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The marine littoral genus *Pseudanurida* (Collembola: Neanuridae) with redescription of *P. sawavai* and new records from Mexico

El género del litoral marino *Pseudanurida* (Collembola: Neanuridae): redescrpción de *P. sawavai* y nuevos registros para México

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RESUMEN

Se redescrbe *Pseudanurida sawavai* Schuster, 1965 con ejemplares procedentes de la costa litoral de los estados de Jalisco y Nayarit, México. Además, se proporciona una clave de identificación para las especies del género y un mapa de su distribución actual incluyendo nuevos registros.

Palabras clave: Collembola marinos, redescrpción, nuevos registros, Puerto Vallarta.

ABSTRACT

Pseudanurida sawavai Schuster, 1965 is redescrbed with specimens from the littoral cost of Jalisco and Nayarit state, México. A key for the species of the genus is provided and a map with distribution of all the species including new records.

Keywords: Marine Collembola, redescription, new records, Puerto Vallarta

In the review by Deharveng *et al.* (2008) about world's aquatic marine springtails, they indicate that there are 109 marine species. Among them, the Neanuridae has members of genera *Anurida* Laboulbène, 1865, *Anuridella* Willem, 1906, *Pseudanurida* Schött, 1901, *Oudemansia*, Schött, 1893 and *Halachorutes* Arlé, 1967. An important contribution was done by Christiansen and Bellinger (1988) on the springtails of the North American sea coast including several records and descriptions of various Mexican species. Palacios-Vargas (2023) compiled all the information on Mexican aquatic Collembola and distribution, but there are not citations of *Pseudanurida* in this country.

The genus *Pseudanurida* only contains six valid species. The genus is grouped with other marine littoral members of the Neanuridae by Deharveng *et al.* (2008) after a cladistic study. It is an important component of the littoral fauna, and some of them are sapro-carnivores (Murphy, 1971; Aslam, *et al.* 2018) and have been found feeding on oyster and fish tissues. Therefore, they are important in decomposition and some species seem to be distributed worldwide, but some descriptions are brief and need redescription as *Pseudanurida sawavai* Schuster, 1965. Recently this species was found in Mexican Pacific Ocean, and a complete redescription is presented here.

Abbreviations used in this contribution are: Abd. —abdominal segment; Ant.—antennal segment; Di —dorso-internal seta or area; De — dorso-external setae or area; Dl —dorsolateral seta or area; Oc — ocular seta; p —seta of posterior row; ss —body sensorial seta; Th. —thoracic seg-

ment; Sgd —dorsal guard sensillum.

MATERIAL AND METHODS

Most specimens were collected in a small river close to the beach at Puerto Vallarta (Fig. 1A, 1B), by epineustic traps (Palacios-Vargas, 1990) and fixed 96% alcohol (Fig. 1B, C). They were cleared on cold KOH 10% and warm lactic acid, rinsed and mounted in Hoyer's solution in microscopic slides.

New records: Bahía Banderas. Jalisco: Puerto Vallarta: beach Boca de Tomates. 20° 67' 16" N; 105° 27' 66", on water between the mangrove of *L. racemosa* and inundation area. Hot sand. 02-09-2024, one female and two juveniles. C. Martínez Pérez col. Idem on 20-10-2024, one juvenile. Nayarit, beach CRIP (Centro Regional de Investigaciones Pesqueras) 20° 44' 42.30" N, 105° 22' 58.96" W, washing sand, trunk and algae, one male. C. Martínez Pérez col.

Pseudanurida sawavai Schuster, 1965

Rejected synonym: *Pseudanurida* cf. *bogoyawlensky* Murphy 1965: 400-02, Fig. 61-72. Type material. Holotype (SMF A 1675) and paratype (SMF A 1676) in Senckenberg-Museum, Frankfurt-am-Main, West Germany.

Type locality: Brazil, Recife, Barra das Jangadas (creek connecting the Rio Pirapama and the Rio Jaboatao, a few km S of Piedade Marine Biol. Station), in mangroves. Other localities: Bahrain, Persian Gulf, edge of an inland freshwater stream; Brazil, Recife, Boa Viagem Beach, under wood; Gambia, West Africa, in mangroves and on rocky shores;

North Borneo (Sabah), on weed-covered rocks in a small inlet inside Labuan Town at low tide; Singapore, Pasir Ris, sparse mangroves by a small stream.

