Three new genera of the family Phrurolithidae (Araneae) from East Asia

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Abstract — Three new genera of the family Phrurolithidae, Pennalithus n. gen., Corealithus n. gen. and Labialithus n. gen., are described, and Pennalithus pennatus (Yaginuma 1967) n. comb., Corealithus coreanus (Paik 1991) n. comb. and Labialithus labialis (Paik 1991) n. comb. are respectively designated as type species. In addition to the above type species, four new combinations are proposed: Pennalithus splendidus (Song & Zheng 1992) n. comb., P. palgongensis (Seo 1988) n. comb., Corealithus subnigerus (Fu, Chen & Zhang 2016) n. comb. and Labialithus lindemanni (Marusik, Omelko & Koponen 2020) n. comb. The above five species of Pennalithus and Corealithus are transferred from Otacilia Thorell 1897, and two species of Labialithus are from Phrurolithus C. L. Koch 1839. A new species, Pennalithus suguroi n. sp., is described, and Phrurolithus pennatoides Seo 2018 is treated as a junior synonym of Pennalithus splendidus.

Key words — Corealithus, Labialithus, new combination, new species, new synonymy, Pennalithus

Introduction

Members of the family Phrurolithidae Banks 1892 are, with a few exceptions, generally characterized by the following features: the first and second legs with several pairs of long spines on the ventral side of the tibiae and metatarsi (Fig. 1 A); the third and fourth legs (the posterior legs) without ventral spines (Fig. 1 B); the chelicera with one or two spines on the anterior side (Figs. 1 C, E; 9 A–B, F); and the male palp with an expansion on the ventral side of the femur (Figs. 1 D; 3 C–E, I; 8 C; 10 C) and without the median apophysis on the bulb (Figs. 2 A, C, F; 3 G, K; 5 A, C, E; 8 E; 10 B). At the present time, 15 genera are recorded under this family in the world (World Spider Catalog 2021). In Central to East Asia, firstly only one genus, Phrurolithus C. L. Koch 1839, was known until Deeleman-Reinhold (2001) redescribed the genus Otacilia Thorell 1897, on which there was no study for more than a century since the original description. Thereafter taxonomic studies on these two genera were activated in the area, especially in China many species were described in recent years (World Spider Catalog 2021). At the same time, some authors studied the generic placements of the species described under the two genera. Consequently, three genera, Abdosetae Fu, Zhang & Mac-Dermott 2010, Alboculus Liu in Liu et al. 2020, and Bosselaerius Zamani & Marusik 2020, were established as new to science, and many transferences between genera were proposed, especially Zamani & Marusik (2020) transferred more than twenty species from Phrurolithus to Otacilia. However, several species assigned to Phrurolithus or Otacilia still remain problematical on their generic placements in spite of many authors’ effort.

In the following lines, I discuss the generic placements of three Otacilia species and one Phrurolithus species the specimens of which I examined.

Otacilia pennata (Yaginuma 1967) and O. splendida (Song & Zheng 1992) were originally described under Phrurolithus and transferred to Otacilia by Zamani & Marusik (2020) mainly on the basis of the differences of the male palpal basic conformation between these two species and Phrurolithus festivus (C. L. Koch 1835), the type species of the genus. First of all, it is necessary to verify the transference of the two species. In P. festivus, the apical part of the male palpal bulb consists of three structures: the embolus relatively short, situated prolaterally; the conductor membranous; and the tegular apophysis somewhat long, situated retrolaterally (Fig. 2 A). The similar conformation is also found in the other related species, for example, P. nipponicus Kishida 1914 and P. claripes ( Dönitz & Strand in Bösenberg & Strand 1906) (Fig. 2 C–D, F–G). While in O. pennata and O. splendida, the embolus is rather small, situated dorsally and its tip is directed retrolaterally, the conductor is somewhat sclerotized, and the tegular apophysis is rather short (Fig. 3 G, K). This conformation of the three structures is different from that of P. festivus and its related species. In addition, in the two Otacilia species, the male palpal tibia has not only the retrolateral tibial apophysis but also an apophysis situated retroventrally (it is here named “retroventral tibial apophysis”) (Fig. 3 C, I). Moreover, there are also differences in the female genitalia: in P. festivus and
its relative species, a pair of membranous bursae is present in the internal genitalia (Fig. 2 B, E, H), while in the two Otacilia species, such bursae are not found, and thin blind ducts protruding anteriorly are characteristic (Fig. 4 B, D). Therefore, it is acceptable that the two species in question were transferred from Phrurolithus.

However, the assignment of the two species to Otacilia is also inadequate because there is a gap between these two species and the other Otacilia species. Among species of Otacilia, conditions of the conductor and tegular apophysis vary depending on species as follows: these structures are distinctly present (Fig. 3 G, K; cf. Fig. 5 C), or both the structures are absent (Fig. 5 E). Even in the case that the three structures including the embolus are present, the conformation of the structures is rather different from that of the two species in question (Fig. 3 G, K; cf. Fig. 5 A). Furthermore, the conformation of the female internal genitalia of the two species differs from that of usual Otacilia species by lacking a pair of membranous bursae situated anteriorly (Fig. 4 B, D), which are present in the latter (Fig. 5 B, D, F).

