



A new species of *Ophionyssus* Mégnin (Acari: Mesostigmata: Macronyssidae) parasitic on *Lacerta schreiberi* Bedriaga (Reptilia: Lacertidae) from the Iberian Peninsula, and a world key to species

MARÍA L. MORAZA¹, NANCY R. IRWIN², RAQUEL GODINHO³, STUART J. E. BAIRD^{3,4} & JOËLLE GOÛY DE BELLOCQ⁵

¹Department of Zoology and Ecology, Faculty of Science, University of Navarra, No. 177, Pamplona, 31080, Spain.
E-mail: mlmoraza@unav.es

²Department of Biology, The University of York, PO Box 373, York YO10 5YW, UK

³INRA, UMR CBGP, Campus International de Baillarguet, CS 30016, F-34988 Montferrier-sur-Lez cedex, France

⁴CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Campus Agrário de Vairão, 4485-661 Vairão, Portugal

⁵Department of Biology, University of Antwerp, Groenenborgerlaan 171, 2020 Antwerp, Belgium

Abstract

A new species, *Ophionyssus schreibericolus* Moraza **sp. nov.** is described, based on adult females, males and protonymphal instars. *Ophionyssus schreibericolus* parasitizes *Lacerta schreiberi*, a lizard endemic to the Iberian Peninsula, and known to have persisted in refugial populations throughout the Pleistocene. A key to adult females, males and protonymphs of the genus *Ophionyssus* is presented. *Ophionyssus viperae* Miron & Ivan 2003 is synonymised with *O. natricis* (new synonymy).

Key words: Acari, Macronyssidae, *Ophionyssus schreibericolus*, parasitic mites, Reptilia, Lacertidae, *Lacerta schreiberi*, Iberian Peninsula

Introduction

Among the 16 species of the genus *Ophionyssus* (Fain & Bannert, 2000; Hallan, 2005), only seven species have been found on lacertid lizards. The others are ectoparasites on different families of hosts (Fain & Bannert, 2000). The European species *O. lacertinus* (Berlese, 1892) parasitizes lizards in Great Britain, Netherlands and Italy (Fain & Bannert, 2000) and *O. sauracum* (Oudemans, 1901) is a common species in several European countries; three species belong to the Canary Islands fauna, *O. galloticolus* Fain & Banner, 2000 from Tenerife, *O. setosus* Fain & Banner, 2000 from Gran Canarias, and *O. dolatelacensis* Fain & Banner, 2002 from Lanzarote; *O. eremiadis* Naglov & Naglova, 1960 has been found in West Kazakhstan (Asia) and finally *O. tropidosaurae* (Till, 1957) is reported from South Africa.

The mites described in the present work were collected from *Lacerta schreiberi*, a lizard endemic to the Iberian Peninsula, ranging from the northwest and extending into the mountains of the Spanish Central System (SCS), with some isolated populations in the south. The host organism is thus part of the Iberian refugial fauna, which has remained on the Iberian Peninsula throughout the last glacial maximum, and further is thought to have persisted in geographically separated populations throughout the Pleistocene (Paulo *et al.*, 2001; Godinho *et al.*, 2008).

Material and methods

Lacerta schreiberi were collected in the Malcata region bordering the Portuguese-Spanish frontier, during their mating season, in April/May of 2006 and again in 2007 (Fig. 9, Table 1). *Lacerta schreiberi* is a protected species, so after examination, photography and removal of a small tissue sample from the tail, they were released at their original point of capture. Photographs and DNA marker information on the host lizards are available from the authors. During processing, the lizards were kept separate, or in courting couples, in white cotton bags. On removal, the bags were cleared of all dislodged ectoparasites. In addition ectoparasites were removed from the ears, under the frill of neck scales, and from the armpits of the lizards. Mites were preserved in 70% ethanol. Before observation, mites were mounted in Hoyer's medium and sealed with Glyptal insulating varnish. Measurements are in micrometres (μm), as a range or a single average value. Leg lengths were measured from the base of the coxa to the apex of the tarsus, omitting the pretarsus. Idiosomal setal notation follows Lindquist & Evans (1965) and leg chaetotaxy follows Evans (1963). Idiosomal notation of glands and lyrifissures follows Johnston & Moraza (1991).

Ophionyssus schreibericolus Moraza sp. n.

(Figs. 1–8)

Material examined. *Holotype.* Female: Malcata province, Portugal, from a female of *Lacerta schreiberi*, May 2007, lizard ID Lag07-57, latitude 40°19'20" N, longitude 6°50'58" W, (deposited in Museo de Zoología, Facultad de Ciencias, Universidad de Navarra, MZUNAV). *Paratypes* from same province and host species (see Table 1): 3 males from same locality and data as holotype, 2 females, 1 male and 134 protonymphs, deposited in Museo de Zoología, Facultad de Ciencias, Universidad de Navarra, MZUNAV; 1 female, 1 male and 4 protonymphs deposited in the Acarology Laboratory of Ohio State University, OSAL; 6 protonymphs deposited in the Departamento de Colecciones del Museo Nacional de Ciencias Naturales, Colección de Tejidos y ADN (Madrid, Spain).

Holotype and paratypes were collected from 25 specimens of *Lacerta schreiberi* (8 females, 15 males, 2 unknown sex) (Table 1).

Diagnosis. Female dorsal shield 700 long, 259 wide (ratio length/width is 2.7); with 12–13 pairs of smooth setae: setae z_2 , s_5 always off the shield; Z_5 on or off the shield; genital shield ca. 329 long, anteriorly with a triangular epigynial membranous lobe; peritremes extend to middle of coxa II; male femur III with strong, finger-like ventral spur and 16–19 pairs of setae on dorsal shield. Protonymph: pentagonal podonotal shield 230 long, 230 wide with 11 pairs of setae, pygidial shield ca. 76 long, ca. 103 wide, with 3 pairs of setae (J_4 , Z_4 , Z_5), 2 posterior pairs subequal in length; 4 large and 8 minute intermediate mesonotal shields.

