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On the collections of Indo-Australian Spirobolida (Diplopoda) kept in the Zoological Museum of the Moscow State University, Russia. 2. Two new species of *Spirobolellus* Pocock, 1894 from islands off Papua New Guinea and Australia

О коллекциях индо-австралийских Spirobolida (Diplopoda), хранящихся в Зоологическом музее Московского государственного университета (Россия). 2. Два новых вида *Spirobolellus* Pocock, 1894 с островов близ Папуа-Новой Гвинеи и Австралии

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KEY WORDS: millipede, Spirobolellidae, taxonomy, new species, New Guinea, Australia.

КЛЮЧЕВЫЕ СЛОВА: двупарноногие многоножки, Spirobolellidae, таксономия, новый вид, Новая Гвинея, Австралия.

ABSTRACT. Two new species of the millipede genus *Spirobolellus* are described: *S. kurtschevae* sp.n. from Lou Island, Admiralty Islands, Papua New Guinea, and *S. tschernovi* sp.n. from Norfolk Island, New South Wales, Australia. Because the telopodite of the anterior gonopods on the caudal face is swollen and directed not laterad, but mesad, *S. tschernovi* sp.n. seems to share this peculiar feature only with *S. antipodarum* (? = *S. reischeki*). This also allows us to confirm that *Desmocricellus* Attems, 1953 is a junior subjective synonym of *Spirobolellus* Pocock, 1894.

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РЕЗЮМЕ. Описаны два новых вида диплопод рода *Spirobolellus*: *S. kurtschevae* sp.n. с острова Лоу (острова Адмиралтейства, Папуа-Новая Гвинея) и *S. tschernovi* sp.n. с острова Норфолк (Новый Южный Уэллс, Австралия). Вид *Spirobolellus tschernovi* sp.n. столь необычен, что, кажется, его вздутый сзади и направленный внутрь, а не вбок телоподит передних гоноподов есть еще только у *S. antipodarum* (? = *S. reischeki*). Это одновременно позволяет подтвердить, что *Desmocricellus* Attems, 1953 — младший субъективный синоним *Spirobolellus* Pocock, 1894.

Introduction

This is the second contribution to the fauna of the millipede order Spirobolida of the southwestern Pacific based on the collections of the Zoological Museum of the Moscow State University (ZMUM), Russia. This time it is devoted to descriptions of two new species of *Spirobolellus* Pocock, 1894, Spirobolellidae, a diverse family that mainly occurs in the Indo-Australian region [Jeekel, 2001; Minelli, 2015]. Our previous contribution dealt with a new species of Pachybolidae from Papua New Guinea [Golovatch *et al*., 2020].

The samples were collected in 1976 and 1977 by Yuriy I. Chernov and Galina F. Kurcheva during two expeditions on board the research vessels "Kallisto" and "Dmitry Mendeleyev", respectively, to several islands and archipelagos in the southwestern Pacific.

The genus *Spirobolellus* presently comprises ca. 80 species occurring in the Indo-Pacific and Caribbean realms. The distribution ranges across Indonesia (Sumatra, Java, Sulawesi and the Moluccas), through Caroline Islands, Micronesia, to eastern Australia, Lord Howe Island, New Caledonia, Loyalty Islands and New

Zealand [Minelli, 2015], as well as from northern South America through Panama to the Greater Antilles. Only Jamaica in the West Indies remains a remarkable exception [Hoffman, 1999]. A global checklist and a distribution map of *Spirobolellus*, albeit neither very accurate, are available on https://www.gbif.org/species/1019087

New Caledonia alone supports as many as 28 species of *Spirobolellus*, several of which are shared with Loyalty Islands [Carl, 1926], thus representing one of the most conspicuous examples of insular species swarms among millipedes [Enghoff, 1993; Minelli, 2015]. Carl [1926] compiled a key to most *Spirobolellus* spp. of the Indo-Pacific, while Hoffman [1999] provided a comprehensive catalogue of New World *Spirobolellus* occurring north of Panama. Jeekel's [2001] catalogue of the Indo-Pacific *Spirobolellus* is nearly complete, supplemented since only by Jeekel [2002, 2003] who described further three new species from Australia. In addition, Johns [2010], when reviewing the fauna of New Zealand and probably based on a revision of pertinent type material, synonymized both *S. drymophilus* Chamberlin, 1920 and *Desmocricellus reischeki* Attems, 1953 with *S. antipodarum* (Newport, 1843)[1] . Therefore, *Desmocricellus* Attems, 1953 became still another genus added to Hoffman's [1999] and Jeekel's [2001] long rosters of the formal generic synonyms of *Spirobolellus*.

Describing new species of *Spirobolellus* is therefore fairly dangerous, especially because many original descriptions are very poor, in particular those by Chamberlin [1920a, b]. The latter author provided no illustrations at all for the numerous new genera and species he then described, causing them to be totally ignored by Carl [1926]. On the other hand, a few congeners tend to be widespread due to introduction, e.g. from Australia to California, U.S.A. [Chamberlin, 1920a]. In this paper, we dare describe two new species, however, because both seem to be among the smallest *Spirobolellus* spp. to be reported so far, and both come from areas where, to our knowledge, no valid congeners have ever been recorded.

Material and methods

All new material treated below is deposited in the ZMUM. Colour pictures were obtained with a Canon EOS 5D digital camera and stacked using Zerene Stacker software. Type material housed in the NHMW is revised and documented for comparison with the new species. NHMW types are illustrated using a Nikon DS-Ri-2 camera mounted on a Nikon SMZ25 stereo microscope using NIS-Elements Microscope Imaging Software with an Extended Depth of Focus (EDF) patch.

