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SOME ORIBATID MITES (Acarina) FROM LAYSAN ISLAND[1]

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Abstract: A taxonomic report is presented on the oribatid mites of Laysan Island based on the collection of Bishop Museum. Of a total of 8 species found, all are new to the known fauna of the island. This includes 5 new species and 1 new genus.

Oribatid mites of the Hawaiian Islands were first investigated by Pearce (1910) and later by Jacot (1934), Newell (1956) and Butler & Usinger (1963). Thirty-three species were recorded and described by them from eight of the Hawaiian Islands, namely Hawaii, Maui, Lanai, Molokai, Oahu, Kauai, French Frigate Shoals and Laysan. Up until now, however, only one species, *Scheloribates calcaratus* Jacot was recorded from Laysan. In December 1963, Dr Nixon Wilson of Bishop Museum visited Laysan (about 26°N Lat. and 172°E) to investigate parasitic mites and at the same time, collected some soil mites. As a result of the examination, I found 8 species of oribatid mites, including 5 new speices. I express my gratitude to Dr Wilson for his kindness in offering me the opportunity to study these interesting mites.

Scapheremaeus sinuosus Aoki, n. sp. Figs. 1–5.

MATERIAL EXAMINED: Holotype (BISHOP 3637), Laysan I., from roots of bunch grass, 10.XII.1963, Nixon Wilson; 3 paratypes, same data but at the resting place of wedge-tailed shearwater.

Measurements: Length: 365 (380) 400 μ; width: 188 (200) 220 μ.

Prodorsum: Rostral seta short, directed outwards and then slightly curved inwards, terminating in a sharp tip. Lamellae extend forward from anterointerior region of bothridium, running parallel to each other, converging anteriorly and bearing a lamellar seta on their tips; posterior extremities of lamellae connected by a transverse curved ridge (translamella seems to be lacking). Middle portion of prodorsum enclosed by these 3 ridges (2 lamellae and 1 transverse ridge) elevated and covered with an irregular network. Lamellar setae appreciably shorter than rostrals. No interlamellar seta can be seen. Laterad to lamella a longitudinal ridge runs from bothridium to a point about mid-distant along lateral margin of prodorsum in each side, where the latter projects in a small angle; they converge at first, then run subparallel and strongly diverge in the terminations connecting an oblique transverse ridge on each side. Interspace between lamella and lateral ridge

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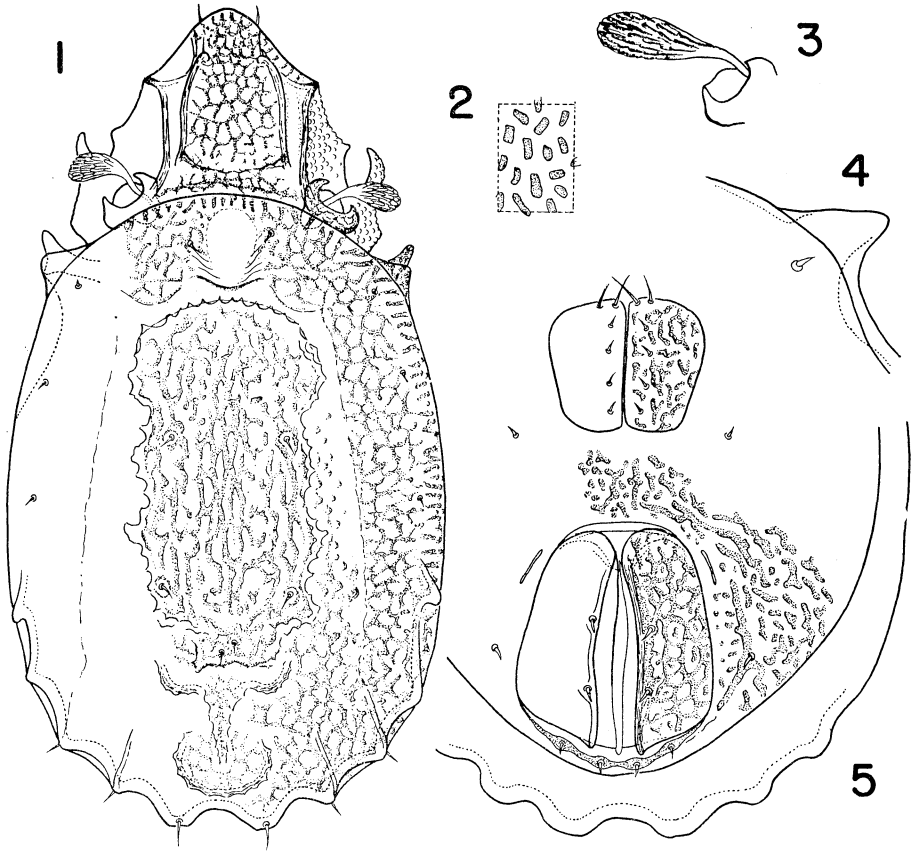
shows smooth integument. A transverse twig-like ornamentation appears between the posterior border of the raised middle field and the anterior border of notogaster. Outside the lateral ridge as well as on tectopedia I a granular structure is observed when the animals are viewed from dorsal aspect; but in fact it consists of many short broken ridges arranged in various directions (fig. 2). Sensillus with a short stalk and a dark-colored oval head with longitudinal stripes (fig. 3).



Figs. 1-5. *Scapheremaeus sinuosus* n. sp. 1, dorsal view; 2, integument on lateral portion of prodorsum; 3, sensillus; 4, humeral edge (in dorsolateral view); 5, anogenital region.

Notogaster: Longitudinally oval in shape. Characteristic are 5 pairs of folds on posterior border, becoming progressively larger and more prominent toward posterior one; posterior 3 pairs of folds each provided with a small seta. Humeral edge triangle (fig. 4), projecting laterally until it reaches the tip of tectopedia III. Middle field unclearly separated from marginal field; its outer margin not a smooth but a ragged line; integument of middle field shows an irregular rugose ornamentation, having a tendency to join longitudinally especially in median part; 3 pairs of short bristles, of which posterior pair is situated near posterior end of elevated field; setae close to each other. Posterior to middle field are 2 arches and 1 large ring which are connected by a longitudinal elevation. Mar-

ginal zone with irregularly rugose structure; there are no distinct radiating chitinous folds except for a pair on the posterior portion; situated just behind anterior border is a pale oval area of weak chitinization, accompanying a short seta laterally on each side; posterior to this area are 3 chitinous arches; there are 3 other pairs of small setae on marginal zone, the posteriormost being minute and difficult to recognize.

