

Article

New Zealand species of *Oribotritia* (Acari: Oribatida: Oribotritiidae): descriptions of two new species and a key to eight species

DONG LIU¹ & ZHI-QIANG ZHANG^{2,3}

¹ Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Changchun 130102, P. R. China.
Email: liudong@neigae.ac.cn

² Landcare Research, 231 Morrin Road, Auckland, New Zealand.

³ Corresponding author. E-mail: zhangz@landcareresearch.co.nz

Abstract

The genus *Oribotritia* (Acari: Oribatida: Oribotritiidae) was represented in New Zealand by six species prior to this work. In this paper, three species of *Oribotritia* from New Zealand are described, including two new species, *Oribotritia mangamuka* **sp. nov.** and *Oribotritia bilaminae* **sp. nov.**, and a known species with some variation. A key to all known species of *Oribotritia* in New Zealand is also provided.

Key words: Soil mites, Oribatida, Oribotritiidae, *Oribotritia*, new species, key, New Zealand

Introduction

The Oribotritiidae is a family of nine genera and 184 species of ptyctimous mites (Subías 2012). *Oribotritia* is its type genus, but it has a complicated history. Berlese (1883) proposed the genus *Tritia*. Unfortunately, this generic name was preoccupied by *Tritia* Risso, 1826, which was proposed by Risso for a genus in the molluscan family Alectrionidae. Therefore, Jacot (1924) used “*Oribotritia*” as a replacement name for *Tritia* Berlese, 1883 and designated *Hoplophora decumana* Koch, 1836 as the type species. Michael (1898) was convinced that this type species was misidentified and indicated that it should be *Phthiracarus berlesei* Michael, 1898. Michael’s view was subsequently accepted by other authors (van der Hammen 1959, Märkel 1964). However, this was further complicated by the fact that the presumed type specimen of *P. berlesei* could not be found in Berlese’s “*Acarotheca Italica*” (Märkel 1964, p. 29, citing Van der Hammen). Fortunately, some *P. berlesei* specimens from Berlese’s “*Acarotheca Italica*” were preserved in the Rijksmuseum van Natuurlijke Historie, Leiden. Märkel (1964) designated a lectotype female from this series. From then on, the dispute about the type species of this genus was finally settled.

Mites of *Oribotritia* are characterized by a prodorsum with one or two pairs of lateral carinae, bothridial squamae situated above the bothridia, posterior median apodeme absent, interlamellar and rostral setae in median position, lamellar setae situated near bothridia, notogaster with 14 pairs of setae, openings of opisthosomal glands and five pairs of lyrifissures present, genitoaggenital and anoanal sutures well developed, infracapitulum of stenarthrous type, palpal setation: 0-(2-4)-0-(2-3)-9(1), tarsi heterotridactylous. The genus has a nearly cosmopolitan distribution except the Antarctic Region. Till the end of 2012, 85 valid species of this genus were reported (Subías 2012), and among these, six species were known from New Zealand (Niedbala 1993, 2000, 2006; Niedbala & Colloff, 1997). During the first author’s visit to Landcare Research in Auckland in April 2012, we

identified three species of *Oribotritia* from the New Zealand Arthropod Collection, including two new species. This paper gives detailed descriptions of the three species and also provides a key to facilitate the identification of eight species of *Oribotritia* known from New Zealand.

Material and methods

Measurements and descriptions are based on specimens mounted in temporary cavity slides that were studied using a light microscope equipped with a drawing attachment. Terminology generally follows Niedbała (2000). The unit of measurement is micrometre (μm).

All holotype specimens are deposited in the New Zealand Arthropod Collection, Landcare Research, Auckland (NZAC). Paratype and other specimens are split between NZAC and Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Changchun (NIGA).

Descriptions of species from New Zealand

Oribotritia mangamuka sp. nov.

(Figs. 1–7)

Material examined: Holotype: adult (NZAC, in alcohol, 76/101), New Zealand: ND, Mangamuka Summit, 400 m, from litter, 13 Dec., 1976, leg. V. A. May. Paratypes: one adult (NZAC, in alcohol, 76/101), same data as holotype; one adult (NIGA, in alcohol, 76/101), same data as holotype.

Etymology. Named after the type locality; Mangamuka is a district in Northland, at the junction of the Mangamuka and Opurehu Rivers; here used as a noun in apposition.

Description. Measurements: Holotype: Prodorsum: length 550, width 450, height 160, setae: *ss* 175, *ro* 90, *le* 50, *in* 50, *ex* 95; notogaster: length 1110, width 810, height 730; setae: c_1 125, d_1 125, e_1 100, h_1 100, ps_1 105; *in-in* 182, *in-le* 100, *ro-ro* 54; ventral region: g_1 20, ag_1 15, ag_2 25; genito-aggenital plate 170×308, anal and adanal plates 130×491. Paratypes: Prodorsum: length 530–550, width 440–445, height 155–160; notogaster: length 1050–1080, width 790–800, height 710–720.

