................................ 19

18. Tarsal claw 2-pronged, AM setae normal ........... *S. baguioensis*
Tarsal claw 3-pronged, AM setae short
and brush like ........................................................................ *S. crossi*

19. Scutum with AL shoulders; scutal shape
subquadrate to quadrate ........................................... *Ascoschoengastia* 20
Scutum without AL shoulders; scutal shape
rectangular to sub-quadrate .................................................. 23
20. Tibiae and tarsi III normal without exagerated
    subterminal tarsal setae .............................................................. 21
    Tibiae and tarsi III swollen, with exagerated
    subterminal tarsal setae .............................................................. A. tafia

21. Sensillae paddle shaped ............................................................... A. indica
    Sensillae clavate ............................................................................ 22

22. FPT B/B/N-FNN-F, with dorsolateral
    nude seta on femur I ................................................................. A rousetti
    FPT N/N/NNN, no dorsolateral nude seta on femur I ......................
    ......................................................................................... A. krishnani

23. Leg I with 3 genualae, in addition to microgenualae ............. 24
    Leg I with 2 genualae. .................................................................. 27

24. Posterolateral setae on scutum usually the shortest.
    Sensillary bases closer to lateral margins than to
    each other .................................................................................. Walchiella 25
    PL setae longer than other setae. SB closer
    to each other than to lateral margins, two bars
    on tarsus I .................................................................................. Trombigastia n. sp. A.
25. Cheliceral blade with teeth ........................................... *W. oudemansi*
   Cheliceral blade without teeth ........................................... 26

26. Six setae in first dorsal idiosomal row,
   2nd and 5th longer than others ........................................... *W. impar.*
   Setae in first dorsal row equal in length ......................... *W. lobiensis.*

27. Scutum small, eyes absent or rudimentary,
   1 pair; sensilla broadly clavate and covered
   with spines ............................................................... *Cheladonta (Susa) 28*
   Scutum wider than long, with convex or biconvex
   posteromargin; 2 pairs of eye lenses;
   sensillae globose. ..................................................... *Guntheria philippinensis*

28. Galeala branched; standard data ca. AW 50,
   PW 60, SD 31 NDV 135 ................................................... *S. n. sp. A*
   Galeala forked; standard data ca. AW 23,
   PW 38, SD 26, NDV setae 115 ........................................... *S. palawanensis*

29. Scutum always with 5 scutal setae ........................................... 30
   Scutum with more than 5 scutal setae, the
   extra scutal setae marginally arranged behind
   true PL setae ............................................................ *Heaslipia gateri.*
30. Palpal claw 2-pronged, scutum broadly subquadrate, coxa of gnathobase and legs striate punctate ........................................... *Eutrombicula* 31

Palpal claw 3-pronged, coxa of gnathobase and legs usually not striate punctate ........................................... 32

31. External palpal claw always longer than internal prong ................................................................. *E. wichmanni*

Internal palpal claw always longer than external prong ................................................................. *E scincoides*

32. Leg III with 2 genualae ................................................................. 33

Leg III with 1 genualae ................................................................. 37

33. Leg III with 1 femorala. SB very close to posterior margin of scutum ........................................... *Chiroptella* 34

Leg III without femoral. Scutum subquadrate with concave lateral margins, with SB approximately halfway between anterior and posterior margin of scutum ........................................... *Sasatrombicula* 36

34. Scutum with shoulders, fT 7B.S ........................................... *C. (Chiroptella)* 35

Scutum without shoulders, fT 7B ...................... *C (Neosomia)* n. sp. A.
35. Scutal measurements circa; AW 59,
    PW 82, SD 62 ................................................................. C. piercei
Smaller scutal measurements circa;
AW 54, PW 73, SD 49 ................................................................. C. insolli

36. Total body setae < 90; PW < 65 .............................................. S. keechongi
Total body setae > 90; PW > 65 ................................................. S. n. sp. A.