In addition to the characters of the reproductive organs, the somatic features are also important. The two species have iridescent scale-like hairs on the surfaces of the body and legs (Fig. 6 A–E); this noteworthy character is also found in the North American genus Phrurotimpus Chamberlin & Ivie 1935 (Dondale & Redner 1982, Penniman 1985, Platnick 1992) and the Mediterranean genus Liophrurillus Wunderlich 1992 (Lucas 1846, Penniman 1985). Although the potential phylogenetic value of this character has not been assessed as Platnick (2019) mentioned, it is possible that in contrast to normal hairs which are found in the other phrurolithid genera, the iridescent hairs are apomorphic. Furthermore, the condition of spines on the prolateral sides of the first and second femora should be paid attention to. As Kamura (2005a) stated, in Phrurolithus, the first femur has only one prolateral spine and the second femur has no prolateral spine (Fig. 7 A), and in Otacilia, the first and second femora each have some (at least two) prolateral spines longitudinally arranged (Fig. 7 B), while in the two species, a different condition from the above two patterns is found: the first femur has some (at least two) spines and the second femur has no spine on the prolateral side (Fig. 7 C).

Judging from the characters shown above, these two species should be assigned to a distinct genus from previously known phrurolithid genera including Phrurolithus and Otacilia.

Similarly to the above two species, Otacilia coreana (Paik 1991) was described under Phrurolithus and transferred to Otacilia by Zamani & Marusik (2020). In this species, the male palp has the embolus and conductor which are relatively large and entirely contiguous to each other (Fig. 8 E), and the female genitalia have the copulatory openings situated anteriorly, the spermathecae situated posteriorly, and the copulatory ducts long (Fig. 8 F–G). These characters are not found in Phrurolithus and the other species of Otacilia, especially the condition of the embolus and conductor is characteristic. Furthermore, in this species, both of the first and second femora have no spine on the prolateral side (Fig. 9 C); it is unique among phrurolithid species, in which the first femur usually has at least one prolateral spine. Therefore, this species should be regarded as a member of a distinct genus from known phrurolithid genera.

Phrurolithus labialis Paik 1991 is similar to P. festivus and its related species in the male palpal conformation (Fig. 10 B; cf. Fig. 2 A, C–D, F–G) and in the spination pattern on the femora of the first and second legs: the first femur has one prolateral spine and the second femur has no prolateral spine (Fig. 9 G; cf. Fig. 7 A). However, P. labialis is unusual in having ventral spines on the tibiae and metatarsi of the posterior legs (Fig. 9 H): at least two spines are present on the fourth tibia, and at least two pairs of spines on the third and fourth metatarsi. In Phrurolithidae, the posterior legs have usually no ventral spine with a few exceptions, namely the North American genera Drassinella Banks 1904 and Phrurotimpus Chamberlin & Ivie 1935; in the former genus, the third and fourth tibiae each have three pairs of ventral spines, and the third and fourth metatarsi each have at least one pair of ventral spines (Platnick & Ubick 1989), and in the latter, the fourth tibia has one pair of ventral spines (Platnick 2019); in addition, in Phrurolinillus Wunderlich 1995 known from Portugal and Spain, such a spine seems to be present as Wunderlich (1995) stated, “tibia III–IV [have] probably only 1 [spine] apically-ventrally”. The fact that some phrurolithid members have ventral spines on the posterior legs complicates a situation because the reduced spination on the posterior legs is considered an apomorphic character in Phrurolithidae (Ramírez 2014). With regard to Phrurotimpus, Penniman (1985) assumed the ventral spines on the fourth tibia is a secondarily derived character. Similarly, it is possible that the ventral spines on the posterior legs in P. labialis occurred after the reduction of the spines had been formed in the common ancestor of phrurolithid species. Although it is needed to do more study concerning the phylogenetic value of this character, it is appropriate that P. labialis is assigned to a distinct genus from known phrurolithid genera.

The abbreviations used in this paper are as follows: ALE, anterior lateral eye; AME, anterior median eye; d, dorsal; MOA, median ocular area; pl, prolateral; PLE, posterior lateral eye; PME, posterior median eye; pv, proventral; rv, retroversal. The eye size means the length of long axis of an eye, but the measurement of the posterior median eye was made at horizontal level. All measurements are given in mm. Photographs of specimens were taken using a microscope camera (Leica, Flexacam C1) attached to a stereomicroscope (Leica, M165 C). The female genitalia were cleared using 10 % KOH solution if needed. The type specimens of the new species described in this paper will be deposited in the collection of the Department of Zoology, National Museum of Nature and Science, Tsukuba, Ibaraki.
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**Taxonomy**
Phrurolithidae Banks 1892

**Pennalithus n. gen.**

[Japanese name: Yabane-urashimagumo-zoku]

**Type species.** Phrurolithus pennatus Yaginuma 1967

**Etymology.** The name is a combination of the first five letters of *pennatus* (the name of the type species) and the latter half of *Phrurolithus*. The gender is masculine.

**Diagnosis.** This genus is distinguished from the other phrurolithid genera by the following characters: the first femur has usually some (at least two) prolateral spines, the second femur lacks prolateral spine (Fig. 7 C); the male palp has the retroventral tibial apophysis (Fig. 3 C, I); the female internal genitalia have a pair of blind ducts protruding anteriorly, and lack membranous bursae (Fig. 4 B, D, F).