Description. Adult female. *Dorsal idiosoma* (Fig. 1). Dorsal shield 679–700 long, 249–259 wide at level of z_4 , 147 at level of J_1 and 66 wide at posterior level (ratio length/ max. width = 2.7), covered with network of punctuate polygonal cells. The shield bears 12–13 pairs of dorsal setae: j_1 (48), j_2 ca. 67, j_3 – j_5 ca. 41, j_6 ca. 37, J_1 37, J_2 ca. 30, J_4 ca. 30; setae z_2 (82), s_5 (56) and Z_5 (33) on or off shield, on soft cuticle; other dorsal setae on soft cuticle (63–74); marginal unsclerotized cuticle hypertrichous, with dorsal setae slightly thicker. Ten pairs of discernible pore-like structures (5 podonotal, 5 opisthonotal), of which 7 (3 podonotal, 4 opisthonotal) superficially appear non-secretory (lyrifissures) and 3 (2 podonotal and 1 opisthonotal) are secretory (gland pores). At least other 5 discernible lyrifissures on soft dorsal cuticle.

Ventral idiosoma (Fig. 2). Sternal shield trapezoidal, 41 long at middle and 50 long at level of posterior corners, 101 wide at anterior margin and 120–125 wide at posterior margin; shield with st_1 (39 long) and st_2 (54 long) smooth, and 2 pairs of lyrifissures (lyrifissures iv_1 , iv_2); setae st_3 and st_4 (47 long) on soft cuticle; distance st_1 – st_1 54, st_2 – st_2 102 and st_1 – st_3 106. Genital shield with anterior border membranous with a triangular lobe which extends to middle of sternal shield; total length, including lobe, 290–329, width at level of st_4 82–120, at level of st_5 31–61 wide; genital setae (43 long) and lyrifissures off the shield, between coxae

IV. Endopodal strips between coxae I and II and between coxae II and II absent; endopodal IV well developed, fused with peritrematal shield bearing glands *gv2*. Metapodal shields present. Anal shield narrow, 143 long, 79–87 wide; circumanal setae 44 long; glands *gv3* at level of post-anal seta; cribrum present; anal valves nude. Opisthogastric region markedly hypertrichous, with ventral setae smooth, thin, 39–54 long. Peritrematal shield reduced, fused with endopodal IV, with two pairs of distinctive lyrifissures *ip*; peritremes narrow, 190 long (including the stigmata), extending to middle of coxae II.

TABLE 1. Collecting data for mites and lizards. * = holotype; PN: mites protonymphal instar.

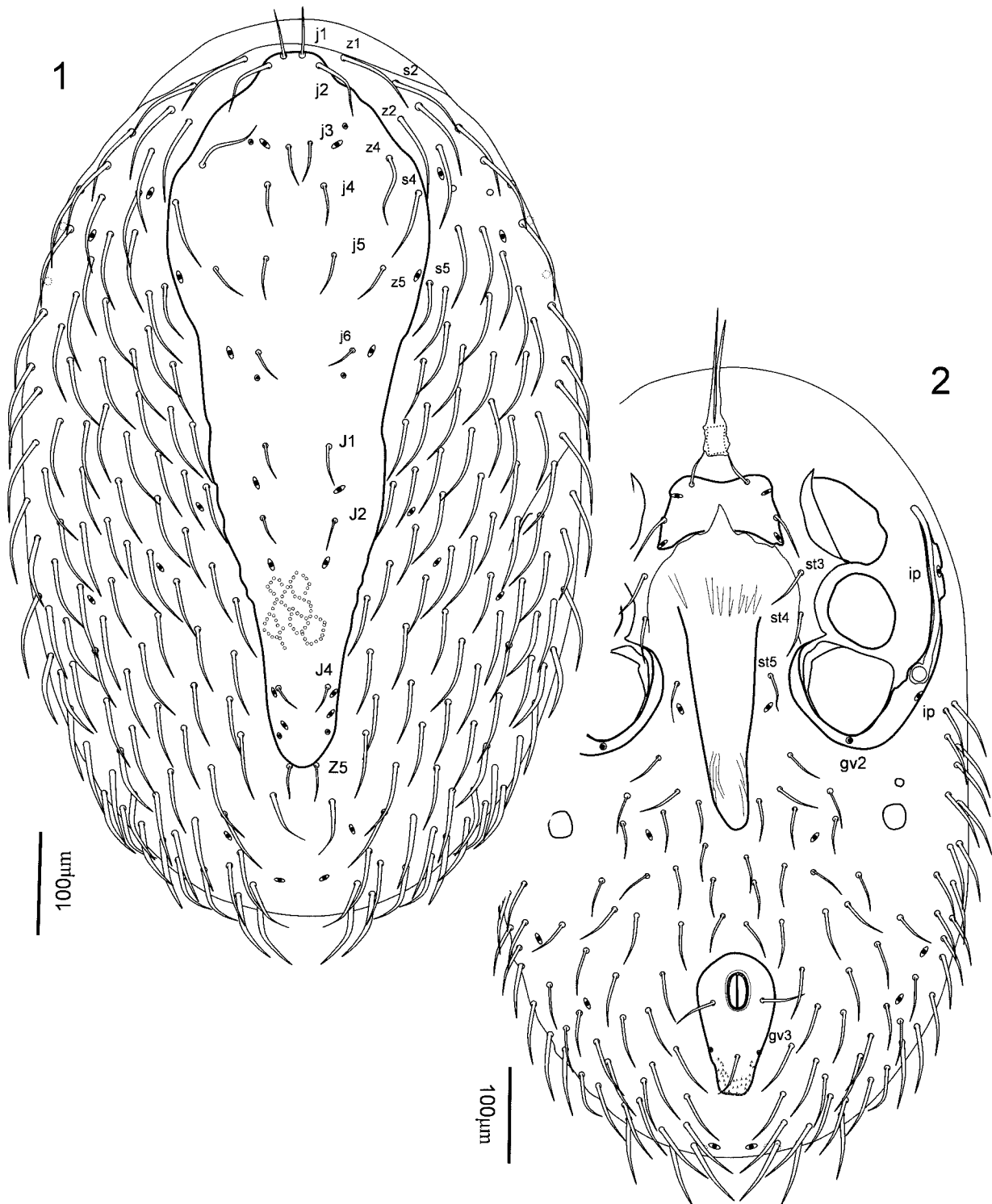
<i>O. schreibericolus</i>			<i>Lacerta schreiberi</i>			Location	
PN	♀	♂	lizard ID	Date captured	Sex	Latitude N	Longitude W
7			60430025	2006/04/30	♂	40°19'52"	7°5'59"
			60430033	2006/04/30	juvenile	40°19'52"	7°5'55"
1	1		60430025	2006/04/30	♂	40°19'52"	7°5'59"
6			60502034	2006/05/02	♂	40°19'32"	6°44'13"
17			60502046	2006/05/02	♂	40°19'35"	6°44'13"
5			60502047	2006/05/02	♂	40°19'39"	6°44'8"
		1	60502046	2006/05/02	♂	40°19'35"	6°44'13"
15			60507082	2006/05/07	escapee	40°23'40"	7°3'25"
			60507083	2006/05/07	♂	40°23'38"	7°3'24"
11			60507089	2006/05/07	♂	40°19'20"	7°1'12"
12		1	60507101	2006/05/07	♂	40°23'58"	7°3'43"
8			60507085	2006/05/07	♀	40°19'14"	7°1'1"
2			60507081	2006/05/07	♀	40°19'20"	7°1'13"
10			60507091	2006/05/07	♀	40°19'20"	7°1'12"
			60507092	2006/05/07	♂	40°19'21"	7°1'14"
1			60507090	2006/05/07	♂	40°19'20"	7°1'12"
5			60507076	2006/05/07	♂	40°23'46"	7°3'22"
			60507077	2006/05/07	♀	40°23'46"	7°3'22"
5			Lag07-78	2007/05/07	♀	40°19'36"	6°47'31"
2			Lag07-81	2007/05/07	♀	40°19'40"	6°47'36"
	1		Lag07-129	2007/05/10	♀	40°17'24"	6°56'25"
	2*	3	Lag07-57	2007/05/--	♀	40°19'20"	6°50'58"
17			Lag07-28	2007/05/04	♂	40°16'28"	6°50'45"
8			Lag07-30	2007/05/--	♂	40°16'29"	6°50'45"
7			Lag07-33	2007/05/--	♂	40°16'28"	6°50'46"