37. Tarsus of leg I with 1 subterminala and 1
pretarsala .......................................................................................... 39
Tarsus of leg I without a subterminala, but
with 2 pretarsalae. Scutum bearing very
coarse punctae ............................................................................. Diplectria 38

38. Total idiosomal setae > 100, FPT beginning B/B .......... D. n. sp. A
Total idiosomal setae < 90, FPT beginning B/N ............... D. calva
39. Scutum somewhat rectangular, posterior margin never angulate, at most broadly convex, PW at least 1.5x greater than SD. Anterior margin without shoulders ........................................ 40
Scutum subquadrate to quadrate, posterior margin at most broadly convex, never angulate, PW less than 1.5X greater than SD ................................................... 47
Scutum with posterior margin broadly U or V shaped, scutum pentagonal or subpentagonal .............. 55

40. Anterior eyes very large (at least 3X greater than posterior eye), conspicuously brown in color, parasubterminala barbed .................. *Toritrombicula samara* Anterior eyes equal to or only slightly larger than posterior, parasubterminala always nude ...................................................... *Leptotrombidium* 41

41. At least PL setae on scutum and some or most of DS modified, foliate or cuneiform .......................... ............................................. *L. (Trombiculindus)* n. sp. A. Scutal setae and DS normal, ciliated or pectinate but not expanded. ...................................................... *L. (Leptotrombidium)* 42
42. Palpal claw bifurcate ....................................................... *L*. n. sp. C  
    Palpal claw trifurcate ..................................................... 43

43. NDV > 60 ........................................................................... 44  
    NDV < 60 ........................................................................... 45

44. Ip > 800, NDV > 80 ............................................................... *L*. n. sp. A  
    Ip < 800, NDV < 70 ............................................................... *L*. fletcheri

45. Dorsal setae 28, 8 in first post humeral row ......................... 46  
    Dorsal setae circa 30, 10 in first post humeral row ..................  
        ...................................................................................... *L*. sandfordi

46. AL setae 40-50, PL 76-90 .................................................... *L*. deliense  
    AL setae 32-37, PL 50-58 .................................................... *L*. n. sp. B

47. SB inserted nearer to line of AL than to line  
    of PL setae ............................................................................ *Siseca* 48  
    SB inserted nearer to line of PL setae or  
    halfway between line of AL and PL setae ............................... 49
48. Standard data: AW > 100, PW > 100, AP > 40, SD > 80; no mastitarsala III ........................................ S. n. sp. A
Smaller standard data: AW < 80, PW < 95, AD < 40, SD < 70, mastitarsala III present ........................................ S. rara

49. AL setae submarginal, scutum with shoulders ................................................................. Myotrombicula 50
AL setae inserted at corners, no scutal shoulders ................................. 51

50. Dorsal and ventral idiosomal setae on prominent plates ......................................................... M. n. sp. A.
No idiosomal setal plates ................................................................. M. n.sp. B.

51. Scutal pitings verrucose or reticulate ............... Trombicula sp.
Scutal pittings normal, sparse or dense ............................................. 52

52. PTF 7B, a distal sclerotized bar on tarsus of leg I ......................................................... Trombigastia n. sp. A.
PTF 4B, no distal sclerotized bar on tarsus of leg I .......................................................... 53
53. With striations at lateral margins of scutum, subterminala and parasubterminala present and distally placed .................................................. *Rudnicula* 54
Without striation at lateral margins of scutum, subterminala proximately displaced, close to mid-point of tarsus, parasubterminala absent ........ *Octasternal taphozusa*

54. Three pairs of sternal setae ................................................. *R. n. sp. A*
Two pairs of sternal setae .................................................. *R. leytensis*

55. Coxa of gnathosome and legs striate punctate.............................................. *Blankaartia acuscutteralis*
Coxa of gnathosome and legs distinctly punctate, never with striae .............................................. *Microtrombicula* 56

56. General shape to scutum between line of AL and PL setae subquadrate. Palpal claw usually 2 pronged .............................................. *M. (Microtrombicula)* 57
General shape of scutum between line of AL and PL setae somewhat rectangular. Palpal claw 3-pronged ................................................................. *M (Eltonellu)* 58
57. Four pair of prominent lateral setae between coxa II and III ........................................... $M. (M.)$ n. sp. A
   No lateral setae between coxa II and III ........... $M. (M.)$ n. sp. B

