Bull. Natl. Mus. Nat. Sci., Ser. B, 45(3), pp. 107–118, August 22, 2019

Taxonomic Reappraisal of *Liparis japonica and L. makinoana* (Orchidaceae)

Chie Tsutsumi*, Tomohisa Yukawa and Masahiro Kato

Department of Botany, National Museum of Nature and Science,
4–1–1 Amakubo, Tsukuba, Ibaraki 305–0005, Japan
* E-mail: tsutsumi@kahaku.go.jp

(Received 3 June 2019; accepted 13 July 2019)

Abstract *Liparis japonica* and *L. makinoana* have been nomenclaturally confused for a long time. Based on a recent DNA sequencing and morphological study, these species appear to be composed of three different entities. Here, we treat the three entities as *L. makinoana* emend. and two new species, *L. suzumushi* and *L. longiracemosa*, with neotypification of *L. makinoana. Liparis japonica* should be treated as a synonym of *Malaxis monophyllos*, based on the original description of the former.

Key words: classification, Japan, *Liparis japonica*, *Liparis makinoana*.

Introduction

Liparis Rich. is an orchid genus consisting of over 320 terrestrial and epiphytic species (Pridgeon *et al.*, 2005) and widely distributed in tropical and temperate regions of the world. In Japan, 17 species of *Liparis* are recorded (Yukawa, 2015). *Liparis japonica* (Miq.) Maxim., *L. makinoana* Schltr., and *L. hostifolia* (Koidz.) Koidz. ex Nakai generally form a species complex characterized by ovoid pseudobulbs, two deciduous, ovate-elliptic leaves, absence of a projection at the lip base, and a beaked anther cap (Yukawa, 2015; Takayama *et al.*, in press). The taxonomic treatments of the species complex, particularly of *L. japonica* and *L. makinoana*, as well as the pictures in various publications are confusing (Iinuma and Makino, 1913; Maekawa, 1971; Satomi, 1982; Hashimoto, 1990; Hashimoto *et al.*, 1991).

Tsutsumi and Yukawa (2008) found three entities in Japan, named as *L. japonica* and *L. makinoana* and tentatively named them as Type I, II, and III of the *L. makinoana* complex [Fig. 1. See also Tsutsumi and Yukawa (2008) for the front views of the flowers]. The entities are distinct from each other in their flower size and nucleic acid sequences in the nuclear ribosomal ITS region (Tsutsumi and Yukawa, 2008). A RAD-Seq analysis also suggested the distinct nature of the three entities (unpublished). These results suggest that the three entities should be treated as distinct species. The other species of the *L. makinoana* complex, *L. hostifolia*, from the subtropical Bonin Islands, has several unique characters: a broadly ovate labellum, short dormancy, and flowering time from November to March (Takayama *et al.*, in press). Therefore, we have excluded it from this reappraisal.

Liparis japonica was originally described as *Microstylis japonica* by Miquel (1866), based on a specimen collected in Japan by H. Bürger. Later, it was recombined with *Liparis* by Maximowicz (1886). The type specimen was supposed to have been deposited in the Naturalis (L) in Leiden, the Netherlands, but it has not been found there (Ohba *et al.*, 2005; A. Schuiteman, pers. comm.). *Liparis makinoana* was described by Schlechter (1919). Its type specimen, collected from Hokkaido, Japan, had been deposited

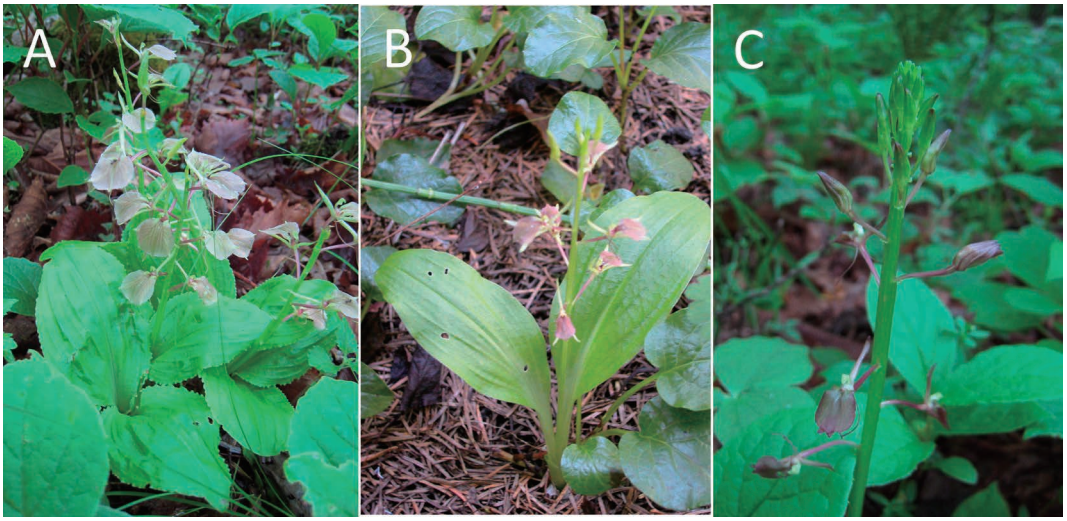

Fig. 1. *Liparis makinoana* complex. A, B: *Liparis suzumushi* (Type I in Tsutsumi and Yukawa, 2008). C, D: *Liparis makinoana* (Type II). E, F: *Liparis longiracemosa* (Type III).

Table 1. Taxonomic treatments of the *Liparis makinoana* complex in previous and present studies.