Gnathosoma. Tritosternum with hyaline border, base 36 long with two setulose laciniae 11 long. Palps 128 long; chelicerae 54 long.

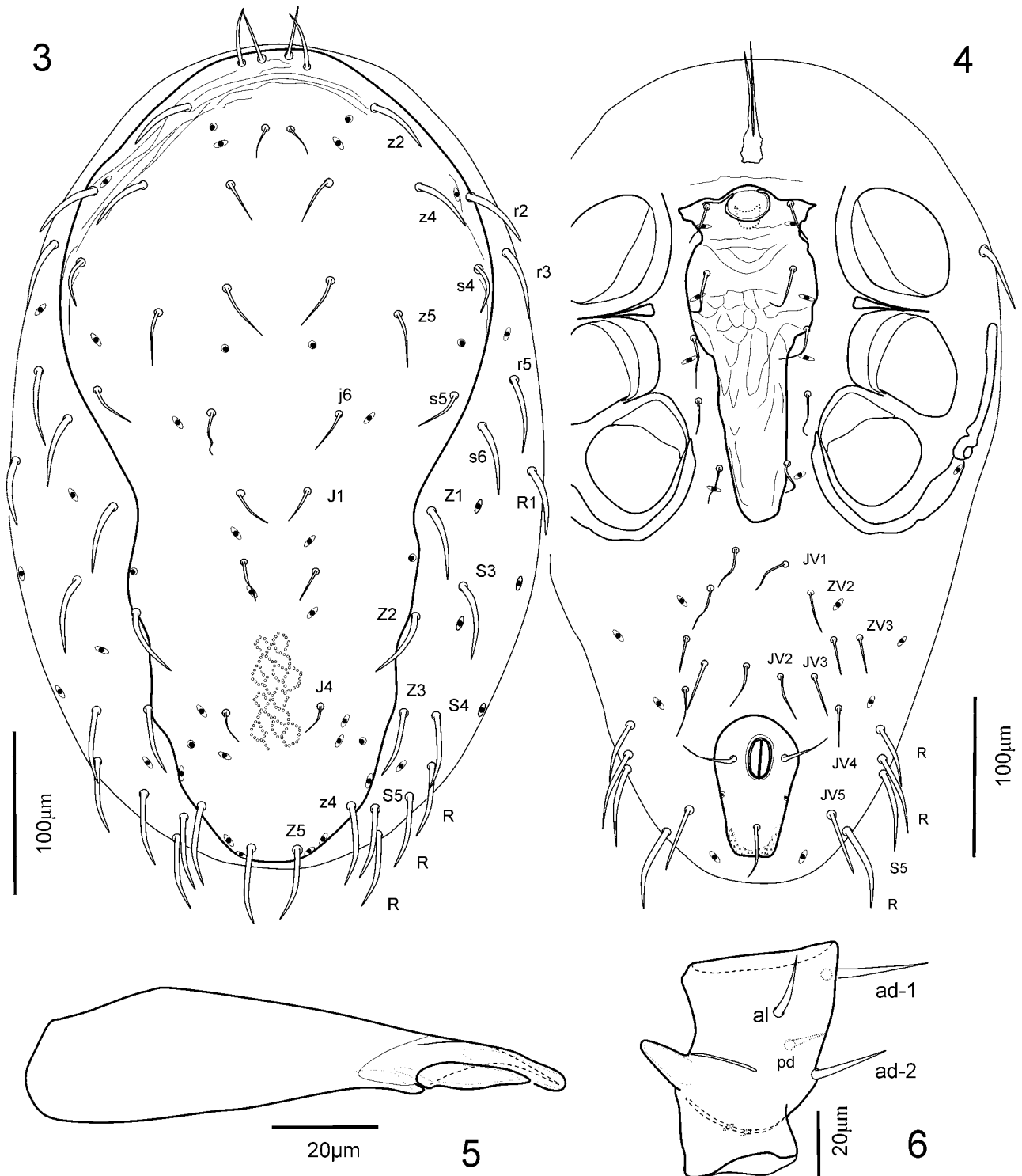
Legs. Legs I–IV with well-developed paired claws and lobulate pulvilli. Tarsus I with apical desclerotization. Setation of trochanters of legs, respectively, 6-5-5-5; femur, 12-10-5-6; genua, 2 3/2 2/1 2 (12) - 2 3/1 2/1 2 (11)- 2 2/1 2/1 2 (10) - 2 2/1 3/1 2 (11); tibia, 2 3/2 2/1 2 (12)- 2 2/1 2/1 2 (10) - 2 1/1 2/1 2 (9) - 2 1/1 3/1 2 (10). Length of legs I–IV respectively: 599, 539, 459, 571.