Anogenital region: Genital aperture wider anteriorly than posteriorly; the reverse is the case in the anal aperture; interspace between genital and anal aperture 3/4 as long as former and 3/7 as long as latter. Six pairs of genital setae, of which 2 are situated on the anterior border; genital seta on inner anterior corners of plate on each side seems to be the longest. Anal plate with a rounded anterior border and a chitinized inner ridge; 2 pairs of anal setae; their mutual distance equal to distance of posterior seta from posterior end of anal plate. One pair of aggenital setae inserted just behind or on level of posterior border of genital aperture; their mutual distance seems to be equal or a little shorter than length of anal plate. Three pairs of adanal setae, the anterior one inserted at level almost mid-distance between the 2 pairs of anal setae; the remaining 2 pairs inserted posterior to anal aperture on a dark transverse chitinous ridge; the latter expanded roundly in the vicinity of insertion of each adanal seta (ad_1 and ad_2). A pair of long adanal fissures aligned parallel to lateral margin of anal aperture. Integument of the 2 apertures as well as ventral plate ornamented with a irregular rugose structure.

Remarks: Characteristic features of this species are: 1) distinct folds on posterior border of notogaster which are well visible in dorsal as well as ventral views; 2) lack of radiating chitinous ornamentation over entire marginal zone; 3) ragged margin of the raised middle field of notogaster; 4) chitinous ornamentation posterior to middle field, consisting of 2 arches, 1 longitudinal elevation and 1 ring; 5) a pair of setae situated very close together near posterior border of raised middle field. As far as I know 15 species belong to the genus *Scapheremaeus* Berlese and they, including the new species, are distinguished in Table 1. The shape and the direction of the sensillus of *S. sinuosus* is similar to those of *S. marmoratus* Berlese, *S. trirugis* Hammer and *S. alveolatus* Hammer, but distinctly differ at least from those of *S. patella* Berlese, *S. corniger* Berl., *S. pulchellus* Berl., *S. marginalis* (Banks), *S. reticulatus* Berl. and *S. pisacensis* Hammer. The integument of the middle field of *S. sinuosus* resembles that of *S. pulchellus*, but differs from those of any other species, *i.e.* smooth in *S. glaber* Hammer, areola-like in *S. guerini* Berlese and *S. alveolatus*, covered by brown flat units in *S. stratus* Hammer, provided with 3 longitudinal folds or ridges in *S. trirugis* and *S. alveolatus*, with irregular indistinct knobs in *S. clavifer* Hammer and *S. pisacensis*, and rugose or reticulate without tendency of longitudinal flowing in the remaining species. Humeral edge of *S. sinuosus* provided with a triangular projection on each side, extending laterally just to extremity of tectopedia III, and not so gently sloping as in *S. guerini*, *S. glaber* and *S. stratus*. No translamella is recognizable while it is present in *S. patella*, *S. reticulatus*, *S. clavifer*, *S. trirugis*, *S. glaber*, *S. stratus*, *S. alveolatus*, *S. obliteratus* Hammer and *S. pisacensis*. Ring-like or arch-like ornamentation to be observed behind the raised middle field of notogaster in *S. corniger*, *S. clavifer* and *S. sinuosus* at least. The body size of *S. sinuosus* seems to appreciably differ from other species of which the measurements are known to me; *S. stratus* (570 μ in length), *S. pisacensis* (570 μ), *S. glaber* (560 μ), *S. obliteratus* (540 μ), *S. marmoratus* (480 μ), *S. clavifer* (470 μ) and *S. palustris* Sellnick (460 μ) are considerably larger and *S. pulchellus* (300 μ) is

smaller than *S. sinuosus*. Shapes of the notogaster differ from each other: the figures resulting from dividing length of notogaster by its width are shown in Table 1. It should be remembered that the notogasters of *S. sinuosus* and *S. reticulatus* are the most elongate, 1.48 and 1.45 of the figures respectively, and those of *S. corniger*, *S. patella*, *S. clavifer*, *S. trirugis*, *S. guerini* and *S. pisacensis* are more round than the remaining species.

Table 1. Comparison of the main characters between the species belonging to the genus *Scapheremaeus*

Species	Characters						
	1	2	3	4	5	6	7
S. patella Berlese	A	Rg	T	r	S	?	1.25
S. guerini Berlese	B	Al	t	r	S	340	1.28
S. corniger Berlese	A	Al	t	R	S	410	1.21
S. marmoratus Berlese	B	Rg	T?	r	S	480	1.35
S. pulchellus Berlese	A	Lf	t	r	S	300	1.39
S. reticulatus Berlese	A	Rt	T	r	S	430	1.45
S. marginalis Banks	B	Rt	T	r	S	?	1.37
S. palustris Sellnick	A	Rt	T	r	S	460	1.36
S. clavifer Hammer	B	Kn	T	R	S	470	1.25
S. trirugis Hammer	B	Rg	T	r	S	410	1.25
S. glaber Hammer	A	Sm	T	r	S	560	1.39
S. stratus Hammer	A	Br	T	r	S	570	1.34
S. alveolatus Hammer	B	Al	T	r	S	410	1.39
S. pisacensis Hammer	A	Kn	T	r	S	570	1.28
S. obliteratus Hammer	B	Rt	T	r	U	540	1.38
S. sinuosus n. sp.	B	Lf	t	R	U	380	1.48

Characters: 1) Direction of sensillus. A: directed dorsoanterolaterally; B: directed rather laterally, more or less bending backwards. 2) Texture of the middle field of notogaster. Al: alveolated; Br: covered by brown round units; Kn: with indistinct knobs or tubercles; Lf: with longitudinally flowing folds or reticulation; Rg: rugose; Rt: reticulate; Sm: smooth. 3) Presence of translamella. T: translamella present; t: without translamella. 4) Structure of the posterior portion behind the raised middle field of notogaster. R: with round or arched chitinous ornamentation; r: without such ornamentation. 5) Posterior border of notogaster. U: uneven and undulating; S: smoothly rounded. 6) Body length in microns. 7) Ratio of the length of notogaster to its width.

Microzetes auxiliaris Grandjean, 1936

MATERIAL EXAMINED: 6 adults, Laysan I., from roots of bunch grass, 10. XII. 1963, N. Wilson.

Measurements: Length: 185 (187) 190 μ; width: 112 (116) 120 μ.