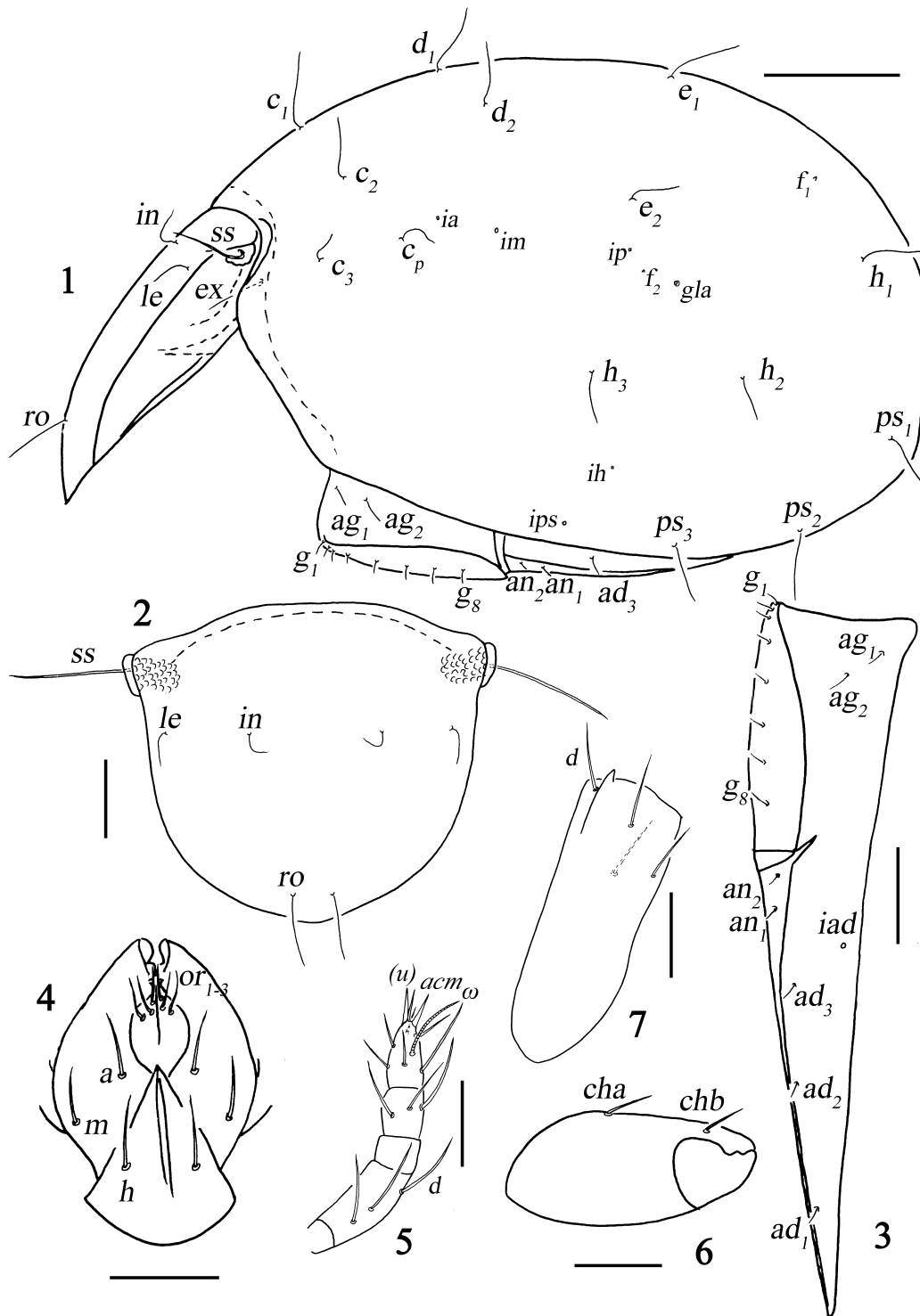
Integument. Colour yellowish. Surface of body finely punctate.

Prodorsum (Figs. 1–2). One strong lateral carina present on each side; sensilli (*ss*) long, setiform, rigid and smooth; other prodorsal setae thin and smooth; rostral setae (*ro*) semi-erect; interlamellar setae (*in*) directed backward; lamellar setae (*le*) procumbent; exothridial setae (*ex*) long; comparative length: $ss > ex > ro > in = le$, $in - in > in - le > ro - ro$, $in - in / ro - ro = 3.37$.

Notogaster (Fig. 1). Setae short ($c_1 < 1/2c_1 - d_1$), thin and smooth; setae *c* far away from anterior border, setae c_3 less so than setae c_1 and c_2 ; two pairs of vestigial setae f_1 and f_2 present, setae f_1 situated anterior to setae h_1 .

Gnathosoma (Figs. 4–6). Subcapitulum normal (Fig. 4); setae *h*, *m*, and *a* simple and smooth; setae *h* longer than distance between them; adoral setae or_1 apparently flat with barbs; or_{2-3} simple and smooth; palpal (Fig. 5) setation: 0-3-0-3-9(1); supracoxal setae simple and smooth; chelicera (Fig. 6) with two smooth setae (*cha*, *chb*).

