

Far Eastern Entomologist

Дальневосточный энтомолог

Journal published by Far East Branch
of the Russian Entomological Society
and Laboratory of Entomology, Federal
Scientific Center of the East Asia
Terrestrial Biodiversity, Vladivostok

Number 349: 1-10

ISSN 1026-051X

January 2018

<https://doi.org/10.25221/fee.349.1>

<http://urn:lsid:zoobank.org:pub:278567DC-01B2-4686-B9C8-F99DC044B100>

NEW AND POORLY-KNOWN MILLIPEDES (DIPLOPODA) FROM KOREA

E. V. Mikhaljova¹⁾, K.-Y. Lim²⁾

1) Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok 690022, Russia. E-mail: Mikhaljova@biosoil.ru

2) Korean Institute of Myriapods, Deokjin-gu, Jeonju-si, Jeollabuk-do, Republic of Korea. E-mail: et88@hanmail.net

Summary. Two new species of the millipedes are described from the Republic of Korea: *Hyleoglomeris dodongiensis* Mikhaljova et Lim, **sp. n.** and *Epanerchodus alienus* Mikhaljova et Lim, **sp. n.** The potential record of *Japanioiulus lobatus* Verhoeff, 1937 from Korea (Takakuwa & Takashima, 1944; Takakuwa, 1954) is confirmed.

Key words: myriapoda, taxonomy, new species, description, fauna, South Korea.

Е. В. Михалёва, К.-Й. Лим. Новые и малоизвестные двупарноногие многоножки (Diplopoda) из Кореи // Дальневосточный энтомолог. 2018. N 349. С. 1-10.

Резюме. Из Республики Корея описаны два новых вида двупарноногих многоножек: *Hyleoglomeris dodongiensis* Mikhaljova et Lim, **sp. n.** и *Epanerchodus alienus* Mikhaljova et Lim, **sp. n.** Подтверждено ранее предполагаемое (Takakuwa & Takashima, 1944; Takakuwa, 1954) обитание в Корее *Japanioiulus lobatus* Verhoeff, 1937.

INTRODUCTION

The present paper continues research in the millipede fauna of Korea. A short historical account of investigation and a list (unfortunately incomplete and not entirely reliable) of the Korean Diplopoda were recently provided by Nguyen *et al.* (2016). At least, three additional species (*Ansiulus deminutus* Mikhaljova, 2001, *Anaulaciulus parvulus* Mikhaljova, 2001 and *Epanerchodus multiprocessus* Mikhaljova, 2001) are known from South Korea too (Mikhaljova & Lim, 2001). In addition, the species, originally described from North Korea as *Anaulaciulus riedeli* (Jędryczkowski, 1982), was synonymized with *Anaulaciulus golovatchi* Mikhaljova, 1982 (Mikhaljova, 2002). *Epanerchodus bifidus* Takakuwa, 1954 and *E. dichotomus* Takakuwa, 1954 were synonymized with *E. koreanus* Verhoeff, 1937 (Mikhaljova & Lim, 2001). The record of *Hoffmaneuuma exiguum* Golovatch, 1978 in Korea need to be confirmed (Mikhaljova, 2004).

The present contribution puts on record a small material from the almost unexplored places of Republic of Korea taken by second author. The material appears to be significant, for it contains species new to science.

MATERIALS AND METHODS

Material treated here has been shared between the collections of the National Institute of Biological Resources, Republic of Korea (NIBR), Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok, Russia (FSCB) and Zoological Museum, State University of Moscow, Moscow, Russia (ZMUM), as indicated in the text. Specimens were collected in 70–75% ethanol. During the study, the gonopods, telopods and some other parts were dissected from a male and mounted in glycerin as temporary micropreparations. Specimens were studied and illustrated using standard stereomicroscopic and drawing equipments. Coloration of the specimens is described from alcohol material. Photographs were prepared at the Centre of Collective Use “Biotechnology and Gene Engineering” of the FSCB using a stereomicroscope SteReo Discovery.V12 and stacked using CombineZM software.

The family-level classification adopted here is that of Shelley (2003).

