

SPIDERS, PLANTHOPPERS & FLIES:

Report on Research Conducted in French Polynesia,
June - August 2000

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REPORT TO:

Haut-Commissaire de la République en Polynésie Française,
Mission d'Aide Financière et de Coopération Régionale,
BP 115, PAPEETE, TAHITI

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I. SPIDERS

OBJECTIVES

The objective of the expedition to the Society and Marquesan archipelagoes was to determine the nature and diversity of the spider fauna of French Polynesia, and identify possible threats. Over the last 12 years we have been studying the extensive radiations of the spider genera *Tetragnatha*, *Theridion*, and a few other groups in the Hawaiian Islands. The spiders in French Polynesia appear to belong to similar groups, and it is almost certain that there has been a radiation of species in at least some of these groups, although information is sparse. We set out to collect representative species from different islands throughout French Polynesia. We intend to generate phylogenetic (or genealogical) patterns of relationship for different groups of spiders in French Polynesia using morphological and various molecular approaches. Using this information, we can test the role of ecological and behavioral attributes in dictating how these spiders form new species. In addition to understanding the ecological and behavioral correlates associated with speciation in the group, we set out to examine the impact of alien species and different levels of disturbance on the native spiders of French Polynesia. In particular, we have been looking at the impact of ants in limiting the distribution of species in Hawaii, and our intention was to examine this issue in French Polynesia. In particular, what species of ants are important in limiting the distribution, and to what extent are species distributions limited by habitat destruction and other anthropogenic disturbance.

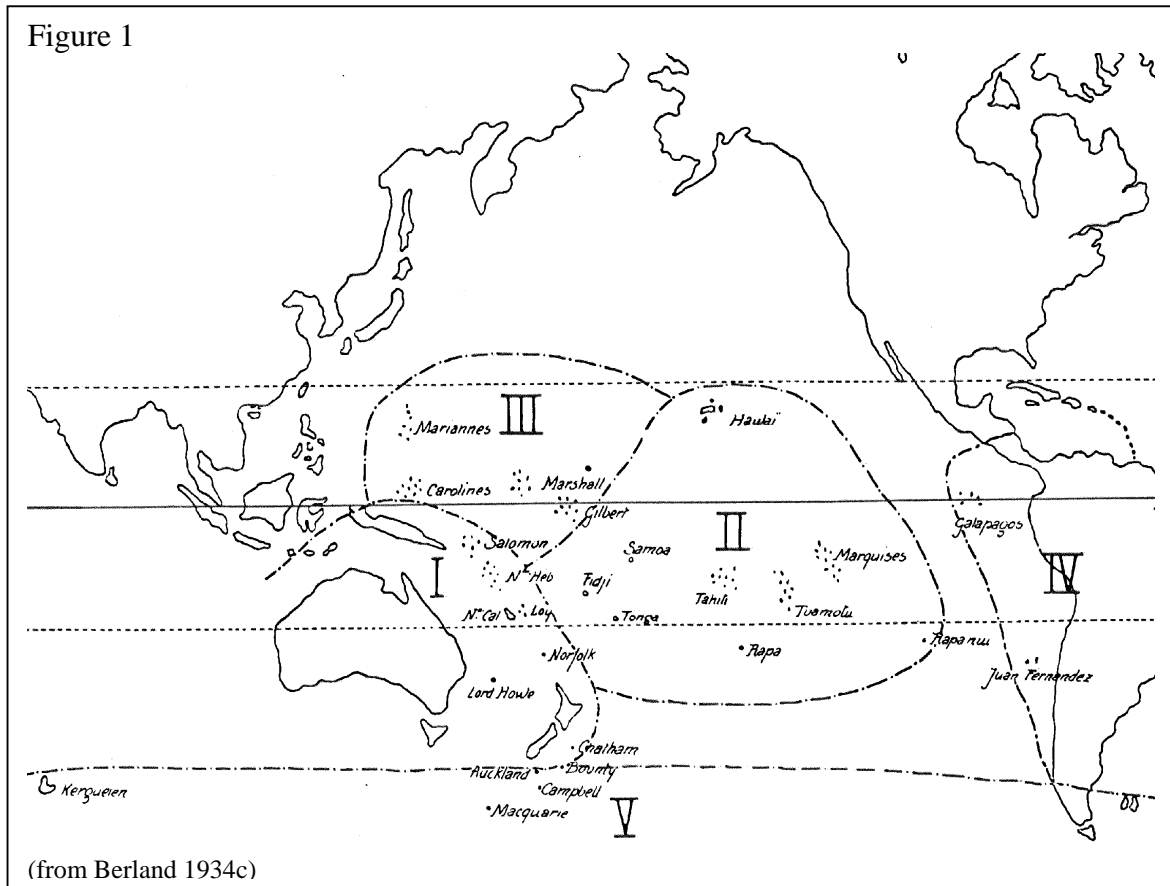
There were 3 primary achievements predicted: (1) Assessment of species identities, numbers of species, distributions, and abundance for the different spider groups in French Polynesia. (2) Assessment of the role of alien species and habitat destruction in limiting the distribution of species in the radiations, and possible management strategies for recovering populations. (3) Assessment of genealogical relationships amongst these species, and hence possible mechanisms governing species formation and evolutionary changes in distribution and abundance. Here we report on (1) and (2). Part (3) requires further study.

BACKGROUND

The islands of the Society and Marquesan archipelagoes differ considerably in size, elevation, distance from the nearest continental landmass, and current population density:

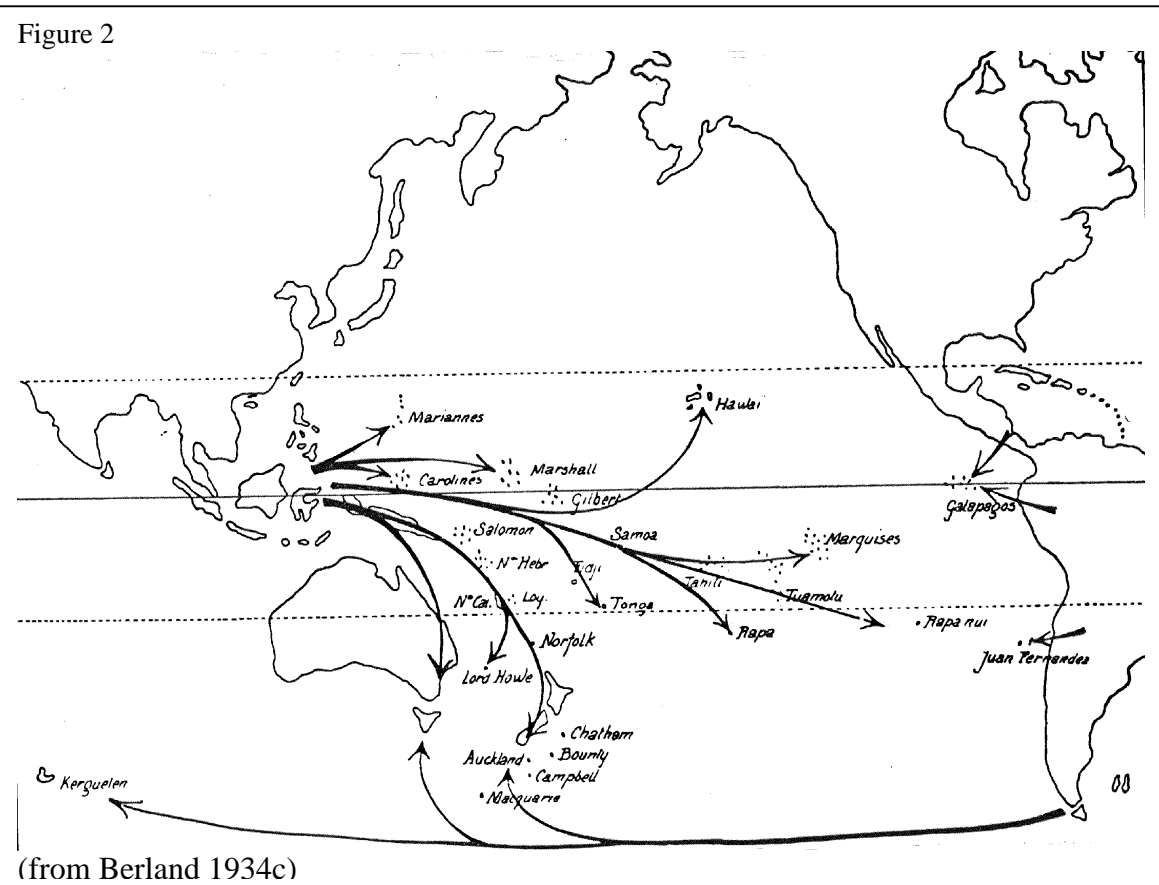
	Area (sq.km)	Altitude (m)	Nearest landmass (km)			Pop.Density (persons/sq km)
			Island	Group	Continent	
Tahiti	1068.8	2241	25	400	6000	89.4
Moorea	132	1207	25	400	6000	26.5
Raiatea	173.3	1017	5	400	6000	27.8
Tahaa	90.9	590	5	400	6000	36.4
Huahine	82.1	669	30	400	6000	30.5
BoraBora	21.9	727	20	400	6000	91.3
Nuku Hiva	345	1186	40	600	7300	-
Ua Huka	82.4	856	40	600	7300	-
Ua Pou	111.6	1231	40	600	7300	-
Hiva Oa	318	1190	100	600	7300	-
Tahuata	70.8	1000	5	600	7300	7.1

Each of the parameters listed is of considerable importance to the evolution of the arthropod fauna in these islands, and the conservation status.



Prior to our expedition to the Marquesas, knowledge of the spider fauna of French Polynesia was limited largely to publications by Lucius Berland (Berland 1927, 1929, 1933, 1934a, 1934b, 1934c, 1935a, 1935b, 1935c, 1938, 1942) from the MNHN in Paris, with some of this information being summarized by Marples (1957). Berland (1934c) recognized 4 major subdivisions of the Pacific (see figure above): I. Australasia/ Papua New Guinea. II Polynesia. III Micronesia. IV Neotropical. V. Antarctic. Berland concludes: “The examination of the spiders of the Pacific thus seems to justify the subdivision as several provinces [see Figure 1]. All information seems to indicate that the settlement of Pacific was done by migrations coming from the Indo-Malaysian area, migrations which would probably have been multiple and following several distinct currents. One of these currents would have been populated from Australia; this is what I call the “austral-canaque” province; a quite distinct current of migration, but of same origin, would have populated Polynesia, whose current archipelagoes constitute probably only the subdivision of a previously more extended continent, with a branch being detached towards Hawaii; another towards Micronesia see Figure 2]. There is no visible relation between America and the Pacific; but on the other hand Galapagos as well as Fernandez received their fauna from the south of America, by the austral lands. In addition the islands of Pacific almost always present a very marked level of endemism, which testifies to an extremely old isolation, and should be fix their separation farther back, at least to about the middle of the Tertiary epoch, and perhaps farther. I will add that the study of several zoological groups, as one can see it in this work, arrive, independently from each other, at conclusions very close to mine, and so appear to me to receive a solid confirmation from it.”

As can be seen, Berland subscribed strongly to one of the popular views of the time, that the islands of Polynesia were formed as a single large continent, which became subdivided to form the islands as we now know them. Recent geological evidence has dismissed this view: The archipelagoes of Hawaii, Marquesas and Societies 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 5.1myrs, to Hawaii the youngest, in the south, at up to 0.4myrs old. The Marquesas range from Nuku Hiva, the oldest in the north at 3.7myrs, to Fatu Hiva the youngest, in the south, at 1.4myrs. The Society Islands range from Bora Bora, the oldest in the north at 3.3myrs, to Tahiti the youngest, in the south, at 1.0myrs.