The classification, however deficient, follows that of Jeekel [2001] and Minelli [2015], allowing for catalogue sections to largely be omitted as redundant.

Taxonomic part

Family Spirobolellidae
Spirobolellus Pocock, 1894

Type species: *Spirobolellus chrysodirus* Pocock, 1894, by original designation.

DIAGNOSIS: A genus of Spirobolellidae containing small- to medium-sized species (typically 15–90 mm long, but length usually 30–40 mm) with slender bodies, short and clavate antennae, nearly smooth, only finely striolate body rings, with small ozopores, but without scobinae. Anterior gonopods massive and relatively complex, their sternite a large and hyaline plate with a distinct antero-central elevation or process; coxite large, mostly simple, squarish and laterally swollen, apically supporting a similarly simple or more elaborate, stout or elongate, 1-segmented and moveable telopodite with a thickened, sometimes ridge-like mesal margin. Posterior gonopods simple, connected basally with a small, weak and thin membranous sternite, each gonopod relatively small, blade-shaped, slightly curved mesad, with neither articulation between coxite and telopodite nor a basal chamber; a seminal groove, if traceable, with a distomesal opening.

Included species: >80 species [Hoffman, 1999; Jeekel, 2001, 2003; Johns, 2010], including *Spirobolellus kurtschevae* sp.n. and *S. tschernovi* sp.n.

Spirobolellus kurtschevae **sp.n.**
Figs 1, 2, 4–7.

HOLOTYPE ♂ (ZMUM), Papua New Guinea, Admiralty Islands, Lou Island, S2º24′, E147º21′, coconut plantation, 2.II.1977, G.F. Kurcheva leg.

PARATYPES: 2 ♀♀ (ZMUM), same data as holotype.

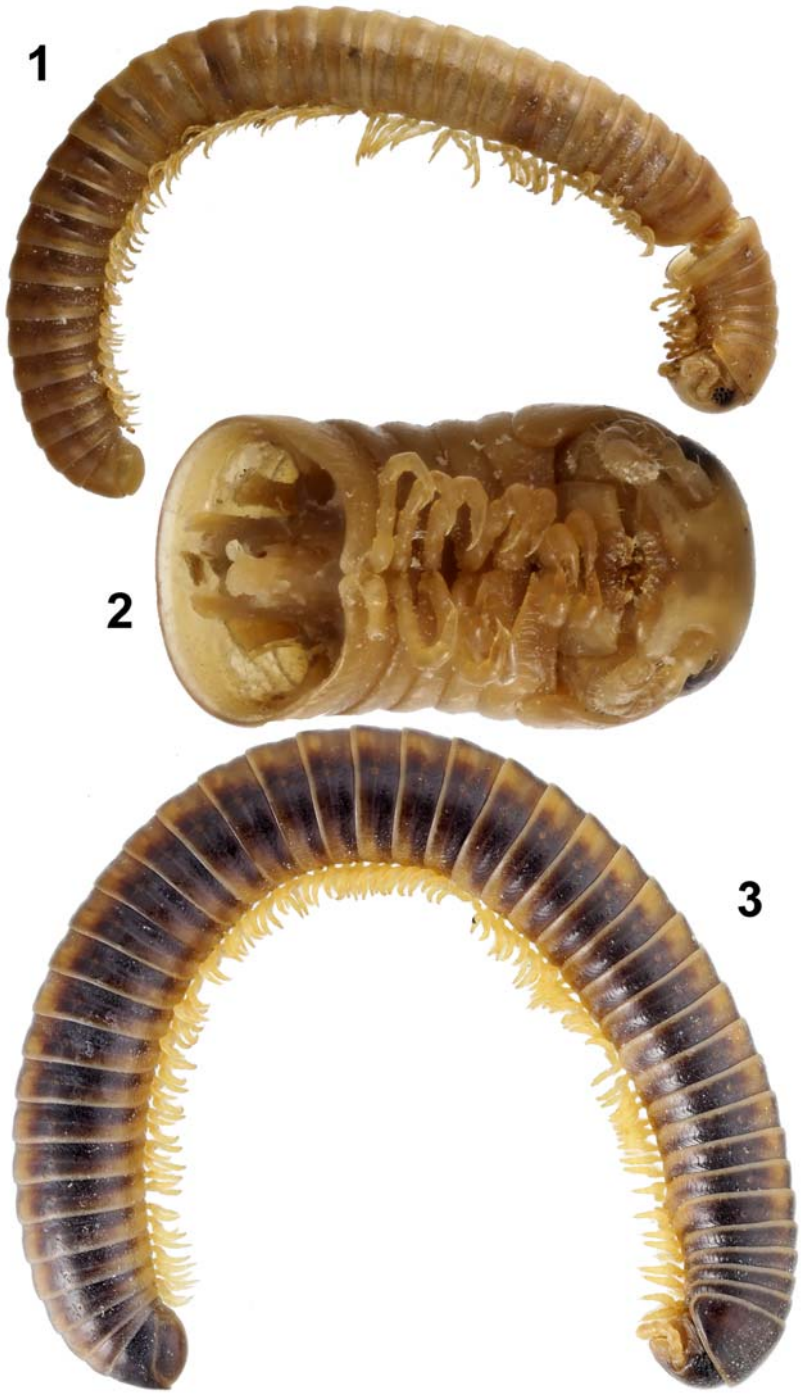
NAME. To honour the late Dr. Galina Fedorovna Kurcheva, the collector.

