

## New *Sphaerochthonius* species from the Neotropical region (Acari: Oribatida)

Heinrich SCHATZ

Institut für Zoologie und Limnologie, Leopold-Franzens-Universität, Technikerstr. 25, A-6020 Innsbruck, Austria. E-mail: heinrich.schatz@uibk.ac.at

**New *Sphaerochthonius* species from the Neotropical region (Acari: Oribatida).** - Two new species of the family Sphaerochthoniidae (Acari: Oribatida) are described and illustrated. *Sphaerochthonius litoralis* sp. n. occurs in the littoral zone of several islands of the Galápagos archipelago (Ecuador), *S. windsori* sp. n. was collected in dry deciduous forests in Panamá. Adult and juvenile instars of both species are described. A key of *Sphaerochthonius* species known from the Neotropical region is added.

**Key-words:** *Sphaerochthonius* - Acari - Oribatida - taxonomy - new species - Galapagos Islands - Panama - Neotropical Region.

### INTRODUCTION

Members of the oribatid mite genus *Sphaerochthonius* are inhabitants of organic litter. They are known from all zoogeographic regions, but occur mainly in the tropics and subtropics. Up to now, four *Sphaerochthonius* species have been described and recorded from the Neotropical region, most of them from one site and single specimen: *Sphaerochthonius fungifer* Mahunka, 1983 (Guatemala, Tikal), *S. phyllophorus* Balogh & Mahunka, 1969 (Brazil, Rio de Janeiro; see also Balogh *et al.*, 1969), *S. uruguayensis* Pérez-Iñigo & Sarasola, 1998 (Uruguay, San Miguel mountain forest) and *S. splendidus* (Berlese, 1904) (Galápagos Islands, see Schatz, 1998, 1999). An additional undescribed species was reported from the Galápagos Islands in the Eastern Pacific Ocean (Schatz, 1998, 1999). The latter species is described in this paper, along with another new *Sphaerochthonius* species from Panamá.

The notogastral setal nomenclature follows that of Grandjean (1934) as summarized by Hunt *et al.* (1998). All measurements are given in micrometers ( $\mu\text{m}$ ).

### DESCRIPTIONS AND REMARKS

*Sphaerochthonius litoralis* sp. n.

Figs 1-14

*Sphaerochthonius* sp. Schatz, 1998: 379; Schatz, 1999: 504

*Type material:* The adult holotype (type locality: Ecuador, Galápagos Islands, Isla Sombbrero Chino southeast off Isla Santiago, near Cape Trenton, 0° 22' S, 90° 35' W) and 2 adult paratypes from the same locality are preserved in alcohol and will be deposited in: Muséum d'histoire naturelle, Genève, Switzerland, other specimens in the author's collection in Innsbruck, Austria.



*Other material examined:* *Sphaerochthonius litoralis* sp. n. is known from 56 specimens (54 adults, 2 tritonymphs) collected on eight islands of the Galápagos Archipelago. No morphological differences between the populations on the different islands were observed. All records are from the eastern and central islands of the Galápagos.

*Specific collection data* (all collections by the author): Isla Bartolomé, near Pinnacle Rock, littoral zone: sea level, in dry to moist leaf litter under *Maytenus octogona* (11.ii.1985: 1 adult, 26.xii.1986: 6 adults), in moist mangrove leaf litter under *Laguncularia racemosa* (26.xii.1986: 1 adult). Isla Floreana (Santa Maria), at flamingo lagoon in Punta Cormorán, littoral zone: at sea level, in moist, decayed mangrove leaf litter under *Laguncularia racemosa* (6.iv.1985: 6 adults). Isla Santa Fé, northeastern part, littoral to arid zone: above beach, 5 m a.s.l., in dry to moist leaf litter under *Cordia lutea* (14.iii.1983: 1 adult). Isla Genovesa, Darwin Bay, littoral zone: at sea level, lava crevice, in dry to moist decayed leaf litter under *Rhizophora mangle* (17.ii.1985: 3 adults); around Lake Arcturus, littoral zone: 20 m a.s.l., in moist, decayed leaf litter and black humus under *Rhizophora mangle* (16.ii.1985: 3 adults). Isla Rábida, littoral zone: at flamingo lagoon, 5 m a.s.l., in moist, decayed mangrove leaf litter under *Rhizophora mangle* (14.iii.1988: 3 adults). Isla San Cristobal, littoral zone: south of Wreck Bay, behind rocky coast, at sea level, in moist leaf litter under *Conocarpus erecta* and *Laguncularia racemosa* (4.i.1987: 1 adult); in moist and salty, well-decayed leaf litter, humus and rotten wood under *Avicennia germinans* (4.i.1987: 5 adults, 1 tritonymph). Isla Santa Cruz, near Charles Darwin Research Station, littoral zone: 5 m a.s.l., in moist leaf litter and humus under *Sesuvium portulacastrum* (3.iii.1985: 1 adult); *ibid.*, behind coast, 5 m a.s.l., in dry to moist, well-decayed leaf litter and pieces of wood under *Hippomane manzinella* (22.i.1987: 1 adult); Puerto Ayora, near Hotel "Fragata", littoral zone: at sea level, in moist, decayed mangrove leaf litter under *Avicennia germinans* (30.xii.1986: 3 adults); *ibid.*, in moist, decayed leaf litter under *Sesuvium portulacastrum* (30.xii.1986: 4 adults). South of Puerto Ayora, "Divine's Bay", littoral zone: at sea level, in moist, partially decayed mangrove leaf litter under *Rhizophora mangle* (29.xii.1986: 8 adults). West of Canal de Itabaca, littoral zone: 5 m a.s.l., in moist, partially decayed mangrove leaf litter and sand under *Avicennia germinans* (13.i.1987: 1 adult). Transition zone near "Caseta": 180 m a.s.l., in dry old dropping of giant tortoise, containing digested grass (26.ii.1985: 1 adult). Moist zone: *Scalesia* forest near Cerro Crocker, 700 m a.s.l., in dry to moist bark, lichens and moss on a *Scalesia pedunculata* trunk, arboricolous (6.iii.1987: 1 adult). Isla Sombrero Chino, northern part, near lava flow, littoral zone, 5 m a.s.l., in moist, decayed leaf litter and red soil under *Sesuvium edmonstonei* (21.ii.1987: 3 adults, 1 tritonymph); *ibid.*, in dry to moist, decayed leaf litter and humus under *Heliotropium angiospermum* (21.ii.1987: 1 adult).

*Diagnosis:* Adults of the new species differs from its congeners by the following combination of character states: surface structure on prodorsum and on major part of notogaster consisting of a polygonal network with triangular thickenings in its angles; nose-shaped protuberance on prodorsum present; except setae *exa*, *exp*, *d*, all prodorsal and notogastral setae biramous, papillate; adoral, subcapitular, epimeral, genital and anal setae distally almost flagelliform; 8 pairs of genital, 9-11 pairs of anal and 5 pairs of adanal setae present, the latter uniramous with branching papillae, setae (*ul*) on palptarsus fused, bifid. Tritonymph with biramous and ciliate setae *d* and asymmetric biramous setae *e*.

*Adult* (Figs 1-12): Total body size ( $n=38$ ): 321 (range: 280-350) x 192 (170-215), length of notogaster 217 (195-225, 66-70% of total body length). Color yellow to light brown. Prodorsal and major part of notogastral surface (plates *Na*, *Py* and *Is*) covered with polygonal network, margins and especially angles of areolae irregularly thickened, surface granulate (Fig. 6). Reticulation of cuticle accentuated by cerotegument. Lateral plates of notogaster, mentum, epimeral, genital and ano-adanal plates with granulate surface.



