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Four new species of the feather mite genus *Sokoloviana* Dubinin, 1951 (Pterolichoidea; Ptiloxenidae) from waders (Charadriiformes; Charadrii)

Jacek Dabert and Rainer Ehrnsberger

Kurzfassung: Es werden vier neue Arten der Gattung *Sokoloviana* (Pterolichoidea; Ptiloxenidae) von Vögeln der Unterordnung Charadrii (Charadriiformes) beschrieben: *Sokoloviana cornuta* sp. nov. von Schlammstelzer *Cladorhynchus leucocephalus; Sokoloviana ibidorhynchae* sp. nov. von Ibisschnabel *Ibidorhyncha strutersi; Sokoloviana chilensis* sp. nov. von Cayannekiebitz *Vanellus chilensis* und *Sokoloviana vanelli* sp. nov. von Rotlappenkiebitz *Vanellus indicus atronuchalis*. Für alle bisher beschriebenen Arten wird ein Bestimmungsschlüssel aufgestellt.

Abstract: Four new species of the genus *Sokoloviana* (Pterolichoidea; Ptiloxenidae) from waders suborder Charadrii (Charadriiformes) are described: *Sokoloviana cornuta* sp. nov. from the Banded Stilt, *Cladorhynchus leucocephalus; Sokoloviana ibidorhynchae* sp. nov. from the Ibis-bill, *Ibidorhyncha* strutersi; Sokoloviana chilensis sp. nov. from the Southern Lapwing, *Vanellus chilensis* and *Sokoloviana vanelli* sp. nov. from the Red-wattled Lapwing, *Vanellus indicus atronuchalis.* A key to all described species is given.

Key words: Taxonomy, feather mites, *Sokoloviana*, Ptiloxenidae, waders.

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1 Einleitung

Die Federmilben gehören zu den Astigmata-Milben, die sehr verschiedene Lebensräume besiedeln. Neben den Federmilben sind weitere Vertreter der Acaridida die Vorratsmilben, Hausstaubmilben, Räudemilben, Krätzmilben, Vogelparasiten sowie Milben, die im Boden und organischen Substraten leben und beim Abbau der organischen Stoffe beteiligt sind.

Die Federmilben leben auf der Haut der Vögel oder besiedeln die Federn auf den Fahnen oder leben im Federkiel. Der Schaden für die Wirte ist in den meisten Fällen unerheblich. Oft ist eine spezifische Zuordnung der Federmilben zu ihren Wirten festzustellen, was als gemeinsame Evolution von Wirten und Parasiten (Co-Speziation) zu verstehen ist. Die Milben der Überfamilie Pterolichoidea mit der Familie Ptiloxenidae sind Bewohner der Schwungfedern.

Die Gattung *Sokoloviana* wurde 1951 von Dubinin mit der Typus-Art *Pterolichus rehbergi* Cannestrini & Berlese,1880 aufgestellt. Die Gattung umfaßt neun beschriebene Arten, die ausschließlich auf Federfahnen von Watvögeln der Unterordnung Charadrii leben. In der vorliegenden Arbeit beschreiben wir vier neue Arten der Gattung *Sokoloviana* und ergänzen die Liste der Wirte der bisher bekannten Federmilben.

Bei den Federmilben der Gattung *Sokoloviana* kommen Männchen und Weibchen vor. Die dorsalen Schilder sind in beiden Geschlechtern gut ausgebildet. Es sind alle Borsten am Körper vorhanden. Die lateralen und dorsalen Borsten sind kurz. Auf der Dorsalseite befinden sich vier Paar von Spaltsinnesorganen. Die Borsten *c3* sind kurz und dick. Die Opisthonotaldrüsen sind gut entwickelt und stark sklerotisiert. Diese stark sklerotisierten und gerippten Strukturen der Drüsen hat Dubinin (1951, 1956) falsch interpretiert als zusätzliche saugnapfähnliche Borsten auf den Coxalfeldern IV. Dieser Fehler ist bisher noch nicht formal korrigiert worden, weder in Dubinins weiteren Veröffentlichungen noch von anderen Autoren.

Das Sternum ist Y-förmig. Die Schilder der Coxalfelder I und II sind sehr schwach entwickelt. An den Beinen befinden sich keine Apophysen, die Beborstung der Beine ist komplett (bis auf die Borsten e auf den Tarsen der Beine IV beim Männchen). Die Borsten *cGI* sind dick, messerförmig, die Borsten *cGII* haarförmig.

Männchen. Am Hinterende befinden sich die großen Opisthosomalloben. Auf ihnen können lateral und terminal kleine Membranen liegen und quer verlaufende Sklerite an ihrer Basis. Auf der Dorsalseite der Loben liegt ein unterschiedlich gestaltetes, perforiertes Cribrum (lateinisch Sieb) (Figs. 2, 6, 10, 14). Die schlitzförmige supraanale Einschnürung ist vorhanden. Die Borsten *f2* sind verbreitert; die Borsten *h2* und speziell *h3* können Membranen tragen. Die Borsten *ps1* sind verdickt, deren Spitzen immer nach vorn zeigen. Das Genitalorgan ist sehr kurz, es liegt im vorderen Bereich der Coxalfelder IV und wird von den Paragenital-Skleriten umgeben. Die Analsaugnäpfe sind groß, mit vielen kleinen Verdickungen auf der Corolla und außen mit einer radialen Streifung versehen. Auf der Ventralseite des Opisthosomas sind Sklerite vorhanden. Auf den Tarsen der Beine IV sind die Borsten *d* kurz und pfriemförmig, die Borsten *e* fehlen.

Weibchen. Körper mit leicht verbreitertem Opishosoma. Der terminale Einschnitt ist vorhanden, ebenso die ringförmige supraanale Einschnürung. Das Epigynium ist gut entwickelt und hat eine hufeisenförmige Gestalt. Die umgebenen Skerite besitzen nach vorn gebogenen Ecken.

Alle Maße werden in µm angegeben.

2 Introduction

The genus *Sokoloviana* was established by Dubinin in 1951 with the *Pterolichus rehbergi* Canestrini & Berlese, 1880 as a type species. The genus includes 9 described species that exclusively inhabit feather vanes of waders suborder Charadrii. In the present paper we describe 4 new species of the genus *Sokoloviana* and we extend the host range for known species. The material for the description and the greatest part of comparative material originate from the collections of Prof. W. T. Atyeo, University Georgia and Dr. B. M. OConnor, University of Michigan. The material from Dubinin's collection was obtained from Dr. S. V. Mironov, Zoological Institute, St. Petersburg, Russia. We would like to express our appreciation to

all of them for making this material available for the present study.

Abbreviations used: AMNH – American Museum of Natural History, USA; BMOC – collection of Dr. Barry M. OConnor; NU – University of Nebraska, USA; SAIMR – South African Institute for Medical Research, Republic of South Africa; UAM – Adam Mickiewicz University, Poznañ, Poland; UGA – University of Georgia, Athens, USA; UMMZ – University of Michigan, Zoological Museum, Ann Arbor, USA; USNM – US National Museum of Natural History; ZISP – Zoological Institute, St. Petersburg, Russia.

The chaetotaxy nomenclature follows Griffiths et al. (1990). All measurements are given in μm.

3 Genus diagnosis

Both sexes. Body elongated. Dorsal shields well developed. All the idiosomal setae present. Lateral and dorsal setae short. Four pairs of dorsal cupules present (ih may be absent in males). Setae *c3* short and thick. Opisthonotal glands well developed, highly sclerotized[1]). Sternum Y-shaped. Shields of coxal fields I-II poorly developed. All legs without apophyses, leg chaetotaxy complete (exept setae on tarsi IV in males). Seta *cGI* thick, knifelike, *cGII* hair-like.

Males. Big opisthosomal lobes present. Small lateral and terminal membranes may be present as well as translobar sclerites at the lobe bases. A perforate, very variable *cribrum* (Latin sieve) on the dorsal side of lobes present (Figs. 2, 6, 10, 14). Slit-like supranal concavity present. Setae *f2* broad, setae *h2*, and especially *h3* may bear membranes. Setae *ps1* thickened with tips always directed anteriorly. Genital organ very short, set on the anterior part of the coxal fields IV. Paragenital sclerites present. Adanal discs big with many verrucae on corolla and external radial striation. Opisthoventral sclerites present. On tarsi IV setae *d* short, awl-like, setae *e* reduced.

Females. Idiosoma with slightly expanded opisthosoma. Terminal cleft present. Circular supranal concavity present. Setae f2 lanceolate. Epigynum well developed, horseshoe-shaped. Paragynal sclerites with bent latero-terminal corners.

4 Description of new species

4.1 *Sokoloviana cornuta* sp. nov.

Male (Figs. 1, 2). Gnathosoma rectangular with lateral semicircular expansions. Length 85 (paratypes 85-90), width 70 (65-75). Idiosoma enlongated. Length 660 (625-635), width 255 (225-240), length to width ratio 2.6-2.8. Propodosoma – length 205 (185-200). Hysterosoma becoming narrower to the end with opisthosomal lobes. Lobes bearing big lateral triangular horns near the base of seta *h2*. Lobes twice as long as wide with rounded terminal tips. Small semicircular postlobar membranes are present. Terminal cleft triangular, narrow. Uniformly dotted prodorsal shield covers the whole propodosoma; scapular shields present. Hysteronotum with hysteronotal and humeral shields. Hysteronotal shield anteriorly with transverse row of semicircular sclerites. Shield covered with numerous small lacunas. Supranal concavity long but not connected with terminal margin of the body; anterior margin of broadened part reaching the

1) The strongly sclerotized and ribbed structure of the glands was wrongly interpreted by Dubinin (1951, 1956). He described these structures as additional, sucker-like setae of coxal fields IV. This rather strange mistake has never been formally corrected in subsequent papers of Dubinin and other authors.