LIST OF THE SPECIES WITH DESCRIPTIONS OF NEW SPECIES

Oder Glomerida Brandt, 1833

Family Glomeridae Leach, 1815

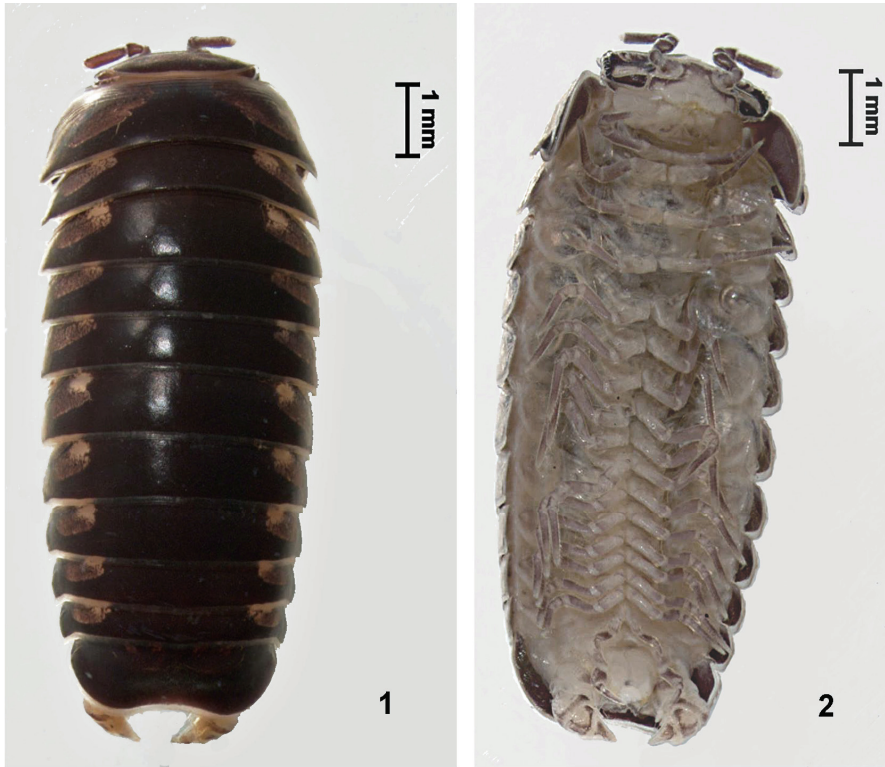
Genus *Hyleoglomeris* Verhoeff, 1910

Hyleoglomeris dodongiensis Mikhaljova et Lim, sp. n.

Figs 1–8

MATERIAL. Holotype – ♂ (NIBRIV0000810169), **Republic of Korea**: Gyeongsangbuk-do: Ulleung-gun, Dodong-ri, Bongrae-Fall, 9.V.2013, leg. K.-Y. Lim.

