Lasioglossum (Acanthalictus) dybowskii (Hymenoptera, Halictidae) newly recorded from South Korea, with a checklist of the genus Lasioglossum in Korean Peninsula

Ryuki Murao¹, Heung-Sik Lee², Osamu Tadauchi¹

¹ Department of Biological Sciences, Faculty of Sciences, Kyushu University, Fukuoka, 812–8581 Japan ² Animal and Plant Quarantine Agency, 8 Jungang daero 30–gil, Junggu, Busan Metropolitan City, Korea 600–016

Corresponding author: Ryuki Murao (r.murao@mbr.nifty.com; murao.ryuki.969@m.kyushu-u.ac.jp)

Abstract
Lasioglossum (Acanthalictus) dybowskii is recorded from South Korea for the first time. The species is redescribed, and drawings and photographs of taxonomically important characters are added. Bionomical data such as flight and flower records and habitat are reported. A checklist of the genus Lasioglossum in the Korean Peninsula is presented.

Keywords
Hymenoptera, Halictidae, Lasioglossum, Acanthalictus, Korean Peninsula, checklist

Introduction
The halictine bee subgenus Acanthalictus Cockerell of the genus Lasioglossum Curtis (Halictidae, Halictinae) is a monotypic group and is known only from the Far East Asia (Michener 2007). It is also placed in the Hemihalictus series (weak-veined Lasioglossum) because of the weak second submarginal vein of the female fore wing. According to recent phylogenetic analyses based on molecular data, this informal group is monophyletic (Danforth et al. 2003; Gibbs et al. 2012). However, the systematics
in *Hemihalictus* series are not clear, due to lack of adequate study on the phylogenetic relationships and definition of each included subgenus.

First author, Murao, had the opportunity to examine specimens of *Acanthalictus* collected in Eastern Asia. In the course of his examination, he found *L. dybowskii* from South Korea, never before recorded from that area. In this paper, we report the new locality data of *L. dybowskii* in the Korean Peninsula, provide a redescription and some bionomical notes for the future reconstruction of systematic and phylogenetic analysis. We also give a checklist of Korean *Lasioglossum* that will be useful in promoting the study of Korean halictine bee fauna.

**Material and methods**

This study is based on the specimens deposited in the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka, Japan (ELKU), the late Dr. Shoichi F. Sakagami’s collection deposited in the Museum of Nature and Human Activities, Hyogo, Japan (MNHAH), the Plant Quarantine Technology Center, Suwon, South Korea (QIA), and the first author’s private collection (without abbreviation). Terminology used in the description follows Murao and Tadauchi (2007), partly Sakagami and Tadauchi (1995), and Gibbs (2010). Abbreviations used in the text are as follows: BL = body length; WL = wing length; HL = head length; HW = head width; IOD = interocellar distance; OOD = ocellocular distance; OCD = ocellocipital distance; UOD = upper interorbital distance; MOD = maximum interorbital distance; LOD = lower interorbital distance; IAD = interantennal distance; AOD = antennocular distance; CAL = clypealveolar distance; CPL = clypeal length; EL = eye length; EW = eye width; GW = genal width; SPL = scape length; Fn = nth antennal flagellomere; FnL = length of nth flagellomere; FnW = width of nth flagellomere; MsW = mesosomal width; SCL = mesoscutellar length; MNL = metanotal length; MPL = metapostnotal length; MtW = metasomal width; Tn = nth metasomal tergum; Sn = nth metasomal sternum; IS = interspace between punctures (e.g., IS 0.5d means ½ of the diameter of a puncture); PP = punctures. Body measurements are given in ranges followed by the average and standard deviation.

**Taxonomy**

**The subgenus *Acanthalictus* Cockerell, 1924**

*Acanthalictus* Cockerell, 1924: 184. Type species: *Halictus dybowskii* Radoszkowski, 1876, by original designation.


**Diagnosis.** This subgenus is characterized in having the following features: 1) lower margin of clypeus reflected forward (Fig. 5); 2) female mandible with two apical teeth (Fig. 6); 3) basal elevation of male labrum high swelled, with longitudinal furrow
(Fig. 8); 4) male S2 gently swelled on apical part (Fig. 15); and 5) male S6 expanded apically as in Fig. 20 (Michener 2007; Pesenko 2007a). In this study, we noticed an additional apparently unique character, namely the female labrum lacking basal elevation (Fig. 7). The comparative morphological study of labrum has not been performed yet in the genus *Lasioglossum*, but this character state may be an autoapomorphy.