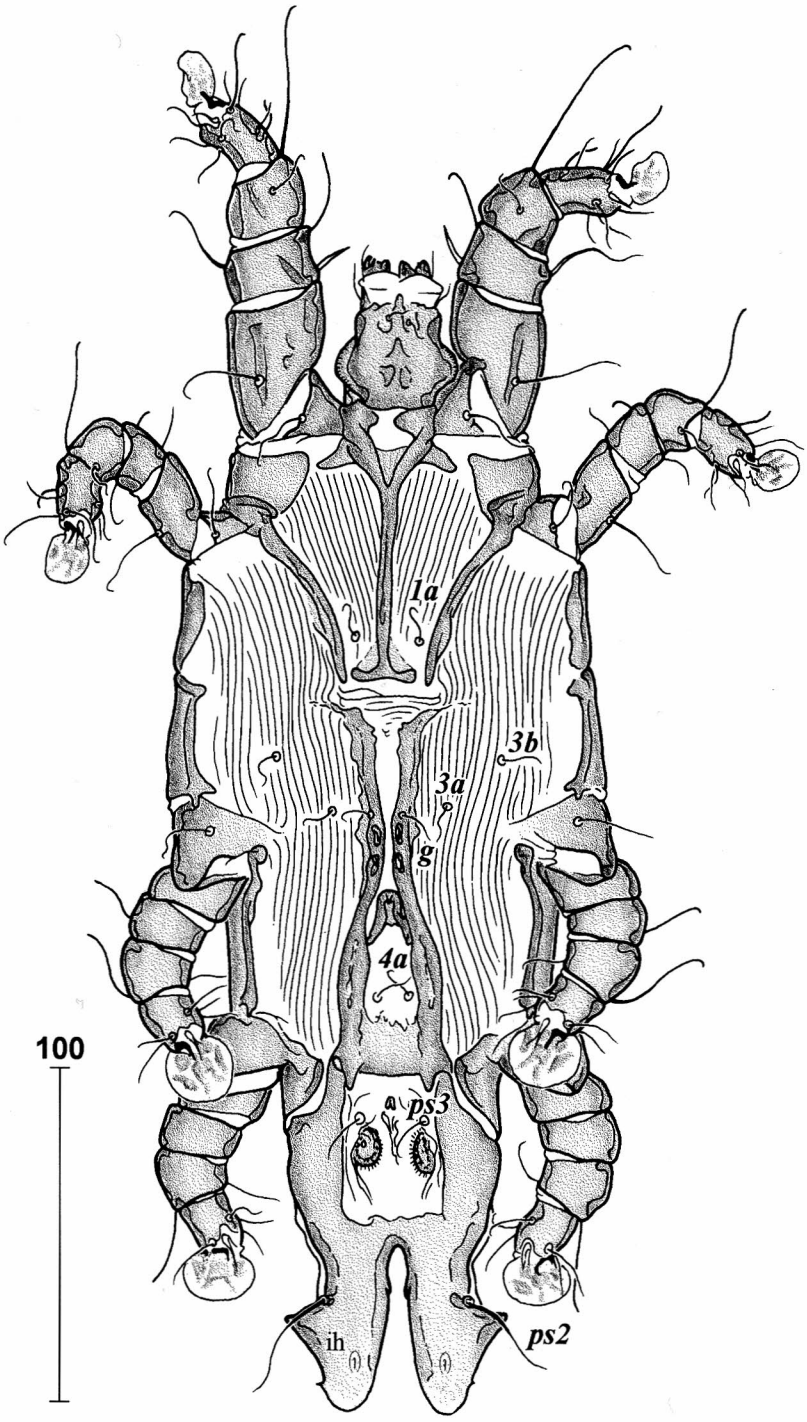

Fig. 1: *Sokoloviana cornuta* sp. nov., male, ventral view.

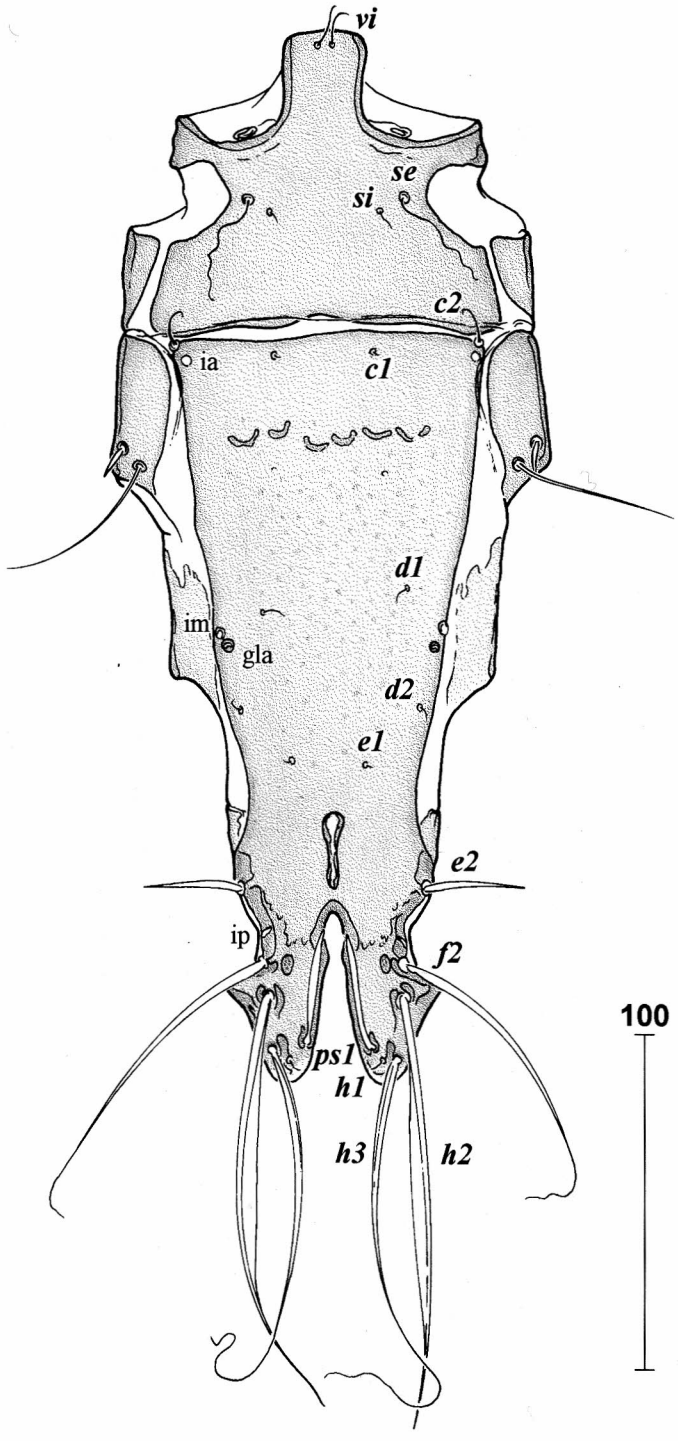

Fig. 2: *Sokoloviana cornuta* sp. nov., male, dorsal view.

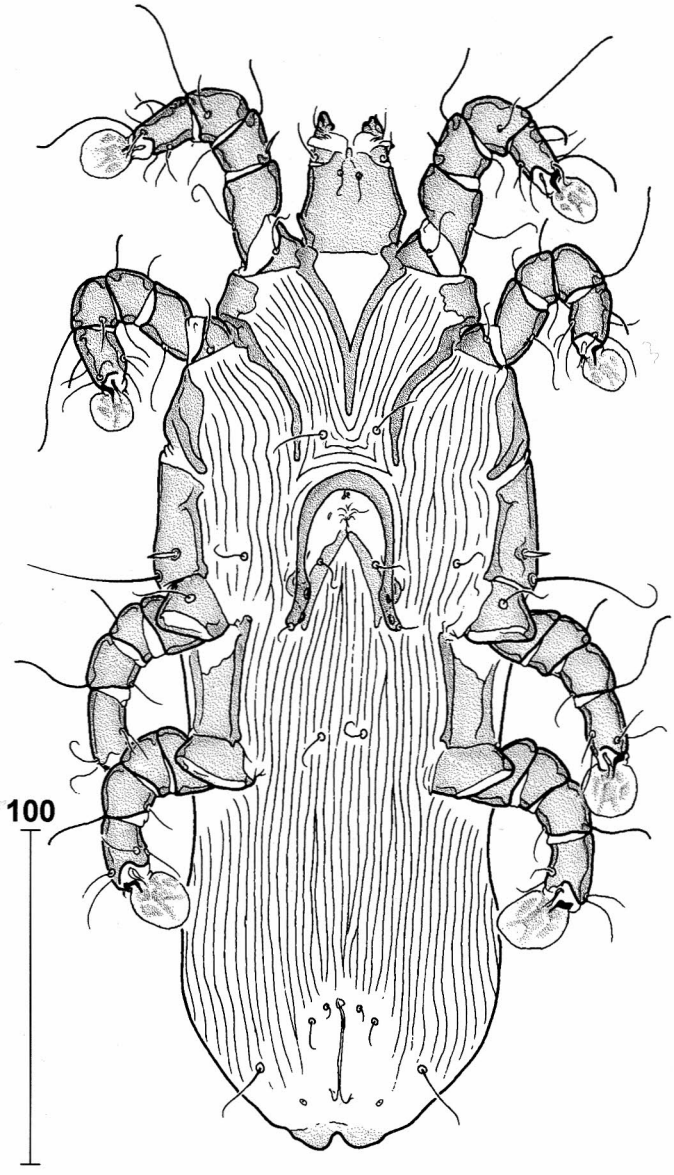

Fig. 3: *Sokoloviana cornuta* sp. nov., female, ventral view.

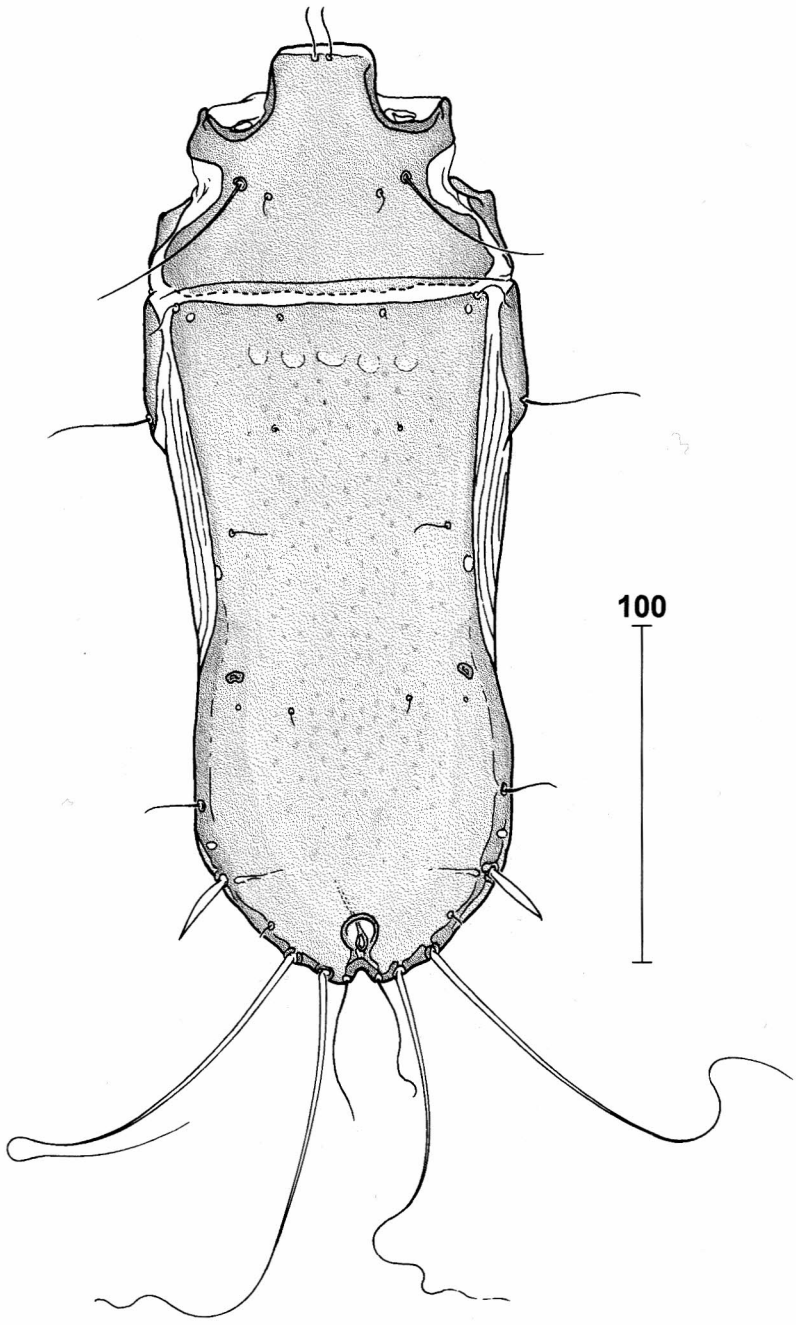

Fig. 4: *Sokoloviana cornuta* sp. nov., female, dorsal view.