ITINERARY

June

16 f Left Berkeley

17 s (Moorea) Arrived Moorea

18 s (Moorea) Went up trail to 3 Coconuts Pass - Gillespie, Roderick, Garb, Spagna, Shapiro. Collected down steep bank to large river around 320m, and on river. Found lots of *T. macilenta*; also *T. maxillosa* on river. Found 2 immatures of *Tetragnatha* sp 4A. Also lots of pholcids, a few *Leucauge* Also collected on small river near pig farm on way back. Found lots of *T. maxillosa*.

- 19 m (Moorea) Looked around various dirt roads. Then up Paopao-Vaiare trail, coming in from Vaiare side - Gillespie, Roderick, Garb, Spagna, Shapiro.. Hiked up to top of ridge. Collected before dark along ridge. Collected in dark on way down. Got jumping spider, crab spider, 1 *Tetragnatha* sp 4A. Collected in dark on way down. Found LOTS of dictynids, pholcids. NO *Tetragnatha*; *Argyrodes* (“Ariamnes”) in local patches (almost all collected in one place, at about 250m).
- 20 t (Moorea) Roderick and Garb went up trail to 3 Coconuts Pass.
- 21 w (Nuku Hiva) Gillespie and Shapiro – flew to Nuku Hiva (arrived 2.30). Took 4WD to Mt. Muake, 864m above Taiohae. Collected on way up to the radio station. Camped on top. Vegetation initially conifer canopy (~780-810m), then a legume (*Paraserionthes falcata*) from about 810-830m, and then pretty bare and open at the summit. Cattle grazing in the area. Collected at night down to conifers. Jumping spiders (near the top), *Leucauge* (small), pholcids near bottom.
- 22 t (Nuku Hiva) Gillespie and Shapiro hiked down from Mt. Muake. Swept extensively to main road just past conifers (to ~750m). Then collected intermittently on way down mountain on main road, to about 550m). Then walked on to Taiohae.
- 23 f (Nuku Hiva). Went up Mt. Tekao – R. Gillespie, Jean-Yves Meyer, Frere Maxime, Pascal Villard and Leo Shapiro. Collected from road (1200m) to camp site at ~1185m. Found *Tetragnatha* right at beginning of trail onwards. Also collected some planthoppers. Collected in proximity of camp site at night.
- 24 s (Nuku Hiva). From camp site, went towards Mt. Tekao summit. First to one peak, then down valley, then up another peak. Collected on way, and on way back, especially at stream at bottom of valley, elev. 1100m. Then back to camp. Picked up pitfall traps. One ant, LOTS of amphipods and oribatid mites Collected in proximity of camp site at night.
- 25 s (Nuku Hiva) Picked up camp and left ~7am. Went down to road (raining fairly hard). Jean-Yves Meyer, Leo Shapiro and R. Gillespie went to old road, 1100m. Climbed up hill (to 1130m) and collected up there. Then went along road a bit more, collected along side. Good number of ants. Drove down to Ag station in Tovii. Collected some on way down, by side of road. Stayed night at ag station (~800m).
- 26 m (Nuku Hiva) Jean-Yves Meyer, Frere Maxime, and R. Gillespie met with officials in Taiohae. L. Shapiro collected on Tovii.
- 27 t (Nuku Hiva to Atuona) Jean Yves Meyer, Frere Maxime, Jean Pierre, Leo Shapiro, R. Gillespie went to dry forest; collected there. Then to airport for Hiva Oa. Met with George Roderick and Teiki Richmond. T. Richmond drove us up to base of Temetiu trail. Camped there at base of trail.
- 28 w (Hiva Oa) Roderick and Gillespie hiked up to summit of Temetiu, 1170m. Got there ~1pm. Hiked around ridge trail. Found lots of crab spiders by beating. Also some salticids, not so many *Tetragnatha*. Camped on ridge, and collected there at night. (Shapiro remained at bottom base of mountain)
- 29 t (Hiva Oa) Roderick and Gillespie collected along Temetiu Ridge Trail, then hiked back down, collecting on way.
- 30 f (Hiva Oa) Teiki Richmond picked drove Roderick, Gillespie, and Shapiro to Ootua. Hiked up Ootua (up stream bed, then round side and straight up to top) to

900m. Then looked around summit, and gullies beside it. Found some planthoppers. Roderick and Gillespie hiked down into gully again after dark. Found a few *Tetragnatha* down there. Lots of pig damage, all through gully and guava.

July

- 1 s (Hiva Oa) Hiked down from Ootua. Teiki Richmond picked us up at bottom at 7am and drove us back to Atuona. Then he took us in his boat to Tahuata. Were driven up mountain on Tahuata to about 535m. Roderick and Gillespie searched for trail through conifers; unable to go very far due to leg injury that Gillespie had received during descent from Mt. Ootua. Collected at night around camp site at 535m.
- 2 s (Tahuata) Hiked down mountain on Tahuata. Teiki Richmond took us back to Atuona.
- 3 m (Hiva Oa) Met Alain LeBronnec and examined library in his house.
- 4 t (Hiva Oa - Tahiti) To airport and to Nuku Hiva, then to Papeete.
- 5 w (Moorea) Got ferry over to Moorea. Shapiro and Arnedo went up to 3 Coconuts.
- 6 t (Tahiti) Roderick, Gillespie and Spagna went over to Tahiti. Met with Jean-Yves Meyer and went with him up Mt. Marau. Stopped at different elevations on Marau: 805m, 870m, 985m, and 1240m. returned to Papeete with Jean-Yves Meyer in afternoon, and picked up Garb, Shapiro, and Arnedo. Drove back up Mt. Marau, camped at 1240m and collected spiders around there at night.
- 7 f (Tahiti) drove down from Mt. Marau, through Papeete, to Papenoo, then went up Papenoo Valley. Collected by river along valley, at 14km, 195m. Then drove over to Tahiti Iti. Camped by the end of the road, beyond the Belvedere on Tahiti Iti, slope of Mt. Teatara, 650m. Collected there at night.
- 8 s (Tahiti) Drove back to Papeete. Then to Moorea.
- 9 s (Moorea)
- 10 m (Moorea)
- 11 t (Moorea) Roderick, Shapiro, and Arnedo went up Mouaputa with Victor Wong.
- 12 w (Raiatea) Gillespie, Roderick, Shapiro, and Arnedo got flight at 10.30am to Raiatea. Hiked up to Temehani Plateau, 800m. Unusual forest there, with lots of hala. Found no *Tetragnatha* except over stream. Camped on summit.
- 13 t (Raiatea) Gillespie and Roderick hiked off summit, then got flight back to Papeete. Shapiro, and Arnedo remained and collected on Raiatea.
- 14 f (Moorea).
- 15 s Back to USA (Gillespie, Roderick); Shapiro & Arnedo to Bora Bora
- 16 s Bora Bora – Shapiro & Arnedo
- 17 m Moorea – Shapiro & Arnedo

PRINCIPLE RESULTS

SOCIETY ISLANDS

Berland (1934a) described knowledge of the spider fauna of Tahiti as follows:

“In spite of its universal prestige, especially in literary work, the fauna of this archipelago is badly known from the point of view which we are considering. In all, there are approximately 15 known species, of which the list is as follows: *Pholcus ancoralis*, *Cyrtophora viridipes*, *Araneus theisi*,

Heteropoda regia, *Corinna cetrata*, *Thorellia ensifera*, *Plexipps paykulli*, *Bavia aericeps*, *Athamus whitmeei*, *Mollica microphthalma* and *pusilla*, *Hasarius albocircumdatus*, *Ascyultus pterygodes*, *Lauharilla insulana*. It is obviously very little: there is almost no trace of endemism; being given what one knows of archipelagoes close to the islands of the Societies, being also given 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 to currently affirm a real poverty of fauna, and we should await other investigations. What is significant above all, it is that the island fits well in the Polynesian group.”

This statement is a reasonable reflection of the knowledge of the spider fauna of the Society Islands prior to our expedition this summer (Marples 1957).

I. TETRAGNATHA

SPECIES DIVERSITY

Prior to this expedition, the only species of *Tetragnatha* reported from the Society islands were *T. macilenta*, *T. huahinensis*, *T. maxillosa*, and *T. mandibulata*. The only reported endemic was *T. huahinensis*. I have now collected on Tahiti, Moorea, and Raiatea. I have also examined historical collections at the Museum National Histoire Naturelle in Paris, and the Bishop Museum in Honolulu. Studies on historical collections have now shown that (1) Reports of the cosmopolitan species *T. mandibulata* in Tahiti are probably not valid; these were misidentifications for either *T. macilenta* or *T. nitens*. (2) *T. huahinensis* is a synonym for *T.*

macilenta. Studies of my own collections have revealed 4 new species of *Tetragnatha*, all of which are undescribed and appear to be endemic to middle and high elevations of the Society islands (from each of Tahiti and Moorea). In total, there are 7 species of *Tetragnatha* in the Society Islands: In addition to the 4 endemic species there is one possibly indigenous (*T. macilenta*), and two probably introduced (*T. nitens* and *T. maxillosa*).

Table 1. Checklist of *Tetragnatha* species in French Polynesia. Green, endemic; blue, widespread but (?) indigenous; red, adventive.

Society Islands	T-high	T-mid	T-low	M-mid	M-low	R
<i>T.sp 1A</i>		X				
<i>T.sp 2A</i>		X				
<i>T.sp 3A</i>	X					
<i>T.sp 4A</i>				X		
<i>T.sp. 5A</i>						X?
<i>T.macilenta</i>	X	X	X	X	X	
<i>T.maxillosa</i>			X		X	
<i>T. nitens</i>					X	
Marquesas	NH	HO	Ta	Note:		
<i>T.marquesiana</i>	X			T-high, Tahiti >1000m; T-mid, Tahiti >500m; M-mid, Moorea >500m; R, Raiatea (elevation unknown). NH Nuku Hiva; HO Hiva Oa; Ta Tahuata		
<i>T.sp M4A</i>	X					
<i>T.sp M5A</i>	X					
<i>T.sp M3A</i>		X				
<i>T.sp M1A</i>			X			
<i>T.nitens</i>	X					

SPECIES DESCRIPTIONS

T. SP. 1A. TAHITI, NEW SPECIES:

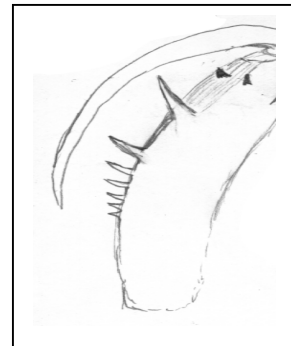
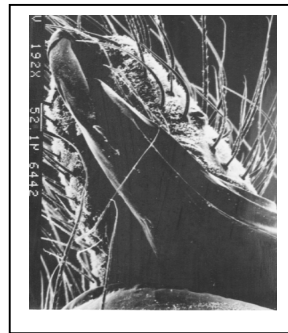
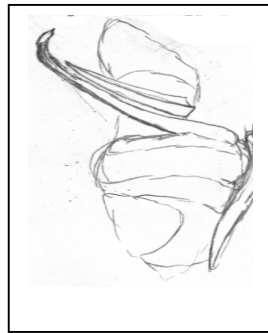
Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Vallee Vaipuarii	600m	28Aug1928	1 male	Bishop	Adamson

This species was given then name *T. mandibulata* by Berland (1934a). Of this animal, Berland (1934a) says “L. Koch has given this name [*Tetragnatha mandibulata*], very badly defined by the description of Walckenaer [referring to Walckenaer 1841], to a Polynesian spider, which appears quite widespread in Oceania, since it is also known from Fiji, Samoa, Tonga, and Tahiti. For the examples that I have under the eyes, the teeth of the chelicerae accord well with the descriptions of Walckenaer (1841), but there are some variations in the color, my specimens having on the cephalothorax a brown median longitudinal band, and on the abdomen two series of spots in longitudinal lines, which recall the drawing of *T. macilenta* L Koch, of Samoa”. This species is certainly similar to *T. macilenta*, but has a different tip to the conductor of the pedipalp. Recognition of this animal as a distinct species will warrant further morphological analyses.