58. Posterior margin broadly rounded .................. $M. (E.)$ n. sp. A
   Posterior margin acutely V shaped .................... $M. (E.)$ n. sp. B
DISCUSSION

The host parasite, habitat and distributional data will be discussed. Chigger infested hosts that were reported or examined included 45 species of mammals in 39 genera and 5 orders, and in 18 genera and 21 species of birds and 4 genera and species of lizards. Rodents of the family Muridae were found to be the most frequent hosts for chiggers with circa 1,000 individual specimens infested. Approximately 800 of these were of the genus *Rattus*, of which 13 species were represented. Among them *R. mindanensis*, *R. everti*, and *R. palawanensis* were predominant. Eight additional Rodent genera also were represented, 4 each in the families Muridae and Sciuridae, of which both tree and ground dwelling squirrel species, were represented. In the Insectivora both tree and ground dwelling shrew species were represented, as well as one species of hedgehog (Erinaceidae). Of the remaining mammals, one species of Primata, *Macaca philippinensis*, and one species of Artiodactyla, an even-toed ungulate (the mouse deer, *Tragulus nigricans*) was represented. In the Chiroptera, 6 families were represented with 12 genera and 15 species. Of the Sauriana 5 genera and species were represented. Of the Aves 18 genera and 21 species were chigger hosts.

Discussion of host, habitat and chigger relationships presented here are based on previous studies and reports, and on examination of chiggers collected during the early 1960's by workers for the B. P. Bishop Museum, Honolulu and the Silliman University Museum of
Natural History, Negros, Republic of the Philippines, and by workers for the University of Michigan Museum of Zoology, during the early and mid 1980's. Collections were made from circa 50 sites in and around 25 major collection areas (see Figures 1, and 33 - 37 and Table 1). Certain of the genera of chigger mites are cosmopolitan and are represented by numerous species in many parts of the world. *Eutrombicula* and *Leptotrombidium*, are good examples of this. Other genera are restricted in distribution, *Schoengastia* is unknown in the New World and Europe, but is present in Africa, Australia, and Asia and the islands around them. The distribution of chigger genera that occur in the Philippine Islands is represented in Table 3. Wharton (1954) notes that the number of species reported from a given country is more and index of how well the area has been collected and studied, rather than an indication of the actual extent of the trombiculid fauna and accordingly the distribution herein reported may reflect intensity of collection efforts, rather than actual distribution.

Habitats in chigger studies have been termed disturbed or transitional, and undisturbed. Disturbed or transitional habitats are those which consist of scrub or secondary regrowth forest or those which have been altered by human activities as in logging or cultivation, or in some cases, natural occurrences such as landslides, floods or fire. Undisturbed habitats are primary forests, rain forests and alpine grasslands. Collection labels accompanying the material for this study do not provide specific information on
habitat type; however, gazetteer and contour map analysis of major
collection areas put them as in and around pueblos and barrios
where agriculture, rice cultivation and forestry now exist or have
been evident in the past. With the exception of birds and bats,
many of which were netted in primary forest, at least in the 1980's
collection (personal communication), the collection sites are
considered to be in disturbed or transitional habitat.

Crossley, (1960) noted that chigger habitat relationships are
not determined by the activities of the larval stage, but by the
requirements for development of the post-larval stages. The
parasitic chigger stage serves as a mechanism for dispersal and is
frequently recovered from hosts in habitats which are unsuitable
for post-larval development. The ability of the predatory post-
larval stages to survive in a given habitat is the "anchor' holding a
given species of chigger to a given habitat.