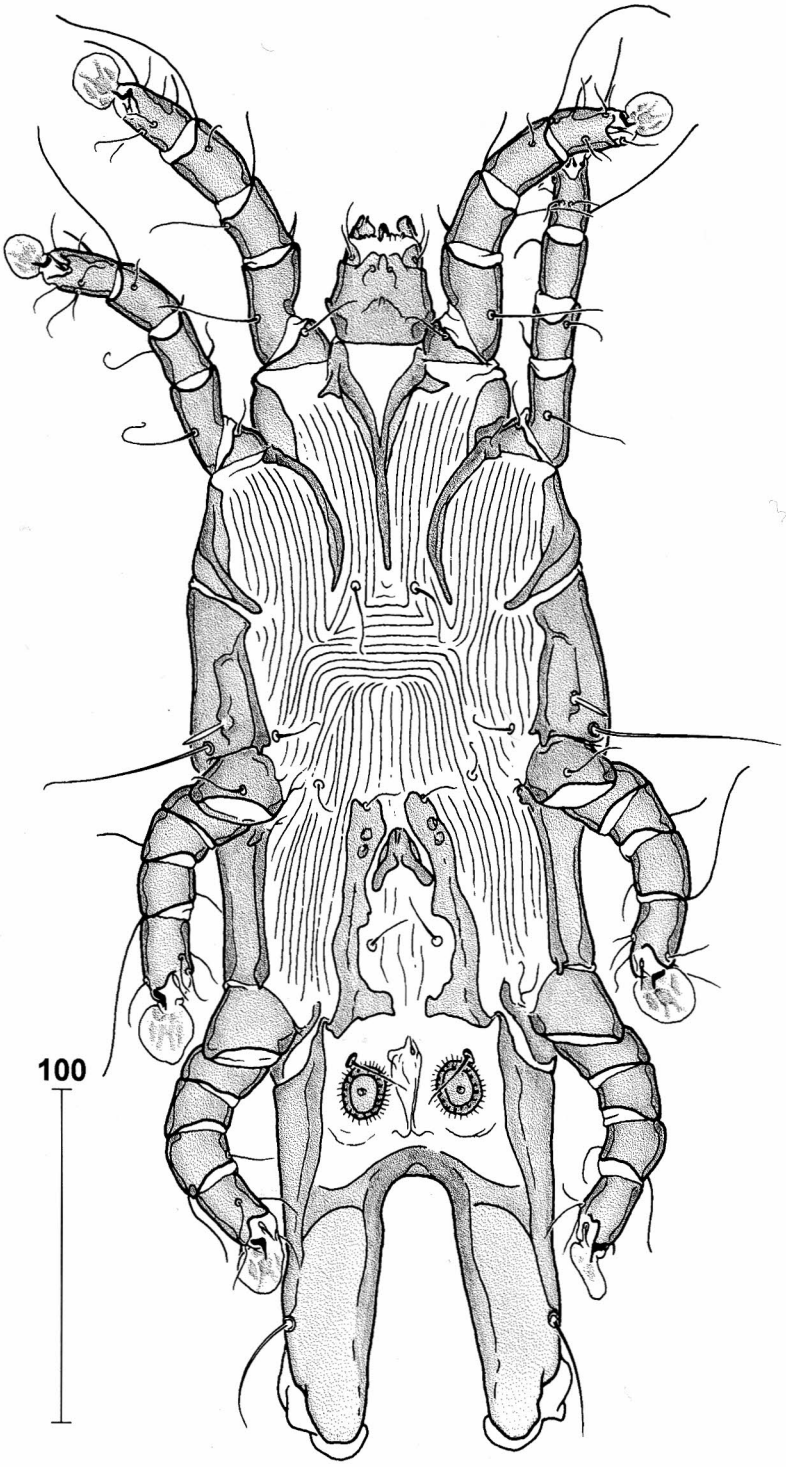

Fig. 5: *Sokoloviana ibidorhynchae* sp. nov., male, ventral view.

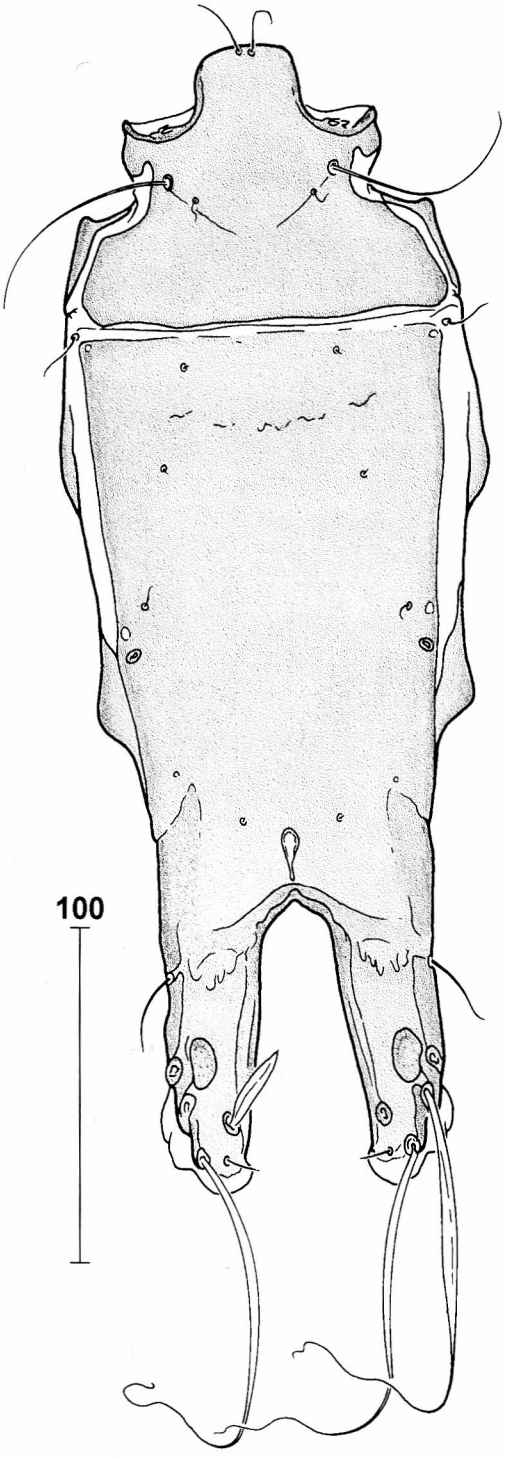

Fig. 6: *Sokoloviana ibidorhynchae* sp. nov., male, dorsal view.

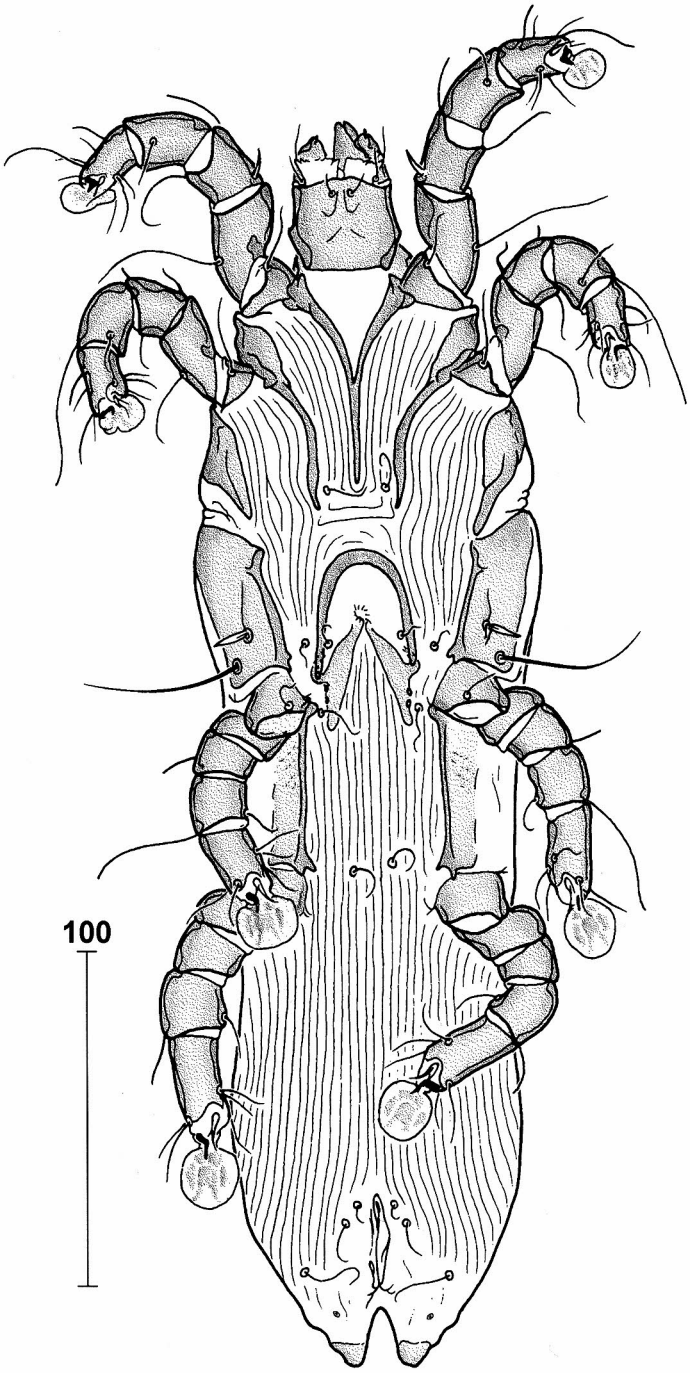

Fig. 7: *Sokoloviana ibidorhynchae* sp. nov., female, ventral view.