*Lasioglossum* (Acanthalictus) *dybowskii* (Radoszkowski, 1876)

http://species-id.net/wiki/Lasioglossum_dybowskii

Figs 1–17, 19–25

*Halictus dybowskii* Radoszkowski, 1876: 110 [Lectotype: Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, Krakow, Poland; ♀, Amur (Khabarovsk Terr., Russia designated by Pesenko 2007b: 107),; Cockerell 1924: 582].


*Evylaeus* (Acanthalictus) *dybowskii*: Pesenko 2007b: 91 [in key], 107 [lectotype designated].


Distribution. Russian Far East, northeastern China, Korean Peninsula (north, south= new record).


Flight period. Female: April to September. Male: July to September.

Habitat in South Korea. One of the collecting sites (Mt. Gariwangsan) for this species is shown in Fig. 18. This site is mountain covered by both broad-leaved and coniferous forests. This species was collected on the flower of *Angelica anomala* (Fig. 17) at the forest edge.

**Figures 1–6.** *Lasioglossum (Acanthalictus) dybowskii* (Radoszkowski). 1–2 lateral habitus 3–4 head in frontal view 5 clypeus in lateral view 6 teeth of mandible. 1, 3, 6 female; 2, 4, 5 male.
Redescription. Female. Coloration. Body black except for the following parts: flagellum dark brown or brown ventrally; tegula blackish brown, translucent; tibial spur yellow; wings transparent and dim, veins and stigma brown or blackish brown.


Measurements (n = 5): BL = 13.14–15.86 (14.06±1.09), WL = 11.43–13.00 (12.29±0.74); HL = 3.25–3.50 (3.32±0.12), HW = 3.80–4.40 (4.03±0.24), IOD = 0.48–0.55 (0.52±0.03), OOD = 0.80–1.00 (0.88±0.08), OCD = 1.15–1.40 (1.25±0.01), UOD = 2.55–2.90 (2.66±0.16), MOD = 2.90–3.35 (3.04±0.19), LOD = 2.93–3.38 (3.08±0.18), IAD = 0.40–0.55 (0.47±0.06), AOD = 0.95–1.15 (1.01±0.08), CAL = 0.42–0.48 (0.46±0.03), CPL = 0.61–0.66 (0.64±0.02), EL = 2.00–2.25 (2.09±0.10), EW = 0.75–0.85 (0.79±0.04), GW = 1.20–1.48 (1.28±0.12), SPL = 1.48–1.77 (1.60±0.11), F1L = 0.23 (0.23±0.00), F2L = 0.23 (0.23±0.00), F3L = 0.23 (0.23±0.00), F2W = 0.23–0.26 (0.23±0.01); MsW = 3.55–3.80 (3.71±0.12), SCL = 0.43–0.48 (0.45±0.02), MNL = 0.23–0.28 (0.25±0.02), MPL = 0.25–0.28 (0.26±0.01); MtW = 4.20–4.75 (4.44±0.22).

Structure and sculpture. Head wider than long; HW:HL = 1:0.82. Vertex flat in frontal view. MOD:UOD:LOD = 1:0.88:1.01. IOD:OOD:OCD = 1:1.69:2.40. IAD:AOD = 1:2.15. PP between ocellocular area and vertex moderately dense, IS smooth (IS = 1–3d). Paraocular area with moderately dense PP, IS smooth; PP on lower paraocular area sparser than on upper ones (IS = 1–1.5d in upper, = 1–3d in lower areas). Frons with dense PP, IS smooth (IS = 0.5–1.5d). Supraclepeus slightly convex, with PP becoming gradually sparse lower part, IS smooth. CPl:CAL = 1:0.72. Clypeus flat and inclined, with sparse PP, IS smooth (IS = 1.5–5d). EW:GW = 1:1.61. Genal area with moderately dense PP, IS smooth (IS = 1–3d). Malar space linear. Occiput not carinate. Postgena slanting, with sparse PP and weak tessellation. Hypostomal carinae nearly parallel. Mandible long, approximately 1.3 × as long as EL. Labrum (Fig. 7): basal area approximately 2 × wider than long; distal process approximately 1.4 × as long as basal area, triangular, and without lateral projection; distal keel narrow, pointed apically. Antenna short, not reaching metasoma. F1–F3L:F2W = 1:1.00:1.00:1.03.