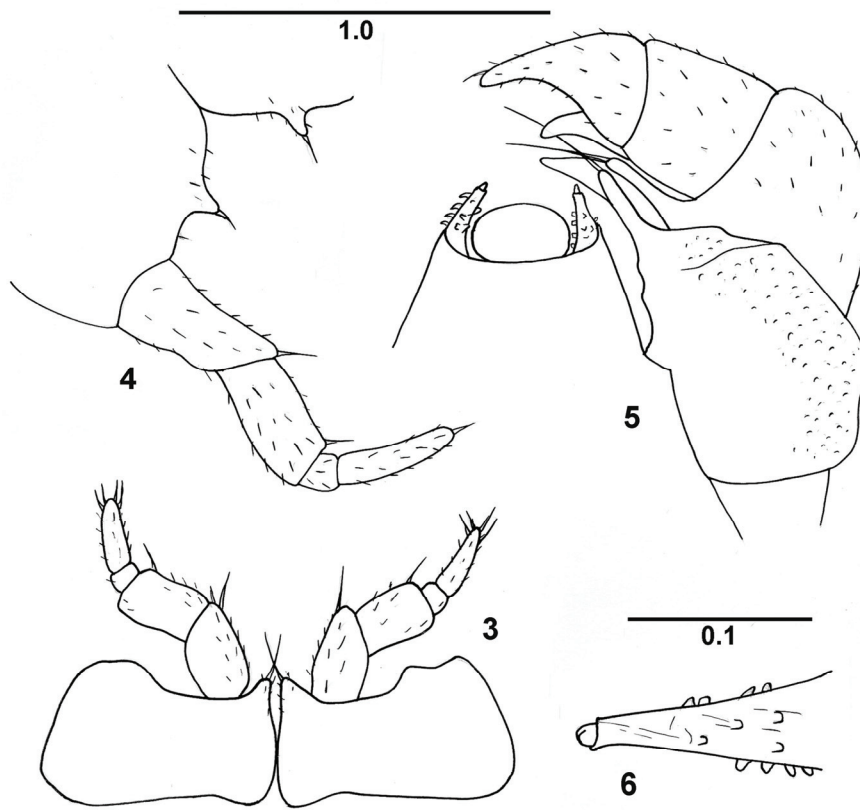
Paratypes: 1 ♂ (NIBRIV0000810170), 1 ♂ (NIBR IV0000810173), 1 ♀ (NIBR IV0000810174), 3 ♀ (NIBR), 2 ♂, 1 ♀ (FSCB), 1 ♂, 1 ♀ (ZMUM), the same label as in holotype.



Figs 1–2. *Hyleoglomeris dodongiensis* sp. n., male paratype. 1 – habitus, dorsal view; 2 – habitus, ventral view.

DESCRIPTION. Length of non-stretched but unrolled specimens 7.9–9.0 mm (male) or 8.0–9.0 mm (female), width 4.0–4.1 mm (male and female). Background coloration of head black brown with several small light spots between and above antennal sockets; clypeus, labrum, Tömösváry's organs and bases of antennal sockets light beige. Ventral part of head light beige, some of gnathochilarium structures brown. Ocelli black. Antennae dark brown with light beige apex. Collum with a large oval marbled black brown central poorly noticeable spot. Thoracic shield with pair of marbled black brown oblong spots placed laterally (Fig. 1). Each following tergite (including following tergite in front of pygidium) with pair of marbled black brown lateral spots and a translucent caudal margin. The spots can be poorly noticeable. Pygidium black brown with a lucid caudal margin but without any pattern. Venter beige-gray (Fig. 2). Legs light brown. Telopods marbled light brown.

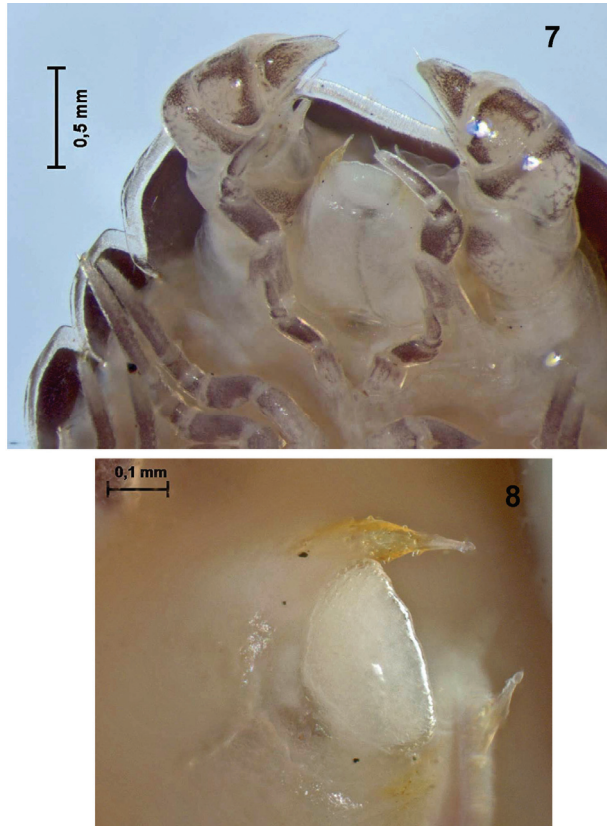
Head with a setose labrum. Ocelli 5(6)+1 (male and female), gradually reducing in size toward Tömösváry's organ; lenses very convex. Antennae with four apical cones, segment 6 ca 2.2–2.3 times longer than wide. Organ of Tömösváry oblong-oval, elongate, ca 1.4–1.5 times as long as broad.



