

New nothroid mites from Chile: *Novonothrus covarrubiasi* n. sp. and *Novonothrus* *puyehue* n. sp. (Acari: Oribatida)

Nuevos ácaros notroídeo de Chile: *Novonothrus covarrubiasi* n. sp.
y *Novonothrus puyehue* n. sp. (Acari: Oribatida)

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ABSTRACT

Adults and immatures of *Novonothrus covarrubiasi* n. sp. and *Novonothrus puyehue* n. sp. from Chile are described. *N. covarrubiasi* is closely similar to *N. flagellatus* Hammer, 1966, but it is distinguished by the length and shape of the notogastral setae, notogastral ornamentation, number of claws and coxisternal setation. *N. puyehue* differs from *N. covarrubiasi* by the smooth and isodiametric notogastral setae and smaller setae c_1 and h_2 .

Key words: acari, oribatida, systematic, *Novonothrus*, Chile.

RESUMEN

Se describen los adultos e inmaduros de dos nuevas especies para Chile, *Novonothrus covarrubiasi* n. sp. y *Novonothrus puyehue* n. sp. *N. covarrubiasi* es próxima a *N. flagellatus* Hammer, 1966, pero se diferencia en la longitud y forma de las setas notogastrales, la ornamentación del notogáster, el número de uñas y en la quetotaxia del área coxoesternal. *N. puyehue* se diferencia de *N. covarrubiasi* por presentar setas notogastrales lisas e isodiamétricas y, setas c_1 y h_2 más cortas.

Palabras clave: acari, oribatida, sistemática, *Novonothrus*, Chile.

INTRODUCTION

The cosmopolitan and rather homogeneous family Nothridae is one of those interesting oribatid mite taxa exhibiting significant taxonomic diversity despite the apparent absence of sexual reproduction in most species (Norton & Palmer 1991). The principal genus, *Nothrus*, includes 54 nominal species according to Balogh (1992) and all those that have been studied appear to be thelytokous (Palmer & Norton 1991). Two other genera have been proposed for mites of this family: *Trichonothrus* from South Africa (Mahunka 1986); and *Novonothrus* from New Zealand (Hammer 1966) and Australia (Palmer & Norton 1991). As currently known each is

monotypic, known from their respective type species, *T. austroafricanus* Mahunka, and *N. flagellatus* Hammer. These are of special interest, being the only named nothrid mites that are bisexual, as noted by Palmer & Norton (1991).

We agree with Mahunka's (1978) transfer of the second named species –*Novonothrus papuensis*– to *Nothrus*. He noted that *Novonothrus* was an invalid name when first proposed by Hammer (1966), who presented a diagnosis, but did not designate one of the two named species as type. But the name is indeed available. A type species –*N. flagellatus* Hammer– was listed by Balogh (1972, p. 143), who also gave a differential generic diagnosis in the form of an identifi-

cation key and a comparative table. All criteria of availability were met at the time, so the attribution *Novonothrus* Balogh (1972) is technically the correct one.

During the latter study, several undescribed species of *Novonothrus* were discovered, including two from southern Australia (one from Victoria, the other from Tasmania) and three from southern Chile. Each of these is bisexual, preserving the pattern that sexual Nothridae are restricted to the southern continents, whereas the asexual genus *Nothrus* is found worldwide, except in Antarctic.

Our purpose is to describe and illustrate two of the new Chilean species of *Novonothrus*, including ontogenetic characters that were previously unknown for the genus. Terminology is mostly that developed by F. Grandjean, see Travé & Vachon (1975) for references.

NOVONOTHRUS COVARRUBIASI N. SP.

Adult

Dimensions - The mean total length of ten specimens 1015 μ (range 98-1050 μ); mean maximum notogastral width 525 μ (500-550 μ). Means for females (n=5) 1039 x

550 μ ; means for males (n=5) 1010 x 520 μ (Table 1).

Prodorsum - Length 426 (420 - 432) μ ; posteriorly slightly narrower than anterior margin of hysterosoma. Ornamentation distinct, foveolate, in form of pits appearing lighter than surrounding cuticle. Rostrum incised medially. Interlamellar (*in*) and lamellar (*le*) setae similar in size and shape; rostral (*ro*) pair slightly shorter and exobotridials (*ex*) minute, difficult to see. All appear smooth, but at very high magnifications inconspicuous sparse barbs may be seen, especially on setae *in* and *le*. Setae *ro* and *le* on small tubercles, located in nearly longitudinal rows. Bothridia prominent, with long, flagelliform, smooth sensilla (Figs.1, 2, *ss*).

Notogaster-Sides slightly convex, generally elliptical in dorsal aspect, but distinctly truncate anteriorly (Fig. 2); moderately arched in lateral aspect (Fig. 1); not carinate. Integument with pits lighter than surrounding cuticle; surface undulating near margins. All 6 pairs of notogastral setae elongate, tapered and weakly barbed, distributed as shown in Figs. 1 and 2 length of c_1 ca 100 μ and h_2 ca 80 μ . Opisthosomal gland (*gla*) posterolateral to seta f_1 . Lyrifissures *ia*, *im*, *ih*, and *ips* present, distributed as illustrated (Fig. 1).

TABLE 1

Some morphological characters of *N. covarrubiasi* n. sp. (mean values: measurements in μ).