T. SP. 2A. TAHITI, NEW SPECIES:

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Belvedere	580m	19Nov1999	2M,2F,1I	-	Gillespie
Tahiti Iti: Mt.Teatarā	650m	7Jul2000	2M2f,12I	-	Gillespie

This species has been found in two locations, Tahiti Iti, 650m, and Tahiti Belvedere, 580m. This species appears to be distributed at middle elevations

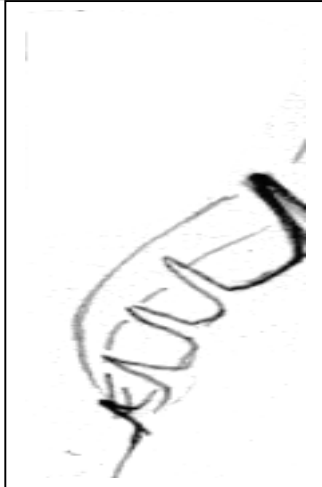


(580m at Belvedere – 650m on Tahiti Iti) throughout Tahiti. It has a “furry” appearance because of the thick hairs on its legs. The illustrations below show the chelicera (jaw) (left), pedipalp (middle) and conductor tip of the pedipalp (right) for a male of this species.



T. SP. 3A. TAHITI, NEW SPECIES:

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Mt Aorai	1700m	Nnov1999	2M,6F,6I	-	Gillespie
Tahiti: Mt Marau	1280m	6Jul2000	8F,2I	-	Gillespie
Tahiti: Mt Marau	1240m	6Jul2000	2M,1F	-	M.Arnedo



These are large, robust and colorful species with smooth legs (not furry) that occur at upper elevations (above 600m) on both Mt. Aorai and Mt. Marau. They frequently do not build webs, and are found at night, especially on Mt Aorai, foraging actively at night in the open. They are less common on Mt. Marau. The illustrations below show the chelicera (jaw) (left), pedipalp (middle) and conductor tip of the pedipalp (right) for a male of this species.

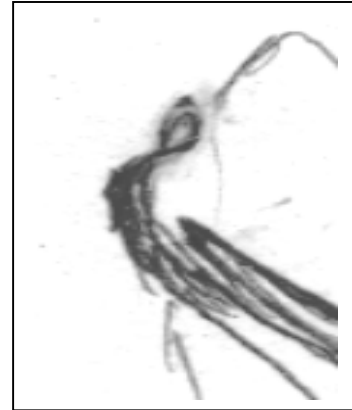
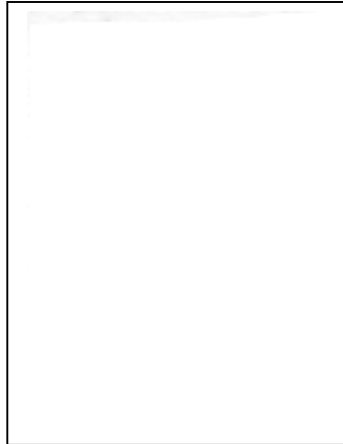
T. SP. 4A. MOOREA, NEW SPECIES:

Location	Elevation	Date	# specimens	Museum	Collector
Moorea: Paopao-Vaiare	320m	19Jun2000	1I	-	Gillespie
Moorea: Paopao-Vaiare	540m	3Jul2000	1F,2I	-	M.Arnedo

Moorea: 3 Coconuts	320m	18Jun2000	2I	-	Gillespie
Moorea: 3 Coconuts	320m	5Jul2000	2M,1F,1I	-	M.Arnedo

As in the low elevation species on Tahiti, this species, which is only on Moorea, has a “hairy” appearance. It is similar in gross morphology to the low elevation Tahiti species, but its chelicera and male pedipalp are very distinct (see diagram).

T. SP 5A RAIATEA (originally called *T. laqueata*) L.Koch



Location	Elevation	Date	# specimens	Museum	Collector
Raiatea: Opoa		1955?	1F	Bishop*	N. Krauss

Types: *T. laqueata* was first described by L. Koch from Upolu, Samoa. The type specimen was deposited in the Museum Godeffroy, which was absorbed into the Hamburg collection in Germany. I have examined 1 male and 3 females from the Hamburg Museum. These specimens are *T. laqueata*. However, since that time, *T. laqueata* has been reported in Raiatea by Marples (1957) based on a single female specimen (now in the Bishop Museum). I have now examined this specimen. It is not *T. laqueata*. It is most similar to *T. insulicola* Okuma, described from Lord Howe Island, but the genitalia is quite different.

T. laqueata has also been recorded from the Bonin Islands and elsewhere in the north pacific. These records are incorrect: The specimens described by Okuma (1980) and Yaginuma (1979) are not *T. laqueata*.

***T. MACILENTA* L.KOCH**

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Vaipaarii	600m	28Aug1928	1M,1I	Bishop*	Samson
Raiatea: Temehani	700m	3Sep1977	-	Bishop	WCGagne
Tahiti: Mt Marau	790m	6Jul2000	1I	-	Roderick
Tahiti: Mt Marau	820m	6Jul2000	1M,3I	-	Roderick
Tahiti: Mt Marau	1240m	6Jul2000	1M,1F,7I	-	Gillespie
Tahiti: Mt Aorai	1700m	Nov1999	1M,3I	-	Gillespie
Moorea: Trail to 3 Coconuts	320m	18Jun2000	1M,4F,1I	-	Gillespie
Moorea: Trail to 3 Coconuts	120m	21Jun2000	1M,2F,1I	-	Roderick
Moorea: Mouaputa	450m	11Ju12000	4F,4I	-	Roderick
BoraBora		Jul2000		-	M.Arnedo

* labeled *T. mandibulata* by Berland

Types: *T. macilenta* was first described by L. Koch from Upolu, Samoa. The type specimen was supposed to have been deposited in the Museum Godeffroy, which was absorbed into the Hamburg collection in Germany. However, 2 females only remain at the Hamburg Museum. These females do appear to be *T. macilenta*, and are from Upolu, Samoa. However, there is an additional male and female in the Hamburg collection (labeled “?syntype, *T. macilenta*”) from New South Wales, Australia. These latter specimens are *T. valida*. In the British Museum, London, *T. macilenta* L. Koch is represented by 1 male from the Solomon Islands (Rennell); 1 male from the Cook Islands, Aitutaki; 1 male and 1 female in forest, Upolu; and many specimens from Apia, Upolu, Samoa (most collected by Marples). However, I have not studied the British Museum collection in any detail. But the Type (male) is not at the British Museum; its location (if it exists at all) is currently unknown.

T. macilenta appears to be a very widespread species throughout Polynesia. Berland (1942) described a new species, *T. huahinensis* from Huahine. However, I have examined the type species (at Bishop Museum); this appears to be *T. macilenta*. Berland describes *T. huahinensis* as follows: Female (no male) color light brown, the margin and two stripes darker, labium brown, sternum light testaceous, the margin gray; abdomen gray with little silver plates on the sides and, in the posterior half, 2 rows of 4 small brown spots. Eyes, the two rows recurved, the first a little more, eyes nearly equal, the anterior lateral a little smaller, the lateral of the two rows a little farther from each other than the median. Chelae with a strong protruberance near the claw. Abdomen long, about 10x 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 chelae.” Interestingly, Berland drew a very similar diagram (Berland 1929) when describing *T. macilenta* L. Koch from Upolu, Samoa.

Chrysanthus (1975) cites Rower (1942), who cites Koch (1872) and Berland (1929). Neither mention Norfolk Is., Hawaii, or the Marquesas. Bonnet says that it is found in Samoa, Norfolk and the Marquesas, citing Berland, Rainbow, and Koch. None of the references mention Hawaii. Also, Berland's assignation of *T. macilenta* was somewhat loose. I found many specimens and discussions of *T. macilenta* from the Marquesas in the literature, but none of these match the actual description of *T. macilenta*. Okuma (1987) states 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 Islands. She did not examine any Polynesian species. I therefore conclude that *T. macilenta* has not been found further east than the Society Islands.

***T. MAXILLOSA* THORELL 1895**

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Nr Tiupi Bay, Papaari	∞	3May1934	1M,1F	Bishop*	
Tahiti: Papeete	-	-	1M,2F	Bishop*¶	
Tahiti: Tiarei	-	-	-	Bishop*¶	
Tahiti: Vallée de la Reine	460ft	17Dec1928	1M,1F	Bishop*¶	

Raiatea: Utoroa	-	-	-	Bishop*	
Raiatea: Temehani Pl.	1400ft	5oct1934	-	Bishop	EC Zimmerman
Raiatea: Opoa.	-	-	II	Bishop	-
Tahiti: Papenoo Valley	195m	7Jul2000	3M,2F,II	-	Gillespie
Moorea: Trail to 3 Coconuts	220m,over stream	18Jun2000	-	-	Gillespie
Raiatea: Temehani Pl.	800m,over stream	12Jul2000	2M,3F,II	-	Gillespie

∞ Sweeping grasses and low herbage; * det. C. Okuma

T. maxillosa was first described by Thorell (1895). There is a good deal of confusion because Thorell (1895) first described the species based on a specimen of *T. mandibulata* that he had misidentified in 1890. Thorell also describes the *T. mandibulata* that Koch (1872) referred to as *T. kochi*. Berland uses the name *T. mandibulata* "Koch, not Walckenaer". However, in almost all cases, he appears to mean *T. maxillosa*. Much of Berland's material has now been examined by C. Okuma. In most cases, Berland's identifications of *T. mandibulata* appear to be *T. maxillosa*:

***T. NITENS* (AUDOUIN IN SAVIGNY). UA POU AND NUKU HIVA:**

Location	Elevation	Date	# specimens	Museum	Collector
Moorea: Baie de Cook	0m	Mar1955	1F	Bishop	Krauss
Moorea: Gump Field Station	0m	18Nov1999	8M,10F,II	-	Gillespie

This species is found along the coast of Moorea.

***T. MANDIBULATA* WALCKENAER (NO CONFIRMED RECORDS IN FRENCH POLYNESIA):**

This species was described by Walckenaer (1841) as follows:

Mandibles carried in front, very-prominent, very-elongate, reinflated in their medium, divergent and whose stem is finished by a spine or hook* of a red blade. Cylindrical abdomen, lengthened, narrower than the corselet, a little bent or raised in the posterior part, color green obscure. The corselet is lengthened, rougeatre, is bordered of a line yellow fine. The palpi and the legs are red. There are grayish or white hairs on the corselet, the legs, and the mandibles.

From the Marainnes, Guam.