Figs 3–6. *Hyleoglomeris dodongiensis* sp. n., male paratype. 3 – leg pair 17; 4 – leg 18; 5 – telopod, front view; 6 – distal part of telopod syncoxital lateral horn. Scales in mm.

Dorsum smooth. Collum semicircular, as usual, with two transverse striae. Thoracic shield with 10–11 (male) or 9–10 (female) delicate striae, of which only 3–6 entirely crossing dorsum. Length of the striae varied. As usual, anterior border of thoracic shield with one stria concealed under caudal margin of collum. Hyposchism field relatively narrow, not projecting caudad beyond tergal contour. Following terga in front of pygidium extremely faintly bisinuate at caudal edge and with two striae starting above lateral edge. Pigidium delicately sinuate medially at caudal margin.

Leg 17 (Fig. 3) with small and irregularly rounded outer coxal lobe, telopodite 4-segmented with four claws apically. Leg 18 (Fig. 4) with a subtriangular syncoxital notch; telopodite 4-segmented.



Figs 7–8. *Hyleoglomeris dodongi* sp. n., male paratype. 7 – telopods; 8 – telopod syncoxital lobe flanked by two lateral horns, ventral view.

Telopods (Figs 5–8) with ovoid, horizontally stretched, central syncoxital lobe curved anteriorly. Surface of syncoxital lobe smooth. Syncoxital lateral horns not very high, directed caudad, covered with tiny tubercles; each horn crowned by an ovate lobule. Micropapillate laterally prefemur with a long, inner digitate process crowned with a long flagelloid. Femur with a similar antero-mesal process also crowned by a flagelloid and posteriorly with a large inner outgrowth apically bearing a membranous sack curved forward. Tibia with a curved medial outgrowth posteriorly. Tarsus with a somewhat curved caudad distal part and a strong subapical seta.

DIAGNOSIS. Differs from congeners mainly by the telopod syncoxital horns covered with tiny tubercles, combined with the coloration pattern of dorsum with pair of marbled black-brown oval lateral spots on each tergite including the thoracic shield.

DISTRIBUTION. Republic of Korea.

ETYMOLOGY. The specific epithet refers to the type locality.

REMARKS. At the moment, 6 species have authentically been recorded from the Korean Peninsula (Mikhailjova & Lim, 2006). New species seems to be especially close to *Hyleoglomeris koreana* Golovatch, 1978, described from near Kannyn, South Korea (Golovatch, 1978) judged from the ovoid, horizontally stretched, central syncoxital lobe of telopods. But *Hyleoglomeris dodongiensis* sp. n. differs from *H. koreana* by the telopod syncoxital horns covered with tiny tubercles, coloration pattern of thoracic shield with pair of marbled black-brown oval lateral spots and the structure of male leg 17 with small and irregularly rounded outer coxal lobe.

Oder Julida Brandt, 1833

Family Julidae Leach, 1814

Genus *Japanioiulus* Verhoeff, 1937

Japanioiulus lobatus Verhoeff, 1937

Japanioiulus lobatus Verhoeff, 1937: 35.

Amblyiulus lobatus: Verhoeff, 1941: 317; Miyosi, 1957: 315; Miyosi, 1959: 55, figs; Takano, 1980: 55; Nishikawa & Murakami, 1991: 299; Nguyen *et al.*, 2016: 45.

Japanioiulus lobatus: Takakuwa & Takashima, 1944: 24; Takakuwa, 1954: 181, figs; Miyosi, 1957: 315; Paik, 1958: 364; Shinohara, 1960: 28.

Trichopachyiulus (subgenus *Japanopachyiulus*) *niponicus* Miyosi, 1957: 316, figs.

Trichopachyiulus niponicus: Miyosi, 1959: 55, figs.

