2003. The Journal of Arachnology 31:157–172

SPIDERS OF THE GENUS *TETRAGNATHA* (ARANEAE, TETRAGNATHIDAE) IN THE SOCIETY ISLANDS

R.G. Gillespie: Division of Insect Biology, University of California Berkeley, 201 Wellman Hall, Berkeley, CA 94720-3112, USA.

ABSTRACT. This study revises the status of knowledge of the spider fauna of the Society Islands. Until recently, the literature on the spider fauna in these islands has suggested that the genus *Tetragnatha* in particular is noticeable for its poor representation in comparison with the large radiation in the Hawaiian Islands. Expeditions were conducted to determine whether this genus is indeed poorly represented in the islands as the literature would suggest. The results indicate that the islands actually have a number of endemic *Tetragnatha*, although there is no noticeable adaptive radiation as is seen in the Hawaiian Islands. Results of field expeditions in 1999–2000 and studies on historical collections have shown that: (1) Reports of the cosmotropical species *T. mandibulata* in the Society Islands are probably not valid; these were misidentifications for either *T. macilenta* or *T. nitens*. (2) *Tetragnatha huahinensis* is a synonym of *T. macilenta*. (3) There are three new species of *Tetragnatha*, all of which are described here and appear to be endemic to middle and high elevations of the Society Islands (from Tahiti, Moorea and Raiatea). In total, there are six species of *Tetragnatha* in the Society Islands: in addition to the three endemic species there is one possibly indigenous (*T. macilenta*), and two that may be of more recent introduction (*T. nitens* and *T. maxillosa*).

Keywords: Tahiti, Moorea, Pacific, descriptions, biogeography

The Society archipelago consists of six high islands (Fig. 1). The archipelago is remote, 400 km from the nearest island group and 6,000 km from the nearest continental landmass (Australia). In common with the other remote Polynesian archipelagoes of Hawaii and the Marquesas, the Society Islands are all volcanic in origin and formed as volcanic hot spots. All three archipelagoes exhibit a chronological arrangement of islands. In Hawaii, the islands range from Kauai, the oldest in the north at 5.1 myrs, to Hawaii, the youngest in the south at up to 0.4 myrs old. The Society Islands range from Bora Bora, the oldest in the north at 3.3 myrs, to Tahiti, the youngest in the south at 1.0 myrs. The similarity between the islands of Hawaii, the Marquesas and Societies is not limited to their geological history, but may also extend to certain elements of the indigenous arthropod fauna (Meyrick 1935).

To date, knowledge of the spider fauna of the Society Islands has shown little in common with the Hawaiian Island chain, though it has been very little studied. What is known can be attributed largely to the initial efforts of L. Koch (1872) and subsequent work by Berland (1927, 1929, 1933, 1934a, 1934b, 1934c, 1935a, 1935b, 1935c, 1938, 1942) from the Muséum National d'Histoire Naturelle (MNHN) in Paris, with some of this information being summarized by Marples (1957). Berland (1934b) described knowledge of the spider fauna of Tahiti as follows (in translation):

''In spite of its universal prestige, especially in literary work, the fauna of this archipelago is poorly known. In all, there are approximately 15 known species as follows: *Pholcus ancoralis*, *Cyrtophora viridipes*, *Araneus theisi*, *Heteropoda regia*, *Corinna cetrata*, *Thorellia ensifera*, *Plexippus paykulli*, *Bavia aericeps*, *Athamus whitmeei*, *Mollica microphthalma and pusilla*, *Hasarius albocircumdatus*, *Ascyultus pterygodes*, and *Lauharilla insulana*. It is obviously very little: there is almost no trace of endemism. Given what is known of archipelagoes close to the Societies, and that the species above are clearly Polynesian (excluding cosmopolitans, of course), one can conclude that Tahiti has not been sufficiently explored. It is not possible currently to affirm a real poverty of fauna, and we should await other investigations. What is significant above all, it is that the islands fit well in the Polynesian group.''

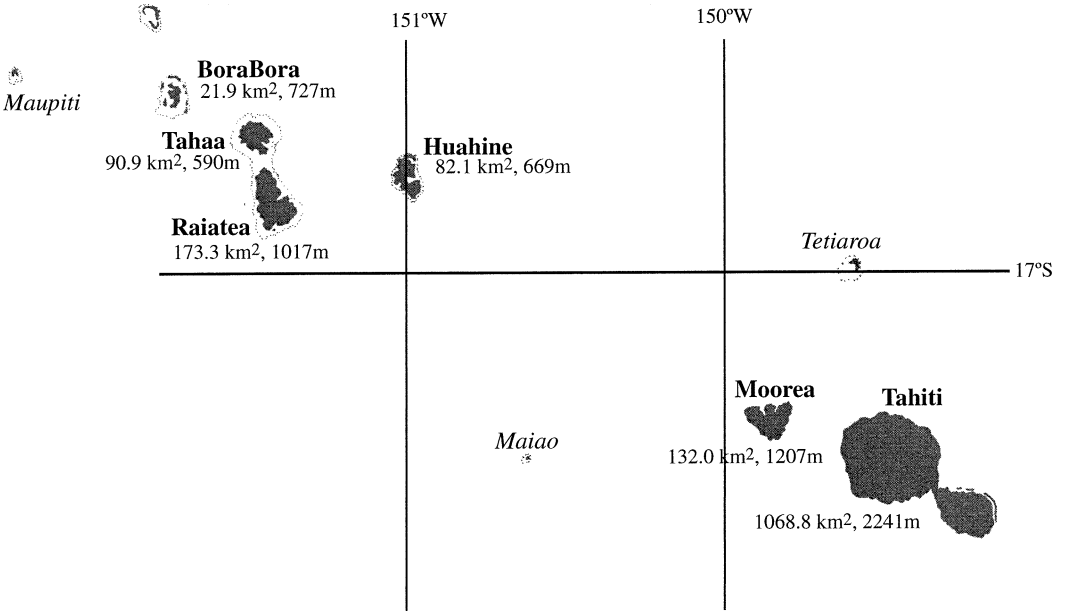


Figure 1.—Map of the Society Islands. Area and elevation are given for each of the main islands.

This statement is a reasonable reflection of the knowledge of the spider fauna of the Society Islands (Marples 1957) before the expeditions in which I was involved in 1999–2000. Prior to these expeditions, the only species of *Tetragnatha* reported from the Society Islands were *T. macilenta* L. Koch, *T. huahinensis* Berland, *T. maxillosa* Thorell, and *T. mandibulata* Walckenaer. The only reported endemic was *T. huahinensis*. The current study set out to reassess the distribution of *Tetragnatha* in the islands and determine whether the lack of representation was due to insufficient collecting, or whether it represented a real paucity of species.

I have now collected on Tahiti, Moorea, Raiatea, and Bora Bora. I have also examined collections at the MNHN, the Museum für Naturkunde der Humboldt-Universität, Berlin (ZMB), the British Natural History Museum, London (BMNH), and the Bishop Museum, Honolulu (BPBM).