* believed to refer to the first stout dent of the ventral row, which extends directly forward beside the base of the fang (Chrysanthus 1975).

The confusion is that Berland uses the drawing of Koch (which looks very like *T. maxillosa*, but apparently Thorell, 1895, calls this species *T. kochi* **Note: need to check on Thorell 1895 Descriptive Catalogue of the Spiders of Burma: 1-406, London**) to identify species. Okuma has now been through much of the material and correctly identified many of the Berland labels of *T. mandibulata* as *T. maxillosa*.

There has been a good deal of confusion regarding *T. mandibulata*, as Chrysanthus (1975) notes. In particular:

T. mandibulata Keyserling, 1865 = *T. keyserlingi* Simon 1890 (p.134) (Note: look up Simon, E. 1890. Études arachnologiques, 22e meoires. Ann Soc. Ent. Fr (6) 10: 131-136.

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

T. mandibulata Thorell 1890 = *T. maxillosa* Thorell 1895 (p.139) It is said that this species is known from Norfolk Is, Hawaii, and Marquesas (Chrysanthus 1975)..

II. THOMISIDAE

Records of the spider family Thomisidae are restricted to a single species description based on collections of two females from one locality, Vaipuarii Valley on Tahiti Island (Berland, 1934a). While only one species is described from the archipelago, this low diversity likely reflects insufficient collecting efforts. Lehtinen (1993) suspected that the rugged interior of the archipelago's islands hold additional unknown species. Jessica Garb conducted a survey of thomisid spiders from Moorea and Tahiti in an effort to find additional species, document their biogeographical distribution and assess their systematic placement in relation to other Pacific thomisid species. The following table reports the number of individual thomisid spiders collected at each locality. All species from the Society Islands are currently placed as *Misumenops melloleitao*. While these collections may include additional new species from either archipelago, more detailed systematic analyses are required to verify this.

Island	Locality	Date	Elevation	# Individuals
Moorea	Vaire-Paopao	19 June	325m	4
Moorea	Belvedere	27 June	550m	21
Moorea	Belvedere	2 July	550m	7
Moorea	Mt. Mohaputa	11 July	840m	2
Tahiti Iti	Belevedere	24 June	650m	11
Tahiti Iti	Belevedere	7 July	650m	5
Tahtiti	Mt. Marau	6 July	1240m	32
Raiatea	Temihana Pl.	13 July	780m	14
TOTAL #				96

The collections reported here extend the known distribution of thomisid spiders in the Society Island archipelago. Once formerly known from one locality on Tahiti, they are now known to exist on other areas of Tahiti as well as in Moorea and Raiatea. This finding supports the possibility of a radiation of this group across the archipelago. Further, males have been collected and will be described. While I collected more than one "morpho-type" from the Society Islands, it is premature to determine the number of species collected and if new species are among these collections. All collected individuals have been preserved in ethanol and entered into a collections database. I have begun DNA extraction as part of the initial phases of a cladistic analysis (both morphological and molecular) to determine the phylogenetic relationships among the variants from different localities to assess if they merit new species status. Thomisid spiders were only found in montane forests and were collected from *Metorsideros*, *Cyathea spp.*, and *Dicranopteris sp.* (native), and mape, *Inocarpus fagifer* (non-native).

III. CONCLUSIONS ON SPIDER BIODIVERSITY

I. Native Species

- a) Tetragnathidae. Native *Tetragnatha* start to occur at elevations of approx. 320m on Moorea, and 550m on Tahiti. These mid elevation habitats are relatively dry.

Different species occur in the wet cloud forests of the mountaintops of Tahiti. It may well be that future collections will reveal additional species on the summits of Moorea as well.

- b) Thomisidae. The species *Misumenops melloleitao* on Moorea and Tahiti seems to be widespread, and tolerates a wide range of conditions from 300m to 1200m.
- c) Salticidae. These appear to be fairly numerous and diverse in all habitats, although more work is need to verify the status of the species (native versus alien).

Salticidae, *sp. A*

Location	Elevation	Date	# specimens	Museum	Collector
Bora Bora: Mt. Hue, ridge	611m	15Jul2000	1M,4F	-	Arnedo, Shapiro
Moorea: Gump Field Station	0m	18Nov1999	8M,10F,1I	-	Gillespie

Salticidae, *sp. A*

Location	Elevation	Date	# specimens	Museum	Collector
Bora Bora: Mt. Hue, ridge	611m	15Jul2000	1F, 1I	-	Arnedo, Shapiro
Moorea: Gump Field Station	0m	18Nov1999	8M,10F,1I	-	Gillespie

Salticidae, *undetermined*

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti Nui: Mt. Marau	1360 m	7Jul2000	5I	-	Arnedo
Moorea: Mt. Mauaputa	800m	11Jul2000	1I	-	Arnedo
Raiatea: Temehani plateau	0m	13Jul2000	2F,3I	-	Arnedo

- d) *Argyrodes*. Representatives in the sub-genus “*Ariamnes*” (free-living) and “*argyrodes*” (kleptoparasitic) are present in the following sites:

Argyrodes, free-living, *Ariamnes*

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti Nui: Mt. Marau	1260 m	6Jul2000	5F,4I	-	Arnedo
Moorea: Belvedere tr.	375m	2Jul2000	2M,2F,2I	-	Arnedo
Moorea: Troi Cocotier tr	360m	5Jul2000	3M,1F,2I	-	Arnedo
Moorea: Vaiare-Paopao	340m	3Jul2000	2F,2I	-	Arnedo

Argyrodes, kleptoparasitic

Location	Elevation	Date	# specimens	Museum	Collector
Moorea: Belvedere tr.	375m	2Jul2000	5M,6F,5I	-	Arnedo
Moorea: Troi Cocotier tr	360m	5Jul2000	1M,2F	-	Arnedo
Moorea: Vaiare- Paopao	340m	3Jul2000	3F	-	Arnedo
Bora Bora: Mt. Hue	611m	15Jul2000	1F,1I		Arnedo, Shapiro

- e) *Theridion*-like species (Theridiidae). Representatives of this group are common in the Societies and Hawaii. In the Societies the native species are represented primarily by the genera *Achaeearanea* and *Theridion*.

Achaeearanea sp. (near Hawaiian species)

Location	Elevation	Date	# specimens	Museum	Collector
Moorea: Mt. Mauaputa	800m	11Jul2000	1M	-	Arnedo
Raiatea: Temehani plateau,	780 m	13Jul2000	2F	-	Arnedo, Shapiro
Tahiti Iti: Above Belvedere	650 m	7Jul2000	1I		Garb
Tahiti Nui: Mt. Marau	820 m	6Jul2000	2F,1I		Gillespie
Tahiti Nui: Mt. Marau	1260 m	6Jul2000	3M,4F,3I		Arnedo

Theridion sp.

Location	Elevation	Date	# specimens	Museum	Collector
Moorea: Mt. Mauaputa	800m	11Jul2000	1M	-	Arnedo
Moorea: Vaiare- PaoPao	340m	3Jul2000	1M	-	Arnedo
Tahiti Nui: Mt. Marau	1360 m	7Jul2000	1I		Arnedo

II. Alien Species

- a) Uloboridae. These are extremely numerous in low, middle, and even high elevation forest throughout the Society Islands. They are orb-web-building cribellate spiders. In gross appearance, they can sometimes be mistaken for *Tetragnatha*. However, they are more frequently diurnal, their orb webs are distinctive (closer mesh, closed hub), and they move much more quickly. It is impossible to say whether these species are having an impact on the native spiders, and I cannot tell with any certainty that they are alien, although their abundance and occurrence in alien-dominated sites would indicate that they might be alien. I have found them in abundance in both native and alien-dominated forests.

- b) Pholcidae. These are also numerous in low and middle (up to 500m or more) elevation wet forest. Again, I cannot tell whether these species are native or alien, although their tremendous abundance in disturbed habitats would suggest that they may be alien.
- c) Araneidae. Most of these appear to be alien. They predominate in low elevation habitats (especially drier roadside areas).
- d) Tetragnathidae. On Moorea, *T. nitens* appears to dominate the mangrove areas around the bays. It is likely to be found in similar areas on Tahiti. *T. maxillosa* is abundant over low elevation streams and rivers on both Tahiti and Moorea. Native *Tetragnatha* start to occur at elevations of approx. 320m on Moorea, and 550m on Tahiti. These mid elevation habitats are relatively dry. Different species occur in the wet cloud forests of the mountaintops of Tahiti. It may well be that future collections will reveal additional species on the summits of Moorea as well.

IV. CONSERVATION ISSUES:

Moorea:

- i. Trois Cocotiers. There was considerable alien vegetation up to the ridge of this trail. In the wet gulches, spiders were numerous, but appeared to be almost all alien species, with numerous pholcids and uloborids, as well as *Tetragnatha macilenta*. However, towards the ridge, the species composition appeared to become largely native.
- ii. Vaiare-Paopao. As with the trail to Trois Cocotiers, there was considerable alien vegetation up to the ridge of this trail. On the slopes, spiders were much less numerous than the Trois Cocotiers, but mostly pholcids and uloborids. There were no *Tetragnatha macilenta*.

Tahiti:

- i. Mt. Aorai. At the bottom of the trail towards Mt. Aorai, the vegetation was very disturbed, and there were extensive stand of *Miconia calvescens*. Spiders were very sparse in this area, but most of them were likely native species. Further up the mountain, the species composition changed, with a different array of species, almost exclusively native by the mountain summit.
- ii. Mt. Marau. The habitat was similar in many ways to m. Aorai, although no native species were found as low as they were on Mt. Aorai. Near the summit, almost all the spiders appeared to be native.
- iii. Tahiti Iti. We collected here in a very disturbed location near the Belvedere on the slope of Mt. Teatara. However, the spiders at this site, although not highly diverse, appeared to be native (Tahiti endemics).

MARQUESAS

Berland (1934b) described the fauna of the Marquesas as follows:

Until present, our knowledge of the spiders was summarized in a short note which I published in 1927 in the Bulletin of the Museum, and I announced 4 species sent by P. Simeon Delmas, of Taiohae: 3 of them were cosmopolitan; and I wondered in conclusion if this archipelago had a good endemic spider fauna. But I had very recently good fortune to be entrusted with an abundant materiel collected in the Marquesas by Mr. Mumford and Mr. Adamson, of the Pacific Entomological Survey, likewise by Mr. LeBronnec and Mr. Tauraa; P. Delmas has also sent me new documents, and the unit raises any doubt in this regard, since, instead of 4, we now know 38 species, which are comprised as follows:

(Berland1933):

Cosmopolitan	8
Polynesian	14
Endemic	16

The coefficient of endemism thus rises to 42%, it is rather close to that of the other archipelagoes, and the Marquesas by no means constitutes an exception in the Polynesian group. This happy result is due to the method employed by Adamson and Mumford: not limiting themselves to the collections made in the coastal zone, where, with the surplus, prevails a deforestation due to cattle imports, they focussed their search on the mountainous part and far from accessible from the interior of each island, where the indigenous fauna has had the most chance to be preserved without alteration. The Polynesian affinities are marked in a certain number of species that one finds in nearby archipelagoes, This is especially true of the salticids such as *Bavia aericeps*, *Thorellia ensifera*, *Athamas whitmeei*, *Mollica microphthalma*; a pholcid *Pholcus ancoralis*; and a sparassid *Heteropoda nobilis*. These species do not come out of the Pacific, in general, or are at most sparse in the area. It is highly improbable that these species have been transported artificially, because they should then be in other places: none, for example, approaches America. They thus seem to be the invaluable witness of a common origin of all these archipelagoes *. Moreover one finds some species which attest to affinities not only with Polynesia, but also with the more remote areas of the Pacific. Thus *Corinna cetrata* is known from the Marquesas, Tahiti, and Easter Island, and also from New Caledonia. Some salticids also have caledonian affinities, and some Malaysian. It is of a certain interest to note the presence of a cribellate spider, genus *Syririsa*, a genus known from Australia and New Caledonia. There is a curious case represented by a salticid: *Sandalodes calvus*, described from Queensland, is abundant in the Marquesas. Certain spiders have affinities from farther away: *Tetragnatha nitens*, a Mediterranean species, is found in Asia minor, India, Malaysia, up to the Marquesas.

