Notes on the biology of the neotropical pisaurid, *Ancylometes bogotensis* (Keyserling) (Araneae: Pisauridae)

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Summary

A pair of *Ancylometes bogotensis* (Keyserling, 1877), obtained from Guyana, were mated and three generations of offspring were reared in captivity. The male wraps the female's legs in silk before mating. The female carries the large flattened egg-sac in her palps and chelicerae until shortly before the spiderlings emerge, when she deposits it in a nursery web. These characters all support the inclusion of *Ancylometes* in the family Pisauridae. The epigyne and male palp are figured, and some notes added to previous descriptions.

Introduction

Ancylometes is a genus of large South American hunting spiders (up to 30 mm body length). About 25 species have been described or assigned to this genus, but nothing is known about their biology apart from some brief remarks made by Pickard-Cambridge (1897).

The genus *Ancylometes* Bertkau, 1880 (= *Lycoctenus* F. O. P.-Cambridge, 1897) was originally assigned to the Lycosidae *sensu lato,* and has generally been listed in the Pisauridae: Thalassiinae since Simon (1897). It was transferred to the Ctenidae: Thalassiinae by Lehtinen (1967), and its affinity to the Ctenidae had also been noted by Lucas (1964). It was transferred back to the Pisauridae by Schiapelli & Gerschman (1970) because of the presence of a small third tarsal claw and "similarities" in the female genitalia and mouth parts. This was followed by Brignoli (1983).

Several aspects of the biology of *Ancylometes bogotensis* (Keyserling, 1877) described in this paper indicate its affinity to the Pisauridae. The male and female genitalia of material from Guyana are illustrated, as the species is apparently variable and previous figures are of poor quality.

Material

An adult female and a subadult male of *A. bogotensis* were received from Mr Phillip Nussle on 21 November 1980, having been collected in Guyana earlier that month. The male moulted to maturity on 18 December 1980, and the pair were mated on 5 January 1981. Over the following two years, three generations of eggs and young were produced in captivity, before the stock died out probably as a result of a combination of inbreeding and inadequate feeding.

The original adult female was collected on the bank of a stream *c.* 2 km north of the airstrip at Imbaimadai, Prov. Essequibo, Guyana (60° 17′ W, 5° 44′ N), altitude *c.* 600 m. The bank was sandy, and bare apart from numerous protruding roots, and about 5 m high; the spider was found about 2 m above the water. The stream was on the edge of woodland. The subadult male was collected, with others, on a road entering a sand quarry just north of the airfield at Timahri, Prov. Demerara, Guyana (58° 12′ W, 6° 30′ N). This site was on the lowlands near the coast and about 250 km from the first site. All were collected in early November 1980.

Methods

Adults of *A. bogotensis* were kept in clear plastic boxes measuring 27 × 15 × 9 cm, containing about 1 cm depth of damp peat to maintain high humidity and a few twigs on which the spiders could climb. Some young instars were kept individually in smaller plastic boxes, and the remainder were kept together in the maternal large box until their numbers were reduced by cannibalism. All were kept in a room maintained at a temperature of 24 ± 2°C, with a controlled light cycle of LD 12:12. Early instars were fed on *Drosophila melanogaster* Meigen, and later instars and adults on larvae and adults of *Tenebrio molitor* L. and various species of moths taken in a light trap. There was also considerable cannibalism, especially among early instars, and later instars were also fed some other spiders (*Araneus, Zygiella, Pardosa, Tegenaria* spp.).

Matings were accomplished by putting the male in the female's box, and placing them in total darkness. On only one occasion (when the mating was photographed) was courtship and mating initiated in the light, but on other occasions once the mating behaviour had commenced it continued when a shaded torch was shone across the box. The pairs were separated immediately after mating had been completed.