Adult male. *Dorsal idiosoma* (Fig. 3). Idiosoma 503–518 long, 297–305 wide between coxae II and III. Dorsal shield 500–517 long, 266–319 wide at level of setae *s4* and *ca*. 171 at level of *J1*. Dorsal ornamentation as in female, with fine striate on the anterior region. Dorsal shield with irregular lateral margins

and 16–19 pairs of dorsal setae: $j1$ (ca. 32) $\leq j2$ (ca. 34) $> j3$ (ca. 19) $< j4$ (ca. 30) $< j5$ (ca. 36) $> j6$ (ca. 27); $J1=J2=J4$ (19–21); $z2 = z4$ (ca. 40), $z5$ (ca. 34), $Z4$ (ca. 48), $Z5$ (ca. 50); setae $Z1 = Z2 = Z3$ on or off shield (43–46); $s4=s5$ (30–34); other dorsal setae on soft cuticle 43–46 long. Podonotal region with a protonymphal complement of setae; marginal setae on the shield and setae on soft cuticle thicker than central setae and with a blunt tip. Shield with 15 pairs of discernible pore-like structures (6 podonotal and 9 opisthonotal), of which 10 (3 podonotal, 7 opisthonotal) superficially appear non-secretory (lyrifissures) and 5 (3 podonotal and 2 opisthonotal) are secretory (gland pores).



FIGURES 1-2. *Ophionyssus schreibericolus* Moraza **sp. nov.**, adult female: 1, idiosoma, dorsal aspect; 2, idiosoma, ventral aspect.



FIGURES 3–6. *Ophionyssus schreibericolus* Moraza **sp. nov.**, adult male: 3, idiosoma, dorsal aspect; 4, idiosoma, ventral aspect; 5, chelicera, latero-antiaxial view; 6, femur III, anterolateral view.

Ventral idiosoma (Fig. 4): Sterno-genital shield 211 long, 81 wide at level of *st2*, 35 wide at level of *st5*, with irregular lateral margins and free from the well-developed endopodal II; shield with an striate network in its anterior third, two pairs of lyrifissures and two (*st1* and *st2*) or three (*st1*, *st2* and *st3*) pairs of setae; setae *st1*, *st3* and *st4* ca. 24 long, *st2* longer (31 long), *st5* ca. 22 long; poroid *iv3*, together with *st4* and *st5*, always off the shield and posterior to setae *st3*; genital aperture large, 26 wide. Anal shield as in female, 87 long, 52 wide; para-anal setae 24 long, post-anal seta 33. Seven pairs of ventral setae: *JV1*–*JV4*, *ZV2*–*ZV3* thin, 24–28

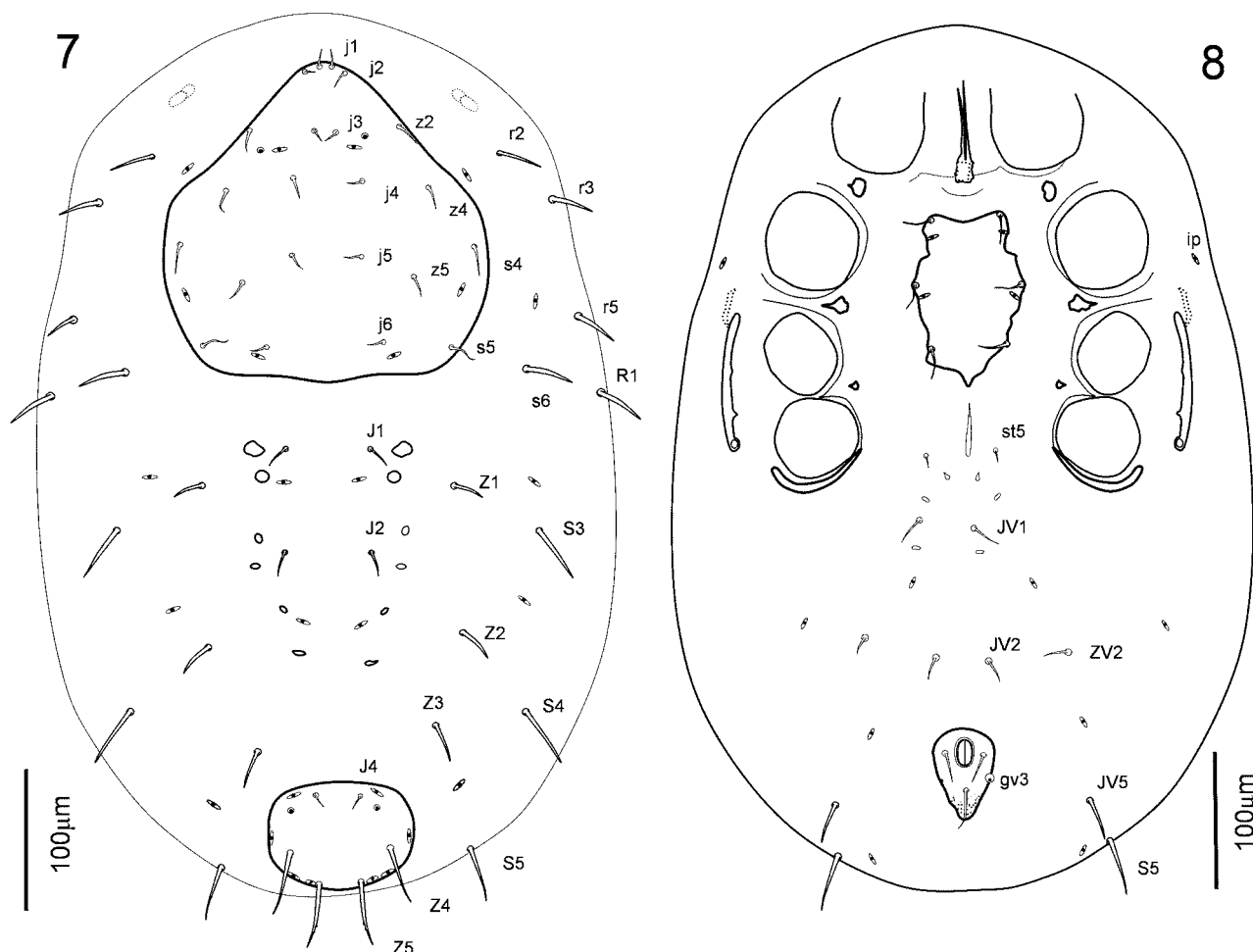
long; *JV5* thicker and longer, *ca.* 42; venter with 4 pairs of lyrifissures. Endopodal II present; peritrematal shields fused with podal IV; peritreme extends to anterior border of coxa III, 87 long.