Finally one recognizes a rather unexpected case: that of a Hawaiian affinity. Mumford and Adamson have told me that this affinity appeared in certain Hemiptera-Homoptera. I have also stated very clearly that the spiders of the genus *Sandalodes* ... is represented largely in Hawaii, and also in Marquesas, where it numbers 6 species, all endemic except *S. calvus* which, as we saw, is also in Australia. On the other hand this genus is completely missing from New Caledonia, as well as from Samoa. It is developed as abundantly in the Marquesas as in Hawaii, the segregation or isolation on distinct islands does not play any role. No Hawaiian species is found in the Marquesas. One would thus be led to believe that there has been a common settlement, or at least simultaneous: Either the migration towards the Marquesas was done by way of Hawaii or through other currents of migration.... But this is only the Hawaiian affinity which is quite clear, and in general the groups which characterize Hawaii by their number: *Tetragnatha*, thomisids, etc, are not found themselves with same abundance in the Marquesas."

* As PA Buxton notes in the Insects of Samoa () "It is no doubt true that certain species are of recent introduction, and that other widely distributed tropical spiders will sooner or later reach Samoa. But we must not forget that the primitive Polynesians traveled and raided in great canoes, which carried as many as a hundred men, and were provisioned for ocean voyages; moreover, Samoa was definitely a centre of their dispersion. We must therefore assume that some of the insects and other arthropods which are domestic were introduced by man many centuries before the European entered the Pacific."

Berland's conclusions – that many of the widespread species that he received from the islands were evidence of a common origin of these archipelagoes, was based on a common belief of the geological history of the islands at that time. We now know this to be incorrect. The islands were formed independently. I would therefore suggest that many of the very widespread species might not be native. Further, the representation of specimens from the native forest that Berland was able to examine did not reflect the actual abundance and diversity of species in the forests. Therefore, the results presented here provide a very different picture of the Marquesan spider fauna.

In a more recent publication, Berland (1935b) wrote: “The islands include a littoral zone, where one finds especially cosmopolitans and .. Polynesian species, but the recent collections of LeBronnec have made known to a very interesting fauna, confined to the interior of island and to a certain altitude, several species not being found below 1000m. It is there that the majority of endemics exist, among which it is curious to come across some forms - although there are some new genera and species – having morphologies characteristic of the European spiders, such as the Erigones and Linyphiids. Recent research tends to have shown that one has to wait to find a fauna of this type .. on all the high summits of the world, which resemble faunal islands on the surface of the continents, and often the same as an island in an island, in the case of the oceans. The comparison between these faunas of altitude is currently almost impossible, because the high summits remain most poorly known of any place on the surface of the Earth”.

This latter summary is a better reflection of what appears to underlie the diversity of the spider fauna of the Marquesas.

I. TETRAGNATHA

T. NITENS (AUDOUIN IN SAVIGNY). UA POU AND NUKU HIVA:

Location	Elevation	Date	# specimens	Museum	Collector
Eiao: Vaituha Valley	1000m	3Oct 1929	1M,5F	Bishop	Adamson*
Nuku Hiva: Vaihakameama	1000m	Nov 1929	1M,6F	Bishop	Adamson*
Nuku Hiva: Vaihakameama	850m	Jun 1931	1F	Bishop	LeBronnec, Tauraa ¶
Nuku Hiva: Tapuaooa	850m	30May1931	1F	Bishop	LeBronnec, Tauraa ¶
Nuku Hiva: Terre Deserte, Ha'atuatua	850m	2Jul1988	2F	Bishop	Montgomery ∞
Nuku Hiva: Tovii Plateau	1100m	11Jun1984	1F,1I	-	Nishida ∞

* Found in the grass on the edge of a little lake (Berland 1933); ¶ Berland 1935a; ∞ det. R.Gillespie

This species was considered indigenous to the Marquesas by Berland (1933). He points out that "the species is widespread in all the area Mediterranean (including southernmost France), almost all Africa to the Cape, Australia, New Zealand, the Chatham islands; it was however not yet known of Polynesia. Its broad distribution cannot be interpreted as an accidental transport, more especially in the case of the Marquesas it was found in the interior of two islands and not on the coast, as it is in general the case for the species

fortuitously introduced.". Additional specimens of this species have been found, records together being as follows:

T. SP. MIA. TAHUATA, NEW SPECIES:

Location	Elevation	Date	# specimens	Museum	Collector
Tahuata: Haaopi summit	900m*	19Jul1930	1M, 1F	Bishop	LeBronnec

[* **Note:** label that I have says Haaopi summit, Tahuata, 2800ft, VII-10-1930]. Labeled *T. macilenta*. This species was given then name *T. macilenta* by Berland (1933), who states that the specimens he was looking at are "Very similar .. to those described by L Koch from Samoa and Tonga, in particular in the chelicerae of the male and the female, also by the shape of the abdomen female, uneven about the middle; there are however some small differences in the dental formula, which is rather variable besides, likewise in the eyes: the anterior lateral ones being smaller than the posterior laterals, which does not seem to agree with the description of L Koch.

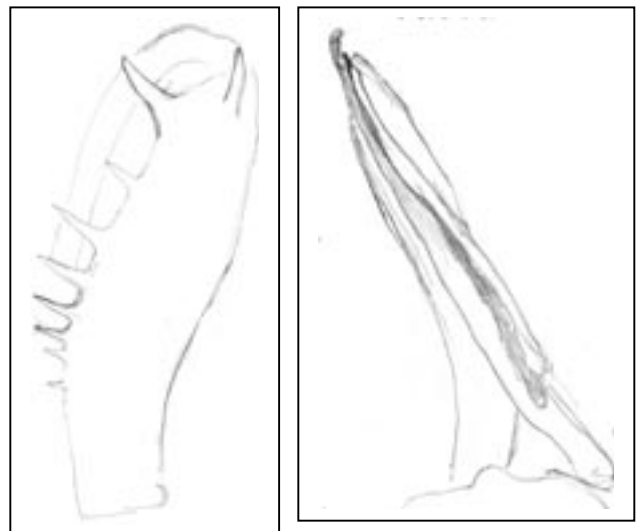
T. MARQUESIANA BERLAND 1935. UA POU AND NUKU HIVA:

Location	Elevation	Date	# specimens	Museum	Collector
Ua Pou: Vaihakaatiki, Hakahetau	1000m	19Nov1931	1M *	Bishop	LeBronnec
Nuku Hiva: Mt Tekao,	1185m	23Jun2000	4M,10F,4I	-	Gillespie
Nuku Hiva: Mt Tekao,	1100m	24Jun2000	1M,1F,4I	-	Gillespie
Nuku Hiva: Mt Tekao,	1200m	25Jun2000	2F,3I	-	Gillespie
Nuku Hiva: Tovii, Old Road,	1100m	25Jun2000	1F,1I	-	Gillespie

* Type specimen, collected on Freycinetia (Berland 1935a).



This is the predominant species on Nuku Hiva. The species was found in abundance, mostly low down in the mossy crevices of



trees in the wet forest. Most of them were found in the center of orb webs, which were spun both by day and night. The color of these spiders was very variable, ranging from maroon-red to dark greenish.

T. SP. M3A. HIVA OA, NEW SPECIES:

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Kaava	930m	7Jan1932	1M, 2I	Bishop	LeBronnec
Hiva Oa: Temetiu summit	1170m	28Jun2000	2M,2F, 29I	-	Gillespie
Hiva Oa: Ootua	875m	30Jun2000	4I	-	Gillespie

This species was initially described as a co-type of *T. marquesiana*. Berland (1935a) notes that "In this specimen, one notes a certain difference with the type: the two subapical teeth of the chelicerae are shorter, and the intern is thicker, the tibia of the palp is shorter than the tarsus; these characters should not thus be considered like having an absolute value." Berland goes on to place two females from Hivaoa in *T. marquesiana* " I think of being able to allot two females from Hivaoa to this species, characterized by a



short, and gibbose abdomen in the middle of the back; I do not give the drawing of their chelicerae, because I am not sure these specimens are adult ". This is the predominant species on Hiva Oa.

T. SP. M4A. NUKU HIVA, NEW SPECIES ("Little Brown"):

Location	Elevation	Date	# specimens	Museum	Collector
Nuku Hiva: Mt Tekao	1185m	23Jun2000	3M,2F, 1I	-	Gillespie

This is an undescribed species from the wet forest of Mt. Tekao. The animal was not common, and was not immediately recognized in the field as a separate species from *T. marquesiana* with which it co-occurs. Accordingly, I am not yet clear as to what ecological differences exist between this species and *T. marquesiana*.



T. sp. M5A. NUKU HIVA, NEW SPECIES:

Location	Elevation	Date	# specimens	Museum	Collector
Nuku Hiva: Oomua	-	-	1m	MNHN Paris	LeBronnec

This species was labeled as *T. macilenta* by Berland. However, *T. macilenta* does not occur in the Marquesas. It is a very distinctive animal, but I have found a single specimen only to date.

**II. THOMISIDAE**

Records of the spider family Thomisidae are restricted to a single species. RG Gillespie and GK Roderick made collections of thomisid species from the Marquesan islands of Nuku Hiva, Hiva Oa and Tahuata. The following table (compiled by JE Garb) reports the number of individual thomisid spiders collected at each locality. All species from the Marquesas Islands are currently placed as *Misumenops delmasi*. While these collections may include additional new species from either archipelago, more detailed systematic analyses are required to verify this.

Island	Locality	Date	Elevation	# Individuals
Tahuata		1 July	535m	2
Nuku Hiva	Tovii Pass	26 June		2
Nuku Hiva	Mt. Muake	22 June	800m	4
Nuku Hiva	Muake-Taiohae	22 June	550m	2
Hiva Oa	Temitui Ridge	28 June	1140m	29
TOTAL #				39

All collected individuals have been preserved in ethanol and entered into a collections database. JE Garb has completed DNA extraction as part of the initial phases of a cladistic analysis (both morphological and molecular) to determine the phylogenetic relationships among the variants from different localities to assess if they merit new species status.

III. CONCLUSIONS ON SPIDER BIODIVERSITY**I. Native Species**

- f) Tetragnathidae. It seems that native *Tetragnatha* are confined to elevations $\geq 900\text{m}$ on all islands of the Marquesas. They are found in very wet cloud forest, usually low in mosses around roots of tree trunks. The lower abundance (and diversity) on Hiva Oa may be, at least partially, due to the pig damage that has destroyed much of the low understory habitat on the summit of Temetiu and at Ootua.
- g) Thomisidae. The species on Nuku Hiva seems to be widespread, and tolerates a wide range of conditions (including the presence of some alien species). On Hiva Oa,

representatives appear to be confined to more pristine forest (although we did find one individual at low elevation, 535m, on Tahuata).