**Description.** Anterior eye row almost straight or very slightly recurved; posterior eye row almost straight or very slightly procurred as seen from above; MOA slightly longer than wide, with anterior width as wide as or slightly narrower than posterior (Fig. 1 E). PME separated from each other by less than its size. Thoracic groove longitudinal, distinct (Figs. 3 A; 6 A–B, D–F). Chelicera with two spines on anterior side (Figs. 1 E, 3 A); promargin of fang furrow with well separated three teeth and retromargin with two teeth close to each other. Femur I with usually two dorsal spines and some (at least two) prolateral spines; femur II with one or two dorsal spines and without prolateral spine (Fig. 7 C); femora III–IV with one dorsal spine; tibiae I–II and metatarsi I–II with many ventral spines; tibiae III–IV and metatarsi III–IV without spine. Leg formula 4-1-2-3. Body and appendages generally dark colored, with iridescent scale-like hairs; abdomen with white markings on dorsum (Figs. 3 A, 6 A–F). Male abdomen with large dorsal scutum covering almost whole abdomen; female abdomen with narrow dorsal scutum from one fifth to one third of abdomen in length on anterior part. Male palp with embolus small, directed retrolaterally; conductor sclerotized; tegular apophysis short; retrolateral and retroventral tibial apophyses distinct; ventral expansion on femur (Fig. 3 B–K). Female internal genitalia with blind ducts anteriorly protruding, and without membranous bursae (Fig. 4 B, D, F).

**Species included.** Three species previously assigned to Otacilia: *Pennalithus pennatus* (Yaginuma 1967) n. comb., *P. splendidus* (Song & Zheng 1992) n. comb., *P. palgongensis* (Seo 1988) n. comb.; and a new species, *P. suguroi* n. sp., described below.

**Specimens examined** (all specimens were collected from Japan; TK means T. Kamura). HOKKAIDO: 1♀, Iwaubetsu, Onnebetsu-mura, Shari-cho, Shari-gun, 44°05’29"N 145°01’23"E, 160 m alt., 23.VII.1991, TK leg. AOMO-Pref.: 1♂, Cape Tappi-misaki, Minmaya-Tatsuhama, Sotogahama-machi, Higashihitsugaru-gun, 41°15’30"N 140°20’33"E, 110 m alt., 27.VII.1979, TK leg. SHIGA Pref.: 1♂1♀, Shiga Univ. campus, Hiratsu, Otsu-shi, 34°56’55"N 135°54’07"E, 115

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**Fig. 1.** A–D, Phrurolithus festivus (C. L. Koch 1835); E, Pennalithus pennatus (Yaginuma 1967) n. comb. A, patellae–tarsi of left legs I (left) and II (right), prolateral view; B, patellae–tarsi of left legs III (right) and IV (left), prolateral view; C, E, chelicerae and eye region, dorsal view; D, left male palp, prolateral view, arrow shows ventral expansion on femur. Scales = 0.5 mm (A–B); 0.1 mm (C–E).
m alt., 8.VII.1993, Y. Hatamori leg. KYOTO Pref.: 1♂3♀, Ōtani, Matsugasaki, Sakyō-ku, Kyoto-shi, 35°03′30″N 135°46′20″E, 75–85 m alt., 23–30.VII.1982 (by pitfall traps, 1♀), 26.VII.1982 (1♂), 16–23.VIII.1982 (by pitfall traps, 2♀), TK leg.; 14♂2♀, marsh of Midorogaike, Hazamacho, Kamigamo, Kita-ku, Kyoto-shi, 35°03′30″N 135°46′15″E, 75 m alt., by pitfall traps, 16–28.VI.1982 (1♂), 28.VI–5.VII.1982 (2♂1♀), 23–30.VII.1982 (1♂), TK leg.; 1♀, Kitashirakawa-nishimachi, Sakyo-ku, 35°01′50″N 135°47′13″E, 70 m alt., 26.VI.1994, Y. Hatamori leg. OSAKA Pref.: 2♂, Yasumoto, Ibaraki-cho, 20.VI.1992, TK leg.; 2♀, Kurumatsukuri, Ibaraki-cho, 15.VIII.1992, TK & S. Kaneno leg.; 1♂, Ai, Ibaraki-cho, 34°50′59″N 135°33′29″E, 70 m alt., 30.VI.1995, TK leg.; 1♀, Otemon Gakuin Univ. campus, Nishi-Ai, Ibaraki-cho, 34°50′50–58″N 135°33′24–33″E, 35–65 m alt., 8.VII.1992, Y. Nishikawa leg.; 1♀, same locality, 11.VII.1995, TK leg.; 2♂, Osaka Castle Park, Chuo-kō, Osaka-shi, 4.VI.2006, F. Akamatsu leg.; 3♀, same locality, 9.VIII.2006, N. Koike & Y. Ikeda leg.; 2♂2♀, same locality, 20.V.2007, N. Koike leg. WAKAYAMA Pref.: 1♂2♀, Sakaï-dani, Iwade-cho, Naga-gun (currently Iwade-shi), 7.VI.1998, TK leg. HYOGO Pref.: 5♀, Nishimachi, Befū-cho, Kasa-ku, 14.VII.1990, TK leg. YAMAGUCHI Pref.: 1♀, Higashi-fukawa, Nagato-shi, 24.VII.1992, TK leg.

