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The genus *Nesobolus* (Diplopoda: Spirobolida: Rhinocricidae) in Cuba

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Abstract: A preliminary revision of the genus *Nesobolus* Chamberlin, 1918, results in three new species for eastern Cuba: *N. similis*, *N. piedra*, and *N. cuba*. *Nesobolus yaterus* Chamberlin 1922, and *Nesobolus libanonus* Chamberlin, 1922, are referred to in the synonymy of *Nesobolus toroanus* Chamberlin, 1918.

Introduction

In 1918, R. V. Chamberlin described the genus *Nesobolus* based on specimens collected near the city of Guantánamo and at the Guaso Plateau. This taxon received the name *Nesobolus toroanus*. Several years later, in 1922, he described two other taxa: *Nesobolus yateras* and *Nesobolus fibanonus* from localities quite close to that of *Nesobolus toroanus*.

H. F. Loomis (1936) assigned to the genus *Nesobolus* three Haitian species: *Nesobolus indus* (Beauvois), *Nesobolus maltzani* (Pocock), and *Nesobolus domingensis* (Pocock). Until the present these are the only members of the genus known outside Cuba.

In the present paper *N. yaterus* and *N. fibanonus* are included in the synonymy of *N. toroanus*, and three new species are described for Cuba.

Methods

Measurements of specimens (in millimeters) were made from the head to the apex of the epiproct; width was measured at the seventh segment; the number of segments is counted from the collum to the epiproct. Averages were calculated; extreme values are given in parentheses.

Gonopod microphotography was made with a scanning microscope, JEOL JSM-T 330.

Taxonomy

Nesobolus Chamberlin, 1918:203-204; 1922:3-4, pl. 2, figs. 3-11, pl. 3, figs. 1-5. Loomis, 1936: 58-61; fig. 24. Torre, 1974:14. González & Golovatch, 1990:10-11.

Diagnosis. Anterior gonopod (coleopod) in frontal view lacks semicircular depression on both sides of

the mesal process of the sternum; posterior gonopod (phallopod) bifurcated; both branches are similar in form and thickness; if different, then neither is widely laminar. Four antennal cones.

The main difference between the genera *Thyroproctus* Pocock, 1894; *Oxypige* Silvestri, 1896; *Anadenobolus* Silvestri, 1897; and *Nesobolus* is that the first genera have one branch of their bifurcated phallopod widely laminar or spatulate; while, in *Nesobolus* both branches are narrow and alike.

Key to species of *Nesobolus*

1. Posterior gonopod (phallopod) with both branches similar in size, form and thickness (fig. 2C) ...
..... *N. similis* new species
Posterior gonopod (phallopod) with one branch shorter and thinner than the other 2
2. Phallopod with one branch much shorter and thinner, the other wider, with the apex much curved and acute (Fig. 4C) *N. cuba* new species
Phallopod with one branch shorter than the other, but both similar in form and thickness 3
3. Anterior gonopod (coleopod) with narrow sternite, mesal process oblong-spatulated (Fig. 1B)
..... *N. toroanus* Chamberlin
Anterior gonopod (coleopod) with very broad sternite, mesal process short and widely elliptical (Fig. 3B) *N. piedra* new species

Nesobolus toroanus Chamberlin, 1918 (Figs. 1A-C, 5, 6A)

Nesobolus toroanus Chamberlin, 1918:204; 1922:3, pl. 2, figs. 3-4. Torre, 1974:4. González & Golovatch, 1990:10.
Nesobolus yaterus Chamberlin, 1922:4, pl. 2, figs. 5-10. González & Golovatch, 1990:11. NEW SYNONYM.

Nesobolus fibanonus Chamberlin, 1922:4, pl. 2, fig. 11, pl. 3, figs. 1-5. González & Golovatch, 1990:10. NEW SYNONYM.

Material examined. Males 598-600, females 601-602; Rifto, Yateras, Guantánamo; R. Ruíz, March 29, 1987. Males 603-604, females 605-607, juveniles 608-613; Guardabosque, Cupeyal del Norte, Sagua de Tánamo, Holguín, under rotten trunks and humus; A. Pérez-Asso and R. Ruíz; March 24, 1987. Males 665-673, females 674-677, juveniles 678-692; Farallones de Moa, Holguín; under rotten trunks bark, in forest over karst; A. Pérez-Asso; April 3, 1987. Specimens in personal collection of A. Pérez-Asso. Male 500; Cayo Fortuna, near Toa river, Yateras, Guantánamo; under brown soil over karst, under royal palm frond, in a coffee plantation; A. Pérez-Asso and R. Ruíz; March 17, 1989. Male 1494, female 1495, juvenile 1496; La Cantera, near Loma Cayo Rey, Melia, Santiago de Cuba; under bark of rotten trunks (stand); A. Pérez-Asso; August 14, 1989. Males 1683-1690, females 1691-1701; La Hembrita, Meseta del Guaso, Guantánamo; under bark of rotten trunks; A. Pérez-Asso and R. Thomas; June 13, 1990. Males 1817-1819, females 1820-1826; Jagueyón, Cuzco river, Guantánamo; under karst flagstone, among humus; A. Pérez-Asso; June 15, 1990. Male 1912, females 1913-1914; La Maravilla, near La Tagua, Meseta del Guaso, Guantánamo; under stones; A. Pérez-Asso; June 17, 1990. Male 2247, female 2248; Rancho de Yaguas, Yateras, Guantánamo; under leaf liner, mango tree and royal palm frond; A. R. Estrada; March 26, 1987. Male 2682, female 2683; Peña Blanca, Toa river, Yateras, Guantánamo; "Curujey" tree; R. Travieso and L. Bacallao; July 26, 1991. Males 3259-3286, females 3287-3326, juveniles 3327-3330; near the scientific center of Jagueyón, Guantánamo; rotten trunks; A. Pérez-Asso; May 26, 1992. Specimens in the collection of the Museo Nacional de Historia Natural, La Habana, Cuba (M.N.H.N.Cu.).