- h) Salticidae. These appear to be fairly numerous and diverse in all habitats, although more work is need to verify the status of the species (native versus alien).
- i) *Argyrodes*. Representatives (in the sub-genus “Ariamnes”) are present, though not usually common, in more native habitats (Mt. Tekao, Mt. Ootua).
- j) Theridiidae. Surprisingly, we found very few of these in the Marquesas, although they are a common group in the Societies and Hawaii.

II. Alien Species

- e) Pholcidae. These are extremely numerous in low and middle (up to 900m) elevation wet forest. I cannot tell whether or not they are impacting the native community. Nor can I tell with certainty that they are alien, although their abundance and predilection for disturbed areas would indicate that they are likely to be alien. These occur on Mt. Muake (not on Mt. Tekao), and on Mt. Ootua (not on the summit of Mt. Temetiu,, although they were on the way up).
- f) Araneidae. Most of these appear to be alien. They predominate in low elevation habitats (especially drier roadside areas). But they can also be found in disturbed sites of otherwise pristine forest (e.g. the summit of Mt Temetiu).
- g) Clubionidae. *Cheirecanthium* is very common low down (eg Tahuata), and almost up to the summit (although not common) of Temetiu. They seem to prefer drier habitats.

IV. CONSERVATION ISSUES:

Nuku Hiva:

- iii. Mt. Muake. There was considerable alien vegetation up to $\geq 900\text{m}$ on the west side. Spiders such as pholcids, and also a lot of ant species, appear to thrive in this (eg summit of Mt. Muake where there was a lot of *Paraserionthis*). There appear to be some native spiders here as well, however, e.g. crab spiders (Thomisidae) and jumping spiders (Salticidae).
- iv. On the dry side of the island, spider diversity was low even in areas where the tree canopy appeared to be largely native; there were just a few jumping spiders (alien?); and numerous ants.
- v. Mt. Tekao. Here, at least at elevations $\geq 1100\text{m}$, there was abundant native vegetation (almost all?); the arthropods also seemed to be almost entirely native. For spiders, *Tetragnatha* (esp. *T. marquesiana*) were the dominant group. I found two species in this forest (*T. marquesiana* and *T. sp.*), and an additional species (*T. sp.*) has been collected by LeBronnec. There were a number of jumping spiders (Salticidae) in this forest; there appear to be a number of species of these, though the densities were not as high as the *Tetragnatha*. There were very few crab spiders (unlike Mt. Muake), and very few Theridiidae. But certainly, this forest had a strikingly healthy community of native spiders.

Hiva Oa:

- i. Temetiu. As on Nuku Hiva, there was considerable alien vegetation up to $\geq 900\text{m}$. there was a tremendous amount of pig damage, even in the most apparently pristine

forests at the summit of Mt. Temetiu. There were also small patches of taro and banana growing near the summit of Temetiu. However, Temetiu seemed to be, overall, a good native community, although not as pristine as Mt Tekao. The spiders seemed to be largely native. There were quite a lot of *Tetragnatha* (not nearly as abundant as on Mt. Tekao), a diversity of jumping spiders (Salticidae), and also a lot of crab spiders (Thomisidae) (many more than on Mt. Tekao, and ≥ 2 species). No Pholcidae, and very few *Leucauge*. Only a few ants.

- ii. Mt. Ootua. It seemed like the habitat here represented the first real “mixture” of native and alien species that I had found. The forest appeared to be very degraded, with lots of *Rubus* (thimbleberry), and strawberry guava. There was a tremendous amount of pig damage, such that very little understory remained. There were many Pholcidae, and a number of Araneidae. The very few *Tetragnatha* that I found here (*T. sp.*). Seemed to be “hanging on by the skin of their teeth”. There were also a few *Argyrodes* here, and a number of jumping spiders. Surprisingly, there were no Thomisidae. This was even more surprising because we found thomisids at lower elevations on Tahuata.

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II. PLANTHOPPERS & FLIES

The goals of the study as outlined in the permit application are summarized below.

- (1) Assessment of species identities, numbers of species, distributions and abundance, and host plant records for the different planthopper and tephritid fly groups in French Polynesia.

The collected species are summarized below in tabular form. Many species were identified using published descriptions for both delphacid planthoppers (Fennah 1958) and tephritid flies (Malloch 1932). At present, there remain unidentified species in both groups. These specimens are currently being identified and compared with non-indigenous species, with the likely outcome of new species. To summarize the patterns of distribution, it appears that most species of indigenous delphacid planthoppers are endemic to only one island. It may be that upon further inspection, all delphacid species will be endemic to only one island. Host records were obtained whenever possible. Previous work suggests that most species are very host specific (Zimmerman 1948, Roderick 1997), but actual host determination is often confounded by the observation that adults can be collected as well on non-hosts. The presence of immatures is often the best indication of actual plant host for these planthoppers.

The tephritid flies in the genus *Trupanea* found on Mts. Aorai (Tahiti) and Mouaputa (Moorea) are unquestionably new species. A third species in this group was found on more than one island (Malloch 1932).

Specimens of both planthoppers and flies will be returned to French Polynesia as voucher specimens, as well as distributed among relevant collections.

- (2) Assessment of genealogical relationships amongst these species, and hence possible mechanisms governing species formation and evolutionary changes in distribution and abundance.

Currently, the specimens are being used in a molecular analysis using both mitochondrial (COI, 12S) and nuclear (wingless) DNA. This work is being conducted in our laboratory at UC, Berkeley. These markers should be able to resolve both relationships among closely related species, as well as relationships between lineages and colonization events. Molecular characters, likely because of rapid rates of adaptive evolution, have not proven to be useful in answering this question (see discussion in Asche 1997).

- (3) For non-indigenous species of tephritid flies, to make a determination of their likely origin.

Once species are identified, non-indigenous species will be compared with other localities, again using DNA techniques.

- (4) Assessment of the role of alien species and habitat destruction in limiting the distribution of species in groups of planthoppers and flies, and possible management strategies for recovering populations.

Ants were collected at many localities, and are currently being identified to species. The role of ants in affecting the distribution and abundance of planthoppers and flies in FP has not been actively studied. Of the impacts we observed, the largest impact would be that of pigs which would make the entire system subject to decline and replacement by non-indigenous species. The pig issue is covered elsewhere in this report.

Section 1. Delphacidae (Hemiptera)

The major reference for this group was published by Fennah (1958), with additional comments by Ashe (1997), noting that there are few morphological similarities that link the species described in the same genera found both in French Polynesia and the Marquesas. The standard reference for this group for Hawaii is by Zimmerman (1948). Lists are included below for the Society Islands and Marquesas, to cover the areas in which we have collected. A substantial collection of Delphacidae also are found in the Austral Islands (Fennah 1958) and have recently been collected also by Manfred Ashe.

Based on the likely new species we found, it appears that the delphacid fauna of French Polynesia may be much more diverse than previously known. Currently we are using molecular data to investigate the relationships among the Delphacidae of French Polynesia and Hawaii, and to determine how the groups may or may not be related.

Other references for the Delphacidae in the Pacific include (Swezey 1954, Howarth and Mull 1992, Nishida 1994, Roderick 1997, Roderick and Gillespie 1998).

Table 1. Checklist of Delphacidae in the Society Islands. Information from Fennah (1958), with insects collected as part of this report marked as X. Note: some of the undetermined species may turn out to be non-indigenous species, rather than new endemic species.

Species	Tahiti	Moorea	Meetia	Huahine	Raiatea	Tahaa	Bora Bora	Tubai
Endemic species								
<i>Ugyops haliacmon</i> Fennah		X?					X	
<i>N. scorpinaca</i> Fennah	<u>X</u>							
<i>N. undet. species Tahiti 1</i>	<u>X</u>							
<i>Nesosydne remmius</i> Fennah		X						
<i>N. undet. species Moorea 1</i>		<u>X</u>						
<i>N. undet. species Moorea 2</i>		<u>X</u>						
<i>N. undet. species Raiatea 1</i>					<u>X</u>			
<i>N. undet. species Raiatea 2</i>					<u>X</u>			
<i>N. undet. species Raiatea 3</i>					<u>X</u>			
Non-indigenous species								
<i>Tarophagus proserpina</i> Kirk.	X				X			
<i>Delphacodes dryope</i> Kirk.	X	X		X				
<i>D. muirella</i> Metcalf	X	X		X	X			
<i>Chloriona eupompe</i> Kirk.	X	X			X			
<i>C. kolophon</i> Kirk.					X			
<i>Sardia pluto</i> Kirk.	X				X			
<i>Peregrinus maidis</i> Ashmead	X							
<i>Coronacella kirkaldyi</i> Muir	X							

Table 2. Checklist of Delphacidae in the Marquesas Islands. Information from Fennah (1958), with insects collected as part of this report marked as X. Note: some of the undetermined species may turn out to be non-indigenous species, rather than new endemic species.

Species	Fatuhiva	Tahuata	Hiva Oa	Fatuuku	Uapou	Uahuka	Nuku Hiva	Hatutu
Endemic species								
<i>Nesosydne cheesmanae</i> Muir			X					
<i>N. cyane</i> Fennah			X					
<i>N. clitarchus</i> Fennah			X					
<i>N. cleantes</i> Fennah			X					
<i>N. agenor</i> Fennah			X					
<i>N. orphne</i> Fennah		X						
<i>N. melampus</i> Fennah			X				X	
<i>N. acastus</i> Fennah			<u>X</u>					
<i>N. oroanda</i> Fennah								X
<i>N. linus</i> Fennah					X	X		
<i>N. dinomache</i> Fennah					X			
<i>N. elatus</i> Fennah					X			
<i>N. sorix</i> Fennah		<u>X</u>						
<i>N. siderion</i> Fennah	X							
<i>N. helicaon</i> Fennah	X							
<i>N. latona</i> Fennah	X							
<i>N. lanista</i> Fennah						X	<u>X</u>	
<i>N. undet. Tahuata 1</i>		<u>X</u>						
<i>N. undet. Hiva Oa 1</i>			<u>X</u>					
<i>N. undet. Hiva Oa 2</i>			<u>X</u>					
<i>N. undet. Hiva Oa 3</i>			<u>X</u>					
<i>N. undet. Nuku Hiva 1</i>							<u>X</u>	
<i>Aloha lycurgus</i> Fennah			X					
<i>A. majuma</i> Fennah			X					
<i>Nesodryas oenone</i> Fennah			X					
<i>N. laocoon</i> Fennah			X					
<i>Leialoha cajeta</i> Fennah			<u>X</u>					
<i>L undet. Nuku Hiva 1</i>							<u>X</u>	
Non-indigenous species								
<i>Chloriona kolophon</i> Kirk.			X					

Delphacidae of the Society Islands—detailed collection notes.**Indigenous species (all endemic)*****Nesosydne scorpinaca* Fennah**

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Mt. Aorai Trail	1700-1900m	15Nov1934	1M, 1F	Bishop	Zimmerman
Tahiti: Mt. Aorai Trail		Nov1999	1F	-	Roderick
Tahiti: Mt. Marau	855m	6Jul2000	3M, 3F, 1I	-	Roderick
Tahiti: Mt. Marau	1300m	6Jul2000	1M, 2F, 1I	-	Roderick

Notes:

Brachypterous. Fennah's description: M 3.3mm, F 3.4 mm
Distinguished by genitalia, tegmina shape and venation, color
Aorai female 3.8mm
Marau 855m, 2.7mm male, 3.1mm female
Marau 1300m, 3.1mm male, 4.0mm female

Nesosydne undetermined species Tahiti 1

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Mt. Aorai Trail		Nov1999	3F, 1I	-	Roderick
Tahiti: Mt. Marau	1300m	6Jul2000	1M	-	Roderick

Notes:

Brachypterous. Darker and longer tegmen than *N. scorpinaca*, with distinct patterning;
styles similar to *N. remmius*.
Aorai F 4.5mm, tegmen 2.4mm
Marau M 2.8mm, tegmen 1.5mm

***Nesosydne remmius* Fennah**

Location	Elevation	Date	# specimens	Museum	Collector
Moorea: Mt. Teaharua, north ridge	460-615m	25Nov1934	1M	Bishop	Zimmerman

Notes:

Brachypterous. Fennah: distinguished by the proportions of the head, coloration, and shape of the male genitalia.
M 2.9mm.