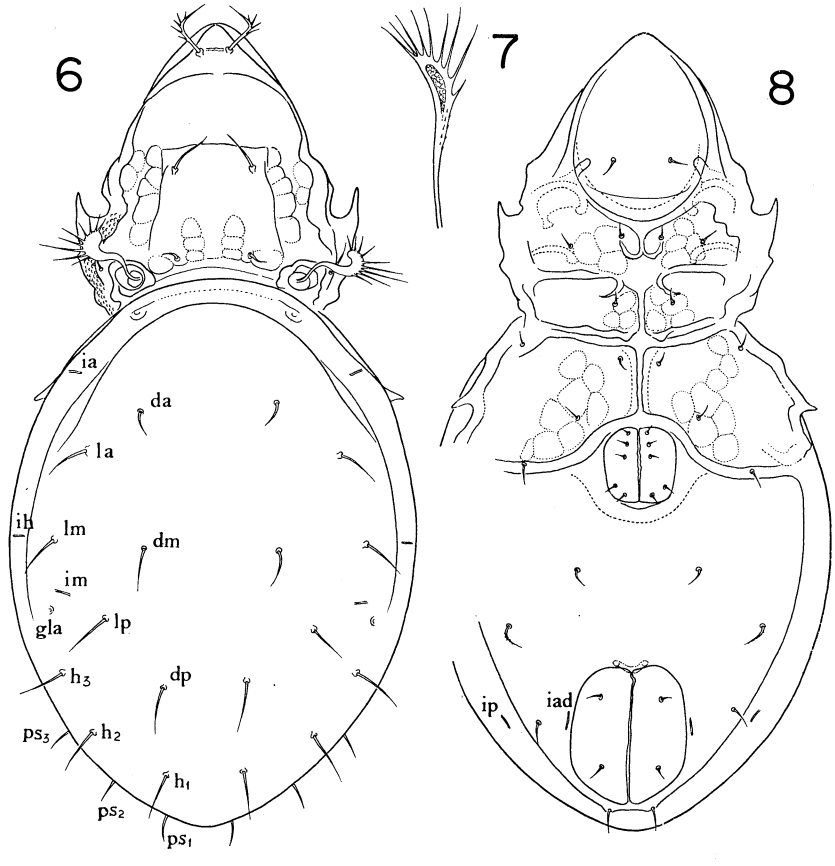
Known distribution: Venezuela (Grandjean 1936), Panama (Grandjean 1936), Peru (Beck 1962).

Multioppia wilsoni Aoki, n. sp. Figs. 6–8.

MATERIAL EXAMINED: Holotype (BISHOP 3638), Laysan I., wedge-tailed shearwater resting place, 10.XII.1963, N. Wilson; 9 paratypes, same data.

Measurements: Length: 264 (314) 365 μ; width: 135 (162) 187 μ.

Prodorsum: Integument smooth except outside of exobothridial seta on each side. Rostral setae set with 4–5 setae-like projections unilaterally, strongly elbowed halfway along their length, so that the distal 1/2 is directed medioventrally. Lamellar setae almost smooth, directed medioanteriorly; their mutual distance about 1.4–1.5× as long as setae. Interlamellar setae directed upwards, equal in length to lamellar setae; their mutual distance a little shorter than that of lamellar setae. Three pairs of pale spots found on proximomedian part; 3 spots of each longitudinal row closely situated together. A pair of pale spots located just outside of interlamellar setae. Middle part of prodorsum containing lamellar and interlamellar setae surrounded by an almost square frame of faint ridges. Several pairs of pale spots can be seen outside this frame. Exobothridial setae seem to be somewhat shorter than lamellar setae, situated at level of anterior margin of bothridia, directed lateroanterodorsally. Sensillus (fig. 7) provided with 9 setalike projection unilaterally, of which anterior-most 6 are almost equal in length to each other, next 2 appreciably longer than former, and posteriormost shortest; some more very tiny barbs may be observed proximal to the shortest projection.



Figs. 6–8. *Multioppia wilsoni* n. sp. 6, dorsal view; 7, sensillus; 8, ventral view.

Notogaster: Somewhat variable in shape; those shown in figs. 6 and 8 are of rather elongate type. Twelve pairs of notogastral setae smooth, arranged as shown in fig. 6: *la* situated closer to *da* than to *dm*; *lm* a little anterior to level of *dm*; *lp* almost mid-distance between levels of *dm* and *dp*; h_1-h_2-h_3 aligned parallel to margin of notogaster. Four pairs of fissures (*ia*, *im*, *ih* and *ips*); *ia* situated in anterior band of notogaster, anterolateral to *da*; *im*, accompanying *gla* posterior to them, situated in a triangle *lm*-*lp*-h_3 in each side; *ih* located marginally at level of *lm*; *ips* visible in ventral view at level of *iad*. On the anterior border, just posterior to bothridia, a pair of chitinized dark spots are present; they presumably indicate glandular openings.

Anogenital region: Space between anal and genital apertures more than 2× as long as genital aperture and shorter than 1.5× as long as anal aperture; 2 pairs of anal setae; 6 pairs of genital setae; gen_2 inserted most laterally; gen_3, gen_4 and gen_5 become progressively closer to inner border of plates. One pair of aggenital setae. Three pairs of adanal setae; each row (ad_1-ad_2-ad_3) widely separated from each other, much closer to lateral margin of ventral plate than to that of anal plate; at least ad_3 distinctly barbed; ad_1 situated on a trapezoid chitinized structure at end of ventral plate. Slit-like spore *iad* aligned parallel to lateral margin of anal aperture.

Epimeral region: Epimerata I, II and the fused epimerata III-IV reticulated, but not perfectly. Apodemata SJ mostly dark and distinct; sometimes a pair of small chitinous projections found on their median extremity on each side. An anchor-shaped (or W-shaped) figure appears between epimerata I. Setal formula is (3–1–2–3). Tectopedia IV terminating in a sharp point.

Mandibles: Chelate portion rather small compared to entire shape, about 30% as long as total length of mandible. Just behind dorsal seta is a small but distinctly angulate projection.

Remarks: Hitherto only 3 species of the genus were described: *M. radiata* Hammer 1961, and *M. stellifera* Ham. 1961, from Peru, and *M. australis* Ham. 1962, from Chile. The latter is most closely related to *M. wilsoni*. They are distinguishable by the following key.