Redescription: Length about 1.2 to 1.5 mm. (juvenile 1.2 mm). The body color very dark blue, almost black (Figs. 2A-C). Cuticle with very strong granulation (Figs. 3B, C), stronger on antennae, legs and dens. There are three kinds of body smooth setae, short (10 μ m), long (25-30 μ m) and sensorial setae between 65 and 75 μ m, setae in posterior part of abdomen are the longest. Antennae as long as head or a little shorter (Fig. 3A) head 250 μ m; antenna, 240; Ant. I = 45 μ m, II = 65; Ant. III + Ant. IV, 240 μ m. Unguis III, 60 μ m. Ant. III and IV no fused. Ant. IV with a clear subapical trilobed bulb, 4 dorsal sensilla and several setae (Figs. 6C, D). No sensorial file on ventral surface (Fig. 6D). Ant. III con 16 (16-19) setae, sensorial organ with three free similar sensilla non under cuticular fold (Fig. 3C), and one tiny microsensillum difficult to observe, the Sgd. Ant. II with 11 (12) setae, Ant. I with six (7) setae. Mouthparts: Clypeus vertical and convex and labrum very short so that the buccal cone is more posterior than in other species (Fig. 7E). Mandibles (Fig. 5D) with 3-4 distal teeth and two bigger basal teeth, the basal one somewhat displaced. Maxilla styliform (Fig. 5D).

Head with 8+8 eyes (Fig. 5A). 3 ocular setae, Oc 3 a little smaller than others (Fig. 5B). 5 dorsal cephalic setae, 3 subdorsal, 3 setae in Di-De cephalic area, setae p2 small than others (5A). Labium with setae A, B, C, D, E, F and G. Only one row with four postlabial setae (Fig. 7E).

Th. I with 2+2 (3+3) dorsal setae. Th. II with microsensillum (m') lateral. Di area formula from Th. II to Abd. IV = 3,3/3,3,3,3. De area from Th. II to Abd. V: 2+ss, 2+ss/2+ss, 2+ss, 2+ss, 2+ss, 1+ss; DI area from Th. II to Abd. IV: 1+ss, 1+ss/1,1,1,1. Abd. V with only one row of setae on tergite (Figs. 4B, C). Abd. VI with only 3 pairs of setae (a, a2, m1) (Fig. 6B). Setation of legs from I to III, coxae 4,6,6; trochanters 6,6,6, femora 10,10,10, Tita 18, 18, 17. Pretarsi with 2 pretarsal setae. Ungues long and slender (60 μ m) usually no internal teeth (Fig. 4A, 7C) (sometimes one small tooth in basal third part), no empodial appendage. Leg III, femur 70 μ m, Tita 65 μ m, unguis III 45 μ m.

Ventral tube with 1+1 setae (Fig. 7B), tenacular rami with 3 teeth each (Fig. 7D). Abd. II without ventral setae. Abd. III and IV with one ventral setae on each side, Abd. IV with 3+3 lateral setae and no ventral (Fig. 6C). Furcula long, reaching ventral tube. Manubrium with six pairs of setae. Dens very long (250-300 μ m), with very strong granulation and six short posterior setae (20 μ m) (Fig. 7A). Mucro short, (25-28 μ m) rounded and up directed lamella not strongly developed (Fig. 7A). Female plate with 2 + 2 pregenital setae, 4 pairs of circumgenital setae and one pair of eugenital. Male genital plate with 2 + 2 pregenital setae, 13 circumgenital setae and 4 + 4 eugenital setae. Each lateral anal valve with 15 (17) setae and 2 hr setae, median valve without setae.

Variation: the mandible has small variations due to the shape and position of the teeth, sometimes the big basal teeth are bent. Some chaetotaxy asymmetries were observed in dorsal part of the body. The number of setae (15-17) of lateral anal valves also have some variation depending on the developmental stage. The cuticular granulation is so strong that microsensillum of Ant. III is impossible to observe very often. Mucrodens varies in length but can reach 300 μ m. The tooth of the unguis can be present or absent. The number of dorsal setae on Th. I can be 2+2 or 3+3.

Remarks: the correct name of the species is *P. sawavai*, as the author indicates: "Die neue Art ist Herrn Prof. Dr. Paulo Sawava, São Paulo, gewidmet. In ciner fri heren Publikation (Schuster, 1962: 40) wurde sie unter der Bezeichnung «Podura n. sp» erwähnt". In one former contribution (Schuster 1962: 40), used "Podura n. sp." The new species is dedicated to Prof. Dr. Paulo Sawava, São Paulo. p. 40), it was mentioned under the name "Podura n. sp."

This species is characterized by the strong reduction of body chaetotaxy. It is the only species in the genus and in the Pseudachorutinae which lacks additional rows of postlabial setae, presenting only four setae on ventral row "v1". It also is the only with only one row of setae dorsally on Abd. V. Another important characteristic is that dorsal Abd. VI has only three pairs of setae. Th. I, has only two pairs of setae (some authors mention 3 + 3) and no lateral setae. A strong reduction of ventral chaetotaxy is also characteristic of this species. Ant. III sensorial organ is like some *Oudemansia*, where the microsensilla are not concealed on a groove, and are of similar size to the ventral guard sensillum, the ventral microsensillum is very tiny and difficult to observe, which has made some authors describe species as lacking it. Ant. IV has a strong reduction of the sensilla, with the presence of only four.