Nesosydne undetermined species Moorea 1

Location	Elevation	Date	# specimens	Museum	Collector
Moorea: Mt. Rotui		13Nov1999	1M	-	Roderick

Notes:

Macropterous. Styles similar to *N. remmius* but macropterous and rounder head.
M 2.6mm, wing 3.0mm

Nesosydne undetermined species Moorea 2

Location	Elevation	Date	# specimens	Museum	Collector
Moorea: Mt. Mouaputa summit	800m	11Jul2000	1M, 1I	-	Roderick

Notes:

Macropterous. Styles similar to *N. remmius* but pokies on style.
M 2.1mm, wing 2.5mm

Nesosydne undetermined species Raiatea 1

Location	Elevation	Date	# specimens	Museum	Collector
Raiatea: Temehani Plateau	720m	12Jul2000	1M, 1F	-	Roderick

Notes:

Brachypterous. Dark patterning on tegmen, 2 dark patches in particular, styles like *N. remmius*.
M 1.9mm, tegmen 1.6mm, F 2.8mm.

Nesosydne undetermined species Raiatea 2

Location	Elevation	Date	# specimens	Museum	Collector
Raiatea: Temehani Plateau trail	270m	13Jul2000	1F	-	Roderick

Notes:

Brachypterous. Distinguished by dark bands on tip of tegmen,
F 2.8mm, tegmen 2.2mm

Nesosydne undetermined species Raiatea 3

Location	Elevation	Date	# specimens	Museum	Collector
Raiatea: Temehani Plateau	720m	12Jul2000	1F	-	M. Arnedo

Notes:

Brachypterous. Distinguished by dark bands on tip of tegmen as above but shapes of bands different from above; light green color, 2 dark patches in particular, styles like *N. remmius*.

F 3.5mm, tegmen 3.8mm.

Ugyops haliacmon Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Bora Bora: Mt. Pahio	180-250m	13Dec1934	1M	Bishop	Zimmerman
Moorea: Tepatu Valley	250m	27Nov1934	1F	Bishop	Zimmerman

Notes:

Brachypterous. Species distinguished by proportions of the head and antennae and by shape of the male genitalia. Female tentative; on *Asplenium nidus*.

M5.7mm, tegmen 4.5mm.

Non-indigenous species:

Tarophagus proserpina (Kirkaldy)

Location	Elevation	Date	# specimens	Museum	Collector
Raiatea	-	26Feb1927	2M, 2F	-	JW Moore

Notes:

On taro; also collected on Cook Islands on taro (Fennah 1958)

Peregrinus maidis (Ashmead)

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Fautaua Valley	-	7Mar1934	11M, 26F (and below)	-	Zimmerman
Tahiti: Arihir, Pare	-	8Mar1934		-	Zimmerman
Tahiti: Tiupi Bay, Papeari	-	28Mar1934		-	Zimmerman
Tahiti: Blue Lagoon, Papeete	-	1Mar1934		-	Zimmerman
Tahiti: Blue Lagoon Hotel, Papeete	-	26Nov1934		-	Zimmerman

Tahiti: Papeete	-	19Feb1927		-	GP Wilder
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Notes:

Legume pods and on seashore. Also collected on Pitcairn Island, on grasses and low herbage

Chloriona eupompe (Kirkaldy)

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Arihiri, Pare	-	10Mar1934	1M	-	Zimmerman
Moorea: Tehau Pt.	3m	24Nov1934		-	Zimmerman
Raiatea: Fetuna	-	Mar1955	2M	-	NLH Krauss

Notes:

Also collected on Rapa, Rurutu I (Austral Isl.) sweeping grasses, Swains I.

Chloriona (Sogatella) kolophon (Kirkaldy)

Location	Elevation	Date	# specimens	Museum	Collector
Raiatea: Fetuna	-	Mar1955	1M	-	NLH Krauss
Hiva Oa: Avaoa Valley	415m	4Jan1932	3M	-	Le Bronnec

Notes:

Hiva Oa on *Ageratum conyzoides*. Also collected on Mangareva on grasses, Pitcairn on grasses.

Sardia pluto (Kirkaldy)

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Tiupi Bay, Papeari	-	19Mar1934 3May1934	15M, 11F (and below)	-	Zimmerman
Tahiti: Blue Lagoon, Papeete	-	1Mar1934		-	Zimmerman
Tahiti: 2k NE of Papeete	8m	2Mar1934		-	Zimmerman
Tahiti: Arihiri, Pare	-	10Mar1934		-	Zimmerman
Raiatea	-	1926-27	1F	-	JW Moore

Notes:

Tahiti on grasses

Delphacodes dryope (Kirkaldy)

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Tehau Pt.	2m	24Nov1934	4M, 5F	-	Zimmerman
Tahiti: Arihiri, Pare	-	10Mar1934	1M, 1F	-	Zimmerman

Notes:

Tahiti on grasses and low herbage, also collected on Mangareva on grasses, and Raivavae (Austral) sweeping shrubs.

Delphacodes muirella Metcalf

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Blue Lagoon, Papeete	-	2Mar1934	3M, 10F (total)	-	Zimmerman
Tahiti: 2k NE of Papeete	-	2Mar1934		-	Zimmerman
Moorea: Tehau Pt.	3m	24Nov1934	2M	-	Zimmerman
Raiatea: Temeharu Plateau	370-490m	5Oct1934	1M, 1F (total)	-	Zimmerman
Raiatea: Tetaro Islet	1m	4Oct1934		-	Zimmerman
Huahini: SE end, Haapu Bay	15-150m	3Oct1934	1F	-	Zimmerman

Notes:

Raiatea on *Metrosideros* and grasses, also collected on Rapa, Rututu, Raivavae (Austral Isl.), Tubuai, Tepoto (Tuamoutus), Pitcairn, on grasses and low herbage.

Coronacella kirkaldyi Muir

Notes:

No additional information in Fennah (1958)

Delphacidae of the Marquesas Islands—Detailed collection notes.**Indigenous species (all endemic)*****Leialoha cajeta* Fennah**

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Mt. Temetiu Ridge, Summit, slope N of summit	1200, 1280, 1190 m	17Dec1930, 14, 19, 21Jan1932	73M, 115F, 28I (total)	-	Le Bronnec
Hiva Oa: Feani Ridge	1200m	12,21Jan1932		-	Le Bronnec
Hiva Oa: Mt. Temetiu Ridge	1170m	28Jun2000	51M, 28F, 83I	-	Roderick
Hiva Oa: Mt. Temetiu Ridge	1120m	26Oct1999	10M, 8F, 7I	-	R Englund

Notes:

Macropterous. Fennah's description: distinguished by bold color pattern, twin carinae on the frons and by male genitalia.

M 3.0mm, tegmen 3.6, F 4.0 mm, tegmen 4.1

Le Bronnec on *Reynoldsia*, *Cyrtandra*, *Rapanea*, *Metrosideros collina*, *Cheirodendron*, and *Weinmannia parviflora*. Feani Ridge on *Alstonia*

Englund collection from *Cheirodendron*, *Broussia*

On *Weinmannia*—check Roderick photos.

Roderick M 2.4mm, tegmen 3.2, F 3.4mm

Undet.. immature

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Mt. Temetiu Ridge	1170m	28Jun2000	51M, 28F, 83I	-	Roderick

Notes:

Very large immature.

***Nesosydne acastus* Fennah**

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Matauuna	1160m	1Aug1929	1M, 1F, 1I	-	Mumford, Adamson
Hiva Oa: Ootua	900m	30Jun2000	4M, 3F, 7I	-	Roderick

Notes:

Brachypterous. Fennah's description: M 3.0mm, F 3.2 mm
 Mumford/Adamson on *Crossostylis biflora*
 M 2.7mm, tegmen 1.7mm, F 3.4mm

Nesosydne undet. Species. Hiva Oa 1

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Ootua	900m	30Jun2000	1F	-	Roderick

Notes:
 Brachypterous. Large *N. acastus*, called naF1.
 F 4.2mm, tegmen 2.5mm

Nesosydne undet. Species Hiva Oa 2

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Ootua	900m	30Jun2000	1F	-	Roderick

Notes:
 Brachypterous. Very large, called naF2
 F 4.9mm, tegmen 3.1mm

Nesosydne undet. Species. Hiva Oa 3

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Ootua	900m	30Jun2000	1M, 2I	-	Roderick
Hiva Oa: Tapeata summit	770m	25Oct1999	1M	-	Englund

Notes:
 Brachypterous. Note styles
 Englund, moss log of *Cyathea* tree fern
 Roderick M3.7mm, tegmen 2.4, Englund M3.9mm.

Nesosydne sorix Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Tahuata: Amatea	800m	28Nov1930	1M, 3F, 1I	Bishop	Le Bronnec, Tauraa
Tahuata: summit	860m	29Oct1999	1M, 3F, 1I	-	R Englund

Notes:

Brachypterous. Fennah's M3.5mm, 4.0mm, Note styles
Both collections on *Metrosideros collina*
M4.0mm, F3.8mm.