Previous treatments	Tsutsumi and Yukawa (2008)	Present study
L. makinoana sensu Ohwi (1953, 1984), Satomi (1982), Nakajima (2012)	Type I	*L. suzumushi*
L. makinoana sensu Maekawa (1971)	Types I and II	*L. makinoana* and *L. suzumushi*
L. makinoana sensu Nevski (1935), Lee (2002), Efimov (2010)	not treated	not treated
L. liliifolia sensu Iinuma and Makino (1913), Hashimoto (1990), Inoue (2016)	Type I	*L. suzumushi*
L. japonica sensu Satomi (1982), Nakajima (2012)	Type II	*L. makinoana*
L. japonica sensu Hashimoto (1990), Inoue (2016)	Types II and III	*L. makinoana* and *L. longiracemosa*
L. japonica sensu Iinuma and Makino (1913), Ohwi (1953, 1984), Maekawa (1971)	Type III	*L. longiracemosa*
L. japonica sensu Nevski (1935), Kitagawa (1939), Lee (2002), Vakhrameeva (2008), Efimov (2010)	not treated	not treated

in the herbarium of Botanischer Garten und Botanisches Museum, Berlin-Dahlem (B), Germany, but it is thought to have been destroyed during the World War II (cf. Hiepko, 1987), and no duplicate was located in any herbaria (Yukawa and Ohba, 1995). To clarify the nomenclatural confusions, the protologues of *L. japonica* and *L. makinoana* should be examined carefully, partly because the type specimens are not available.

Few diagnostic characters are given in the protologue of *L. japonica*, but we consider it is identical to *Malaxis monophyllos* (L.) Sw., as noted below. Although Type I of the *L. makinoana* complex is usually treated as the species *L. makinoana*, morphological comparison of the three entities suggests that the protologue of *L. makinoana* does not agree with Type I, but does agree with Type II, which is usually called as *L. japonica* (Table 1). On the contrary, both Type I and Type III have no valid scientific name. We have thoroughly checked descriptions of *Liparis* taxa from Japan and adjacent regions. However, we

did not find any taxa assignable to Types I and III.Therefore we describe them here as new species, *L. suzumushi* and *L. longiracemosa*, respectively.

Key to *Liparis makinoana* complex in Japan

1. Flowering in spring to early summer (May to July); labellum ovate or broadly ovate, slightly revolute, with inconspicuous purple veins
   2. Flowering in May to June; labellum 14–17 mm long, 11–15 mm wide ..... *L. suzumushi* (1)
   2. Flowering in June to July; labellum 8–12 mm long, 5–9 mm wide
      3. Labellum 9–12 mm long, 6–9 mm wide; flowers somewhat sparse on inflorescence ..... *L. makinoana* (2)
      3. Labellum 8–10 mm long, 5–7 mm wide; flowers sparse on inflorescence ... *L. longiracemosa* (3)
1. Flowering in winter to spring (November to March); labellum broadly ovate, strongly recurved, with dark purple veins ..... *L. hostifolia*

Taxonomic treatment

1. *Liparis suzumushi* Tsutsumi, T.Yukawa et M. Kato, sp. nov.

(Fig. 2)

Similar to *L. makinoana* and *L. longiracemosa*, but has different flowering period (May to June), shorter inflorescence (10–25 cm long), and larger labellum (14–17 mm long, 11–15 mm wide).

Type. Japan. Shizuoka: Gotenba, Nakabata, eastern foot of Mt. Fuji, ca. 600 m alt., 8 May 1976, *A. Takahashi & F. Konta 10873* (TNS 01281158).

Liparis makinoana auct. non Schltr.: Ohwi, Fl. Jap.: 379 (1953); Maekawa, Wild Orchids Jap.: 327, pl. 126 (1971) p.p.; Satomi in Satake *et al.*, Wild Flower Jap. Herb. Pl. 1: 219, pl. 197-2 (1982); Nakajima, Ill. Jap. Orchids: 240, pl. 61–12 (2012).

Liparis liliifolia auct. non (L.) A.Rich. ex Lindl.: Iinuma & Makino, Somoku-Dzusetsu, 3rd ed. 4: 1231, pl. 67 (1913); Inoue in Iwatsuki *et al.*, Fl. Jap. 4b: 287 (2016).

Japanese name. Suzumushi-so.

Pseudobulb ovoid, 1–3 cm long. *Leaves* 2, ovate-elliptic, obtuse or subacute, 10–20 cm long, 2–6(–9) cm wide, conduplicate, glossy, glabrous, margin entire or somewhat undulate, green; petiole 3–10 cm long, winged. *Inflorescence* terminal, racemose; scape 10–25 cm long, with 4–16 flowers; axis glabrous, ridged, green. *Bract* ovate, acute, 1–5 mm long, green. *Pedicellate ovary* clavate, twisted, 12–19 mm long, purplish. *Dorsal sepal* linear-lanceolate, subacute, occasionally slightly revolute, erect or somewhat recurved, 13–16 mm long, 3.5–4 mm wide, green to purplish. *Lateral sepals* obliquely ovate or obliquely lanceolate, subacute, somewhat revolute, 13–16 mm long, 3.5–4 mm wide, greenish. *Petals* falcate, linear, obtuse, strongly revolute, pendulous, sometimes slightly twisted, 13–16 mm long, 0.5–1.0 mm wide, purplish. *Labellum* entire or minutely erose, broadly-ovate, clawed, strongly recurved near base, obtuse or truncate, apiculate at apex, 14–17 mm long, 11–15 mm wide, purplish or greenish-purple. *Column* terete, incurved, with rounded wings in distal part, dilated at base, with shallow groove at base on ventral side, 5.5–7 mm long, green, pale green on ventral surface, purple at base; pollinia 4 in 2 pairs, waxy, yellow; anther cap with beaked apex, green.

Distribution. Japan (southern Hokkaido, Honshu, Shikoku), Korea, Russia.

Ecology. Terrestrial, in semi-open deciduous forests or in semi-open secondary conifer forests.

Flowering season. May to June.