Diagnosis. Males with pregonopodal legs modified; coxa of legs 3 and 4 with prominent oblong ventral lobe and coxa of legs 5, 6 and 7 with triangular ventral lobe; coxal formula 3=4, 5=6=7 (Fig. 6A). Gonopods according to Fig. 1; coleopod with narrow sternite, mesal process oblong-spatulated, narrowed toward connection with sternite, tip also narrowed, apex rounded and overlapping telepodite; coxae prominent; coxal endite with prominent lobe in frontal view that may

cover area connecting with sternite and external mesal process (Fig. 1B); telepodite oblong and straight, distal process large, occupying approximately 1/3 of telepodite; apex truncated and slightly emarginate (Fig. 1A); phallopod with bifurcated telepodite, one branch shorter than other, both similar in form and thickness (Fig. 1C).

Variability. Males: n=42, length 28.42 (23-37); width 2.71 (2.30-3.20); number of segments 46 (41-54); females: n=43; length 31.11 (24-42); width 2.92 (2.50-3.30); number of segments 46.02 (40-54). Body uniform dark brown, or segments with anterior and central regions dark brown and posterior region light brown, with a ringed colour pattern; legs and antennae light brown, sometimes reddish or yellowish. Males with a small rounded ventral lobe at articles 2 to 5 from third pair of legs to seventh.

Distribution. Border zones between the provinces of Holguín, Santiago de Cuba and Guantánamo (Fig. 5).

Note. Type species *Nesobolus toroanus* Chamberlin, 1918, was collected in Guantánamo, Monte Toro, Nimfilas, Ramona el Mono, San Felipe, Los Hondones and Belona; all these localities belong to the Guaso Plateau or nearby areas, within the province of Guantánamo. In 1922, Chamberlin described two new species: *Nesobolus yaterus*, collected at Yateras, Bella Vista, and Jaguey; and *Nesobolus libanonus*, from Alto de la Unión and Monte Libano. All these localities also belong to the Guaso Plateau or its environs. Chamberlin himself (1922) admits the close relationship between these three species and considers the differences between them to be derived from leg coloration; the ventral process present at the articles of pregonopodal legs, and "differences" in the lower branch of the phallopod's telepodite

Leg color really depends on adult's maturity stage, and can vary from pale yellow to reddish. Completely mature specimens can have brown legs. The ventral lobes present in articles 2 to 5 of legs 3 to 7 are fairly variable both between and within populations or geographical areas. It may sometimes be much pronounced and at other times barely noticeable or even absent from some articles. Gonopods of all studied specimens, on the contrary, are identical, although they came from several different localities. No doubt this is the most impor-

tant characteristic in defining species within this genus.

Nesobolus similis new species
(Figs. 2A-C, 5, 6B-C)

Types. Holotype male 2835; paratypes males 2833-2834, females 2836-2838, juveniles 2839-2840; La Ermita, Yunque de Baracoa, Guantánamo; near forestal house; under bark of rotten trunks; A. Pérez-Asso; May 16, 1992.

Additional material. Males 176-177, females 178-180, juveniles 181-187; La Melba, Moa, Holguín; under bark; A. R. Estrada; March 9, 1986. Males 725-730, females 731-737, juveniles 738-741; Arroyo Bueno, La Melba; under bark of rotten tree trunks, in rainforest; A. Pérez-Asso; April 5, 1987. Males 818-823, females 824-830, juveniles 831-833; La Melba; under leaf litter, rainforest; A. Pérez-Asso, A. R. Estrada; April 6, 1987. Males 835-845, females 846-855; La Melba; under bark and rotten tree trunks; A. Pérez-Asso and A. R. Estrada; April 6, 1987. Males 1329-1331, females 1352-1362, juveniles 1363-1365; Jaguaní river, La Melba; under bark of rotten tree trunks; A. Pérez-Asso and A. R. Estrada; September 23, 1987. Males 1408-1410; Jaguaní river, La Melba; under bark of rotten tree trunks; A. Pérez-Asso; September 24, 1987. Males 1479-1482, females 1483-1485; Arroyo Bueno, La Melba; under bark of rotten tree trunks; A. Pérez-Asso; September 25, 1987. Males 1496-1497, females 1498, 1499, juvenile 1500; Jaguaní river, La Melba; under bark of rotten tree trunks; A. Pérez-Asso; September, 1987. Specimens in personal collection of A. Pérez-Asso. Males 943-947, females 948-950, juveniles 951-956; base of Yunque de Baracoa (at 200 m), La Ermita, Guantánamo; in dry coconuts; A. Pérez-Asso and E. Alfaro; July 28, 1989. Males 2723-2732 and 2756-2760, females 2733-2743 and 2761-2764, juveniles 2744-2753; Toa and Jaguaní rivers confluence, Yateras, Guantánamo; in a coconut plantation; R. Travieso and L. Bacallao; August 6, 1991. Males 2780-2782, females 2784-2790; base of Yunque de Baracoa; in rotten tree trunks and under bark; A. Pérez-Asso; May 15, 1992. Males 2865-2867, juvenile 2868; wall in base of Yunque de Baracoa; under bark; A. Pérez-Asso; May 15, 1992. Males 2888-2890, females 2891-2892, juveniles 2893-2894; top of Yunque de Baracoa; under bark of trees; A. Pérez-Asso; May 16, 1992. Males 3191-3198, females 3199-3204, juveniles 3207-3209; La Ermita; under bark of

rotten tree trunks; A. Pérez-Asso and E. Gutiérrez; May 18, 1992. Specimens in the M.N.H.N.Cu.