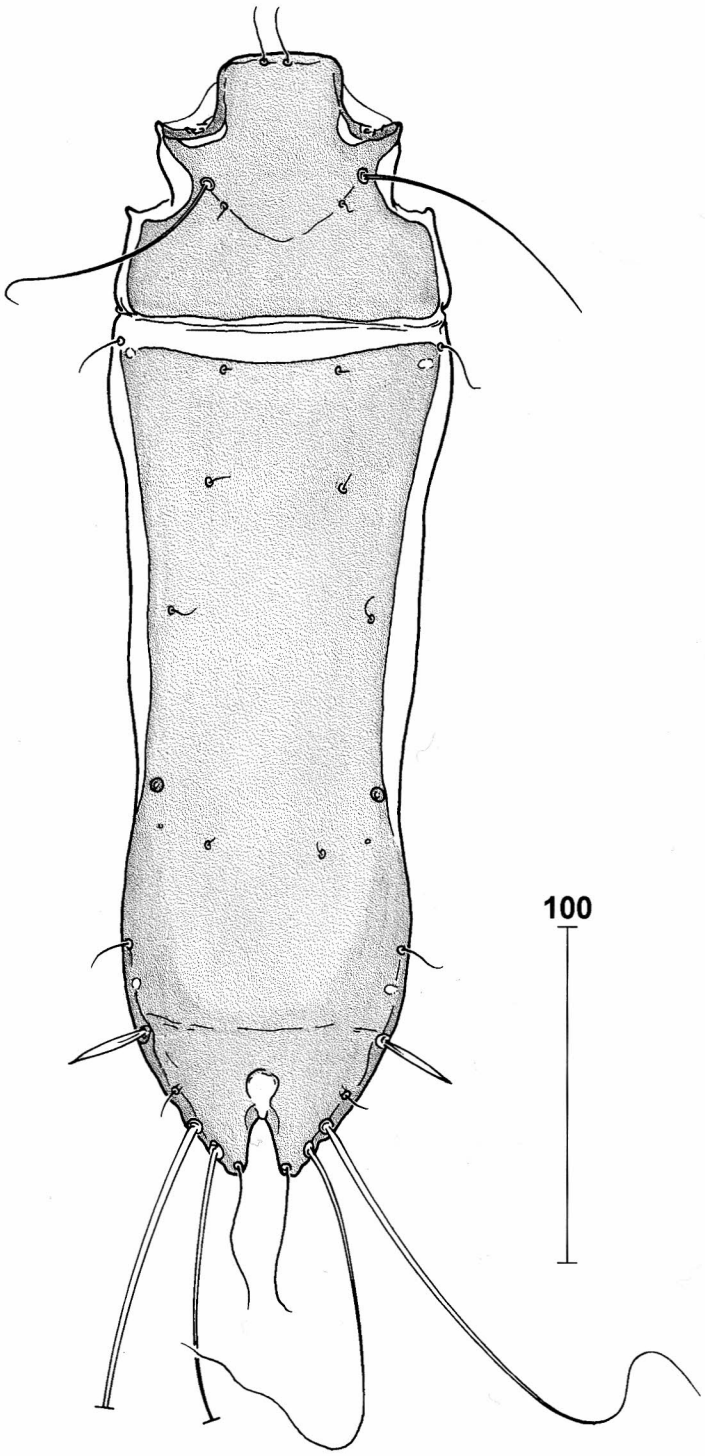

Fig. 8: *Sokoloviana ibidorhynchae* sp. nov., female, dorsal view.

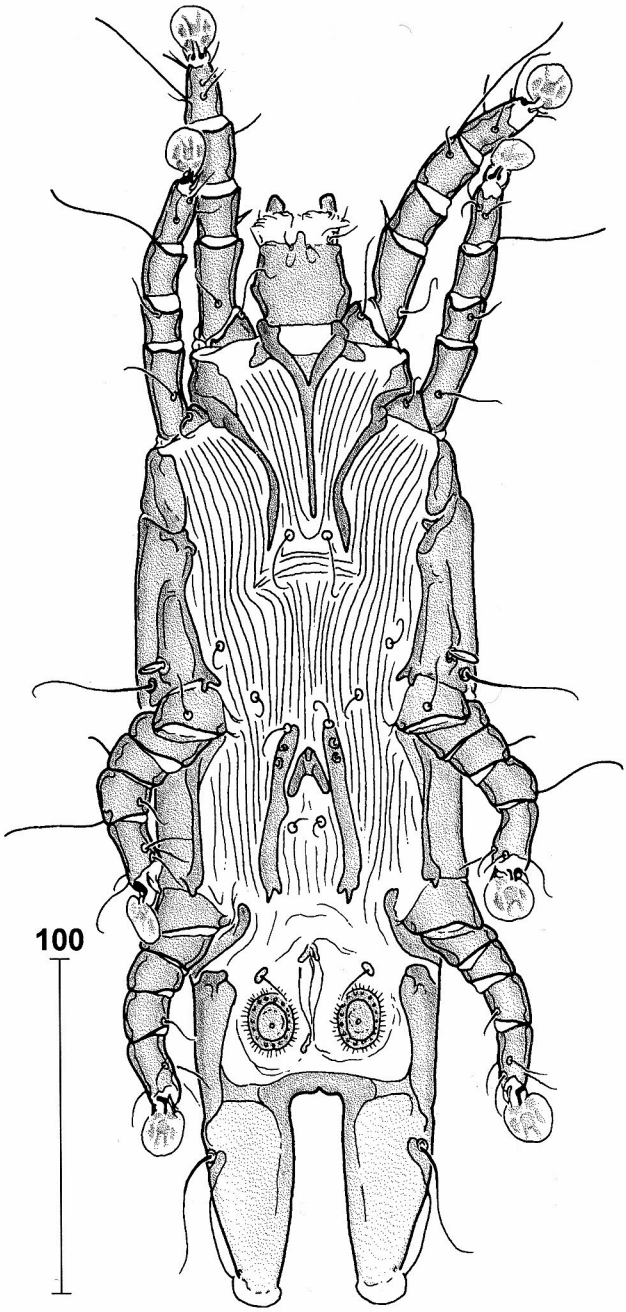

Fig. 9: *Sokoloviana chilensis* sp. nov., male, ventral view.

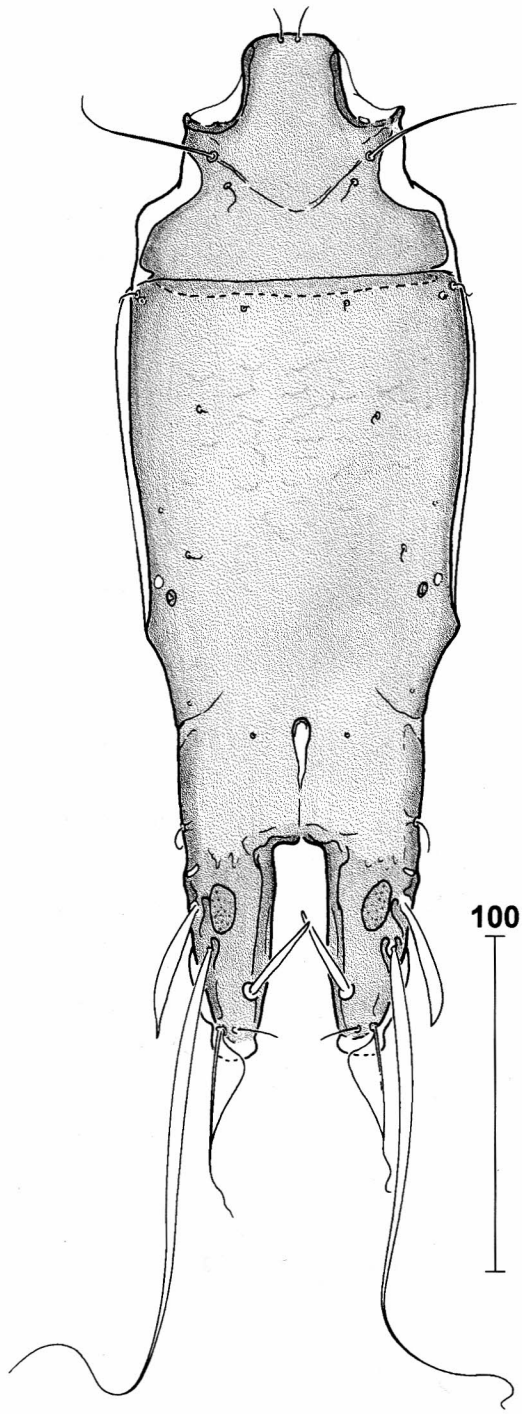

Fig. 10: *Sokoloviana chilensis* sp. nov., male, dorsal view.

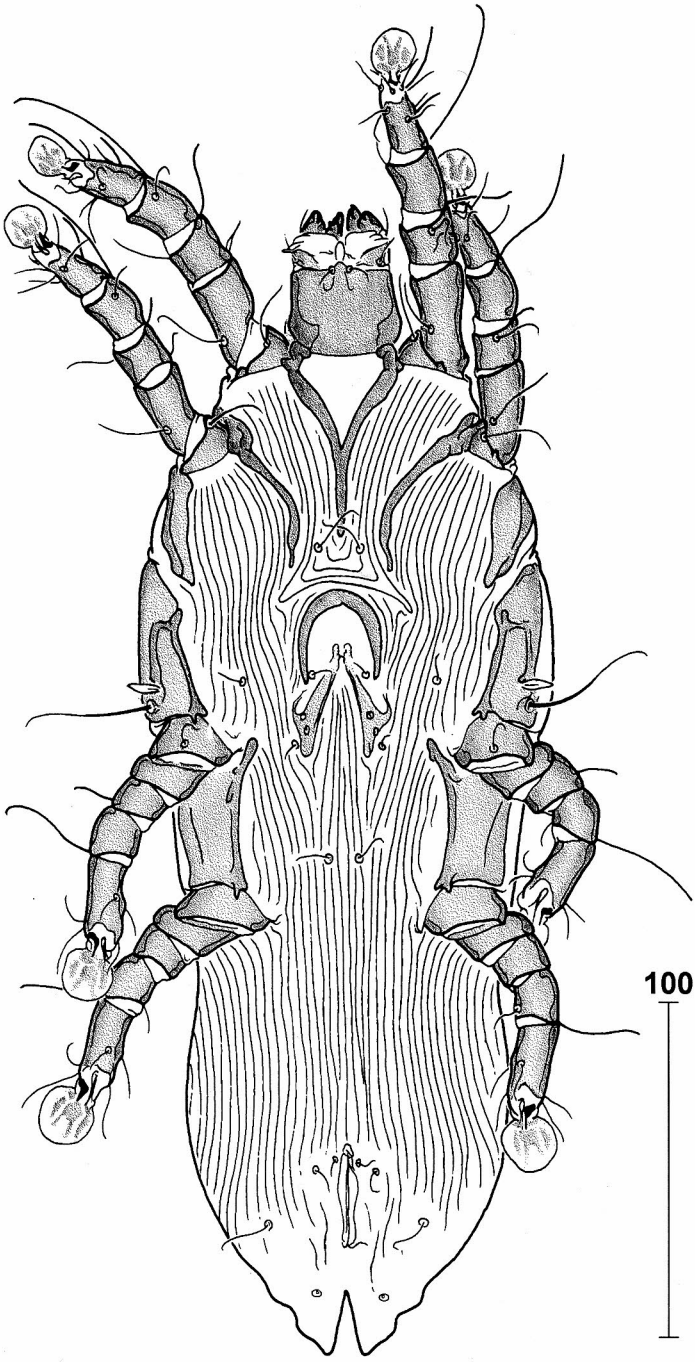

Fig. 11: *Sokoloviana chilensis* sp. nov., female, ventral view.