Key to species of Multioppia Ham., 1961

1. Sensillus provided with 12–17 seta-like projection. Rostral setae gently curved medially. Median pale spots of each row on prodorsum more or less separated from each other. No pale spots off interlamellar setae. Notogastral setae short and fine. Body length ca 310 μ 2

   Sensillus provided with 9–11 seta-like projections. Rostral setae strongly curved or elbowed medially. Median pale spots of each row on prodorsum very close to each other. Another pair of pale spots found off interlamellar setae. Notogastral setae slightly feathered or barbed. Body length ca 270 μ.....3

2. Sensillus with 16–17 seta-like projections; their relative length and number is M(6) L(5)S(5–6)*. Lamellar setae 1/2 as long as mutual distance. Interlamellar setae

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* From distal end to proximal part. S: short setae; M: middle-sized setae; L: long setae. Figures in parentheses indicate number of setae.

situated off anterior border of posterior spots of median spot-group. Notogastral setae *la* situated at level of almost mid-distance between *da* and *dm*; *dm* situated mid-distant between *da* and *dp*..... **radiata** Ham., 1961

Sensillus with 12–15 seta-like projections; their relative length and number is S(3) M(3)L(3)S(3). Lamellar setae 1/2–2/3 as long as their mutual distance. Interlamellar setae situated just off the posterior spots of median spot-group. Notogastral setae *la* situated at level of *dm*; *dm* situated closer to *da* than to *dp*..... ..... **stellifera** Ham., 1961

3. Sensillus with 11 seta-like projections; their relative length and number is M(8)S (3). Rostral setae curved, feathered, but without long pectinations. Distance between anal and genital aperture almost 2× as long as genital aperture. Notogastral setae *lm* situated posterolateral to *dm*, at level of *dp*; *lp* posterolateral to *dp*; h_2 far distant from lateral margin of notogaster, aligned on the extension of line *da-dp* as well as *lm-lp*. Fissures *im* anterior to *lm*..... **australis** Ham., 1962

Sensillus with 9 seta-like projections; their relative length and number is M(6)L (2)S(1). Rostral setae strongly elbowed, with 4 or 5 distinct pectinations. Distance between anal and genital aperture more than 2× as long as genital aperture. Notogastral setae *lm* situated at level of *dm*; *lp* anterolateral to *dp*; h_2 close to lateral margin, h_1-h_2-h_3 aligned parallel to margin. Fissures *im* posterior to *lm*..... ..... **wilsoni** Aoki, n. sp.

Tectocepheus sarekensis Trägardh, 1910

MATERIAL EXAMINED: 3 exs., Laysan I., roots of bunch grass, 10. XII. 1963, N. Wilson.

Length: 293–310 μ; width: 168–170 μ. Body size of the examined specimens are considerably smaller than those given by Knülle (1954). They seem to be similar in size to *T. velatus* (Michael 1880). But the median and lateral borders of lamella run parallel toward the tip and the prodorsum bears indistinct longitudinal furrows behind the translamella, which clearly indicate that these animals belong to *T. sarekensis*. It is interesting to note that Knülle (1954) observed that smaller individuals show a tendency to have slender tips of lamellae and most of the specimens from Laysan I., smaller in size, show the same tendency.

Known distribution: Europe.

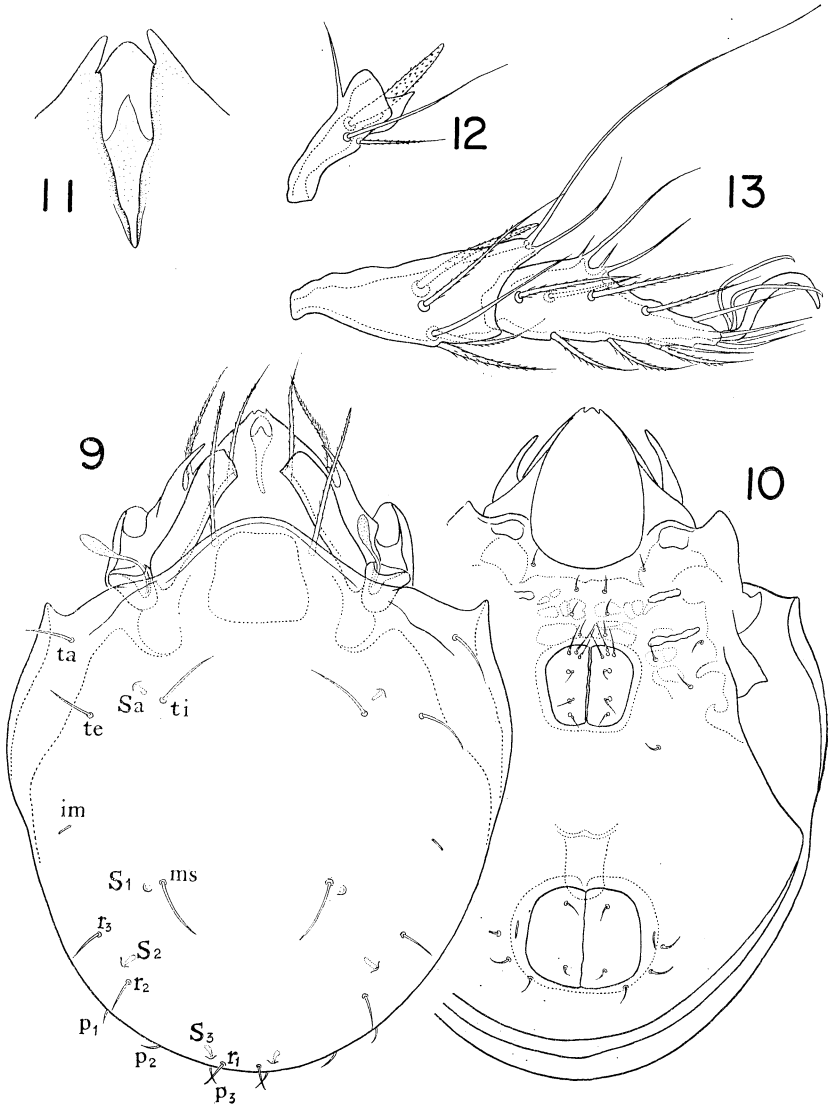
Hypozetes laysanensis Aoki, n. sp. Figs. 9–13.

MATERIAL EXAMINED: Holotype (BISHOP 3639), Laysan I., at resting place of wedge-tailed shearwater, 10.XII.1963, N. Wilson; 7 paratypes, same data.