Prodorsum (Fig. 1): Shape elongate, lateral edges slightly converging anteriorly. Rostrum medially with a thickened, nose-shaped protuberance, slightly protruding anteriorly beyond anterior margin of prodorsal shield. Surface structure polygonal to hexagonal as on notogaster, area between interlamellar setae with larger polygons. Rostral, lamellar and interlamellar setae biramous, papillate ("T-shaped" in the sense of Wallwork, 1960), both rami of *ro*, *le* almost equal in length, *il* with longer anterior rami, extension of both rami *ro* 40-50, *le* 50-55, *il* 30-35 long. Anterior (*exa*) and posterior (*exp*) exobothridial setae inserted close to each other anterolateral to bothridia; both uniramous, papillate, *exa* ~12, *exp* 25 long. Bothridia directed laterad, head of sensilli ramose with branching papillae, rami directed dorsad (hence sensilli appearing narrow in dorsal view, see Fig. 1, broader in lateral view, see Fig. 2), total length of sensilli 50, head 40. Between bothridia a small elevated ridge present on prodorsum.

Notogaster (Figs 1-3): Shape almost round. Small angle on each side of notogaster on broadest part, formed by lateral angle of triangular lateral plates *L*. Broad transverse scissure (of type "L" in the sense of Grandjean, 1947; see Norton, 2001) present between plates *Na* and *Py*, originating from lateral angles of plates *L*, curved anteriad, covered by hypertrophied posterior part of plate *Na*, hiding insertions of setal row *d* on scissure. Indistinct thickened suture present on plate *Py*, also originating from lateral angles of plates *L*, almost transverse, passing near insertions of setal row *e*. On ventral side single transverse scissure anterior to plate *Py* and straight longitudinal scissure present on each side between plates *Is* and *L*.

Sixteen pairs of notogastral setae present. Setae *d* short, setiform, smooth, *d*<sub>1</sub> 4-5, *d*<sub>2</sub> 7 long. Other notogastral setae biramous, papillate. Rami of setal row *c* aligned in almost longitudinal direction, slightly asymmetric with shorter anterior rami, extension of both rami: *c*<sub>1</sub> 75, *c*<sub>2</sub> 65-70, *c*<sub>3</sub> 65-70, *c*<sub>p</sub> 60-70, rami of setae *e* aligned transversely, extension *e*<sub>1</sub> 70-75, *e*<sub>2</sub> 60, rami of *f*<sub>1</sub> aligned longitudinally, extension 70, rami of *f*<sub>2</sub> aligned transversely, extension 60, setae *h*<sub>1</sub>-*h*<sub>3</sub> on edge of notogaster, extension of both rami 60, setae *ps*<sub>1</sub>-*ps*<sub>3</sub> visible in lateral and ventral view, extension of both rami: *ps*<sub>1</sub> 50-60, *ps*<sub>2</sub>, *ps*<sub>3</sub> 40-50, setae *ps*<sub>2</sub> and *ps*<sub>3</sub> inserting on plates *Is* lateral to ano-adanal plates.

Gnathosoma (Figs 3-5): Mentum small (35 x 30), subcapitular setae setiform, basally slightly thickened, distally very thin, almost flagelliform, *h*, *m*<sub>1</sub>, *m*<sub>2</sub> 10-12, *a* 16-20 long. Three pairs of adoral setae present, same shape as subcapitular setae, ~12 long. Chelicerae (Fig. 4) of chelate-dentate type, narrow, size (n=6): 45-60 x 20-25, movable digit 20-25 long, both setae inserted near dorsal margin, directed anteriad, *cha* setiform, ciliate, 20-22 long, *chb* strongly thickened, palmate, 10-12 long. Palps (Fig. 5) with 5 short articles, attenuating from trochanter to tibia, tarsus distally prolonged. Setal formula (trochanter to tarsus, solenidion in parentheses) 0 - 2 - 1 - 3 - 11(1), setae *cm* 40 long, *acm* flagelliform, 35 long, with a distal loop, other tarsal setae relatively long (12-15). Setae (*ul*) and *sul* eupathids, (*ul*) fused, bifid with long curved seta and short spine.

Epimeral region (Fig. 3): Epimeral plates I and II separate, plates III and IV almost completely fused on each side. Epimeral setal formula 3-2-3-4, setae 3*c* inserting on anteriorly directed apophyses, setae 4*b*, 4*c*, 4*d* in one row on posterior part of plate. Setae relatively long, setiform, basally slightly thickened, distally very thin,



almost flagelliform, *1a*, *1c*, *2a*, *2b* ciliate, others smooth, *1c*, *2a*, *2b* 25-30, others 15-20 long.

Genito-anal region (Figs 3, 7): Genital plates small, elongate (70-75 x 20), shape oval, surface granulate. Eight pairs of genital setae present, shape as epimeral setae, 20-27 long. Anal and adanal plates fused. Ten pairs of anal setae present (some specimens with 9 or 11 pairs), basally thickened, distally very thin, almost flagelliform, curved mediad and posteriad, 12-15 long. Five pairs of adanal setae present (Fig. 7), uniramous with branching papillae, 20-30 long, bases connected by a sclerotized ridge.

Legs (Figs 8-12): Legs of moderate length (without claws 30-37% of body length). Setal formulas of legs (trochanter to tarsus, solenidia in parentheses): leg I 0 - 4 - 4 - 6(1) - 19(3), leg II 1 - 5 - 4 - 6(1) - 17(2), leg III 2 - 3 - 3 - 4(1) - 12, leg IV 2 - 3 - 3 - 4(1) - 11. All legs heterotridactylous, with a small, but strong median claw and two almost setiform lateral claws. Setae *d* and *l'* on femur I and setae *d* on femora II - IV thickened and densely ciliate. Solenidia  $\omega_1$  on tarsus I curved anteriorly, covered with cerotegument granulae, 25 long, solenidia  $\phi_1$  on tibia I very long (85-90), inserted on large distal projection.

*Immatures* (Figs 13,14): Tritonymph: Color pale. Size (n=2) 275-295 x 180, notogaster 200-210 long.

Prodorsum (Fig. 13): Nose-shaped structure as in adult. Prodorsal setae as in adult, extension of both rami: *ro* 40, *le* 50, *il* 35, anterior ramus of *il* almost twice as long as posterior one, *exa* 10, *exp* 18-20. Total length of sensilli 50  $\mu$ m, head 30.