Gnathosoma. Chelicerae total length (including digits) 104 (Fig. 5); movable digit 22 long, as long as pointed spermatodactyl; fixed digit with a rounded tip.

Legs. Legs I–IV with well-developed, paired claws and lobulate pulvilli. Setation of trochanter of legs, respectively, 6-5-5-5; femur, 12-10-4-6; genua, 2 3/1 2/1 2 (11) - 2 3/1 2/1 2 (11)- 2 2/1 2/1 2 (10) - 2 2/1 3/1 2 (11); tibia, 2 3/1 2/1 2 (11)- 2 2/1 3/1 2 (11) - 2 1/1 2/1 2 (9) - 2 1/1 3/1 2 (10). Femur III with a conical, thumb-like ventral spur (Fig. 6). Length of legs I–IV (excluding claws) respectively: 455, 341, 370, 493.

Protonymph. Idiosomal length for non-engorged mites 617 long, 406 wide.

Dorsum (Fig. 7). Podonotal shield pentagonal, as long as wide (230 long, 230 wide), with a polygonal, reticulate sculpture and 11 pairs of short, smooth, thin setae: setae *j1-j6 ca.* 11 long; *z2, z4, z5* 17 long; *s4* and *s5* 22 long; 3 pairs of lyrifissures, and 1 pair of glands (*gdj3*). Pygidial shield 103 long, 76 wide, with 3 pairs of setae: *J4* thin, short, 11 long; *Z5* and *Z4* subequal, thicker, slightly barbed, 41–44 long; 5 pairs of pore-like structures (4 lyrifissures and 1 pair of glands). Soft dorsal cuticle with 4 pairs of minute mesonotal platelets. Setae *J1* and *J2* thin, 19 long; other dorsal setae *s6 (ca. 33), r2, r3, r5 (ca. 27 long); Z1-Z3 (ca. 25 long), S3-S5 (ca. 44 long)* and *R1 (ca. 33 long)* on the soft dorsal cuticle longer and thicker. Seven pairs of lyrifissures on soft cuticle, 2 are podonotals, 5 opisthontal.



FIGURES 7–8. *Ophionyssus schreibericolus* Moraza **sp. nov.**, protonymph: 7, idiosoma, dorsal aspect; 8, idiosoma, ventral aspect.

Ventral idiosoma (Fig. 8). Sternal shield with 3 pairs of thin setae (*st1, st2* and *st3*) 19 long, and 2 pairs of lyrifissures (*iv1, iv2*); shield 95 long, 82 wide at level of setae *st2*. Genital setae minute, 11 long; setae *JV1,*

JV2 and *ZV2* 19–21 long; setae *ZV5* thicker and longer, 29 long. Poststernal sclerites may be present on genital region, between setae *st5* and *JVI*. Anal shield 66 long, 45 wide; para-anal setae 21 long, post-anal seta *ca.* 29 long; 4 pairs of ventral lyrifissures present. Endopodal I–IV present, slightly sclerotized. Peritreme 103 long, from middle of coxae IV to anterior border of coxae III; peritrematal lyrifissure present.

Legs. Setation of trochanters of legs, respectively, 4-4-4-4; that of femur, 2 2/1 2/2 1 (10), 1 1/1 2/2 1 (8), 1 1/2 1/0 0 (5), 0 1/1 2/0 0 (4); genua, 2 2/1 2/1 1 (9) - 1 2/0 2/0 1 (6), 1 2/0 2/0 1 (6), 1 2/0 2/0 1 (6); tibia, 1 2/1 2/1 1 (8), 1 1/1 2/1 1 (7), 1 1/1 2/1 1 (7) - 1 1/1 2/1 1 (7); tarsi II–IV, 3 3/2 1/1 3/2 3 (18). Setae *ad1* and *pd1* on femur I, setae *ad1*, *pd1* and *pd2* on femur II, and seta *ad1* on femur III and IV longer and thicker than other dorsal setae on the segment.

Etymology. The species name “*schreibericolus*” refers to the mite's relationship with the host species, *Lacerta schreiberi*, Schreiber's green lizard, “*icolus*” -of, -dwelling in.