Etymology. It is named after an insect species, *Meloimorpha japonica* (“Suzumushi” in Japa-

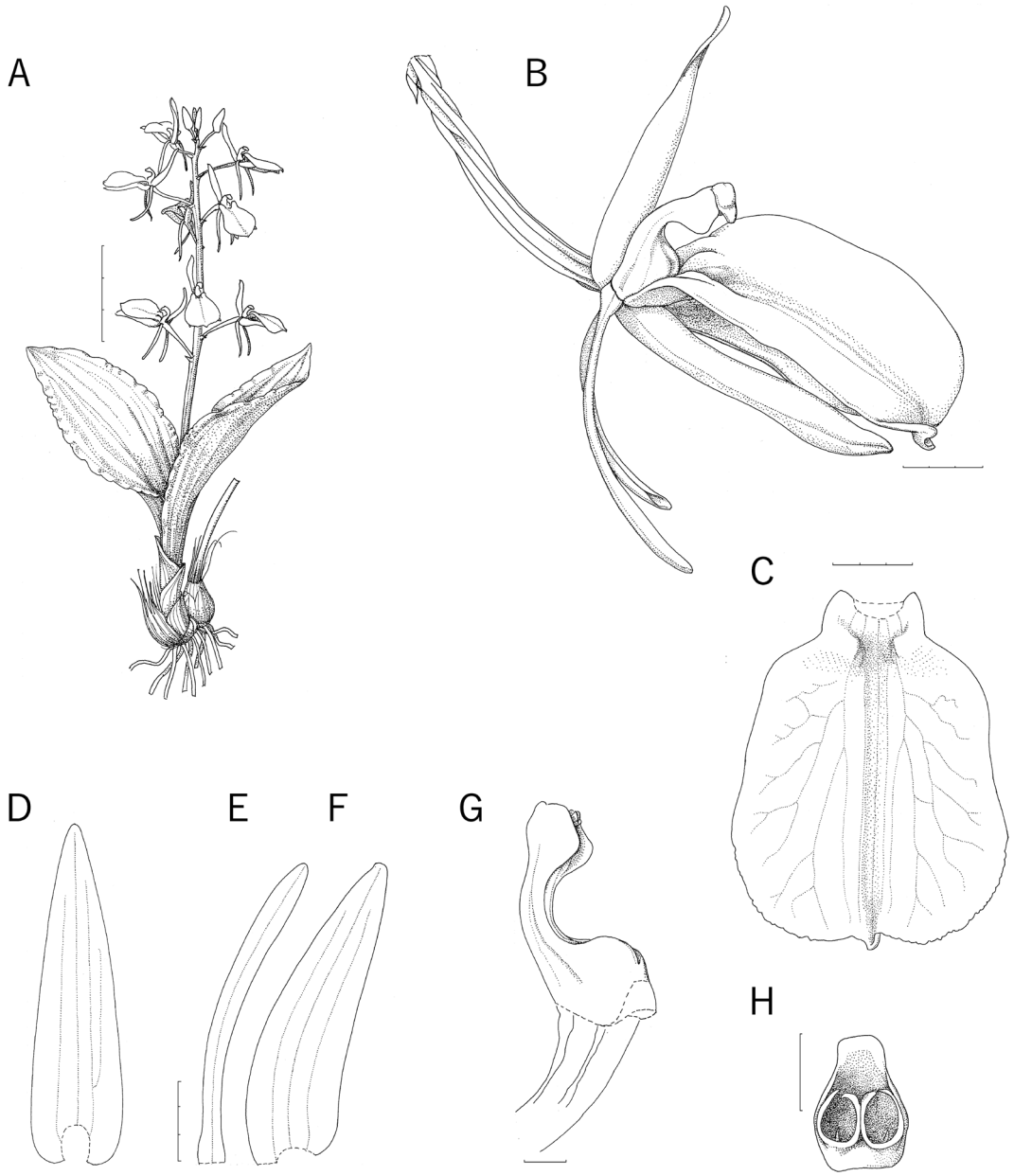

Fig. 2. *Liparis suzumushi* Tsutsumi, T.Yukawa & M.Kato. A: Habit. B: Flower. C: Labellum. D: Dorsal sepal. E: Petal. F: Lateral sepal. G: Column. H: Anther cap. Scale bars = 3 cm (A), 3 mm (B–G), 1 mm (H). Reproduced from illustration of '*L. makinoana*' in Nakajima (2012) with permission.

nese), because the lip of the flower somewhat resembles the wings of male *M. japonica.*

Notes. Liparis suzumushi is named for Type I of the *L. makinoana* complex, which has been wrongly identified as *L. makinoana.* This species is distinct from the other members of the complex in having a different flowering season (May to June *versus* June to July), fewer flowers on a short inflorescence (*versus* more flowers on a long inflorescence), and a larger labellum 14–17 mm long and 11–15 mm wide (*versus* ＜13 mm long and ＜10 mm wide).

This species has sometimes been referred to as *L. liliifolia* (L.) A.Rich. ex Lindl. (Iinuma and Makino, 1913; Hashimoto, 1990; Hashimoto and Kanda, 1991; Inoue, 2016). *Liparis liliifolia* is distributed in North America and is phylogenetically distinct from the *L. makinoana* complex (Tsutsumi *et al.*, 2007; Lee *et al.*, 2010), although they are morphologically similar. Therefore, we treat *L. suzumushi* as a species distinct from *L. liliifolia.*

Plants identified as '*L. makinoana*' also have been recorded from Korea and Russia (Nevski, 1935; Lee, 2002). Since we did not examined the materials from these areas and further analyses are needed to confirm the distribution of this entity.