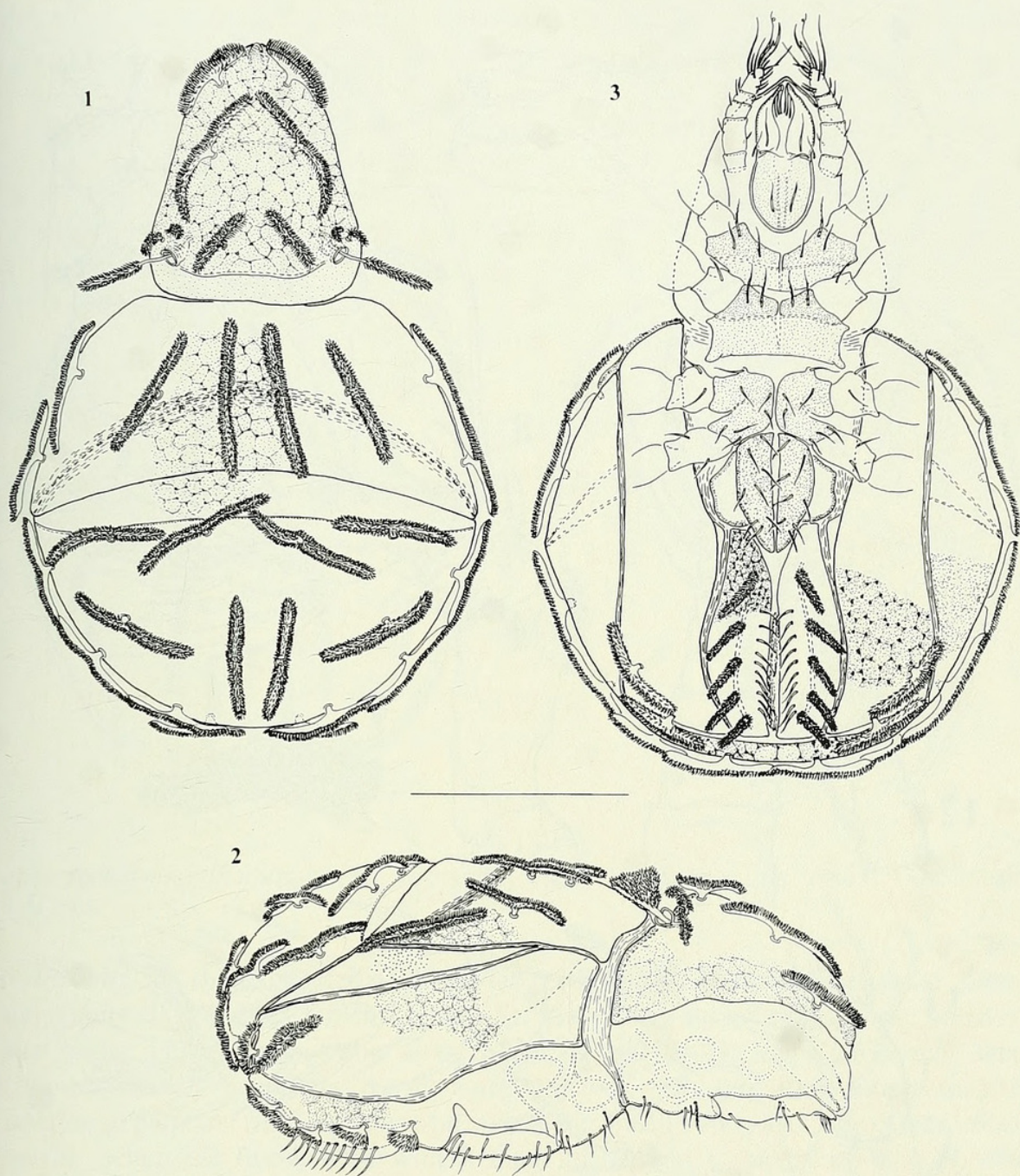
Gastronotic region (Figs 13,14): Broad dorsal scissure between plates *Na* and *Py* well-developed and deep, additional posterior scissure present along insertions of setal row *e*. Surface structure of plates *Na*, *Py*, *Is* with polygonal structure as in adults, lateral plates *L* triangular, surface granulate with radial striae, inner margin with a series of folds. Sixteen pairs of notogastral setae present, setae  $c_1$ - $c_p$  biramous, papillate, extension of both rami 55-60. Setae *d* on anterior slope of cavity, biramous, ciliate, small, rami directed transversely, extension of both rami:  $d_1$  17,  $d_2$  8-10. Setae *e* biramous, papillate, asymmetric, with long rami directed posteriad,  $e_1$  70-80,  $e_2$  40-50 long, and short second rami originating on base, directed mediad, 15-20 long, setae *f*, *h*, *ps* biramous, papillate, extension of both rami:  $f$ ,  $h$ ,  $ps_1$  45-55,  $ps_2$ ,  $ps_3$  35, latter inserting on plate *Is*, rami aligned almost transversely, rami of setal row *f* aligned longitudinally, others parallel to body edge.

Gnathosoma (Fig. 14): Size of mentum 30x20, subcapitular setae 12-14 long. Palps: setal formula as in adult, setae *acm* 25-30 long, setae (*v*) short, thick, spiniform, (*ul*) fused, bifid.

Ventral region (Fig. 14): Shape of epimeral plates and shape, position and number of epimeral setae as in adult, setae of rows 1 and 2 12-15 long, others 6-9. Genital plates with 3 pairs of genital papillae, 7 pairs of genital setae, 10-12 long. Anal and adanal plates fused, 9 pairs of anal setae, 9-10 long, and 5 pairs of adanal setae present, the latter uniramous, papillate, 20 long. Shape of genital and anal setae as in adults.

Legs: All legs monodactylous, setal formula as in adults, setae *d* and *l'* on femur I and setae *d* on femora II - IV thickened with short ciliae. Solenidium  $\phi_1$  on tibia I 70-75 long.