Algunos caracteres morfológicos de *N. covarrubiasi* n. sp. (valores medios: medidas en μ).

| CHARACTERS | <i>N. covarrubiasi</i> n. sp. | | | | | |
|-------------------------|-------------------------------|-------------|--------------|--------------|-----------------|---------------|
| | LARVA (n=2) | PN (n=5) | DN (n=10) | TN (n=10) | FEMALE (n=5) | MALE (n=5) |
| Body length | 410 | 612 | 770 | 960 | 1030 | 1010 |
| Body width | 230 | 350 | 500 | 550 | 550 | 520 |
| Length of | | | | | | |
| seta d_1 | 24 | 38 | 60 | 80 | 85 | 75 |
| seta h_1 | 33 | 55 | 55 | 70 | 70 | 70 |
| seta h_2 | 53 | 65 | 70 | 70 | 78 | 75 |
| genital opening | — | 45 | 72 | 102 | 170 | 150 |
| anal opening | 85 | 156 | 294 | 312 | 320 | 280 |
| Coxisternal setation | 2-1-2 | 4-2-3-0 | 4-3-4-2 | 5-3-5-4 | | 5-4-6-5 |

Venter-Plates on ventral surface sclerotized and well delimited in all areas. Genital plates divided; with 9 pairs of setae (*g*), 5 anterior pairs slightly shorter than 4 posterior pairs (Fig. 3). Preanal plate with small apodeme. Anal plate with 2 pairs of setae (*an*) and lyrifissure *ian*. Three pairs of adanal setae (*ad*) and lyrifissure (*iad*) situated on aggenital-adanal sclerite. Adanal setae longer than anal setae. Epimeral setal formula 5 (6)-4-6-5.

Gnathosoma-Subcapitulum (Fig. 4) with 4 pairs of subcapitular setae (*a*, *m*, *n*, *h*) of which *a* and *h* are the longest. Rutellum broad, with three or more wide teeth. Adoral setae on lateral lips heteromorphic: *or*₁ and *or*₂ serrate; *or*₁ with a distinct notch in the proximal 1/3; *or*₂ distally broad and flattened; *or*₃ smooth, long acute. Palps 5-segmented; palp setation 0-1-1-3-9. Solenidium ω baculiform, inserted on proximal half of tarsus, reaching distally almost to tip of segment. Palp setae weakly barbed. Chelicera (Fig. 5) chelate, dentate; length 225 μ ; width 100 μ ; digits tridentate. Cheliceral setae weakly barbed; *cha* 75 μ and *chb* 45 μ long.

Legs-Setal formulae (famulus included) for trochanter, femur, genu, tibia, tarsus, respectively as follows: Leg I 1-7-5-6-24; leg II 1-7-5-5-23; leg III 2-5-5-5-21; leg IV 1-6-5-5-21. All legs with 3 tarsal claws. Solenidial formulae for genu, tibia, tarsus as follows: I (1-2-2), II (1-1-2), III (1-1-0), IV (1-1-0). Position of solenidia and probable setal homologies indicated on Figs. 6, 7, 8 and 9.

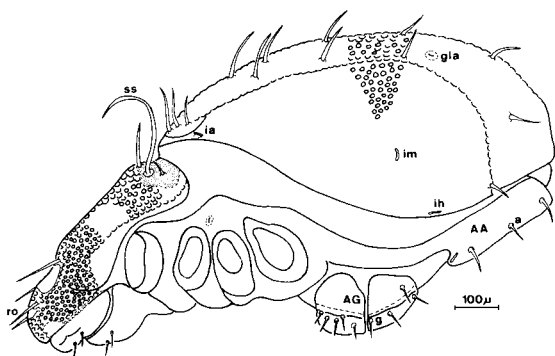


Fig. 1: *N. covarrubiasi* n. sp., adult. Lateral view.
Vista Lateral del adulto de *N. covarrubiasi* n. sp.

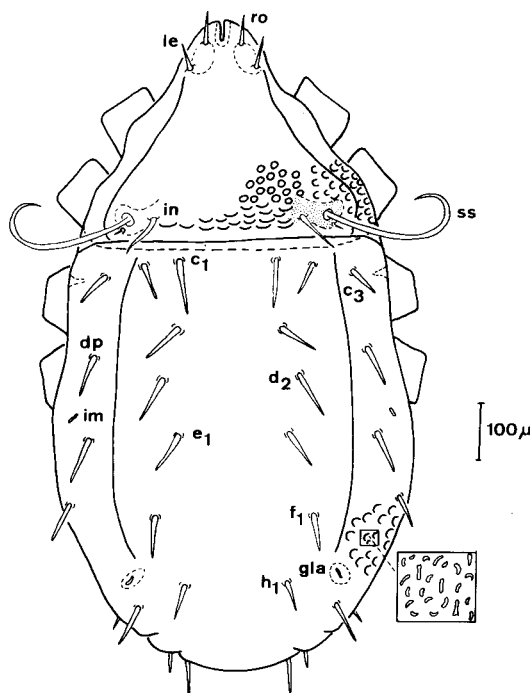


Fig. 2: *N. covarrubiasi* n. sp., adult. Dorsal view.
Vista Dorsal del adulto de *N. covarrubiasi* n. sp.