Ano-genital region (Figs. 1, 3). Genito-aggenital plates with eight pairs of setae, among which three pairs in progenital position; two pairs of aggenital setae present, setae ag_2 longer than ag_1 ; anogenital cleft short and oblique; anal plates with two pairs of short anal setae; three pairs of short adanal setae present, setae ad_2 situated slightly close to ad_3 , ratio of distance between setae: $ad_1 - ad_2 / ad_2 - ad_3 = 1.29$; lyrifissures *iad* situated anterolateral to setae ad_3 .



FIGURES 1–7. *Oribotritia mangamuka* sp. nov.: 1, lateral view of body (legs removed); 2, prodorsum, dorsal view; 3, left side of ano-genital region; 4, subcapitulum, palpi removed; 5, palp, antiaxial view; 6, chelicera, antiaxial view; 7, femur I. Scale bars: 1=200 μ m; 2–4, 6=100 μ m; 5, 7=50 μ m.

Legs (Fig. 7). Setal counts (solenidia) for trochanter-femur-genu-tibia for leg segments: I: 1-4-5(2)-5(1); II: 1-4-4(1)-3(1), III: 3-2-3(1)-3(1), IV: 3-2-2(1)-3(1); anterodorsal part of femur I with small triangular spine.

Distribution. Known only from the type locality.

Remark. This new species is similar to *Oribotritia contortula* Niedbala, 1993 in sharing the following features: one pair of lateral carinae present, similar shape of prodorsal and notogastral setae, eight pairs of genital setae and two pairs anal setae present, but the new species can be easily distinguished from the latter species by the following eleven characters (a versus b): in *O. mangamuka* sp. nov., (1a) colour yellowish; (2a) interlamellar setae directed backward; (3a) sensilli much longer ($ss=175$, $ss/in=3.5$); (4a) rostral setae situated close to each other ($in-in/ro-ro=3.37$); (5a) $in=le$; (6a) setae c_p situated higher than insertion level of setae c_3 ; (7a) setae e_2 situated higher than insertion level of setae c_3 ; (8a) setae h_2 situated more anteriorly, between the insertions level of ps_2 and ps_3 ; (9a) $ad_1-ad_2/ad_2-ad_3=1.29$; (10a) lyrifissures *iad* situated anterolateral to setae ad_3 ; (11a) an oblique continuation of anogenital cleft present; in *O. contortula*, (1b) colour brown or dark brown; (2b) interlamellar setae not directed backward; (3b) sensilli shorter ($ss=126$, $ss/in=2.3$); (4b) rostral setae situated far from each other ($in-in/ro-ro\approx 1.86$); (5b) $in<le$; (6b) setae c_p situated lower than insertion level of setae c_3 ; (7b) setae e_2 situated at same level of setae c_3 ; (8b) setae h_2 situated more posteriorly, at the same level of ps_2 ; (9b) $ad_1-ad_2/ad_2-ad_3=1.94$; (10b) lyrifissures *iad* situated posteolateral to setae ad_3 ; (11b) an oblique continuation of anogenital cleft absent.

***Oribotritia bilaminae* sp. nov.**

(Figs. 8–15)

Material examined: Holotype: adult (NZAC, in alcohol, 77/22), New Zealand: FD, Camp, Tutoko Bench, Darran Mts., from rotten branches in *Nothofagus* forest, 950 m, 15 Jan., 1977, leg. T. K. Crosby. Paratypes: three adult (NZAC, in alcohol, 77/22), same data as holotype; one adult (NIGA, in alcohol, 77/22), same data as holotype.

Etymology. In the adults of this new species, the lateral carinae of the prodorsum consist of two laminae and hence named *bilaminae*; used here as a noun in apposition.