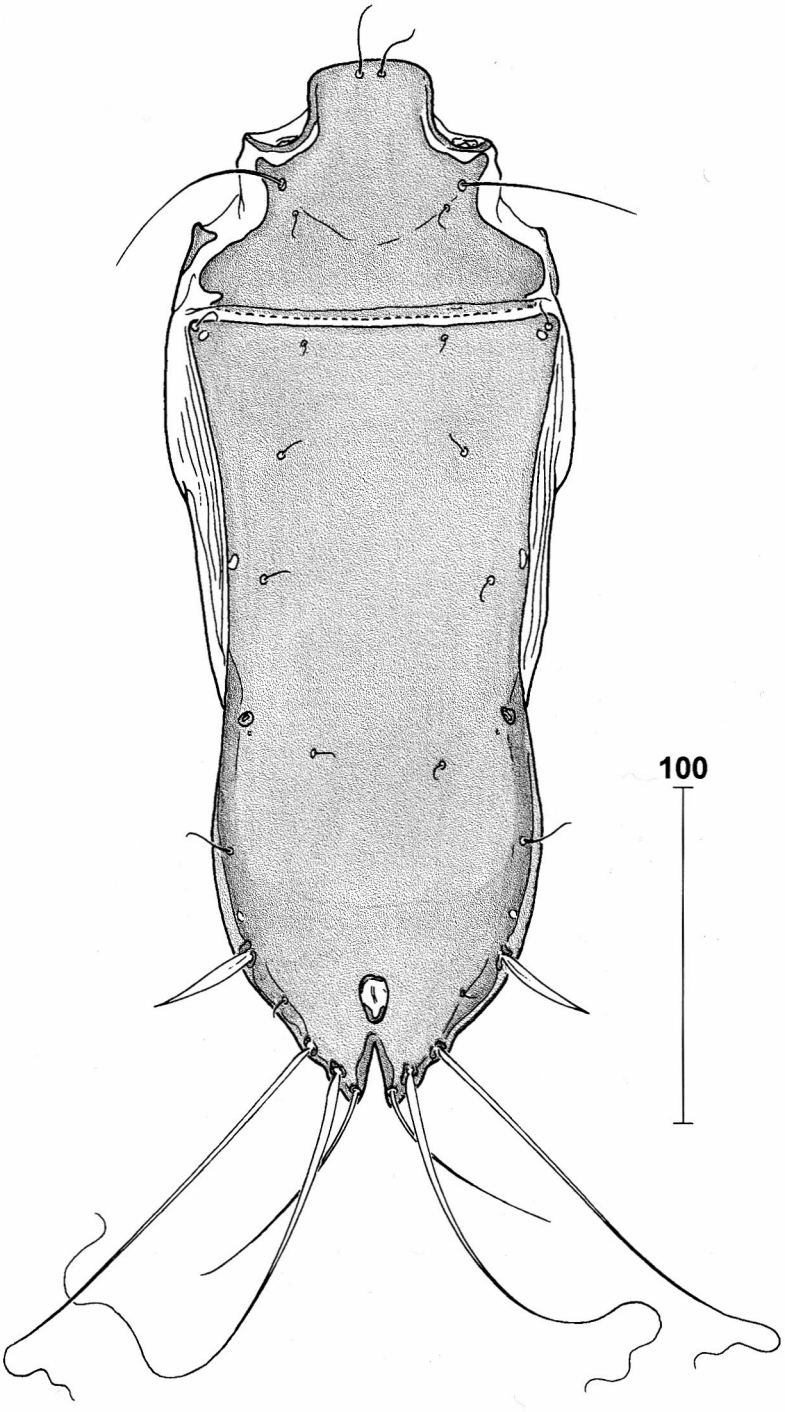

Fig. 12: *Sokoloviana chilensis* sp. nov., female, dorsal view.

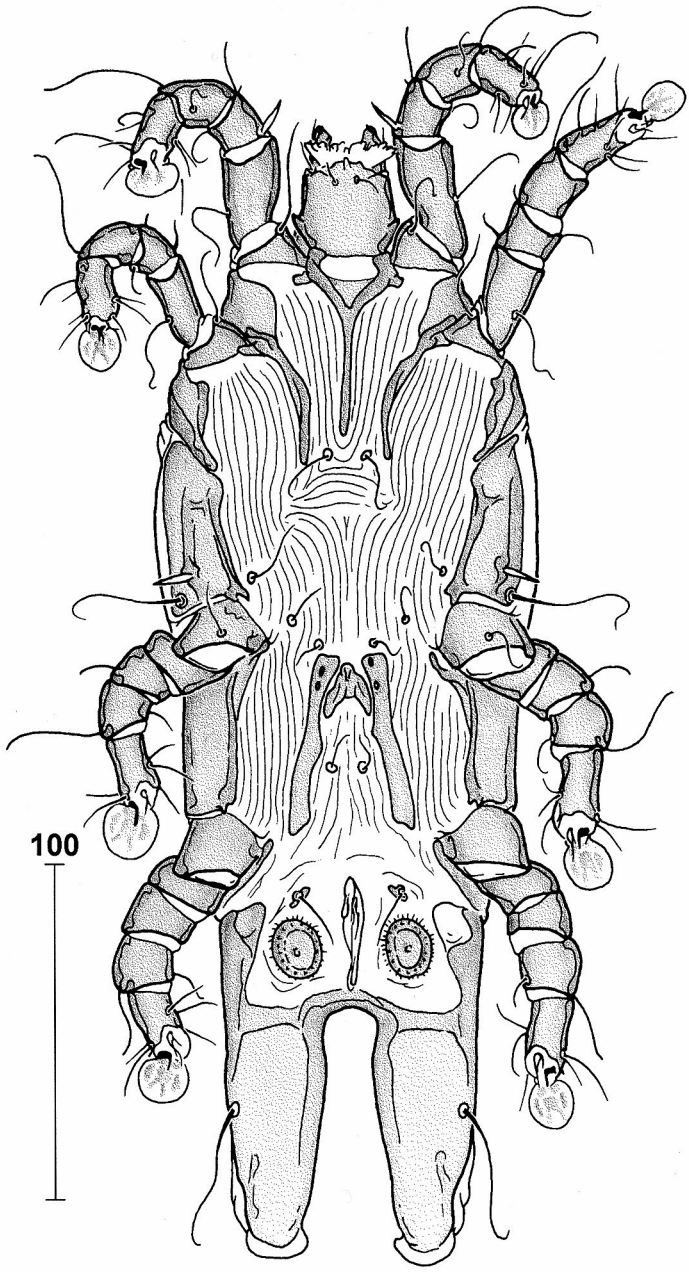

Fig. 13: *Sokoloviana vanelli* sp. nov., male, ventral view.

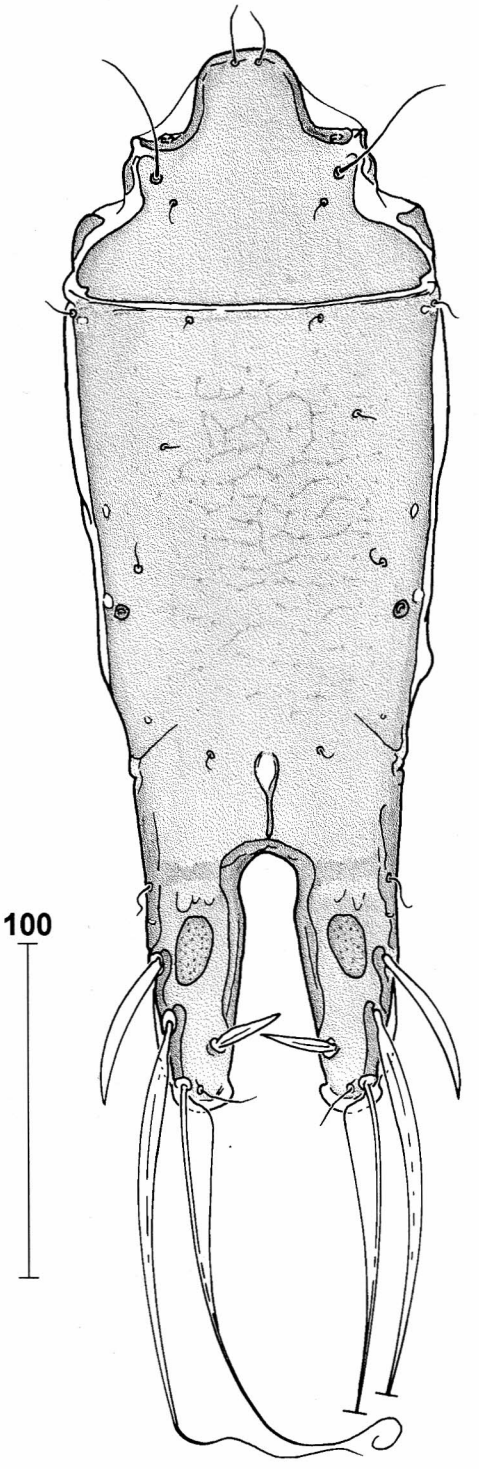

Fig. 14: *Sokoloviana vanelli* sp. nov., male, dorsal view.

level of the middle of the adanal discs. Cribrum very small. Setae *se* relatively short and thin; setae *c3* awl-like. Setae *e2* dagger-like; setae *f2* long, twice as long as lobes; *h2* and *h3* as macrochaetae with almost completely reduced membranes. Setae *ps1* set near the lobes tips, are relatively thin and long, but not reaching the base of the terminal cleft. Sternum with triangular shield between free branches and transversal sclerite on the posterior end. Paragenital sclerites very long, slightly divergent near the tips of epimerites I and II. Sclerites fused by transversal shield posteriorly genital setae and connected terminally with well developed opisthoventral sclerites. Genital acetabules set on the paragenital sclerites posteriorly to basis of setae *g* and anteriorly to aedeagus. Aedeagus set between bases of the legs III and IV. Postanal shield covers the whole surface of lobes. Distance adanal discs – terminal cleft three times of disc diameter. Setae *3a* and *g* on the same level, both posteriorly to setae *3b*. Cupules ih present. Legs I distinctly larger than the other legs. Legs IV reaching the base of the terminal cleft. Setae *mG* I thick.

Female (Figs. 3, 4). Gnathosoma rectangular. Length 65-80, width 60-65. Idiosoma elongated with dilated opisthosoma. Length 535-570, width 195-230, length to width ratio 2.5-2.7. Propodosoma – length 145-160. Opisthosoma terminus rounded with small triangular cleft, as long as wide. Shields of pronotum similar to that of males. Hysteronotum with hysteronotal and scapular shields. Anterior part of the hysteronotal shield with transverse row of semicircular lacunas. Shield sculptured like that of the males. Supranal concavity round, not connected with the terminal cleft. Needlelike setae *e2* closer to *f2* than to the openings of opisthonotal glands gla. Fused part of sternum shorter than free part. Epigynum with long branches, fused with genital acetabules and genital setae *g*.

Etymology. The species name „cornuta" (Latin horned) derives from the horns on the males' opisthosomal lobes.

Type material. From the Banded Stilt *Cladorhynchus leucocephalus*: holotype male, 2 males, 3 females paratypes, Australia, Western Australia, 20 miles SE Beverley, 32°18′S, 117°10′E, 14 January 1968, C.D. Fisher (UMMZ 225835). Types deposited at UMMZ (holotype, paratypes) and UAM (paratypes).

Additional material: From the same host species: 1 male, 3 females, same data as above (UMMZ 225834).