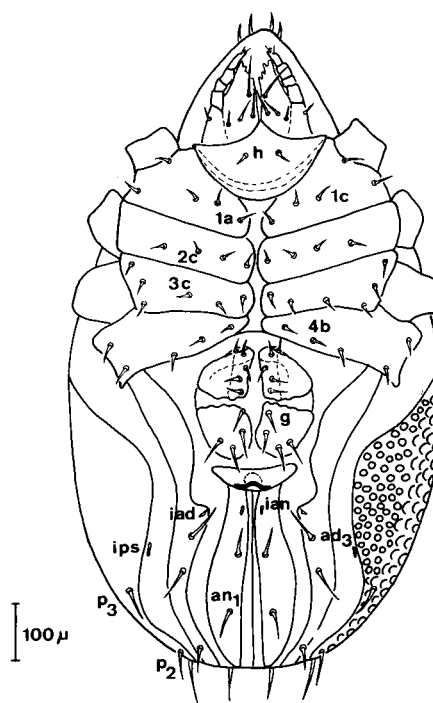


Fig. 3: *N. covarrubiasi* n. sp., Ventral view.
Vista Ventral del adulto de *N. covarrubiasi* n. sp.

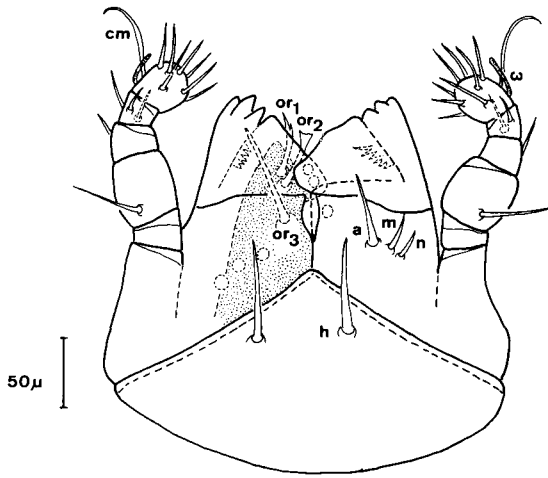


Fig. 4: *N. covarrubiasi* n. sp., adult. Subcapitulum.
Subcapítulo del adulto de *N. covarrubiasi* n. sp.

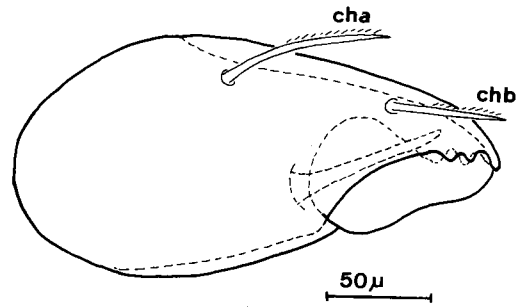
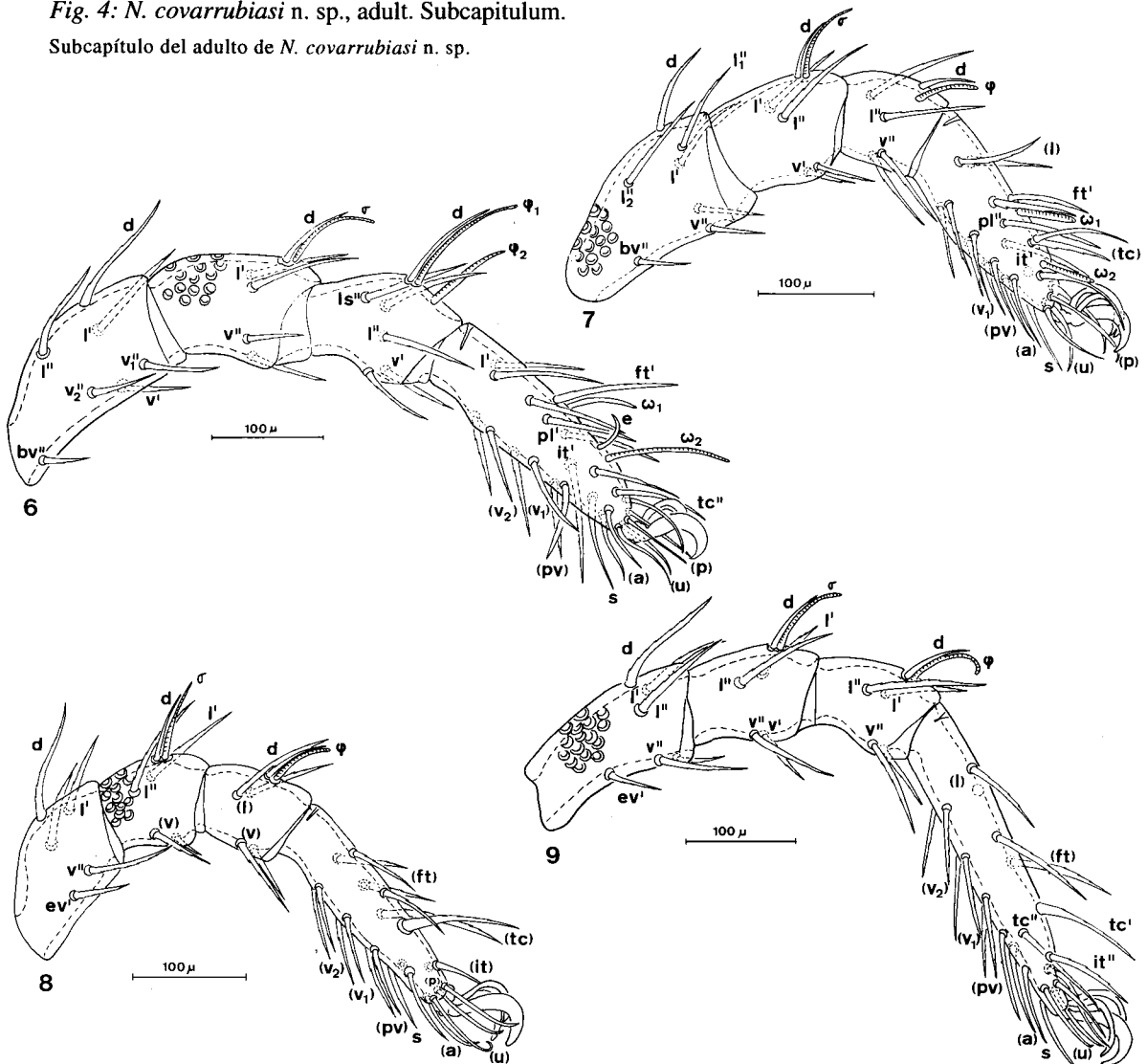