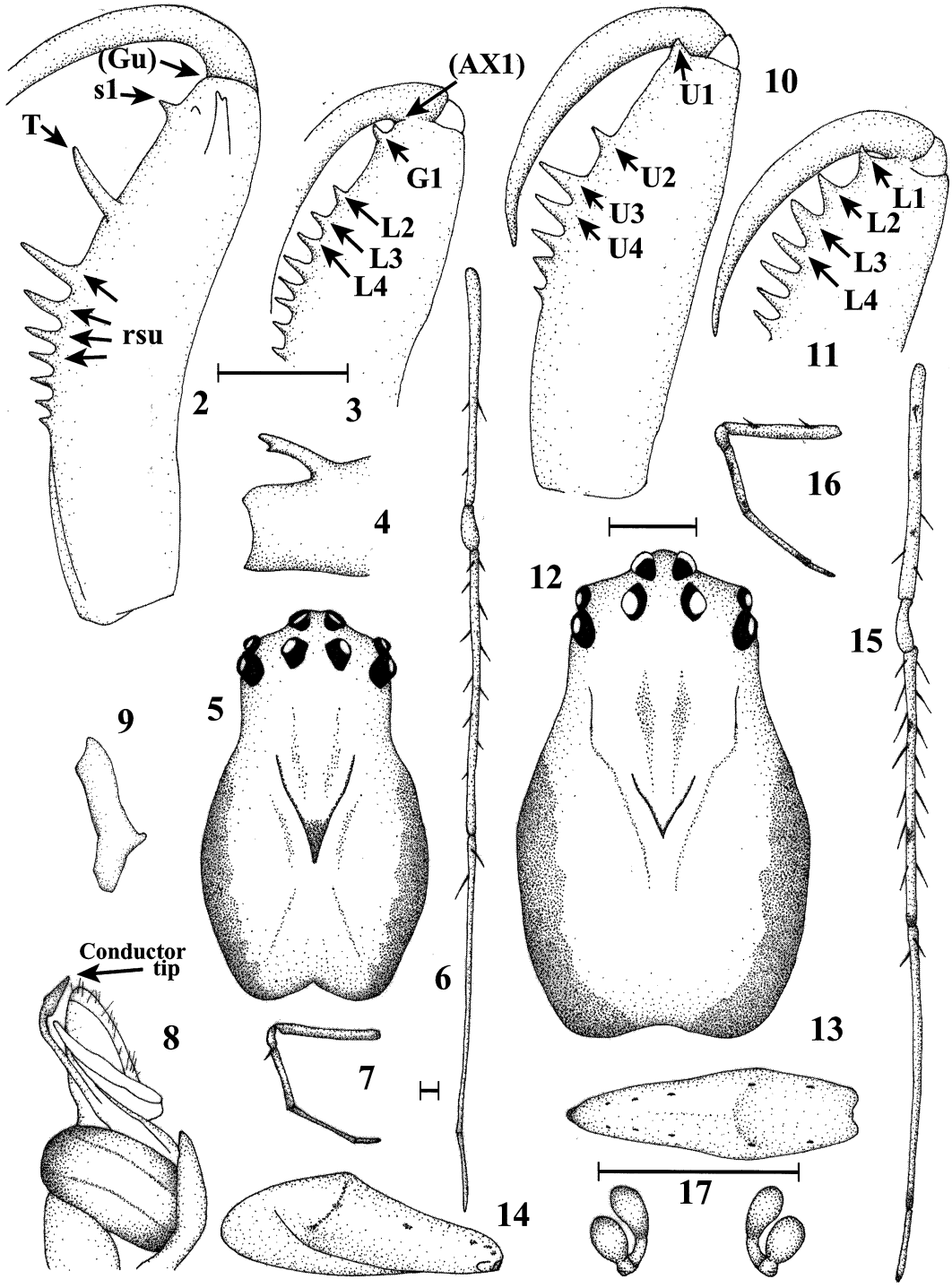
METHODS

Characters examined.—Morphological measurements taken were the same as those described in Gillespie (1991): genital morphology, arrangement of eyes; cheliceral tooth pattern; form and setation of the first and third legs; and form and pattern of the dorsum and carapace. In order to estimate variability within a taxon and determine which features best characterize a species, where possible measurements were taken on six individuals of each sex of each species with additional observations on other individuals once diagnostic characters had been identified.

Terminology.—The terminology for the teeth on the cheliceral margins of the males is that used in previous papers (Gillespie 1991; Figs. 2, 3, 8, 10, 11). Setation on femora, tibiae and metatarsi of legs I & II is denoted by: fI, fIII, tI, tIII, mI and mIII. CITR refers to the cheliceral inter-tooth ratio, the ratio of 3 lengths: (1) between distal end of male chelicerae to sl; (2) s1 to T; and (3) T to rsu1. All new holotypes have been deposited in the BPBM and all paratypes will be deposited in the Essig Museum of Entomology of the University of California, Berkeley (EMUC). Most of the recent collections were performed by the author (RGG) and George Roderick (GKR). Unless indicated otherwise, all measurements are in mm.

DISCUSSION

Three new species of *Tetragnatha* that appear to be endemic to the Society Islands are described: *T. rava, T. moua*, and *T. tuamoaa*.



Figures 2–17.—*Tetragnatha rava*: Male holotype. 2. Promargin of right chelicera; 3. Retromargin of left chelicera; 4. Dorsal spur of right chelicera, lateral; 5. Carapace, dorsal; 6. Right leg I, dorsal; 7. Right leg III, prolateral; 8. Left palpus, ventral; 9. Left paracymbium, lateral. Female allotype. 10. Promargin of right chelicera; 11. Retromargin of left chelicera; 12. Carapace, dorsal; 13. Abdomen, dorsal; 14. Abdomen, lateral; 15. Right leg I, dorsal; 16. Right leg III, prolateral; 17. Seminal receptacles, ventral. Scale bars = 0.5; that between Figs. 2 & 3 applies to Figs. 2, 3, 4, 10 & 11; above Fig. 12 applies to Figs. 5 & 12; between Figs. 6 & 7 applies to Figs. 6, 7, 13, 14, 15 & 16; at Fig. 17 applies to Figs. 8, 9 & 17.

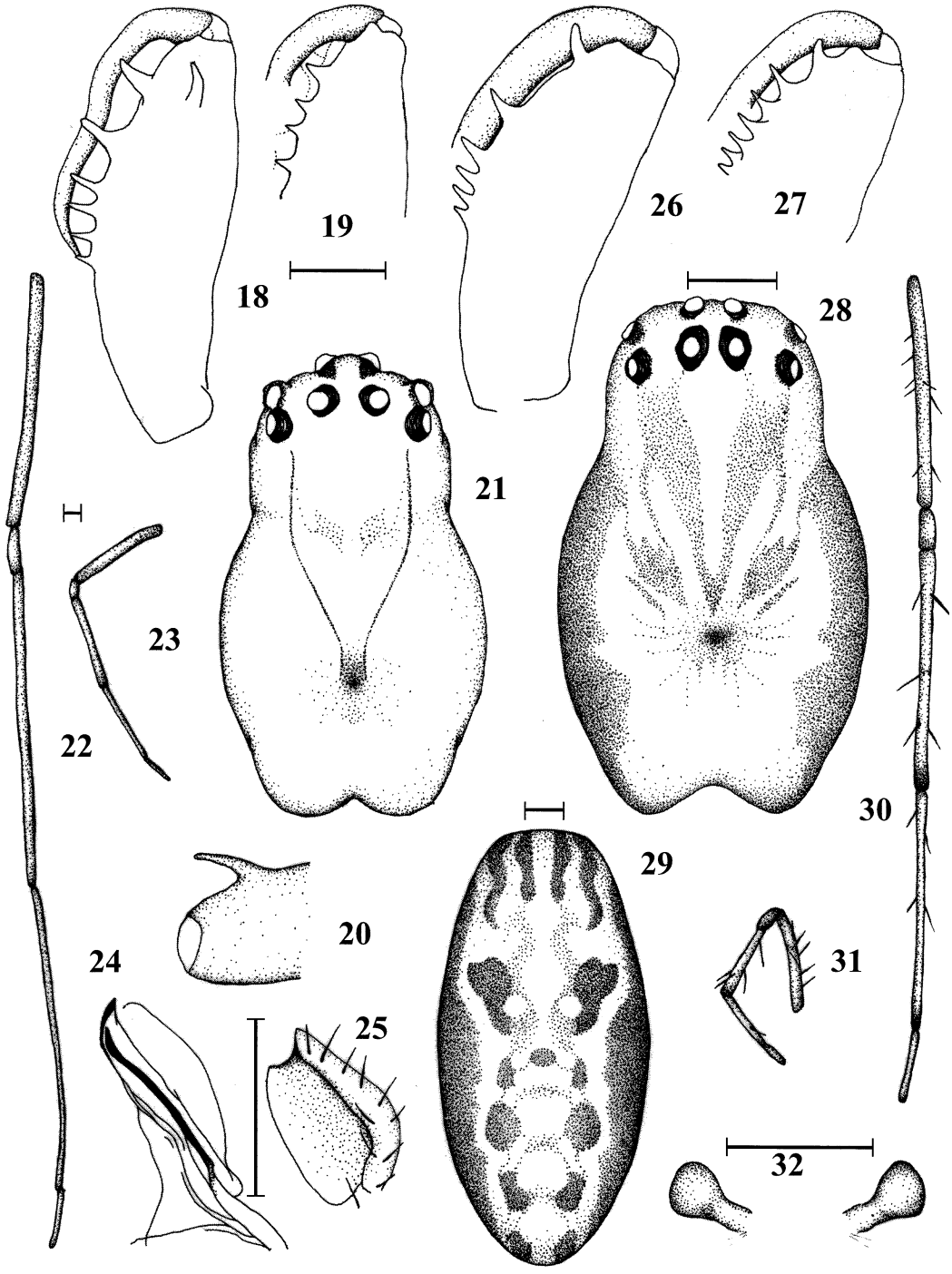
There are three additional species in the archipelago, none of which is endemic; *T. macilenta* is widely distributed in the western Pacific; it may be indigenous to the Society Islands. *T. maxillosa* and *T. nitens* are also widely distributed from the tropical Pacific, and these may represent more recent introductions. Other designations of species to the Society Islands appear to be incorrect. There is no indication that *T. laqueata* or *T. mandibulata* occur in the islands. *T. huahinensis*, which was described as a new species unique to the island of Huahine, appears to be a synonym of *T. macilenta*.