It seems that there are no pseudocelli (reflex bleeding sites) on head or body, but other studies should be done to be sure. Prothorax with 3 + 3 setae (2 + 2). Setae ventrally, none on Abd. I and 2 (1 + 1) on Abd. III and IV. Abd. V with a single row of setae dorsally and ventrally. Abd. VI with dorsal valve rounded, not extending beyond ventral valves, with 3 + 3 dorsal and no ventral setae (Fig. 5C). Lateral anal valves with 15-17 setae and 2 hr. median anal valve without setae hr) Claw with a closely appressed inner tooth (often absent).

Distribution: This species is of extremely wide distribution. It has been recorded both from mangroves and from exposed shore conditions. Even so, in Gambia it occurs in mangroves more than 80 km (50 mi) from the coast where for much of the year the water is virtually fresh. In southeast Asia, both localities were estuarine with direct, running fresh-water influence. In Bahrain it was found only by running fresh water and one of the Ceylon records was from exclusively fresh water, 64 km (40 mi) from the coast. Specimens recorded from Florida by Christiansen & Bellinger (1988), are assigned to this species, because the

presence of a clear inner tooth on the unguis is just one intraspecific variation.

New Localities: Puerto Rico: Colón, Aguadilla Parque, mangrove litter, April 27, 1985 (F. Soto). Florida: Monroe Co., Long Key State Park, under and on rocks 3-6 feet below high tide mark, 5 January 1985 (K. Christiansen).

Palacios-Vargas & Bu (2020) recorded this species from the China at Hainan Island (western coast) in flotation of sand samples on the beach. Its distribution covers marine littoral environments from Brazil, Cuba, Gambia, Bahrain, Malaysia (Sabah), Singapore, and Sri Lanka (Murphy, 1971). Its distribution, together with other species known in the genus are presented in Fig. 8. *P. sawavai* lives in areas of immediate freshwater influence and it is the widest distributed in the seashores of America, but it has also been cited from other continents.

Key to the species of *Pseudanurida*.

1. Dens with 12 setae; Abd. VI with three rows of dorsal setae and several on ventral side; tergites with many setae in rows; Abd. V with many ventral setae before genital plate; Ant. III organ in distal part; unguis with a strong basal inner tooth; mandible with many teeth; maxilla with two rudimentary lamellae; pseudocelli on head, Th. I and Abd. I.....
..... *P. billitonensis* Schott, 1901
Indonesia (Biliton), Singapore, Japan (Okinawa).
- Dens with only 6 setae; Abd. VI without setae on ventral side; tergites with few, rows of setae (only one row on Th. I (3+3); as well as Abd. V (dorsal and ventral). Ant. III organ in proximal part; unguis teeth in distal position or with teeth; mandible with two big proximal teeth; and several small distal teeth; maxilla without lame **2**
- 2 Head with macrosetae strongly differentiated; Abd. VI with many setae dorsally; ventral tube without setae. Ant. III + IV short and short. Pseudocelli no differentiated..... *P. bogoyawlensky* (Becker, 1905)
Persic golf, Pakistan.
- Head without macrosetae differentiated; Abd. VI with 3 + 3 dorsal setae. Ventral tube with 1+1 seta on anterior part of valves **3**
- 3 Abd. VI cylindrical and elongated, anal valves, dorsal and lateral no isolated; pseudocelli on head and Abd. III and IV; tenaculum with strong and long corpus; mucro with lamella with structure similar to one tooth; Ant. III + IV short; no sexual dimorphism..... *P. yini* Murphy, 1971
Malaya (Perak).
- Abd. VI no cylindrical and no elongated, anal valves, dorsal and lateral isolated; pseudocelli no differentiated; tenaculum with normal corpus; mucro without lamellar structure-like tooth; Ant. II + IV long; no sexual dimorphism **4**
- 4 Body with long setae, mucro about half the size of dens ..
..... *P. longisetosa* Lee & Kim, 1994
Korea.
- Body with short setae, mucro very short, much smaller than dens **5**

- 5 Ant. III + IV relatively short, long sensorial setae on p3 row on Abd. I-III and on p2 on Abd. V; no sexual dimorphism *P. sawavai* Schuster, 1965
Brazil (Recife), Ceylon, China, Cuba, Gambia, Mexico, North Borneo, Puerto Rico, Singapur, USA.
- Ant. III + IV elongated; no long sensorial setae on p3 row on Abd. I-III and on p2 on Abd. V; males with sexual dimorphism, Abd. VI very elongated
..... *P. glauerti* (Womersley, 1933)
Australia

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Figure 1. Locality of *Pseudanurida sawavai*. A, vegetation and river with crocodiles; B, epineustic traps; C, among roots of mangroves.