Dorsolateral angle of pronotum obtuse; lateral surface with oblique ridges on anterior half (Fig. 9); lateral ridge absent; lateral lobe rounded. Mesoscutum (Fig. 10) with dense PP, but PP on disc sparser than laterally (IS = 1–2d on disc, = 0.5–1d in the remainder); mesoscutum anteriorly shallowly depressed along middle parapsidal line; parapsidal line a narrow groove. Mesoscutellum similarly sculptured as mesoscutum. Metanotum rugulose. Mesepisternum (Fig. 11) reticulate-rugulae over entire surface. SCL:MNL:MPL = 1:0.56:0.59. Propodeum: metapostnotum (Fig. 12) with
longitudinal ridges that do not attain posterior margin, posteriorly weakly rugulose, posterior margin not carinate; dorsolateral slope with oblique ridges; lateral and posterior surfaces rugulose; posterior surface with lateral carinae on lower half, without oblique carina. Coxae of usual shape, without tubercle. Fore trochanter narrow, longer than wide. Basitibial plate of hind leg carinate marginally. Inner hind tibial spur serrate (Fig. 19). Fore wing with three submarginal cell.

Figures 7–12. Lasioglossum (Acanthalictus) dybowskii (Radoszkowski). 7–8 labrum 9 lateral surface of pronotum 10 mesoscutum 11 mesepisternum 12 metapostnotum. 7, 9–12 female; 8 male.
Lasioglossum (Acanthalictus) dybowskii (Hymenoptera, Halictidae) newly recorded...

T1–T3 as in Fig. 13: disc of T1 medially with sparse fine PP, apically with moderately dense fine PP, and without lineolation over entire surface; discs of T2–T3 basally with sparse fine PP, the remaining parts sculptured similarly to T1. Disc of T4 with

Figures 13–18. Lasioglossum (Acanthalictus) dybowskii (Radoszkowski). 13–14 1st to 3rd metasomal terga 15 2nd metasomal sterna in lateral view (arrow indicate) 16 setae on metasomal sterna 17 female on the flower of Angelica anomala 18 collecting site at Mt. Gariwangsan, South Korea. 13, 17 female; 14–16 male.
moderately dense PP and very weak tessellation over entire surface. Metasomal sterna not modified.

**Male. Coloration.** Body black except the following parts: clypeus slightly dark yellow on lower half; flagellum dark brown ventrally; pronotum anteriorly yellowish brown; tegula blackish brown, translucent; fore tibia reddish brown on outer surface; tibial spur yellow; wings transparent, veins and stigma pale brown.

**Pubescence.** Body setae whitish to pale yellowish. Head with sparse erect setae except for lower paraocular area that is covered with thin tomentum. Mesosoma with sparse elect fine branched setae, and pronotum with thin tomentum marginally. T1 basally with sparse erect setae. T2–T3 basolateral with thin whitish appressed setae. S2–S5 as in Fig. 16: S2 apicolaterally with sparse semi-erect fine branched setae; S3–S5 laterally with erect fine branched seta tufts; setae on S5 longer than on other sterna.

**Measurements** (n = 1, unit mm): BL = 17.14, WL = 13.14; HL = 3.70, HW = 3.75, IOD = 0.55, OOD = 0.85, OCD = 1.30, UOD = 2.50, MOD = 2.70, LOD = 2.25, IAD = 0.5, AOD = 0.7. CAL = 0.40, CPL = 0.94, EL = 2.40, EW = 0.85, GW = 1.25, SPL = 0.81, F1L = 0.26, F2L = 0.42, F3L = 0.42, F2W = 0.26; MsW = 3.70, SCL = 0.80, MNL = 0.50, MPL = 0.63; MrW = 3.85.