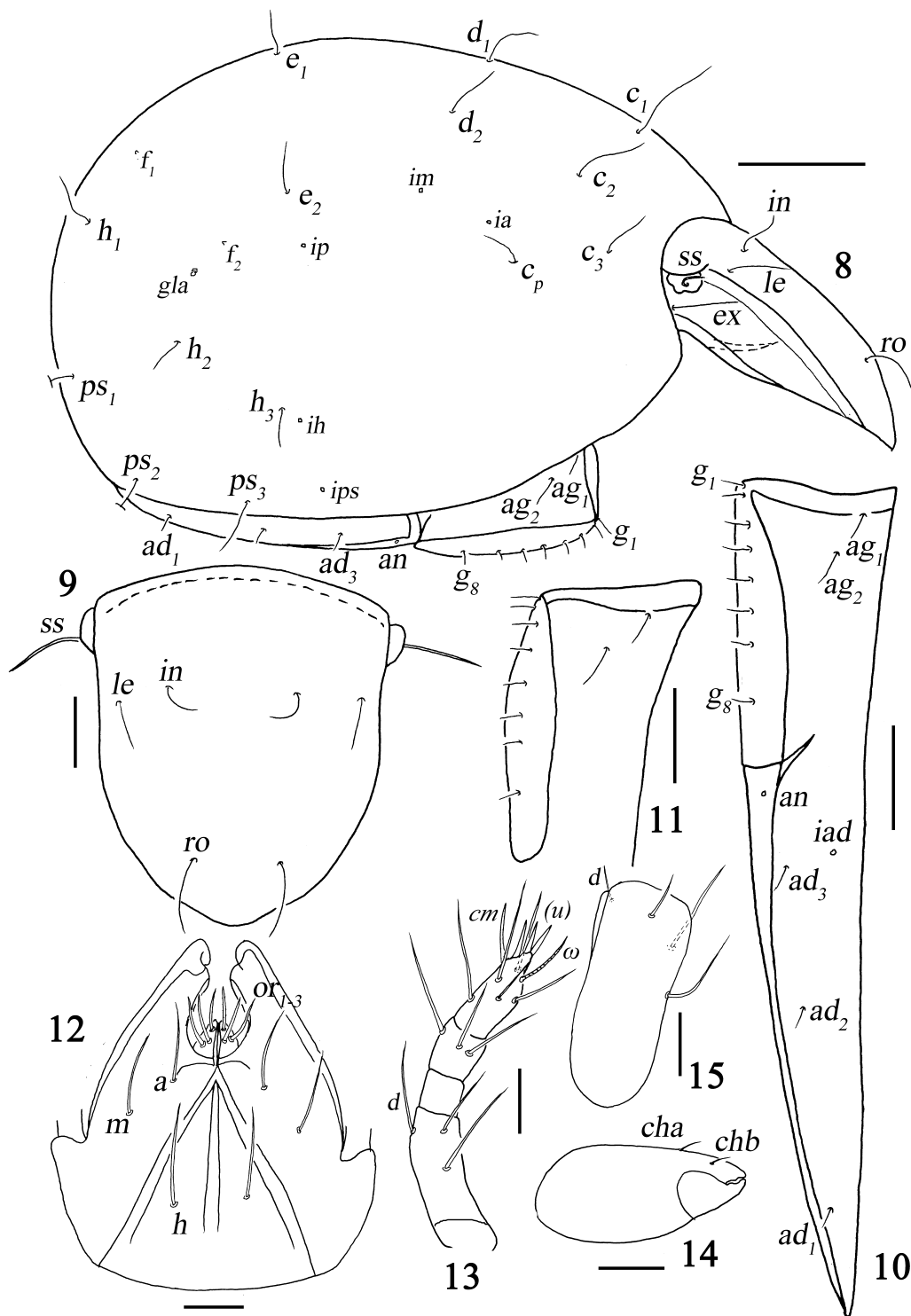
Description. *Measurements:* Holotype: Prodorsum: length 580, width 440, height 200, setae: ss 65, ro 110, le 80, in 60, ex 100; notogaster: length 1170, width 815, height 780; setae: c_1 140, c_2 100, c_3 60, d_1 80, e_1 75, h_1 145, ps_3 95; $in-in$ 190, $in-le$ 95, $ro-ro$ 135; ventral region: g_1 50, ag_1 55, ag_2 65; genito-aggenital plate 175×320 , anal and adanal plates 125×530 . Paratypes: Prodorsum: length 460–600, width 420–450, height 190–192; notogaster: length 1050–1150, width 710–780, height 555–800.

Integument. Colour brown. Surface of body punctate.

Prodorsum (Figs. 8–9). Two strong lateral carinae present on each side, lower one thinner and shorter; sensilli (ss) short, setiform, rigid and smooth; other prodorsal setae thin and smooth; rostral setae (ro) procumbent; lamellar setae (le) semi-erect; exobothridial setae (ex) long; comparative length: $ro>ex>le>ss>in$, $in-in>ro-ro>in-le$, $in-in/ro-ro=1.41$.

Notogaster (Fig. 8). Setae short ($c_1>1/2c_1-d_1$), thin and smooth; setae c far away from anterior border, setae c_3 less so than setae c_1 and c_2 ; two pairs of vestigial setae f_1 and f_2 present, setae f_1 situated anterior to setae h_1 .

Gnathosoma (Figs. 12–14). Subcapitulum normal (Fig. 12); setae h , m , and a simple and smooth; setae h longer than distance $h-h$; adoral setae or_1 apparently flat with barbs; or_{2-3} simple and smooth; palpal setation: 0–3–0–3–9(1) (Fig. 13); supracoxal setae simple and smooth; chelicera (Fig. 14) with two smooth setae (*cha*, *chb*).



FIGURES 8–15. *Oribotritia bilaminae* sp. nov.: 8, lateral view of body (legs removed); 9, prodorsum, dorsal view; 10, left side of ano-genital region; 11, left side of genito-aggenital plate; 12, subcapitulum, palpi removed; 13, palp, antiaxial view; 14, chelicera, antiaxial view; 15, femur I. Scale bars: 8=200 μ m; 9–11, 14=100 μ m; 12, 13, 15=50 μ m.

Ano-genital region (Figs. 8, 10–11). Genito-aggenital plates with eight pairs of setae, among which two pairs in progenital position; distance between setae g_7 and g_8 longest; two pairs of aggenital setae present, setae ag_2 longer than ag_1 ; anogenital cleft short and oblique; anal plates with one pair of short anal setae; three pairs of short adanal setae present, setae ad_2 situated close to ad_3 , ratio of distance between setae: $ad_1-ad_2/ad_2-ad_3=1.41$; lyrifissures *iad* situated anterolateral to setae ad_3 .