Other specimens examined: JAPAN. **Hokkaido**. Hidaka: Shizunai-cho, Livestock Farm of Hokkaido Univ., 04-rinpan, 9 June 1998, *H. Takahashi et al.* (SAPS 009837); Shizunai-cho, Livestock Farm of Hokkaido Univ., 02-rinpan, 30 May 2000, *H. Takahashi* (SAPS 009835); Shizunai-gun, Shizunai-cho, Misono, Livestock Farm, Fac. of Agr., Hokkaido Univ., 2-rinpan, 24 May 1995, *H. Takahashi & T. Sato 17817* (SAPS 009838). —Iburi: Kojyohama, 26 May 1951, *S. Kono* (TI); Tomakomai-shi, Experimental Forest of Hokkaido University, 412–421-rinpan, 31 May 1990, *H. Takahashi et al. 10173* (SAPS 009840); Tomakomai, 29 June 1915, *Y. Kudo & T. Yoshimi* (SAPS 005678). —Ishikari: Chitose, 3 June 1975, *S. Kurosawa & Y. Tateishi* (TI). —Oshima: Hakodate, 3 June 1916, *F. C. Greatrex* (SAPS 009846); Kamiiso-gun, Kamiiso-cho, near Kamiiso dam, along small valley, 1 June 1992, *H. Takahashi et al. 11637* (SAPS 009839). —Shiribeshi: 21 April 1931, *K. Tagashi 21758* (SAPS 009842). **Akita**. Kitaakita-gun, Takanosumachi, 10 June 1969, *R. Kumikawa* (TNS 255710); Oga, Honzan, 18 June 1933, *S. Muramatsu* (TI); Ugo, Hachimori, 27 May 1932, *S. Muramatsu* (TI). **Miyagi**. Shiraishi-shi, Hachimoriyama, ca. 450 m alt., 14 May 1978, *T. Sasaki & Y. Yamamoto* (TUS 45989). **Niigata**. Nishikubiki-gun, Ichiburi, 31 May 1960, *collecter unknown* (KYO); Sanjo-shi, 23 May 1943, *Nakamura* (TUS 168196). **Ibaraki**. Kuji-gun, Keganо-mura, 25 May 1935, *H. Tsurumachi* (TUS 179702); Naka-gun, Yamagata-mahi, cliff in Ryujin river, 5 May 1969, *collecter unknown* (TNS 253959); Naka-gun, Yamagata-machi, along Ryujin-gawa River, 26 May 1935, *H. Tsurumachi* (TUS 169489). **Kanagawa**. Around Mt. Tanzawa, Yozukugawa, Nyudodana, 3 May 1956, *H. Kanai* (TI); Hakone, 12 April 1953, *K. Segawa* (TI); Mt. Hakone, 15 May 1925, *S. Muramatsu* (TI); Mt. Hakone (Mt. Kami), 3 June 1953, *J. Haginiwa JH021248* (TNS 971248); Ashigara, *C. Tsutsumi* (TNS 8505372–4). **Shizuoka**. Sunto-gun, Subashiri-mura, 30 May 1931, *K. Segawa* (TI); Suntou-gun, Oyama-cho, Nakajima, 400 m alt., 20 May 1998, *E. Aihara* (TNS 01281159); Gotenba-shi, Yaga, 18 May 1969, *K. Inoue* (TNS 281001). **Ehime**. Nii-gun, Nakahagi-mura, beginning of June 1930, *H. Yamamoto* (KYO). **Kochi**. Kitakawa-mura, 17 May 1888, *K. Watanabe* (TNS 62606); Yuzuhara-mura, en route from Tanono to Onogahara, 800 m alt., 24 May 1959, *G. Murata & T. Shimizu* (KYO).

2. *Liparis makinoana* Schltr.

(Fig. 3)

Liparis makinoana Schltr. in Repert. Spec. Nov. Regni Veg. Beih. 4 [Orch. Sin.-Jap. Prodr.]: 63 & 200 (1919); Maekawa in Wild Orchids Jap.: 327, pl. 126 (1971) p.p.

Neotype designated here. Japan. Hokkaido: near Hakodate (Nodafu in Momijiyama-cho), in mossy, wet place [Japonica, insula Jesso, circa Hakodate, Nodafu, in muscosis udis], Dr. Albrecht, 22 June or 4 July 1861 (LE 01016040), specimen at left bottom (Fig. 4, arrow).

Liparis japonica auct. non (Miq.) Maxim.: Satomi in Satake *et al.*, Wild Flower Jap. Herb. Pl.1: 219, pl. 197-1 (1982); Nakajima, Ill. Jap. Orchids: 234, pl. 61-06 (2012); Inoue in Iwatsuki *et al.*, Fl. Jap. 4b: 286 (2016), p.p.

Japanese name. Seitaka-suzumushi-so.

Pseudobulb ovoid, 1–3 cm long. *Leaves* 2, ovate-elliptic, obtuse or subacute, 7–20 cm long, 2–6 cm wide, conduplicate, glossy, glabrous,