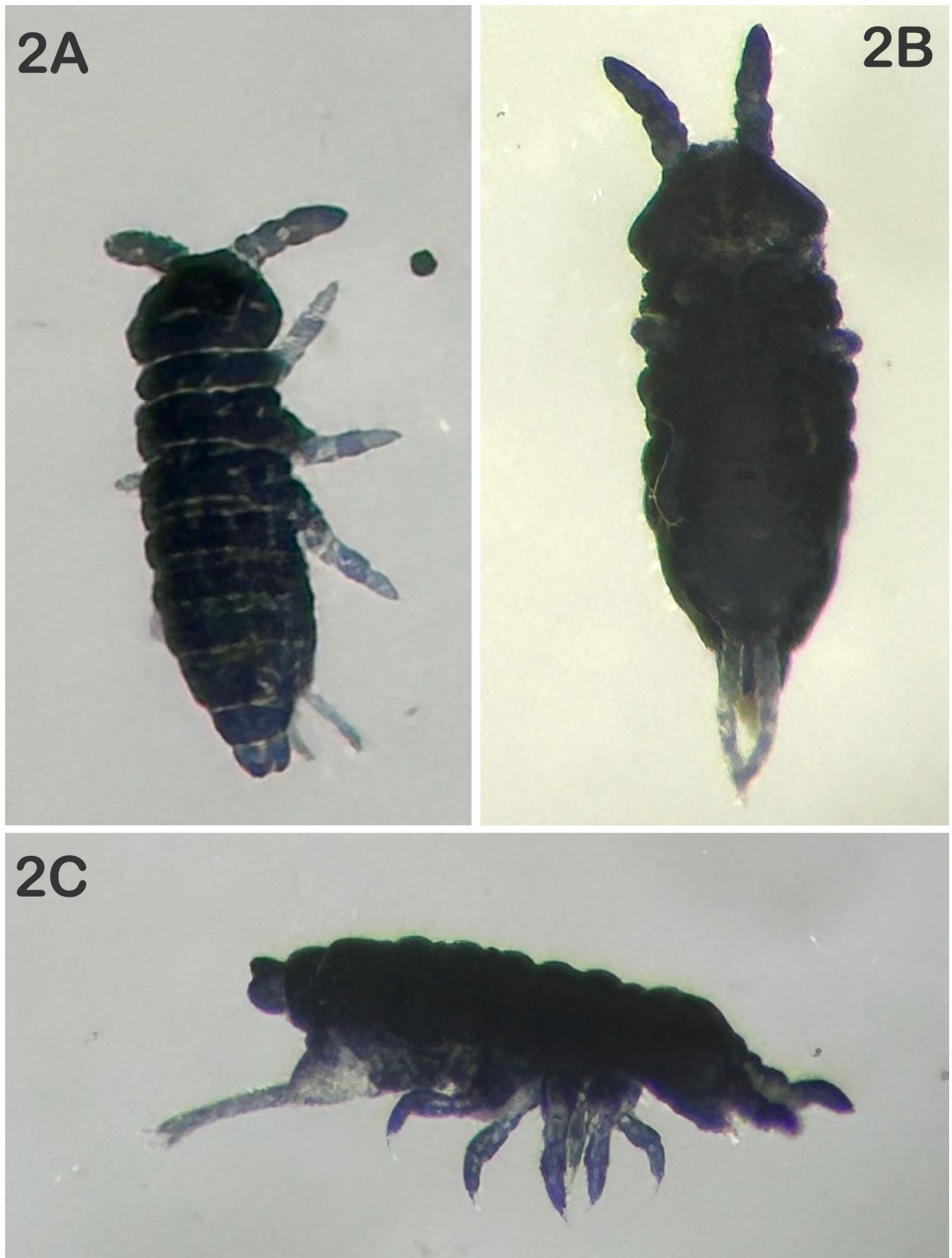


Figure 2. *Pseudanurida sawavai*. A, habitus in dorsal view; B, habitus in ventral view; C, habitus in lateral view.



Figure 3. *Pseudanurida sawavai*. A, head and body; B, ventral Abd. I-IV, showing areas without granulation; C, Ant. III ventral view with three sensilla.