Trichopachyiulus (*Japanopachyiulus*) *niponicus*: Shinohara, 1960: 28; Murakami, 1972: 63.

?*Amblyiulus niponicus*: Mauriès, 1982: 441.

Japanioiulus (sic!) *lobatus*: Enghoff, 1992: 13.

Trichopachyiulus (*Japanopachyiulus*) *niponicus*: Enghoff, 1992: 13.

MATERIAL. **Republic of Korea**: Gyeongsangbuk-do: Ulleung-gun, Dokdo-ri, 7.V 2013, 2 ♂, 3 ♀, 1 juvenile (FSCB), leg. K.-Y. Lim; Gyeongsangbuk-do: Ulleung-gun, Dokdo-ri, 8.V 2013, 5 ♂, 5 ♀ (NIBR), leg. K.-Y. Lim; Gyeongsangbuk-do: Ulleung-gun, Dokdo-ri, 9.V 2013, 5 ♀ (NIBR), leg. K.-Y. Lim; Gyeongsangbuk-do: Ulleung-gun, Buk-mean, Geaneum-island, 9.V 2013, 4 ♂ (NIBR), leg. K.-Y. Lim.

DISTRIBUTION. Japan, Republic of Korea.

REMARKS. The species was originally described by Verhoeff from Abuta (Hokkaido, Japan) as type species of his monotypic genus *Japanioiulus* (Verhoeff, 1937). Then *Japanioiulus* was synonymized with *Amblyiulus* Silvestri, 1896, thus new species combination – *Amblyiulus lobatus* – is also given (Verhoeff, 1941). Mauriès (1982) placed *Japanioiulus* under *Syrioioiulus* Verhoeff, 1914. Nevertheless Enghoff (1992) returned to using the name *Japanioiulus* (sic!) *lobatus*.

The first record of *Japanioiulus lobatus* in Korea was published by Takakuwa and Takashima (1944). However they noted that this record may be erroneous. In addition, any materials on this species or collection place in Korea were not presented.

Then Takakuwa (1954) and Nguyen *et al.* (2016) repeated the dubious information concerning the Korean find of this species. So the above specimens of *Japanioiulus lobatus* are the first reliable confirmation of inhabitation of this species in Korea.

Trichopachyiulus (subgenus *Japanopachyiulus*) *niponicus* was originally described from Hokkaido, Japan (Miyosi, 1957). Mauriès (1982) supposedly placed this species to *Amblyiulus*. A decade later *Trichopachyiulus* (*Japanopachyiulus*) *niponicus* was synonymized with the type species of *Japanioiulus*, *J. lobatus* Verhoeff, 1937 (Enghoff, 1992).

There are good illustrations of gonopods and other structures of this species (Miyosi, 1957).