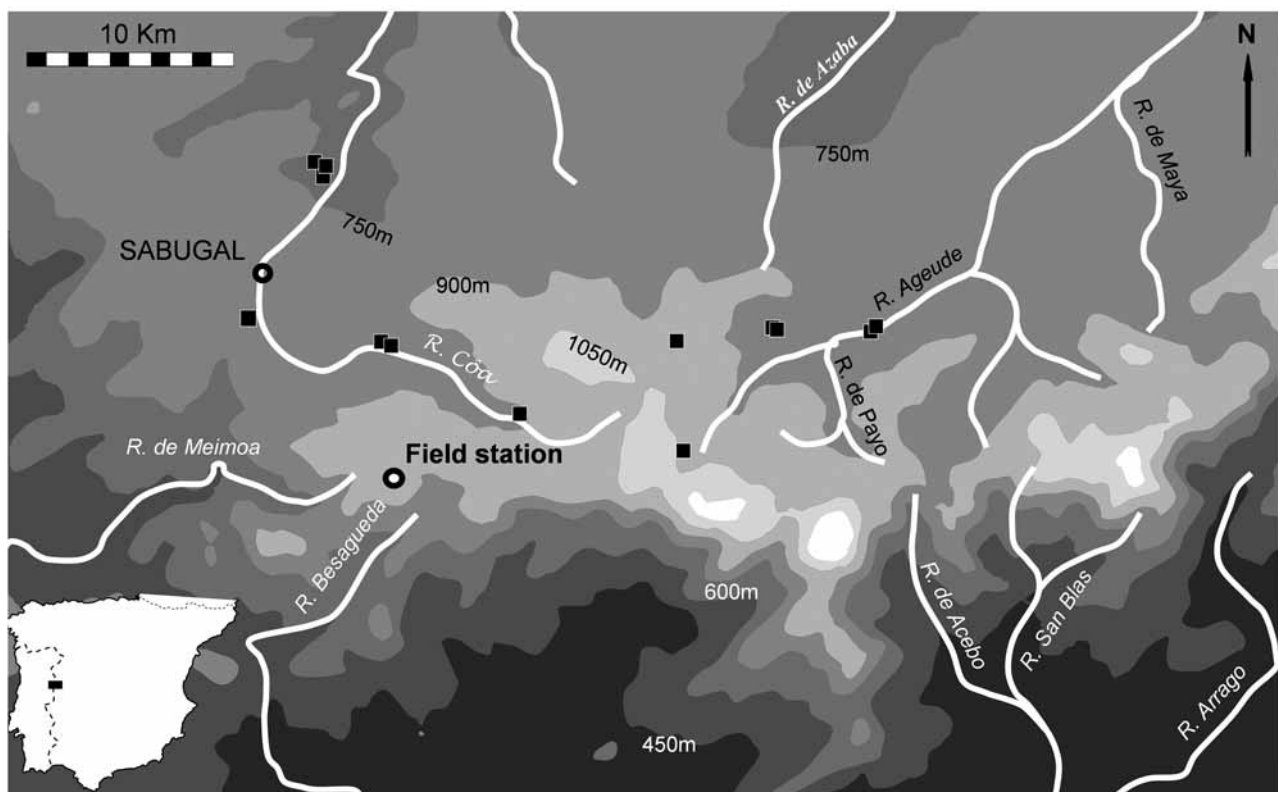


FIGURE 9. Sampling locations of *Lacerta schreiberi* (squares) in the Malcata region, near Sagubal. Inset: location of field area in Iberian Peninsula (dark rectangle).

Remarks. The new species is closely related to *O. dolatelacensis*, *O. sauracum* and *O. lacertinus*, with 12–13 pairs of setae on the dorsal shield and peritremes that extend as far as the anterior border of coxae II in the female. However, males of these three species lack ventral spur on femur III. In females of *O. dolatelacensis* the anterior epyginal lobe is rounded, females and males have shorter peritremes, and males have 5 ventral setae and ventral conical setae on femur III. The female of *O. lacertinus* has setae *s5* and *z2* on the shield and *J4* and *Z5* are minute, one-third the length of *J2*; males with 23 pairs of setae on dorsal shield, and femur III with an enlarged ventral, spur-like setae. The female of *O. sauracum* has *s5* on the dorsal shield, 2 postero-lateral setae on tibia IV (compared with 3 setae on the new species) and with smaller genital and anal shields; males have conical, spine-like ventral setae on femur III and IV; and protonymphs have two setae on pygidial shield (*J4* and *Z5*).

During the 2006 sampling period, 127 lizards were inspected for mites. At least one mite, either on the lizard or in its transport bag, was detected for 83 lizard specimens—a 65.35% frequency per individual.

Analyzing data from Table 1, the average parasite load is 6 mites/host. This is the first record of the genus *Ophionyssus* on any host taxa from the Iberian Peninsula and it would likely be found on other species of lizards of the region.

Differences among the species of *Ophionyssus* are highlighted in the following key to females, males and protonymphs. The key is based on previous published descriptions, and on examined females and protonymphs of *O. natricis*. *Ophionyssus viperae* Miron & Ivan 2003, found on *Vipera ursinii* in Romania is a synonym of *O. natricis* (new synonymy).

Key to females of *Ophionyssus*

1. Dorsal shield of female divided into a large anterior and minute pygidial shields 2
 - Dorsal shield of female entire 6
2. Podonotal shield with 10 pairs of setae, two pairs of minute mesonotal scutellae and pygidial shield with 1 or 2 setae or nude; sternal shield ratio width/length: 2.5; peritreme extending to posterior margin of coxae II; podonotum 300 long, 276 wide; on snakes in Africa; in vivaria all over the world *O. natricis* (Gervais, 1844)
 - Anterior dorsal shield with other characteristics; mesonotal scutellae absent 3
3. Anterior dorsal shield roughly pentagonal with 12–13 pairs of setae (z_2 on or off shield); pygidial shield with setae Z_5 or one seta Z_5 or nude; dorsal soft cuticle hypertrichy absent, with Z_1 – Z_4 , s_6 , S_3 – S_5 , r_2 , r_3 , r_5 , R_1 , and deutonymphal setae R ; sternal shield ratio width/length: 2–2.5; peritremes shortened, confined to region of coxae IV; idiosoma 687 long, 440 wide; on Scincidae, Java *O. javanensis* Micherdzinsli & Lukoschus, 1987
 - Podonotal shield with 7–8 pairs of setae; pygidial shield nude 4
4. Anterior dorsal shield with 8 pairs of setae, roughly rhomboidal: setae j_1 off the shield; 2 pairs of opisthonotal setae on the shield; sternal shield ratio width/length: 1.5–2; peritremes extending to anterior border of coxae III; female 870 long, 595 wide; on Scincidae, South Africa *O. mabuyae* Till, 1957
 - Podonotal shield with 8 pairs of setae: 1 pair of opisthonotal setae J on the shield 5
5. Anterior dorsal shield with 7–8 pairs of setae; setae j_1 off the shield, only one seta j_2 may be present; dorsal setae on soft cuticle elongate, except 3 pairs of short setae (s_4 , s_5 , J); sternal shield ratio width/length: 1.5–2; peritremes shortened, confined to region of coxae IV; dorsal shield 405–450 long, 255 wide; on Scincidae, Australia
 - *O. arnhemlandensis* Domrow, 1985
 - Anterior dorsal shield ovoid; setae j_1 on anterior margin of podonotal shield; setae j_2 absent; most dorsal setae on soft cuticle as long as setae on the shield; sternal shield ratio width/length: 1.5–2; peritremes extending to middle of coxae III; dorsal shield 700–820 long; on Lacertidae and Agamidae; Asia *O. eremiadis* Naglov & Naglova, 1960
6. Dorsal shield with 24–30 pairs of setae; genital setae on genital shield 7
 - Dorsal shield shortened, with fewer than 24 pairs of setae (11–15 pairs of setae); genital setae off genital shield 9
7. Dorsal shield with reticulate surface and 30 pairs of dorsal setae including 14 pairs on opisthonotal region (J_5 present); at least 16 pairs of ventral setae on soft cuticle; sternal shield ratio width/length: 4.5–5; peritremes extending to posterior margins of coxae II; dorsal shield 520–555 long; on Scincidae, South Australia
 - *O. ehmanni* Domrow, 1985
 - Dorsal shield elongated, with 24–25 pairs of setae; setae J_5 present or absent; peritremes extending to anterior border of coxae I 8
8. Setae J_5 absent; dorsal shield with 23–24 pairs of setae including 11 pairs of opisthonotal setae; ventra soft cuticle with hypertrichy; sternal shield ratio width/length: 3.5–4; genu IV, pl_2 present; dorsal shield 675 long, 322 wide; on Pygopodidae, New Zealand *O. galeotes* Domrow *et al.*, 1980
 - Setae J_5 present; dorsal shield with 25 pairs of setae, including 13 pairs of opisthonotal setae; sternal shield ratio width/length: 2–2.5; genua IV, pl_2 absent; dorsal shield 758 long, 352 wide; on Scincidae, New Zealand, Tasmania and South Australia *O. scincorum* Domrow *et al.*, 1980
9. Dorsal and ventral setae on soft posterior cuticle very long, thick and spine-like; 11–13 pairs of heterogeneous setae on the shield; sternal shield ratio width/length: 7–8.5; peritremes extends to the anterior border of coxae II; dorsal shield 525 long, 255 wide; Lacertidae, South Africa *O. tropidosaurae* (Till, 1957)
 - Setae on soft posterior cuticle slender; sternal shield longer 10
10. Peritremes not extending beyond anterior border of coxae III; sternal shield ratio width/length: 2–2.5; para-anal setae level with middle of anal opening; dorsal shield with 11 pairs of fine setae; those of soft cuticle much longer and thicker; dorsal shield 586 long, 290 wide; Scincidae, South Africa *O. lawrencei* (Till, 1957)
 - Peritremes extending beyond anterior border of coxae III; para-anal setae level with anterior or posterior borders of anal opening 11
11. Peritremes extending to anterior border of coxae I; anal pores level with posterior margin of anal opening 12