Fig. 5: *N. covarrubiasi* n. sp., adult. Quelicera.
Quelicero del adulto de *N. covarrubiasi* n. sp.



Figs. 6-9: *N. covarrubiasi* n. sp., adult. Fig. 6. Leg I; Fig. 7. Leg II; Fig. 8. Leg III; Fig. 9. Leg IV.
Adulto de *N. covarrubiasi* n. sp., Fig. 6. Pata I; Fig. 7. Pata II; Fig. 8. Pata III; Fig. 9. Pata IV.

IMMATURES

General - Total mean lengths x widths are shown on Table 1.

Prodorsum (Figs. 10, 12) - Certain ontogenetic changes occur on each prodorsal seta. Seta *ro* anterior to and slightly lateral to *le* in all immature instars, but pair *ro* with greater mutual distance in larva than in nymphs. Seta *in* thick and heavily barbed in all immatures. Seta *ex* regressive, only the alveolus in larva, vestigial, difficult to see in nymphs and minute in adults; (sometimes a doubled *ex*, two minute setae in the same alveolus, is found in the larva). Sensillus (*ss*) regressive, minute and difficult to see in larva; large and flagelliform in nymphs. Botridium similar to all instars.

Gastronomic region (Figs. 10, 12) - Larva with 11 setal pairs visible in dorsal aspect (12 total, h_2 ventral), and nymphs with the normal complement of 12 pairs (16 total, 4 ventrals); c_2 shorter and heavily barbed in larva, smooth in nymphs; setae f_1 , f_2 and h_2 tapered and weakly barbed in all instars; rest of dorsal setae smooth in all instars. Dorsal setae increase gradually in length during ontogeny (Table 1); seta d_1 24 μ in larva and 80 μ in tritonymph. Opisthosomal gland opening near seta f_2 and notogastral ornamentation tuberculate in all instars.

Ventral region-Setation of coxisterna I to IV (I to III in larva) as follows: Larva 2-1-1; protonymph 4-2-3-0; deutonymph 4-3-4-2; tritonymph 5-3-5-4. The formula of the ontogeny of genital setation as follows: 1-4-7. The ano-adanal setation formula: 0 (0) - 0 (0) - 3 (0) - 3 (2), as shown on Figs. 11, 13 and 14.

Legs - Setal formulae (trochanter to tarsus) as follows: Larva, I (0-2-3-4-16), II (0-2-3-3-13), III (0-2-2-3-13); protonymph, I (0-4-4-4-16), II (0-4-4-4-13), III (2-2-3-3-13), IV (0-0-0-0-7); deutonymph, I (1-7-4-5-18), II (1-6-5-4-18), III (2-3-4-4-13), IV (1-2-5-5-12); tritonymph, I (1-7-4-5-20), II (1-6-5-5-20), III (2-5-4-4-20), IV (1-3-5-5-17). Specific patterns of setal ontogeny given in Table 2. Solenidial formulae (genus to tarsus) as follows: Larva, I (0-0-1), II (1-1-1), III (1-1-0); protonymph, I (1-1-1), II (1-1-1), III (1-1-0), IV (0-0-0); deutonymph,

I (1-2-2), II (1-1-1), III (1-1-0), IV (0-0-0); tritonymph, I (1-2-2), II (1-1-1), III (1-1-0), IV (0-0-0). All genual and tibia solenidia coupled with respective seta *d*. Famulus normal, emergent in all immatures. All legs monodactylous in all immature instars. Larval setae and solenidia position indicated on Figs. 15, 16 and 17.

MATERIAL EXAMINED-Twenty adults (12 females, 8 males) and 25 immatures were examined from three different collections: a) Osorno Prov., Parque Nacional Puyehue, Antillanca Rd., 690 m elev. Col: A. Newton & M. Thayer, 18-XII-1982. Ex: leaf & long litter in Valdivian rainforest (FM 82-709); b) Cautin, Volcan Villarrica, 1100 m elev. Col: N. Platnick, O. Francke, 28-I-1985. Ex: dry forest litter; c) Cautin Prov. Volcan Villarrica, 1250 m elev. Col: A. Newton & M. Thayer, 15-XII-1982. Ex: litter of *Nothofagus dombeyi*-*N. pumilio* forest with *Chusquea* (FM 82-701).