Diagnosis. Pennalithus pennatus and P. splendidus are distinguished from each other by the following points: in P. pennatus, the male palp has the retrolateral tibial apophysis smoothly tapered (Fig. 3 C, F), the conductor rounded (Fig. 3 G), and the epigyne has the copulatory openings situated medially (Fig. 4 A), while in P. splendidus, the retrolateral tibial apophysis is sinuous (Fig. 3 I, J), the conductor is

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**Fig. 2.** A–B, Phrurolithus festivus (C. L. Koch 1835); C–E, P. nipponicus Kishida 1914; F–H, P. claripes (Dönhart & Strand in Bösenberg & Strand 1906). A, C, F, left male palp, ventral view; D, G, apical part of left male palpal bulb, dorsal view; B, E, H, female internal genitalia, dorsal view. Abbreviations: C, conductor; E, embolus; TA, tegular apophysis. Scales = 0.1 mm. A, after Kamura (2004); C, F, after Kamura (2009).
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angular (Fig. 3 K), and the copulatory openings situated anteromedially (Fig. 4 C). The male of P. pennatus is distinguished from that of P. palgongensis by the palp with the retrolateral tibial apophysis shorter (Fig. 3 C) than that of the latter species (Namkung 2002, fig. 33-8 b–c). The female of P. pennatus is separated from the females of P. suguroi and P. palgongensis by the epigyne with the copulatory openings situated medially (Fig. 4 A) instead of laterally in the latter two species (Fig. 4 E; Seo 1988, fig. 29; Namkung 2002, fig. 33-8 a).

**Description.** Body length ♂ 2.43–3.53, ♀ 3.31–4.56. Numbers of spines on legs: ♂: Femur I d 2, pl 2, 3 or 4; femur II d 1 or 2; femora III–IV d 1; tibia I pv 6, 7 or 8, rv 6, 7 or 8; tibia II pv 5, 6 or 7, rv 5, 6 or 7; metatarsus I pv 5, rv 4 or 5; metatarsus

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*Fig. 3. A–G, Pennalithus pennatus (Yaginuma 1967) n. comb.; H–K, P. splendidus (Song & Zheng 1992) n. comb. A, female body, dorsal view; B, H, left male palp, ventral view; C, I, same, retrolateral view; D, femur of left male palp, prolateral view; E, same, ventral view; F, J, tibia of left male palp, dorsal view; G, K, apical part of left male palpal bulb, anterodorsal view. Abbreviations: RvTA, retroventral tibial apophysis; others are the same as those in Fig. 2. Scales = 1 mm (A); 0.1 mm (B–K). A, after Kamura (2009).*
II pv 4 or 5, rv 3. ♀: Femur I d 2 (rarely 1), pl 3, 4 or 5; femur II d 1 or 2; femora III–IV d 1; tibia I pv 7 or 8, rv 9; 8 or 10; tibia II pv 7 or 8, rv 6, 7 or 8; metatarsus I pv 5 (rarely 4), rv 4 (rarely 5); metatarsus II pv 4 or 5, rv 3 or 4.

Abdomen dark brown with white markings on dorsum (Fig. 3 A, Fig. 6 A–C). Male palp (Fig. 3 B–G): Embolus small and directed retrolaterally, conductor sclerotized and rounded, tegular apophysis short, retrolateral tibial apophysis smoothly shaped, femur with setose expansion on ventroapical part and longitudinal ridge retroventrally. Epigyne with copulatory openings medially situated (Fig. 4 A); female internal genitalia with a pair of long blind ducts protruding anteriorly (Fig. 4 B).

**Distribution.** Japan, Korea, China, Russia (Khabarovsk Prov.).

**Pennalithus splendidus** (Song & Zheng 1992) n. comb. (Figs. 3 H–K, 4 C–D, 6 D–E)

**Phrurolithus pennatus:** Tu & Zhu 1986, p. 93, figs. 24–28. [nec Yagi-numa (1967), misidentification]

**Phrurolithus splendidus** Song & Zheng 1992, p. 103, figs. 1–9; Suguro et al. 2018, p. 19, figs. 1–6.

**Phrurolithus pennatoides** Seo 2018, p. 287, fig. 20 A–H. n. syn.

**Otacilia splendidia:** Zamani & Marusik 2020, p. 312.

For complete list of literatures, see World Spider Catalog (2021).

**Specimens examined.** All specimens were collected from Yakushima Is., Kagoshima Pref., Japan, by T. Yamauchi et al. 1♂, Mt. Kankakedake, Nagata, 220 m alt., 8–28.VI.2007 (by a Malaise trap), deposited in the collection of the Department of Zoology, National Museum of Nature and Science, Tsukuba (NSMT-Ar 17175). 1♀, same locality and same collecting method, 22.VII–22.VIII.2006 (NSMT-Ar 17176).

1♂, Han-yama, Nagata, 250 m alt., 28.VI–30.VII.2007 (by a Malaise trap). 1♀, same locality, 19–22.VII.2006 (by a collision trap).

**Diagnosis.** For the discrimination of this species from **Pennalithus pennatus**, see the diagnosis of the latter species. The male of this species is distinguished from that of **P. palgongensis** by the palp with the retrolateral tibial apophysis shorter (Fig. 3 I) than that of the latter species (Seo 1988, fig. 30).