Description

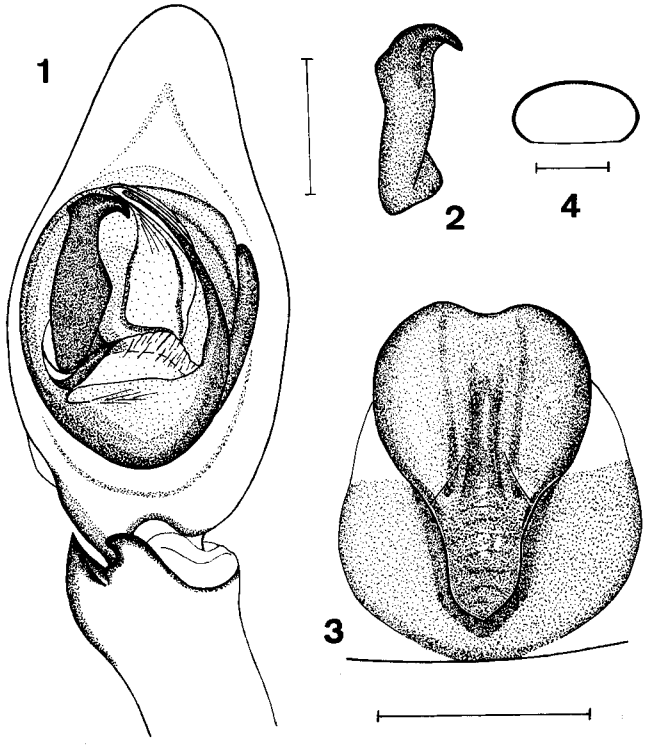
The material from Guyana was compared with the type specimen (♀) of *Ctenus bogotensis* Keyserling and the type specimen (♂) of *Lycoctenus brunneus* F. O. P.-Cambridge from Santarem, Brazil, and also with 4♀ and 1♂ (coll. Godman & Salvin) from Panama determined as *bogotensis* by Pickard-Cambridge (as described by Schiapelli & Gerschman, 1970: 167; all in British Museum (Natural History). The males from Guyana are identical with the latter male, but differ slightly from the male of *brunneus,* most notably in the shape of the palpal unca (cf. Figs. 1, 2). *L. brunneus* was synonymised with *bogotensis* by Strand (1907), synonymy confirmed by Schiapelli & Gerschman (1970). The females from Guyana correspond closely to the type of *bogotensis.* The following notes taken from Guyana material are additional to the description of the female given by Schiapelli & Gerschman (1970). All measurements in mm.

Male: Total length 18.8; carapace length 10.5, width 8.6; abdomen length 8.8. Carapace dark reddish brown. Mostly covered with fine black pubescence, but with broad irregular lateral band of white hairs giving the appearance of a grey band in life, and with a broad band of white hairs extending from ocular region to fovea, ending in a V (Figs. 5-12). Some long hairs in

ocular region. Eye sizes and interdistances: AME 0.46, ALE 0.28, PME 0.53, PLE 0.50; clypeus 0.57; AME-AME 0.28, AME-ALE 0.39, ALE-PLE 0.32, PME-PME 0.21, PME-AME 0.21. Abdomen pale brown above with a pair of dark blotches on shoulders antero-laterally, covered with short dark hairs. Ventrally pale brown with a lighter broad central band from epigastric region to spinners. Sternum reddish brown, covered with long dark hairs. Legs light brown with irregular darker markings, except metatarsi and tarsi uniformly dark brown. Measurements: I: fe 12.5, pa 5.2, ti 12.5, mt 12.7, ta 6.7, total 49.6. IV: fe 12.7, pa 4.5, ti 11.3, mt 14.4, ta 6.2, total 49.1. Femur I l/w 6.1, tibia I l/w 12.3 (at midpoint of articles). Male palp (Fig. 1): No variation among reared siblings, but according to Schiapelli & Gerschman (1970) varies considerably, especially in shape of unca, e.g. that of the type of *L. brunneus* (Fig. 2). Whether some of these variants represent separate species must remain open to question.

Female: Total length 24.8; carapace length 12.3, width 9.8; abdomen length 13.3. Carapace dark reddish brown with faint darker striae and fovea. Covered with fine black pubescence, and with longer hairs in ocular region. Eye sizes and interdistances: AME 0.43, ALE 0.34, PME 0.57, PLE 0.53; clypeus 0.61; AME-AME 0.43, AME-ALE 0.51, ALE-PLE 0.37, PME-PME 0.28, PME-AME 0.32. Abdomen as male but darker, and lighter ventral median band less distinct. Sternum and legs uniform dark reddish brown. Leg measurements: I: fe 10.3, pa 4.9, ti 8.8, mt 7.2, ta 3.9, total 35.1. IV: fe 11.1, pa 4.3, ti 9.4, mt 11.7, ta 4.5, total 41.0. Femur I l/w 3.7, tibia I l/w 6.0. Epigyne (Fig. 3): Varies slightly in shape, even among reared siblings.