Etymology. The specific epithet alludes to the similarity between the branches of the gonopod's phallopod.

Diagnosis. Males with pregonopodal feet modified; coxa of the third pair of legs with a prominent triangular-oblong ventral lobe; coxa of legs 4 and 5 with asymmetrical to almost triangular lobe; coxa of legs 6 and 7 with small triangular-rounded ventral lobe; coxal formula 3, 4=5, 6=7 (for the population from Yunque de Baracoa); or otherwise, coxa of third pair of legs with prominent oblong-cylindrical ventral lobe; coxa of fourth pair of legs with asymmetrical lobe; coxa of legs 5, 6 and 7 with triangular rounded lobe; coxal formula 3, 4, 5=6=7 (for La Melba population). Gonopods as shown in Fig. 2; coleopod with wide sternite; mesal process oblong, slightly narrowed toward connection with the sternite, tip widely rounded or almost truncate, apex overlapping telopodite; coxae prominent, coxal endite without prominent lobe in anterior view (Fig. 2B); telopodite rounded and somewhat curved; distal process large, occupies approximately 1/2 of telopodite; apex acute or rounded (Fig. 2A); phallopod with bifurcated telopodite, both branches similar in size, form, and thickness (Fig. 2C).

Holotype. Length 27, width 2.65, number of segments 46. Segments with median region dark brown to black and posterior region pale brown to reddish; posterior margin of segments wide and very pale or colourless; collum, epiproct, hypoproct, and anal valve reddish brown, legs and antennae brown to reddish; head reddish brown with barely noticeable dark brown spot at center of vertex. Clypeal setae 2+2; labral setae 4+4; antennal cones 4. Modifications of pregonopodal legs are described in diagnosis for the population of Yunque de Baracoa.

Variability. Population of Yunque de Baracoa: males: n=15, length 28.60 (25-31); width 2.62 (2.40-2.90); number of segments 46.6 (44-51); females: n=15, length 31.20 (26-37), width 2.81 (2.50-3.05), number of segments 47.13 (44-50). Body uniform dark brown or segments with median region dark brown and posterior region pale brown, with a ringed color pattern, identical to that of *N. toroanus*; legs and antennae yellow to brown. Males with a small rounded ventral lobe in articles 2 and

3 of legs 3 to 7, diminishing size toward the rear; articles 4 and 5 without modifications or rarely slightly modified.

Population of La Melba: males: n=35, length 27.82 (22-35), width 2.52 (2.25-2.85), number of segments 45.48 (40-52); females: n=28, length 31.17 (26-36), width 2.63 (2.20-3.00), number of segments 46.00 (42-52). Body uniform dark brown or brown, only the rear edge of the segments is paler; legs and antennae yellowish. Males with a small rounded ventral lobe in articles 2 and 3 of legs 3 and 4 and sometimes also of legs 5 and 6.

Distribution. Yunque de Baracoa, region between the rivers Toa and Jaguaní.

Note. Observed differences in the coxa of pregonopodal legs between males of both populations are remarkable; they also show slight differences in color pattern.

Nesobolus piedra new species
(Figs. 3A-C, 5, 6E-F)

Types. Holotype male 1110; paratype males 1105-1109, 1111-1122, females 1123-1142, juveniles 1143-1167; La Isabelica, Gran Piedra, Santiago de Cuba; under palm frond and leaves of arborescent fern plants in the forest; A. Pérez-Asso and E. Alfaro; August 3, 1989. Specimens at the M.N.H.N.Cu.

Etymology. The specific epithet alludes to the type locality, thus a noun in apposition and masculine.

Diagnosis. Males with pregonopodal legs slightly modified; coxa of legs 3 with rounded ventral lobe; coxa of legs 4 with triangular ventral lobe; coxa of legs 5, 6 and 7 not modified; coxal formula 3, 4, 5=6=7. Males with ventral depression in articles 2 and 3 of practically all legs. Gonopods according to Fig. 3; coleopod with very broad sternite; mesal process short and widely elliptical, slightly narrowed toward connection with sternite; tip rounded, apex slightly overlapping telopodite or of equal size, coxae reduced, coxal endite without prominent lobe in frontal view (Fig. 1B); telopodite oblong and straight, distal process small, occupying approximately 1/3 of telopodite, apex rounded (Fig. 1A); phallopod with bifurcated telopodite, one branch shorter than other, similar in form and thickness (Fig. 1C).

Holotype. Length 34, width 3.00; number of segments 50. Segments with anterior and median region dark brown to black, and with posterior region brown, posterior margin of segments wide and very pale to white; collum, epiproct, hypoproct, and anal valves dark brown; legs and antennae light brown, head brown with barely noticeable dark brown spot at vertex center. Clypeal setae 2+2, labral setae 5+6; antennal cones 4. Modifications of pregonopodal legs as described in diagnosis. Elliptical-oblong ventral depression at article 2 of legs 8 to 49 approximately; a chordate ventral depression at article 3 of legs 3 to 49 approximately; that is visible up to body segment 28.