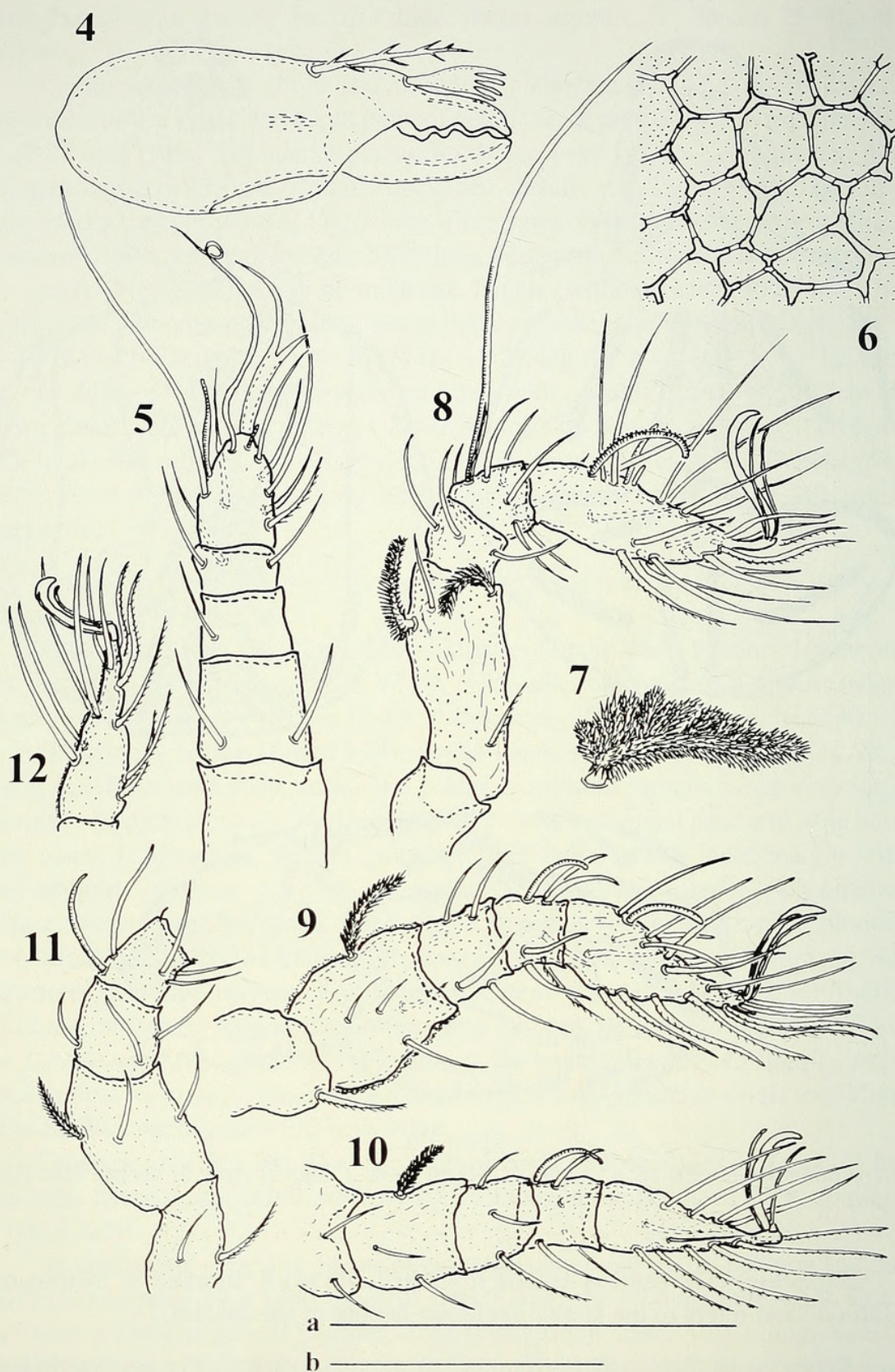
FIGS 1-3

*Sphaerochthonius litoralis* sp. n., adult - 1. Dorsal view; 2. Lateral view; 3. Ventral view (Scale: 100  $\mu$ m).

**Etymology:** The name is derived from the Latin word "litoralis" = "belonging to the littoral" and refers to the known preferred habitat of the species.

**Remarks:** In many aspects the new species morphologically corresponds with the original description of *S. transversus* Wallwork, 1960. Both species have a reticulate surface structure, biramous notogastral setae with rami of almost equal length, especially in row *e* and *f*, and 5 pairs of adanal setae. Differences between the two species are found in: the presence of a nose-shaped structure on prodorsum in

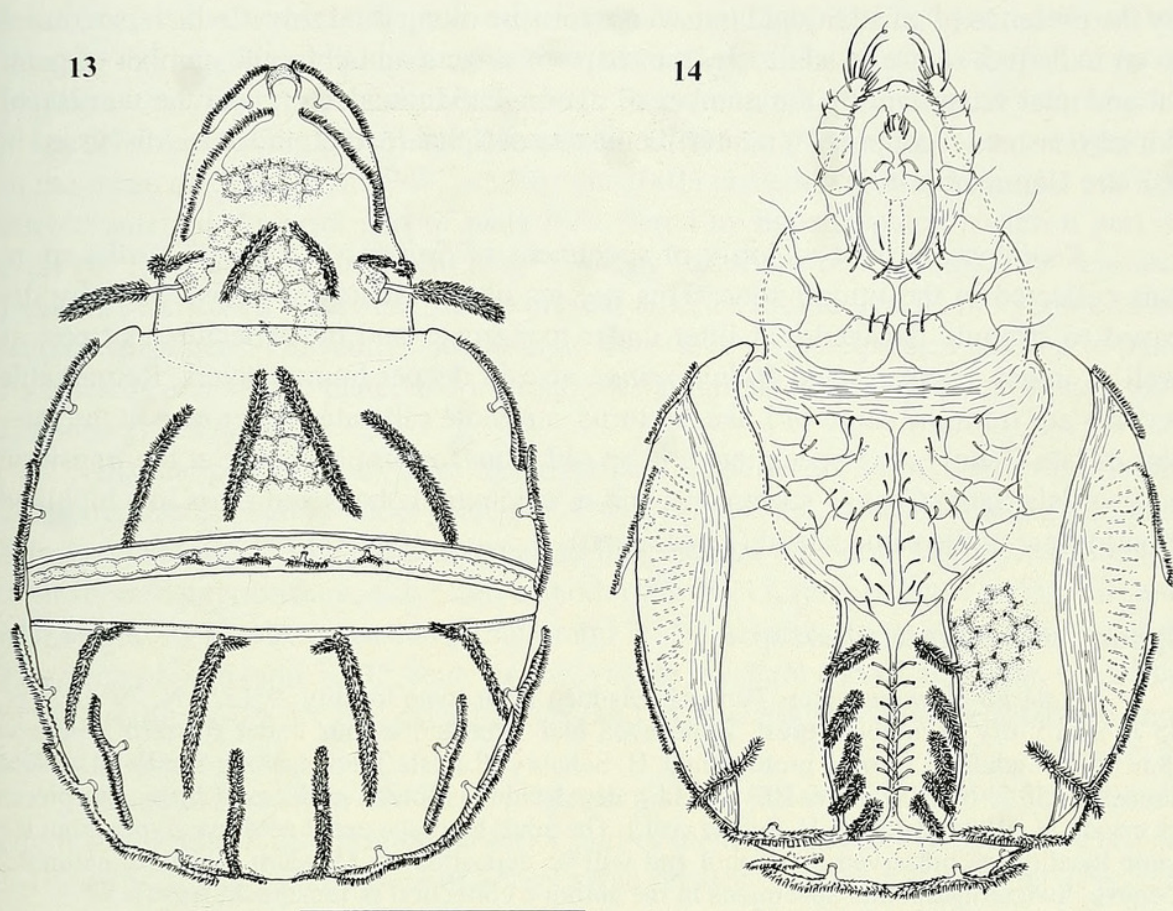




FIGS 4-12

*Sphaerochthonius litoralis* sp. n., adult - 4. Chelicera; 5. Palp; 6. Surface structure on notogaster; 7. Adanal setae *adj*; 8. Leg I; 9. Leg II; 10. Leg III; 11. Leg IV, trochanter - tibia; 12. Leg IV, tarsus. All appendages in abaxial aspect (Scale a - Figs 4-7, Scale b - Figs 8-12: 50  $\mu$ m).





FIGS 13-14

*Sphaerochthonius litoralis* sp. n., tritonymph - 13. Dorsal view; 14. Ventral view (Scale: 100  $\mu$ m).

*S. litoralis*, the shape of interlamellar setae *il* (*litoralis*: biramous, *transversus*: uniramous), details in surface structure (*litoralis*: triangles in angles of polygons, *transversus*: dense granulate secretion along edges of polygons), shape of adanal setae (*litoralis*: widely branching, *transversus*: biramous with very short inner rami), in setation of palptarsi (*litoralis*: setae (*ul*) fused, bifid with 1 long and 1 short seta, *transversus*: setae (*ul*) fused, bifid with 2 long setae), and in shape of setae *d*, *e* in tritonymphs (*litoralis*: *d*<sub>1</sub>, *d*<sub>2</sub> biramous, *e*<sub>1</sub>, *e*<sub>2</sub> biramous, anterior ramus short, *transversus*: setae *d* not mentioned, probably very short, setae *e* uniramous).

The number of anal setae varies in *S. litoralis*: 75% of the adult population on the Galápagos Islands bear 10 pairs, 7.5% 9 pairs, and 17.5% 11 pairs. No correlation between the anal setation and occurrence on different islands or sites could be found. This character is variable within several species of the family; different numbers of anal setae are known from *Similochthonius australis* (Mahunka, 1985): 5-7, *S. decoratus* Mahunka, 1985: 4-5, *Sphaerochthonius strinatii* Mahunka, 1982: 9-10, *S. suzukii* Aoki, 1977: 7-8, *S. transversus* Wallwork, 1960: 10 and more, *S. variesetosus* Mahunka, 1997: 10-13 pairs of anal setae.