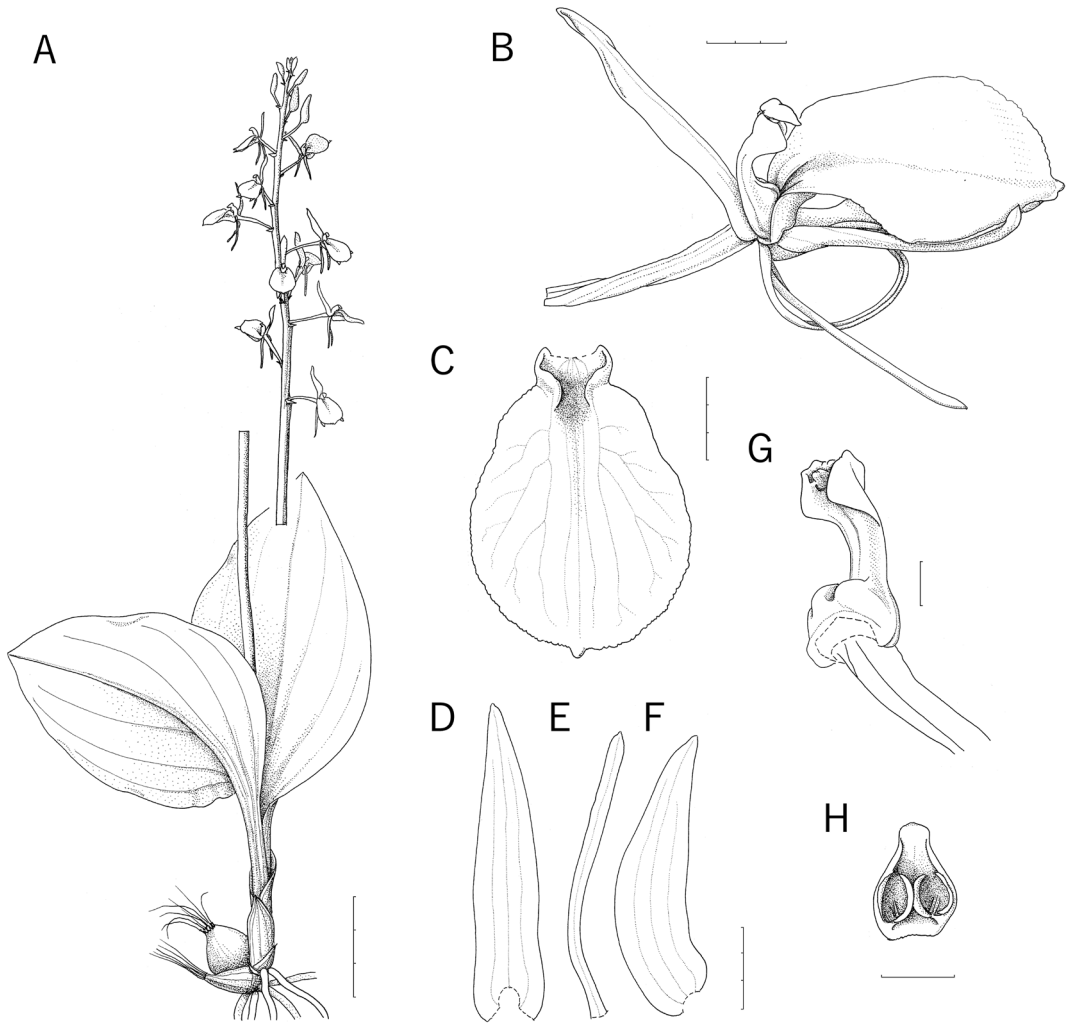

Fig. 3. *Liparis makinoana* Schltr. A: Habit. B: Flower. C: Labellum. D: Dorsal sepal. E: Petal. F: Lateral sepal. G: Column. H: Anther cap. Scale bars = 3 cm (A), 3 mm (B–G) or 1 mm (H). Reproduced from illustration of '*L. japonica*' in Nakajima (2012) with permission.

margin entire or somewhat undulate, green; petiole 3–10 cm long, winged. *Inflorescence* terminal, racemose, 10–35 cm long, with 4–30 flowers; axis glabrous, ridged, green. *Bract* ovate, acute, 1–5 mm long, green. *Pedicellate ovary* clavate, twisted, 8–13 mm long, green to purplish. *Dorsal sepal* linear-lanceolate, subacute, occasionally slightly revolute, erect or somewhat recurved, 9–12 mm long, 2–2.5 mm wide, green. *Lateral sepals* obliquely ovate or obliquely lanceolate, subacute, somewhat revolute, 8–11 mm long, 2–3 mm wide, green. *Petals* falcate, linear, obtuse, strongly revolute, pendulous, sometimes slightly twisted, 9–12 mm long, 0.5–1 mm wide, purplish. *Labellum* entire or minutely erose, ovate, clawed, strongly recurved in basal part, obtuse, apiculate at apex, 9–12 mm long, 6–9 mm wide, purplish or greenish-purple. *Column* terete, incurved, with rounded wings in distal part, dilated at base, with shallow groove at base on ventral side, 4–5 mm long, green, pale green on ventral surface, purplish in basal part; pollinia 4 in 2 pairs, waxy, yellow; anther cap with beaked apex, green.

Fig. 4. Herbarium sheet designated as neotype of *Liparis makinoana* by Efimov (2010), in which plant marked by arrow is here designated as neotype of *Liparis makinoana.*

Distribution. Japan (Hokkaido, Honshu), China, Korea, Russia.

Ecology. Terrestrial, in semi-open secondary conifer forests or in semi-open deciduous forests.

Flowering season. June to July.

Notes. *Liparis makinoana* was described by Schlechter (1919), based on the type specimen (destroyed during World War II) collected in Hokkaido, where *L. suzumushi* and *L. longiracemosa* (see below) also occur. Most of the characters in the protologue were unclear for identification purposes, but the labellum size (1.2 cm long, 8 mm wide) is similar to Type II of the *L. makinoana* complex.

Efimov (2010) designated a herbarium sheet, LE 01016040, collected near Hakodate, Hokkaido, as the neotype. The sheet has plural plants. The plant at the bottom left has flower characters, such as scape length, flower number, and labellum size, similar to those of Type II, and is designated here as neotype of *L. makinoana* according to Art. 9.17 of the current International Code of Nomenclature for algae, fungi, and plants (Turland *et al.*, 2018). The central large plant is *L. koreojaponica* Tsutsumi, T.Yukawa, N.S.Lee, C.S.Lee et M.Kato and the remaining small plants at the right side and the top left are thought to be *L. makinoana* or *L. suzumushi*.