Of the 33 genera of chiggers found, 6 principally with Rodent
or Insectivora hosts, have been previously reported as widely
distributed throughout the Pacific Islands and Southeast Asia.
These are Ascoschoengastia, Eutrombicula, Gahrliepia,
Leptotrombidium, Schoengastia and Walchiella. Although showing
a wide geographic distribution, these genera have been generally
reported from similar types of habitats, i. e. disturbed or
transitional, throughout their recorded ranges. Of these
Leptotrombidium was the predominant mammal-infesting genus,
with all 5 orders serving as hosts, as well as occasionally occurring
on birds and lizards. Of the *Leptotrombidium* sp., *L. deliense*, a proven vector of Rickettsial typhus, was predominant in occurring across ordinal host lines, as well as in most collection areas, regardless of altitude, in disturbed or transitional habitats. However, *L. deliense* seems to have a fundamental relationship with secondary trees or true scrub, rather than climax forest. *Leptotrombidium deliense* is obviously a highly adaptable species, for it has been found in several distinctive types of soil, ranging from coralline material to clayey loam and to almost pure humus (Audy 1949). This chigger has been collected in virtually every habitat surveyed in Malaya, with the exception of sandy beaches (Traub and Wisseman 1968), and, along with *L. fletcheri*, has also been found as high as 2100 m elevation in Malaya and 2400 m in Borneo (Traub and Audy 1953). However, it should be noted that since these countries are in tropical latitudes, the temperature at those altitudes is temperate, as is the case in the Philippine Islands. A second species, *L. fletcheri*, also a vector, was encountered much less frequently, represented only on *Rattus* sp. and other rodents. This taxon tended towards higher elevation habitats, although no clear demarkation line was evident. The closely related *L. fletcheri* is nearly as far-ranging as *L. deliense*. This species is not as facultative as *L. deliense* and is primarily found in terrain characterized by grasses and herbs (Philip et al. 1949, Hubert and Baker 1963, Gentry et al. 1963). Both *L. deliense* and *L. fletcheri* may occur together on the same host. This phenomenon of two
closely allied species infesting the same individual host is not uncommon among trombiculids, and this may occur even when the 2 species have different ecological requirements and actually vary considerably in their specific distribution within the general area (Traub and Wiseman 19 ). This was also found in the Philippine Islands. In the genus *Gahrliepia*, the subgenera (*Ripiaspichia*), (*Scrobiculata*) and (*Walchia*) were represented with the previously described *G. (W.) fulleri* the most prevalent occurring on *Rattus* sp. other rodents and lizards. *Gahrliepia* (*Ripiaspichia*) is represented by two new species from *Rattus* and other rodents which are confined to Leyte and Biliran Islands. Also, the previously described *G. (R.) serrata* from *Rattus* is present on Luzon Island. These species were not widespread or numerous. One collection of *G. (Scrobiculata)* was made from a *Rattus* host on Busanga Island. The genus *Schoengastia* was present only on Luzon Island, where it was represented by *S. dentata* from the high elevations of Baguio from a *Rattus* host and by *S. crossi*, collected on black plates at near sea level in suburban Manila. The second most frequently encountered genus, *Eutrombicula*, represented principally by *E. wichmanni*, occurred on *Rattus* sp., lizards and birds; again, irrespective of altitude, and in disturbed or transitional habitats. Its non-occurrence on other Rodents or Insectivores that have a similar habitat with *Rattus* sp. in inexplicable. The genus *Ascoschoengastia* principally *A. krishnani* was also widely encountered throughout the collection sites, confined to rodents,
with the exception of one bat infesting species. Additional mammalian host and distributional data are contained in Tables 1, 2 and 3.

Of the bat fauna, the Chiroptera, members of the genera *Chiroptella* and *Rudnicula* were widely represented, and several new species in both were found, as well as in other genera of the order, as listed in Table 1.

Bird infesting chiggers were not heavily represented in the collections; however, the genera *Toritrombicula* and *Odontacarus* were represented wherever collections were made, along with *Blankaartia* and other mainly mammalian genera.