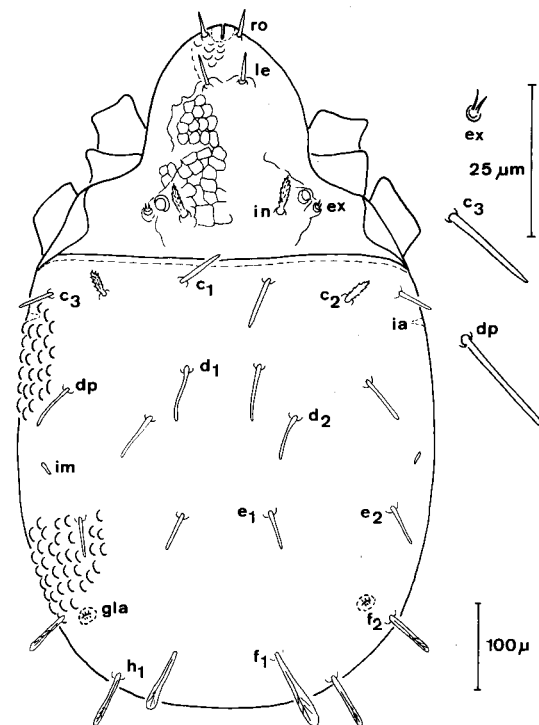


Fig. 10: *N. covarrubiasi* n. sp., larva. Dorsal view.

Vista dorsal de la larva de *N. covarrubiasi* n. sp.

TABLE 2

Ontogenetic appearance of leg setae in *N. covarrubiasi* n. sp.
(— no change; () a given pair).

Aparición ontogenética de las setas de las patas en *N. covarrubiasi* n. sp.
(— no hay cambio; () un par dado).

N. covarrubiasi n. sp.

| | Troch. | Femur | Genu | Tibia | Tarsus |
|---------|--------|---|-----------------------|-----------------------|---|
| LEG I | | | | | |
| LV | — | d, bv'' | d, l', l'' | d, l', ls'', v' | (ft),(tc), e, (u), (p), (a), s, (pv), pl' |
| PN | — | | l', l'' | v' | — pl'' |
| DN | v' | v', v'' ₁ , v'' ₂ | — | v'' | (it) |
| TN | — | — | — | — | l', l'' |
| AD | — | — | v'' | l'' | (v), (v ₂) |
| LEG II | | | | | |
| LV | — | d, bv'' | d, l', l'' | d, l', l'' | (ft), (tc), s (pv) |
| PN | — | l', l'' | v' | l'' | — |
| DN | v' | v', v'' | v'' | — | (it), (l) |
| TN | — | — | — | — | (pl) |
| AD | — | l'' | — | v'' | (v ₁), (v ₂) |
| LEG III | | | | | |
| LV | — | d, ev' | d, l' | d, l', v' | (ft),(tc), s, (u), (p), pv' (a) |
| PN | v', l' | — | l'' | — | — |
| DN | — | l' | v' | l'' | pv'', (it) |
| TN | — | v', v'' | — | — | (l), (v ₁) |
| AD | — | — | v'' | v'' | (v ₂) |
| LEG IV | | | | | |
| PN | — | — | — | — | (pv), (u), (p), ft'' |
| DN | v' | d, ev' | d, l', l'' v', v'' | d, l', l'' v', v'' | s, (a), (tc) |
| TN | — | l' | — | — | ft', (l), (v) |
| AD | — | l'', v', v'' | — | — | (v ₁), (v ₂) |

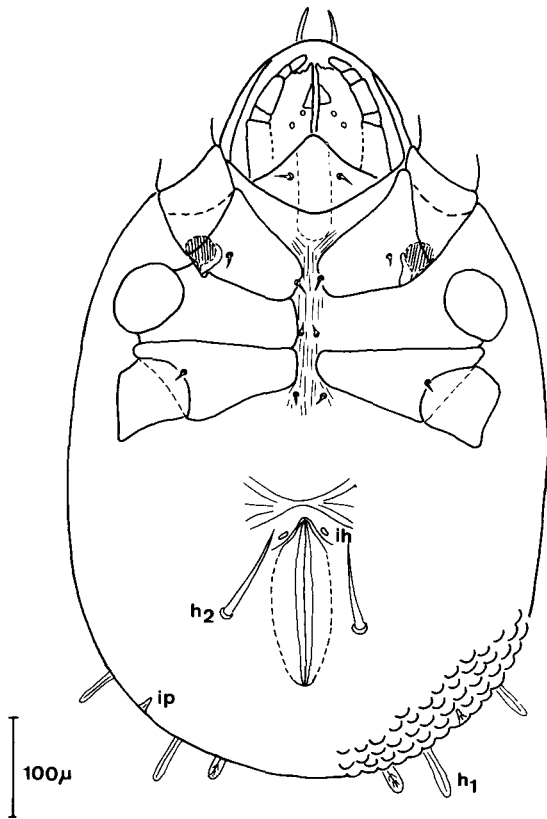


Fig. 11: *N. covarrubiasi* n. sp., larva. Ventral view.
Vista Ventral de la larva de *N. covarrubiasi* n. sp.