- Peritremes extending as far as anterior border of coxae II 14
- 12. Dorsal shield with 13 pairs of setae; sternal shield trapezoidal with straight anterior border, ratio width/length: 3–3.5; genital shield 120 long; anal shield 125 x 80; hypertrichy on ventral soft cuticle present; dorsal shield 570 long, 315 wide (ratio 1.5–2); on Cordylidae, South Africa *O. africanus* (Till, 1957)
- Dorsal shield with 14–15 pairs of setae; genital shield at least twice as long as 120 13
- 13. Dorsal shield with 15 pairs of setae, setae *s5* and *z2* on dorsal shield, *Z5* off shield; sternal shield rectangular with slightly concave anterior border, ratio width/length: 3; genital shield 280 long; anal shield 115 x 69; dorsal shield 600 long, 280 wide (ratio 2–2.2); on Lacertidae, Gran Canaria (Canary Islands)..... *O. setosus* Fain & Bannert
- Dorsal shield with 14 pairs of setae, setae *s5* and *Z5* on shield, *z2* off shield; sternal shield trapezoidal with anterior border concave, ratio width/length:3–3.5; genital shield 270 long; anal shield 120 x 60; dorsal shield 558 long, 300 wide (ratio 1.5–1.9); on Lacertidae, Tenerife (Canary Islands) *O. galloticolus* Fain & Bannert
- 14. Peritremes extending to anterior margin of coxae II; dorsal shield with 14–15 pairs of setae (*z2*, *s5* and one or 2 setae *Z5* on shield; sternal shield, ratio width/length: 3; genital shield 144 long; anal shield 160 x 84; tibia IV with 3 postero-dorsal setae; dorsal shield 696 long, 264 wide (ratio 2.6); on Lacertidae, Europe *O. lacertinus* (Berlese)
- Peritremes extending as far as anterior third of coxae II; dorsal shield with 12–13 pairs of setae; setae *z2* off dorsal shield 15
- 15. Dorsal shield with 12 pairs of setae (*z2*, *s5*, *Z5* off shield); peritremes extending to posterior third of coxae II; sternal shield slightly trapezoidal with anterior border concave, ratio width/length: 2.5; genital shield 350 long, with rounded anterior pyginal lobe; anal shield 138 x 75; dorsal shield 633 x 225–246 wide (ratio 2.4); on Lacertidae, Lanzarote (Canary Islands) *O. dolatellacensis* Fain & Bannert
- Dorsal shield with 12–13 pairs of setae; peritremes longer; sternal shield, ratio width/length: 2.5–3 16
- 16. Dorsal shield with 13 pairs of setae (*s5* on shield, *z2* and *Z5* off shield); peritremes extending to approx. anterior third of coxa II; genital shield 150 long, 60 wide; anal shield 105 x 75; tibia IV with 2 postero-dorsal setae; dorsal shield 670 long, 192 wide (ratio 2.6); on Lacertidae, Europe *O. sauracum* (Oudemans)
- Dorsal shield with 12–13 pairs of setae (*z2* and *s5* off shield, *Z5* on or off shield); peritremes extend to middle of coxa II; genital shield 329 long; anal shield 143 x 79; tibia IV with 3 postero-dorsal setae; dorsal shield 700 x 259 wide (ratio 2.7); on Lacertidae, Iberian Peninsula *O. schreibericolus* Moraza **sp. nov.**

