

A taxonomic study on the genus *Lycoris* (Amaryllidaceae)

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Ten taxa of the genus *Lycoris* (Amaryllidaceae) were reexamined on the basis of their morphological characteristics and distributions. Also, a new key and an enumeration were prepared. Ten taxa treated were classified into four groups. Group 1 consists of *L. sanguinea* var. *sanguinea*, *L. sanguinea* var. *koreana* and *L. sanguinea* var. *kiushiana*, and group 2 comprises *L. aurea*, *L. albiflora* and *L. chinensis* var. *sinuolata*. Group 3 contains *L. squamigera*, *L. flavescens* and *L. chejuensis*, while in group 4 *L. radiata* is the only species present. Morphologically, two similar taxa, *L. sanguinea* var. *sanguinea* and *L. sanguinea* var. *koreana*, could be divided by the length of bracts and width of perianths. *Lycoris flavescens*, *L. chejuensis* and *L. chinensis* var. *sinuolata* were treated as Korean endemic taxa. *Lycoris albiflora* and *L. sanguinea* var. *kiushiana* are distributed only in Japan, *L. sanguinea* var. *sanguinea* in China and Japan, and *L. aurea* in China, Taiwan and Japan.

Keywords: *Lycoris*, classification, key, enumeration, distribution

The genus *Lycoris* Herbert, which belongs to the family Amaryllidaceae under the order Liliales, consists of about 20 taxa, and its distribution is limited to moist and warm temperate woodlands of eastern Asia, as in China, Korea, Japan, Taiwan, and the Himalaya (Yamaguchi, 1959; Melchior, 1964; Nishikawa *et al.*, 1979; Kurita, 1987).

After Herbert, who described *L. aurea* and established this genus, Traub (1957, 1958) classified it into two subgenera; subgenus *Symmantus* which is actinomorphic in perianth arrangement and has no white stripe on the midrib of leaves, and subgenus *Lycoris* which is zygomorphic in perianth arrangement and has a white stripe on the midrib. Traub's classification, however, has given rise to many problems, because the presence of white stripe on the midrib of leaves sometimes is not distinct and the perianth arrangement is changed in some taxa. For example, the perianths of *L. squamigera* Maxim. belonging to

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the subgenus *Symmanthus* under Traub's classification show actinomorphic arrangement before full bloom, but they are changed into zygomorphic arrangement after anthers are opened.

Korean *Lycoris* was reported by Nakai (1911) as species of *L. squamigera* Maxim., and he also described a new species, *L. koreana* from the Mt. Backyang (Nakai, 1930). Koyama (1959) treated the latter as a variety, *L. sanguinea* var. *koreana*, based on the reason that there was no difference between the two except the protrusion of stamens out of corolla when their morphological and cytological characteristics were compared. Tae and Ko (1993) and Kim and Lee (1991) supported Koyama (1959)'s treatment based on their observation of its morphological, cytological and palynological characteristics. Lee and Oh (1974) regarded *L. sanguinea* var. *koreana* as *L. radiata* (L'Hérit.) Herb.

Lee (1979) reported that the genus *Lycoris* in Korea consisted of five species; *L. aurea*, *L. albiflora* Koidz., *L. koreana*, *L. radiata* and *L. squamigera*. However, Kim and Lee (1991) argued that *L. aurea* and *L. albiflora* are not distributed in Korea, and treated the plants previously called *L. aurea* as *L. chinensis* K. Tae et S. Ko and those called *L. albiflora* as a new species *L. flavescens* M. Kim et S. Lee. They also stated that the Korean *Lycoris* is composed of five taxa or four species and one variety including *L. chinensis*, *L. flavescens*, *L. radiata*, *L. squamigera* and *L. sanguinea* var. *koreana*. Recently, Tae and Ko (1993) added a new species, *L. chejuensis*, and treated the plants previously called *L. chinensis* as a variety, *L. chinensis* var. *sinuolata*. Likewise, the confusions on species identification has been raised owing to the similarities of morphological characteristics, and to karyotype variations among taxa.