**Remarks.** This species was recorded from China as **Phrurolithus pennatus** due to a misidentification (Tu & Zhu 1986). Thereafter Song & Zheng (1992) described it as a new species. Suguro et al. (2018) reported this species from Japan.

A comparison between the original descriptions of **Pennalithus splendidus** and **Phrurolithus pennatoides** Seo 2018 (see Song & Zheng 1992, figs. 3–9; Seo 2018, fig. 20 C–H) shows that these two species have the same conformations of the male palp and female genitalia, and they are regarded as synonymous.

**Pennalithus suguroi** n. sp.

[Japanese name: Tsushima-urashimagumo] (Figs. 4 E–F, 6 F)

**Type series.** Holotype (♀) and paratype (♀): Mikata, Mitsushima-machi, Tsushima-shi, Nagasaki Pref., Japan, 16.VII.2012, T. Suguro leg.

**Etymology.** Specific name is dedicated to the collector of the type specimens.

**Diagnosis.** This species is distinguished from **Pennalithus pennatus** and **P. splendidus** by the following characters: in the female genitalia of this species, the copulatory openings are situated laterally, the copulatory ducts are massive, and a pair of blind ducts protruding anteriorly is rather short (Fig. 4 E–F), while in the latter two congeners, the copulatory openings are situated medially, the copulatory ducts are thin, and a pair of blind ducts is long (Fig. 4 A–D). This species is separated from **P. palgongensis** by its short blind ducts in the female genitalia (Fig. 4 F) instead of rather long in the latter species (Seo 1988, fig. 30).

**Description (female).** Measurements based on holotype. Body length 3.00. Carapace length 1.20; width 0.96. Abdomen length 1.80; width 1.06. Eye sizes: AME 0.08; ALE 0.10; PME 0.07; PLE 0.08. Distances between eyes: AME-AME 0.03; AME-ALE 0.01; PME-PME 0.05; PME-PLE 0.04; ALE-PLE 0.05. MOA anterior width 0.19; posterior width 0.19; length 0.22. Clypeus height 0.09. Lengths of legs as in Table 1.

**Variation.** Paratype. Body length 3.25; carapace length 1.25, width 0.98; abdomen length 2.00, width 1.24.

**Description (male).** Measurements based on holotype. Body length 3.47–3.67, ♀ 4.80–5.10. Numbers of spines on legs: ♀: Femur I d 2, pl 2, 3 or 4; femur II d 1 or 2; femora III–IV d 1; tibia I pv 7 or 8, rv 8; tibia II pv 7, rv 6 or 7; metatarsus I pv 5, rv 4 or 5; metatarsus II pv 5, rv 3. ♀: Femur I d 2, pl 3 or 4; femur II d 1 or 2; femora III–IV d 1; tibia I pv 8, rv 8 or 9; tibia II pv 7 or 8, rv 8; metatarsus I pv 4 or 5, rv 5; metatarsus II pv 4 or 5, rv 4.

Abdomen dark reddish brown with white markings on dorsum (Fig. 6 D–E). Male palp (Fig. 3 H–K): Embolus small and directed retrolaterally, conductor sclerotized and angular, tegular apophysis short, retrolateral tibial apophysis sinuous, femur with setose expansion on ventroapical part and longitudinal ridge retroventrally. Epigyne with copulatory openings situated anteromedially (Fig. 4 C); female internal genitalia with a pair of long blind ducts protruding anteriorly (Fig. 4 D).

**Distribution.** China (Yakushima Is.), Korea.

**Remarks.** This species was recorded from China as **Phrurolithus pennatus** due to a misidentification (Tu & Zhu 1986). Thereafter Song & Zheng (1992) described it as a new species. Suguro et al. (2018) reported this species from Japan.
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Fig. 4. A–B, Pennalithus pennatus (Yaginuma 1967) n. comb.; C–D, P. splendidus (Song & Zheng 1992) n. comb.; E–F, P. suguroi n. sp. (holotype). A, C, E, epigyne, ventral view; B, D, F, female internal genitalia, dorsal view. Scale = 0.1 mm.

Fig. 5. A–B, Otacilia komurai (Yaginuma 1952); C–D, O. taiwanica (Hayashi & Yoshida 1993); E–F, O. lynx (Kamura 1994). Abbreviations are the same as those in Fig. 2. Scales = 0.1 mm. A, after Kamura (2005a); C–D, after Kamura (2001); E–F, after Kamura (1994).
part. Body and appendages with sparse iridescent scale-like hairs. Epigyne with copulatory openings situated laterally (Fig. 4 E); female internal genitalia with copulatory ducts massive, short blind ducts protruding anteriorly, and without membranous bursae (Fig. 4 F).