DIAGNOSIS. Differs from all other species of *Spirobolellus* in being one of the smallest congeners (10–15 mm long), devoid of a clear colour pattern, as well as by certain details of gonopodal structure: anterior gonopods featuring a high, squarish, apically bisinuate sternite nearly as high as a broad and simple telopodite, the latter bearing a relatively inconspicuous bulge directed laterad on caudal face; posterior gonopods with a broadened distal third and a subacuminate tip (Figs 4–7).

DESCRIPTION. Holotype ♂ ca. 13.5 mm long and 1.0 mm wide, with 35p+1ap+T body segments. Smaller paratype ♀ ca. 10 mm long and 0.9 mm wide, with 28p+2ap+T body segments. Larger ♀ paratype ca. 16 mm long and 1.5 mm wide, with 34p+1ap+T body segments. Coloration uniformly red-brown, pattern vague, slightly cingulate, sometimes also with an indistinct dark greyish line at ozopore level. Eye patches ovoid, dark brown (Figs 1, 2).

Body slender, cylindrical, each segment distinctly constricted only between meso- and prozonae (Fig. 1). Postcollum constriction faint (Fig. 2). Labrum with three middle teeth, a short axial suture, 3+3 supralabral and 4–5+4–5

[1] Johns [2010], in his endnote that advanced new synonymies, made several small mistakes. He slightly misspelled the name *S. antipodarum*, referring to it as *S. antipodarus,* which is incorrect because the end suffix *-arum* is «genitive plural» and remains unchanged regardless of gender. In addition, the correct year when Newport described his *S. antipodarum* was 1843, not 1844 [Newport, 1843]. The other species was misspelled as *S. dryomophilus*, the correct spelling being *S. drymophilus* Chamberlin, 1920 [Chamberlin, 1920b].

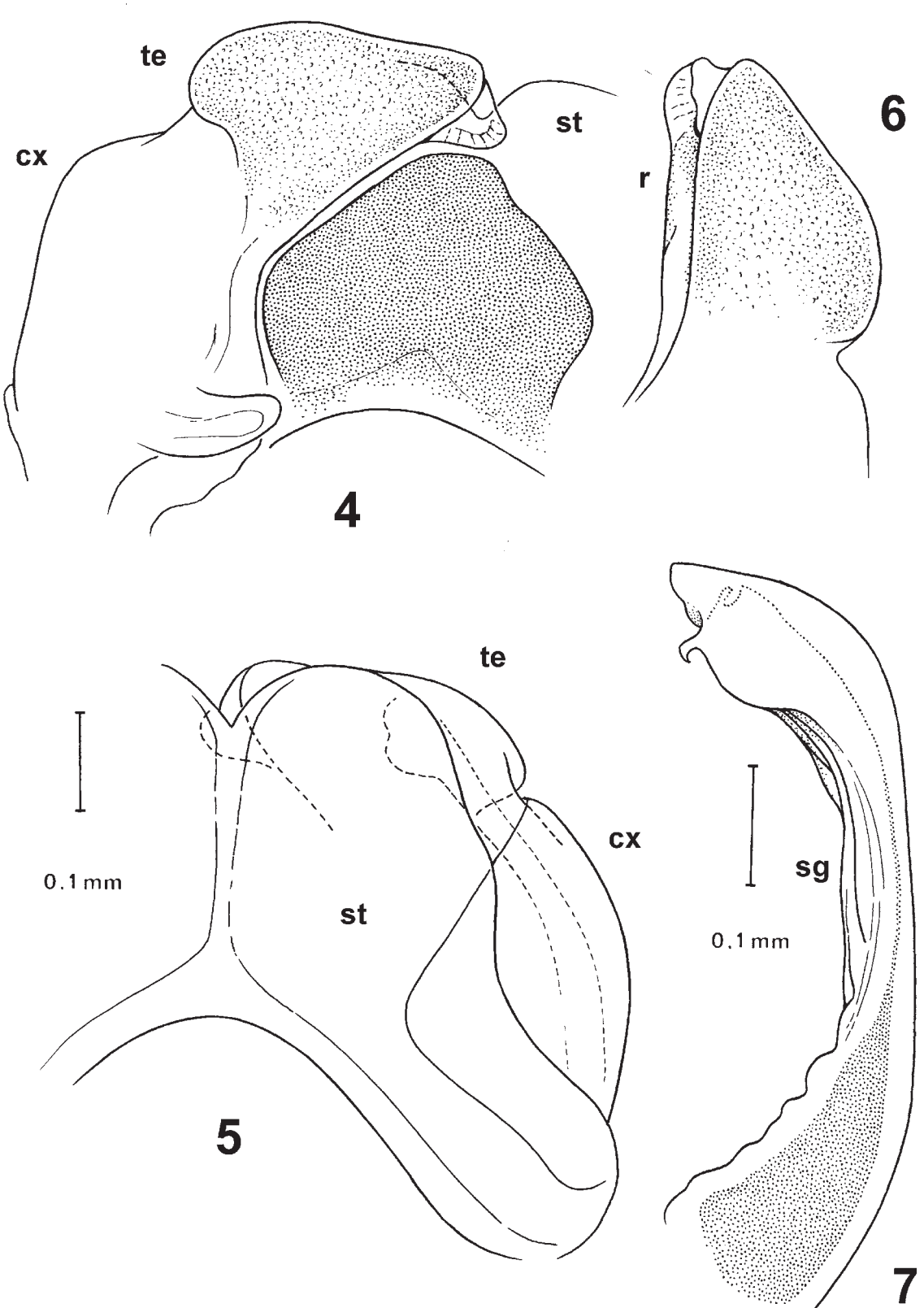


Figs 1–3. *Spirobolellus kurtschevae* sp.n., ♂ holotype, and *Spirobolellus tschernovi* sp.n., ♂ paratype with 41p+1ap+T. 1, 3 — habitus, lateral views; 2 — anterior part of body, ventral view. Pictures by K.V. Makarov, taken not to scale.