Variability. Males: n=10, length 33.30 (30-38), width 2.82 (2.55-3.00), number of segments 49.70 (47-52); females: n=20 length 38.85 (31-50), width 3.27 (2.85-4.40), number of segments 50.70 (48-54). Segments with anterior and central regions dark brown, posterior region pale brown to ashy; legs and antennae yellow. Males with small ventral rounded lobe at article 2 of legs 3 to 7; article 3 of legs 3 to 7 with chordate ventral depression slightly marked or insinuated. Males with ventral depression at article 2 elliptical or oblong, and at article 3 chordate in practically all legs; sometimes also present in chordate form at article 4, but smaller; the last pair of legs do not show these ventral depressions. Females do not show these ventral depressions, but the ventral coxa of articles 1 to 3 may be keeled.

Distribution. Known only from the type locality.

Note. *N. piedra* shows a character not present in the remaining species known for this genus (at least in Cuba); the ventral leg depressions with well-defined form and arrangement. The frontal gonopod (coleopod) is also very different from that of *N. toroanus* and *N. similis*; although phallopod of *N. piedra* is similar to that of *N. toroanus*.

Nesobolus cuba new species
(Figs. 4A-C, 5, 6D)

Types. Holotype male 1227; paratype male 1222; top of Pico Cuba, Sierra Maestra, Santiago de Cuba; under leaf litter, among humus, in the forest; A. Pérez-Asso; August 8, 1989.

Additional material. Male 2466; Pico Cuba, in "Curujey"; A. Avila and E. Gutiérrez; September 15, 1991.

Etymology. The specific epithet alludes to the type locality, a noun in apposition, masculine.

Diagnosis. Males with modified pregonopodal legs; coxa of third and fourth pair of legs with prominent oblong ventral lobe, coxa of fifth pair with oblong ventral lobe, but not as well developed as at coxa of legs 3 and 4, coxa of legs 6 and 7 with small rounded ventral lobe; coxal formula 3=4, 5, 6=7. Gonopods according to Fig. 4; coleopod with narrow sternite, mesal process oblong-spatulated, slightly narrowed toward connection with sternite, tip also narrowed (similar to *N. toroanus*), apex rounded, slightly overlapping telopodites; coxas prominent; coxal endite without lobe at the zone of connection between sternite and medial sternal process in frontal view, higher internal angle prominent and curved (Fig. 4B); telepodite reduced; smaller than coxa, apex also small (Fig. 4A); phallopod with bifurcated telepodite, one branch much shorter and thinner, other wider, but not more than telepodite, apex much curved and acute (Fig. 4C).

Holotype. Length 32, width 3, number of segments 54. Segments with anterior and median section dark brown, and posterior region dark reddish brown, posterior margin of segments pale; anterior third of body bisinuated, rest straight; pregonopodal legs and antennae brown, central and rear legs pale brown. Clypeal setae 2+2; labral setae 5+5; antennal cones 4. Modifications of pregonopodal legs and gonopods as described in diagnosis. Penis exposed.

Variability. Males: n=3, length 36.66 (32-43), width 3.16 (3.00- 3.45), number of segments 52-66 (50-54). Body uniform dark brown to black or as that of holotype, posterior margin of segments pale, legs and antennae brown to light brown. Articles 2 to 5 of pregonopodal legs without modifications.

Distribution. Known only from the type locality.

Note. Females of this species are unknown. The phallopod of the gonopod has one branch much wider than in the rest of the Cuban species of this genus; but the form of the anterior gonopod (coleo-

pod) and the modifications of the pregonopodal legs correspond with them perfectly.