Liparis makinoana in the present concept has been referred to '*L. japonica*' in several previous literature on Japanese flora (Table 1). '*Liparis japonica*' mentioned in some floristic treatments in China, Korea, and Russia (Nevski, 1935; Lee, 2002; Chen *et al.*, 2009, as a synonym of *L. elongata* Fukuy.), along with *L. koreana* (Nakai) Nakai ex W. T. Lee described from the northern part of Korean Peninsula, is also similar to *L. makinoana*, and further analyses are needed to decide their taxonomic treatment.

Other specimens examined: JAPAN. **Hokkaido**. Hidaka: Mt. Apoi, 9 July 1933, *H. Hara* (TI); Mt. Horoman, 11 July 1933, *H. Hara* (TI); Saru-gun, Monbetsu-cho, Satohira, 7 July 1963, *Y. Takahashi* (KYO). —Iburi: Abuta-gun, Touya-mura, Tomioka, 450–620 m alt., 29 June 1991, *Y. Tateishi et al.* (TUS 155386). —Ishikari: Mt. Teine, 5 July 1912, *S. Hayakawa* (TI). —Kamikawa: Tohma-cho, 310 m alt., 9 July 2007, *C. Tsutsumi et al.* (TNS 766277); Kamuikotan, June 1913, *H. Koidzumi* (TNS 416409). —Kushiro: Shitakara-mura, Setsuri, June 1895, *S. Ito* (SAPS 009862); Akan-gun, Tsurui-mura, 30 m alt., 20 July 1997, *K. Takita* (TNS 01091437); Akkeshi, 5 July 1917, *Y. Kudo* (TUS 26552). —Oshima: Hakodate, 7 July 1918, *F. C. Greatrex* (SAPS 009864); Yunokawa, 4 July 1916, *F. C. Greatrex* (SAPS 009855); Yunokawa, near Hakodate, 25 June 1921, *I. Yamamoto* (SAPS 009853); near Kamiiso, 25 July 1915, *F. C. Greatrex* (SAPS 009824). **Iwate**. Kamiihei-gun, Kurihashi-mura, *Y. Kudo* (KYO). **Miyagi**. Kurihara-gun, Tsukidate-cho, date unknown, *collecter unknown* (TNS 01064095). **Gunma**. Sanpei-pass, near Oze, 17 July 1946, *G. Nakai 2717* (KYO). **Tochigi**. Shiohara, Shonoyu, 23 July 1887, *K. Nemoto* (TNS 32642). **Kanagawa**. Mt. Tanzawa, 9 July 1961, *J. Haginiwa JH021249* (TNS 971249); Hakonesagamiguchi, 23 July 1935, *A. Kojima* (TNS 702484). **Yamanashi.** Oshino, 5 July 1980, *J. Satoh* (TI). **Shizuoka**. Mt. Fuji, Subashiriguchi, 6-goume, 4 August 1908, *I. Amamiya* (TNS 16992). **Nagano**. Komoro-machi, Goka, Mt. Morizumi, 31 August 1933, *K. Misaizu* (KYO); Minamisaku-gun, Kawakami-mura, Azusayama, 16 July 1976, *J. Haginiwa JH021250* (TNS 971250).

3. *Liparis longiracemosa* Tsutsumi, T.Yukawa et M.Kato, sp. nov.

(Fig. 5)

Similar to *L. makinoana*, but different in terms of smaller labellum, the wider sepals, and the sparser flowers on the inflorescence.

Liparis japonica (Miq.) Maxim. sensu Maximowicz in Bull. Acad. Imp. Sci. Saint-Pétersbourg 31: 102 (1886), p.p.; Maximowicz in Mel. Biol. 12: 544 (1887), p.p.; Iinuma & Makino, Somoku-Dzusetsu, 3rd ed. 4: 1231, pl. 67 (1913); Ohwi, Fl. Jap.: 379 (1953); Maekawa, Wild Orchids Jap.: 331, pl. 128 (1971); Inoue in Iwatsuki *et al.*, Fl. Jap. 4b: 286 (2016), p.p.

Type: Kitaakita-shi, Anitotorinai, Akita Pref., Japan. 530 m alt., 23 June 2008. *C. Tsutsumi*, *K.*