Systematic remarks. *Sokoloviana cornuta* belongs to the species group *„gracilis-mariae"*. Males of this group have relatively short opisthosomal lobes and long highly developed paragenital sclerites. Females of this species have a large epigynum, connected with genital setae. The new species is easy to be distinguished from all other species of the genus by big horns on the males' opisthosomal lobes. Female of the new species differs from *Sokoloviana gracilis* by the shape of the terminal cleft: triangular in *S. cornuta*, semicircular in *S. gracilis*. The female of *S. cornuta* differs from *S. mariae* in the sculpture of the hysteronotal shield: covered by numerous small lacunas and a transverse row of big lacunas on the anterior part of the shield in *S. cornuta*; shield smooth with lateral row of big lacunas in *S. mariae*.

4.2 *Sokoloviana ibidorhynchae* sp. nov.

Male (Figs. 5, 6). Gnathosoma rectangular with small lateral processes. Length 70 (60-75), width 60 (60). Idiosoma elongated,

length 690 (670-695), width 240 (230-240). Ratio length to width 2.9-3.0. Propodosoma - length 170 (160-170). Hysterosoma almost parallel-sided. Opisthosomal lobes large, slightly divergent, three times as long as wide. Tips rounded latero-terminal. Lobes with rounded terminal membranes and doubled rectangular lateral membranes. Terminal cleft slightly divergent with regularly rounded anterior margin. Pronotal shield covers the whole pronotum; scapular shields reduced. Hysteronotum with hysteronotal shield only, humeral shields absent. Hysteronotal shield without lacunas. Supranal concavity does not reach the terminal margin of the body, anterior margin of broadened part reaching the level of the adanal discs' middle. Cribrum big with well developed anterior margin. Setae *c3* awl-like. Setae *e2* needle-like, setae *h2* and *h3* as macrochaetae with reduced membranes; setae *ps1* set near the tips of the lobes, 1/5 of the lobes' length. Setae *ps1* lanceolate, shorter than the distance between them. Sternum without additional sclerites. Paragenital sclerites extend from the bases of setae *g* to the anterior tips of the opisthoventral sclerites. Paragenital sclerites and opisthoventral sclerites connected by a thin bent junction. Paragenital sclerites with latero-medial expansions. At the basis of the lobes translobar sclerites. Genital acetabules set on the paragenital sclerites on the level of the aedeagus' basis. Aedeagus set on the level near the bases of the legs III. Distance between the adanal discs and the terminal cleft same as the diameter of the discs. Setae *3a* posteriorly to setae *3b* and anteriorly to *g*. Cupules ih absent. All the legs similar in size. Tibiae of legs IV reaching the terminal cleft.

Female (Figs. 7, 8). Gnathosoma rectangular. Length 65-85, width 60-70, Idiosoma elongated and slender with dilated opisthosoma; length 665-705, width 195-225; ratio length to width 3.1-3.5. Propodosoma – length 150-180. Terminus of opisthosoma slightly acute. Distinct terminal, triangular cleft with slightly concave margins; cleft twice as long as wide. Shields on propodosoma like the males; hysteronotum with hysteronotal shield only. Shield uniformly dotted. Supranal concavity round connected terminally with terminal cleft. Well sclerotized terminal end of *bursa copulatrix* extends slightly to the terminal cleft. Setae *e2* set twice closer to *f2* than to gla. Fused part of the sternum as long as free one. Branches of epigynum extend at least beyond the level of setae *3a*, often reaching the level between setae *3b* and genital acetabules.

Etymology. The species name *„ibidorhynchae"* derives from the generic name of the host species *Ibidorhyncha strutersi*.

Type material. From the Ibis-bill *Ibidorhyncha strutersi*: male holotype, 4 males, 15 females paratypes, China, Chensi Prov., Tsinling Mts, Taipai Shan, 12 October 1905 (UGA 5952, AMNH 742850). Types deposited at UGA (holotype, paratypes) and UAM (paratypes).

Systematic remarks. The new species *Sokoloviana ibidorhynchae* is generally similar to *Sokoloviana* species living on oystercatchers (*Haematopus*) and plovers (*Charadrius*). *S. tropica, S. kucheruki* and *S. rehbergi* are most similar to the new species. The males of these three species have a similar shape of the paragenital sclerites. Females (apart from *S. rehbergi*) have similar slender shape of the body, long branches of the epigynum and the *bursa copulatrix* extending to the terminal cleft. Males of S. *ibidorhynchae* differ from above-mentioned species in the shape of the lateral membranes of the lobes and big cribrum. Females of the new species have a smooth hysteronotal shield, while in *S. tropica* there

are numerous small lacunas on the shield. Females of *S. ibidorhynchae* differ from *S. kucheruki* in the location of the setae *e2*; in *S. ibidorhynchae* these setae are located twice closer to *f2* than to gla, whilst the setae *e2* in *S. kucheruki* are situated in the middle distance between *f2* and gla.

4.3 *Sokoloviana chilensis* sp. nov.

Male (Figs. 9, 10). Gnathosoma rectangular with lateral expansions. Length 80 (70), width 60. Idiosoma elongated; length 600 (595-610), width 195 (205-220), ratio length to width 2.7-3.1. Propodosoma – length 150 (145-150). Hysterosoma almost rectangular; opisthosomal lobes large and parallel, three times longer than wide, the basis twice broader than the rounded tips. Lobes with narrow lateral membranes and rounded terminal membranes. Terminal cleft rectangular. Pronotal shield covers the whole pronotum; scapular shields reduced. Hysteronotum with hysteronotal shield only, humeral shields absent. Hysteronotal shield uniformly dotted with fine netlike pattern. Supranal concavity extends beyond the level of the adanal discs' anterior margin and is connected with the terminal cleft by a narrow suture. Cribrum big with well developed inner margins. Setae *c3* lanceolate, setae *e2* fine, hair-like; setae *f2* knifelike not reaching the tips of opisthosomal lobes; setae *h2* as macrochaetae, long; setae *h3* with membranous inner expansions and hair-like short distal part. Setae *ps1* dagger-like, as long as distance between them. Setae set near the tips of the lobes, 1/4 of the lobes' length. Fused part of the sternum twice as long as free parts. Between free branches triangular shield. Paragenital sclerites band-like, extend from the basis of setae g to the level of the bases of legs IV. In most cases the posterior ends with irregular prongs. At the basis of the lobes translobar sclerites. Genital acetabules set on the paragenital sclerites on the level of the aedeagus' basis. Aedeagus set near the level of the bases of legs III. Distance between adanal discs and the terminal cleft same as the diameter of the discs. Setae *3a* set posteriorly to setae *3b* and anteriorly to *g*. Cupules ih absent. All the legs similar in size. Tarsi of legs IV reaching terminal cleft.

Female (Figs. 11, 12). Gnathosoma rectangular. Length 75-80, width 65-70. Idiosoma elongated; length 600-625, width 215-235, ratio length to width 2.6-2.8. Propodosoma – length 145-155. Opisthosoma dilated, slightly acute with triangular terminal cleft, two times as long as wide. Shields on pronotum like the males, hysteronotal shields sculptured like those of the males. Lateral and terminal parts of hysteronotal shield highly sclerotized. Supranal concavity round, distance to terminal cleft like diameter of the concavity. Setae *e2* set slightly closer to *f2* than to gla. Fused part of the sternum as long as free one. Branches of epigynum extend slightly beyond the setae *3a*.

Etymology. The species name *„chilensis"* derives from the specific name of the host *Vanellus chilensis*.

Type material. From the Southern lapwing *Vanellus chilensis*: male holotype, 3 males, 3 females paratypes, Paraguay, Departamento Alto Paraguay, West bank of Rio Paraguay along Riacho San Alberto, 21°50′S, 57°56′W, 19 September 1988, S.M. Goodman (UMMZ 227481, SMG 2470). Types deposited at UMMZ.

Additional material: From the same host species: 1 male, 1 female, Paraguay, Departamento Concepcion, East bank of Rio Paraguay, 1.5 km S Puerto Risso, 22°24′S, 57°52′W, 18 September 1988; S.M. Goodman (UMMZ 227480, SMG 2459); 1 male, 1

female, Argentina, Buenos Aires, January 1897, P. Neumann (NU 5618, AMNH 735336); 2 males, 2 females, Colombia, Santa Marta, Mamotoco, 26 December 1945, M.A. Carriker Jr., (NU 8682, USNM 386784).

Systematic remarks. Two new species *S. chilensis* and *S. vanelli* sp. nov. (described below) together with already described species *S. allocerca, S. leptosoma* and *S. zumpti* belong to a homogeneous group of species inhabiting birds of the subfamily Vanellinae. Males of these mites possess setae *h3* with membranous inner extensions. Paragenital sclerites simple, band-like. Sternum with triangular sclerite between branches. Females relatively dumpy with dilated anterior part of idiosoma. Epigynum with short branches. Males of the new species are in general appearance most similar to *S. allocerca. S. chilensis* differs from *S. allocerca* (also from *S. leptosoma*) in the length of setae *f2*: in the new species *f2* do not reach the tips of the opisthosomal lobes, in *S. leptosoma* and *S. allocerca* the setae *f2* extend far beyond the tips of the opisthosomal lobes. Females of this group are very similar (see Gaud 1972). The new species differs from *S. leptosoma* and *S. zumpti* in the shape of setae *c3*: in *S. chilensis* lanceolate, in *S. leptosoma* and *S. zumpti* awl-like. New species differs from *S. allocerca* in location of setae *e2*: in S. *chilensis* setae *e2* set almost in the middle distance between *f2* and gla, in *S. allocerca* setae *e2* almost twice as close to *f2* as to gla.

4.4 *Sokoloviana vanelli* sp. nov.

Male (Figs. 13, 14). Gnathosoma rectangular with lateral expansions. Length 85 (65-75), width 65 (60-65. Idiosoma elongated; length 575 (570-610), width 210 (195-210), ratio length to width 2.7-3.0. Propodosoma – length 125 (130-145). Hysterosoma almost rectangular; opisthosomal lobes large, outer margins of lobes parallel. Lobes three times longer than wide, the basis approximately twice as broad as the rounded tips. Lobes with doubled narrow lateral membranes and rounded terminal membranes. Terminal cleft slightly divergent with expanded rounded base. Pronotal shield covers the whole pronotum; scapular shields reduced. Hysteronotum with hysteronotal shield only, humeral shields absent. Hysteronotal shield uniformly dotted with fine netlike pattern. Supranal concavity extends beyond the level of the anterior margins of the adanal discs and nearly reaching the terminal cleft with a narrow suture. Cribrum big without distinct margins. Setae *c3* awl-like, setae *e2* fine, hair-like; setae *f2* knifelike not reaching the tips of opisthosomal lobes; setae *h2* as macrochaetae, long; setae *h3* with membranous inner expansions and hair-like long distal part. Setae *ps1* dagger-like, shorter than the distance between them, set near the tips of the lobes, 1/5 of the lobes' length. Fused part of the sternum twice as long as free parts. Between free branches triangular shield. Paragenital sclerites band-like, extend from the level slightly posteriorly to setae *g* to the level of the bases of legs IV. At the basis of the lobes translobar sclerites. Genital acetabules set on the paragenital sclerites on the level of the aedeagus' basis. Aedeagus set near the level of the bases of legs III. Distance between adanal discs and the terminal cleft shorter than the diameter of the discs. Setae set *3a* posteriorly to setae *3b* and anteriorly to *g*. Cupules ih absent. All legs similar in size. Tibiae of legs IV reaching terminal cleft.