Legs (Fig. 15). Setal counts (solenidia) for trochanter-femur-genu-tibia for leg segments: I: 1-4-5(2)-5(1); II: 1-4-4(1)-3(1), III: 3-2-3(1)-3(1), IV: 3-2-2(1)-3(1); anteriodorsal part of femur I with narrow and obtuse crista.

Distribution. Known only from the type locality.

Remark. This new species is similar to *Oribotritia brevis* Niedbala & Colloff, 1997 in sharing the following features: similar shape of prodorsal and notogastral setae, eight pairs of genital setae and one pair anal setae present, but the new species can be easily distinguished from the latter species by the following five characters (a versus b): in *O. bilaminae* sp. nov., (1a) two pairs of lateral carinae present; (2a) exobothridial setae longer than interlamellar setae; (3a) distance between setae g_7 and g_8 longer than that between g_6 and g_7 ; (4a) setae ps_1 situated much higher than insertion level of setae ps_2 and ps_3 ; (5a) lyrifissures *iad* situated anterolateral to setae ad_3 ; in *O. brevis*, (1b) one pair of lateral carinae present; (2b) exobothridial setae shorter than interlamellar setae; (3b) distance between setae g_7 and g_8 shorter than that between g_6 and g_7 ; (4b) setae ps_1 situated at same level of setae ps_2 and ps_3 ; (5b) lyrifissures *iad* situated posterolateral to setae ad_3 .

On the basis of the shape of prodorsal and notogastral setae, the presence of two pairs of lateral carinae, and lyrifissures *iad* situated laterally anterior of setae ad_3 , the new species resembles *Oribotritia duplex* Niedbala, 2000, but the new species can be easily distinguished from the latter species by the following eight characters (a versus b): in *O. bilaminae* sp. nov., (1a) two pairs of lateral carinae close to each other; (2a) sensilli much shorter ($ss=65$, $ro>ex>le>ss>in$); (3a) notogastral setae much shorter (eg. $c_1=140$); (4a) distance between setae g_7 and g_8 longer than that between g_6 and g_7 ; (5a) one pair anal setae present; (6a) setae ad_2 situated much close to ad_3 ; (7a) palpal setation: 0-3-0-3-9(1); (8a) anteriodorsal part of femur I with narrow and obtuse crista; in *O. duplex*, (1b) two pairs of lateral carinae far from each other; (2b) sensilli much longer ($ss=177$, $ss>ro>ex>le>in$); (3b) notogastral setae much longer (eg. $c_1=222$); (4b) distance between setae g_7 and g_8 shorter than that between g_6 and g_7 ; (5b) two pairs anal setae present; (6b) setae ad_2 situated nearly medially between ad_1 and ad_3 ; (7b) palpal setation: 0-4-0-3-9(1); (8b) anteriodorsal part of femur I with shorter and broader crista.

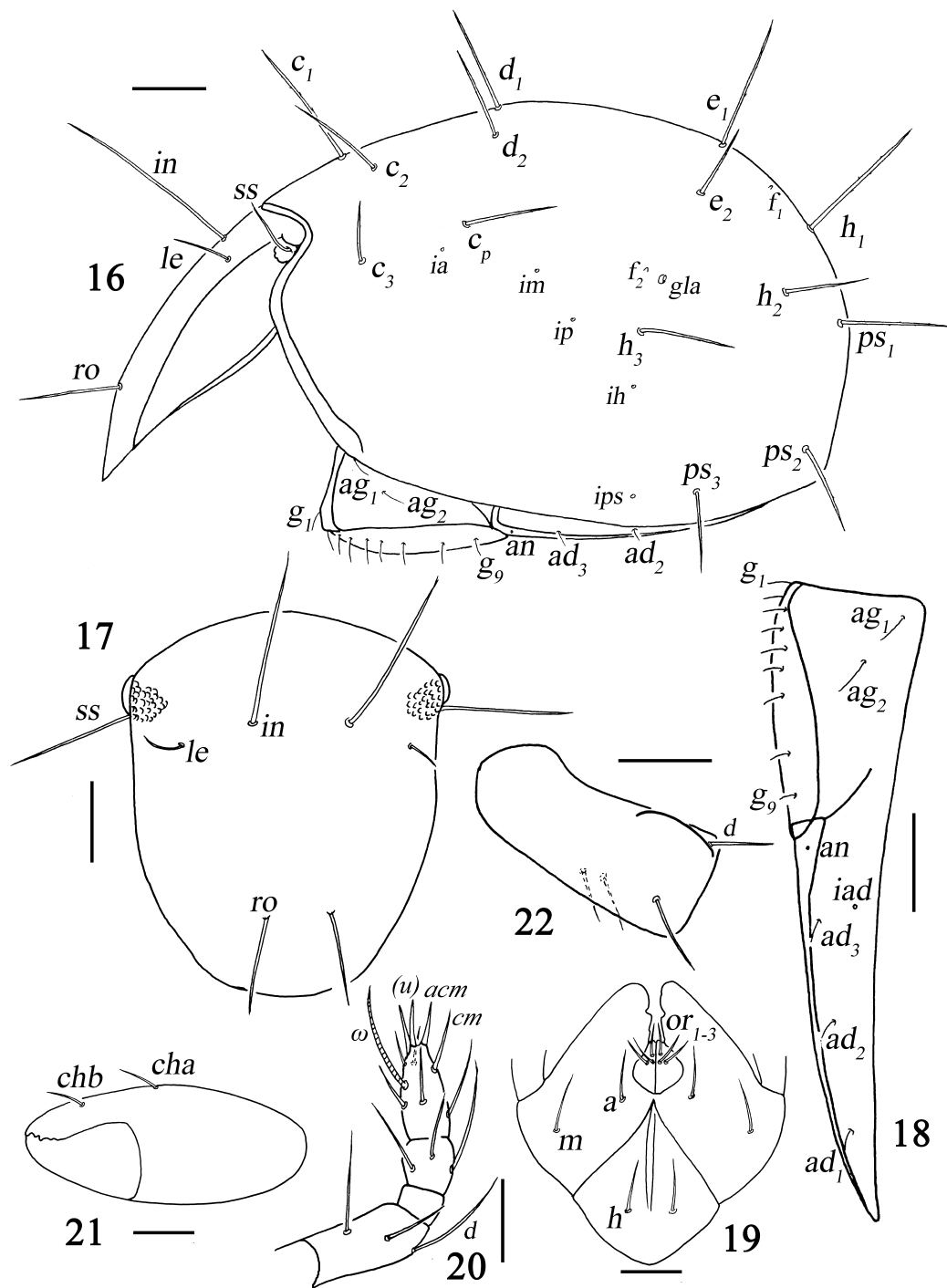
***Oribotritia contraria* Niedbala, 1993**