Рис. 1–3. *Spirobolellus kurtschevae* sp.n., голотип ♂, и *Spirobolellus tschernovi* sp.n., паратип ♂ с 41p+1ap+T. 1, 3 — общий вид, сбоку; 2 — передняя часть тела, снизу. Фотографии К.В. Макарова, сняты без масштаба.

labral setae. Epicranial suture fine, but visible. Antennae very short, clavate, setose, each located inside an evident cephalic hollow; antennomeres 1–5 subequal, 6th the largest, almost twice as long; 7th the shortest and ring-shaped, 8th with four apical sensilla (Figs 1, 2). Each eye patch composed of 21–25 ommatidia arranged in five or six subvertical rows, isthmus ca. 2x diameter of eye patch (Fig. 2).

Tegument bare, mostly smooth and shining (Figs 1, 2). Collum broadly and regularly rounded, clearly bordered both anteriorly and laterally (Fig. 1). Following segments/rings with evident constrictions solely between meso- and prozonae, but only with faint transverse lines between meta- and mesozonae (Fig. 1); metazonae very finely and mostly longitudinally striolate, clearly, densely and regularly striolate



Figs 4–7. *Spirobolellus kurtschevae* sp.n., ♂ holotype. 4, 5 — anterior gonopods, posterior and anterior views, respectively; 6 — left coxite and telopodite of anterior gonopods, mesoposterior view; 7 — left posterior gonopod, subcaudal view. Abbreviations: st — sternite; cx — coxite; te — telopodite; r — ridge; sg — seminal groove.

Рис. 4–7. *Spirobolellus kurtschevae* sp.n., голотип ♂. 4, 5 — передние гоноподы, соответственно сзади и спереди; 6 — левые коксит и телоподит передних гоноподов, одновременно изнутри и сзади; 7 — левый задний гонопод, почти сзади. Обозначения: st — стернит; cx — коксит; te — телоподит; r — гребень; sg — семенной канал.

ventrolaterally, striolations being increasingly sparse, irregular/confused and incomplete dorsolaterad, dorsum nearly smooth; striolations on meso- and, especially, prozonae increasingly arcuated near metazonae, then subvertical anteriorly, likewise increasingly obliterate, finer and sparser dorsad, lunulate near stricture, but traceable also across dorsum; ozopores small, inconspicuous, starting with segment 6, lying on line between meta- and mesozonae (Figs 1, 2). Scobinae absent. Telson (Fig. 1) as usual, epiproct flat dorsoventrally, very small and rounded caudally; paraprocts strongly and regularly convex, smooth, not bordered along caudal margin, with only a small and inconspicuous gutter between both valves; hypoproct roundly subtriangular, short. Only ♂ segments 6 and 7 clearly swollen ventrally, 7th being a complete ring due to a strong, slightly convex, ventral bridge in middle part, the bridge being ca. 1/3 as long as entire ring.

Legs short and slender, ca. 2/3 as long as midbody height, sparsely setose and each usually with a spine below and above claw; claw slightly curved ventrad, ca. 1/3 as long as tarsus; sole pads absent; only ♂ legs 1 and 2 somewhat shorter; ♂ coxae 3–5 transversely squarish, each with an evident ventral swelling, this being the highest on coxa 3 and the lowest on coxa 5 (Fig. 2).

Gonopods (Figs 4–7) typical of *Spirobolellus*. Anterior gonopods with a broad, squarish, apically roundly bisinuate sternite (**st**), the latter being only barely shorter than both coxa (**cx**) and telopodite (**te**); **cx** and **te** subequal in size, rounded, **te** poorly swollen and drawn laterad on caudal face, with a characteristic, rounded, apical tooth extended proximad into a strong mesal ridge (**r**). Posterior gonopods simple, slender, blade-shaped; coxal part slightly undulate at mesal margin; seminal groove (**sg**) fully mesal, extended until a small, distal, mesal hook; middle third of gonopod narrowed, basal and distal thirds broadened, tip subtriangular, roundly acuminate.

REMARKS. This is the first *Spirobolellus* ever to be reported from the New Guinea region, formally the Admiralty Islands, Papua New Guinea. The geographically closest record belongs to *S. chrysogrammus* Pocock, 1894 from Kai Islands, Sulawesi and Ambon, Indonesia [Attems, 1914].

Spirobolellus tschernovi **sp.n.**
Figs 3, 8–14.

HOLOTYPE ♂ (ZMUM), Australia, New South Wales, Phillip Island near Norfolk Island, S29º07′10″, E167º57′01″, rotten wood on supra-littoral stones, 30.XII.1976, Y.I. Chernov leg.

PARATYPES: 8 ♂♂, 16 ♀♀ (ZMUM), same data as holotype; 1 ♂, 1 ♀, 3 juv. (ZMUM), Australia, New South Wales, Norfolk Island, S29º02′, E167º57′, mixed leaved and *Araucaria* forest, rotten wood, 31.XII.1976, Y.I. Chernov leg.