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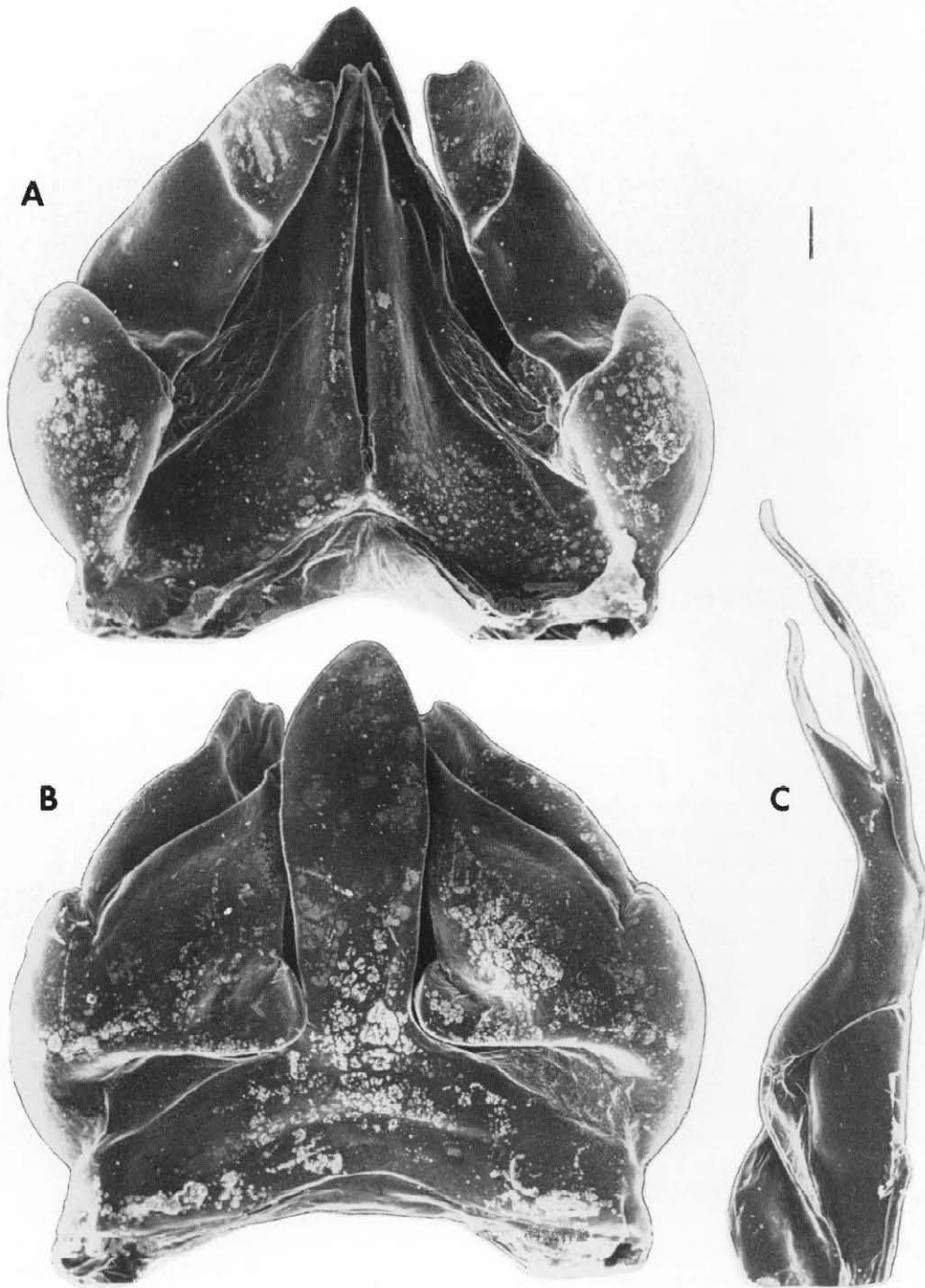


Fig. 1. *Nesobolus toroanus* Chamberlin, 1918. A. Anterior gonopod (coleopod), posterior aspect. B. Anterior gonopod, anterior aspect. C. Posterior gonopod (phallopod). Scale lines = 100mm.