Measurements: Length: 445 (472) 490 μ; width: 310 (340) 354 μ.

Prodorsum: Rostrum tricuspidate, the median cuspis broadly rounded and a pair of lateral cuspidis more prominent and exceeding tip of median cuspis and terminating in rather rounded tips. A longitudinal pale-colored area can be seen posterior to median cuspis of rostrum; it becomes narrower posteriorly and terminates in a very narrow projection with a rounded tip; a sharp pointed projection being directed forward is situated about halfway along length of pale-colored area (fig. 11). Rostral setae densely barbed on each side, inserted on apophyses on each side. Lamellar seta inserted just under inner extremity

of lamella as in other species of the genus, minutely barbed over entire length. Interlamllar seta inserted under anterior border of notogaster, minutely barbed, but more densely barbed on tip. Lamellar setae exceed tips of rostrals for a short distance. Interlamellar setae not so long, never exceeding tips of rostrals. Lamellae slightly constricted at mid-distance along their length. Tectopedia I sharply pointed in anterior tip, exceeding anterior extremities of lamellae for a short distance. Sensillus usually directed anterolaterally, with



Figs. 9–13. *Hypozetes laysanensis* n. sp. 9, dorsal view; 10, ventral view; 11, rostrum, showing cuspidis and incisions; 12, genu I with a thickened seta and blade-like projection; 13, tarsus and tibia I.

a minutely barbed club-shaped head.

Notogaster: Lateroanterior extremity of lamella rather prominent and sharply protruding forwards. Ten pairs of notogastral setae seem to be almost smooth in lower magnification, but in fact very minutely barbed. Three pairs of sacculi; *Sa* situated anterolaterad to *ti*, more distant from *te* than from *ti*; S_1 in vicinity of insertion of *ms*, situated posterolaterad to latter; S_2 situated between r_2 and r_3, somewhat nearer to former; S_3 situated just anterolaterad to r_1. Fissures *im* located about mid-distance between *te* and r_3 on each side, aligned obliquely. A large rounded trapezoid pale colored area found on anterior portion of notogaster.

Anogenital region: Anal aperture slightly wider posteriorly. Two pairs of anal setae and 3 pairs of adanal setae. Adanal slit *iad* situated parallel to lateral border of anal aperture. A pair of aggenital setae. Genital aperture wider anteriorly, with 6 pairs of setae, anterior 3 pairs situated close to each other on each side and posterior 3 pairs arranged longitudinally on each side, *i.e.* the distances gen_1–gen_1, gen_2-gen_2 and gen_3-gen_3 are almost equal.

Epimeral region: There are weakly chitinized reticulate micro-sculpture. Apodemata II and SJ recognized as short transverse ridges. Formula of epimeral setae is (4–1–3–1). Projections on tectopedia II thumb-like and tectopedia III fin-like.

Legs: Setal formula of solenidion on legs I–IV are (2–2–1–0), (2–1–1–0), (0–1–1–0) and (0–0–1–0) respectively. All legs with 1 thickened blunt seta on each tibia and genu; neither tarsi nor femora with such setae. Genua I and II each provided with a blade-like structure on anteroventral portion (fig. 12).

Remarks: Hitherto only 2 species of *Hypozetes* Balogh were described: *H. imitator* Balogh from East Africa and *H. bulgaricus* Jeleva from Bulgaria. *H. laysanensis* n. sp. is the third species and bears striking resemblance to both of the other 2 species. The principal differences between them are summarized as follows:

1) the measurement of *H. laysanensis* is intermediate (472×340) between those of *H. imitator* (430×293) and *H. bulgaricus* (503×369).

2) The anterior margins of pteromorphae of *H. laysanensis* are more prominently projected forward than those of the other 2 species.

3) Posterior 2 setae on genital plate arranged longitudinally in *H. laysanensis* while they are arranged obliquely, *i.e* anterior one is located anterolaterad to posterior one, in the other 2 species.

4) Sacculi (*Sa*) are located closer to *ti* than to *te*, while they are located closer to *te* than to *ti* in *H. bulgaricus* and almost mid-distance between *ti* and *te* in *H. imitator*.

5) Interlamellar setae of *H. imitator* and *H. laysanensis* rather short and not reaching tips of rostral and lamellar setae, while those of *H. bulgaricus* are markedly long and exceed the latter quite well.

6) Ratios of body length to body width, calculated from the figures of Balogh (1959) and Jeleva (1962), are 1.36 : 1 both in *H. bulgaricus* and *H. laysanensis*, but 1.47 : 1 in *H. imitator*. It means that *H. imitator* seems to be more elongate in shape than the other 2 species.

As to the interesting feature just posterior to the anterior tip of rostrum which is observed in *H. laysanensis* neither description nor figure are available from Balogh's as well

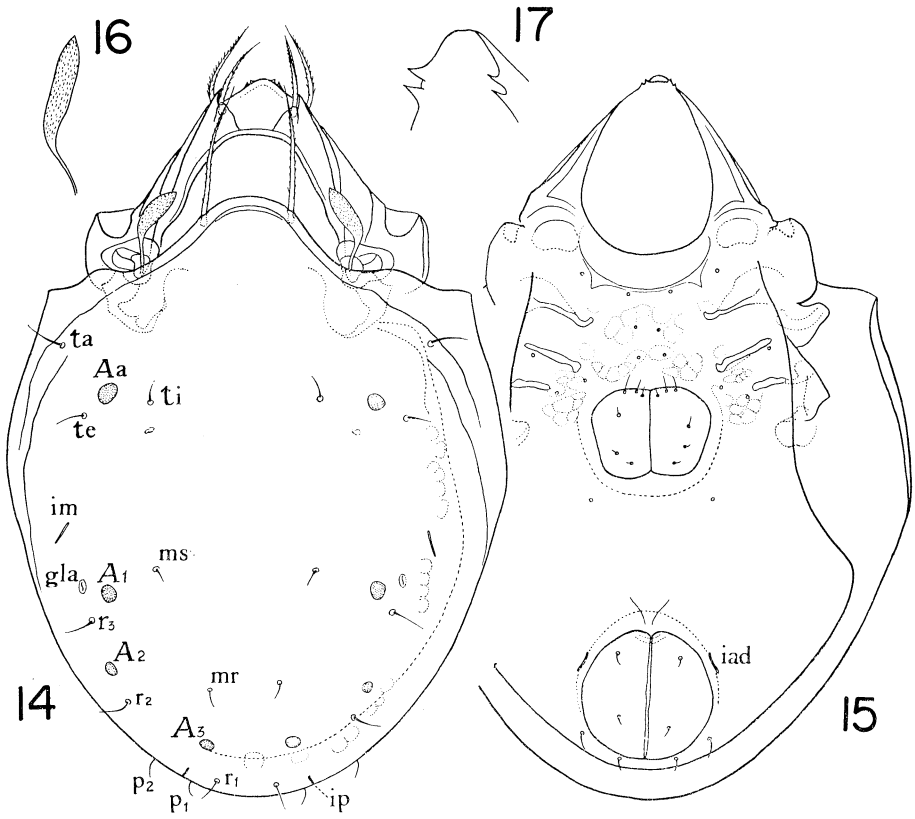
as Jeleva's papers, although only an anteriorly directed projection is to be seen on the original drawing of *H. bulgaricus*. Jeleva (1962) noticed as one of the characteristic features, the comparatively long setae *p* of *H. bulgaricus*. But, in fact, setae *p* of *H. laysanensis*, and supposedly those of *H. imitator* also strongly curved ventrally so that they may be considered to be comparatively shorter than the setae *r*. In case of *H. laysanensis* setae *p* seem to be very short in dorsal view compared to *r* (only 1/3 as long as *r*), but ratio of *r* to *p* is actually about 12 : 7.