NAME. To honour the late Academician Yuriy Ivanovich Chernov, the collector.

DIAGNOSIS. Differs from most species of *Spirobolellus* by the relatively small body, the presence of a distinct colour pattern, and the telopodite of the anterior gonopods, much like in *S. antipodarum* (Newport, 1843), being double-headed, swollen and directed not laterad, but mesad on the caudal face. Differs from *S. antipodarum* by the central process of the anterior gonopod sternite being regularly rounded (vs. slightly bisinuate), and the posterior gonopod clearly narrowed in the middle third (vs. nearly parallel-sided) (cf. Figs 3, 8–14 and 15–18).

DESCRIPTION. Holotype ♂ ca. 16 mm long and 1.6 mm wide, with 38p+1ap+T body segments. Adult paratypes ca. 18–21 mm long and 1.7–2.2 mm wide (♂, ♀), with 36–42p+2–0ap+T body segments, mostly 38p+2ap+T. ♂♂ usually being a little smaller than ♀♀. Coloration mostly dark brown, often purplish; pattern usually distinct: antennae, legs, venter, two large paramedian stripes in dorsal quarter, as well as caudal margins of body segments narrowly cingulate, all contrasting light yellowish grey against a generally dark background. Eye patches ovoid, dark brown to blackish (Fig. 3).

All characters as in *S. kurtschevae* sp.n., except as follows.

Anterior gonopods (Figs 8, 9, 11–13) with a subtriangular, regularly rounded, central process of sternite (**st**); coxite (**cx**) and telopodite (**te**) subequal, likewise rounded, **te** double-headed, clearly higher than **st**, its apical part bulged and directed mesad like a smaller basal part, mesal ridge (**r**) thick and evident. Posterior gonopods (Figs 10, 14) blade-shaped, distinctly expanded in basal and apical thirds, narrowed in middle one, with two small spikes marking a distomesal opening of a vague seminal groove; tip broadly subtriangular.

REMARK. There is a "*Spirobolellus norfolkensis* Mauriès, 1980" among the *Spirobolellus* spp. listed on https://www.gbif.org/species/1019087, apparently also coming from Norfolk Island. However, this is a *nomen nudum*, the valid name being *Spirobolellus tschernovi* sp.n.

Spirobolellus vs. *Desmocricellus*

Newport [1843] described his *Spirostreptus antipodarum* Newport, 1843 very briefly from an unknown locality in North Island, New Zealand. The number of syntypes, all kept in the London Museum, remained and still remains unspecified [Newport, 1843, 1844a, b]. Karsch [1881] repeated the original description verbatim, including the statement that all specimens were immature, with only 30 body segments (vs. about 50 in the adults) and 1.5–2 inches long (= ca. 36–51 mm). Again without any additional information on the type series, but apparently upon its revision, Pocock [1894] transferred that "spirostreptid" species to the newly created genus *Spirobolellus*, order Spirobolida, while Johns [2010] synonymized *S. antipodarum* with both *S. drymophilus* Chamberlin, 1920 and *Desmocricellus reischeki* Attems, 1953, all from New Zealand.

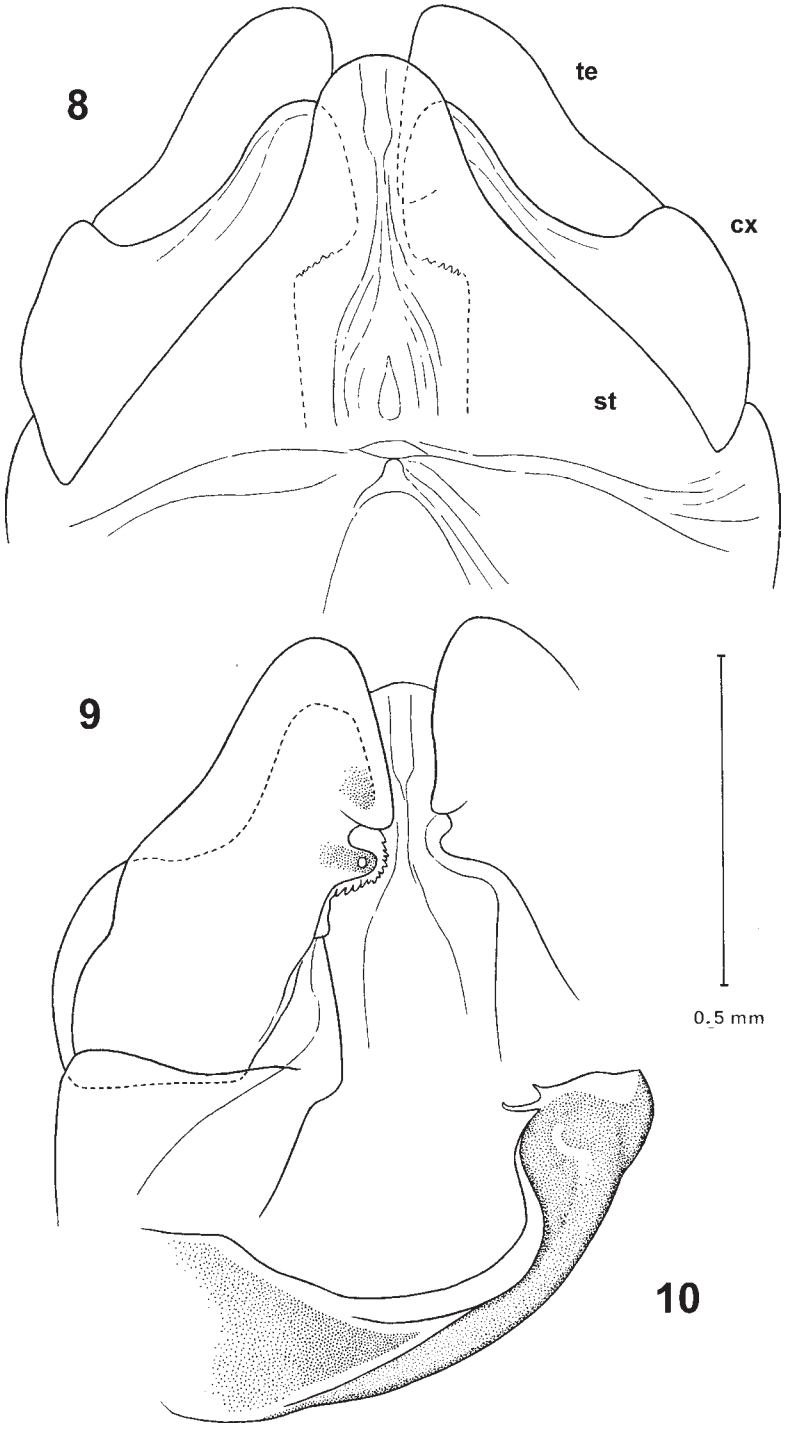
Peter Johns revised the type series of *Desmocricellus reischeki*, housed in the NHMW, back in 1967 (Fig. 19). We have also re-examined it, this resulting in the following account.