Oder Polydesmida Pocock, 1887

Family Polydesmidae Leach, 1815

Genus *Epanerchodus* Attems, 1901

***Epanerchodus alienus* Mikhailjova et Lim, sp. n.**

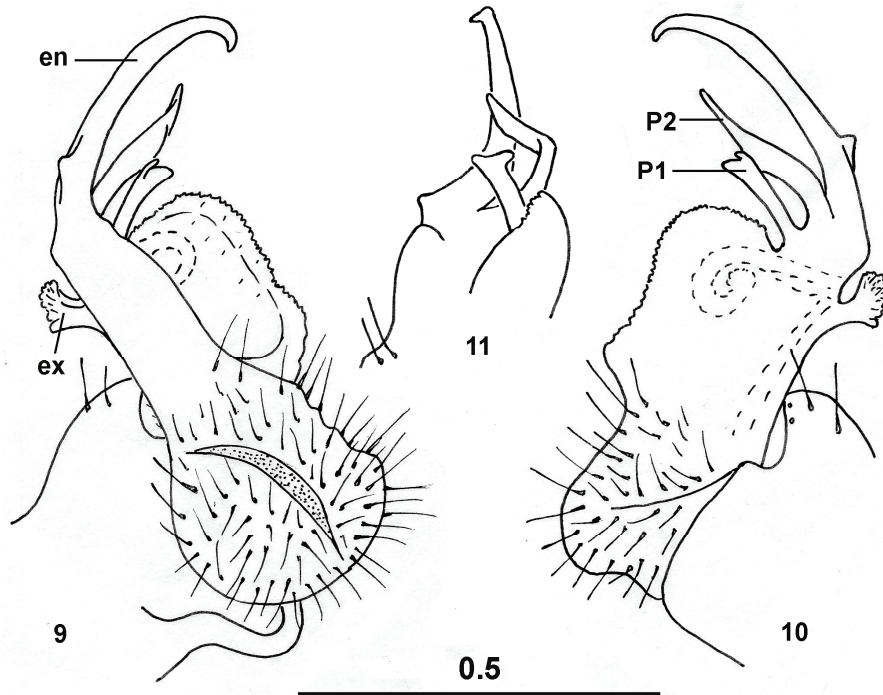
Figs 9–11

MATERIAL. Holotype – ♂ (NIBRIV0000810171), **Republic of Korea:** Gyeongsangbuk-do: Ulleung-gun, Dodong-ri, Bongrae-Fall, 9.V 2013, leg. K.-Y. Lim. Paratypes: 1 ♀ (NIBRIV0000810172), 1 ♂, 1 ♀ (FSCB), the same label as in holotype.

DESCRIPTION. MALE. Length 17–19 mm, width with paraterga 2.0 mm, without paraterga 1.0 mm. Coloration pink. Ventral part of body beige excluding pink paraterga. Antennae, head, legs beige. Body with 20 segments. Tegument (excluding paraterga) very delicately alveolate. Head very densely setose throughout. Vertigial setae absent. Genae ovale in dorsal view. Antennae long and slender, slightly clavate, in situ reaching to middle of the segment 4. Antennomeres 5 and 6 distodorsally with a small group of short dense bacilliform sensilla or setae. Antennomere 7 with a minute parbasal cone and a distodorsal group of seta-formed sensilla. Length ratios of antennomeres 2–7 as 1.6:2.1:1.7:1.7:1.8:1, width ratios as 0.8:0.8:0.8:1.0:1.2:1, respectively.

Collum semicircular, in width equal to head; posterior corners angular. Segments 2–4 somewhat shorter and narrower than others. Body parallel-sided on somites 6–17, further on gradually tapering toward telson. Paraterga well-developed, set high, starting from collum, male dorsum very faintly convex. Their front edges slightly bordered and upturned, straight, usually forming a distinct shoulder. Caudolateral corners of paraterga beak-shaped, pointed on segments 5–19. Metatergal polygonal sculpture as usual, three transverse rows of bosses, second and third rows being developed stronger than first one. Tergal setae short, almost all broken off. Ozopores evident, dorsal, ozopore formula normal. Epiproct produced into a caudal process, medium-sized, conical, rounded at tip, with rare setae. Hypoproct semi-circular; caudal, paramedian, setiferous papillae small and well-separated.

Sterna without modifications, setose. Legs long and slender; postfemur, tibia and tarsus with sphaerotrichs on ventral side; prefemur and femur with bifurcated setae on ventral surface. Sphaerotrichs missing toward hind part of body. Posteriormost legs without sphaerotrichs. Claws normal. Leg pair 1 reduced in size as compared to subsequent pairs (about half the size of leg pairs of midbody). Leg pair 2 slightly reduced in size as compared to subsequent pairs. Legs without any outgrowths on postfemora and tibiae.



Figs 9–11. *Epanerchodus alienus* sp. n., male paratype. 9 – gonopod, mesal view; 10 – gonopod, lateral view; 11 – distal part of gonopod, caudoventral view; **en** – telopodite (= endomere in terms of Golovatch, 2014, 2015); **ex** – outer horn (= exomere in terms of Golovatch, 2014, 2015); **P1** – postfemoral process (= process **P1** in terms of Golovatch, 2014, 2015); **P2** – additional process (= process **P2** in terms of Golovatch, 2014, 2015). Scale in mm.