Ceratozetes incurvus Aoki, n. sp. Figs. 14–17.

MATERIAL EXAMINED: Holotype (BISHOP 3640), Laysan I., from roots of bunch grass, 10. XII.1963, N. Wilson.

Measurements: Length: 270 μ; width: 185 μ.

Prodorsum: Rostrum rounded, with 2 small sharp thorns on each side; thorns situated close to each other and directed ventrally, so that they can be seen most distinctly in ventral aspect only (fig. 17). Lamellae connected by a distinct translamella; latter continued



Figs. 14–17. *Ceratozetes incurvus* n. sp. 14, dorsal view; 15, ventral view; 16, sensillus; 17, lateroventral view of rostrum, showing 2 pairs of thorns.

with inner chitinous borders of lamellae, forming an arch. Cuspis of lamella provided with a sharp and incurved tooth outside, from which a dorsal line runs to bothridium. Lamellar seta inserted just interior to tooth, longer than rostral seta and shorter than interlamellar seta; all setae densely barbed. Bothridium with a large opening. Sensillus of characteristic shape, with a short stalk and a large spindle-shaped head; the latter with parallel sides in mid portion, directed inwards and very finely and densely barbed (fig. 16).

Notogaster: Anterior border markedly protruding forwards and overlapping prodorsum. A chitinous line found just behind border, extending far posteriorly on each side and overlapping other chitinous lines reaching anteriormost pair of notogastral setae. Pteromorpha with an undulating anterior border. Ten pairs of notogastral setae, 4 pairs of areae porosae and 2 pairs of fissures. Adopting the usual notation proposed for oribatid mites which have 10 pairs of notogastral setae we cannot find setae p_3, but a pair of additional setae posterior to *ms*; these additional setae are provisionally here called *mr*. Areae porosae *Aa* situated a little anterior to assumed line between *ti* and *te*, closer to *te* than to *ti*; posterior or lateroposterior to *ti* is a small pale area on each side; A_1 situated on or slightly in front of assumed line between *ms* and r_3; *gla* located laterad to anterior border of A_1; *im* long, aligned obliquely, situated anterolaterad to *gla*; A_2 between r_2 and r_3, closer to former than to latter; there are many pale areas on periphery; appearances are very similar to real areae porosae, so that it seems to be difficult to designate A_3 among them; A_3 are probably one located posterior to *mr*; *ip* situated near posterior margin, anterior to p_1.

Remarks: Rajski (1958) divided the genus *Ceratozetes* provisionally into 2 groups, using the type of ending of the cuspis as a criterion. *C. incurvus* n. sp. apparently belongs to his "second group" which has a tooth on the tip of cuspis. Among them *C. cisalpinus* Berlese 1905, differs from *C. incurvus* by the blunt tooth of cuspis, the slender sensillae and the larger body size. *C. minimus* Sellnick 1928, is distinguishable from *C. incurvus* by lacking areae porosae and their slightly thickened seta-like sensillae. *C. thienemanni* Willmann 1943, and *C. sellnicki* Rajski 1958, clearly differ from *C. incurvus* in lacking translamella and having slender spindle-shaped or seta-like sensillae. *C. imperatorius* Aoki 1963, is also to be included in this "second group", but it is discriminated by having slender outside-directed sensillae, very minute notogastral setae, distinctly tricuspidate rostrum and larger body size.

Galumna flabellifera Hammer, 1958 Figs. 18–22.

MATERIAL EXAMINED: 9 adults, Laysan I., from roots of bunch grass, 10. XII. 1963, N. Wilson; 1 adult, same data, at the resting place of wedge-tailed shearwater.

Measurements: Length: 303 (317) 337 μ; width: 204 (211) 220 μ.

Prodorsum: Sublamellar carina *L* extinguished a short distance anterior to the insertion of interlamellar seta. Rostral setae smooth, curved inwards and markedly larger than lamellar or interlamellar setae. Lamellar setae minute, inserted just behind sublamellar carina *L* and somewhat closer to *ro* than to *in*. Interlamellar setae the shortest, directed upwards (fig. 21). Sensillus directed at first (in bothridium) posterolaterally, then turned strongly forwards and at last dorsolaterally; distal 1/2 of sensillus broadened with round tip; there are many (16–23) seta-like projections along the anterior as well as the distal margin (fig. 20).

Notogaster: Dorsosejugal suture slightly incurvate in middle. Five pairs of areae porosae and 9 pairs of alveoli present; *At* transversely long; *Aa* the largest, quite round (fig. 22), although they seem to be somewhat oval in dorsal view (fig. 18); A_1 round, A_2 and A_3 oval in shape; notogastral alveoli *ti* and *te* situated almost at same level; a pair of minute light spots found behind the above-mentioned alveoli; mutual distance between *ms* almost equal to that of *ti*; *im* located mid-distance between *ti* and *ms*, aligned obliquely; their directions are variable and not always symmetric; A_1, *ms* and *gla* located almost at same level; r_3 situated at or a little anterior to this level, between A_1 and *gla*; central pore found a little behind *ms*; r_2 between A_2 and A_3, closer to A_2 than to A_3; r_1 just anterior to A_3; p_1, p_2 and p_3 situated marginally; p_3 far distant from p_2, located anterior to level of A_2; 2 fissures (*ih* and *ips*) found laterad to *gla* on each side and aligned parallel to each other.