KEY TO SPECIES

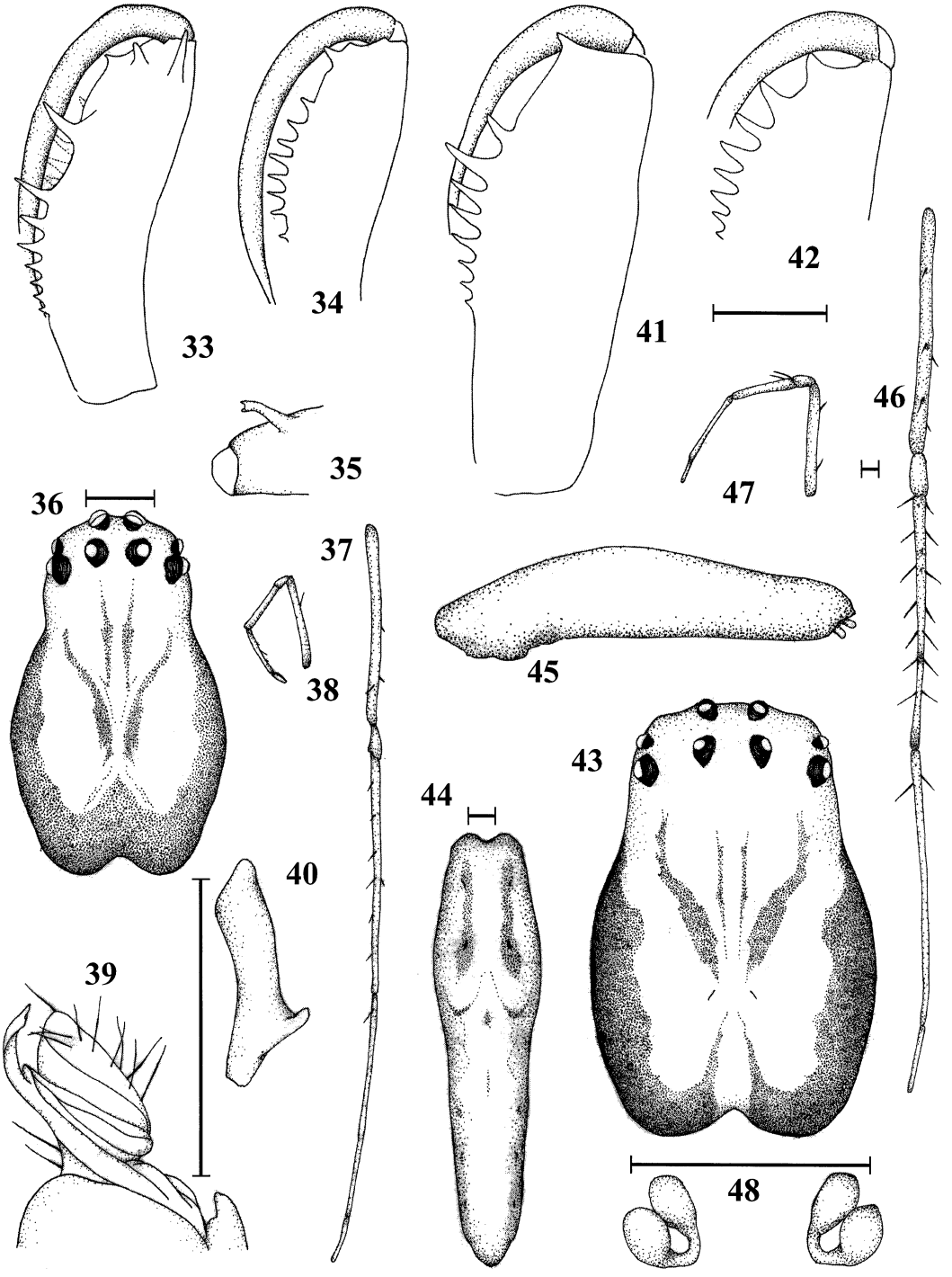
1. Anterior and posterior eye rows strongly recurved (Figs. 65, 72); abdomen very long, 6–10 times as long as broad (Figs. 66, 77) ..... *T. macilenta*
   Anterior and posterior eye rows not strongly recurved (Figs. 5, 12, 21, 28, 36, 43); abdomen ≤ 4 times as long as broad 2
2. Males 3
   Females 7
3. Dorsal spur of chelicerae and first two marginal teeth (s1 and T) all large and clustered near apex of chelicerae (Levi 1981, p. 299, fig. 31; Okuma 1987, p. 84, fig. 31a) .. *T. nitens*
   Dorsal spur of chelicerae and first two marginal teeth not clustered (Figs. 2, 18, 33) 4
4. First two marginal teeth (s1 and T) large, much longer than remaining marginal teeth, and well separated; conductor cap broad and hooked, shaped much like the head of a vulture (Okuma 1987, p. 83, fig. 30 a & b). ..... *T. maxillosa*
   s1 similar in length (Fig. 18) or smaller (Figs. 2, 33) than at least first of remaining marginal teeth (rsu) 5
5. First large marginal tooth (s1) similar in size to second (T) (Fig. 18). Conductor broad, with a very slight curl at tip (Fig. 80) ..... *T. moua*
   First marginal tooth (s1) much smaller than second (T) (Figs. 2, 33). Conductor curved over well below tip (Figs. 79, 81) 6
6. Conductor pointed at tip (Fig. 79) ..... *T. rava*
   Conductor rounded at tip (Fig. 81) ..... *T. tuamoaa*
7. Very strong apical teeth on both upper and lower margins of chelicerae, projecting out (approximately at right angles) from cheliceral margin (Okuma 1987, p. 83, figs. 30e, f) ..... *T. maxillosa*
   Apical teeth similar in size or smaller than remaining cheliceral teeth (Figs. 10, 26, 41) 8
8. Prominent tooth at apex of underside of chelicerae pointing straight up, parallel to cheliceral margin (Levi 1981, p. 299, fig. 25; Okuma 1987, p. 84, fig. 31 h) ..... *T. nitens*
   No prominent tooth at apex of underside of chelicerae (Figs. 10, 26, 41) 9
9. Abdomen little more than 2× as long as broad (Fig. 29). ALEs similar in size to PLEs (Fig. 28). Seminal receptacles single large bulbs (Fig. 32) ..... *T. moua*
   Abdomen approximately 4× as long as broad (Figs. 13, 44). ALEs smaller than PLEs (Figs. 12, 43). Seminal receptacles with two lobes (Figs. 17, 48) 10
10. Anterior median eyes closer together than posterior median eyes (Fig. 12); connection between bulbs of seminal receptacles long, looped below lower bulb (Fig. 17) ..... *T. rava*
    Anterior median eyes about same distance apart as posterior median eyes (Fig. 43); connection between bulbs of seminal receptacles fairly short, direct (Fig. 48) ..... *T. tuamoaa*

Tetragnatha rava new species
(Figs. 2–17, 79)

Type data.—Holotype male from Tahiti: Tahiti Iti, Mt. Teatara, 650m, 17.79°S, 149.25°W, 7 July 2000, RGG and GKR (BPBM). Paratypes (all in EMUC): Tahiti: 2 males, 2 females, 1 immature, Belvedere: 580 m, 17.57° S, 149.56°W, 19 November 1999, RGG; 2 males, 2 females, 12 immatures, Tahiti Iti, Mt Teatara, 650 m, 17.79° S, 149.25°W, 7 July 2000, RGG and GKR.



Figures 18–32.—*Tetragnatha moua*: Male holotype. 18. Promargin of right chelicera; 19. Retromargin of left chelicera; 20. Dorsal spur of right chelicera, lateral; 21. Carapace, dorsal; 22. Right leg I, dorsal; 23. Right leg III, prolateral; 24. Distal end of left palpus, ventral; 25. Left paracymbium, lateral. Female allotype. 26. Promargin of right chelicera; 27. Retromargin of left chelicera; 28. Carapace, dorsal; 29. Abdomen, dorsal; 30. Right leg I, dorsal; 31. Right leg III, prolateral; 32. Seminal receptacles, ventral. Scale bars = 0.5; that between Figs. 18 & 19 applies to Figs. 18, 19, 26 & 27; above Fig. 28 applies to Figs. 21 & 28; between Figs. 22 & 23 applies to Figs. 22, 23, 30 & 31; above Fig. 29 applies to Fig. 29; between Figs. 24 & 25 applies to Figs. 24 & 25.



Figures 33–48.—*Tetragnatha tuamoaa*: Male holotype. 33. Promargin of right chelicera; 34. Retromargin of left chelicera; 35. Dorsal spur of right chelicera, lateral; 36. Carapace, dorsal; 37. Right leg I, dorsal; 38. Right leg III, prolateral; 39. Distal end of left palpus, ventral; 40. Left paracymbium, lateral. Female allotype. 41. Promargin of right chelicera; 42. Retromargin of left chelicera; 43. Carapace, dorsal; 44. Abdomen, dorsal; 45. Abdomen, lateral; 46. Right leg I, dorsal; 47. Right leg III, prolateral; 48. Seminal receptacles, ventral. Scale bars = 0.5; that between Figs. 41 & 42 applies to Figs. 33, 34, 35, 41 & 42; above Fig. 36 applies to Figs. 36 & 43; between Figs. 46 & 47 applies to Figs. 37, 38, 46 & 47; that between Figs. 39 & 40 applies to Figs. 39 & 40; that above 44 applies to Figs. 44 & 45.

Etymology.—The specific epithet, regarded as a noun in apposition, is the Tahitian word for ''brownish'' and refers to the light brown coloration of these spiders.

Diagnosis.—*Tetragnatha rava* is most similar to *T. tuamoaa* on Moorea. It differs in having the two anterior median eyes closer together than the two posterior median eyes (Figs. 5 & 12), while the median eye pairs are similarly well separated in *T. tuamoaa*; by having a sharper point to the conductor of the male palp (Fig. 79 compared to Fig. 81); and by having a longer connection between the bulbs of the female seminal receptacles (Fig. 17, compare to Fig. 48).