Following traditional terminology, gonopods (Figs 9–11) with a usual, heavily setose prefemoral portion. Femur well-developed, with strong mushroom-shaped outer horn (**ex**) apically carrying tiny knobs. Clivus broad, with a lamelliform delicately roughened margin. Seminal groove ending up at bottom of a broad femoral cavity. Telopodite (**en**) basally with a low projection and a hook-shaped apex. Postfemoral process (**P1**) shortest, slender with obtuse broadened apex. Additional process-branch (**P2**) of telopodite long and slender without any projections, its apex pointed.

Using modern terminology (Golovatch, 2014, 2015) gonopod telopodite with strong mushroom-shaped exomere (**ex**) apically carrying tiny knobs and three distofemoral processes: longest endomere (**en**) with a basal low projection and a hook-shaped apex (Figs 9–11). Process **P1** shortest, slender with obtuse broadened apex. Process **P2** longer than **P1**, slender with pointed apex and without any projections.

FEMALE. Length 20–21 mm, width with paraterga 2.5 mm, without paraterga 2.0 mm. Leg prefemora less bulging laterad. Epigynal ridge transverse, low, rounded. Other nonsexual characters as in male.

DIAGNOSIS. Differs from congeners mainly by the configuration of the gonopod postfemoral process (= process **P1** in terms of Golovatch 2014, 2015) with obtuse broadened apex coupled with the apically pointed additional process (= process **P2** in terms of Golovatch 2014, 2015).

DISTRIBUTION. Republic of Korea.

ETYMOLOGY. The specific epithet refers to the distinguishing characters of the species.

REMARKS. New species seems to be especially close to *Epanerchodus sanctus* Miyosi, 1951, described from Ehime Prefecture, Japan (Miyosi, 1951) judged from the presence of gonopod postfemoral (= process **P1** in terms of Golovatch, 2014, 2015) and additional (= process **P2** in terms of Golovatch, 2014, 2015) processes, configuration of the gonopod telopodite (= endomere in terms of Golovatch, 2014, 2015) and outer horn (= exomere in terms of Golovatch, 2014, 2015). But *Epanerchodus alienus* **sp. n.** differs from *E. sanctus* by the shape of the gonopod postfemoral process (= process **P1** in terms of Golovatch, 2014, 2015) with obtuse broadened apex, the apically pointed additional process (= process **P2** in terms of Golovatch, 2014, 2015) without any projections and the presence of the sphaerotrichs on ventral side of male leg postfemur, tibia and tarsus.

ACKNOWLEDGEMENTS

This work was supported by a grant from the National Institute of Biological Resources (NIBR), funded by the Ministry of Environment (MOE) of the Republic of Korea. Our special thanks extend to Dr. S.I. Golovatch (A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia) for his opinion on name of *Japanioiulus lobatus* and Dr. V.M. Loktionov (FSCB, Vladivostok, Russia) for the help in preparation of photographs. Mrs. G.A. Sinelnikova (FSCB, Vladivostok, Russia) kindly inked the figures 3–6.

REFERENCES

- Enghoff, H. 1992. *Dolichoiiulus* – a mostly Macaronesian multitude of millipedes. With the description of a related new genus from Tenerife, Canary Islands (Diplopoda, Julida, Julidae). *Entomologica Scandinavica Supplements*, 40: 1–158.
- Golovatch, S.I. 1978. Some new East Asian millipedes (Diplopoda) in the collection of the Zoological Institute of the USSR Academy of Sciences. *Entomologicheskoe Obozrenie*, 57(3): 677–681.
- Golovatch, S.I. 2014. Review of the millipede genus *Epanerchodus* Attems, 1901 in continental China, with descriptions of new species (Diplopoda: Polydesmidae). *Zootaxa*, 3760(2): 275–288. DOI: <http://dx.doi.org/10.11646/zootaxa.3760.2.7>