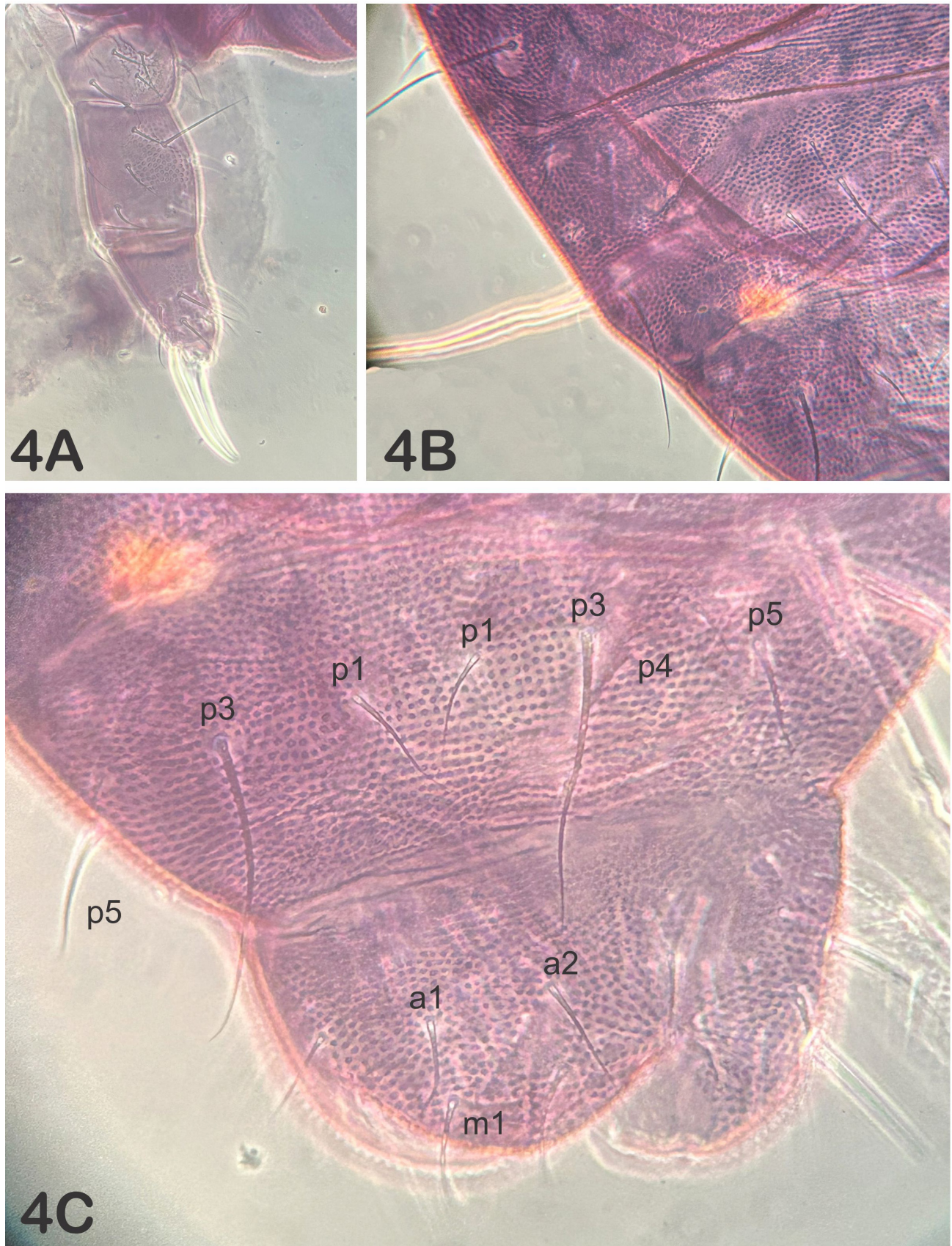


Figure 4. *Pseudanurida sawavai*, microphotographies under microscope; A, leg III; B, dorsal Abd. II-V; C, Abd. V and VI in dorsal view.

