

A new marine littoral species of *Oudemansia* Schött (Collembola, Neanuridae) from Lakshadweep Island, India with a key to world species of the genus

Guru P. Mandal*, Pritha Mandal, Kusumendra K. Suman and Kaushik K. Bhattacharya

Zoological Survey of India, Prani Vigyan Bhawan, M Block, New Alipore, Kolkata 700053,
West Bengal, India.

Email: gpmandal.zsi@gmail.com

ABSTRACT: A new species, *Oudemansia dhritiae* sp. nov. is described from Lakshadweep Island, India. It is characterised by unguis with a single internal tooth and without any lateral teeth; mandibles with 11 teeth, six dental setae, and antennae IV with 6 sensilla. Identification key to the world species of *Oudemansia* Schött, 1893 is provided. © 2024 Association for Advancement of Entomology

KEY WORDS: Taxonomy, chaetotaxy, springtails, Pseudachorutinae, anal spines

INTRODUCTION

The Collembolans have a very diverse distribution occurring in all parts of the world, inhabiting a wide range of ecological niches and in any climatic region. Commonly, ‘Springtails’ are soil and litter dwelling, often preferring wet or damp surroundings. Collembolan may be found in mosses, in soil, under stones, in caves, in ant-nest and in termite mound. They are also present in the intertidal zone of the coast, on the surface of lakes and ponds, and on snowfields (Cheng, 1976). The strong water repellent body cuticle of Collembola has made them possible to live in aquatic habitat (Noble-Nesbitt, 1963). Littoral species live in sand or in the small crevices of rocks under algae (Hopkin, 1997). Globally, family Neanuridae comprises 1608 species under 180 genera (Bellinger *et al.*, 1996–2023). In India, the family Neanuridae comprises

55 species under 24 genera (Mandal, 2018). According to Deharveng *et al.* (2008), a total of 525 water dependent species of Collembola have been recognized worldwide, out of which 103 live in freshwater and 109 are linked to marine habitats; among them are 8 species of Neanuridae of the genus *Oudemansia*. Prabhoo (1970) reported *O. subcoerulea* Denis, 1948, from the coast of Kanyakumari (Cape Comorin) in India, later synonymized with *O. coerulea* Schött, 1893. A second species, new to science, has been collected in the Lakshadweep archipelago, an Indian territory that comprises 36 islands in the Arabian Sea. Agatti Island is one of its atolls, which hosts of a diverse flora and fauna favored by local environmental conditions, such as temperature range of 25–35°C, humidity 70–76 per cent and an average annual rainfall of 1600mm. The new species *Oudemansia*

* Author for correspondence

dhritiae **sp. nov.** is described from the marine littoral zone of this island.

MATERIALS AND METHODS

Specimens were collected from rock crevices near sea-shore using entomological aspirator and were preserved in 70 per cent ethanol, and later on mounted in Hoyer's solution (Krantz, 1978). Four specimens were de-pigmented using Nesbitt's solution (Krantz, 1978) and mounted in Hoyer's medium on slides for the study of chaetotaxy. The slides were dried on a hot plate for 48 hours and slide coverslips were sealed. Mounted slides were photographed using Leica DM 2500 binocular microscope attached to an image capturing device namely Leica DFC 295. Chaetotaxy and other morphological parts were digitally drawn using CorelDRAW Suite 2021 version 23.1.0.389. Some specimens were photographed for further details using Scanning Electron Microscope (SEM), model – ZEISS EVO 18 special edition.

Material Deposition: ZSI Zoological Survey of India, New Alipore, Kolkata, India.

Abbreviations used in descriptions and figures: a—setae of anterior row; A–G, d–f—labial setae according to Massoud (1967), Deharveng (1979, 1981, 1983), D'Haese (2003).

Abd.—Abdominal segment; Ant.—antennal segment; d—cephalic dorsal setae; lb—labium; LS—labral sclerotization; m—setae of median row; ms—microsensillum; Md—mandible; Mx—maxilla; or—subapical organite; Oc—Ocular setae; p—setae of posterior row; PAO—postantennal organ; pl—prelabral setae; pso—pseudocellum, pseudocelli; S—cylindrical sensillum on Ant. IV; sd—subdorsal cephalic seta; Sgd—dorsal guard sensillum; Sgv—ventral guard sensillum; ss—body sensorial seta; Th.—thoracic segment; Tita—tibiotarsus; VT—ventral tube.