Color (Fig. 6 F). Carapace dark brown, with fringe darker. Chelicerae, endites, labium and sternum yellowish to light reddish brown; sternum with fringe darker. Leg coxae dusky yellow; coxa I darker. Leg I and II: Femora, patellae and tibiae dark brown, femora and patellae with dorsal side lighter, tibiae with distal one third whitish yellow, metatarsi and tarsi yellowish brown. Leg III: Femora, patellae, tibiae and metatarsi dark brown, with dorsal side lighter, tarsi yellowish brown. Leg IV: Femora, patellae, tibiae and meta-

| Leg | Femur | Patella | Tibia | Metatarsus | Tarsus | Total |
|-----|-------|---------|-------|------------|--------|-------|
| I   | 1.06  | 0.42    | 1.06  | 0.97       | 0.64   | 4.15  |
| II  | 0.92  | 0.37    | 0.81  | 0.78       | 0.59   | 3.47  |
| III | 0.80  | 0.35    | 0.62  | 0.73       | 0.51   | 3.01  |
| IV  | 1.22  | 0.42    | 1.07  | 1.20       | 0.70   | 4.61  |

Fig. 6. Habitus of *Pennalithus* species. A, *P. pennatus* (Yaginuma 1967) n. comb., male; B–C, same, female; D, *P. splendidus* (Song & Zheng 1992) n. comb., male; E, same, female; F, *P. suguroi* n. sp., female (holotype). Scales = 1 mm.
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Phrurolithus festivus (C. L. Koch 1835), prodorsal view; B, Otacilia komurai (Yaginuma 1952), dorsal view; C, Pennalithus pennatus (Yaginuma 1967) n. comb., prodorsal view. Scales = 0.5 mm.

Fig. 7. Femora of left legs I and II. A, Phrurolithus festivus (C. L. Koch 1835), prodorsal view; B, Otacilia komurai (Yaginuma 1952), dorsal view; C, Pennalithus pennatus (Yaginuma 1967) n. comb., prodorsal view. Scales = 0.5 mm.

tarsi dark brown, with dorsal side lighter, tibiae with distal one fourth whitish yellow, metatarsi with distal one fourth yellowish brown, tarsi yellowish brown. Abdomen dark brown, with a pair of pale white markings anteriorly, a pair of distinct white markings medially, and pale chevrons and a white marking posteriorly, ventral side, anal tubercle and spinnerets yellowish white to dusky yellow.

Male. Unknown.

Distribution. Known only from Tsushima-shi, Nagasaki Pref., Japan.

Pennalithus palgongensis (Seo 1988) n. comb.

Phrurolithus palgongensis Seo 1988, p. 83. fig. 27–32; Paik 1991, p. 180, figs. 39–46; Danilov 1999, p. 316, fig. 3D; Namkung 2002, p. 419, fig. 33–8 a–c.

Phrurolithus liaoningensis Song, Zhu, Gao & Guan 1994, p. 169, figs. 1–5; Song et al. 1999, p. 411, figs. 239 M–N, 240 M–N.

Otacilia palgongensis: Zamani & Marusik 2020, p. 312.

For complete list of literatures, see World Spider Catalog (2021).

Diagnosis. See the diagnoses of Pennalithus pennatus, P. splendidus and P. suguroi.

Distribution. Korea, China, Russia (Maritime Prov.).

Remarks. The generic placement of this species is based on the following characters shown in the original description: the first femur has three prolateral spines and the female internal genitalia have a pair of blind ducts protruding anteriorly.

Although Namkung (2002) synonymized Phrurolithus liaoningensis Song, Zhu, Gao & Guan 1994 with this species, it seems that there is a difference between the figures of the original descriptions of these two species; that is, judging from the figures, in this species, the copulatory openings seem to face anterolateral direction (see Seo et al. 1994, figs. 2–3). Therefore, it is possible that these two species are distinctive from each other. However, since I did not examine the specimens of these species, I refrain from comment on the validity of P. liaoningensis.

Corealithus n. gen.

[Japanese name: Kireobi-urashimagumo-zoku]

Type species. Phrurolithus coreanus Paik 1991

Etymology. The name is a combination of the first five letters of coreanus (the name of the type species), and the latter half of Phrurolithus. The gender is masculine.

Diagnosis. This genus is distinguished from the other phrurolithid genera by the following characters: the first and second femora lack prolateral spine (Fig. 9 C); the male palp has the retrolateral tibial apophysis furcate (Fig. 8 C–D) and the embolus and conductor contiguous to each other (Fig. 8 E); the female genitalia have the copulatory openings situated anteriorly (Fig. 8 F) and a pair of membranous bursae smaller than that found in Phrurolithus and Otacilia (Fig. 8 G; cf. Figs. 2 B, E; 5 B, D, F).

Description. Anterior and posterior eye rows each almost straight as seen from above; MOA slightly longer than wide, with anterior width as wide as or slightly narrower than posterior; PME separated from each other by less than its size (Fig. 9 A–B). Thoracic groove longitudinal, shallow, indistinct (Figs. 8 A, 9 D–E). Chelicera with one or two spines on anterior side (Figs. 8 A, 9 A–B); promargin of fang furrow with well separated three teeth and retromargin with two teeth close to each other. Femora I–IV with one dorsal spine; femora I–II without prolateral spine (Fig. 9 C); tibiae I–II and metatarsi I–II with many ventral spines; tibiae III–IV and metatarsi III–IV without spine. Leg formula 4–1–2–3. Body and appendages generally dark colored, abdomen with
white markings on dorsum (Figs. 8 A, 9 D–E). Male abdomen with large dorsal scutum covering almost whole abdomen; female abdomen without dorsal scutum. Male palp with embolus long; conductor long, not sclerotized; embolus and conductor contiguous to each other; tegular apophysis short; retrolateral tibial apophysis furcate, consisting of two branches; ventral expansion on femur (Fig. 8 B–E). Epigyne with copulatory openings situated anteriorly; female internal genitalia with spermathecae situated posteriorly, and membranous bursae (Fig. 8 F–G).