**Structure and sculpture.** Head as long as wide; HW:HL = 1:0.99. Vertex flat in frontal view. MOD:UOD:LOD = 1:0.93:0.83. IOD:OOD:OCD = 1:1.55:2.36. IAD:AOD = 1:1.4. PP between ocellocular area and vertex moderately dense, IS smooth (IS = 1–3d). Paraocular area with dense PP, IS smooth; PP on lower paraocular area sparser than on upper one (IS ≤ d in upper part, IS ≤ d or 0.5–2d in lower part). Frons with reticulate PP. Supraclypeus weakly convex with dense PP, IS smooth (IS = 1–1.5d). CPL:CAL = 1:0.43. Clypeus with dense PP, IS smooth (IS = 0.5–1.5d). EW:GW = 1:1.47. Malar space short, 0.19 × as long as mandible at base. Genal area sparsely punctuate, IS = 1–8d. Occiput not carinate. Postgena slanting, with sparse PP and weak tessellation. Hypostomal carinae nearly parallel. Mandible edentate (without subapical tooth) and robust. Labrum without distal process. Antenna short, not reaching metasoma. F1–F3L:F2W = 1:1.63:1.63:1.00, F2L:F2W = 1:0.62; flagellum nearly flattened ventrally.

Dorsolateral angle of pronotum obtuse; lateral surface with oblique ridges on anterior half; lateral ridge absent; lateral lobe rounded. Tegula ovoid, with shallow and moderately dense PP (IS = 1–2d) on anterior half. Mesocutum and mesoscutellum with dense PP over entire surface, IS smooth (IS = 1–1.5d); mesoscutum anteriorly deeply depressed along middle parapsidal line; parapsidal line a narrow groove. Metanotum and mesepisternum reticulate-rugulose over entire surface. SCL:MNL:MPL = 1:0.63:0.78. Propodeum: metapostnotum with irregular sinuate ridges that not attain posterior margin, posteriorly weakly rugulose, posterior margin not carinate; dorso-lateral slope and lateral surface reticulate-rugulose; posterior surface with lateral carinae on lower half, without oblique carina, and with many oblique ridges over entire surface. Fore trochanter rounded and narrow, longer than wide. Hind tibia without basitibial plate. Hind basitarsus slender, approximately 6 × as long as wide. Inner hind tibial spur finely serrate. Fore wing with three submarginal cell.
Figures 19–25. Lasioglossum (Acanthalictus) dybowskii (Radoszkowski). 19 inner hind tibial spur 20 6th metasomal sternum 21 7–8th metasomal sterna 22 genitalia in ventral view 23 genitalia in dorsal view 24 genitalia in lateral view 25 ventral retrorse lobe of genitalia, 19 female; 20–25 male. Scale bars: 19, 25 = 0.25 mm; 20–24 = 0.5 mm.

T1–T4 (Fig. 14 in T1–T3): disc of T1 medially and apically with fine PP that become gradually denser toward apical part, without lineolation; T2–T4 similarly punctuate as T1 nearly over entire surface, IS smooth. S7–S8 (Fig. 21): S7 with short and triangular median process; median process of S8 triangular, with sparse simple setae.

Genitalia (Figs 22–25): gonobase flat at the bottom, ventral arms not connected with each other at upper ends; gonocoxite smooth, and inner dorsal margin angulate at the approximately basal one-third; gonostylus located at ventral side of gonocoxite, and with sparse short setae; ventral retrorse lobe slender, not reaching gonobase, rounded apically, and with dense short setae.
A checklist of the genus *Lasioglossum* in Korean Peninsula

Forty species of *Lasioglossum* in total have been recorded from the Korean Peninsula by various researchers (Ebmer 1978b, 1995, 1996, 2006; Ebmer et al. 2006; Lee et al. 1999; Murao 2011; Murao and Tadauchi 2007, 2008, 2011; Pesenko 2006, 2007b). *Lasioglossum problematicum* (Blüthgen) known from Far East Asia is also recorded from North Korea by Ebmer (1978b) based on female specimens. After that, Pesenko (2007b) regarded the continental records of *L. problematicum* as *L. virideglaucum* Ebmer and Sakagami. Females of *L. problematicum* and *L. virideglaucum* cannot be distinguished from each other (Ebmer 2006; Murao et al. 2006), and the distribution of these species should be verified based on male specimens or a DNA analysis. In the following list, *Lasioglossum nipponicola* Sakagami and Tadauchi, *L. gorkiense* (Blüthgen), and *L. koreanum* Ebmer are synonymized by Pesenko (2006) as follows: *L. nipponicola* = *L. agelastum* Fan & Ebmer, *L. gorkiense* = *L. scitulum* (Smith), and *L. koreanum* = *L. occidens* (Smith). However, these synonymies need to be revised in a future study.