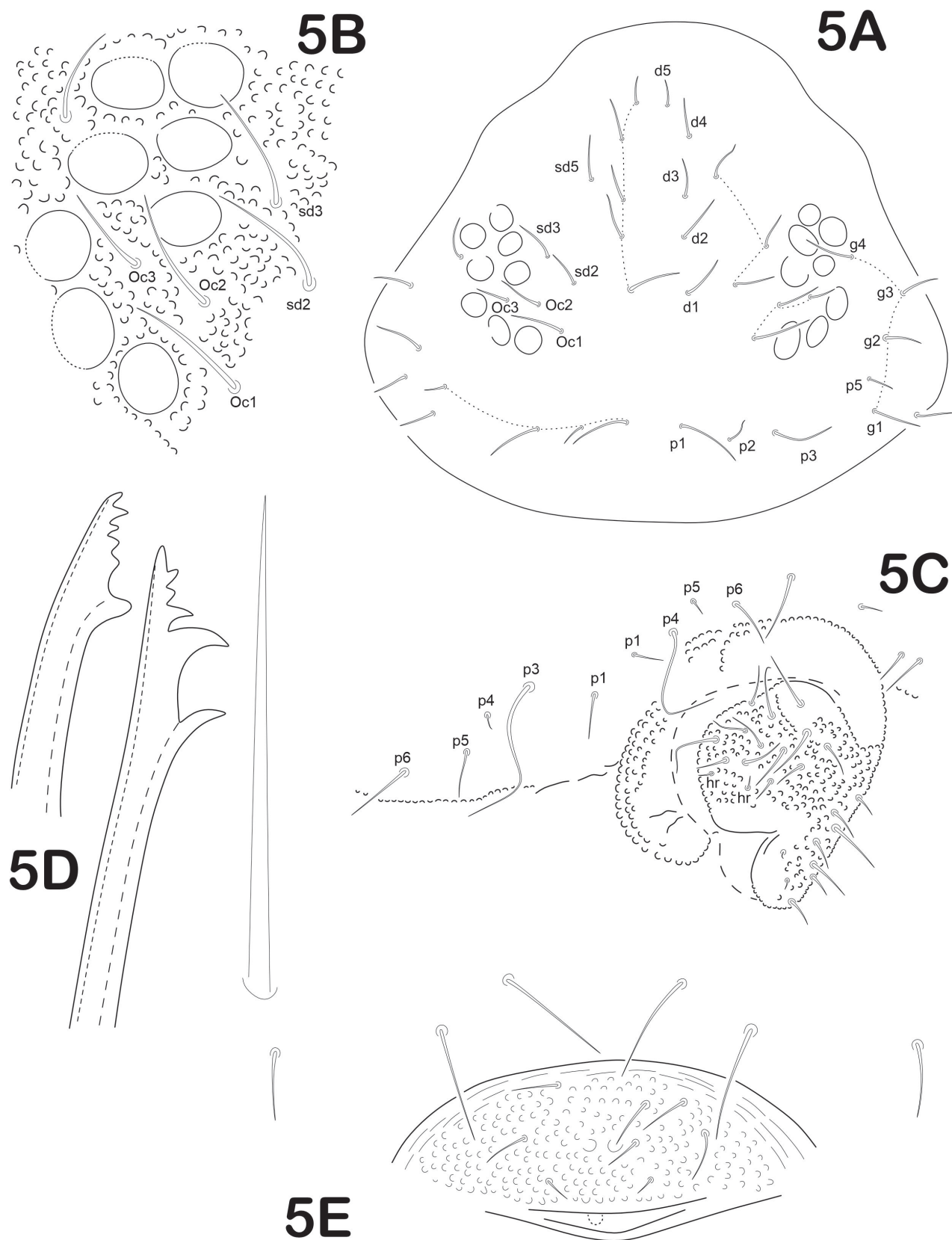


Figure 5. *Pseudanurida sawavai*. A, dorsal chaetotaxy of head; B, magnification of ocular area; C, Abd. V and VI in dorsal view; D, mandible and maxilla; E, genital plate of female.