(Figs. 16–22)

Oribotritia contraria Niedbala, 1993: 140 (Figs. 11–19).

Material examined: one adult (NZAC, in alcohol, 84/67), New Zealand: TO, Whirinaki State Forest, from litter, 12 Sep., 1984, leg. C. Crowe; one adult (NIGA, in alcohol, 84/67), New Zealand: TO, Whirinaki State Forest, from litter, 12 Sep., 1984, leg. C. Crowe.

Description. *Measurements:* Prodorsum: length 400–410, width 375–387, height 145–150, setae: ss 175, ro 160, le 85, in 235; notogaster: length 880–890, width 655–665, height 595–597; setae: c_1 195, c_3 125, c_p 155, d_1 165, e_1 185, h_1 190, h_2 175, ps_1 190, ps_2 135, ps_3 120; *in-in* 125, *in-le* 100, *ro-ro* 80; ventral region: g_1 37, ag_1 50, ag_2 60; genito-aggenital plate 150×370, anal and adanal plates 95×420.



FIGURES 16–22. *Oribotritia contraria* Niedbała, 1993: 16, lateral view of body (legs removed); 17, prodorsum, dorsal view; 18, left side of ano-genital region; 19, subcapitulum, palpi removed; 20, palp, antiaxial view; 21, chelicera, antiaxial view; 22, femur I. Scale bars: 16–18=100µm; 19–22=50µm.

Integument. Colour yellowish. Surface of body punctate.

Prodorsum (Figs. 16–17). One strong lateral carina present on each side; sensilli (*ss*) long, setiform, rigid and smooth; rostral setae (*ro*) rough and semi-erect; interlamellar setae (*in*) long and thick, rough and strongly erect; lamellar setae (*le*) rough and erect, thinner and shorter than rostral and lamellar setae; exobothridial setae (*ex*) vestigial; comparative length: $in > ss > ro > le$, $in - in > in - le > ro - ro$, $in - in / ro - ro = 1.56$.

Notogaster (Fig. 16). Setae medium-long ($c_1/c_1 - d_1 = 0.82$), rigid and weakly barbed; setae *c* far away from anterior border, setae c_2 more so than setae c_1 and c_3 ; two pairs of vestigial setae f_1 and f_2 present, setae f_1 situated anterior to setae h_1 .

Gnathosoma (Figs. 19–21). Subcapitulum normal (Fig. 19); setae *h*, *m*, and *a* simple and smooth; setae *h* longer than distance between them; adoral setae or_1 apparently flat with barbs; or_{2-3} simple and smooth; palpal (Fig. 20) setation: 0-3-0-3-9(1); supracoxal setae simple and smooth; chelicera (Fig. 21) with two smooth setae (*cha*, *chb*).

Ano-genital region (Figs. 16, 18). Genito-aggenital plates with nine pairs of setae, among which two pairs in progenital position; distance between setae g_7 and g_8 longest; two pairs of aggenital setae present, setae ag_2 longer than ag_1 ; anogenital cleft long and oblique; anal plates with one pair of short anal setae; three pairs of short adanal setae present, ratio of distance between setae: $ad_1 - ad_2 / ad_2 - ad_3 \approx 1$; lyrifissures *iad* situated anterolateral to setae ad_3 .