Spirobolellus reischeki (Attems, 1953)
Figs 15–19.

Desmocricellus reischeki Attems, 1953: 185, figs 93–96.

TYPE MATERIAL: Syntypes (NHMW 2346–2348, 9354): anterior body parts of 2 ♂ and 11 ♀, 28 middle body parts, several detached segments, 25 posterior body parts; 1st vial: 1 head and two segments (Fig. 15), dissected ♂ segments 3–6 and 7–11, four middle parts; 2nd vial: 1 ♂ complete; 3rd vial: 6 ♂ anterior body parts, 1 ♀ anterior body part; 4th vial (NHMW 9354): anterior body part, dissected gonopods (Figs 16, 17).

TYPE LOCALITY: New Zealand, "aus morschem Holz", leg. & don. Andreas Reischek.

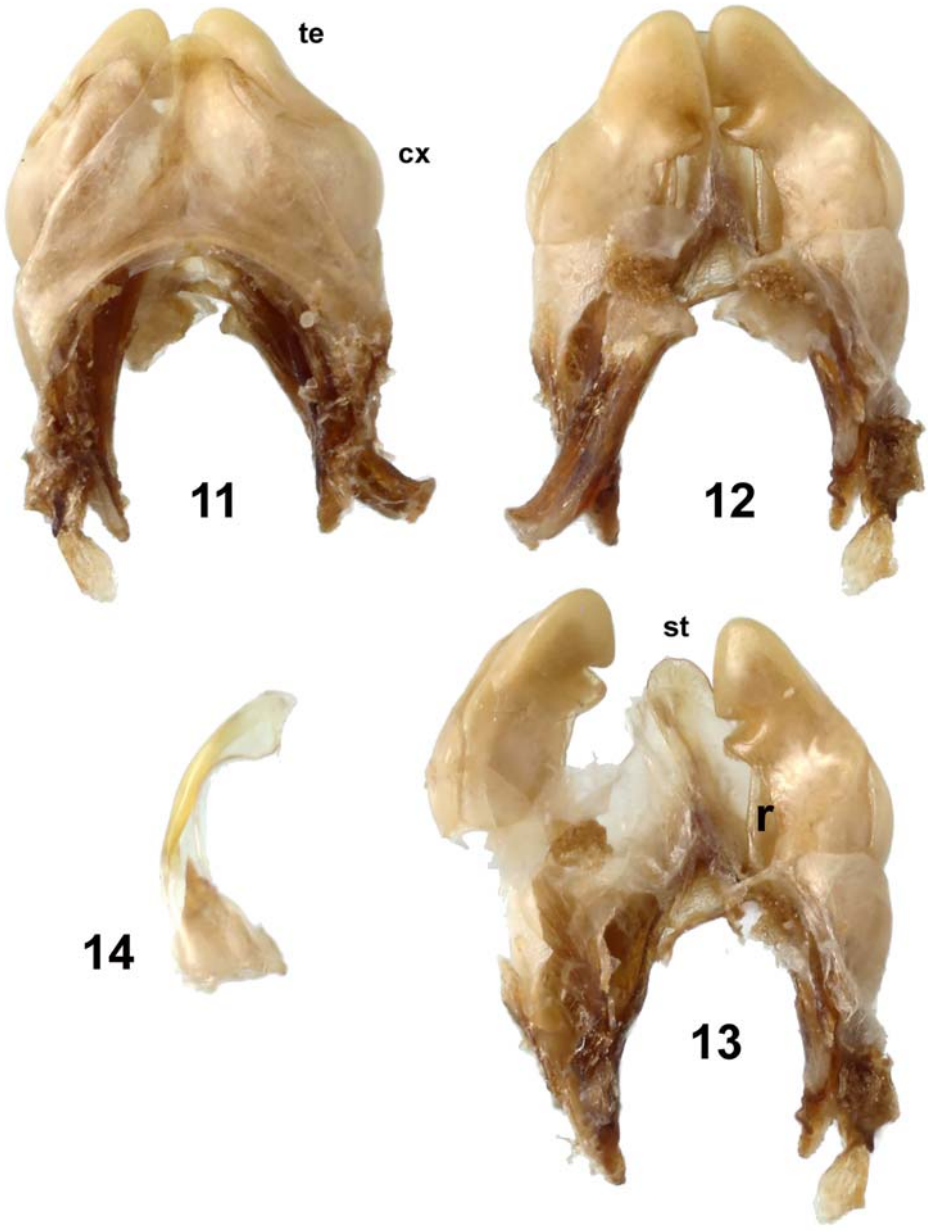


Figs 8–10. *Spirobolellus tschernovi* sp.n., ♂ paratype. 8, 9 — anterior gonopods, anterior and posterior views, respectively; 10 — left posterior gonopod, subcaudal view. Abbreviations: st — sternite; cx — coxite; te — telopodite.