Description.—*Holotype male:* (Figs. 2–9, 79) Length of carapace 2.2, total length 8.2. Chelicerae 94% length of carapace. Cheliceral fang slightly shorter than base, bent over at both proximal and distal ends. Promargin of chelicerae (Fig. 2): Gu absent, but very small tooth present dorsal/lateral to sl; distance between apex and s1 much less than between s1 and T, CITR approx. 0.2:0.5:0.3; s1 small point, longer than wide (approximately half width and 25% height of T); T large, pointing slightly up and out from margin of chelicerae; rsu 7 straight spikes, decreasing in size. Retromargin of chelicerae (Fig. 3): total of 9 teeth; AX1 absent; G1 quite small and pointing straight up out, L2–L7 showing slight increase in size proximally until fourth to last tooth. Dorsal spur not long, straight (12% length of carapace); tip projecting dorsally (Fig. 4). Thoracic fovea distinctly marked around depression (Fig. 5). Coloration and eye pattern as in female. Leg setation similar to female (Figs. 6–7). Conductor (Figs. 8, 79): tip pointed and slightly curled back. Male paracymbium narrow with lateral projection, pointed at apex (Fig. 9).

Allotype female: (Figs. 10–17) Length of carapace 3.0, total length 11.0. Chelicerae 58% length of carapace. Cheliceral fang slightly greater than half length of base, tapering to smooth point distally. Promargin of chelicerae (Fig. 10): 7 teeth, U1 short, pointing straight up, slightly wider, shorter than U2 and well separated (25% cheliceral length) from U2; U2 short, U3 taller than other teeth; U4–U7 decreasing in size proximally. Retromargin of chelicerae (Fig. 11): series of 7 teeth: L1 slightly larger than U1, smaller than L2. Remaining retromarginal teeth decreasing slightly in length and width proximally. Posterior eyes half width of distance between them. Median ocular area wider posteriorly (Fig. 12); lateral eyes contiguous. Carapace brown with very pronounced markings including dark margins. Abdomen elongate, dilated at midline; dorsum light brown with paired markings down sides (Figs. 13, 14). Legs sparsely marked with occasional spots (Figs. 15, 16). Leg spines medium length and robust; setation: fI 1/3/2; tI 7/0/7; mI 1/1/0; fIII with 2 dorsal only, and tIII and mIII without macrosetae. Seminal receptacles (Fig. 17): narrow anterior bulb, slightly wider posterior bulb, connected by long loop.

Variation.—(n = 4♂, 4♀). Male: Cephalothorax 2.2–2.4. CITR little variation; rsu sometimes 6. Female: Length of carapace 3.0–3.3. Color patterns vary slightly; no polymorphism.

Natural history.—*Tetragnatha rava* is found mostly at middle elevations (580 m at Belvedere–650 m on Tahiti Iti) on Tahiti. Because of the relatively low elevation at which it is found, its habitat tends to be disturbed, with mixed native and non-native vegetation. The animal has a ''furry'' appearance because of the macrosetae on its legs.

Tetragnatha moua new species
(Figs. 18–32, 80)

Types.—Holotype male from Tahiti: Mt. Aorai, 1700 m, 17.61° S, 149.50°W, RGG and GKR, 17 November 1999 (BPBM). Paratypes (all in EMUC): Tahiti: 2 males, 6 females, 6 immatures, Mt. Aorai 1700 m, 17.61° S, 149.50°W, 17 November 1999, RGG and GKR; 8 females, 2 immatures, Mt. Marau 1280 m, 17.61°S, 149.55°W, 6 July 2000, RGG and GKR; 2 males, 1 female, Mt. Marau 1240 m, 17.61°S, 149.54°W, 6 July 2000, M. Arnedo.

Etymology.—The specific epithet, regarded as a noun in apposition, is the Tahitian word for ''mountain'' and refers to the montane environment to which this species is restricted.

Diagnosis.—*Tetragnatha moua* is very distinct from all other species based on genital morphology (Figs. 24, 32, 80) and cheliceral armature (Figs. 18–20, 26, 27).

Description.—*Holotype male:* (Figs. 18–25, 80) Length of carapace 2.6, total length 6.4. Chelicerae 81% length of carapace. Cheliceral fang considerably shorter than base,

bent over at both proximal and distal ends and in middle. Promargin of chelicerae (Fig. 18): Gu absent; distance between apex and s1 slightly less than between s1 and T, CITR approx. 0.3:0.4:0.3; s1 large, longer than wide (approximately 1 $^{2}/_{3}$ and 90% height of T); T pointing straight out from margin of chelicerae; rsu 4 straight spikes, decreasing in size proximally. Retromargin of chelicerae (Fig. 19): total of 5 teeth; AX1 absent; G1 prominent but small and pointing straight up out, L2–L5 decreasing in size proximally. Dorsal spur fairly long, slightly bent (16% length of carapace); tip pointed (Fig. 20). Thoracic fovea distinctly marked around depression (Fig. 21). Coloration and eye pattern as in female. Legs almost completely devoid of setation (Figs. 22, 23). Conductor (Figs. 24, 80): tip broad, curled over at top, embolus surrounded by conductor, shorter. Paracymbium rounded with pointed apex (Fig. 25).

Allotype female: (Figs. 26–32) Length of carapace 2.8, total length 8.5. Chelicerae 70% length of carapace. Cheliceral fang slightly greater than half length of base, tapering to smooth point distally. Promargin of chelicerae (Fig. 26): 6 teeth, U1 long, curved up and out, similar in size to U2 and well separated (24% cheliceral length) from U2; U3–U6 decreasing in size proximally. Retromargin of chelicerae (Fig. 27): series of 7 teeth: L1 smaller than U1, similar in size to L2. Remaining retromarginal teeth decreasing very slightly in length and width proximally. Posterior eyes wider than distance between them. Median ocular area approximately square (Fig. 28); lateral eyes contiguous. Carapace brown with very pronounced markings including dark margins, and pair of dark lines running from behind PLE's and converging broadly towards fovea. Abdomen plump, elongate oval; dorsum dark brown with quite elaborate reddish markings down center and sides (Fig. 29). Legs sparsely marked (Figs. 30, 31). Leg spines medium length and quite robust; setation: fI 2/1/5; tI 2/1/3; mI 1/1/2; fIII with 4 dorsal, 2 prolateral, tIII with 2 dorsal, 2 prolateral, and mIII with no dorsal and 1 prolateral, macrosetae. Seminal receptacles (Fig. 32): pair of single large bulbs.

Variation.—(n = 4♂, 6♀).—Male: Cephalothorax 2.6–2.9. CITR little variation. Female: Length of carapace 2.7–2.9. Color patterns vary slightly; no polymorphism.

Natural history.—*Tetragnatha moua* is a large, robust and colorful species with smooth legs (not furry) that occurs at upper elevations (above 600m) on both Mt. Aorai and Mt. Marau. Individuals frequently do not build webs, and are found at night, especially on Mt Aorai, foraging actively in the open. They are less common on Mt. Marau.

Tetragnatha tuamoaa new species
(Figs. 33–48, 81)

Types.—Holotype male, allotype female from Moorea: Trois Cocotiers, 320 m, 17.55°S, 149.50°W, M. Arnedo, 5 July 2000 (BPBM). Paratypes (all in EMUC): Moorea: 1 immature, Paopao-Vaiare 320 m, 17.52°S, 149.80°W, 19 June 2000, RGG; 1 female, 2 immatures, Paopao-Vaiare 320 m, 17.52°S, 149.80°W, 3 July 2000, M. Arnedo; 2 immatures, Trois Cocotiers, 320 m, 17.55°S, 149.50°W, 18 June 2000, RGG; 2 males, 1 female, 1 immature, Trois Cocotiers, 320 m, 17.55°S, 149.50°W, 5 July 2000, M. Arnedo.

Etymology.—The specific epithet, regarded as a noun in apposition, is the Tahitian word for ''mountain ridge'' and refers to the situations to which the species is confined on Moorea.

Diagnosis.—*Tetragnatha tuamoaa* is most similar to *T. rava* on Tahiti. It is distinguished by the separation of the AMEs, with the median ocular area almost square (Figs. 36 & 43); by the angular (not pointed) tip of the conductor (Fig. 81); and by the tighter connection between the bulbs of the seminal receptacles.

Description.—*Holotype male:* (Figs. 33–40, 81) Length of carapace 2.6, total length 9.0. Chelicerae 65% length of carapace. Cheliceral fang slightly shorter than base, bent over at both proximal and distal ends. Promargin of chelicerae (Fig. 33): Gu absent, but prominent tooth (larger than sl) present dorsal/lateral to sl; distance between apex and s1 much less than between s1 and T, CITR approx. 0.2:0.4:0.4; s1 small, pointed slightly down, as wide as high (approximately 1/3 width and 22% height of T); T large, pointing slightly up and out from margin of chelicerae; rsu 7 straight spikes, decreasing in size. Retromargin of chelicerae (Fig. 34): total of 9 teeth; AX1 absent; G1 quite small and pointing straight up and out, L2- L7 showing slight increase in size proximally until fourth to last

tooth. Dorsal spur quite long, slightly bent (16% length of carapace); tip bifurcated (Fig. 35). Thoracic fovea distinctly marked around depression (Fig. 36). Coloration and eye pattern as in female. Leg setae shorter than female, but setation pattern similar to female (Figs. 37, 38). Conductor (Fig. 39, 81): tip broad, blunt, curled back. Paracymbium narrow, apex pointed (Fig. 40).