RESULTS AND DISCUSSION

Systematics

Poduromorpha Börner, 1913;

Neanuridae Börner, 1901 sensu Yosii, 1956;

Pseudachorutinae Börner, 1906;

Genus *Oudemansia* Schött, 1893

Type species. *Oudemansia coerulea* Schött, 1893

Diagnosis: Body deep blue to bluish black in colour, 0.8–2.0mm in length, without any digitations. Head bears 8+8 eyes and lacks PAO. Cephalic and abdominal pseudocelli are well developed. A trilobed apical bulb present on Ant. IV. Beak like structure of the labrum with long distal and short proximal setae, total 11–13 labral setae, labral sclerotification is the characteristic of the genus. Forked hypopharynx is well developed and placed above the truncate labium. Long, well-formed sensorial setae present on Th.II and III and on the abdominal segments. Abd.VI with 2–4 distinguishable spines or spiniform setae. Unguiculus absent and unguis is with or without any internal or lateral tooth. Tenent hair usually absent from tibiotarsi. Furcula strongly developed and with a moderately long micro. 3+3 teeth present on retinaculum. All the representatives under this genus are usually from marine or littoral habitat.

Distribution. Vietnam, New Caledonia, Japan, Madagascar, Indonesia, Africa, Australia, China, North America and India.

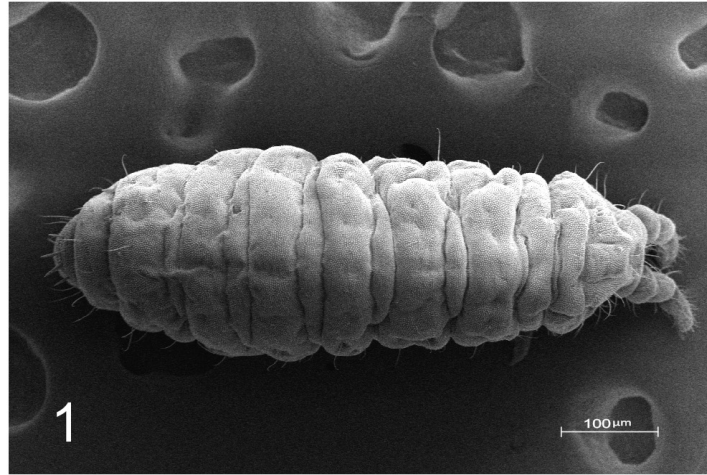
Oudemansia dhritiae **sp. nov.** Figs. 1–24

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Type Locality. India: Lakshadweep, Kattupallikad, near mosque, Agatti Island, (10°51' 98" N; 72°11' 92" E), 70m above sea level.

Type material. India: Lakshadweep, Kattupallikad, near mosque, Agatti Island, G.P. Mandal leg., 23 February, 2019. Holotype, female adult (Reg. No. 3222/H14) and 11 paratypes: 1 male and 5 females mounted on slides (with Reg. No. 3223/H14), and 4 specimens in ethyl alcohol (Reg. No. 2812/H14).

Description: Adult body length excluding appendages up to 1.05–1.42 mm (Fig.1). Body colour dark purple. Abdomen with intersegmental areas devoid of pigment. Body colour is not even, but as scattered patches of pigment (Fig. 2) all over