Pteromorphae: Proportion of length to width of widest part approximately 7 : 4. Anterior border broadly rounded, while posterior end forms an angle of 90°. Alveoli *ta* situated at tip of chitinous stripe directed just toward constriction of outer margin; in vicinity of hinged portion some radiating structure can be seen, including *ia*.

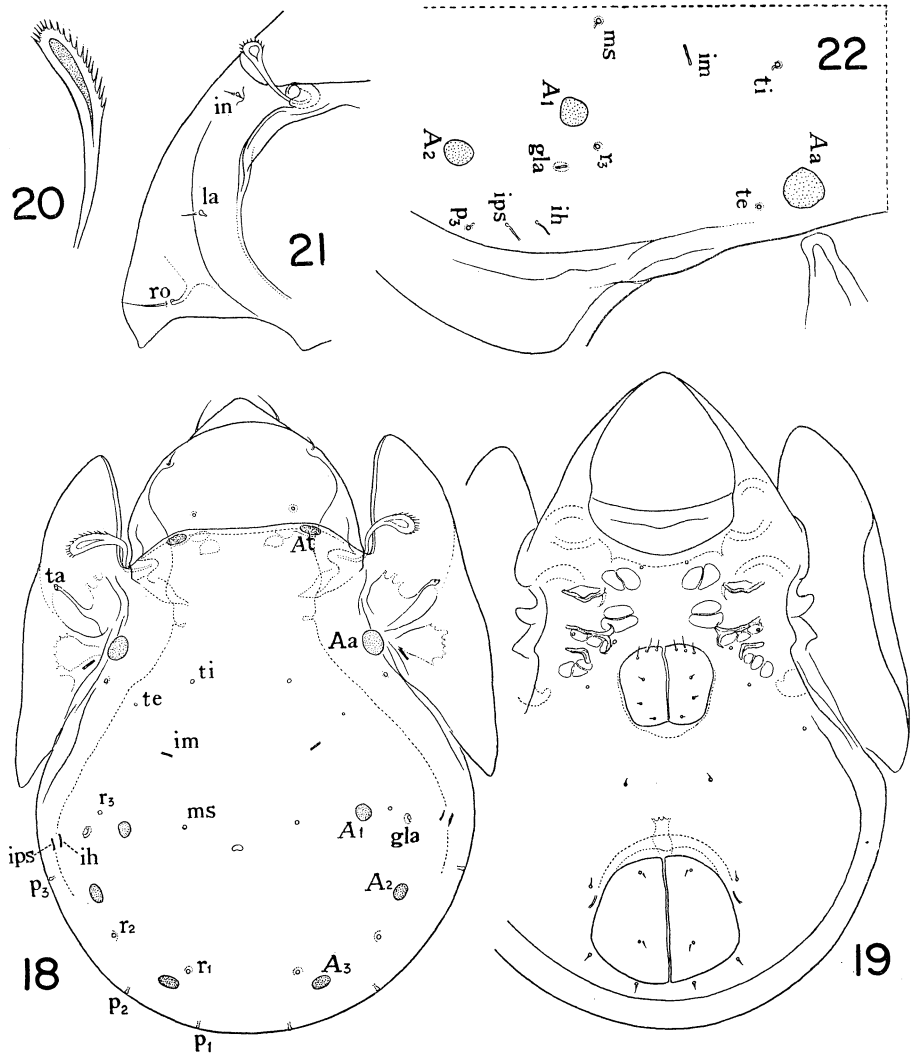
Anogenital region: Anal aperture broadest posteriorly, provided with 2 pairs of anal setae, anterior one being very close to anterior border. Three pairs of adanal setae: ad_1 and ad_2 inserted behind posterior margin of anal aperture, arranged in such a way that distance between ad_1 and ad_1 is almost equal to distance between ad_1 and ad_2; ad_3 located far anteriorly, just in front of *iad*. Aggenital setae situated somewhat closer to genital aperture than to anals, their mutual distance almost equal to, or a bit larger than, that of an_1 and an_2. Genital aperture with 6 pairs of setae, of which anterior 3 pairs inserted close to anterior border of genital plates; among the other 3 pairs gen_2 is most distant from and gen_1 is closest to inner margin.

Epimeral region: Apodemata I, II and III distinctly recognizable; apod. II bent at their middle point; apod. SJ the longest, with a pair of hook-shaped or claw-like appendages at their median extremities; apod. III short, strongly elbowed postriad. Two pairs of distinct pale area found between camerostome and genital aperture; each of them divided by a single line into 2 portions; some more pale areas just behind apod. SJ as well as III. Setal formula (1–0–2–1). Tectopedia II recognized as thumb-like projections; tectopedia III fin-shaped.

Remarks: The examined specimens showed a great resemblance to *G. minutus* Ewing 1909, as well as *G. flabellifera* Hammer 1958. However, I consider these specimens from Laysan I. provisionally as *G. flabellifera*. *G. flabellifera* itself seems to be very similar to *G. minutus* and Hammer (1958) did not mention any difference between them. For the time being, I am not sure whether they are identical or not. The differences which I noticed are as follows: 1) Shape of *Aa* fusiform in *G. mimutus*, while it is not fusiform in *G. flabellifera*: slightly oblong in the specimens from Argentina and Bolivia, and round in the specimens from Laysan I. 2) Interlamellar setae well visible in *G. minutus*, while they are minutely short in *G. flabellifera* and only recognizable in lateral view.

Genus **Nesoribatula** Aoki, n. gen.

Generic characters: 13 pairs of notogastral setae; shoulder with a pair of setae c_1 which



Fgs. 18–22. *Galimna flabellifera* Hammer. 18, dorsal view; 19, ventral view; 20, sensillus; 21, lateral view of propodosoma; 22, middle part of notogaster (right side).

are similar in shape to the remaining notogastral setae; c_2 lacking; 3 pairs of *ps*. Notogaster with 4 pairs of sacculi, without true areae porosae. Dorsosejugal suture straight in middle. Prodorsum without translamella. Lamella almost equal in width throughout. Insertions of lamellar and rostral setae connected by a slender ridge. Bothridium scarcely covered by anterior portion of notogaster. Sensillus club-shaped. Two pairs of anal and 4 pairs of genital setae; 3 pairs of adanal and a pair of aggenital setae. Legs tridactyle.