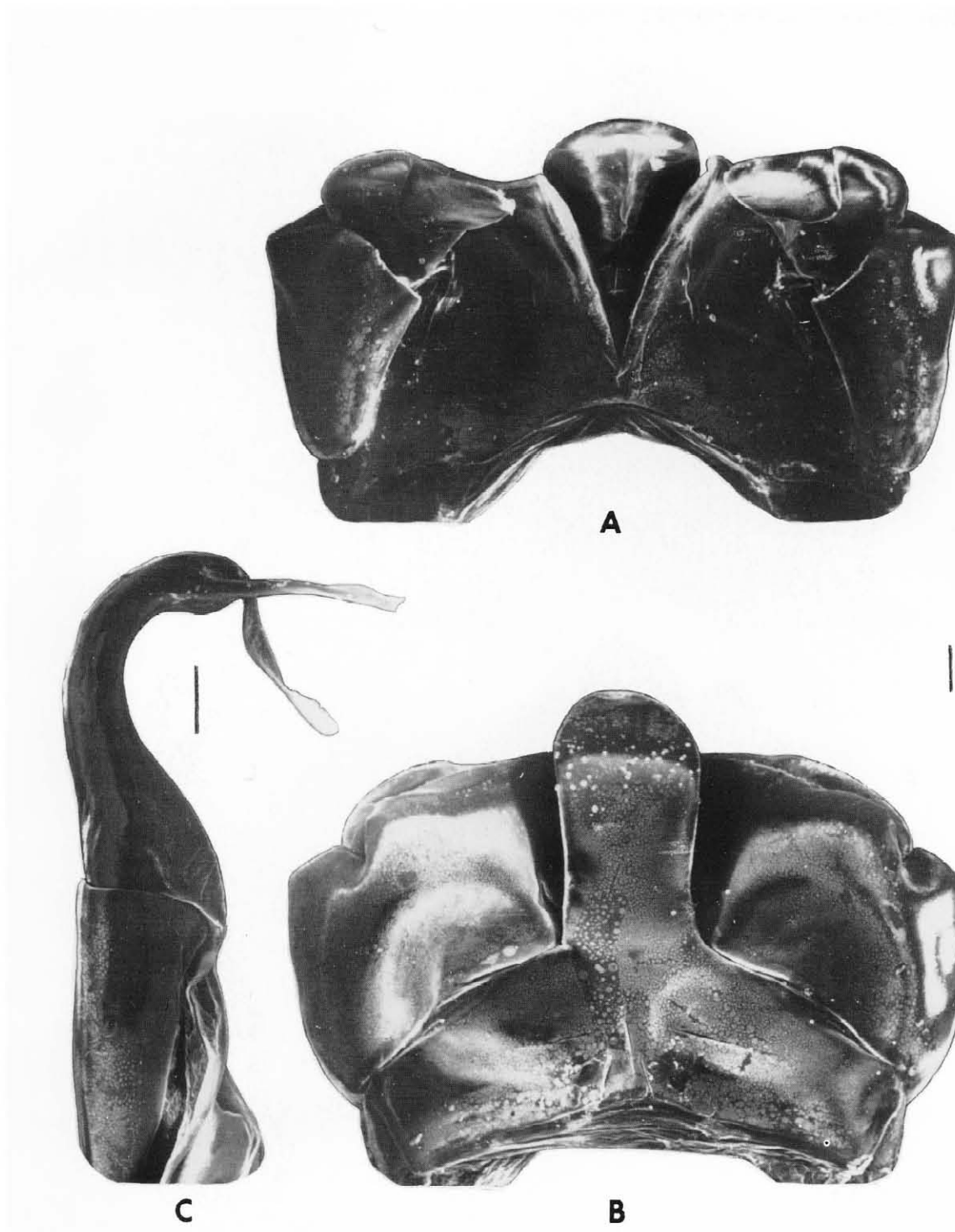


Fig. 2. *Nesobolus similis* new species. A. Anterior gonopod (coleopod), posterior aspect. B. Anterior gonopod, anterior aspect. C. Posterior gonopod (phallopod). Scale lines = 100 μ m.

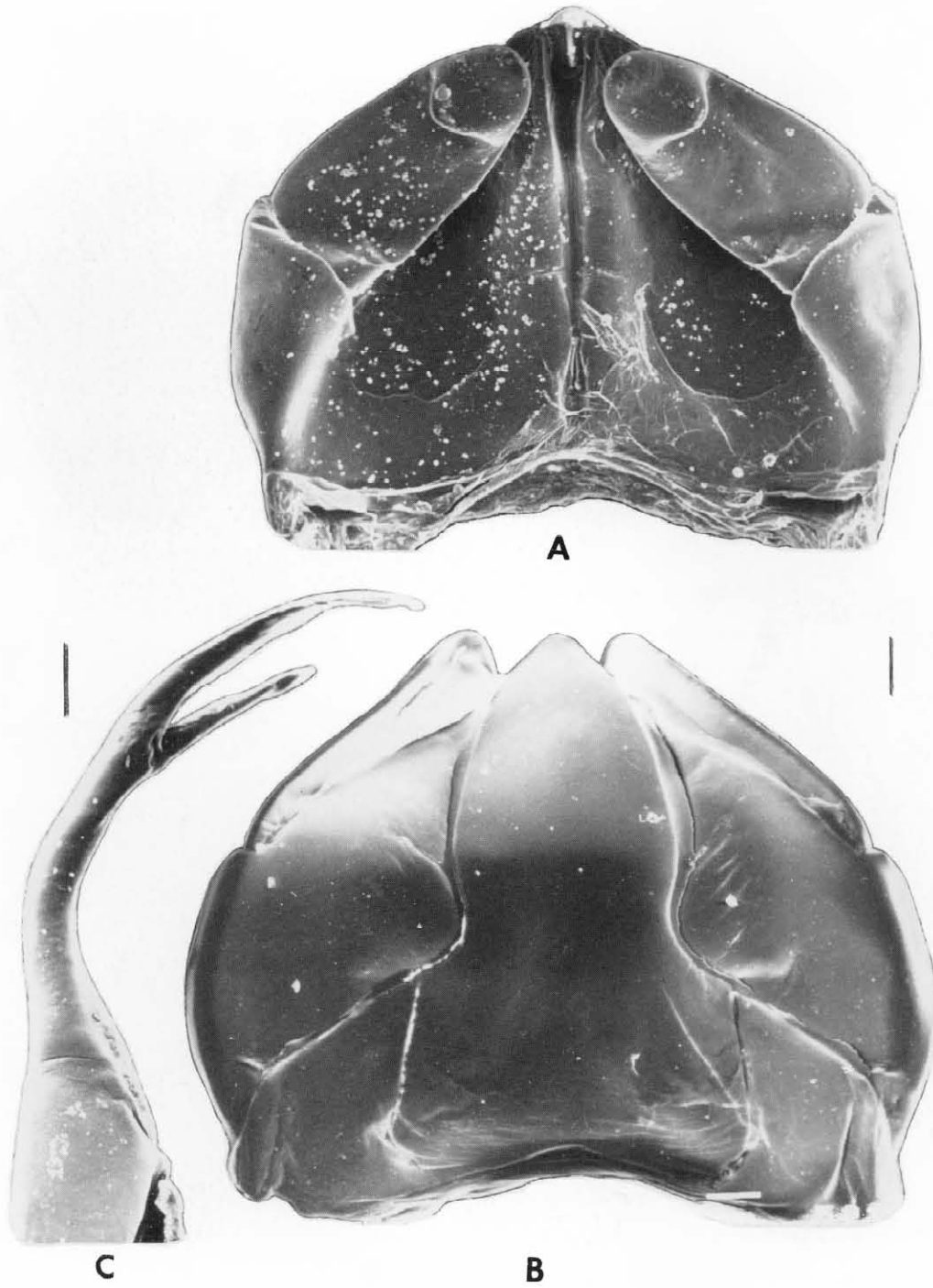


Fig. 3. *Nesobolus piedra* new species. A. Anterior gonopod (coleopod), posterior aspect. B. Anterior gonopod, anterior aspect. C. Posterior gonopod (phallopod). Scale lines = 100 μ m.