The tritonymph of *Sphaerochthonius litoralis* sp. n. differs from the adult instar by the smaller posterior edge of plate *Na*, leaving the scissure and setae *d* uncovered;



by the presence of an additional transverse scissure along setal row *e*, which is reduced to an indistinct suture in adults; by the shape of setae *d* and *e*; by the number of genital and anal setae; and by the number of claws. The monodactyly and the number of dorsal scissures ("coupures") in juvenile instars of Sphaerochthoniidae are discussed in van der Hammen (1959).

*Ecology:* The vast majority of specimens of *Sphaerochthonius litoralis* sp. n. was collected in the littoral zone. This species occurs mainly in moist, partially decayed to strongly decayed leaf litter under mangroves and other deciduous trees, as well as under *Sesuvium* and *Heliotropium*, also in deeper humus layers. Remarkable records are from the shore of Lake Arcturus, a remote saltwater crater lake in the interior of Isla Genovesa (3 specimens); in an old giant tortoise dropping at the transition zone of Isla Santa Cruz (1 specimen); and in epiphytic lichens and moss in a highland cloud forest of the same island (1 specimen).

***Sphaerochthonius windsori* sp. n.**

Figs 15-26

*Material examined:* Rep. Panamá: Madden Dam (type locality: 9°12,5' N, 79°37,2' W, 45 m a.s.l.), dry deciduous forest, in decayed leaf litter and humus under *Bursera simaruba* (8.ii.1996: 7 adults, 1 trito-, 1 protonymph, H. Schatz coll.). Isla Taboga, along Sendero Las Tres Cruces (9°33,5' N, 8°37,1' W, 100 m a.s.l.), dry deciduous forest, in decayed litter with pieces of wood (24.i.1996: 2 adults, H. Schatz coll.). The adult holotype and 2 adult paratypes from the same locality are preserved in alcohol and will be deposited in: Muséum d'histoire naturelle, Genève, Switzerland, other specimens in the author's collection in Innsbruck, Austria.

*Diagnosis:* Adults of the new species differs from its congeners by the following combination of character states: surface structure on prodorsum and on major part of notogaster consisting of polygonal network surrounded by relatively large round and elevated areolae; nose-shaped protuberance present on prodorsum; except setae *exp*, *d*, all prodorsal and notogastral setae biramous, both rami almost equal in length or slightly asymmetric, ciliate to papillate; rami of notogastral setae *e*, *f* aligned in transverse direction; 8 pairs of genital, 4 pairs of anal and 4 pairs of biramous adanal setae present; seta *l'* on palptarsus with ciliae at right angle, setae (*ul*) fused, bifid. Juvenile instars: setae *d* very short, setiform, setae *e* and *f* biramous, rami aligned in transverse direction, adanal setae setiform in protonymph, biramous in tritonymph.

*Adult* (Figs 15-24): Total body size (n=9): 270 (255-295) x 188 (180-190), length of notogaster 181 (170-200, 64-71% of total body length). Color dark yellow to light brown. Prodorsal and major part of notogastral surface (except lateral plates *L*) covered with irregular polygonal network surrounded by smaller and larger elevated areolae, surface granulate (Fig. 18). Lateral plates *L* granulate, with longitudinal striae (Fig. 17). Mentum, epimeral, genital and ano-adanal plates with granulate surface.

Prodorsum (Fig. 15): Shape almost quadrangular, anterior edge rounded. Rostrum medially with a nose-shaped protuberance, slightly protruding anteriorly beyond anterior margin of prodorsal shield. Rostral, lamellar, interlamellar (Fig. 19) and anterior exobothridial setae biramous, papillate ("T-shaped" in the sense of Wallwork, 1960), both rami almost equal in length, extension of both rami: *ro* 40-45, *le* 45-50, *il* 30-35, *exa* 12-15. Papillae of *ro*, *le*, *il* 3-5 long. Posterior exobothridial



setae (*exp*) lateral to bothridia, curved, uniramous, papillate, directed laterad to antero-dorsad, 10 long. Bothridia directed laterad, head of sensilli with anterodorsad directed papillae, total length of sensilli 50, head 40. Posterior edge of prodorsum sclerotized.

Notogaster (Fig 15): Shape almost round. Broad transverse scissure (of type "L" in the sense of Grandjean, 1947; see Norton, 2001) present between plates *Na* and *Py*, curved anteriorly. Anterior part of plate *Py* covered by hypertrophied posterior part of plate *Na* (overlapping part 27-50 long\*), hiding insertions of setal row *d* on scissure. Indistinct thickened transverse suture present anterior to setal row *e*, not visible in all studied specimens. On ventral side a single transverse scissure present anterior to plate *Py* towards ano-adanal plate, and a straight longitudinal scissure present on each side between plates *Is* and *L*.

Sixteen pairs of notogastral setae present. Setae *d* very short, setiform, smooth, 2-3 long, hardly visible under plate *Na*. Other notogastral setae biramous, papillate. Rami of setal row *c* aligned in diagonal to longitudinal direction, slightly asymmetric with shorter anterior rami, extension of both rami 30-45, rami of setae *e* (Fig. 20) and *f* aligned transversely, extension of both rami 20-30, setae *h*<sub>1</sub>-*h*<sub>3</sub> on edge of notogaster, extension of both rami 30-35, setae *ps*<sub>1</sub>-*ps*<sub>3</sub> visible in lateral and ventral view, extension of both rami: *ps*<sub>1</sub> 25-30, *ps*<sub>2</sub>, *ps*<sub>3</sub> 20-25, *ps*<sub>2</sub> and *ps*<sub>3</sub> inserting on plates *Is* lateral to ano-adanal plates.

Gnathosoma (Figs 17, 22, 23): Mentum small (25 x 20-25), subcapitular setae attenuating, setae *h* inserting on posterior part of mentum, directed posteriorly, *h*, *m*<sub>1</sub>, *m*<sub>2</sub> 5-10, *a* 15-20 long. Three pairs of adoral setae present, ~10 long. Chelicerae (Fig. 22) narrow, size (n=4): 45-55 x 16-20, movable digit 13-17 long, both setae directed anteriorly, *cha* setiform, ciliate, 15-20 long, *chb* strongly thickened, palmate, 12-15 long, with 4-6 fingers. Palps (Fig. 23) with 5 short articles, total length 40-50. Setal formula (trochanter to tarsus, solenidion in parentheses) 0 - 2 - 1 - 3 - 11(1), *cm* 50 long, *acm* flagelliform, with a distal loop, 30-35 long, setae (*lt*) 15-20 long, seta *l'* pectinate with ciliae at right angle. Setae (*ul*) and *sul* eupathids, (*ul*) fused, bifid with two short spines.

Epimeral region (Fig. 17): Epimeral plates I and II separate, plates III and IV almost completely fused on each side. Epimeral setal formula 3-2-3-4, setae *3c* inserting on anteriorly directed apophyses, *4b*, *4c*, *4d* in one row on posterior part of plate. Setae attenuating, on plates I and II ciliate, 10-15 long, on plates III and IV smooth, 6-10 long.

Genito-anal region (Figs 17, 21): Genital plates small, shape oval, surface granulate, almost spiculate. Eight pairs of genital setae present, attenuating, 8-12 long. Anal and adanal plates fused. Four pairs of anal setae present (Fig. 21), basally thickened, distally attenuating, curved mediad and posteriorly, 8-12 long. Four pairs of adanal setae present (Fig. 21), biramous with ciliae, extension of both rami 12-15, ciliae 2-3 long. Bases of adanal setae connected by a sclerotized ridge.