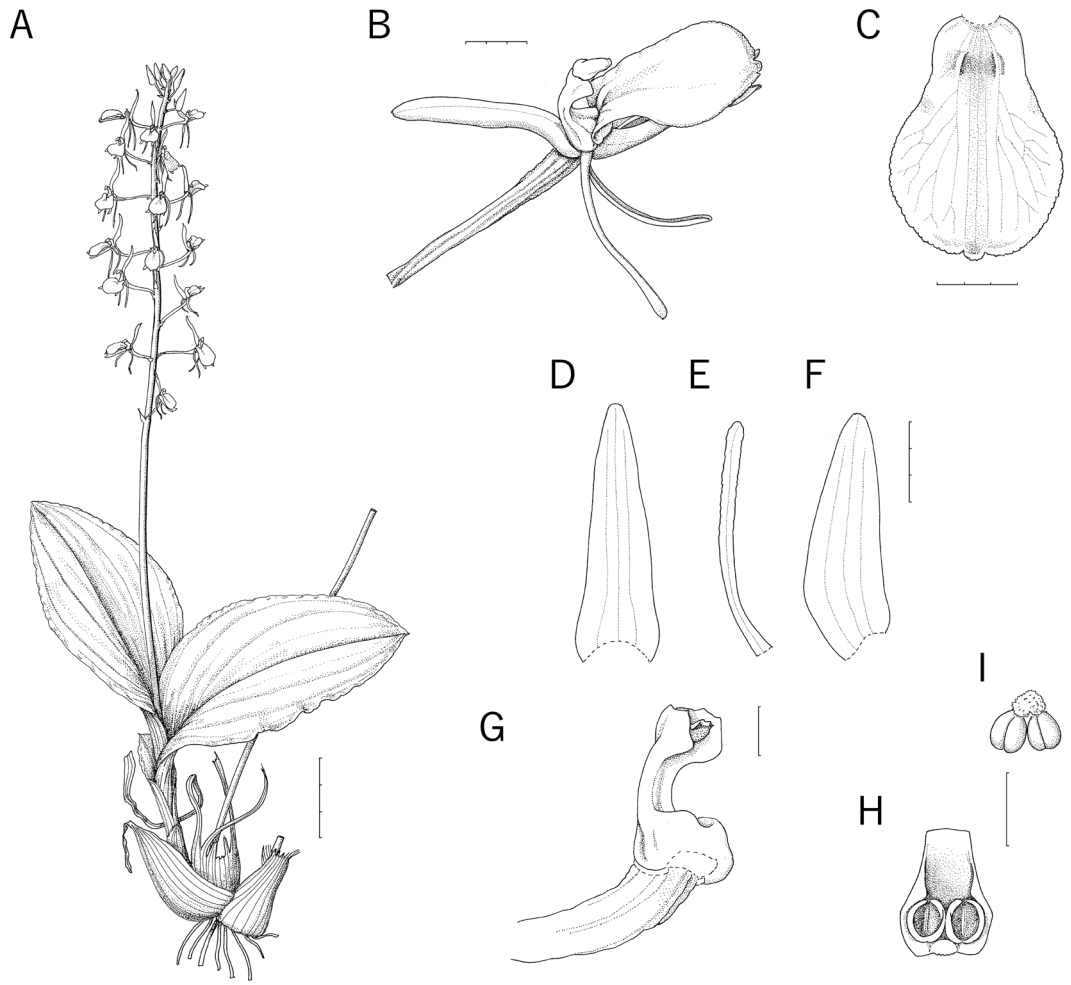

Fig. 5. *Liparis longiracemosa* Tsutsumi, T.Yukawa & M.Kato. A: Habit. B: Flower. C: Labellum. D: Dorsal sepal. E: Petal. F: Lateral sepal. G: Column. H: Anther cap. I: Pollinia. Scale bars = 3 cm (A), 3 mm (B–G) or 1 mm (H–I). Reproduced from illustration of '*Liparis* sp.' in Nakajima (2012) with permission.

Miyoshi, *M. Taguchi & Kon CT1608* (holotype: TNS 778816).

Distribution. Japan (Hokkaido, Honshu, Shikoku, Kyushu).

Ecology. Growing in semi-open, somewhat damp places in deciduous or mixed conifer-deciduous forests.

Flowering season. June to July.

Japanese name. Akita-suzumushi-so.

Etymology. The species is so named as it has a long inflorescence.

Pseudobulb ovoid, 1–3.5 cm long. *Leaves* 2, ovate-elliptic, obtuse or subacute, 10–20 cm long, 2–6 (–9) cm wide, conduplicate, glossy, glabrous, margin entire or somewhat undulate, green; petiole 3–10 cm long, winged. *Inflorescence* terminal, racemose, 15–40 cm long, with 4–40 flowers; axis glabrous, ridged, green. *Bract* ovate, acute, 1–5 mm long, green. *Pedicellate ovary* clavate, twisted, 10–20 mm long, purplish. *Dorsal sepal* linear-lanceolate, subacute, occasionally slightly revolute, erect or somewhat recurved, 8–11 mm long, 2.5–3.5 mm wide, purplish. *Lateral sepals* obliquely ovate or obliquely lanceolate, subacute, somewhat revolute, 8–11 mm long, 2.5–3.5 mm wide, purplish. *Petals*

falcate, linear, obtuse, strongly revolute, pendulous, sometimes slightly twisted, 9–12 mm long, 0.5–1.0 mm wide, purplish. *Labellum* entire or minutely erose, ovate, recurved at base, obtuse, apiculate at apex, 8–10 mm long, 5–7 mm wide, dark purple, purplish, or green. *Column* terete, incurved, with rounded wings in distal part, dilated at base, with shallow groove at base on ventral side, 4–5 mm long, green, pale green on ventral surface, purplish in basal part; pollinia 4 in 2 pairs, waxy, yellow; anther cap with beaked apex, green to purplish.

Notes. *Liparis longiracemosa* is similar to *L. makinoana*, but distinguishable by the smaller labellum (8–10 mm × 5–7 mm *vs*. 9–12 mm × 6–9 mm in *L. makinoana*), wider sepals (8–11 mm × 2.5–3.5 mm *vs*. 8–11 mm × 2–3) mm, and sparser flowers on the inflorescence when compared with the latter. Flower color varies from green to dark purplish.