Allotype female: (Figs. 41–48) Length of carapace 3.0, total length 11.0. Chelicerae 65% length of carapace. Cheliceral fang slightly greater than half length of base, tapering to smooth point distally. Promargin of chelicerae (Fig. 41): 9 teeth, U1 short, pointing out, slightly wider, shorter than U2 and well separated (25% cheliceral length) from U2; U2 medium length, U3 taller than other teeth; U4–U7 decreasing in size proximally. Retromargin of chelicerae (Fig. 42): series of 8 teeth: L1 slightly broader than U1, smaller than L2. Remaining retromarginal teeth decreasing slightly in length and width proximally. Eyes small, posterior eyes half width of distance between them. Median ocular area almost square (Fig. 43); lateral eyes contiguous. Carapace brown with very pronounced markings including dark margins. Abdomen elongate, dilated at midline; dorsum light brown with paired markings down sides (Figs. 44, 45). Legs sparsely marked with occasional spots (Figs. 46, 47). Leg spines medium length and robust; setation: fI 0/3/2; tI 7/0/7; mI 1/0/1; fIII with 2 dorsal only, and tIII with 1 dorsal and mIII without macrosetae. Seminal receptacles (Fig. 48): fairly narrow anterior bulb, slightly wider posterior bulb, connected by robust loop.

Variation.—(n = 2♂, 4♀). Male: Cephalothorax 2.4–2.6. CITR little variation; rsu sometimes 6. Female: Length of carapace 2.9–3.2. Color patterns vary slightly; no polymorphism.

Natural history.—As in the low elevation *Tetragnatha rara* on Tahiti, *T. tuamoaa* has a ''hairy'' appearance. It is similar in gross morphology to *T. rava*, but its eye configuration, and male and female genitalia are distinct.

Other material examined (non-types).—Raiatea: 1♀, Opoa, approximately 16.83°S, 151.38°W, 1955, N. Krauss (BPBM).

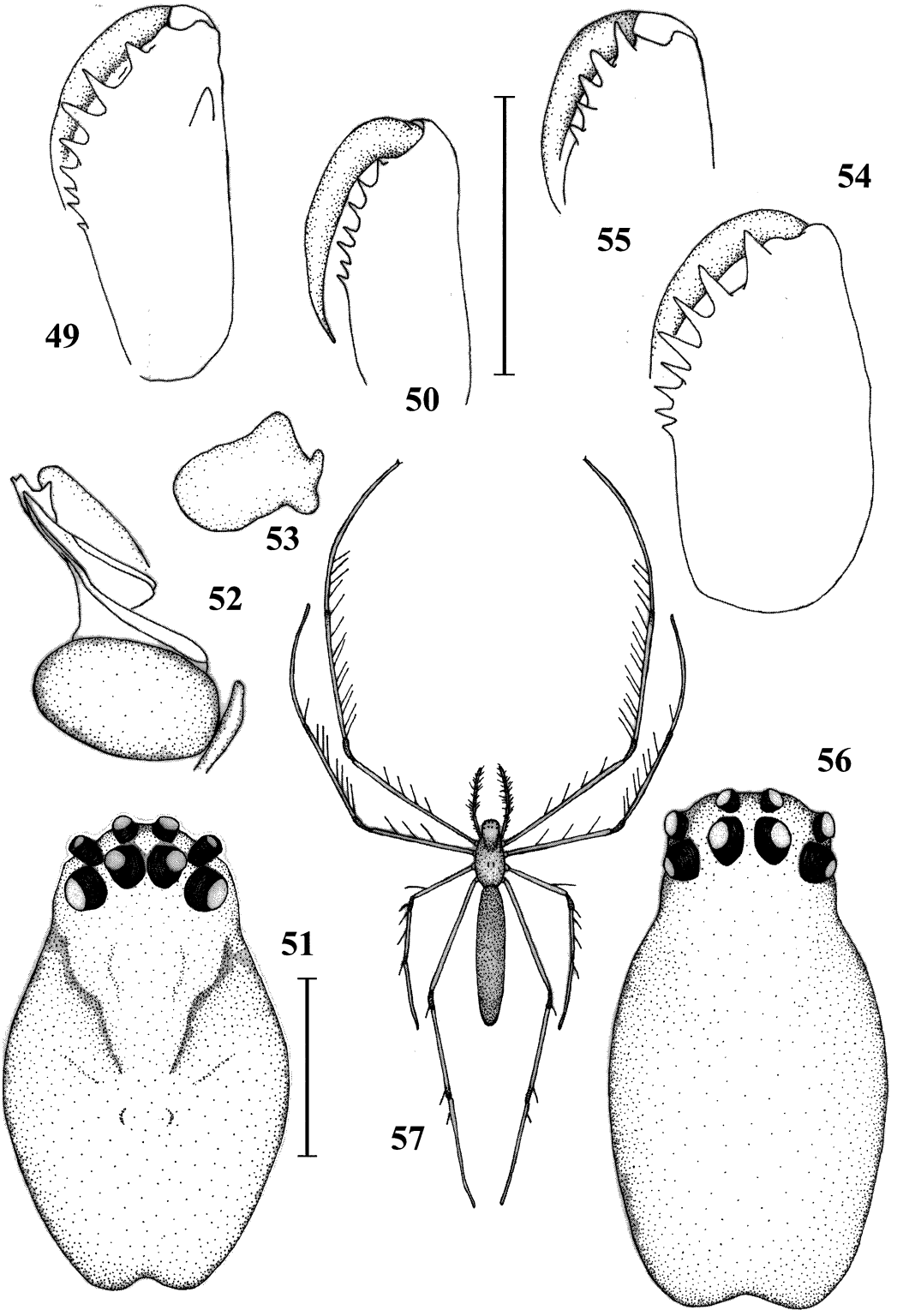
Remarks.—The female from Raiatea was identified as *T. laqueata* by Marples (1957), although Marples did state that ''Identifications [were] more or less uncertain''. This female is certainly not *T. laqueata*. *Tetragnatha laqueata* was first described by L. Koch from Upolu, Samoa. The type specimen was deposited in the Museum Godeffroy, which was mostly absorbed into the Museum für Naturkunde der Humboldt-Universität Berlin in Germany. I have examined 1 male and 3 female syntypes of *T. laqueata* collected from Upolu, Samoa, housed in the Museum für Naturkunde (Figs. 49–57). These specimens are *T. laqueata* as described by Koch (1872). However, since that time, *T. laqueata* has also been recorded from the Bonin Islands and elsewhere in the north Pacific. These latter records are likely to be incorrect: the specimens described by Okuma (1980) and Yaginuma (1979) are quite different from *T. laqueata* as described by Koch (1872). The single female specimen from Raiatea reported by Marples (1957) (BPBM) is most similar to *T. tuamoaa*. There are differences in the female genitalia. However, until a male specimen is found, I have adopted the more conservative approach to placing it in the same species as *T. tuamoaa*.

Tetragnatha macilenta L. Koch
(Figs. 58–78)

Tetragnatha macilenta L. Koch 1872: 192, T. XVI, fig. 6, T. XVII, fig. 1 (male syntype lost, two female syntypes from Upolu, Samoa, in ZMB, examined); Berland 1929: 60, figs. 45–51 (1 male, 2 females from Upolu, Samoa, in MNHN, examined); Roewer 1942: 986; Bonnet 1959: 4338; Okuma 1987: 63, fig. 16.

Tetragnatha huahinensis Berland 1942: 19, fig. 8 a–d (female holotype from Mt. Turi, Huahine, 16.72°S, 151.10°W, 1 October 1934, E.C. Zimmerman, in BPBM, examined). NEW SYNONYMY.

Types.—*Tetragnatha macilenta* was first described by L. Koch from Upolu, Samoa. The type was a male specimen and was supposed (L. Koch 1872) to have been deposited in the Museum Godeffroy, which, as mentioned above, was mostly absorbed into the ZMB. However, two females only remain at the ZMB. These females do appear to be *T. macilenta*, and are from Upolu, Samoa. However, there is also a male and female in the ZMB collection that were thought to be the syntypes of *T. macilenta* from New South Wales, Australia. These latter specimens are *T. valida* (not *T. macilenta*). In the BMNH, *T.*


49
50
54
55
53
52
56
51
57

macilenta L. Koch is represented by one male from the Solomon Islands (collected by Rennell); one male from the Cook Islands, Aitutaki; one male and one female in forest, Upolu, Samoa; and many specimens from Apia, Upolu, Samoa (most collected by Marples). However, although I have not studied the BMNH collection in any detail, the male type is not in this collection. Accordingly the location of the type, if it still exists, is currently unknown.