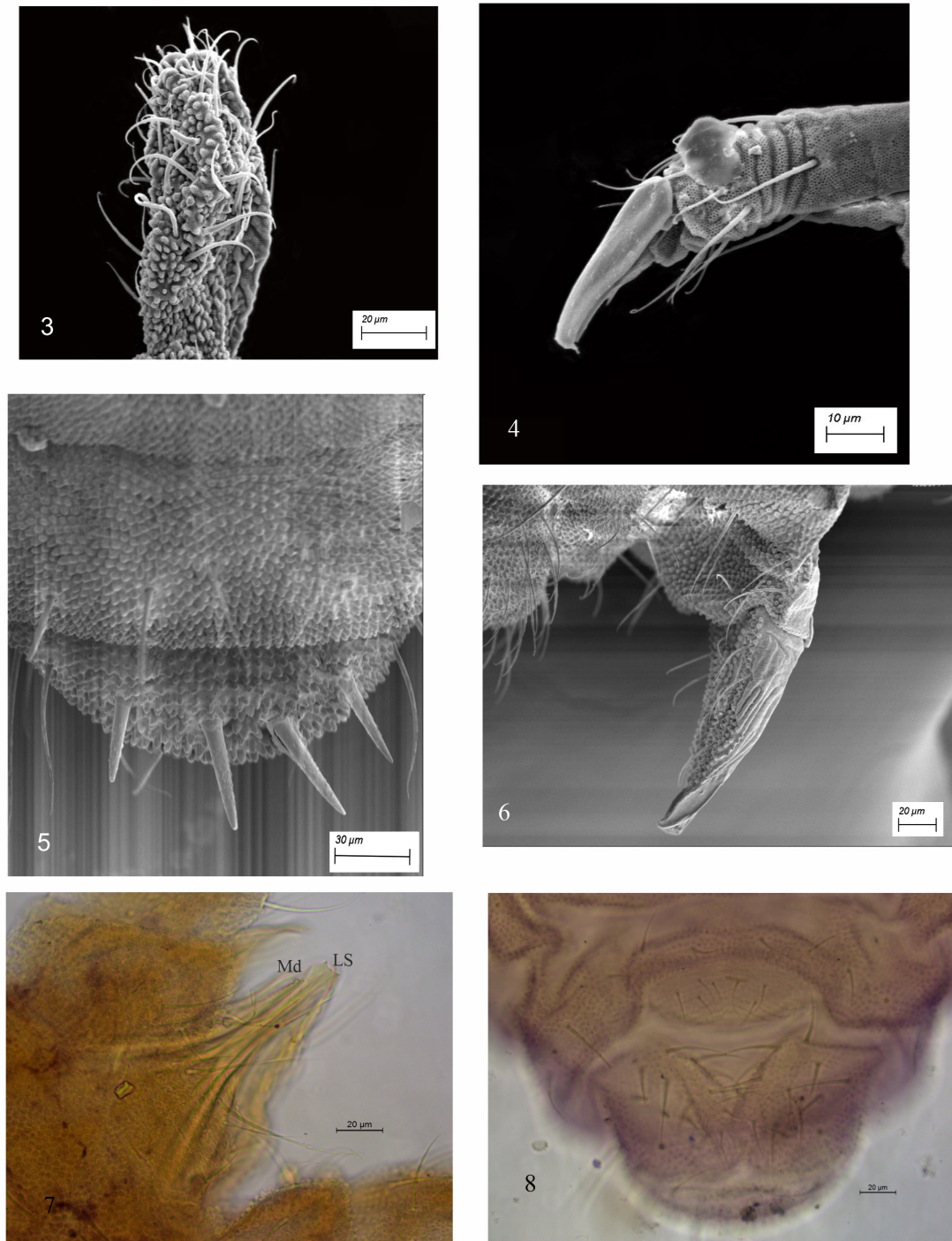
Figs. 1-2 *Oudemansia dhritiae* sp. nov. 1 - SEM photograph of habitus, 2 - dorsal view of full body with colour pattern

the body. Cuticular granulations are prominent and with conspicuous pseudocelli.

Antennae. Antennal segment ratio- Ant. I: Ant. II: Ant. III: Ant. IV = 1: 1.08: 1.06: 1.2. Ant. IV with trilobed apical bulb placed distally (Fig. 9), subapical organite present in a groove. Antennae and head subequal. S1 and S2 are slight thin and 4 well differentiated sensilla (S3, S4, S7, S8) which are very prominent, present on Ant. IV (Fig. 9). Ant. III organ with slightly bent conspicuous Sgv with ms nearby, relatively short Sgd (Fig. 10). Ant. I and Ant. II with 7 and 11 setae, respectively (Fig.11).

Mouthparts. Labrum long, setae arranged in four rows (Fig.14), four prelabral setae and nine labral setae present; labral formula 4/3,4,2. Labium proximally truncate with 4+4 distal setae arranged in a cascade, setae A and C quite long (Fig. 15). The mandible contains two strong apical teeth, and 9 small teeth placed below (Fig. 18). Maxillae styliform and labral sclerotification present (Figs. 16, 17). Hypopharynx cylindrically placed above mandible with rough edges.