Рис. 8–10. *Spirobolellus tschernovi* sp.n., паратип ♂. 8, 9 — передние гоноподы, соответственно спереди и сзади; 10 — левый задний гонопод, почти сзади. Обозначения: st — стернит; cx — коксит; te — телоподит.

ALCOHOL LABELS: “Neuseeland 22/ Reischek/ aus morschem Holz”; “*Desmocricellus*/ *reischeki* Att. Type/ Neuseeland/ aus morschem Holz./ Reischek” (A); “*Desmocricellus reischeki* Attems 1953/ = *Spirobolellus dryomophilus*/ Chamberlin 1920/ det. P.M. Johns 27.X.67”; vial: “Lectotype ♂/ Lectoparatype ♂/ P.M. Johns 27.X.1967”

SLIDES: slide (NHMW 2346): 2 gonopods, “*Desmocricellus*/ Neuseeland/ Reischek” (A), “*Desmocricellus*/ *reischeki* Att/ P.M. Johns. 27.X.1967/ A? LECTOPARATYPE/ B? LECTOTYPE”; slide (NHMW 2347): gonopods, “*Desmocricellus*/ *reischeki*/ Neuseeland” (A), “*Desmocricellus*/ *reischeki* Att./ LECTOPARATYPE/ P.M. Johns 27.X.1967” ; slide (NHMW 2348): gnathochilarium



Figs 11–14. *Spirobolellus tschernovi* sp.n., ♂ paratype. 11, 12 — intact anterior gonopods, anterior and posterior views, respectively; 13 — dissected anterior gonopods to remove a posterior gonopod; 14 — right posterior gonopod, subcaudal view. Abbreviations: st — sternite; cx — coxite; te — telopodite; r — ridge. Pictures by K.V. Makarov, taken not to scale.

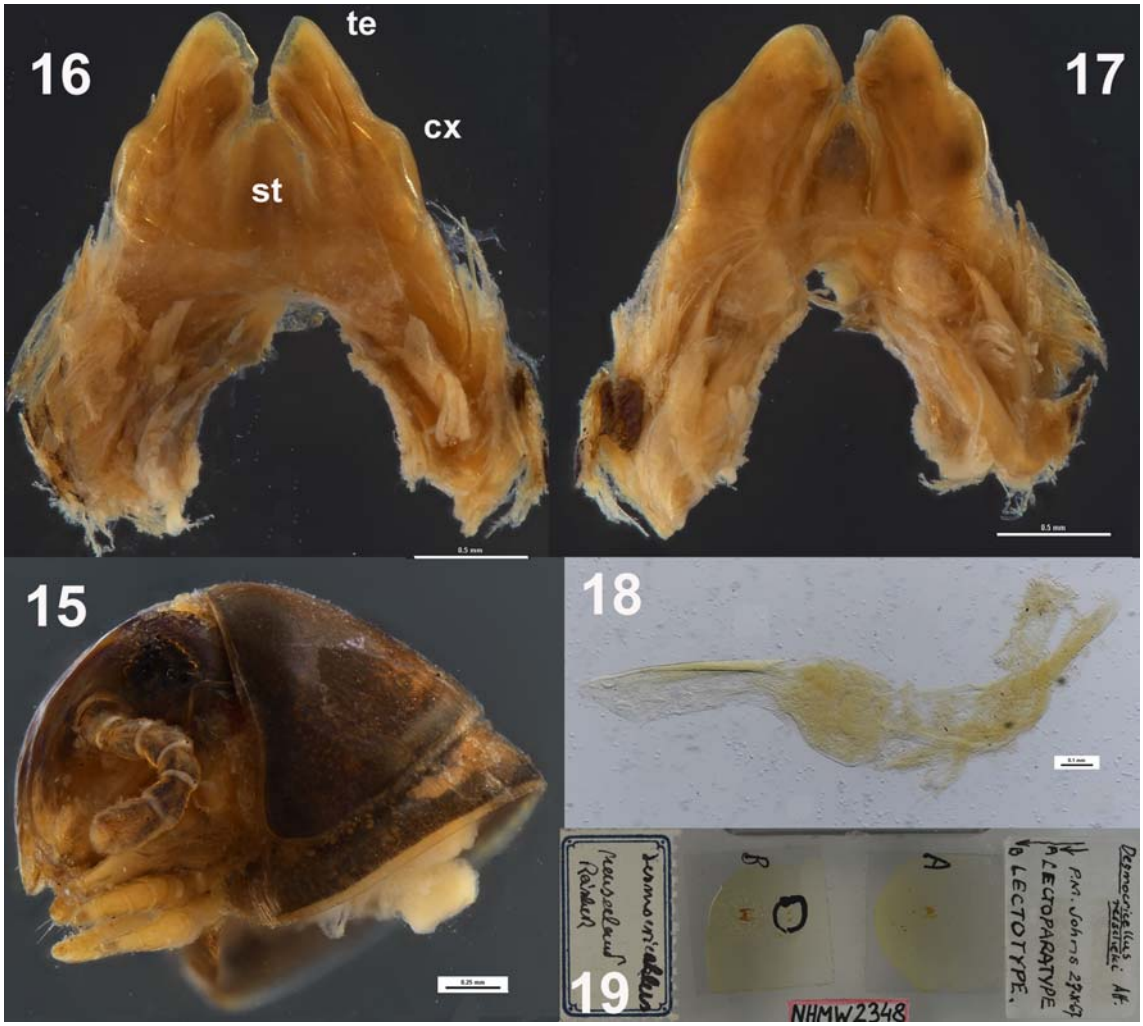
Рис. 11–14. *Spirobolellus tschernovi* sp.n., паратип ♂. 11, 12 — целые передние гоноподы, соответственно спереди и сзади; 13 — отпрепарированные передние гоноподы для удаления заднего гонопода; 14 — правый задний гонопод, почти сзади. Обозначения: st — стернит; cx — коксит; te — телоподит; r — гребень. Фотографии К.В. Макарова, сняты без масштаба.