Nesosydne undet. Tahuata 1

Location	Elevation	Date	# specimens	Museum	Collector
Tahuata: summit	860m	29Oct1999	11M, 3F, 2I	-	R Englund

Notes:
Brachypterous. on *Metrosideros collina*
M3.3mm, tegmen 1.4mm, F 3.7mm

Nesosydne undet. Nukahiva 1

Location	Elevation	Date	# specimens	Museum	Collector
Nukahiva: Mt. Tekao	1200m	23Jun2000	1M	-	Gillespie
Nukahiva: Mt. Tekao	1200m	23Jun2000	1F	-	Gillespie

Notes:
Brachypterous.
Male on cytandra, female on psychotria
M 3.2mm, 1.5mm; F 3.6mm, tegmin 1.7mm

Leialoha undet. Nukahiva 1

Location	Elevation	Date	# specimens	Museum	Collector
Nukahiva: Mt. Tekao	1200m	23Jun2000	1M, 1F	-	Gillespie
Nukahiva: Mt. Tekao	1200m	23Jun2000	1F	-	Gillespie

Notes:
Brachypterous. Note twin carinae, need to dissect genitalia
On *Oparanthus*
M 2.2mm, tegmen 2.5mm, F 2.9mm

Nesosydne cheesmane Muir

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Feani summit	1200m	21Jan1932	1M, 1F (and below)	-	Le Bronnec
Hiva Oa: Temetiu summit	1280m	21Jan1932		-	Le Bronnec

Notes:

Brachypterous; In moss; on *Weinmannia*
M4.0mm, F5.0mm

Nesosydne cyane Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Kakahopuanui, Kaava ridge	860m	27Oct1937	3M, 6F	-	Le Bronnec

Brachypterous; on *Reynoldsia*, *Weinmannia*, *Glochidion ramiflorum*, *Loranthus*, and *Cyrtandra*
M3.7mm, F4.2mm

Nesosydne clitarchus Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Avaoa valley	415m	27Oct1937	23M, 41F (and below)	-	Le Bronnec
Hiva Oa: Kaava ridge	860m	7Jan1932		-	Le Bronnec

Notes:

Brachypterous; on *Piper latifolium*; very dark species
M3.1mm, F3.8mm

Nesosydne cleanthes Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Temitiu summit	1280m	20Jan1932	1M	-	Le Bronnec

Notes:

Brachypterous; on *Weinmannia*
M3.2mm

N. agenor Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Mounaofefe	615m	3Mar1929	1M	-	Mumford, Adamson
Hiva Oa: Atuona Valley		28Mar1929	1M	-	Mumford, Adamson

Notes:

Brachypterous; on *Premna tahitensis* Mounaofefe, on *Morinda citrifolia* Atuona
M3.8mm

N. orphne Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Tahuata: Hanamiai Valley	500m	28May1930	1M	-	Mumford, Adamson

Notes:
Brachypterous; sweeping grasses
M3.0

N. malampus Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Vaiepoepo	750m	12Nov1929	1M	-	Mumford, Adamson
Hiva Oa: Kopaafaa	860m	25Feb1930	1F	-	Mumford, Adamson
Nuku Hiva: Ooumu	1250m	12Nov1929	3F	-	Mumford, Adamson

Notes:
Brachypterous; Vaiepoepo on *Weinmannia parviflora*; Ooumu beating on *Ascarina*?
Provisionally this species?
M3.3, F 3.2

N. oroanda Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Tahuata: Hanamiai Valley	500m	28May1930	1M	-	Le Bronnec, Tauraa

Notes:
M 3.0mm

N. linus Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Uapou: Teavanui, Paaumea Valley	890m	27Nov1931	32M, 44F (and below)	-	Le Bronnec
Uapou: Tekohepu	980m	28Nov1931		-	Le Bronnec

summit					
Uapou: Teavanui Pass	890m	28Nov1931		-	Le Bronnec
Uapou: Vaihakaatiki, Hakahetau Valley	930m	18Nov1931		-	Le Bronnec
Uapou: Teavaituhai, Hakahetau Valley	930m	19Nov1931		-	Le Bronnec
Ua Huka: Hitikau Crest	900m	3Mar1931		-	Le Bronnec, Tauraa

Notes:

M 3.3mm, tegmen 3.4mm; F 3.5mm, tegmen 3.9mm

Teavanui on *Freycinetia*, Tekohepu on *Metrosideros collina*, *Freycinetia*, and *Cyathea*,
Hitikau Crest *Hibiscus tiliaceus*

N. dinomache Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Uapou: Vaihakaatiki, Hakahetau Valley	930m	18Nov1931	11M, 6F (and below)	-	Le Bronnec
Uapou: Tekohepu summit	980- 1015m	28Nov1931		-	Le Bronnec
Uapou: Teavaituhai, Paaumea side	620m	19Nov1931		-	Le Bronnec
Uapou: Teavanui Pass	890m	26Nov1931		-	Le Bronnec

Notes:

On *Cyrtandra*, *Weinmannia*, *Sclerotheca*, *Vaccinium*

M3.6mm, F4.0mm

N. elatus Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Uapou: Tekohepu summit	920m	30Nov1931	120M, 90F, 115I (and below)	-	Le Bronnec
Uapou: Teavaituhai, Paaumea side	920m?	20Nov1931		-	Le Bronnec
Uapou: Vaihakaatiki, Hakahetau Valley	860m	19Nov1931		-	Le Bronnec
Uapou: Teoatea Hakahetau Valley	680m	20Nov1931		-	Le Bronnec
Uapou: Teavanui Pass	890m	27Nov1931		-	Le Bronnec

Notes:

M3.2mm, tegmen 3.3mm, F3.8mm, tegmen 3.2mm

On *Cyrtandra*, *Freycinetia*, beating *Bidens lantanoides*

N. siderion Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Fatu Hiva: Ridge east of Oomoa Valley	950m	28Aug1930	1M	-	Le Bronnec

Notes:
Brachypterous, M4.0
On *Reynoldsia tahitensis*

N. helicaon Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Fatu Hiva: Ihiota, Hanavave Valley	185m	10Nov1930	2M	-	Le Bronnec

Notes:
Brachypterous, M4.4
On herbage

N. latona Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Fatu Hiva: Teavaipuhiau	660m	25Aug1930	1M	-	Le Bronnec

Notes:
Brachypterous, M4.4
On *Weinmannia parviflora*

N. lanista Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Nuku Hiva: Tapuaooa	850-960m	3Nov1929	12M, 6F, 9I	-	Le Bronnec, Tauraa
Nuku Hiva: Tevanui, Toovii	615m	27Oct1929		-	Mumford, Adamson
Ua Huka: Hitikau Ridge	890m	4Mar1931		-	Le Bronnec, Tauraa
Ua Huka: Tauheeputa	545m	23Mar1931		-	Le Bronnec,

					Tauraa
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Notes:

Brachypterous, M4.1, F5.0

On *Piper latifolium*, *Weinmannia*, *Sida*

Aloha lycurgus Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Kaava Ridge	850m	6Jan1932	1M, 1F	-	Le Bronnec

Notes:

Brachypterous, M3.6, tegmen2.9, F4.0, tegmen3.1

On ferns

Aloha majuma Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Temetiu summit	1280m	20Jan1932	1M, 1F	-	Le Bronnec

Notes:

Brachypterous, M3.6, tegmen2.9, F4.5, tegmen3.2

On *Cyrtandra*

Nesodryas oenone Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Kaava Ridge	860m	7Jan1932	6M, 8F	-	Le Bronnec

Notes:

Macropterous, M3.1, tegmen3.8, F3.5, tegmen4.3

On *Pandanus*

Nesodryas laocoon Fennah

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Matauuna	1140m	4Mar1930	1M	-	Mumford, Adamson

Notes:

Brachypterous, M2.9
On dry leaves

Non-indigenous species

***Chloriona kolophon* (Kirkaldy)**

Location	Elevation	Date	# specimens	Museum	Collector
<u>Raiatea:</u> Fetuna	-	Mar1955	1M	-	NLH Krauss
<u>Hiva Oa:</u> Aavao Valley	450m	4Jan1932	3M	-	Le Bronnec

Notes:

Hiva Oa on *Ageratum conyzoides*. Also collected on Mangareva on grasses, Pitcairn on grasses.

Section 2—Tephritidae (Diptera)

Only three endemic species of Tephritidae have been described from French Polynesia, *Bactrocera (Dacus) perfuscus* Aubertin, *Trupanea (Trypanea) simplex* Malloch (both in Malloch 1932) and *Paroxyna sororcula* Wiedemann (Malloch 1935). We have found at least 2 new *Trupanea* species, one on Tahiti and one on Moorea, both from high elevations (above 750m). Other non-indigenous *Bactrocera* are pests both in the Society Islands and on Tahuata. Our collections are described below for *B. perfuscus* and *Trupanea* species. References for Tephritidae of this region include (Hardy and Delfinado 1980, Evenhuis 1989, White and Elson-Harris 1992, Drew and Hancock 1994, Hancock and Drew 1994, Hardy and Drew 1996, Drew et al. 1998, Drew and Hancock 2000).

***Bactrocera perfuscus* Aubertin**

Location	Elevation	Date	# specimens	Museum	Collector
<u>Nuku Hiva:</u> Teuanui, Tovii	615m	27Oct1929	31	-	Mumford, Adamson
<u>Uapou:</u> Hakahetau Valley	300-615m	31Jan1930	10	-	RR Whitten
<u>Uapou:</u> Papaika	300m	14Dec1929	9	-	RR Whitten
<u>Tahuata:</u> Vaitupaabei	540m	9Jul1930	1	-	Le Bronnec, Tauraa
<u>Tahuata:</u> Vaitahu	535m	1Jul2000	1M, 1F	-	Roderick

Notes:

Records from (Malloch 1932).

Recorded additionally from Hiva Oa, Tahuata, and Nuku Hiva, Jan 1925 (Aubertin and Cheesman 1929)

Genus Trupanea***Trupanea simplex* Malloch**

Location	Elevation	Date	# specimens	Museum	Collector
Hiva Oa: Atuona Valley	100m	25Feb1929	1F	-	Mumford, Adamson
Eiao: coconut plantation		1Oct1929	1M	-	Adamson
Uahuka: Putiovai		23Mar1931	1F	-	Le Bronnec, Tauraa

Notes: continuous dark patch on upper tip of wing.

Trupanea undet. Moorea 1

Location	Elevation	Date	# specimens	Museum	Collector
Moorea: Mouaputa Summit	top	11Jul2000	5M, 2F	-	Roderick

Notes:

On ericaceous fruit—pictures

Wing 2.6mm, wings consistent between sexes; different pattern from above.

Trupanea undet. Tahiti 1

Location	Elevation	Date	# specimens	Museum	Collector
Tahiti: Aorai	Near top	Nov1999	7M, 6F	-	Roderick

Notes:

On *Dodonaea*.

Wing 2.6mm, wings consistent between sexes; different pattern from above two.

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III. OLIGOCHAETES

Aquatic oligochaetes collected by Alexa Bely, French Polynesia, summer 2000

I believe these are the first records of the genera *Pristinella* and *Chaetogaster* for French Polynesia.

DATE	ISLAND	SITE	COLLECTOR	TAXA (sample sizes range from 1-20 individuals)
30 June 2000	Moorea	stream behind Marae	Emily Betts	<i>Dero (Aulophorus)</i> sp.
2 July 2000	Moorea	stream behind Belvedere (north slope)	Alexa Bely	enchytraeids
3 July 2000	Moorea	stream at base of Vaiare to Paopao trail	Alexa Bely	<i>Aeolosoma</i> sp. <i>Pristina</i> sp. <i>Pristinella</i> sp. <i>Chaetogaster</i> sp. (<i>diastrophus</i> ?) <i>Dero (Aulophorus)</i> sp.
4 July 2000	Moorea	stream behind Maharepa school	Alexa Bely	<i>Aeolosoma</i> sp. <i>Pristina</i> sp. unidentified tubificids
7 July 2000	Tahiti Nui	Vaitupa River (along road to Mt. Marau)	Alexa Bely	<i>Pristina</i> sp. <i>Aeolosoma</i> sp.
7 July 2000	Tahiti Nui	pool along road from Papenoo to Otiaroa	Alexa Bely	<i>Pristina</i> sp. <i>Aeolosoma</i> sp. <i>Nais</i> sp.
7 July 2000	Tahiti Nui	Papenoo River	Alexa Bely	<i>Aeolosoma</i> sp. <i>Nais</i> sp. (<i>communis</i> ?) <i>Nais</i> sp. (<i>variabilis</i> ?) <i>Chaetogaster</i> sp. (<i>diaphanus</i> ?)
11 July 2000	Moorea	stream near north base of Mouaputa (~300m)	Alexa Bely	sample not yet processed
13 July 2000	Raiatea	stream pools, Temehanirahi Plateau (~750 m)	Alexa Bely	no oligochaetes found

Collection Permit information:

name: Alexandra Bely

permit number: 271

issued on: May 30, 2000

permit title: Evolution of aquatic oligochaete annelids