Head. Eyes with 8+8 ommatidia in three groups, one with A, B, C and D other with E, F, G and last one with H (Fig. 12). Oc1–3 setae present, Oc3 is

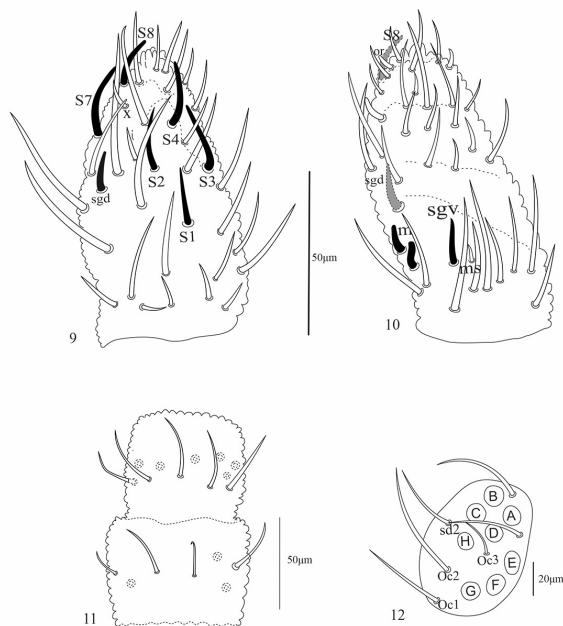


Figs. 3-8 *Oudemansia dhritiae* **sp. nov.** 3 - setae and sensilla of Ant. IV, 4 - fore leg, 5 - Abd. VI with anal spine, 6 - furcula, 7 - labral sclerotification, 8 - genital setae, 3-6 - SEM photographs, 7-8 - microscopic photographs

smaller, Oc2 larger than Oc1. PAO absent. Cephalic pso present, five dorsal cephalic setae are observed (d1–d5). Head with 4+4 sub dorsal setae (sd2–5) and 3+3 posterior setae (p1–p3), p2 smaller and thinner, c row setae absent (Fig. 13).

Chaetotaxy. (Fig. 21) Body setae composed of ordinary mesosetae usually smooth or unilaterally ciliated and long sensorial setae. Sensorial setae formula by half tergite: 022/11111. Th.I with 2+2 m setae. Th.II and Th.III with 3+3 anterior (a1, a4, a5), 1+1 medial (m6=ss) and 5+5 posterior setae (p1, p2, p4–p6; p5=ss). Abd. I–IV with 3+3 anterior (a1, a4, a5) and 5+5 posterior setae (p1, p2, p4–p6; p5=ss). Abd. V with 2+2 anterior setae (a1, a4) and 3+3 posterior setae (p1, p3, p4; p3=ss). Abd. VI with 2+2 anal spines with moderately coarse surface. Anal spines a1 are slightly larger and curved than a2. Abd. VI with 1+1 anterior (a3), and 2+2 medial ordinary setae (m1, m2). Pseudocelli present on Abd. I and Abd. III–IV.

Legs. Without tenent hair. Ratio of Tita: Unguis is 1.27: 1. Legs I–III show chaetotaxy as follows:



Figs. 9-12 *Oudemansia dhritiae* sp. nov. 9 - dorsal view of Ant III and IV, 10 - ventral view of Ant III and IV, 11 - dorsal view of Ant I and II, 12 - ocular area

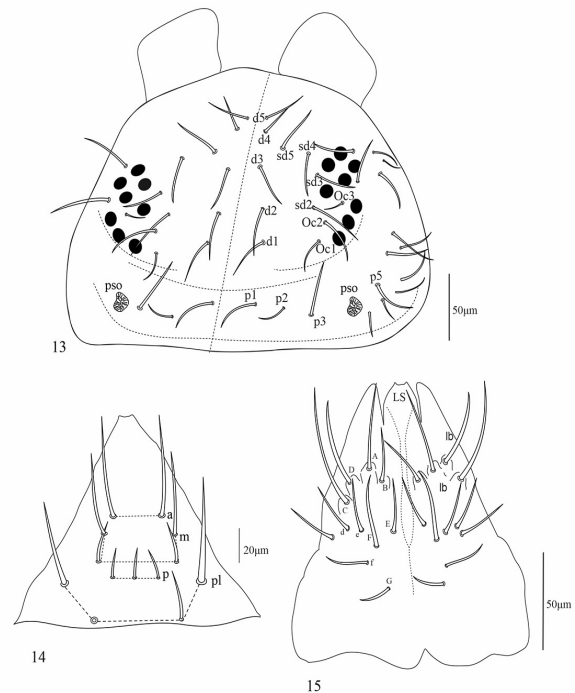
Coxa-3,6,7; Trochanter-6,6,6; Femur-12,11,11; Tibiotarsus-18,18,17 (Figs. 20, 22). Length of Tita I–III 54, 57, 64µm, respectively. Unguis with one internal and devoid of any lateral teeth (Figs. 4, 22). Unguiculus absent.