Legs (Fig. 24): Legs of moderate length (without claws 35-46% of body length). Setal formula of legs (trochanter to tarsus, solenidia in parentheses): leg I (Fig. 24) 0 - 4 - 4 - 6(1) - 19(3), leg II 1 - 5 - 4 - 6(1) - 17(2), leg III 2 - 3 - 3 - 4(1) -

\* The degree of overlap of the hypertrophied posterior part of plate *Na* depends on the way of preparation. When squeezed, the plates move apart and the transverse scissure becomes uncovered. In this position setae *d* are well visible.



12, leg IV 2-3-3-4(1)-11. All legs heterotridactylous, with a small, but strong medial claw and two weaker lateral claws, claws 20-30 long. Setae *d* and *l'* on femur I and setae *d* of femora II and III uniramous, papillate, setae *d* on femur IV thickened with short ciliae. Solenidia  $\omega_1$  on tarsus I curved anteriad, 25 long, solenidia  $\varphi_1$  on tibia I very long (70-90), inserted on large distal projection.

*Immatures* (Figs 25, 26): Color pale. Size: protonymph (n=1): 190 x 130, notogaster 130 long, tritonymph (n=1): 260 x 170, notogaster 170 long. Surface structure of both instars as in adult, in protonymph surrounding areolae very small.

*Prodorsum* (Fig. 25): Nose-shaped structure as in adult in both instars. Shape of prodorsal setae as in adult, extension of both rami *ro*, *le* 30-35, *exa* 12-15, *exp* 10 long in tritonymph; extension of both rami *ro*, *le* 20, *il* 15, *exa* 12, *exp* 7 long in protonymph. Total length of sensilli 50, head 40 in tritonymph; length of sensilli 25, head 20 in protonymph.

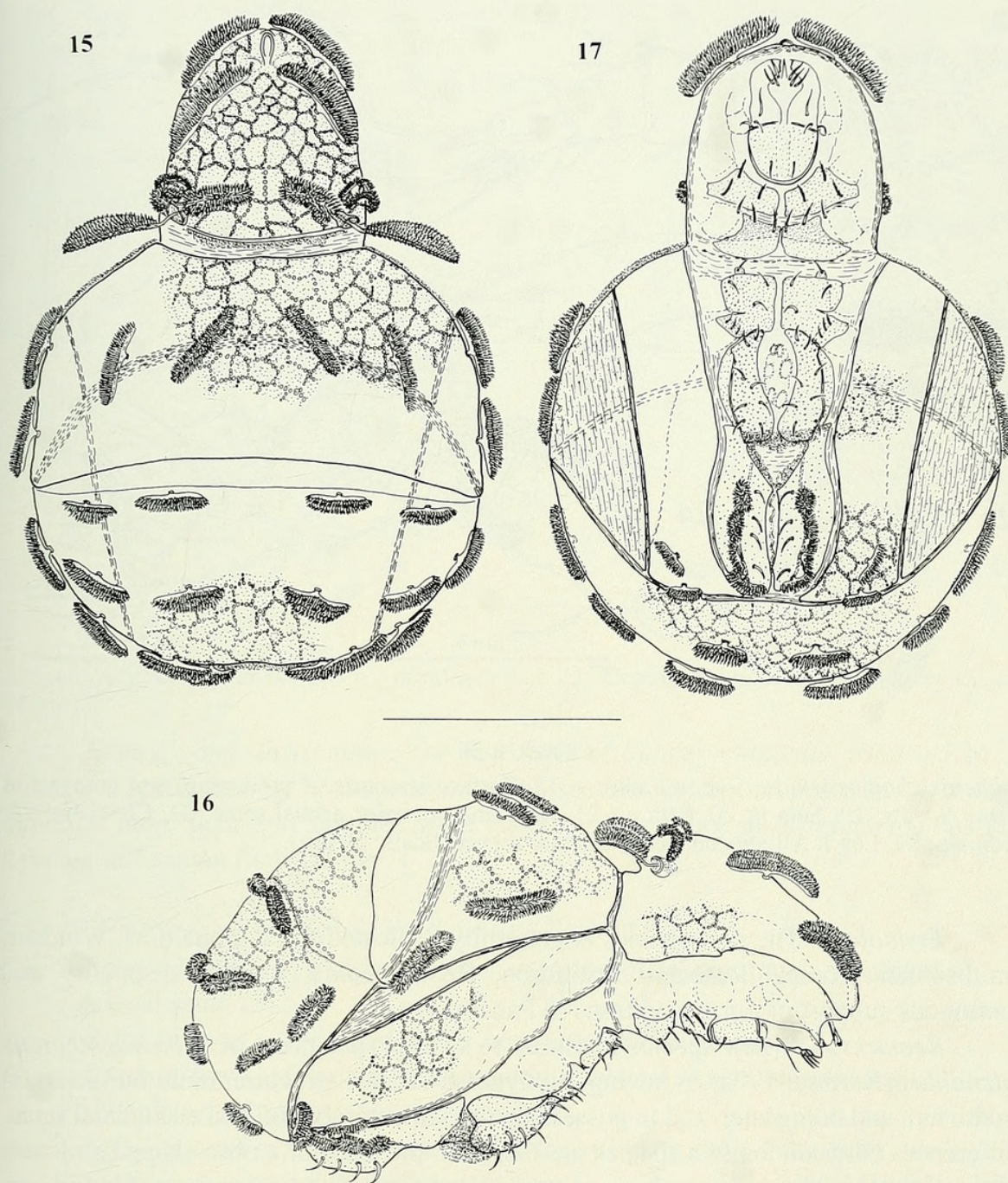
*Gastronotic region* (Figs 25, 26): Broad dorsal scissure between plates *Na* and *Py* present as a well-developed sulcus. Lateral plates *L* triangular, surface granulate with radial striae, inner margin with a series of folds. In both instars sixteen pairs of gastronotic setae present, setae  $c_1$ - $c_p$  biramous, papillate, slightly asymmetric, extension of both rami 25-35 in tritonymph; setae  $c_1$ - $c_p$  biramous, ciliate, slightly asymmetric, extension of both rami 15-20 in protonymph. Setae *d* on anterior slope of cavity, very short, setiform, smooth, 2 long in tritonymph; 1-2 long in protonymph, hardly visible in between the surface microstructure. Pygidial plate *Py* with two transverse ridges, setal row *e* on anterior, row *f* on posterior ridge, rami of setae *e*, *f* directed transversely in both instars, setae *h* and  $ps_1$  on lateral edge of notogaster, setae  $ps_2$  and  $ps_3$  on plate *Is*. All posterior setae biramous, papillate, extension of both rami 15-20 in tritonymph; biramous, ciliate, extension of both rami 10-15 in protonymph.

*Gnathosoma*: Number of subcapitular and adoral setae of both instars as in adult. Size of chelicera 50 x 17 in tritonymph, setae *cha* 15, *chb* 10 long, palmate, with 4 fingers in tritonymph; chelicera of protonymph not studied. Palp: setal formula of both instars of both instars as in adult, setae *cm* 45 long in tritonymph, 22 in protonymph, setae *acm* without loop in both instars, length 27 in tritonymph, 15 in protonymph, eupathidial setae (*ul*) fused, bifid, setae *l'* pectinate with ciliae at right angle in both instars.

*Ventral region* (Fig. 26): Shape of epimeral plates, position, number and shape of epimeral setae in tritonymph as in adults, setae 5 long. Epimeral setal formula 2-1-2?-2? (not well studied due to folded legs) in protonymph, setae 4-5 long. Genital plates with 6 pairs of setae, setiform, 7 long in tritonymph; 1 pair of genital setae, setiform to spiniform, 4 long in protonymph. Anal and adanal plates fused, 4 pairs of setiform anal setae and 4 pairs of biramous, ciliate adanal setae present, extension of both rami 6-8 in tritonymph; no anal setae, 4 pairs of setiform adanal setae, 4-5 long in protonymph.