Female (Figs. 15, 16). Gnathosoma rectangular. Length 75-80, width 60-70. Idiosoma elongated; length 600-610, width

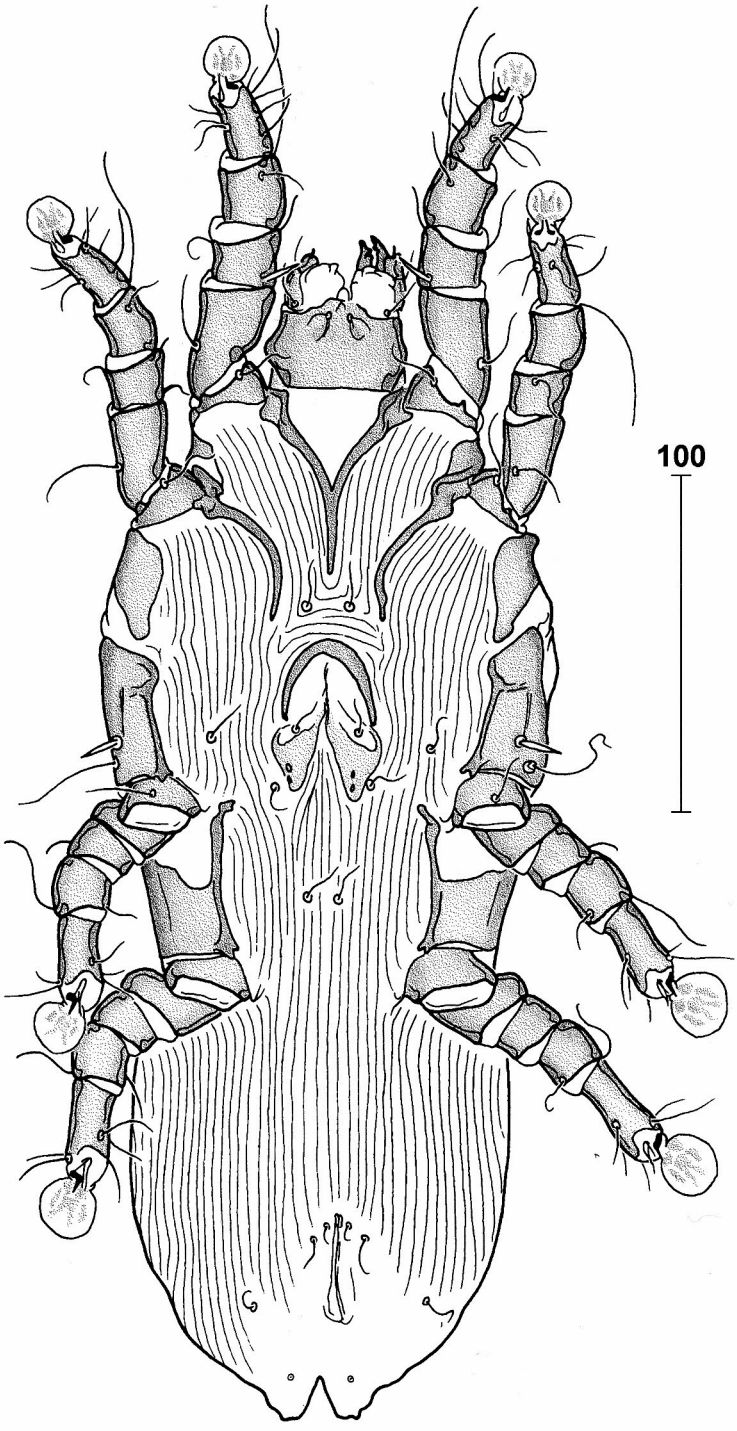

Fig. 15: *Sokoloviana vanelli* sp. nov., female, ventral view.

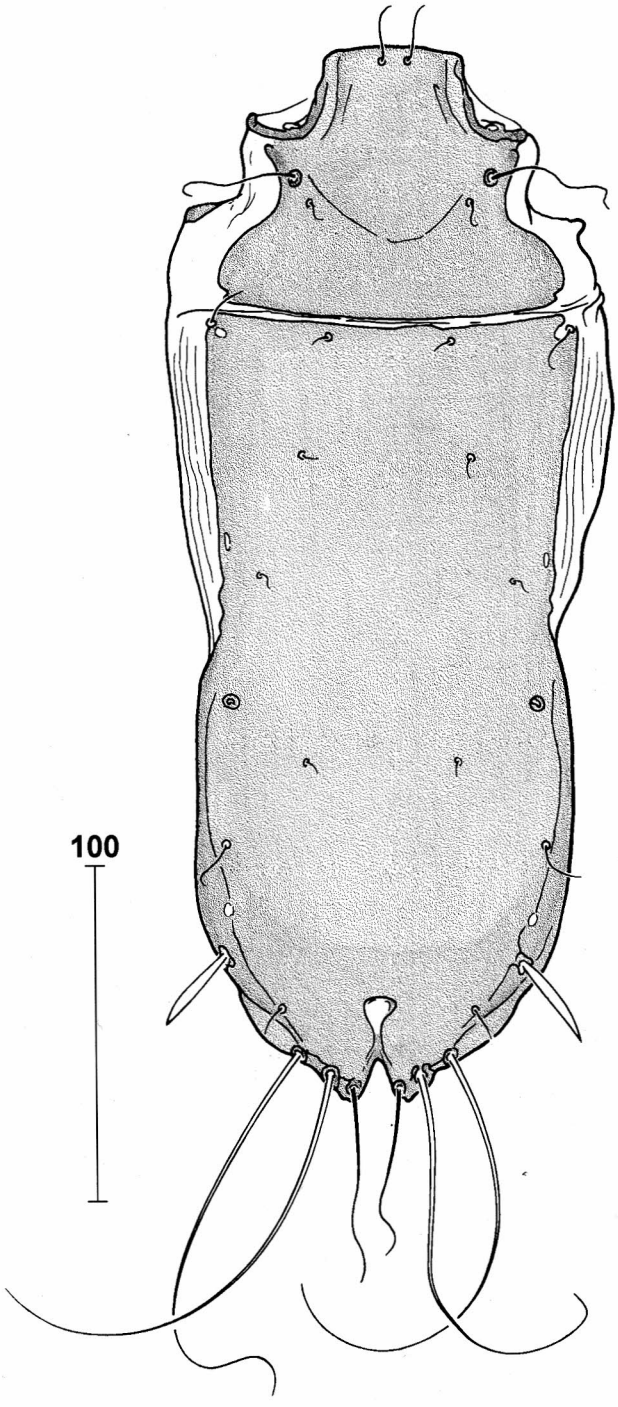

Fig. 16: *Sokoloviana vanelli* sp. nov., female, dorsal view.

195-205, ratio length to width 2.9-3.1. Propodosoma – length 140-150. Opisthosoma dilated, with triangular terminal cleft, twice as long as wide. Shields on pronotum like the males, hysteronotal shields sculptured like those of the males. Lateral and terminal parts of hysteronotal shield strongly sclerotized. Supranal concavity round, distance to terminal cleft shorter than diameter of the cleft. Setae *e2* set slightly closer to *f2* than to gla. Fused part of the sternum shorter than free branches. Branches of epigynum short, at the most reaching setae *3a*.

Etymology. The species name *„vanelli"* derives from the generic host name.

Type material. From the Red-wattled Lapwing *Vanellus indicus atronuchalis*: male holotype, 8 males, 2 females paratypes, South Vietnam, Forest of Fimnon, November 1939, J.F. Rock (NU 8690, USNM 360597). Types deposited at USNM.

Additional material. From the same host species: 1 male, 1 female, Vietnam, Doug mé, near Phan Raug, 28 March 1936 (NU 11862, AMNH 423235). From the Northern Masked Plover *Vanellus miles miles*: 1 male, 1 female, Australia, Northern Territory, Oenpelli, 23 September 1948, H. G. Deignan (UGA 2397, USNM 405639). From the Southern Masked Plover *Vanellus miles novaehollandiae (=V. lobatus)*: 3 males, 3 females, Australia, Kangaroo Island, 25 January 1920 (UGA 2396, USNM 278774). From the River Lapwing *Vanellus duvaucelli*: 5 males, 5 females, India, Zoonzaleru River, 7 March 1877, C. T. Bingham (NU 8717, USNM 95517); 1 male, 1 female, West Malaysia, Terong g, Lay Song, 28 October 1896, W.L. Abbot (NU 8720, USNM 160080). From the Banded Plover *Vanellus tricolor*: 2 males, 3 females, Java, 12 July 1909, W. Palmer (NU 8708, USNM 219185). From the Gray-headed Lapwing *Vanellus cinereus*: 3 males, 2 females, Japan, Kinshiu, 19 December 1887, Ringer (NU 8692, USNM 114746); 2 males, 2 females, China, Nanking, 13 May 1923, A. de C. Sowerby (NU 8693, USNM 276432); 1 male, 1 female, Japan, Honshu Island, Aomori Prefecture, Mutsu, Agawara Lagoon, 41°18′N, 141°15′E, 22 April 1927 (UMMZ 63892).

Systematic remarks. The new species *S. vanelli* is very similar to *S. zumpti* and *S. chilensis*. The common feature is the males' short setae *f2*. The males of the new species differ from the remaining two species in the shape of the terminal cleft: key-hole-like in *S. vanelli*, rectangular in *S. chilensis*, triangular in *S. zumpti*. Paragenital sclerites in *S. vanelli* do not reach the bases of *g*, in remaining species the sclerites are connected with *g*. Females are more difficult to distinguish. Females of *S. vanelli* differ from remaining two species in the shape of epigynum: epigynum not reaching setae *3a* in *S. vanelli*, epigynum extending distinctly beyond setae *3a* in both remaining species. Females of *S. vanelli* differ from *S. chilensis* in the shape of setae *c3*: awl-like in *S. vanelli*, lanceolate in *S. chilensis*. Females of *S. vanelli* differ from *S. zumpti* in the location of *e2*: almost in the middle distance between *f2* and gla in *S. vanelli*, almost twice as close to *f2* as to gla in *S. zumpti*.

5 Comparative material

5.1 *Sokoloviana allocerca* Gaud, 1972

Species was described by Gaud (1972) from several species of African Vanellinae: the Senegal Wattled Plover *Vanellus senegallus*, the Long-toed Lapwing *V. crassirostris*, the Blacksmith-Plover *V. armatus*, the Spur-winged Plover *V. spinosus* and the Crowned Plover *V. coronatus*.

Material examined. From the southern

race of the White-winged Plover *Vanellus crassirostris leucoptera*: 2 males, 2 females, Sudan, Shambe, 7 March 1927, W. L. Brown (NU 8696, USNM 309150). From the Senegal Wattled Plover *Vanellus senegallus*: 3 males, 3 females, Africa, Anglo-Egyptian Sudan, Equatoria Prov., Lado, 30 January 1910, J.A. Loring (NU 8710, USNM 216170)

5.2 *Sokoloviana gracilis* (Mégnin & Trouessart, 1884)

This species was described by Mégnin and Trouessart (1884) as *Pterolichus rehbergi* var. *gracilis* from the Black-winged Stilt *Himantopus himantopus*. It was reported many times from the same host by other authors (Poppe, 1889; Berlese, 1886; Canestrini & Kramer, 1899; Bedford, 1932, 1936; Dubinin, 1951, 1956; Radford, 1953; Gaud, 1972).