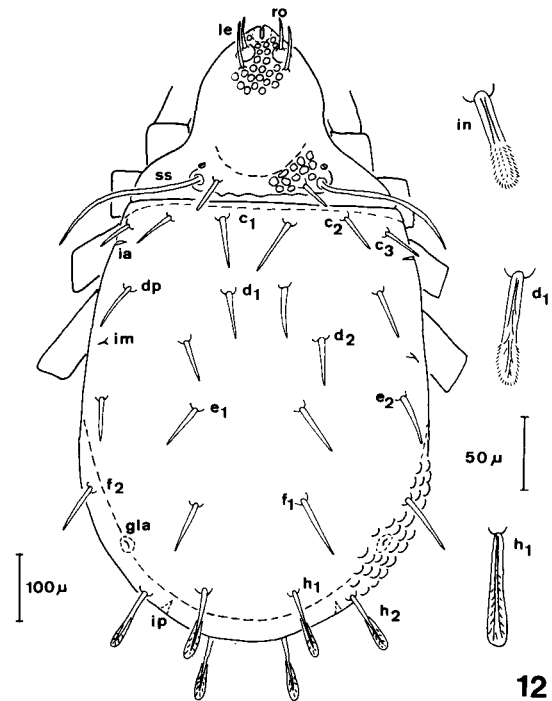


Fig. 12: *N. covarrubiasi* n. sp., tritonymph. Dorsal view.
Vista dorsal de la tritoninfa de *N. covarrubiasi* n. sp.

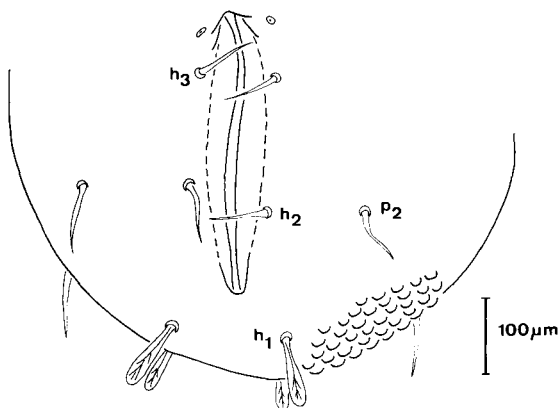


Fig. 13: *N. covarrubiasi* n. sp., protonymph. Posterior-ventral region.
Región Postero-Ventral de la protoninfa de *N. covarrubiasi* n. sp.

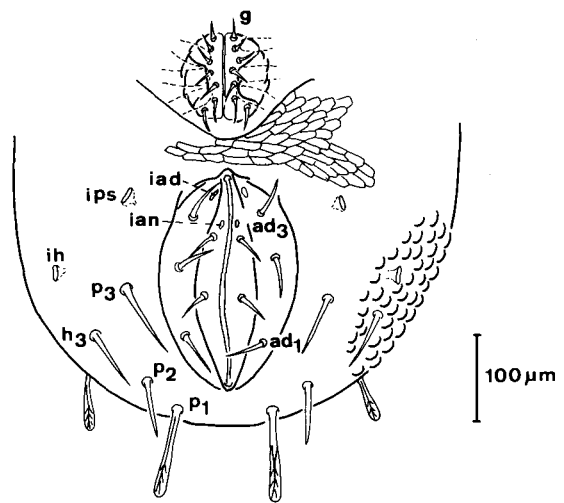
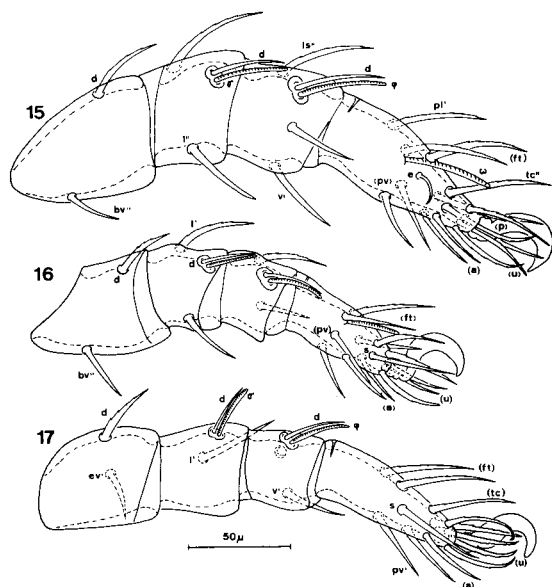


Fig. 14: *N. covarrubiasi* n. sp., tritonymph. Posterior-ventral region.
Región Postero-Ventral de la tritoninfa de *N. covarrubiasi* n. sp.



Figs. 15-17: *N. covarrubiasi* n. sp., larva. Fig. 15. Leg I; Fig. 16. Leg II; Fig. 17. Leg III.

N. covarrubiasi n. sp. larva. Fig. 15. Pata I; Fig. 16. Pata II; fig. 17, Pata III.

Distribution of the type specimens will be as follows: Holotype and two paratypes deposited in Field Museum of Natural History, Chicago, Illinois, USA; 2 paratypes in Museo de Zoología, Universidad de Concepción, Chile; 2 paratypes in British Museum of Natural History, London, England. Other paratypes were kept by Roy A. Norton, Syracuse-New York, USA.

ETYMOLOGY - This species is dedicated to the Chilean acarologist Dr. René Covarrubias.

REMARKS - The adults of *N. covarrubiasi* n. sp. are similar to those of *N. flagellatus* Hammer, 1966, from which it is distinguished by the following characters:

- length and shape of the notogastral setae: *N. flagellatus* with all notogastral setae rather short, spatulate and veined; tapered and weakly barbed in *N. covarrubiasi* n. sp.
- notogastral ornamentation: that of *N. flagellatus* in form of uniform dark nodules; that of *N. covarrubiasi* n. sp. with pits appearing lighter than surrounding cuticle.
- tarsal claws: *N. flagellatus* is monodactylous while *N. covarrubiasi* n. sp. is tridactylous.

- coxisternal setation: that of *N. flagellatus* is 9-5(6)-6-5 while that of *N. covarrubiasi* n. sp. is 5-4-6-5.