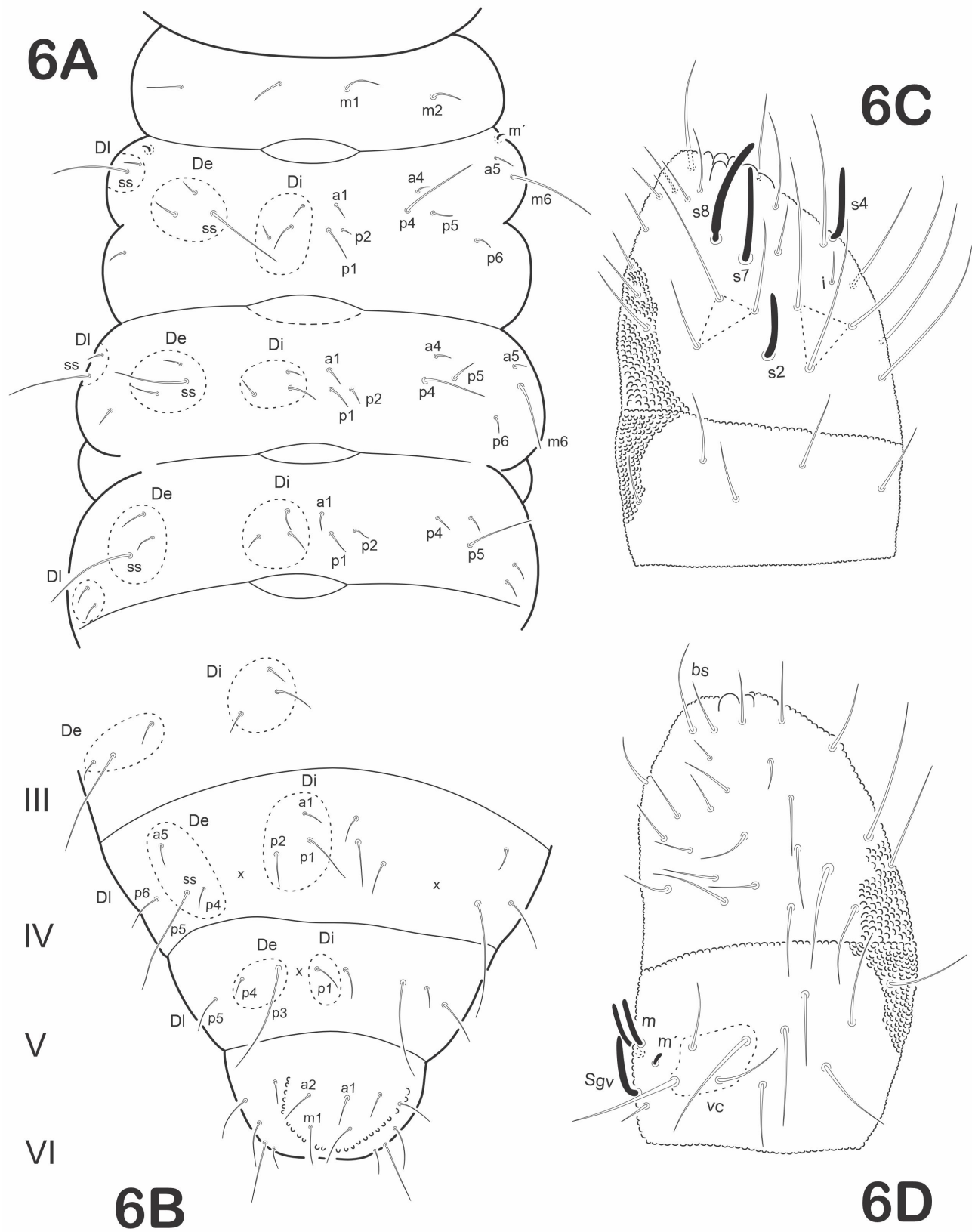


Figure 6. *Pseudanurida sawavai*. A, chaetotaxy from Th. I- Abd. I; B, Abd. III-VI; C, Ant. III-IV dorsal view; D, Ant. III-IV ventral view.