The present study was focused on clarifying the taxonomic status of the 10 taxa including four foreign taxa morphologically and geographically. Their distribution maps were based on the specimens examined and the cited literatures.

Enumeration of the genus *Lycoris*

Lycoris Herb., App. 20, 1821.

Amaryllis L'Hérit., pro parte. Sert. Angl. P. 15, 1788.

Pleurastis Rafin., Fl. Tellur. 4: 12, 1836.

Nerine Miquel, Ann. Mus. Lugd.-Bat. 2: 139, 1866.

Orexis Salisb., Gen. Pl. Fragm. P. 117, 1866.

Korean Name: Sang-Sa-Hwa-Sok, 상사화속(Yang, 1976; Lee and Kim, 1987; Tae *et al.*, 1987; Kim and Lee, 1991; Tae and Ko, 1993), 꽃무릇속(Lee, 1976).

Perennial herbs. Bulb glabrous. Leaves linear or bandlike, 2–12 per bulb. Scape produced from July to November. Umbel 6-flowered. Flower bisexual, actinomorphic or zygomorphic. Stamens 6. Bracts 2. Style longer than the stamens. Stigma minute, red. Placentation axile with three locules. Ovules about 6 per locule. Ca. 20 taxa, in eastern Asia.

〈Key to the 10 taxa of the genus *Lycoris*〉

1. Six perianths actinomorphic in shape, orange to red in color (group 1).
 2. Styles 4.5–6.8 cm in length. Filaments 2.9–5.6 cm in length. Flower blooms from August to September. Perianth 3.5–4.2 cm in length. Bract 0.5–0.8 cm in width.
 3. Bracts 2.35–3.15 cm in length. Perianth 0.6–0.7 cm in width.....*L. sanguinea* var. *sanguinea*
 3. Bracts 3.20–4.64 cm in length. Perianth 0.8–1.1 cm in width.....*L. sanguinea* var. *koreana*
 2. Styles 8.2–10.3 cm in length. Filaments 6.2–8.2 cm in length. Flower blooms in July. Perianth 6.5–7.1 cm in length. Bract 1.1–1.2 cm in width.....*L. sanguinea* var. *kiushiana*
1. Six perianths zygomorphic in shape, pale purple, red, deep yellow, yellow, white or yellowish white in color (group 2, 3, 4).
 4. Perianths deep yellow, yellow, white, yellowish white or pale purple in color. Leaves green and yellowish green in color without whitish stripe on midrib. Somatic chromosome number 12–18, 27 or 30 (group 2, 3).
 5. Perianth margin undulate and reflexed (group 2).
 6. Perianths deep yellow in color. Flower blooms from late July to early August. Pedicel 2.2–4.0 cm in length. Somatic chromosome number 16.....*L. chinensis* var. *sinudata*
 6. Perianths yellow or white. Flower blooms from September to November. Pedicel 0.5–1.6 cm in length. Somatic chromosome number 12–17 or 18.
 7. Perianths white in color. Leaves produced from February to early May. Somatic chromosome number 16, 17 or 18.....*L. albiflora*
 7. Perianths yellow in color. Leaves produced from October to early April. Somatic chromosome number 12, 13, 14 or 15.....*L. aurea*
 5. Perianth margin smooth, not reflexed (group 3).
 8. Perianths yellowish white or yellow in color. Tepal tube 1.1–2.2 cm in length. Styles 7.1–9.6 cm in length. Somatic chromosome number 19 or 30.
 9. Perianths yellowish white in color, 5.9–6.7 cm in length. Bulbs circular in shape. Somatic chromosome number 30.....*L. chejuensis*

9. Perianths yellow in color, 5.3–5.8 cm in length. Bulbs ovate in shape. Somatic chromosome number 19.....*L. flavescens*
8. Perianths pale purple in color. Tepal tube 2.4–3.2 cm in length. Styles 10.1–12.6 cm in length. Somatic chromosome number 27.....*L. squamigera*
4. Perianths red in color. Leaves dark green in color with whitish stripe on midrib. Somatic chromosome number 33 (group 4).....*L. radiata*

〈Group 1〉

1. *L. sanguinea* Maxim. var. *sanguinea*, Engl. Bot. Jahrb. 6: 80, 1885; Nishiyama, Contr. Lab. Genet. Kyoto Imp. Univ. 3: 513, 1928; Inariyama, Sci. Rep. Tokyo Bunrika Daigaku, Sect. B, 6: 78, 1951; Tae and Ko, Korean J. Pl. Taxon. 21: 108, 1991.