NOVONOTHRUS PUYEHUE N. SP.

Adult

Diagnosis - This species is unique in the genus in that the adults have smooth and isodiametric notogastral setae. Epimeral setal formula 5(6)-4-5-5. Seate capitular *a*, *m* and *n* similar in shape and length, shorter than *h*. Cheliceral setae *cha* 62,5 µ and *chb* 47,5 µ (Figs. 18- 19).

Dimensions - The mean total length of ten specimens 988 µ (range 935 - 1041 µ); mean maximum notogastral width 527 µ (456 - 598 µ). Means for females (n=5) 1023 x 590 µ; means for males (n=5) 950 x 480 µ (Table 3).

Legs - Setal formulae (famulus included) for trochanter, femur, genu, tibia, tarsus, respectively as follows: Leg I 1-7-5-6-24; leg II 1-7-5-5-23; leg III 2-5-5-5-21; leg IV 1-6-5-5-21. All legs with 3 tarsal claws. Solenidial formulae for genu, tibia, tarsus as follows: I (1-2-2), II (1-1-2), III (1-1-0), IV (1-1-0).

LARVA (Figs. 20, 21) - This stage is similar to the larva of *N. silvestris*, described by Sniczak & Zelazna (1992). It differs from it mainly by the length and shape of setae *in*. In *N. puyehue* these setae are shorter and thinner than setae *le*, whereas in *N. silvestris* they are short and thin like setae *ex*. In the former species setae *c*₂ and *h*₁ are longer than in *N. silvestris*. Leg chaetotaxy as follows: Leg I 0-2-3-4-16; leg II 0-2-3-3- 13; leg III 0-2-2-3-13. Solenidial formulae as follows: I (1-1-1), II (1-1-1), III (0-1-0). All legs monodactylous. Coxisternal setation 2-1-2. Cuticular ornamentation tuberculate.

PROTONYMPH - Cuticular ornamentation slightly tuberculate. Seta *in* 30 µ long; sensilla 245 µ long. Seta *ex* short, 12.5 µ long, difficult to see. All notogastral setae short, thick and barbed; seta *h*₁ 153 µ long. Coxisternal setation 2-2-2-1. All legs monodactylous.

DEUTONYMPH - Ornamentation strongly tuberculate. Seta *in* 42.5 µ long and sensilla

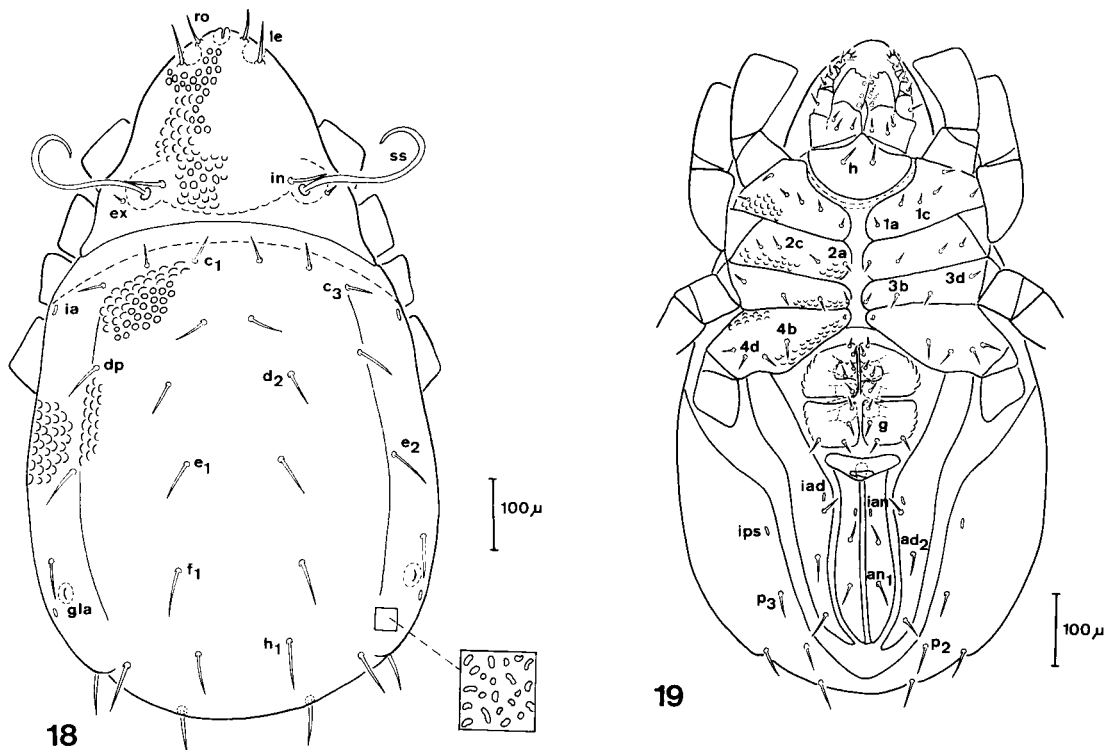
TABLE 3

Some morphological characters of *N. puyehue* n. sp.
(mean values: measurement in μ).

Algunos caracteres morfológicos de *N. puyehue* n. sp. (valores medios: medidas en μ).