Legs (Fig. 22). Setal counts (solenidia) for trochanter-femur-genu-tibia for leg segments: I: 1-4-5(2)-5(1); II: 1-4-4(1)-3(1), III: 3-2-3(1)-3(1), IV: 3-2-2(1)-3(1); anterodorsal part of femur I with weak and obtuse crista.

Distribution. New Zealand (Niedbała 1993 and this paper), New Caledonia (Niedbała 2006; Niedbała & Penttinen 2007), Australia (Niedbała 2006).

Remark. Niedbała (1993) described *O. contraria* from 7 specimens collected near Whanganui Inlet, 3.2 km west of Mangarakau. Our specimens from the Whirinaki State Forest agree broadly with those from Whanganui. Compared with the original description of this species, we noted some variation in the following nine characters (a versus b): in Whirinaki specimens we studied, (1a) anterior region of prodorsum straight in lateral view; (2a) lamellar setae relatively shorter ($in = 85$); (3a) $in - in / ro - ro = 1.56$; (4a) setae c_2 more far away from anterior border than c_1 ; (5a) vestigial setae f_1 situated much higher than insertion level of setae h_1 ; (6a) setae h_2 situated higher than insertion level of setae ps_1 ; (7a) $ad_1 - ad_2 / ad_2 - ad_3 \approx 1$; (8a) anteriodorsal part of femur I with weak and obtuse crista; (9a) body smaller (≤ 410 length of prodorsum; ≤ 890 length of notogaster); in original description of *O. contraria* based on specimens from Whanganui, (1b) anterior region of prodorsum humped in lateral view; (2b) lamellar setae relatively longer ($in = 111$); (3b) $in - in / ro - ro \approx 2$; (4b) setae c_1 more far away from anterior border than c_2 ; (5b) vestigial setae f_1 situated in same level of setae h_1 ; (6b) setae h_2 situated lower than insertion level of setae ps_1 ; (7b) $ad_1 - ad_2 / ad_2 - ad_3 \approx 2$; (8b) femur I with a narrow, dorsodistal tooth; (9b) body larger ($= 571$ length of prodorsum; $= 1150$ length of notogaster). These differences may be considered intraspecific or interspecific. We here present a detailed description of our Whirinaki specimens as we felt that they might represent a new species. Due to the lack of additional specimens for comparative study and also the lack of biological data, we tentatively placed our Whirinaki specimens within *O. contraria*. Niedbała (2006) noted that the specimens from Australia (1) are smaller than specimens from New Zealand and New Caledonia and (2) aggenital setae ag_2 are longer than setae ag_1 . We highlight the need for detailed studies on characters that have yet been commonly used to separate species in the Oribotritiidae.

Key to species of *Oribotritia* reported from New Zealand

- 1 Interlamellar setae thick, rigid and more than twice as long as lamellar setae . *O. contraria* Niedbala, 1993
- Interlamellar setae thin, fine and similar in length or shorter than lamellar setae 2
- 2 Sensilli spinose; anal plates without setae *O. incognita* Niedbala, 2000
- Sensilli smooth; anal plates with setae 3
- 3 Lateral carinae of prodorsum consisting of two laminae *O. bilaminae* sp. nov.
- Lateral carinae of prodorsum consisting of a single lamina 4
- 4 Two pairs of anal setae present 5
- One pair of anal setae present 6
- 5 Distance between interlamellar setae more than three times longer than that between rostral setae; lyrifissures *iad* situated laterally anterior of setae *ad*₃. *O. mangamuka* sp. nov.
- Distance between interlamellar setae less than two times longer than that between rostral setae; lyrifissures *iad* situated laterally posterior of setae *ad*₃. *O. contortula* Niedbala, 1993
- 6 Exobothridial setae vestigial; lyrifissures *iad* situated laterally anterior of setae *ad*₃
- *O. teretis* Niedbala, 1993
- Exobothridial setae present; lyrifissures *iad* situated laterally posterior of setae *ad*₃ 7
- 7 Sensilli shorter than lamellar setae; eight pairs of genital setae present *O. brevis* Niedbala & Colloff, 1997
- Sensilli longer than lamellar setae; nine pairs of genital setae present . . . *O. paraincognita* Niedbala, 2006

Discussion

The genus *Oribotritia* belongs to the superfamily Euphthiracaroidae which has been poorly studied in New Zealand. Until now, only 17 euphthiracaroid species in five genera were found in this region (Ramsay 1966; Niedbala 1993, 2000, 2006; Niedbala & Colloff, 1997; Liu & Zhang 2013a,b). This work added two new species of *Oribotritia*. In all known species of this genus, five species are reported only in New Zealand (*O. teretis*, *O. paraincognita*, *O. incognita*, *O. mangamuka* sp. nov., *O. bilaminae* sp. nov.). Other three species—*O. brevis*, *O. contortula*, *O. contraria*—also occur on the Australian continent and surrounding islands (Tasmania and New Caledonia). All these species are distributed in the Australian Region. The total number of species for this genus is now raised from 85 to 87; New Zealand has eight (about 9%) of the total in the world and as many as five (63% of the total) species are endemic to New Zealand (cf 82% endemism for oribatid fauna as a whole, according to Hammer 1968). New Zealand has been long isolated from other continental landmasses and its biodiversity is varied and unique. We would not be surprised if more new species of this genus will be discovered in New Zealand in the future.