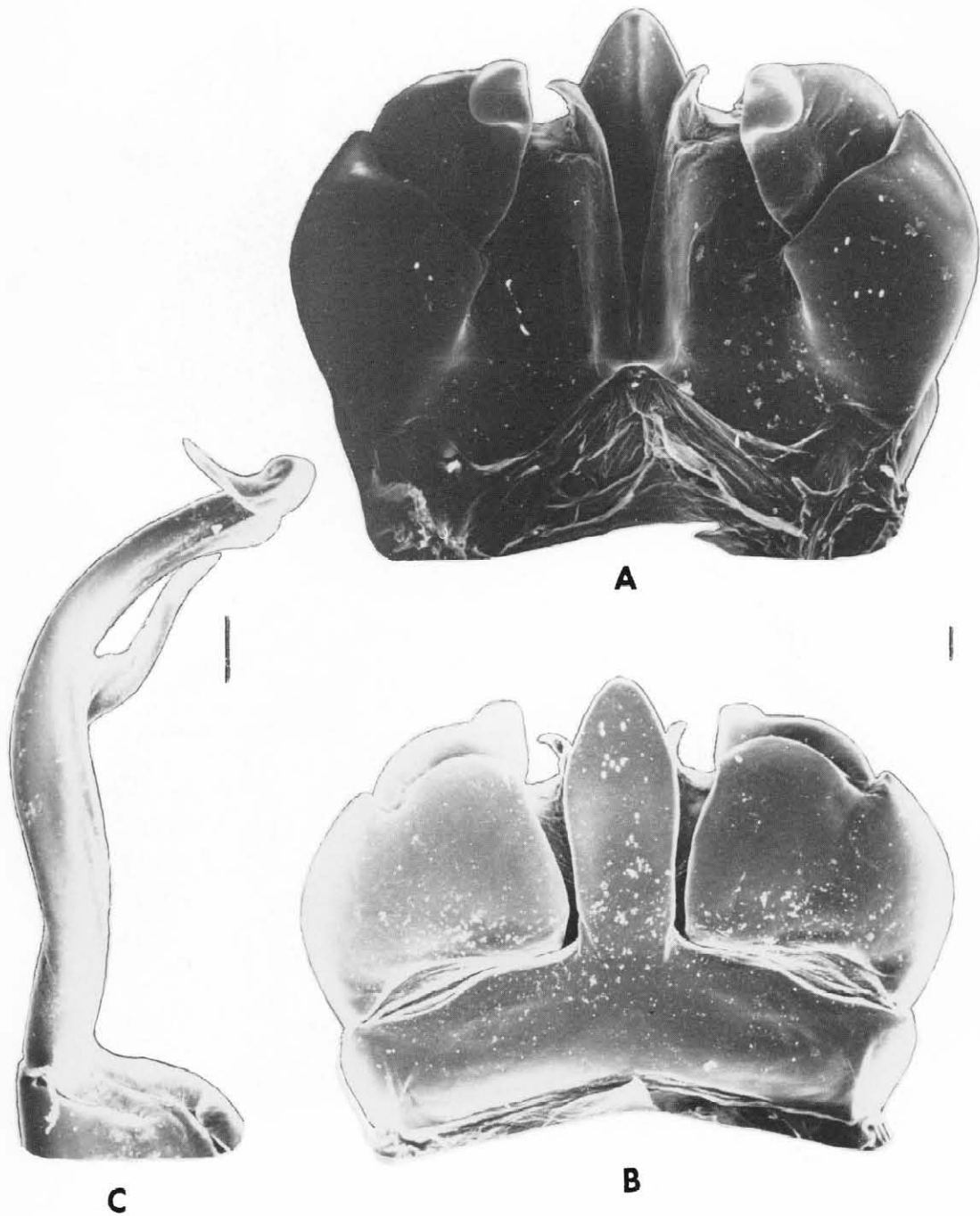


Fig. 4. *Nesobolus cuba* new species. A. Anterior gonopod (coleopod), posterior aspect. B. Anterior gonopod, anterior aspect. C. Posterior gonopod (phallopod). Scale lines = 100mm.