Notes: In life, the male appears generally much paler and more clearly marked than the female, but this difference is much less obvious in preserved specimens. The legs of the male are longer and relatively much thinner than those of the female or the males of some other species, e.g. in *A. demerarensis* (F. O. P.-C.) ♂, fe I l/w = 4.8, tibia I l/w = 7.5 (i.e. much closer to *bogotensis* ♀). Voucher specimens from Guyana have been deposited in the British Museum (Natural History), reg. no. BM 1987.7.7.7-8.



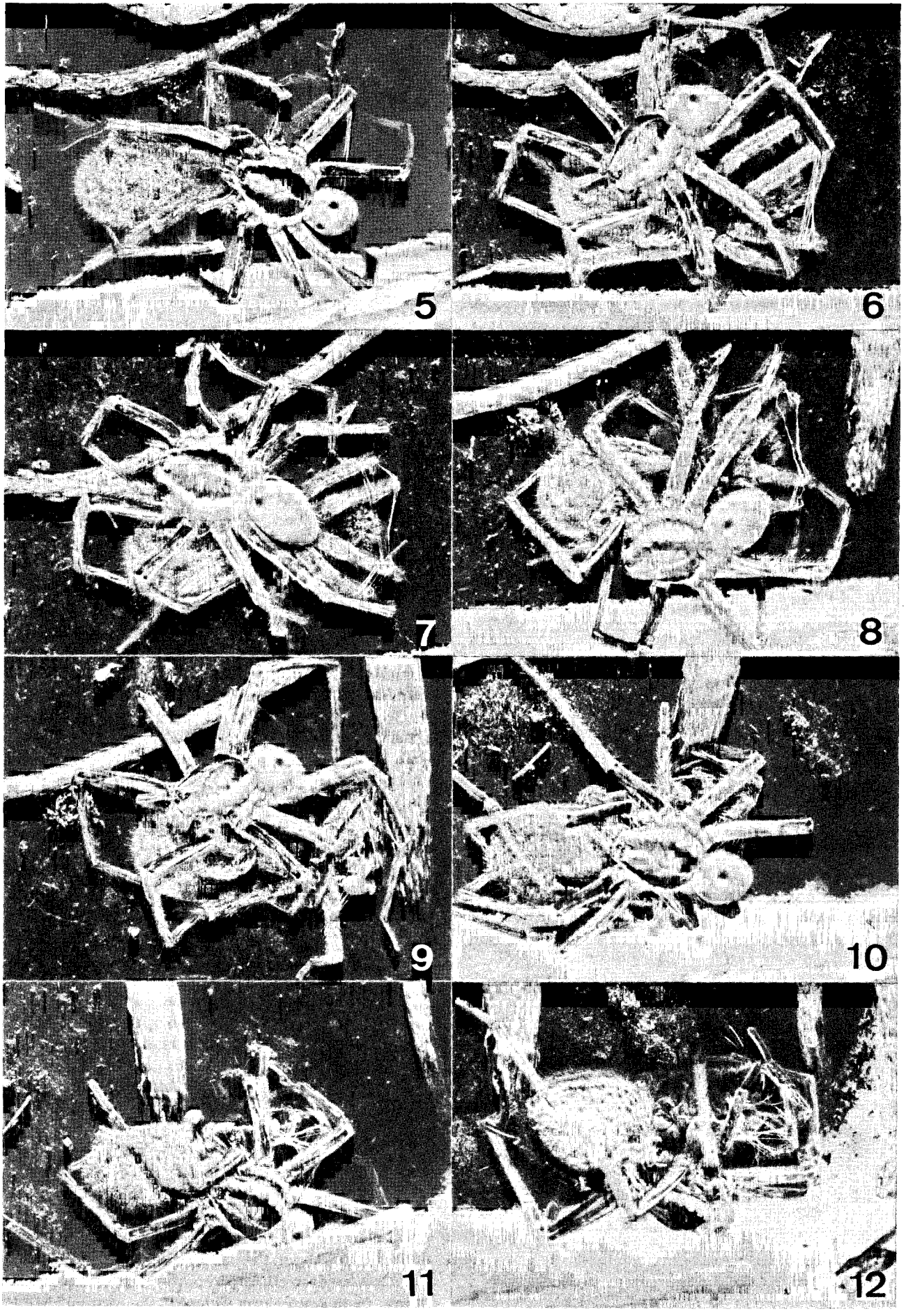
Figs. 1-4: *Ancylometes bogotensis* (Keyserling). **1** Right male palp, ventral view, hairs omitted (Guyana); **2** Palpal unca of type of "*Lycoctenus brunneus* F. O. P.-Cambridge", ventral view, (Santarem, Brazil); **3** Female epigyne, ventral view, hairs omitted (Guyana); **4** Diagrammatic cross-section of egg-sac, to show thick upper-surface and thin under-surface. Scale lines: 1-3 = 1.0 mm, 4 = 10 mm.