Acknowledgements

We are very grateful to Prof. Jun Chen, Institute of Zoology, Chinese Academy of Sciences, for supplying references to the first author. We thank all the people who collected specimens for us. Sincere thanks are also due to the two anonymous reviewers for their critical reading of the manuscript and valuable suggestions. The first author's work was supported by the Funds for The Excellent Youth Scholars of "NEIGAE, CAS" (DLSYQ2012004), the Knowledge Innovation Programs of the Chinese Academy of Sciences (KSCX2-EW-Z-8), the Major Program of National Natural Science Foundation of China—Fauna Sinica (31093430), the key research program of the Chinese Academy of Sciences (Grant No. KZZD-EW-TZ-16), and the National Natural Science-Foundation of China (Grant No. 31101617). The senior author's visit to New Zealand in April 2012 and also the second author's research on defining New Zealand mites were supported by Core

funding for Crown Research Institutes from the Ministry of Business, Innovation and Employment's Science and Innovation Group.

References

- Berlese, A. (1883) Excursion in Sicilia. Acarofauna Sicula. I seria. *Bullettino della Società Entomologica Italiana*, 15, 212–220.
- Hammer, M. (1968) Investigations on the oribatid fauna of New Zealand, with a comparison between the oribatid fauna of New Zealand and that of the Andes Mountains, South America. Part III. *Biologiske Skrifter Kongelige Danske Videnskabernes Selskab*, 16(2), 1–96.
- Jacot, A.P. (1924) Oribatoidea Sinensis III. *Journal of the North China British Asiatic Society*, 55, 78–83.
- Liu, D. & Zhang, Z.-Q. (2013a) Two new species of *Austrophthiracarus* (Acari: Oribatida: Phthiracaridae) from New Zealand. *Zootaxa*, 3682 (2), 385–391.
<http://dx.doi.org/10.11646/zootaxa.3682.2.10>
- Liu, D. & Zhang, Z.-Q. (2013b) The genus *Notophthiracarus* of New Zealand (Acari: Oribatida: Phthiracaridae): three new species and a key to 24 described species. *Zootaxa*, 3682 (2), 392–400.
<http://dx.doi.org/10.11646/zootaxa.3682.2.11>
- Märkel, K. (1964) Die Euphthiracaridae Jacot, 1930, und ihre Gattungen (Acari, Oribatei). *Zoologische Verhandlungen*, 67, 1–78.
- Michael, A.D. (1898) Oribatidae. *Das Tierreich*, 3, 1–93.
- Niedbala, W. (1993) New species of Euptyctima (Acari, Oribatida) from New Zealand. *New Zealand Journal of Zoology*, 20, 137–159.
<http://dx.doi.org/10.1080/03014223.1993.10422856>
- Niedbala, W. (2000) The ptyctimous mites fauna of the Oriental and Australian Regions and their centres of origin (Acari: Oribatida). *Genus*, supplement, 1–493.
- Niedbala, W. (2006) Supplement to the knowledge of ptyctimous mites (Acari: Oribatida) from Australian Region. *Annales Zoologici*, 56 (Supplement 1), 99–156.
- Niedbala, W. & Colloff, M.J. (1997) Euptyctime oribatid mites from Tasmanian rainforest (Acari: Oribatida). *Journal of Natural History*, 31, 489–538.
<http://dx.doi.org/10.1080/00222939700770261>
- Niedbala W. & Penttinen R. (2007) New species of ptyctimous mites (Acari: Oribatida: Oribotritiidae, Steganacaridae) with some new records from Australasian Region. *Annales Zoologici*, 57 (3), 517–532.
<http://dx.doi.org/10.3161/000345410x535370>
- Ramsay, G.W. (1966) Three new box-mites (Acari: Oribatei: Phthiracaridae) from the Brothers, Cook Strait, New Zealand. *New Zealand Journal of Science*, 9, 901–912.
- Risso, A. (1826) *Histoire naturelle des principales productions de l'Europe Méridionale et particulièrement de celles des environs de Nice et des Alpes Maritimes*. Paris: F.G. Levrault. Vol. 4: IV, 1–439.
- Subías, L.S. (2012) Listado sistemático, sinonímico y biogeográfico de los ácaros oribátidos (Acariformes: Oribatida) del mundo (Excepto fósiles). *Graellsia*, 60 (número extraordinario): 3–305 (2004) (Actualizado en junio de 2006, en abril de 2007, en mayo de 2008, en abril de 2009, en julio de 2010, en febrero de 2011 y en abril de 2012). Available from: <http://www.ucm.es/info/zoo/Artropodos/Catalogo.pdf> (accessed 22 May 2013).
- van der Hammen, L. (1959) Berlese's primitive oribatid mites. *Zoologische Verhandlungen*, 40, 1–93.

Accepted by Qing-Hai Fan: 14 Jun. 2013; published 30 Jun. 2013