Synonymy.—Berland (1942) described a new species, *T. huahinensis*, from Huahine. However, this specimen appears to be *T. macilenta* (Figs. 63–66). Berland describes *T. huahinensis* as follows (in translation): ''Female (no male) color light brown, margin and two stripes darker, labium brown, sternum light, margin gray; abdomen gray with little silver plates on sides and, in posterior half, 2 rows of 4 small brown spots. Both eye rows recurved, first a little more, eyes nearly equal in size, anterior lateral a little smaller, lateral of two rows a little farther from each other than median. Chelicerae with strong tooth near fang. Abdomen long, about 10× as long as wide. Total length 12mm. Society Islands, Huahine, Mt. Turi, alt. 600–700ft, Oct. 1 1934, one female holotype''. Berland goes on to say ''I think that *T. huahinensis* is well characterized by the length of the abdomen and by the peculiar form of the chelicerae.'' Interestingly, Berland (1929) drew a very similar diagram when discussing *T. macilenta* L. Koch from Upolu, Samoa. What is more, comparison of the type of *T. huahinensis* (as illustrated in Berland 1942) with the illustrations shown here of *T. macilenta* (Figs. 58–78) leaves little doubt that *T. huahinensis* is a synonym of *T. macilenta*.

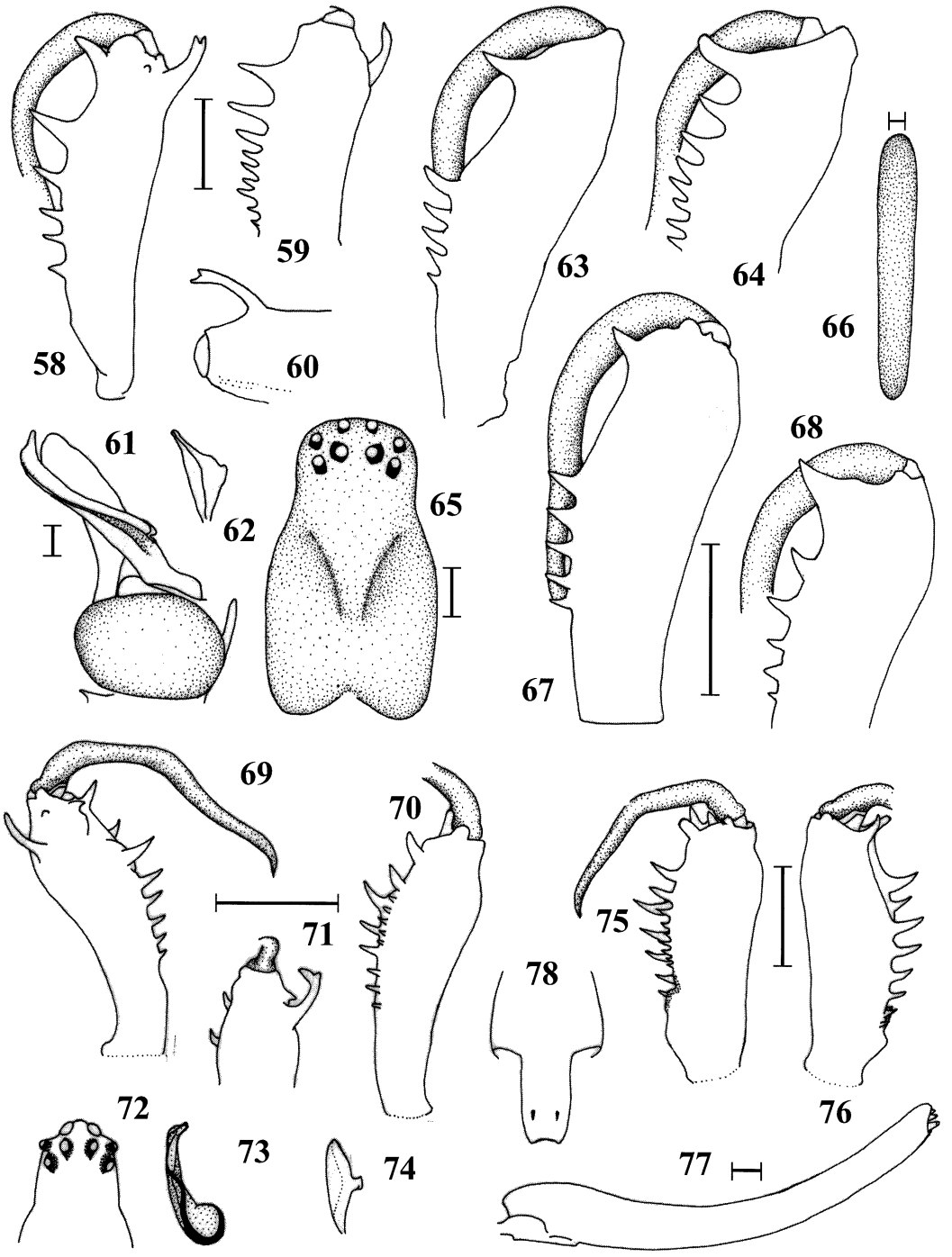
Material examined.—In the Society Islands, *T. macilenta* has been collected from Tahiti: 1♂,1 immature, Vaipaarii, 600 m, August 1928, Samson (labeled *T. mandibulata* by Berland); 2♂, 4♀, 8 immatures, Mt. Marau 790–1240 m, 17.60°S, 149.57°W, July 2000, RGG and GKR; 1♂, 3 immatures, Mt Aorai 1700 m, 17.61° S, 149.50°W, November 1999, RGG and GKR; Moorea: 2♂, 6♀, 2 immatures, Trois Cocotiers, 320 m, 17.55°S, 149.50°W, June 2000, RGG and GKR; 4♀, 4 immatures, Mouaputa, 450 m, 17.53°S, 149.80°W, July 2000, GKR; Raiatea: 1♀, Temehani, 700 m, 16.78°S, 151.45°W, September 1977, WC Gagne; Bora Bora: 2♀, 16.45° S, 151.87° W, July 2000, M. Arnedo.

Remarks.—*Tetragnatha macilenta* appears to be widespread through Polynesia, although not as widespread as the literature would suggest. Roewer (1942) cited L. Koch (1872) and Berland (1929) in describing the distribution of the species as Norfolk Island, Samoa, Marianas, Tonga, Marquesas Islands, and Hawaii. However, neither Koch nor Berland mention Hawaii, so the inclusion of Hawaii is likely a publication error. Moreover, the records from the Marquesas are based on the publications of Berland (1933, 1935b). Examination of museum specimens (BPBM, MNHN) has shown that all the specimens from the Marquesas that were labeled as *T. macilenta* are in fact other species.

Subsequently, Bonnet (1959) cited the distribution of *T. macilenta* as Samoa, Norfolk Island, and Marquesas, reflecting accurately the work of L. Koch (1872), Karsch (1878) and Rainbow (1920) who documented the species from Samoa and Norfolk Island. Subsequently, Chrysanthus (1975) examined specimens from New Guinea and the Bismarck Archipelago, but cited Roewer (1942) and Bonnet (1959) in stating that it is ''further known from Norfolk Island, Hawaii and Marquesas Islands.'' Most recently, Okuma (1987) stated that *T. macilenta* is found from Australia, New Guinea, Solomon Is., Norfolk Is., Samoa, Marianas, Tonga, Marquesas and Hawaii. However, the specimens she examined were all from Australia, New Guinea, Solomons, Tonga, New Britain, and Admiralty Is-

←

Figures 49–57.—*Tetragnatha laqueata*: Male and female syntypes collected from Upolu, Samoa, currently in the Museum für Naturkunde der Humboldt-Universität Berlin. Male: 49. Promargin of right chelicera; 50. Retromargin of left chelicera; 51. Carapace, dorsal; 52. Left palpus, ventral; 53. Left paracymbium, lateral. Female. 54. Promargin of right chelicera; 55. Retromargin of left chelicera; 56. Carapace, dorsal; 57. *T. laqueata* redrawn from Koch (1872). Scale bars = 0.5; that between Figs. 50 & 55 applies to Figs. 49, 50 & 52–55; that beside Fig. 51 applies to Figs. 51 & 56.



Figures 58–78.—*Tetragnatha macilenta*: 58–62. Male from Temehani Pl (700m), Raiatea, Society Islands, collected by W. Gagne (4 September 1977). 58. Promargin of right chelicera; 59. Retromargin of left chelicera; 60. Dorsal spur of right chelicera, lateral; 61. Left palpus, ventral; 62. Left paracymbium, lateral. 63–66. Female from Huahine, Society Islands, 500–700m, collected by E. Zimmerman (1 October 1934; drawn from type female of *T. huahinensis* Berland). 63. Promargin of right chelicera; 64. Retromargin of left chelicera; 65. Carapace, dorsal; 66. Abdomen, dorsal. 67, 68. *T. macilenta* syntype female

lands. She did not examine any Polynesian species, instead referring to L. Koch (1872), Berland (1929), Roewer (1942) and Chrysanthus (1975). I therefore conclude that *T. macilenta* has not been found further east than the Society Islands.