*Legs*: All legs monodactylous, setal formula not studied in detail, setae *d* and *l'* on femur I, setae *d* on femora II - IV thickened, papillate in tritonymph; setae *d* on femora I and II thickened and ciliate in protonymph. Solenidion  $\varphi_1$  on tibia I 80 long in tritonymph, 55 long in protonymph.





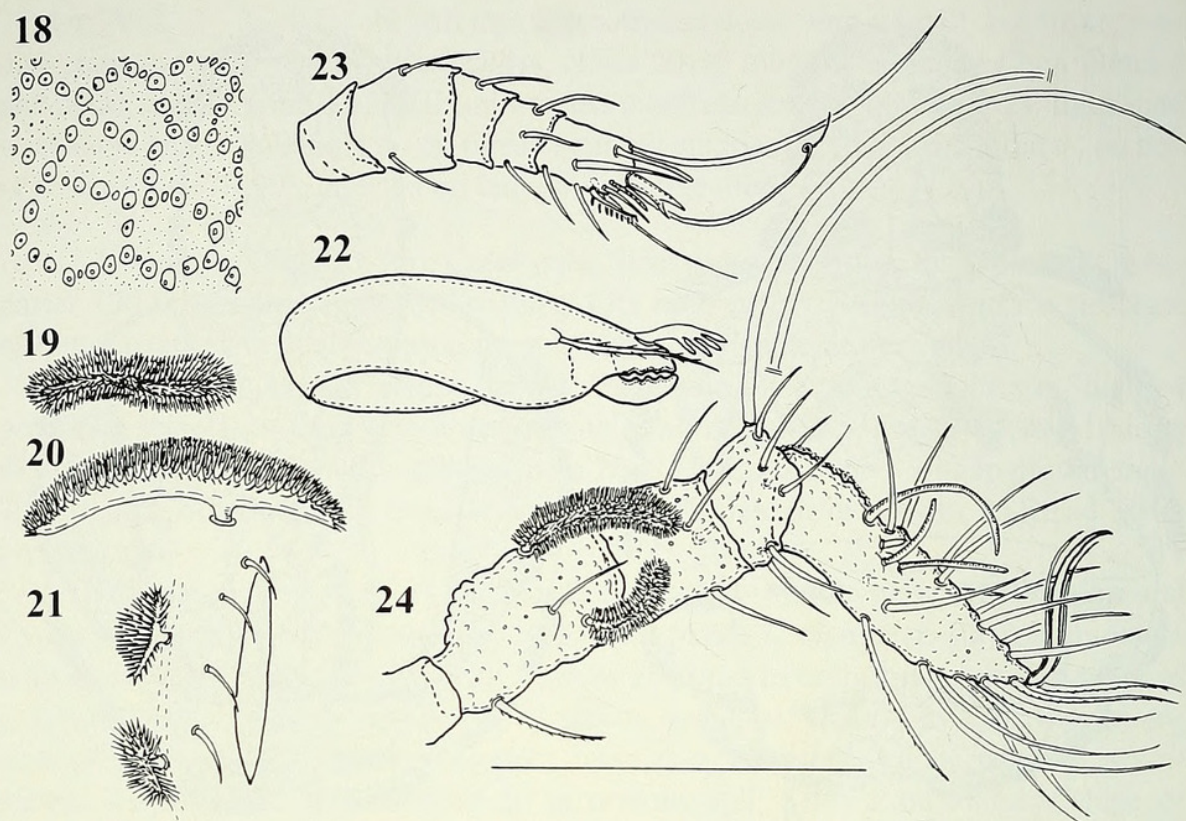
FIGS 15-17

*Sphaerocothonius windsori* sp. n., adult - 15. Dorsal view; 16. Lateral view; 17. Ventral view (Scale: 100  $\mu$ m).

**Eggs:** Several females observed with one or two large eggs. Dimensions of eggs ( $n=6$ ) 107-125 x 70-100, shape of eggs oval to elliptic. Eggs mostly in longitudinal orientation, except in one female in transverse orientation in posterior part of notogaster. Surface and edge of eggs appearing smooth inside the notogaster, but not studied in detail.

**Variation:** One adult specimen from Isla Taboga with 9 genital setae on one side.





FIGS 18-24

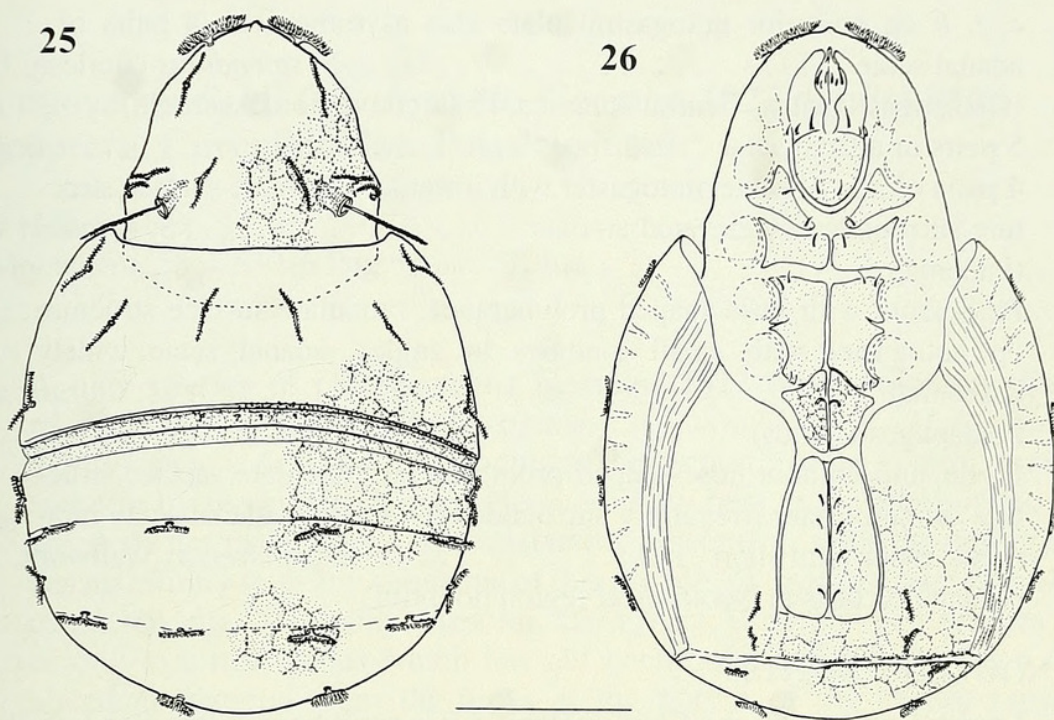
*Sphaerochthonius windsori* sp. n., adult - 18. Surface structure of prodorsum and notogastral plates *Na*, *Py*; 19. Seta *il*; 20. Seta *e*<sub>1</sub>; 21. Anal and posterior adanal setae; 22. Chelicera; 23. Pedipalp; 24. Leg I. All appendages in abaxial aspect (Scale: 50  $\mu$ m).

**Etymology:** The new species is gratefully dedicated to Dr Donald M. Windsor, Smithsonian Tropical Research Institution, Rep. Panamá, for his hospitality and continuous support of our expeditions in Panamá.