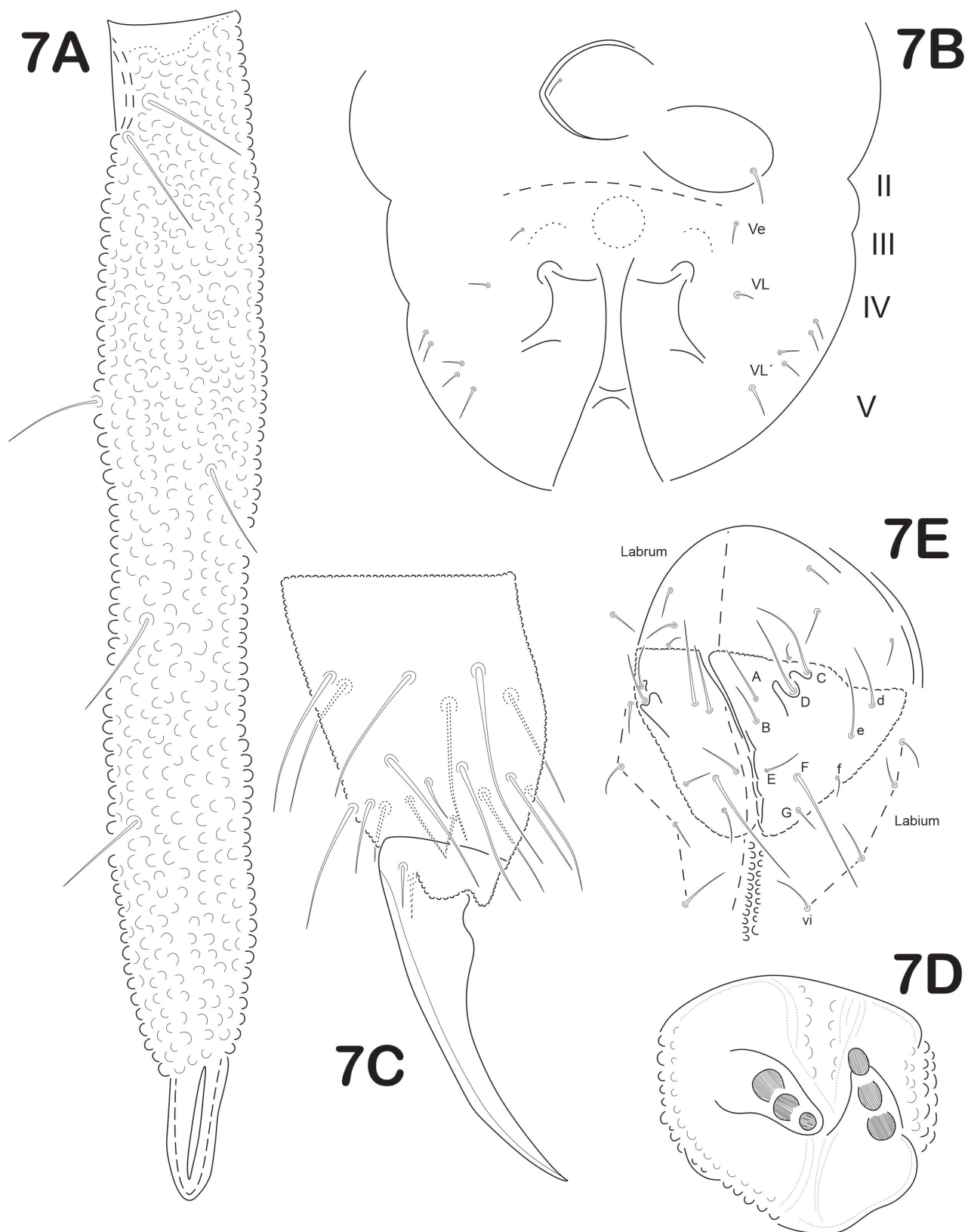


Figure 7. *Pseudanurida sawavai*. A, furcula; B, ventral chaetotaxy from Abd. II to Abd. V; C, tibiotarsus III and foot complex; D, telson; E, labrum and labium.

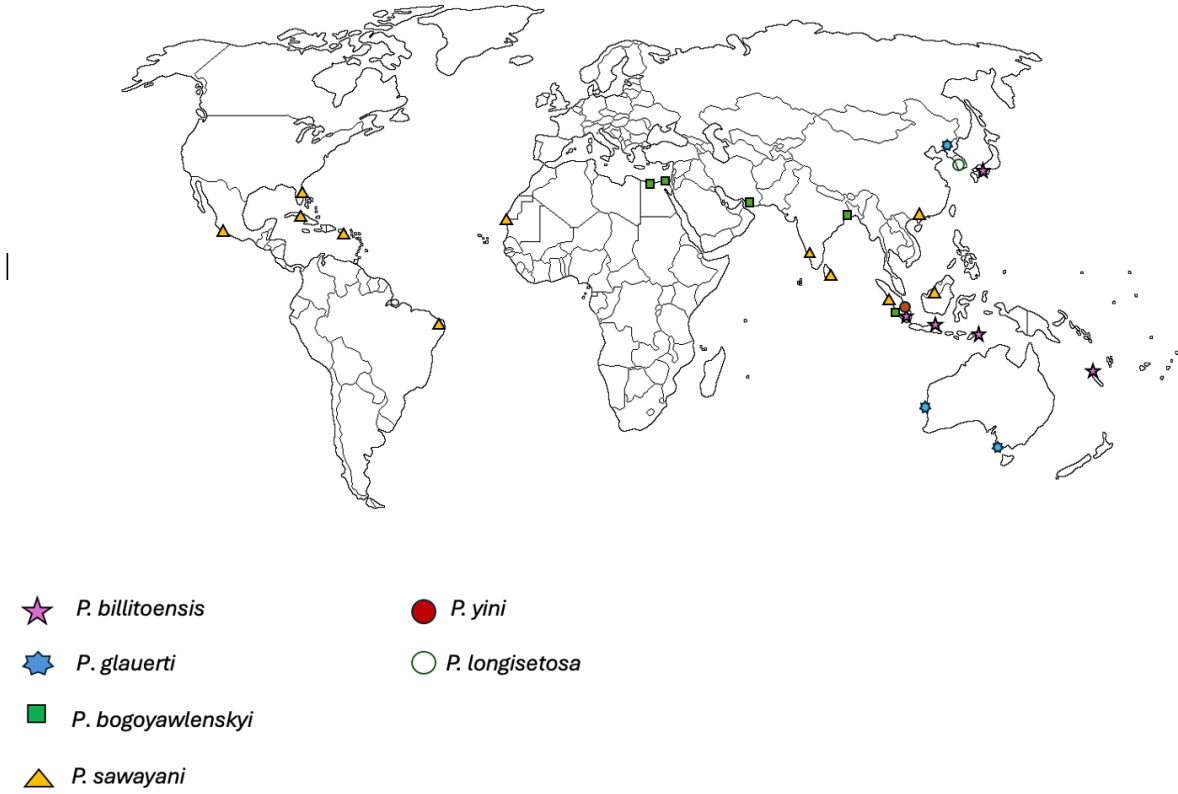


Figure 8. Global distribution of species of the genus *Pseudanurida*, based on records reported in scientific literature. Symbols on different colors represent known occurrence of localities across different continents.