**Lasioglossum series** (strong-veined *Lasioglossum*)

5. *Lasioglossum kansuense* (Blüthgen, 1934): North Korea (Ebmer 1978b)
7. *Lasioglossum nipponicola* Sakagami & Tadauchi, 1995: South Korea (Lee et al. 1999; Ebmer 2006)
8. *Lasioglossum primavera* Sakagami & Maeta, 1990: South Korea (Murao and Tadauchi 2011)
10. *Lasioglossum subopacum subopacum* (Smith, 1853): South Korea (Murao 2011)

**Hemihalictus series** (weak-veined *Lasioglossum*)

13. *Lasioglossum affine* (Smith, 1853): North and South Korea (Ebmer 1978b; Murao and Tadauchi 2007; Pesenko 2007b)
15. *Lasioglossum apristum* (Vachal, 1903): North and South Korea (Ebmer 1978b, 1995; Murao and Tadauchi 2007)
16. *Lasioglossum baleicum* (Cockerell, 1937): North and South Korea (Ebmer 1978b, 2006; Murao and Tadauchi 2007)
17. *Lasioglossum calceatum* (Scopoli, 1763): North Korea (Ebmer 1978b)
18. *Lasioglossum duplex* (Dalla Torre, 1896): South Korea (Murao and Tadauchi 2007)
19. *Lasioglossum dybowskii* (Radoszkowski, 1876): North and South Korea (Ebmer 1996; present study)
22. *Lasioglossum hoffmanni* (Strand, 1915): North and South Korea (Ebmer 1978b, 1995, as *L. vulsum*; Murao and Tadauchi 2007)
23. *Lasioglossum kankauchare* (Strand, 1914): North Korea (Ebmer 1978b)
25. *Lasioglossum nipponense* (Hirashima, 1953): South Korea (Ebmer 2006; Murao and Tadauchi 2007)
27. *Lasioglossum percrassiceps* (Cockerell, 1931): South Korea (Murao and Tadauchi 2007)
29. *Lasioglossum rufitarse* (Zetterstedt, 1838): North Korea (Ebmer 1978b)
31. *Lasioglossum sibiriacum* (Blüthgen, 1923): North and South Korea (Ebmer 1978b, 1995; Murao and Tadauchi 2007)
32. *Lasioglossum simplicior* (Cockerell, 1931): North Korea (Ebmer 1978b)
33. *Lasioglossum speculinum* (Cockerell, 1925): North Korea (Ebmer 1978b)
37. *Lasioglossum transpositum* (Cockerell, 1925): South Korea (Murao and Tadauchi 2008)
38. *Lasioglossum villosulum trichope* (Strand, 1914): North Korea (Ebmer 1978b)

**Acknowledgements**

We express our thanks to Dr. Layne Westover (Kyushu University) for his kindness in brushing up an early draft. Murao expresses his thanks to Dr. Maxim Yu. Proshchalykin (Institute of Biology and Soil Science, Far Eastern Branch of Russian Academy of Sciences, Vladivostok, Russia) for sending a valuable reference. This research was supported in part by the JSPS Institutional Program for Young Researcher Overseas Visits (to Murao), the Environment Research and Technology Development Fund (S-9-2(8)) of the Ministry of the Environment, Japan (to Tadauchi), and the Grant-in-Aid for Scientific Research (B) from the Japan Society for the Promotion of Science (No. 24405016) (Head Investigator: Tadauchi).
References


Murao R (2011) Taxonomic notes on Lasioglossum (Lasioglossum) subopacum (Smith) and L. (L.) okinawa Ebmer et Maeta (Hymenoptera, Halictidae) from Asia. Zookeys 143: 83–92. doi: 10.3897/zookeys.143.2077


Lasioglossum (Acanthalictus) dybowskii (Hymenoptera, Halictidae) newly recorded...