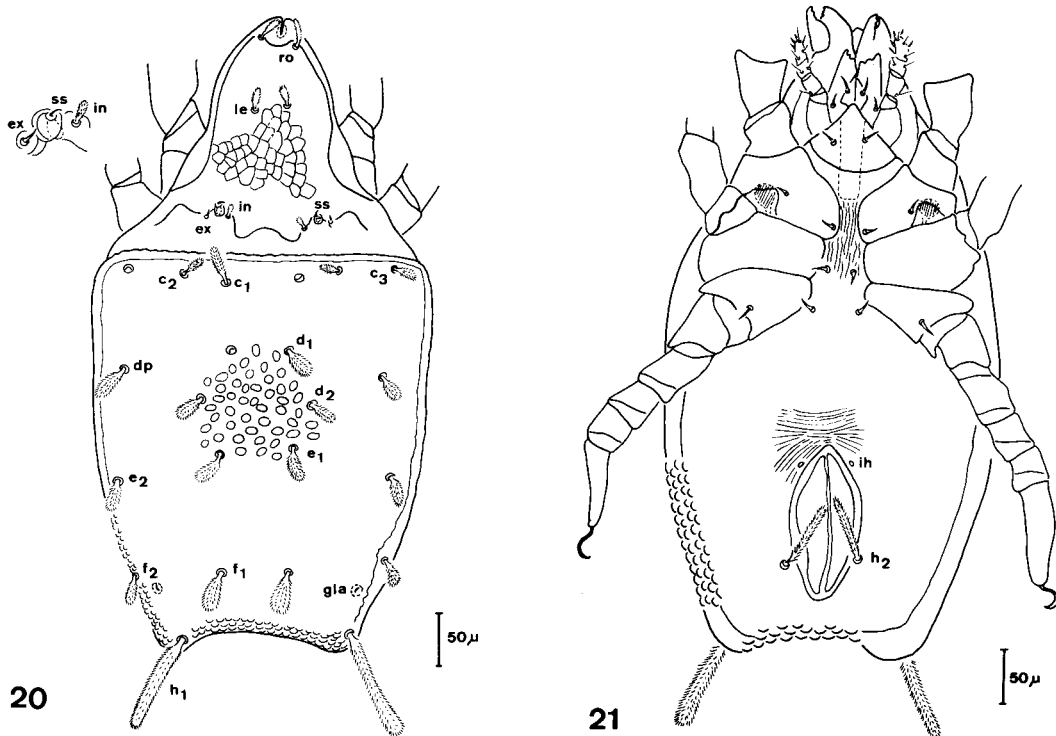
N. puyehue n.sp.

| CHARACTERS | LARVA (n=2) | PN (n=2) | DN (n=1) | TN (n=2) | FEMALE (n=5) | MALE (n=5) |
|-----------------|----------------|-------------|-------------|-------------|-----------------|---------------|
| Body length | 435 | 580 | 610 | 750 | 1020 | 950 |
| Body width | 260 | 340 | 365 | 460 | 590 | 480 |
| Length of | | | | | | |
| seta d_1 | 20 | 52 | 56 | 75 | 80 | 75 |
| seta h_1 | 85 | 153 | 287 | 56 | 76 | 80 |
| seta h_2 | 43 | 42 | 42 45 45 | 42 | | |
| genital opening | — | 38 | 50 | 100 | 174 | 110 |
| anal opening | 135 | 160 | 204 | 210 | 293 | 250 |
| Coxisternal | | | | | | |
| setation | 2-1-2 | 2-2-2-1 | 5-3-4-4 | 5-4-4-4 | | 5(6)-4-5-5 |



Figs. 18-19: *N. puyehue* n. sp., adult. Fig. 18. Dorsal view. 19. Ventral view.

Adulto de *N. puyehue* n. sp., Fig. 18. Vista dorsal, Fig. 19 Vista ventral.



Figs. 20-21.- *N. puyehue* n. sp., larva. Fig. 20. Dorsal view. Fig. 21. Ventral view.
Larva de *N. puyehue* n. sp., Fig. 20. Vista dorsal, Fig. 21. Vista ventral.

250 μ long. Seta *ex* absent. Coxisternal setation 5-3-4-4. All legs monodactylous. Dorsal setae short, thick and barbed.

TRITONYMPH - Ornamentation tuberculate. All dorsal setae barbed. Seta in 65 μ long and sensilla 187.5 μ long. Seta *ex* short, 15 μ long. Coxisternal setation 5-4-4-4. All legs monodactylous. Setae *ro* and *le* 37.5 and 50 μ long respectively. Genital opening with 9 genital setae.

MATERIAL EXAMINED - The holotype and about 100 paratypes are preserved in alcohol, and 13 paratypes are slide-mounted. All specimens were collected from: Chile, Osorno Province, Parque Nacional Puyehue, Antillanca Rd. 470 m (20-25)-XII-1982, valdivian rainforest litter, A. Newton & M. Thayer.

Distribution of types specimens will be as follows: Holotype and two paratypes deposited in Field Museum of Natural History, Chicago, Illinois, USA; 2 paratypes in Museo de Zoología, Universidad de Concepción, Chile; 2 paratypes in British

Museum of Natural History, London, England. Other paratypes were kept by Roy A. Norton, Syracuse-New York, USA.

ETYMOLOGY - The name "puyehue" comes from the area where the specimens were collected: Puyehue National Park, Osorno, Chile.

REMARKS - Adults of *N. puyehue* n. sp. are similar to those of *N. covarrubiasi* n. sp. in having slightly convex margin, tridactylous legs and ornamentation in form of pits. The former can be distinguished by the presence of a much smaller setae *h*₂ and *c*₁ and isodiametric and smooth notogastral setae.

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