Other specimens examined: JAPAN. **Hokkaido**. Hidaka: Shizunai-gun, Shizunai-cho. Misono, Livestock Farm, Fac. Of Agr., Hokkaido University, 12-rinpan, 13 July 1996, *H. Takahashi 20548* (SAPS 009767); Shizunai-gun, Shizunai-cho, Misono, Livestock Farm, Hokkaido University, 12-rinpan, 1 July 1998, *H. Takahashi 25064* (SAPS 009765); Shizunai-gun, Shizunai-cho, Misono, Livestock Farm, Hokkaido University, 12-rinpan, 1 July 1998, *H. Takahashi 25064* (SAPS 009766). —Iburi: Hayakita, 16 June 1956, *K. Ito & A. Umezawa* (SAPS 009763); Tomakomai, 18 July 1994, *M. Nakajima* (TI); Tomakomai, Experimental Forest of Hokkaido University, 31 July 1933, *H. Hara* (TI); Yuufutsu-gun, Hobetsu-cho, 29 July 1991, *K. Ito* (SAPS 009769); Outside of Toyoura-cho, 25 June 1990, *Y. Goda 797* (KYO); Mt. Usu, 23 July 1939, *I. Yamamoto* (KYO). —Kamikawa: *C. Tsutsumi* (TNS 8505378–81). —Shiribeshi: Around Ezofuji, Hangetsu lakeside, 15 July 1951, *Y. Kuwabara* (SAPS 009783); Souya, Sarufutsu, 26-rinpan, July 1931 (SAPS 009784). **Aomori**. Higashitsugaru-gun, Tairadate, Yunosawa, 28 July 1959, *H. Hara* (TI). **Akita**. 13 June 1983, *Yoshie Hanei* (TNS 9504246–7); Kitaakita-shi, Anitotorinai, 530 m alt., 23 June 2008, *C. Tsutsumi et al.* (TNS 778815). **Miyagi**. Mt. Daito, 6 June 1959, *H. Ohashi 1980* (TI). **Niigata**. Itoigawa-shi, near Tsukimizu-no-ike, 6 June 1971, *S. Iwano 14714* (TUS 146016); **Toyama**. Kurobe canyon, 9 June 1960, *N. Fukuoka* (KYO). **Fukui**. National forests of Kurokawa, 10 June 1939, *K. Hirobe* (KYO). **Nagano**. Shimoina-gun, Urugi-mura, Mt. Chausu, 1200 m alt., 13 June 1957, *T. Yamazaki* (TI). **Shiga**. Shiga-gun, Mt. Hira, 11 June 1944, *G. Nakai* (KYO); Mt. Watamuki, 19 June 1937, *C. Hashimoto* (KYO). **Kyoto**. Ayabe-shi, Okukanbayashi, Wasadani, ca. 300 m alt., 14 June 1980, *G. Murata 41065* (KYO); Miyadzu-shi, Sugiyama, 13 June 1997, *S. Tsugaru et al.* (KYO); Hosonomura, Mt. Ryugadake, 29 July 1933, *M. Tagawa* (KYO). **Osaka**. Mt. Kongo, 14 June 1931, *Z. Tashiro* (KYO). **Hyogo**. Mt. Rokko, 23 June 1929, *Z. Tashiro* (KYO). **Kagawa**. Mt. Otaki, 26 June 1932, *Z. Tashiro* (KYO). **Ehime**. Kawanouchi, 21 July 1915, *H. Yamamoto* (KYO); Syusogun, Ishine-mura, Yasuitani (KYO). **Kochi**. Agawa-gun, Nanokawa-mura, Shimonanokawa, *K. Watanabe* (TI); Nanogawa, 30 June 1887, *K. Watanabe* (TNS 62607); Nanokawa-mura, 7 June 1888, *K. Watanabe* (TI). **Miyazaki**. Gokase-cho, Mt. Shiraiwa, *Yukawa 07-21* (TNS 8505608).

Interpretation of Liparis japonica

Liparis japonica was described as *Microstylis japonica* by Miquel (1866) based on a specimen with fruits only, collected in Japan by H. Bürger. The type specimen has not been found (Ohba *et al.*, 2005; A. Schuiteman, pers. comm.). We re-examined the protologue and found it to be identical to *Malaxis monophyllos* (L.) Sw. (1) The description "labellum apice 3 apiculis incrassates?" (3 apiced labellum) is a significant diagnostic character of *M. monophyllos*, whereas it is not evident in the *L. makinoana* complex. (2) The description "An *M. diphyllae* Lindl. L. c. p. 19 affinis?" suggests an affinity of this entity to *Microstylis diphyllos*, which is currently treated as conspecific with *Malaxis monophyllos*. Therefore, we conclude that *Microstylis japonica* is a

synonym of *Malaxis monophyllos*, as given below.

Maximowicz (1886) transferred *Microstylis japonica* to *Liparis* with citations of Miquel (1866), Iinuma (1874), and Franchet and Savatier (1875). The specimen cited by Franchet and Savatier (1875), which is deposited in Muséum National d'Histoire Naturelle, Paris, France (P), is *L. krameri* Franch. et Sav., and the illustration of Iinuma (1874) is assignable to *L. longiracemosa*. Therefore, *L. japonica* sensu Maxim. is a heterogeneous assemblage of multiple *Liparis* species.

Malaxis monophyllos (L.) Sw. in Kongl. Vetensk. Acad. Nya Handl. 21: 234 (1800).

Microstylis japonica Miq., Ann. Mus. Bot. Lugduno-Batavi 2: 203 (1866), syn. nov. — *Liparis japonica* (Miq.) Maxim. in Bull. Acad. Imp. Sci. Saint-Pétersbourg 31: 102 (1886), excl. cit. & descr.; Maximowicz in Mel. Biol. 12: 544 (1887), excl. cit. & descr.

Acknowledgments

We thank P. Efimov, M. Goto, H. Hongo, X.-H. Jin, Kon, C.-S. Lee, N.-S. Lee, A. Maeda, T. Minamitani, K. Miyoshi, H. Nakayama, K. Oikawa, A. Okuda, K. Sakamoto, M. Taguchi, H. Takeuchi, K. Tanaka, K. Watanabe, C.-K. Yang, and Y. Yamashita for help in our field trips and plant sampling. We also thank T. Kurosawa and H. Nagamasu for useful comments, M. Nakajima and Bun'ichi Sogo Shuppan for the illustrations, and K. Suzuki for cultivating the living plants. We are grateful to the directors and curators of SAPS (H. Takahashi), TUS (K. Yonekura), KYO (H. Nagamasu), and TI (A. Shimizu) for allowing us to study the herbarium specimens. This study was partly supported by the National Museum of Nature and Science research grant entitled "Integrated Analysis of Natural History Collections for Conservation of Highly Endangered Species".

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