Figures 58–78 compare specimens of *T. macilenta*, with Figs. 58–62 a specimen from Raiatea, Figs. 63–66 the female type of *T. huahinensis* from Huahine, and Figs. 67, 68 the female syntype of *T. macilenta* from Upolu, Samoa (ZMB). Note the similarity between Figs. 63 and 67, and 64 and 68. Figs. 69–78 show the general features of *T. macilenta* from Australia, New Guinea, Solomon Islands, Tonga, Admiralty Islands, New Britain, and Samoa, redrawn from Okuma (1987).

Tetragnatha maxillosa Thorell

Tetragnatha mandibulata Walckenaer: Thorell 1890: 221 (misidentification).

Tetragnatha maxillosa Thorell 1895: 139; Gravely 1921: 430; Roewer 1942: 984; Bonnet 1959: 4339; Chrysanthus 1975: 8, Figs. 14–21; Okuma 1983: 72; Okuma 1987: 83, fig. 30.

Tetragnatha maxillosa insignita Strand 1911: 138.

Material examined.—In the Society Islands, *T. maxillosa* has been collected from the following localities: Tahiti: 1♂,1 ♀*, Near Tiupi Bay, Papaari, 17.74° S, 149.34°W, sweeping grasses and low herbage, May 1934 (BPBM); 1♂, 2 ♀*, Papeete, 17.53° S, 149.37°W (BPBM); 1 ♀*, Tiarei, 17.55° S, 149.35°W; 1♂, 1 ♀*, Vallée de la Reine, 140 m, 17.54° S, 149.40°W, December 1928 (BPBM); 3♂, 2♀, Papenoo Valley 195 m, 17.55° S, 149.43°W, July 2000, RGG and GKR; Moorea: 3♀, 2♂, Trois Cocotiers, 220 m, 17.55°S, 149.50°W, over stream, June 2000, RGG and GKR (EMUC); Raiatea: 1 ♀*, Uturoa, 16.80°S, 151.45°W; 1 ♀, Temehani Plateau, 427 m, 16.78°S, 151.45°W, October 1934, E.C. Zimmerman (BPBM); 2 ♂, 3 ♀, same data except 800m, over stream, July 2000, RGG and GKR (EMUC); 1 immature, Opoa (BPBM). (* det. C. Okuma, confirmed by author; all others determined by author).

Remarks.—*Tetragnatha maxillosa* was first described by Thorell (1895) from Java, and reported also from Burma, Malaya and India. Chrysanthus (1975) redescribed and illustrated the species and recorded it from New Guinea for the first time. There is a good deal of confusion because Thorell (1895) first described the species based on a specimen that he had initially (Thorell 1890) misidentified as *T. mandibulata* Walckenaer (see below). Berland used the name ''*T. mandibulata* Koch, not Walckenaer'' for specimens that in almost all cases appear, upon recent examination by C. Okuma and myself, to be *T. maxillosa* (see below).

Tetragnatha nitens (Audouin)

Eugnatha nitens Audouin in Savigny 1826: 118, Pl. 2, fig. 2 (specimens from Rosetta, Egypt, lost).

Eugnatha pelusia Audouin in Savigny, 1826: 119, pl. 2, fig. 3 (specimen from Rosetta, Egypt, lost).

Tetragnatha andina Taczanowski 1878: 144, pl. 1, fig. 2.

Tetragnatha antillana Simon 1897: 868; Seeley 1928: 104, figs. 1–4; Roewer 1942: 988; Chickering 1957: 306, figs. 1–6; Bonnet 1959: 4318; Chickering 1962: 428, figs. 1–6.

Tetragnatha vicina Simon 1897: 869.

Tetragnatha peninsulana Banks 1898: 246, pl. 15, fig. 12.

Tetragnatha galapagoensis Banks 1902: 61, pl. 1, fig. 10.

Tetragnatha aptans Chamberlin 1920: 41, figs. 7, 8.

Tetragnatha eremita Chamberlin 1924: 645, figs. 89, 90.

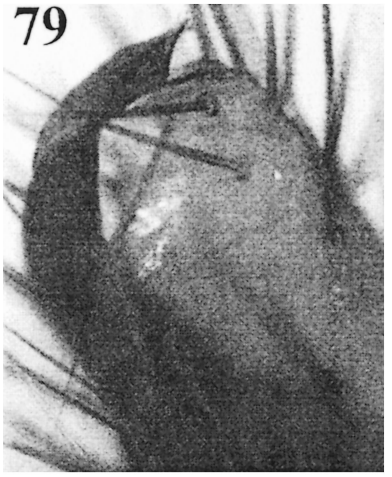
Tetragnatha seminola Gertsch 1936: 10, figs. 22, 23.

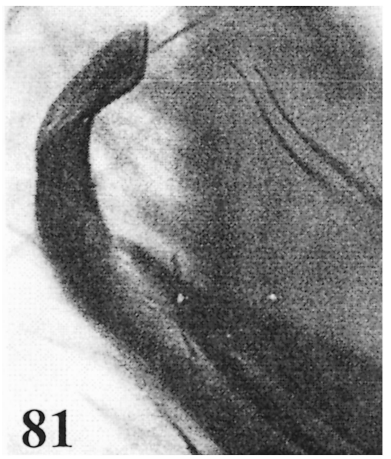
Tetragnatha steckleri Gertsch & Ivie 1936: 19, figs. 31–33.

Tetragnatha elmora Chamberlin & Ivie 1942: 62, fig. 160.

←

from ZMB. 67. Promargin of right chelicera; 68. Retromargin of left chelicera. 69–78. *T. macilenta* redrawn from Okuma (1987). 69–74 Male. 69. Promargin of left chelicera; 70. Dorsal spur of left chelicera; 71. Retromargin of left chelicera; 72. Eye group of male; 73. Conductor and embolus; 74. Left paracymbium, lateral. 75–78 Female. 75. Promargin of left chelicera; 76. Retromargin of left chelicera; 77. Genital fold of female. 78. Abdomen, lateral. Scale bars = 0.5; that between Figs. 58 & 59 applies to Figs. 58, 59, 60, 62, 63 & 64; that between Figs 67 & 68 applies to Figs. 67 & 68. Figs. 69–78—scale bars inferred from text where possible; that between Figs. 69 & 70 applies to Figs. 69, 70 & 71; that between Figs. 75 & 76 applies to Figs. 75 & 76.





Tetragnatha festina Bryant 1945: 407, figs. 38, 39, 41.

Tetragnatha haitensis Bryant 1945: 408, fig. 37.

Tetragnatha nitens (Audouin): Bonnet 1959: 4345; Levi 1981: 291, plate 5a–b, figs. 23–34; Okuma 1968: 40, figs. 9–16; Okuma 1983: 75; Okuma 1987: 84, fig. 31; Roewer 1942: 978.

Material examined.—In the Society Islands, *T. nitens* has been collected only from Moorea: 1 female, Baie de Cook, 0 m, 17.50°S, 149.82°W, March 1955, Krauss (BPBM); 8 males, 10 females, Gump Field Station in mangroves, 0 m, 17.49°S, 149.83°W, November 1999, RGG and GKR (EMUC).

Remarks.—*Tetragnatha nitens* is found along the coast of Moorea. This species has a huge distribution and is said to be ''cosmotropical'' (Platnick 1997). It may not be native to the Society Islands.

Tetragnatha mandibulata Walckenaer

Tetragnatha mandibulata Walckenaer 1837: 211.

Tetragnatha mandibulata (Walckenaer): Roewer 1942: 984; Bonnet 1959: 4338; Chrysanthus 1963: 733, figs. 24–26, 36–39; Chrysanthus 1975: 6; Okuma 1983: 70; Okuma 1987: 85, fig. 32.

Remarks.—As mentioned above, there has been much confusion regarding this species, perhaps based on the inadequacy of the initial description. The species was described by Walckenaer (1837) as follows (in translation): ''Mandibles carried in front, very-prominent, very-elongate, dilated at the middle, divergent, and whose base terminates in a spine or hook* of a red blade. Cylindrical abdomen, elongate, narrower than the cephalothorax, a little bent or raised in the posterior part, color drab green. The cephalothorax is elongate, reddish, bordered by a fine yellow line. The palpi and the legs are red. There are grayish or white hairs on the cephalothorax, the legs, and the mandibles. From the Marianas archipelago, Guam, collected by M. Freycinet.'' (* the spine is believed to refer to the first stout tooth of the ventral row, which extends directly forward beside the base of the fang,

←

Figs. 79–81.—High magnification photographs of distal tips of conductor of male palps. 79. *T. rava*; 80. *T. moua*; 81. *T. tuamoaa*.

Chrysanthus 1975). L. Koch (1872) drew what he thought to be *T. mandibulata*. However, it was clear that he was uncertain, as he labeled the specimen ''*Tetragnatha mandibulata* Walck.? ''. Subsequently, the specimens that Berland examined have been ascribed to L. Koch rather than Walckenaer, but appear to be *T. maxillosa* (see above). The confusion with *T. mandibulata* has been summarized by Chrysanthus (1975), who notes:

''*Tetragnatha mandibulata* sensu Keyserling, 1865 = *T. keyserlingi* Simon (Simon 1890) p. 134.