Courtship and mating

In all cases, when the male was put in the female's box, the female was sitting on the peat at the bottom of the box, and there were a number of her draglines both on the peat and on twigs higher in the box. The male responded to these draglines by rapid, small amplitude, vibrations of his first pair of legs in the direction of the female, accompanied by a small amount of slow up-and-down movement of his palps. If the female was not receptive, she rapidly lunged at the male and chased him around the box, and in several instances caught and killed him. However, if she was receptive, she soon adopted a passive posture, drawing in her legs close to her body so that the patellae of all her legs almost touched each other above her carapace (as in Fig. 6). The male then advanced, head-to-head, with vibrating front legs, and climbed over her. He immediately began spinning silk threads between the distal ends of her front tibiae (Fig. 5), later circling round to attach similar threads between her second and third pairs of legs (Fig. 6). After completing this "outer ring" of threads he moved around laying down threads further in between her patellae, first anteriorly, then posteriorly, to form an "inner ring" (Figs. 7-9). This whole process took about 15-20 minutes, after which he turned the trussed-up female on one side for mating in the position shown in Figs. 10-11. The mating position was a modified type III (Foelix, 1982), i.e. that used by modern hunting spiders. Each palp was inserted several times, alternately, the mating lasting about 10-15 minutes in total. Figure 12, photographed while the male was resting between insertions, shows the epigyne and the extensive mass of threads between the female's legs II and III.

After the completion of mating, the male rapidly ran away, and the female slowly struggled free from her bonds, and spent 2-3 hours cleaning the silk from her legs.

Only one complete sequence of courtship and mating (which took place in the light) was observed and photographed, but enough was seen of several other matings to establish that the general pattern was consistent. Owing to the difficulties of observation, with activity usually occurring in the dark, it was not



Figs. 5-12: *Ancylometes bogotensis* (Keyserling). Sequence of courtship and mating, showing wrapping of female. **5-9** Female ventral side down, male spinning threads around female's legs; **10-12** Female turned on her right side for mating. For further description see text.

possible to record details of the number of palpal insertions or the precise timing of events. Sperm webs or sperm induction were not seen.

Life cycle

The egg-sac was a flattened disc about 15-18 mm in diameter, with a convex upper-surface of hard, thick, purplish-brown silk, and a flat or slightly hollowed, softer, pale under-surface of thin silk through which the eggs could be seen (Fig. 4). It was carried by the mother in her palps and chelicerae until shortly before the young were due to emerge, when it was deposited in the middle of a large, irregular, nursery web which was spun among the twigs in the box. Two females each produced two egg-sacs, and a third female produced three egg-sacs. No female mated more than once. The mean duration between mating and construction of the first egg-sac was 17.7 days (range 13-24, $n = 3$) and the mean duration between egg-laying and emergence of the young was 22.7 days (range 19-28, $n = 6$). The duration between emergence of the first batch of young and construction of the second egg-sac was 31-34 days ($n = 3$), and between emergence of the second batch of young and construction of the third egg-sac 45 days ($n = 1$). The young, which numbered about 300-400*, remained fairly closely aggregated in the nursery web for 1-2 days, then moulted and began dispersing on their own silk threads. The female moved away soon after the young emerged from the egg-sac. The mean duration of each of the first 6 instars after the first free-living moult was 9.8 days. After that, the duration of instars increased to 3-4 weeks. Males usually reached maturity after 13 moults and females after 14 moults (about 205-230 days after emergence). The duration of the complete life cycle from egg-laying to egg-laying was therefore about 8½ months.

The spiders usually rested on the peat on the bottom of the box with legs spread out, but sometimes rested higher up among the twigs. They normally waited until prey came close, then made a quick lunge to grab it, but would occasionally chase active prey (e.g. moths or spiders) around the box.

Discussion

In view of the widely separated localities, it is rather remarkable that the original female and male proved to belong to the same species. They produced three generations of offspring, and it is most unlikely that the female was mated before capture, because she had been kept in captivity for about 2 months before being mated, and then laid eggs 13 days after mating. Females of later generations never took more than 24 days from mating to egg-laying. Also, all males produced in later generations were identical with the original male.