Species included. Two species previously assigned to Otacilia: Corealithus coreanus (Paik 1991) n. comb., C. subnigerus (Fu, Chen & Zhang 2016) n. comb.

Corealithus coreanus (Paik 1991) n. comb.
(Figs. 8 A–G, 9 A–E)

Phrurolithus coreanus Paik 1991, p. 174, figs. 1–9; Ikeda 1991, p. 17, figs. 1–8.

Fig. 8. Corealithus coreanus (Paik 1991) n. comb. A, female body, dorsal view; B, left male palp, ventral view; C, same, retrolateral view; D, same, dorsal view; E, same, proventral view; F, epigyne, ventral view; G, female internal genitalia, dorsal view. Abbreviations are the same as those in Fig. 2. Scales = 1 mm (A); 0.1 mm (B–G). A–B, F, after Kamura (2009).

Species included. Two species previously assigned to Otacilia: Corealithus coreanus (Paik 1991) n. comb., C. subnigerus (Fu, Chen & Zhang 2016) n. comb.

Corealithus coreanus (Paik 1991) n. comb.
(Figs. 8 A–G, 9 A–E)

Phrurolithus coreanus Paik 1991, p. 174, figs. 1–9; Ikeda 1991, p. 17, figs. 1–8.

Specimens examined (TK means T. Kamura). RUSSIA: 1♀, Shumshu Is., Kuril Isls, 50°45′59″N 156°14′23″E, 9.VIII.1997, H. Tanaka leg. JAPAN: AKITA Pref.: 1♂, Kimimachi-zaka, Futatsui-machi, Kita-akita-gun (currently Noshiro-shi), 28.VI.1995, Y. Shirota leg. SHIGA Pref.: 3♀, Kamitanakami-Kiryu-cho, Otutsu-shi, 8.VI.1997, TK leg. KYOTO Pref.: 2♂2♀, Ashiu, Miyama-cho, Kita-kuwata-gun (currently Nantan-shi), 25 & 26.V.1985, TK leg.; 1♂♀, Yawata-Takabou, Yawata-shi, 2.VI.2002, TK leg.; 6♂10♀, Ōtani, Matsugasaki, Sakyo-ku, Kyoto-shi, 35°03′30″N 135°46′20″E, 75–85 m alt., 5–18.V.1982 (by pitfall traps, 5♂), 25.V–9.VI.1982 (by pitfall traps, 1♂1♀), 9–16.VI.1982 (by pitfall traps, 1♀), 16–28.VI.1982 (by pitfall traps, 2♀), 28.VI.1982 & 5.VII.1982 (3♀), 16–23.VIII.1982 (by pitfall traps, 3♀), TK leg.; 3♂, marsh of Midorogaike, Hazamacho, Kamigamo, Kita-ku, Kyoto-shi, 35°03′30″N 135°46′15″E,
Three new genera of Phrurolithidae

Labialithus n. gen.

[Japanese name: Usuuro-urashimagumo-zoku]

Type species. Phrurolithus labialis Paik 1991

Etymology. The name is a combination of the first five letters of labialis (the name of the type species), and the latter half of Phrurolithus. The gender is masculine.

Diagnosis. This genus can easily be distinguished from most phrurolithid genera by having ventral spines on the tibiae and metatarsi of the posterior legs (Fig. 9 H); and is also separated from Phrurotimpus and Phrurolinillus, in which the third and fourth metatarsi lack ventral spines although at least the fourth tibia has one or one pair of ventral spines, by the presence of ventral spines on the posterior metatarsi. Drassinella is the only phrurolithid genus that is similar to Labialithus in having ventral spines on both the tibiae and metatarsi of the posterior legs, but Labialithus is distinguished from the former by lacking lateral spines on the posterior legs instead of having spines on the pro- and retrolateral sides of the tibiae and metatarsi of the posterior legs in the former (Platnick & Ubick 1989).

Description. Anterior eye row almost straight or slightly recurved, posterior eye row slightly procurred as seen from above; MOA with length as long as or slightly shorter than width, anterior width slightly narrower than posterior width; PME separated from each other by about its size or less (Fig. 9 F). Thoracic groove indistinct (Figs. 9 I–J, 10 A). Chelicera with one spine on anterior side in male (Fig. 9 A), two spines in female (Fig. 9 B). Abdomen dark brown with white markings on dorsum (Figs. 8 A, 9 D–E). Male palp (Fig. 8 B–E): Embolus and conductor large, contiguous to each other; tegular apophysis rounded; retrolateral tibial apophysis furcate, consisting of two long branches; femur with setose ventral expansion having small retrolateral tubercle. Epigyne (Fig. 8 F): Copulatory openings anterior situated with recurved ridge. Female internal genitalia (Fig. 8 G): Spermathecae situated posteriorly, copulatory ducts rather thin, membranous bursae situated anteriorly.

Distribution. Korea, Japan, Russia (Kuril Isls.).

Remarks. This species was originally described from Korea using only female specimens by Paik (1991). Ikeda (1991) recorded this species from Japan and described the male. In addition, this species was also collected from Kuril Isls., Russia.