- Golovatch, S.I. 2015. Two new species of the millipede order Polydesmida from Southern China (Diplopoda). *Zoologicheskii Zhurnal*, 94(9): 1023–1028. DOI: <http://dx.doi.org/107868/S004451341509010X>
- Jędryczkowski, W. 1982. New and rare millipedes (Diplopoda, Julida, Julidae) from North Korea. *Annales Zoologici PAN*, 36(19): 375–384.
- Mauriès, J.-P. 1982. *Dolichoilulus tongiorgii* (Strasser), diplopode halophile nouveau pour la faune de France. Remarques sur la classification des Pachyiulini (Myriapoda, Diplopoda, Julida). *Bulletin du Muséum national d' Histoire naturelle, Paris, 4^e série, 4, section A*, 3–4: 433–444. [In French with English summary]
- Mikhailjova, E.V. 2002. A contribution to the millipede faunas of Korea and the Russian Far East (Diplopoda). *Arthropoda Selecta*, [2001], 10(2): 147–150.
- Mikhailjova, E.V. 2004. *The millipedes (Diplopoda) of the Asian part of Russia*. Sofia-Moscow, 292 pp.
- Mikhailjova, E.V. & Lim, K.-Y. 2001. New millipedes from Korea, with notes on the identity of *Epanerchodus koreanus* Verhoeff, 1937 (Diplopoda). *Arthropoda Selecta*, 10(1): 19–26.
- Mikhailjova, E.V. & Lim, K.-Y. 2006. New species of the genus *Hyleoglomeris* from Korea (Diplopoda: Glomerida: Glomeridae). *Zootaxa*, 1224: 45–58.
- Miyosi, Y. 1951. Beiträge zur Kenntniss Japanischer Myriopoden. II. Aufsatz: Üeber 3 neue Arten von *Epanerchodus* (Polydesmidae). *Zoological Magazine*, 60(10): 220–223. [In Japanese with German summary]
- Miyosi, Y. 1957. Beiträge zur Kenntniss Japanischer Myriopoden. 21. Aufsatz: Üeber eine neue Art von *Trichopachyiulus*. *Zoological Magazine*, 66: 315–318.
- Miyosi, Y. 1959. *Über Japanische Diplopoden*. Arachnological Society of East Asia, Osaka. 223 pp. [In Japanese]
- Murakami, Y. 1972. Some myriapods from Hokkaido, Northern Japan. *Memoirs of the National Science Museum*, 5: 57–64.
- Nguyen, A.D., Jang, K.H., Hyun, J.S. & Hwang, U.W. 2016. An updated checklist and perspective study of millipedes (Arthropoda: Myriapoda: Diplopoda) in the Korean Peninsula. *Animal Systematics, Evolution and Diversity*, 32(1): 44–48. DOI: <http://dx.doi.org/10.5635/ASED.2016.32.1.044>
- Nishikawa, Y. & Murakami, Y. 1991. Distributional records on Japanese millipeds (I). *Faculty of Letters Review Otemon Gakuin University*, 25: 291–313. [In Japanese]
- Paik, K.-Y. 1958. A list of Chilopoda, Symphyla and Diplopoda from Korea. *Kyungpook University, Theses Coll.*, 2: 351–369. [In Korean with English summary]
- Shelley, R.M. 2003. A revised, annotated, family-level classification of the Diplopoda. *Arthropoda Selecta*, [2002], 11(3): 187–207.
- Shinohara, K. 1960. Three new species of Julioidea from Chichibu. *Bulletin of the Chichibu Museum of Natural History*, 10: 23–30. [In Japanese with English summary]
- Takakuwa, Y. 1954. *Diplopden aus Japan und ihn angrenzenden Gebieten*. Japan Society for the Promotion of Science, 241 pp. [In Japanese with German summary]
- Takakuwa, Y. & Takashima, H. 1944. Chilopods and Diplopods known from Korea, part II. *Acta Arachnologica*, 9(1/2): 22–32.
- Takano, M. 1980. On the Chilopoda and Diplopoda from some Japanese seashores. *Arachnological Society of Asia, Atypus*, 76: 52–62. [In Japanese]
- Verhoeff, K.W. 1937. Zur Kenntnis ostasiatischer Diplopoden. II. *Zoologischer Anzeiger*, 119(1/2): 33–40.
- Verhoeff, K.W. 1941. Asiatische Beiträge V., VI. *Revue de la Faculté des Sciences de l'Université d' Istanbul*, 6(3–4): 277–318.