Ventral chaetotaxy. Thorax devoid of setae. VT with 2+2 lateral setae. Tenaculum well developed and usually with 3+3 teeth (Fig. 19). Abd.II and III with 2+2 ventro-internal setae. Abd. IV with 4+4 ventro-lateral setae. Lateral anal valves with 15+15 setae.

Furcula. Complete and well developed; manubrium with 7+7 setae. Dens roughly granulated with 6 setae (Fig. 23). Mucro with two lateral lamellae, slightly larger than one-third of dens (Fig. 23). Ratio of mucro: dens = 1: 2.5 (range=2.18–2.51; n=4).

Female genital plate with 7 circumgenital, 2 small eugenital setae and 3+3 pregenital setae (Fig. 24).

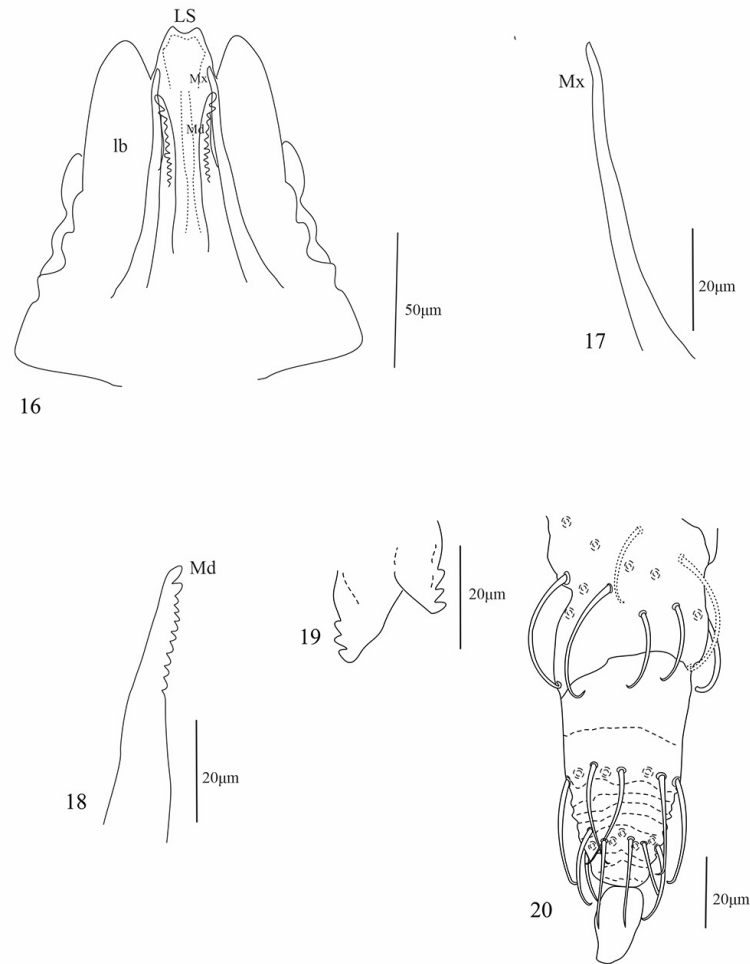
Etymology. The species name is dedicated to Dr. Dhriti Banerjee, the first woman Director of



Figs. 13-15 *Oudemansia dhritiae* sp. nov. 13 - head chaetotaxy, 14 - labrum, 15 - labial setae with labral sclerotization