Current distribution of genera and subgenera by major islands is given in Table 1 with 33 genera or subgenera and 60 species. One of the genera and 24 of the species are new. As reflected in Table 1, the genus *Leptotrombidium*, with Rickettsial transmission capability, is represented on most of the major islands, and where not found the collections were small and consisted only of bats or lizards. This genus, principally represented by *L. deliense*, and to a much lesser extent by *L. fletcheri*, both proven vectors of scrub typhus, doubtlessly exists throughout the Philippine archipelago. Interestingly, the disease entity of scrub typhus or chigger borne rickettsiosis has not been reported to the Philippine Public Health Bureau, nor has this diagnosis been made in any U. S. military personnel who have participated in jungle training there in recent years (personal communications). This
same phenomenon has been noted in Japan and southern China (personal communications). However, in retrospective serological studies subsequently performed in Vietnam and with preserved sera, chigger borne typhus proved to be a leading cause of acute fever of unknown origin among those diagnosed with this catch-all disease entity (Kundin and Jones 1972), (Bremen, et al. 1973). It is likely that cases continue to occur in the Philippines and are routinely treated at a susceptible stage with effective broad spectrum antibiotics, or that the disease runs its course without full diagnostic evaluation. Consequently the disease can not be viewed as obsolete and remains a potential problem if the right set of ecological circumstances occur. Also, the genus *Eutrombicula*, known to cause scrub itch, is widely represented and presumably exists throughout the archipelago as well. Additionally *Blankaartia*, another scrub itch chigger associated with birds around marshes and rice paddies, has been reported and was found in this study. It too presumably exists in marshes and throughout the extensive rice growing regions of the Philippines. Other chiggers capable of causing scrub itch in man are species in the genera *Neotrombicula* and *Schoengastia*, the later being represented in collections studied.

New distributional records for several previously described species were found. *Ascoschoengastia tafia* was found on Palawan Island from *Rattus* sp.; *Neoschoengastia posekanyi*, from Mindanao, Negros, and Palawan Islands from bird hosts; *Parascoschoengastia monticola* from bird hosts on Mindanao;
Sasatrombicula keechongi, from bat hosts on Negros Island; and Diplectria calva, from bat hosts on Negros Island. These new distributions doubtlessly represent parasite radiation along with specific or related hosts, although the site of host origin can not be ascertained from this limited data.

Regarding parasite/host relationships, Table 2 indicates that the genus Leptotrombidium was found to parasitize all groups of animals represented in the study. This is not surprising, as it has been pointed out by Traub and Wiseman (1974) and others that this genus tends to be habitat specific, rather than host specific. This, however, may be misleading as relatively few strictly arboreal forms were available, and infestation of tree dwelling/roosting forms is most likely coincidental.

The genus Leptotrombidium was, however most prevalent on Rattus species. Species of bat chiggers were rarely found on other groups; Chiroptella rarely on Rattus, Rudnicula and Whartonia rarely on birds. The bird associate, Blankaartia, was found only rarely on bats but has previously been reported from marsh mammals. These opportunistic attachments illustrate the survival mechanism of attach to available host. Whether this strategy results in continuation of the life cycle is not definite as habitat, as previously stated, is important to the free living stages, and these might find ecological conditions inhospitable as nymphs or adults in the habitat of an unusual host.
SUMMARY AND CONCLUSIONS

Collections of chiggers from various Philippine Islands made in 1963-65 by workers for the B.P. Bishop Museum, Honolulu, Hawaii and the Silliman University Natural History Museum, Negros, Republic of the Philippines and the University of Michigan Museum of Zoology in 1984-87 were processed and examined. The collection consisted of approximately 15,000 chiggers from approximately 1,000 hosts. Hosts included species of Rattus, other rodents, insectivores, deer, primates, bats, birds and lizards.

Two subfamilies of Trombiculidae were present in the collection the Leeuwenhoekinae and the Trombiculinae.

Chiggers of 33 genera and 60 species were represented in the collection. Of the 60 species 24 are previously undescribed, and 5 previously described species represent new distributional records for the Philippine Islands. Four of the previously described species are of medical importance: Leptotrombidium deliense, and L. fletcheri as vectors of Rickettsia tsutsugamushi and Eutrombicula wichmanni, and Blankaartia acuscutellaria as causative agents of dermatitic trombidiosis.

There was little known of chiggers, hosts, disease and discomfort factors in the Philippine Islands prior to explosive events of World War II.
Morbidity and mortality occurred in U. S. and allied troops in the latter stages of World War II and reports indicate similar problems among Japanese occupying forces.

Early chigger studies revealed the presence of 5 genera with 14 nominal species with distribution data limited to areas of morbidity and mortality.

The current study expands the number of taxa to 33 genera or subgenera and 60 species of which one genus and 24 species are new.

Although this study greatly expands chigger distribution and host associations, vast and diverse regions remain uncollected or categorized as to habitat and doubtlessly the chigger fauna is larger and more diverse than currently reported.
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