According to Schiapelli & Gerschman (1970), *A. bogotensis* is widespread throughout Central and South America, but is very variable, and they list 7 other species as synonyms of *bogotensis*. The other 18 described species of the genus are apparently all much more restricted in distribution. In the present state of our knowledge, based on a few scattered collections, there must remain some doubt about the validity of some of these species and synonyms. However, the capture of *bogotensis* in two widely separated localities in Guyana supports the concept of it being a single, widespread and variable species rather than a complex of closely related species. *A. bogotensis* was also recorded from Guyana by Caporiacco (1948).

The most interesting aspect of the biology of *A. bogotensis* is undoubtedly the wrapping of the female by the male before mating. Wrapping of the female's legs I and II has been reported by Bruce & Carico (1986, in press) in the pisaurid *Pisaurina mira* (Walckenaer), but in that species mating takes place while the spiders are suspended on draglines. Apart from this, the use of silk to tie the female has been reported only in *Xysticus* (Bristowe, 1958). In *Xysticus* the female is tied to the substrate, whereas in both *Pisaurina* and *Ancylometes* her legs only are tied to each other.

The mating position of *A. bogotensis* is similar to the type III position used by most hunting spiders, including lycosids and pisaurids (Foelix, 1982), but looks slightly different from normal as a result of the female's legs being trussed-up tightly over her carapace. The mating position of *P. mira* shown by Bruce & Carico (in press) is also slightly different, but this is probably related to the changed orientation resulting from the female hanging on a dragline.

Other aspects of the reproductive biology of *Ancylometes* which indicate relationship with the Pisauridae are the method of holding the egg-sac with the palps and chelicerae, and the construction of a nursery web. Construction of the egg-sac was not seen.

As the total duration of the life cycle in captivity was about 8½ months, it seems likely that there are two generations per year in the wild, where the temperature is probably higher and the food supply more varied. In captivity a large proportion of the brood died as a result of moulting difficulties when about half grown, but it proved to be possible to prevent this by feeding them a few other spiders at intervals during their growth. Probably other spiders contain some essential nutrients which were lacking in the other prey provided. A similar phenomenon has been found when rearing various tropical mygalomorphs.

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*A larger preserved female, probably of *A. bogotensis*, or of a closely related species, received from Venezuela, was carrying a similar egg-sac 20 mm in diameter which contained 930 eggs. Possibly the captive females produced fewer eggs than they would in the wild.

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Brignoliella ratnapura, n. sp., and an enigmatic new structure in spiders (Araneae, Tetrablemmidae)

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Introduction

Since my early survey of the family (Shear, 1978), numerous new species of tetrablemmid spiders have been discovered in tropical regions (e.g. Deeleman-Reinhold, 1980; Bourne, 1980), and a much more comprehensive review has been published (Lehtinen, 1981). The tetrablemmids are emerging as a major spider family in the tropical forest litter habitat.

In most tetrablemmid genera, sexual dimorphism is pronounced, and takes the form of strong modifications of the chelicerae, anterior legs, and carapaces of males. In the genus *Brignoliella,* for example, the male carapace is distinctly raised, often almost box-like, there is a clypeal horn, and the chelicerae bear anteriorly projecting spurs (Fig. 1). Previous authors have mentioned in passing another dimorphism not known in other spider families: the male tarsi I are swollen, pyriform, or spindle-shaped (Fig. 2). Herein a detailed description of this neglected aspect of sexual dimorphism is provided, illustrating for the first time modified setae, probably chemosensory, located on the ventral surface of the enlarged tarsi (Figs. 4, 5).

Family TETRABLEMMIDAE O. P.-Cambridge

Subfamily **Brignoliellinae** Shear

Genus *Brignoliella* Shear

***Brignoliella ratnapura,* new species** (Figs. 1-5)

Type: Male holotype (American Museum of Natural History) from leaf litter in Ratnapura Peak wilderness area, Sri Lanka, collected 5 November 1979 by W. Sedgwick.

Diagnosis: Unique in the details of the male palpus, which has an unusually swollen tibia (Fig. 3), abruptly narrowed distally, to provide an almost pyriform impression. No other described species of *Brignoliella* has the swollen first tarsi with special setae (but see footnote below).

Male holotype: Length 1.56 mm. Carapace 0.86 mm long, 0.55 mm wide (length measurements include clypeal horn). Unsclerotised areas of abdomen white, otherwise dark orange-brown. Clypeal horn and cheliceral teeth black.

Structure typical for genus. Carapace (Fig. 1) with cephalic part strongly raised, box-like, raised region with 16 marginal setae. Eyes six, on distinct tubercles, median eyes nearly touching, separated from posterior