Type species: *Nesoribatula pacifica* n. sp.; here designated.

This new genus, belonging to the family Oribatulidae, seems to be closely related to the

genera *Oribatula*, *Eporibatula* and especially *Dometorina*. They are distinguishable by the following key:

1. Dorsosejugal suture convex. Two pairs of scapular setae. True areae porosae on notogaster 2
   Dorsosejugal suture straight in middle. One pair of scapular setae. No true areae porosae, but sacculi on notogaster. Setae ps_3 present 3
2. Thirteen pairs of notogastral setae; ps_3 lacking. Scapular setae normal ..... **Oribatula** Berlese, 1896
   Fourteen pairs of notogastral setae; ps_3 present. Scapular setae thicker than remaining notogastral setae ..... **Eporibatula** Sellnick, 1928
3. Ten pairs of notogastral setae. Bothridium entirely covered by anterior portion of notogaster ..... **Dometorina** Grandjean, 1951
   Thirteen pairs of notogastral setae. Bothridium scarcely covered by anterior portion of notogaster ..... **Nesoribatula**, n. gen.

Nesoribatula pacifica Aoki, n. sp. Figs. 23–25.

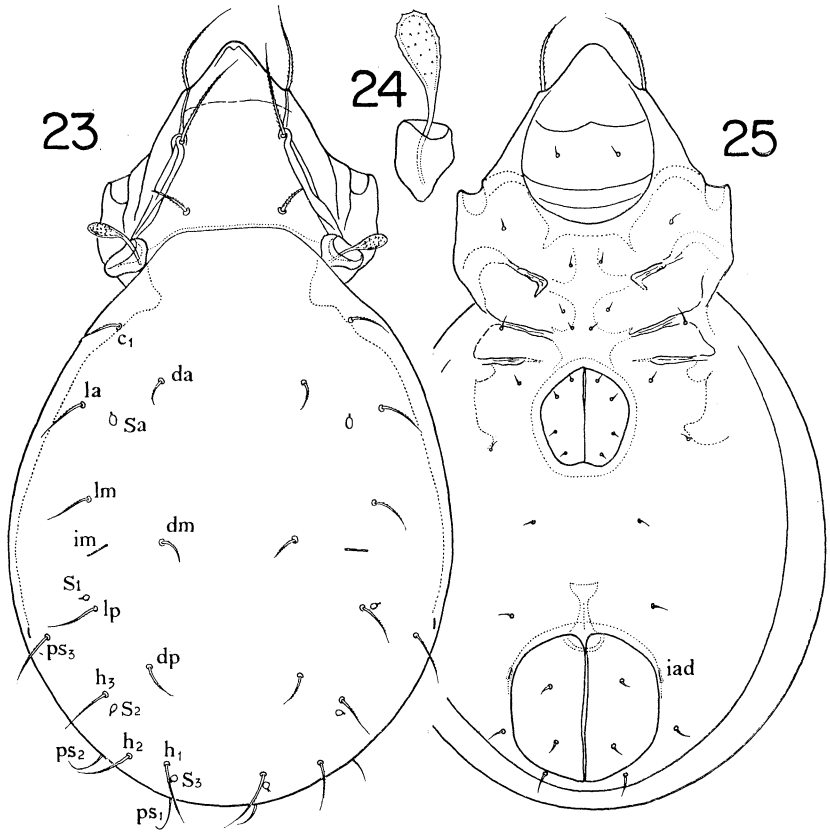
MATERIAL EXAMINED: Holotype (BISHOP 3641), Laysan I., at resting place of wedge-tailed shearwater, 10.XII.1963, N. Wilson; 1 paratype, same data but from roots of bunch grass.

Measurements: Length: 350 and 390 μ; width: 205 and 230 μ.

Prodorsum: Tip of rostrum rounded; a M-shaped chitinous line found just behind it. Lamellae almost straight ridges, equal in width throughout, converging forwards; tip of each lamella terminating in a ?-shaped structure, provided with a lamellar seta. A slender ridge extends anteriorly from insertion of lamellar seta and reaches lateral margin of prodorsum where rostral seta is inserted. Prodorsal setae rather thick and finely barbed; rostral and interlamellar setae almost equal in length and a little shorter than lamellar setae. Sensillus club-shaped, with a sparsely barbed head which is almost equal in length to its stalk (fig. 24).

Notogaster: Dorsosejugal suture present, almost straight line in middle. There are 13 pairs of notogastral setae; setae c_2 lacking; all setae extremely finely barbed. Mutual distance between *dp-dp* somewhat larger than those of *da-da* as well as *dm-dm*; ps_3 situated far in front, anterior to level of insertions of *dp*, fairly distant from lateral margin of notogaster. Four pairs of sacculi; *Sa* larger than remaining, situated a little posterior to the level of *la*; S_1, S_2 and S_3 located in the vicinity of *lp*, h_3 and h_1 respectively; S_1 laterad or anterolaterad to *lp*, S_2 and S_3 just posteriad to h_3 and h_1 respectively. Two pairs of fissures found on middle part; *im* long, situated almost mid-distant between *lm* and *lp*, aligned transversely or obliquely; *ips* short, located outside of ps_3.

Anogenital region: Anal aperture a round hexagon, its length and width equal. Two pairs of anal setae rather distant from margin. Three pairs of adanal setae; distance ad_1-ad_1 slightly larger than ad_1-ad_2; distance ad_1-ad_2 almost equal to an_1-an_2; ad_3 far in front, anterior to level of anterior border of anal aperture; mutual distance ad_3-ad_3 equal to width of anal aperture. Mutual distance of aggenital setae somewhat smaller than that of ad_3. Distance between genital and anal aperture almost equal to length of latter. Genital aperture suboval, pointed in front and incurvate at posterior border. Four pairs of



Figs. 23–25. *Nesoribatula pacifica*, n. sp. 23, dorsal view; 24, sensillus; 25, ventral view.

genital setae arranged rather marginally; the distance between gen_2-gen_3 larger than gen_1-gen_2 as well as gen_3-gen_4.

Epimeral region: Apodemata II and SJ aligned obliquely, parallel to each other, while apodemata III aligned transversely. Integument between apodemata smooth, with 7 pairs of epimeral setae; setal formula (3–1–2–2).

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