Tetragnatha mandibulata sensu L. Koch 1871 = *T. kochi* Thorell (Thorell 1895) p. 140

Tetragnatha mandibulata sensu Thorell 1890 = *T. maxillosa* Thorell (Thorell 1895) p. 139.''

Note that Thorell (1895) assigned the specimens that L. Koch examined to *Tetragnatha kochi*. As Chrysanthus (1975) notes ''the differences between these three species are small, and their identification requires careful examination; it may be, therefore, that some records in the arachnological literature are incorrect.'' Certainly, all specimens that I have examined (and Okuma before me) that have been assigned to ''*T. mandibulata* Koch, not Walckenaer'' are *T. maxillosa*. I conclude, therefore, that there are no confirmed records of *T. mandibulata* in French Polynesia. However, *T. mandibulata* is found in Hawaii, Micronesia, the Philippines, and Australia through to West Africa (Platnick 1997).

ACKNOWLEDGMENTS

I am greatly indebted to the Délégation de la Recherche in Tahiti for allowing access to collecting sites. In particular, I am most grateful to Jean-Yves Meyer for helping with the immense problems of logistics. I also express my sincere thanks to Christine Rollard (Muséum National d'Histoire Naturelle, Paris), Jason Dunlop (the Museum für Naturkunde der Humboldt-Universität, Berlin), Paul Hillyard (the Natural History Museum, London), and Gordon Nishida and David Preston (the Bishop Museum, Honolulu). Finally, I am hugely indebted to Lesley Pankaew, a very talented young art student at the University of California at Berkeley, for her help with the drawings. The manuscript was much improved by comments from Herb Levi and Mark Harvey.

LITERATURE CITED

Audouin, V. 1826. Explication sommaire des planches d'arachnides de l'Egypte et de la Syrie. Pp. 99–186. *In* Description de l'Égypte ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française, vol. 1(4). C.L.F. Panckoucke: Paris.

Banks, N. 1898. Arachnida from Baja California and other parts of Mexico. Proceedings of the California Academy of Sciences (Zoology) 1: 205–308.

Banks, N. 1902. Papers from the Hopkins Stanford Galapagos Expedition; 1898–1899. VII. Entomological Results (6). Arachnida. With field notes by Robert E. Snodgrass. Proceedings of the Washington Academy of Sciences 4:49–86.

Berland, L. 1927. Note sur les Araignees recueillies aux iles Marquises par le R.P. Simeon Delmas. Bulletin of the Museum of Natural History 38: 366–368.

Berland, L. 1929. Araignées (Araneida), Pp. 35–78. *In* Insects of Samoa and other Samoan terrestrial Arthropoda. British Museum (Natural History), London.

Berland, L. 1933. Araignées des iles Marquises. Bernice P. Bishop Museum Bulletin 114:39–70.

Berland, L. 1934a. Araignées de Polynésie. Annales de la Société Entomologique de France 103:321–336.

Berland, L. 1934b. Les Araignées des Tahiti. Bernice P. Bishop Museum Bulletin 113:97–107.

Berland, L. 1934c. Les Araignees du Pacifique. *In* Contribution a l'étude du peuplement zoologique et botanique des iles du Pacifique. Société de Biogéographie IV (P. Lechevalier, ed.). Lechevalier et fils, Paris.

Berland, L. 1935a. Les Araignées des iles Marquises et la Biogéographie. Compte Rendu Sommaire des Séances de la Société de Biogéographie 100: 27–28.

Berland, L. 1935b. Nouvelle Araignées marquisiennes. Bernice P. Bishop Museum Bulletin 142:31–63.

Berland, L. 1935c. Sur la présence d'espèces Jordaniennes chez les Araignees des certaines iles du Pacifique. Annales de la Société Entomologique de France 103:147–148.

Berland, L. 1938. Liste des Araignees recuellies a Maupiti (Iles de la Societe) par M. Ropiteau. Bulletin de la Société des Etudes Oceaniennes 6: 47–48.

Berland, L. 1942. Polynesian spiders. Occasional Papers of the Bernice P. Bishop Museum 17:1–24.

Bonnet, P. 1959. Bibliographia Araneorum, Pp. 1–5058. Vol. 2(5). Douladoure, Toulouse.

Bryant, E.B. 1945. The Argiopidae of Hispaniola.

Bulletin of the Museum of Comparative Zoology Harvard 95:357–422.
Chamberlin, R.V. 1920. South American Arachnida, chiefly from the Guano Islands of Peru. Brooklyn Museum Science Bulletin 3:35–44.
Chamberlin, R.V. 1924. The spider fauna of the shores and islands of the Gulf of California. Proceedings of the California Academy of Sciences 12:561–694.
Chamberlin, R.V. & W. Ivie. 1942. A hundred new species of American spiders. University of Utah Biological Series 7:1–117.
Chickering, A.M. 1957. The genus *Tetragnatha* (Araneae, Argiopidae) in Panama. Bulletin of the Museum of Comparative Zoology Harvard 116: 301–354.
Chickering, A.M. 1962. The genus *Tetragnatha* (Araneae, Argiopidae) in Jamaica, W. I. Bulletin of the Museum of Comparative Zoology Harvard 127:423–450.
Chrysanthus, F. 1963. Spiders from South New Guinea V. Nova Guinea, Zoology 24:727–750.
Chrysanthus, F. 1975. Further notes on the spiders of New Guinea II (Araneae, Tetragnathidae, Theridiidae). Zoologische Verhandelingen Leiden 140:3–50.
Gertsch, W.J. 1936. Further diagnoses of new American spiders. American Museum Novitates 852:1–27.
Gertsch, W.J. & W. Ivie. 1936. Descriptions of new American spiders. American Museum Novitates 858:1–25.
Gillespie, R.G. 1991. Hawaiian spiders of the genus *Tetragnatha*: I. Spiny leg clade. Journal of Arachnology 19:174–209.
Gravely, F.H. 1921. Some Indian spiders of the subfamily Tetragnathinae. Records of the Indian Museum 22:423–459.
Karsch, E. 1878. Exotisch-araneologisches. Zeitschrift Fur die Gesammten Naturwissenschaften 51:332– 333,771–826.
Koch, L. 1872. *Tetragnatha* Latr., Pp. 170–196 in Die Arachniden Australiens, vol. 1. Bauer and Raspe, Nürnberg.
Levi, H.W. 1981. The American orb-weaver genus *Dolichognatha* and *Tetragnatha* north of Mexico (Araneae: Araneidae, Tetragnathinae). Bulletin of the Museum of Comparative Zoology Harvard 149:271–318.
Marples, B.J. 1957. Spiders from some Pacific Islands, II. Pacific Science 11:386–395.
Meyrick, E. 1935. Pyrales and Microlepidoptera of the Marquesas Islands. Bernice P. Bishop Museum. Bulletin. 114:333–355.
Okuma, C. 1968. Two spiders new to fauna of Japan. Acta Arachnologica 21:40–42.
Okuma, C. 1980. Notes on a spider *Tetragnatha laqueata* L. Koch, 1871 of the Bonin Islands, Japan (Araneae: Tetragnathidae). Esakia 15:75–78.
Okuma, C. 1983. New synonomies and new records of some cosmopolitan species of the genus *Tetragnatha* (Araneae; Tetragnathidae). Esakia 20: 69–80.
Okuma, C. 1987. A revision of the Australasian species of the genus *Tetragnatha* (Araneae, Tetragnathidae). Esakia 25:37–96.
Platnick, N.I. 1997. Advances in Spider Taxonomy 1992–1995, with redescriptions 1940–1980. New York Entomological Society in association with the American Museum of Natural History, New York.
Rainbow, W.J. 1920. Arachnida from Lord Howe and Norfolk Islands. Records of the South Australian Museum 1:229–272.
Roewer, C. 1942. Katalog der Araneae von 1758 bis 1940. R. Friedländer und Sons: Bremen.
Seeley, R.M. 1928. Revision of the spider genus *Tetragnatha*. Bulletin of the New York State Museum 278:99–150.
Simon, E. 1890. Études arachnologiques, 22e memoires. Annales de la Société Entomologique de France (6) 10:131–136.
Simon, E. 1897. On the spiders of the island of St Vincent. III. Proceedings of the Zoological Society London 65:860–890.
Strand, E. 1911. Araneae von den Aru- und Kei-Inseln. Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft 34:129–199.
Taczanowski, L. 1878. Les Aranéides du Pérou central. Horae Societatis Entomologicae Rossicae 14:140–175.
Thorell, T. 1890. Studi sui ragni Ragni Malesi e Papuani, I. Annali del Museo Civico di Storia Naturale di Genova 8.
Thorell, T. 1895. Descriptive Catalogue of the Spiders of Burma. British Museum (Natural History), London.
Walckenaer, C.A. 1837. Histoire naturelle des Insectes. Aptères, Pp. 203–226. Vol. II. Librairie Encyclopédique de Roret, Paris.
Yaginuma, T. 1979. Spiders of the Bonin islands, Japan. Nature and Animals (Japan) 9:33–36.

Manuscript received 28 September 2001, revised 19 April 2002.