**Remarks:** The new species is similar to studied specimens of *Sphaerochthonius splendidus* (Berlese, 1904) in having a polygonal surface structure, biramous setae on prodorsum and notogaster, and in possessing the same number of anal and adanal setae. Differences between the two species are found in: presence of a nose-shaped structure on prodorsum in *S. windsori*, shape of notogastral setae *c*<sub>1</sub>, *c*<sub>2</sub>, rows *e* and *f* (*windsori*: biramous, subequal in length, *splendidus*: biramous, strongly asymmetric with short anterior rami), alignment of rami of setal rows *e* and *f* (*windsori*: transverse, *splendidus*: longitudinal), details in surface structure (*windsori*: large and round elevated areolae, forming edges of polygonal network, *splendidus*: clearly outlined polygons, areolae absent or small). *Sphaerochthonius splendidus* has a wide circumtropical and -subtropical distribution and was also frequently found in Panamá by the author.

The tritonymphs of *Sphaerochthonius windsori* sp. n. differ from the adult instar by the smaller posterior edge of plate *Na*, leaving the scissure uncovered; by the presence of additional transverse ridges along setal rows *e* and *f* (the anterior is present as an indistinct suture or totally reduced in adults); by the number of epimeral, genital, and anal setae; and by the number of claws (see also remarks on *S. litoralis* sp. n.).





FIGS 25-26

*Sphaerochthonius windsori* sp. n., protonymph - 25. Dorsal view; 26. Ventral view (Scale: 50  $\mu$ m).

**Ecology and distribution:** The few finds of *Sphaerochthonius windsori* sp. n. indicate a preference for arid conditions. The species was not recorded in other sites, although more than 300 samples were taken by the author in different regions and habitats in Panamá (Schatz, 1997).

#### KEY TO KNOWN NEOTROPICAL *SPHAEROCHTHONIUS* SPECIES

- 1 Setae of rows *e, f, h* on posterior notogastral plate uniramous, 4 pairs of adanal setae ..... 2
- Setae of rows *e, f, h* on posterior notogastral plate biramous ..... 4
- 2 Setae of rows *e, f, h* on posterior notogastral plate long, notogaster with reticulate surface structure ..... 3
- Setae of rows *e, f, h* on posterior notogastral plate short, fungiform, notogaster with foveolate surface structure ..... *S. fungifer* Mahunka, 1983 (Guatemala, Tikal)
- 3 Setae of rows *e, f, h* on posterior notogastral plate broad, phylliform ..... *S. phyllophorus* Balogh and Mahunka, 1969 (Brazil, Rio de Janeiro)
- Setae of rows *e, f, h* on posterior notogastral plate long, small, papillate ..... *S. uruguayensis* Pérez-Iñigo and Sarasola, 1998 (Uruguay)
- 4 Anterior notogastral setae (row *c*) biramous, T-shaped, both rami of almost equal length ..... 5
- Anterior notogastral setae (row *c*) biramous, T-shaped, strongly asymmetrical, anterior ramus much shorter than posterior one, setae of rows



- e, f, h* on posterior notogastral plate also asymmetrical, 4 pairs of adanal setae . . . . . *S. splendidus* (Berlese, 1904) (Galápagos Islands, Central America, Holarctic region, Australia)
- 5 5 pairs of adanal setae . . . . . 6
- 4 pairs of adanal setae, notogaster with irregular reticulate surface structure surrounded by elevated areolae . . . . . *S. windsori* sp. n. (Panamá)
- 6 Prodorsum with nose-shaped protuberance, reticulate surface structure on notogaster with small triangles in angles, adanal setae widely branching . . . . . *S. litoralis* sp. n. (Galápagos Islands)
- Prodorsum without nose-shaped protuberance, reticulate surface structure on notogaster irregularly surrounded by areolae, adanal setae biramous, inner rami short . . . . . *S. transversus* Wallwork, 1960 (Ghana; records in Neotropical region doubtful)

#### ACKNOWLEDGEMENTS

Logistic support by the Charles Darwin Research Station, the Servicio Parque Nacional Galápagos, Ecuador, the Smithsonian Tropical Research Institution, Rep. Panamá, and the Institute of Zoology and Limnology, Leopold-Franzens-University of Innsbruck, Austria, is gratefully acknowledged, as are the collecting permits from the authorities of Ecuador and Panamá. Dr R.A. Norton, Syracuse, N.Y., USA, provided constructive criticism of the manuscript.

#### REFERENCES

- BALOGH, J., MAHUNKA, S. & ZICSI, A. 1969. The scientific results of the Hungarian Soil Zoological expedition to South America. 14. A report on the collectings of the second expedition. *Folia Entomologica Hungarica (series nova)* 22: 453-474.
- GRANDJEAN, F. 1934. La notation des poils gastronotiques et des poils dorsaux du propodosoma chez les Oribates (Acariens). *Bulletin de la Société zoologique de France* 59: 12-44.
- GRANDJEAN, F. 1947. Les Enarthronota (Acariens). Première série. *Annales des Sciences naturelles, Zoologie* 11<sup>e</sup> série, 8: 213-248.
- HAMMEN, L. VAN DER 1959. Berlese's primitive Oribatid mites. *Zoologische Verhandelingen Leiden* 40: 1-93.
- HUNT, G. S., NORTON, R. A., KELLY, J. P. H., COLLOFF, M. J. & LINDSAY, S. M. 1998. An interactive glossary of oribatid mites. *CSIRO Publishing Melbourne*, CD-ROM.
- NORTON, R. A. 2001. Systematic relationships of Nothrolahmanniidae, and the evolutionary plasticity of body form in Enarthronota (Acari: Oribatida) (pp. 58-75). In: HALLIDAY, R. B., WALTER, D. E., PROCTOR, H. C., NORTON, R. A. & COLLOFF, M. J. (eds). *Acarology: Proceedings of the 10th International Congress*. *CSIRO Publishing, Melbourne*.
- SCHATZ, H. 1997. Oribatid mites from the northern neotropical region - a survey of research, past and present. *Abhandlungen und Berichte des Naturkundemuseums Görlitz* 70: 61-70.
- SCHATZ, H. 1998. Oribatid mites (Acari: Oribatida) from the Galápagos Islands - Faunistics, Ecology and Speciation. *Experimental and Applied Acarology* 22: 373-409.
- SCHATZ, H. 1999. Oribatid mites of the Galápagos Islands: Faunistics, ecology and speciation (pp. 499-530). In: BRUIN, J., VAN DER GEEST, L. P. S. & SABELIS, M. W. (eds). *Ecology and evolution of the Acari*. *Kluwer Academic Publishers, Dordrecht*.
- WALLWORK, J.A. 1960. Some Oribatei from Ghana. I. Sampling localities. II. Some members of the Enarthronota Grandj. *Acarologia* 2: 368-388.





Schatz, Heinrich. 2003. "New Sphaerochthonius species from the Neotropical region (Acari: Oribatida)." *Revue suisse de zoologie* 110, 111–124.

<https://doi.org/10.5962/bhl.part.80178>.

**View This Item Online:** <https://www.biodiversitylibrary.org/item/128314>

**DOI:** <https://doi.org/10.5962/bhl.part.80178>

**Permalink:** <https://www.biodiversitylibrary.org/partpdf/80178>

#### **Holding Institution**

Smithsonian Libraries and Archives

#### **Sponsored by**

Biodiversity Heritage Library

#### **Copyright & Reuse**

Copyright Status: In Copyright. Digitized with the permission of the rights holder

Rights Holder: Muséum d'histoire naturelle - Ville de Genève

License: <http://creativecommons.org/licenses/by-nc-sa/3.0/>

Rights: <https://www.biodiversitylibrary.org/permissions/>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.