Table 1. Differential characters of world species of *Oudemansia*

Species	Country	Unguis teeth	Ant. IV sensilla number	Dental setae number	Dens posterior granulation	Ratio dens: mucro	Abd. VI spines	Mandibular teeth	Colour	Size (mm)
<i>O. schoetti</i>	Vietnam New Caledonia	one internal, no lateral	2	6	coarse	2.10	2 acuminate and slightly curved	Several in one row	Black	0.85
<i>O. esakii</i>	Japan	one internal, no lateral	6-8	6	coarse	2.5–3.0	Spiniform setae	20 in one row	Blue violet, indigo	2.50
<i>O. georgia</i>	North America	one internal, no lateral	6 (5?)	6	?	2.0–2.5	Spiniform setae	13 in one row	Blue	1.60
<i>O. petiti</i>	Madagascar	without internal, one small lateral	4	6	coarse	2.50	4 short, acuminate and straight	many in two rows	Red violet	1.25
<i>O. dhritiae</i> sp. nov.	India	one internal, no lateral	6	6	coarse	2.1–2.5	4 strong, blunt and straight	11 in one row	Deep purple	1.05-1.4
<i>O. coerulea</i>	Indonesia	without internal or lateral	4-5(?)	6	coarse	2.0–3.0	4 long, acuminate and curved	9 in one row (after Y & S 1997)	Blue	1.50
<i>O. barnardi</i>	Australia Africa,	without internal or lateral	4–5	6(5)	coarse	4.0	4 short, blunt and straight	?	Blue-black	1.40
<i>O. subcoerulea</i>	Vietnam	one internal, no lateral	?	6	fine	2.15	4 acuminate and slightly curved	?	Black	1.10
<i>O. dubia</i>	Madagascar	one internal, no lateral	5	6	coarse	2.60	4 acuminate and slightly curved	15 in one row	Black	1.25
<i>O. chenorum</i>	China	one internal, no lateral	4	6	coarse	2.60	4 Short, blunt and straight	14 in one row	Blue-black	1.24



Figs. 16-20 *Oudemansia dhritiae* sp. nov.

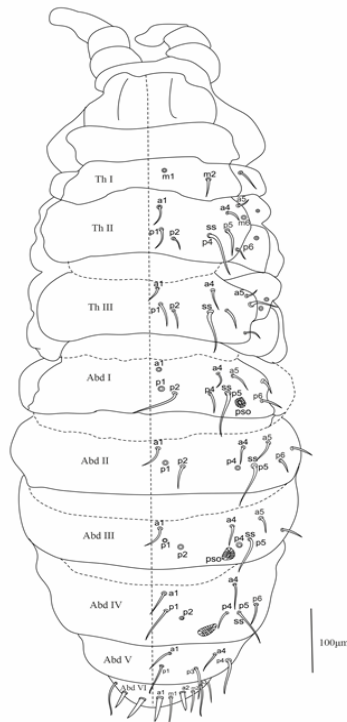
16 - mouthparts with maxillae and mandible, 17 - magnified picture of maxilla, 18 - magnified picture of mandible, 19 - tenaculum, 20 - fore leg

Zoological Survey of India, for her contribution towards eminence in entomology and to the knowledge of Dipteran Taxonomy.

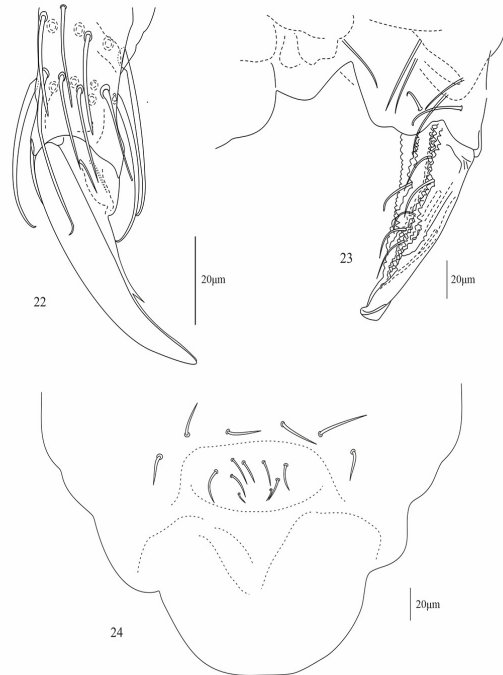
Distribution. Only known from the type locality.