Material examined. From the Black-winged Stilt *Himantopus himantopus*: 2 males, 2 females, Egypt, Wadi Gedeed Governate, Dakhla Oasis, 13 km N Mut, 25°28′N, 28°58′E, 22 March 1984, S. M. Goodman (UMMZ 206818, SMG 967). From the Ceylon Stilt *Himantopus ceylonensis* (NEW HOST): 2 males, 2 females, Ceylon, Southern Prov., Hambantota, 1944, S. D. Ripley (NU 9188, USNM 375864). From the Pied Stilt *Himantopus leucocephalus* (NEW HOST): 1 male, 2 females, Celebes, Rano Lindoe, 16 March 1917, R. C. Raven (NU 9172, USNM 250675). From the South American Stilt *Himantopus melanurus* (NEW HOST): 1 male, 1 female, Argentina, Buenos Aires, Guamini, 6 March 1921, A. Wetmore (NU 9185, USNM 286064). From the South African Stilt *Himantopus meridionalis* (NEW HOST): 2 females, Mozambique, Bela Vista, 28 January 1954, D. W. Lamm (NU 9168, USNM 457816). From the Black-necked Stilt *Himantopus mexicanus* (NEW HOST): 1 male, 1 female, USA, Florida, Osceda Co., Lake Kissimmee, 1901, E. A. Mearns (NU 9191, USNM 176858). From the Black Stilt *Himantopus novaezelandiae* (NEW HOST): 1 male, 10 females, New Zealand, no further data, (UMMZ B1170b).

5.3 *Sokoloviana kucheruki* Cerny, 1976

Cerny (1976) did describe this species from the Killdeer *Charadrius vociferus* from Cuba.

Material examined. From the Killdeer *Charadrius vociferus*: 2 males, 2 females, USA, Nebraska, Cherry Co., 15 mi S Valentine, 2 September 1960, W. T. Atyeo, N. L. Braash (NU 4695); 2 males, 2 females, Haiti, Petit-Trou-de-Nippes, 9 April 1930, W. M. Perrygo (NU 8803, USNM 317231); 1 female, Puerto Rico, Manati, 8 July 1912, A. Wetmore (NU 8804, USNM 238728).

5.4 *Sokoloviana leptosoma* (Gaud, 1953)

Species was described by Gaud (1953) as *Pterolichus leptosoma* from the African species the White-crowned Plover *Vanellus albiceps*. Gaud discovered this species a second time on the same host species (1972).

Material examined. From the White-crowned Plover *Vanellus albiceps*: 2 male, 3 females,. Mozambique, Inhambane District, Zinave National Park, Save River, 212 km SSE Beira, 21°35′S, 33°20′E; 9 October 1965, W. W. Dalquist (UMMZ 211363).

5.5 *Sokoloviana mariae* Dubinin, 1951

Sokoloviana mariae was described by Dubinin (1951) from the Pied Avocet *Recurvirostra avosetta*. This species is being regularly

found on the same host (Dubinin, 1953, 1956; Gaud, 1972).

Material examined. From the Pied Avocet *Recurvirostra avosetta*: 11 males, 47 females, Russia, Western Siberia, Novaia Zemlia, 3 July 1936, B. Bykhovskij (ZISP 254); 3 males, 3 females, SW Africa, Gaucha, 31 October 1952, C. O. Handley Jr. (NU 9184, USNM 448088). From the Rednecked Avocet *Recurvirostra novaehollandiae* (NEW HOST): 1 male, 1 female, NW Australia, 18 October 1902, J. P. Rogers (UGA 5969, AMNH 743112). From the American Avocet *Recurvirostra americana* (NEW HOST): 3 males, 3 females, Mexico, Michoacan, La Barcak, 19 January 1903, Nelson & Goldman (NU 9182, USNM 184857). From the Andean Avocet *Recurvirostra andina* (NEW HOST): 1 male, 1 female, no data, Percy collection (UGA 5974, AMNH 424882)

5.6 *Sokoloviana pavlovskyi* Cerny, 1974

Described by Cerny (1974) from the Semipalmated Plover *Charadrius semipalmatus* from Cuba.

Material examined. We have failed to obtain type material.

5.7 *Sokoloviana rehbergi* (Canestrini & Berlese, 1880)

This oldest known species (type species) was described by Canestrini & Berlese (1880) as *Pterolichus rehbergi* from the Eurasian Oystercatcher *Haematopus ostralegus*. It has been found many times on the same species by later authors: Dubinin, 1956 (also old references review); Dabert & Ehrnsberger, 1995.

Material examined. From the Eurasian Oystercatcher *Haematopus ostralegus*: 23 males, 29 females, Germany, Dornumersiel, fall 1979, Stricker (UAM 1237); 7 males, 10 females, Germany, Nordsee, Aussengroden, 8 February 1991 (UAM 1663). From the American Black Oystercatcher *Haematopus bachmani* (NEW HOST): 2 males, 2 females, USA, Alaska, South Central District, Prince William Sound, Orca Inlet, 10 mi SW Cordova, 60°30′N, 145°44′W, 3 May 1981, J. G. Strauch Jr (BMOC #81-0820-2); 1 male, 1 female, same data (BMOC #81-0820-1). From the Magellanic Oystercatcher *Haematopus leucopodus* (NEW HOST): 1 male, Falkland Islands, New Island, 21 January 1954, O. S. Pettingill Jr. (USNM 135912). From the African Black Oystercatcher *Haematopus moquini* (NEW HOST): 8 males, 1 female, South West Africa, Plumpudding Island, 10 October 1948, R. W. Rand (NU 3617, SAIMR MT 40/1/54).

5.8 *Sokoloviana tropica* Dubinin, 1956

Species described by Dubinin (1956) from the Blackish Oystercatcher *Haematopus ater* from Falkland Islands.

Type material. From the Blackish Oystercatcher *Haematopus ater*: syntypes 6 males, 4 females, Falkland Islands, 3 May 1947, V. B. Dubinin (ZISP 217).

Additional material examined. From the same host species: 1 male, 1 female, Peru, Chincha Islands, North Island, 11 June, R. E. Coker (NU 8679, USNM 212052). From the American Oystercatcher *Haematopus palliatus* (NEW HOST): 1 male, 3 females, USA, USA, Texas, Arkansas Co., Deadman Island, Arkansas Bay, 12 May 1960, W. B. Davis (NU 1686).

5.9 *Sokoloviana zumpti* Gaud, 1972

Gaud (1972) described this species from the Crowned Plover *Vanellus coronatus*.

Material examined. From the Crowned Plover *Vanellus coronatus*: 5 males, 4 females, Africa, Kenkel Bosch, 10 September 1919 (NU 8707, USNM 275308).

6 Key to the species of the genus *Sokoloviana*

Males

1. – Paragenital sclerites fused by transverse sclerite posteriorly to genital organ 2
   – Paragenital sclerites free 4
2. – Opisthosomal lobes with big external horns ..... *S. cornuta*
   – Opisthosomal lobes without external horns 3
3. – Paragenital sclerites fused anteriorly to genital organ ..... *S. gracilis*
   – Paragenital sclerites free anteriorly to genital organ ..... *S. mariae*
4. – Setae *h3* with membranous inner expansion and hair-like distal part 5
   – Setae *h3* without membranous inner expansion 9
5. – Setae *f2* not reaching tips of opisthosomal lobes 6
   – Setae *f2* extending far behind opisthosomal lobes 8
6. – Terminal cleft rectangular, setae *c3* lanceolate ..... *S. chilensis*
   – Terminal cleft divergent, setae *c3* awl-like 7
7. – Setae *ps1* set near tips of the lobes, 1/5 of the lobes' length, terminal cleft key-hole-like ..... *S. vanelli*
   – Setae *ps1* set near tips of the lobes, at least 1/3 of the lobes' length, terminal cleft triangular with rounded base ..... *S. zumpti*
8. – Setae *c3* awl-like; cribrum three times longer than wide, distance *4a-g* shorter than *g-ps3* ..... *S. leptosoma*
   – Setae *c3* lanceolate; cribrum nearly twice as long as wide, distance *4a-g* longer than *g-ps3* ..... *S. allocerca*
9. – Paragenital sclerites very long, extending anteriorly beyond setae *3a* ..... *S. pavlovskyi*
   – Paragenital sclerites shorter, not reaching the level of setae *3a* 10
10. – Small adanal scerites present 11
    – Adanal sclerites absent 12
11. – Terminal cleft triangular, acute at the base, opisthosomal lobes without lateral membranes ..... *S. rehbergi*
    – Terminal cleft with rounded base, lateral membranes present ..... *S. tropica*
12. – Cribrum well developed, ovoid; lateral membranes doubled, rectangular ..... *S. ibidorhynchae*
    – Cribrum slit-like, lateral membranes one-partial, rounded ..... *S. kucheruki*

Females

1. – Long branches of epigynum fused with genital setae *g* 2
   – Epigynum not reaching genital setae *g* 4
2. – Terminal cleft semicircular ..... *S. gracilis*
   – Terminal cleft triangular 3
3. – Hysteronotal shield covered by numerous small lacunas ..... *S. cornuta*
   – Hysteronotal shield smooth ..... *S. mariae*
4. – Terminal cleft with regular margins 5
   – Terminal cleft with irregular margins ..... *S. pavlovskyi*
5. – Opisthosoma with membranous lobes, bearing a single small tooth, the end of bursa copulatrix not reaching terminal cleft 6
   – Opisthosoma without membranous lobes, the end of bursa copulatrix reaching terminal cleft 10
6. – Setae *c3* awl-like, acute 7
   – Setae *c3* lanceolate 9
7. – Distance between *e2-gla* almost the same as *e2-f2*, hysteronotum covered with numerous small lacunas 8
   – Distance between *e2-gla* almost twice as long as *e2-f2*, hysteronotum smooth ..... *S. zumpti*
8. – Branches of epigynum at the most reaching setae *3a* ..... *S. vanelli*
   – Branches of epigynum extending beyond setae *3a* ..... *S. leptosoma*
9. – Distance between *e2-gla* almost the same as *e2-f2*, hysteronotum covered with numerous small lacunas ..... *S. chilensis*
   – Distance between *e2-gla* almost twice as long as *e2-f2*, hysteronotum smooth ..... *S. allocerca*
10. – Terminal cleft as long as wide 11
    – Terminal cleft twice as long as wide 12
11. – Branches of the epigynum to the setae *g*, fused with genital acetabules, distance between *e2-gla* almost twice as long as *e2-f2* ..... *S. tropica*
    – Branches of the epigynum extending only beyond the setae *3a*, distance between *e2-gla* almost the same as *e2-f2* ..... *S. rehbergi*
12. – Setae *se* a bit longer than the distance between them, pronotal shield with two longitudinal sutures near the setae *vi*, hysteronotal shield with numerous small lacunas ..... *S. kucheruki*
    – Setae *se* almost twice as long as the distance between them, pronotal shield without sutures, hysteronotal shield smooth ..... *S. ibidorhynchae*

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