Key to males of *Ophionyssus*

1. Holoventral shield present with 13 pairs of setae plus post-anal seta; femur III with ventral spur; dorsal shield with 44 pairs of setae 2
 - Holoventral shield absent; sternogenital with 2–3 pairs of setae; femur III ventral spur present or absent 3
2. Genu IV, seta *pl-2* present; peritremes extend to anterior half of coxae II; holoventral shield 490 long; dorsal shield 605 long, 345 wide *O. galeotes*
 - Genu IV, seta *pl-2* absent; peritremes extend to just beyond posterior margins of coxae II; holoventral shield 490–535 long; dorsal shield 600–635 long, 385–405 wide *O. scincorum*
3. Femur III ventral spur present 4
 - Femur III ventral spur absent 6
4. Dorsal shield with 17–19 pairs of setae; shield 689 long, 254 wide; 11–13 pairs of dorsal setae on soft cuticle; peritremes extend to anterior third of coxae III; 7–8 pairs of ventral setae; femur III ventral spur thumb-like in shape *O. schreibericolus*
 - Dorsal shield with 24 pairs of setae; peritremes extend to anterior margin of coxae III; 9–10 pairs of ventral setae on soft cuticle; femur III with strong curved spur 5
5. Sternogenital shield 186 long; anal shield 78 x 45; dorsal shield 460 long, 255 wide; 7–8 pairs of ventral setae *O. galloticolus*
 - Sternogenital shield 195 long; anal shield 84 x 50; dorsal shield 485 long, 290 wide *O. setosus*
6. Sternogenital shield with 2 pairs of setae (*st1*, *st2*) 7
 - Sternogenital shield with 3 pairs of setae (*st1-st3*) 10
7. Dorsal shield with 13–14 pairs of setae, 412 long, 255 wide; peritremes extend to posterior half of coxae III; 6–7 pairs of ventral setae; tarsus II–IV with ventral setae inflated basally and set on slight prominences *O. arnhemlandensis*
 - Dorsal shield with more than 14 pairs of setae; tarsus II–IV without ventral setae inflated basally and set on slight prominences 8
8. Femur III and sometimes IV with spine-like or spur-like ventral setae 9
 - Femur III and IV without modified ventral setae; dorsal shield with 17 pairs of setae; shield 204 long, 240 wide; peritremes extend to anterior border of coxae III; at least 11 pairs of ventral setae *O. natricis*

9. Dorsal shield with 15 pair of setae; shield 442 long, 219 wide at level of *r*₂; peritremes extend to middle of coxae III; 5 pairs of ventral setae; femora III and IV with conical spine-like ventral setae *O. dolatelacensis*
- Dorsal shield with 23 pairs of setae, 1 or more additional unpaired setae may be present on margin of opisthotal region; shield 516 long, 250 wide; peritremes extend to posterior margin of coxae II; 7 pairs of ventral setae; femora III with enlarged, spur-like ventral setae..... *O. lacertinus*
10. Dorsal shield with 16 pairs of setae; shield 528 long, 264 wide; peritremes extend to anterior margin of coxae III; 5–6 pairs of ventral setae; femora III and IV with conical, spine-like ventral seta..... *O. sauracum*
- Dorsal shield with 17 pairs of setae; peritremes extend to middle of coxae III; 8 pairs of ventral setae... *O. eremialis*
- Dorsal shield with 19 pairs of setae; male with *S*₅ conspicuously elongate; peritremes confined to coxae IV; 10 pairs of ventral setae *O. javanensis*

Key to protonymphs of *Ophionyssus*

1. Pygidial shield with 2 pairs of setae 2
- Pygidial shield with 3–5 pairs of setae 3
2. Setae *J*₄ and *Z*₅ on pygidial shield; *J*₄ ca. 1/3 the length of *Z*₅; pygidial shield as long as wide (84 x 81) and four times narrower than podonotal shield (213 x 180, ratio 1.2) *O. sauracum*
- Setae *Z*₄ and *Z*₅ on pygidial shield; both pairs elongate, similar in length, and 2.5 times *J*₄; shield wider than long (84 x 52) and twice as narrow as podonotal shield (181 x 8.4, ratio 2.1)..... *O. javanensis*
3. Pygidial shield with 5 pairs of setae: *J*₅, *Z*₄, *Z*₅, *S*₄, *S*₅; *Z*₅ elongate, thicker and barbed; *J*₅ minute; *Z*₄=*S*₄<*S*₅=1/3 *Z*₅; shield wider than long, with concave posterior margin *O. scincorum*
- Pygidial shield with 3 pairs of setae: *Z*₄, *Z*₅, *S*₅; setae *Z*₄<*S*₅<*Z*₅, *Z*₅= 2.5 times *Z*₄ and 1.6 times *S*₅; pygidial shield 65 x 115, twice narrower than podonotal shield *O. galeotes*
- Pygidial shield with 3 pairs of setae: *J*₄, *Z*₄, *Z*₅..... 4
4. Posterior pairs of setae *Z*₅ on pygidial shield subequal in length to *Z*₄ and 4 times the length of *J*₄; shield 76x103, ratio 0.7; podonotal shield as long as wide (230x230) *O. schreibericolus* **sp. nov.**
- Posterior pairs *Z*₅ on pygidial shield longer than *Z*₄ 5
5. Setae *Z*₅ slightly longer than *Z*₄ 6
- Setae *Z*₅ conspicuously longer than *Z*₄ 7
6. Setae *Z*₅ twice the length of *J*₄; *J*₄=1/3 the length of *Z*₄; pygidial shield as long as wide (87 x 82), three and a half as narrow as podonotal shield (300 x 216, ratio 1.4) *O. dolatelacensis*
- Setae *Z*₅ = 3 times the length of *J*₄; *J*₄=1/2 the length of *Z*₄; setae *z*₂ on podonotal shield; pygidial shield 63 x 75; podonotal shield 204 x 192..... *O. natricis*
7. Setae *Z*₅ = 2 times longer than *Z*₄; *Z*₅ =3 times longer than *J*₄; pygidial shield 71 x 124, ratio 0.6; setae *z*₂ off podonotal shield; podonotal shield 219 x 243 *O. eremiadis*
- Setae *Z*₅ = 2.5 to 3 times longer than *Z*₄; setae *z*₂ on podonotal shield..... 8
8. Setae *Z*₅ (29 long) = 3 times longer than *Z*₄ and *J*₄; *J*₄ (6–8 long) <*Z*₄ (9 long); pygidial shield 54 x 72; podonotal shield 192 x 168 *O. galloticolus*
- Setae *Z*₅ (35 long) = 2.7 times longer than *Z*₄ (13 long) and 3.5 longer than *J*₄ (10); pygidial shield 70 x 90; podonotal shield 210 x 195 *O. setosus*

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