Remarks: *Oudemansia dhritiae* sp. nov. is characterized by having six dental setae (as all species of the genus) and one internal tooth on unguis (as the other 6 species of the genus). The new species has 6 sensilla on Ant. IV and a single row of 11 teeth (two strong apical and below 9 small ones) on its mandible which is different from other species of the genus. The unguis of *O. dhritiae* sp. nov. is similar to that of *O. dubia*

Denis, 1947, however differing from it in the number of sensilla on Ant. IV. The new species shows significant resemblance with *O. chenorum* on the basis of setae pattern in female genital plate and Ant. IV sensilla number (Palacios-Vargas and Bu 2020), on the other hand *O. dhritiae* sp. nov. is dissimilar in ratio of dens: mucro and mandibular teeth number. *O. petiti* Delamare Debutteville & Massoud, 1964 and the new species has resemblance in sensilla number, conversely the former species has one small lateral tooth on unguis. Prabhoo (1970) first time reported *O. subcoerulea* Denis, 1948 from Kanyakumari, India and he mentioned 3 apical and 2 basal sense rods (or



Figs. 21 *Oudemansia dhririae* sp. nov. gorsal body chaetotaxy



Figs. 22-24 *Oudemansia dhririae* sp. nov. 22 - tibiotarsus of hind leg with internal tooth on unguis, 23 - furcula, 24 - female genital chaetotaxy

sensilla) on Ant IV and termed Sgv as guard sensilla of Ant. III organ, however the new species has 6 sensilla in Ant IV and differs from the previous one in mandibular teeth no. The main diagnostic characters of the world species of *Oudemansia* are summarized (Table 1).

Key to the world species of the genus *Oudemansia* (Modified from Massoud, 1967 and Palacios-Vargas and Bu, 2020)

- 1. Abd. VI with 2 anal spines*O. schoetti* Denis, 1948
- Abd. VI with more than 2 anal spines or spiniform setae.....2
- 2. Abd. VI only with spiniform setae3
- Abd. VI with 4 true anal spines well defined4
- 3. Mandible with 20 teeth. Ratio dens: mucro = 2.5-3.0*O. esakii* (Kinoshita, 1932)

- Mandible with 13 teeth. Ratio dens: mucro = 2.0-2.5..... *georgia* Christiansen & Bellinger, 1980
- 4. Unguis without internal tooth 5
- Unguis with one internal tooth 7
- 5. Unguis with small lateral teeth. Mandible with many teeth in two rows
O. petiti Delamare Debutteville & Massoud, 1964
- Unguis without lateral teeth. Mandible with teeth in one row6
- 6. With 4 acuminate and curved anal spines on individual papillae*O. coerulea* Schött, 1893
- With 4 blunt and straight anal spines without individual papillae.....
.....*O. barnardi* (Womersley, 1934)
- 7. Posterior surface of dens with fine granulations; Ungues III: mucro = 1 to 1.05

-*O. subcoerulea* Denis, 1948
 –Posterior surface of dens with coarse granulations;
 Ungues III: mucro = 1 to 1.4.....8
 8. Ant. IV with 5 sensilla; Abd. VI with 4
 acuminate and slightly curved anal spines
 *O. dubia* Denis, 1947
 - Ant. IV with 4 sensilla; Abd. VI with 4 blunt and
 straight anal spines9
 9. Mandible with 14 teeth in one row, basal two
 prominent. Ratio Dens: mucro = 1: 2.6
*O. chenorum* Palacios-Vargas & Bu, 2020
 –Mandible with 11 teeth in one row, apical two teeth
 larger. Ratio Dens: mucro = 1: 1.8–2.5
*O. dhritiae* sp. nov.

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REFERENCES

Bellinger P.F., Christiansen K.A. and Janssens F. (1996–2023) Checklist of the Collembola of the world. <http://www.collembola.org> (last accessed on 18th December, 2023).
 Börner C. (1901) Zur Kenntnis der Apterygoten-Fauna von Bremen und der Nachbardistrikte. Beitrag zu einer Apterygoten-Fauna Mitteleuropas. Abhandlungen des Naturwissenschaftlichen Vereins zu Bremen 17 (1): 1–141. doi:10.5962/bhl.part.18332.
 Börner C. (1906) Das System der Collembolen nebst Beschreibung neuer Collembolen des Hamburger Naturhistorischen Museums. Mitteilungen aus den Naturhistorischen Museum in Hamburg. 2. Beiheft zum Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten 23: 147–188.