and nine legs, "*Desmocricellus*/ *reischeki*/ Neuseeland/ 1.–6.Bp Gnath" (A), "*Desmocricellus*/ *reischeki* Att/ LECTOPARATYPE/ P.M. Johns 27.X.1967".

CURRENT STATUS: synonymized with both *Spirobolellus antipodarum* Newport, 1843 and *S. drymophilus* Chamberlin, 1920 [Johns, 2010]. Jeekel [2001: 17] slightly misspelled the name as "*reischecki*".

DISCUSSION. Peter M. Johns studied the material in October 1967, labelled the specimens as *Spirobolellus drymophilus* Chamberlin, 1920 [Chamberlin, 1920b: 213–214], and designed a ♂ lectotype and a ♂ paralectotype. However, this designation has since never been formalized and it requires publication even though the species was immediately synonymized with *S. drymophilus*, later with *S. antipodarum* as well [Johns, 2010].

If the synonymy is correct, *Desmocricellus* becomes another generic synonym of *Spirobolellus*. Both the genus *Desmocricellus* Attems, 1953 and its sole species, *D. reischeki* Attems, 1953, were diagnosed by Attems [1953] as being distinct primarily by the presence of a deep mesal



Figs 15–19. *Spirobolellus antipodarum* (Newport, 1843), syntypes of *Desmocricellus reischeki* Attems, 1953. 15 — ♂ head, collum and segment 2, lateral view; 16, 17 — anterior gonopods, anterior and posterior views, respectively; 18 — posterior gonopod, mesal view; 19 — labeled slide NHMW 2348.

Рис. 15–19. *Spirobolellus antipodarum* (Newport, 1843), синтипы *Desmocricellus reischeki* Attems, 1953. 15 — голова, коллум и сегмент 2 у ♂, сбоку; 16, 17 — передние гоноподы, соответственно спереди и сзади; 18 — задний гонопод, изнутри; 19 — микропрепарат NHMW 2348 с этикетками.

pouch with a thick inner margin of the anterior gonopods, allowing the posterior gonopods to hinge into. However, this is far from a unique character as numerous Spirobolida show such or similar mesal pouches in the anterior gonopods, where the posterior gonopods are deeply concealed! The mesal margin of the pouch can thereby be thin or thickened. As a result, we fully agree with Johns [2010] who synonymized, albeit indirectly, *Desmocricellus* with *Spirobolellus*.

The synonymies of *S. drymophilus* and *S. reischeki* with *S. antipodarum* advanced by Johns [2010] may well be correct, but we believe they still require verification. The more so as Johns [2010] also reported another, presumably new congener from New Zealand, this meaning that more than just a single *Spirobolellus* may populate New Zealand. Thus, *S. drymophilus* was stated to measure 34 mm in length and 3.5 mm in width in the ♂, less than that in the ♀, and with 40–43 body segments, vs. 2.5 mm width and 43 body segments in the ♂ of *S. reischeki*. The colour patterns of these two species seem to be similarly black with two paramedian rows of light spots. Slight differences are observed in the shape of the collum (ventrally subtriangular, vs. broadly and regularly rounded), and of the central process of the anterior gonopod sternite (bisinuate (Figs 16, 17), vs. truncate). All useful information derived from Newport's [1843] original description of *S. antipodarum* can be reduced to the animals being brown, apparently devoid of a specific colour pattern, and the collum triangular and subacute on the sides. The types of both *S. antipodarum* and *S. drymophilus* are currently inaccessible to us for study, although available in the London Museum and the Museum of Comparative Zoology at Harvard, Mass, U.S.A., respectively. Their revision remains necessary to reconfirm the synonymies of Johns [2010].

What remains beyond doubt is that both *S. antipodarum* (?= *S. reischeki*, ?= *S. drymophilus*) and *S. tschernovi* sp.n. are very similar (see Diagnosis above), as they share double-headed telopodites of the anterior gonopods which are swol-

len and directed not laterad, but mesad on the caudal face. Yet both are definitely different, *S. tschernovi* sp.n. being considerably smaller, also showing a broadly and regularly rounded apex of the anterior gonopod sternite and a medially narrowed posterior gonopod.

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Compliance with ethical standards

Conflict of Interest: The authors declare that they have no conflict of interest.

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