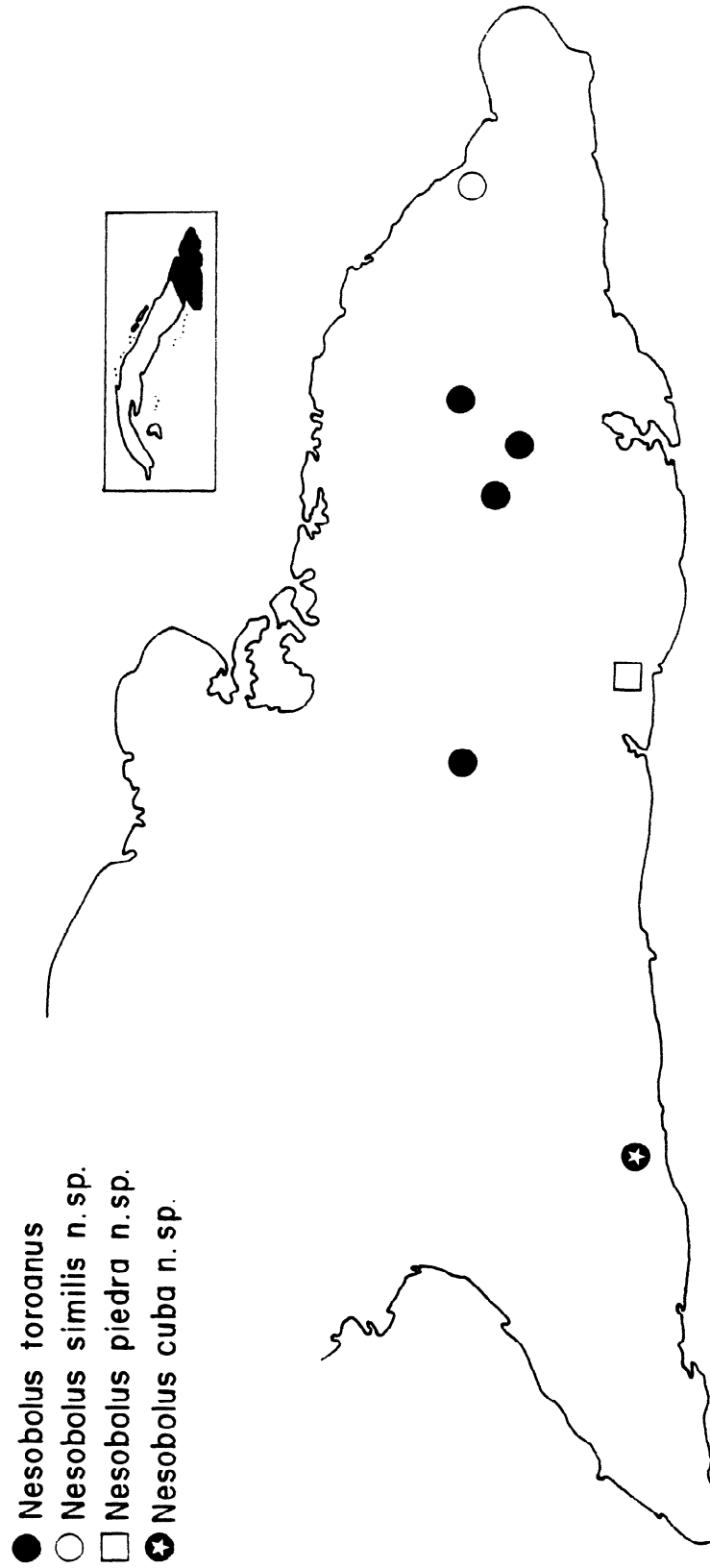


Fig. 5. Geographical distribution. Scale line = 100 km.

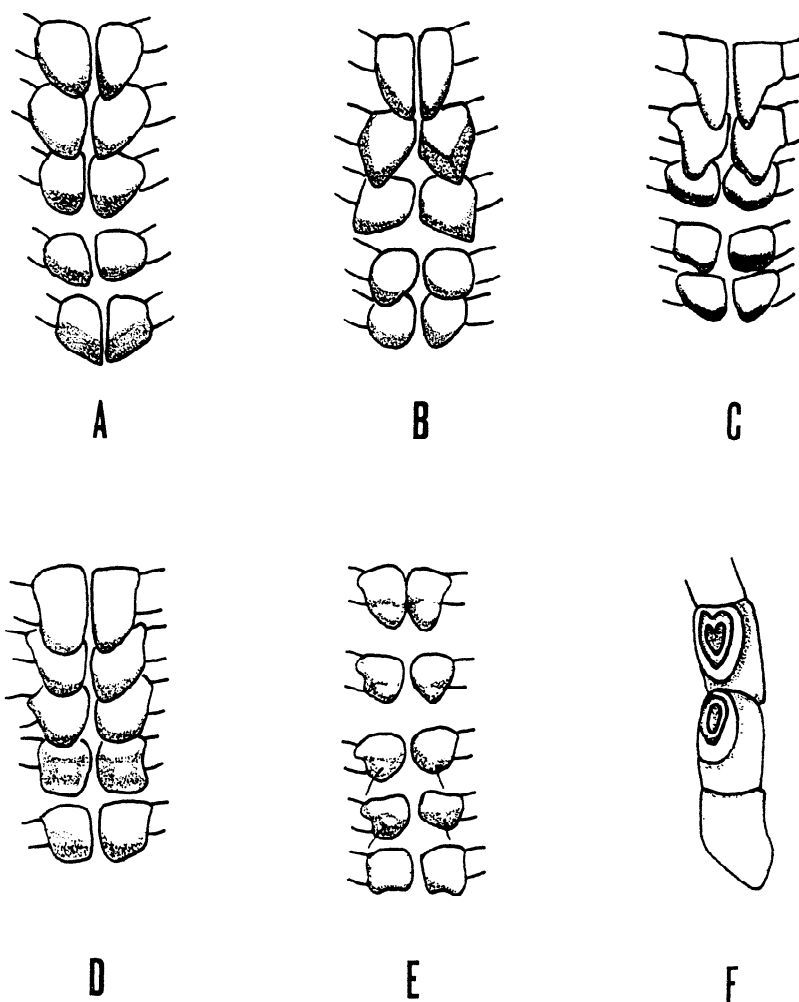


Fig. 6. A. *Nesobolus toroanus* Chamberlin, 1918: coxal formula 3=4, 5=6=7. B. *Nesobolus similis* new species: coxal formula 3, 4=5, 6=7. C. *Nesobolus similis* new species: coxal formula 3, 4, 5=6=7. D. *Nesobolus cuba* new species: coxal formula 3=4, 5, 6=7. E. *Nesobolus piedra* new species: coxal formula 3, 4, 5=6=7. F. *Nesobolus piedra* new species: ventral depression in articles 2 and 3.