Corealithus subnigerus (Fu, Chen & Zhang 2016) n. comb.

Phrurolithus subnigerus Fu, Chen & Zhang 2016, p. 287, figs. 13 A–G, 14 A–E.

Otaclilia subnigera: Zamani et al. 2020, p. 312.

Diagnosis. See the diagnosis of C. coreanus.

Distribution. China.

Remarks. The generic placement of this species is based on the correspondence between the characters shown in the original description of this species and those mentioned in the diagnosis of the genus.

Labialithus labialis (Paik 1991) n. comb.

(Figs. 9 F–J, 10 A–F)

Phrurolithus labialis Paik 1991, p. 177, figs. 17–28; Seo 2000, p. 177, fig. 1–4; Kamura 2001, p. 56, figs. 21–23; Kamura 2005b, p. 93, figs. 1–2.

For complete list of literatures, see World Spider Catalog (2021).

Specimens examined (all specimens were collected from Japan). 1♀, Kunitachi-shi (riverside of Tama-gawa River),
Tokyo, 24.III.2006, S. Hatsushiba leg. 1♀, Kami-echi, Atsugi-shi, Kanagawa Pref., 13.IV.1995, M. Ban leg. (National Museum of Nature and Science, Tsukuba, NSMT-Ar 4842). 1♀, Maioka, Totsuka-ku, Yokohama-shi, Kanagawa Pref., 9.V.1990, K. Kumada leg. 1♂1♀, Asahi, Matsumoto-shi, Nagano Pref., 3.V.2007, T. Komatsu leg. 1♀, Port Yokkaichi, Okayama-shi, Okayama Pref., 20.VIII.1993, K. Nojima leg. 1♀, Okushi, Osaki-cho, Toyota-gun, Hiroshima Pref., 6.V.1993, Y. Ihara leg.

**Diagnosis.** The female of this species is very similar to that of *Labialithus lindemanni*, but is separated from the latter by the following points: in this species, the copulatory openings have a distinct anterior margin (Fig. 10 D–E), while in *L. lindemanni*, the copulatory openings lack a distinct margin (Marusik et al. 2020, fig. 7 A); in this species, ducts connecting the copulatory openings and anterior situated membranous bursae are longer (Fig. 10 F) than those of *L. lindemanni* (see Marusik et al. 2020, fig. 7 D–F).

**Description.** Body length ♂ 2.30–2.78 ♀ 2.30–2.98. Numbers of spines on legs: ♂: Femur I pl 1; tibia I pv 4, rv 4; tibia II pv 4, rv 3 or 4; tibia III pv 0 or 1, rv 0 or 1 [ventral side: none, 1pv, or 1rv]; tibia IV pv 1 or 2, rv 2 [ventral side, proximal-medial: 1rv-2 or 2-2]; metatarsus I pv 4, rv 3 or 4; metatarsus II pv 4, rv 3; metatarsus III pv 2, rv 2; metatarsus IV pv 2 or 3, rv 2. ♀: Femur I pl 1; tibia I pv 4 (rarely 3), rv 4; tibia II pv 4, rv 3 or 4; tibia III pv 0 or 1, rv 0 or 1 [ventral side:
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none, 1pv, or 1rv]; tibia IV pv 0, 1 or 2, rv 1 or 2 [ventral side, proximal-medial: 1rv-1pv, 1rv-1rv, 1rv-2, or 2-2]; metatarsus I pv 4 (rarely 3), rv 3 (rarely 4); metatarsus II pv 4, rv 3 (rarely 2); metatarsus III pv 2, rv 2; metatarsus IV pv 2, rv 2.

Cephalothorax and appendages yellowish to light reddish brown, abdomen dusky yellow to grayish brown with pale chevrons on dorsoposterior part, male abdomen with dorsal scutum yellowish to light reddish brown (Figs. 9 I–J, 10 A). Male palp with embolus situated prolaterally, conductor membranous, tegular apophysis situated retrolaterally, retrolateral tibial apophysis distinct, and setose ventral expansion on femur (Fig. 10 B–C). Epigyne with copulatory openings situated medially (Fig. 10 D), copulatory openings often with mating plugs (Fig. 10 E); female internal genitalia with spermathecae situated posterolaterally, membranous bursae situated anteriorly, copulatory opening and membranous bursa connected by duct with small lateral branch (Fig. 10 F).

Distribution. Korea, Japan.

Remarks. The female of this species was described by Paik (1991) and Kamura (2001), the male was described by Seo (2000) and Kamura (2005b). Although Kamura (2005b) stated that the male was described for the first time in the paper, it was a mistake due to overlooking the previous work by Seo (2000) in which the male was described.

Labialithus lindemanni (Marusik, Omelko & Koponen 2020) n. comb.

Phrurolithus lindemanni Marusik, Omelko & Koponen 2020, p. 255, figs. 6 A–G, 7 A–F.

Diagnosis. See the diagnosis of L. labialis.

Distribution. Russia (Maritime Prov.).

Remarks. According to the original description, in this species, the tibiae and metatarsi of the posterior legs have ventral spines, and the conformation of the female genitalia is rather similar to that of the type species (Marusik et al. 2020, fig. 7 A–F). On the basis of these characters, this species is transferred to Labialithus.
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