Börner C. (1913) Die Familien der Collembolen., Zoologischer Anzeiger 41: 315–322.
 Cheng L. (1976) Marine Insects. UC San Diego: Marine Biology Research Division: pp. 151-186. <https://escholarship.org/uc/item/1pm1485b>
 Christiansen K. and Bellinger P. (1980) The Collembola of North America North of the Rio Grande. Part 1. Poduridae and Hypogastruridae. Grinnell College, Iowa. 386pp.
 Deharveng L. (1979) Contribution à la connaissance des Collemboles Neanurinae de France et de la péninsule Ibérique. Travaux du Laboratoire d’Ecobiologie des Arthropodes Edaphiques, Toulouse 1: 1–61.
 Deharveng L. (1981) Nouvelles espèces de Neanurinae européens appartenant aux genres Bilobella et Monobella. Bulletin de la Société d’Histoire Naturelle de Toulouse 117: 95–102.
 Deharveng L. (1983) Morphologie évolutive des Collemboles Neanurinae en particulier de la lignée Neanurienne. Travaux du Laboratoire d’Ecobiologie des Arthropodes Edaphiques, Toulouse 4: 1–63.
 Deharveng L., D’Haese C.A. and Bedos A. (2008) Global diversity of springtails (Collembola; Hexapoda) in freshwater. In Freshwater Animal Diversity Assessment. Springer, Dordrecht. pp329-338. doi:10.1007/978-1-4020-8259-7_36.
 Delamare Deboutteville C. and Massoud Z. (1964) Collemboles marins interstitiels des plages de Madagascar. Vie et Milieu 17: 381–392.
 Denis J.R. (1947) Croisière du Bougainville, Aux Iles Australes Françaises. Mémoires du Muséum 20: 31–52.
 Denis J.R. (1948) Collemboles d’Indochine. Notes d’Entomologie Chinoise, Musée Heude 12: 183–311.
 D’Haese C.A. (2003) Homology and morphology in Poduromorpha (Hexapoda, Collembola). European Journal of Entomology 101: 385–407.
 Hopkin S.P. (1997) Biology of the springtails: (Insecta: Collembola). Oxford University Press, Oxford. 300pp.
 Kinoshita S. (1932) Collembola. In: Iconographia Insectorum Japonicorum. Hokuryukan, Tokyo. pp2115–2126.
 Krantz G.W. (1978) A manual of acarology. Corvallis (OR), Oregon State University Book Stores.

- Mandal G.P. (2018) Collembola of India - an updated checklist. *Halteres* 9: 116–130. doi: 10.5281/zenodo.1280640.
- Massoud Z. (1967) Monographie des Neanuridae, Collemboles Poduromorphes à pièces buccales modifiées. In: Delamare Deboutteville C. and Rapoport E.H. (Eds.), *Biologie de l'Amérique Australe*, Paris, CNRS, III. pp7–399.
- Noble-Nesbitt J. (1963) A site of water and ionic exchange with the medium in *Podura aquatica* L. (Collembola, Isotomidae). *Journal of Experimental Biology* 40: 701–711.
- Palacios-Vargas J.G. and Bu Y. (2020) New records of Collembola from marine littoral sand of Hainan Island, China, with description of a new *Oudemansia* species (Neanuridae: Pseudachorutinae). *Zootaxa* 4810(1): 117–130. doi: 10.11646/zootaxa.4810.1.6
- Prabhoo N.R. (1970) *Oudemansia subcoelurea* Denis—the first record of a marine Collembola (Insecta) from India. *Current Science* 39: 490–491.
- Schött H. (1893) Beiträge zur Kenntniss der Insektenfauna von Kamerun. 1. Collembola. *Bihang till Kongliga Svenska Vetenskapsakademiens Handlingar* 19 (2): 1–28.
- Womersley H. (1934) On some Collembola-Arthropleona from South Africa and Southern Rhodesia. *Annals of the South African Museum* 30: 441–475.

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