Bulbs circular, tunicate with brown color, 2.4–3.6 cm long. Leaves pale green, grow from late February to early April. Peduncle produced from late August to September, 18–49 cm tall. Umbel 3-or 4-flowered with orange-red color, actinomorphic. Perianths 6, 3.5–4.3 cm long, about 6–7 mm in diameter. Perianth margin smooth. Style 4.0–6.6 cm long. Filaments 2.9–4.5 cm long. Style and filaments similar to perianth in length. Pedicel 0.9–3.9 cm long. Bracts 2, membranous, about 2–3 cm in length. Seed circular or ovate, fertile (Fig. 1).

Distribution: China (Yangtze River valley), Japan (Fig. 5).

Specimens examined: JAPAN. Without specific locality, 4 Aug. 1931, *Col.?*; without specific locality, 10 Aug. 1890, *Forbes s.n.* (BM); without specific locality, 4 Aug. 1951, *Leatrex s.n.* (K). **Akita:** Minamiakita-gun, Ohiramura, 17 Aug. 1952, *Hara & Uozu s.n.* (TI). **Chiba:** Mar. 1990, *Kazuno s.n.* (JNU); 14 Aug. 1990, *Kim s.n.* (JNU). **Fukui:** Wakasahimejinjya, Onyu, Obama-shi, alt. ca. 50 m, 12 Aug. 1974, *Kurasaki s.n.* (TI 6440). **Kanagawa:** Yokohama, 22 Aug. 1979, *Bisset s.n.* (BM); Nagakama, 2 Aug. 1892, *Etwes s.n.* (K); Oiso Koma, 8 Mar. 1925, *Honda s.n.* (TI); Yokohama, in 1862, *Maximowicz s.n.* (BM, K, P). **Kyoto:** Shizuhara near Ohara, 19 Apr. 1964, *Murata s.n.* (KYO 18964). **Oita:** Beppu Temple Kankai, 16 Apr. 1952, *Hashimoto s.n.* (TI). **Osaka:** "En route from Tano to Izuriha," Takatsuki-shi, 30 July 1988, *Deguchi & Takahashi s.n.* (KYO 7400). **Saitama:** Waganochi, 24 July 1961, *Hanagiri s.n.* (TI). **Tokyo:** 26 Aug. 1903, *Uno s.n.* (BM). **Toyama:** Shimoarakawa-gun, Miyazaki-mura, Miyazaki, 6 Aug. 1958, *Kanai s.n.* (TI); Mt. Mitake, 25 Sep. 1920, *Hattori s.n.* (TI). **Yamagata:** Akumi-gun, Fukura-mura, Mega, 30 Aug. 1963, *Ohashi s.n.* (TI 10617).

Figs. 1-4. 1. *Lycoris sanguinea* Maxim. var. *sanguinea* Koyama (H. Ohashi, TI 10617). 2. *Lycoris sanguinea* Maxim. var. *kiushiana* Koyama (T. Yamazaki, TI). 3. *Lycoris albiflora* Koidz. (H. Ohba & S. Akiyama, TI 2627). 4. *Lycoris aurea* Herb. (H. Hiroshi, TI, KYO).

2. *L. sanguinea* Maxim. var. *koreana* (Nakai) Koyama, *Baileya* 7: 6, 1959; Kurita, *Cytologia* 53: 319, 1988; Kim and Lee, *Korean J. Pl. Taxon.* 21: 130, 1991.

L. koreana Nakai, *Bot. Mag. (Tokyo)* 44: 516, 1930; Nakai, *Bull. Natl. Sci. Mus.* 31: 148, 1952; Lee, *Ill. Fl. Kor.* P. 224, 1979; Tae and Kim, *Korean J. Pl. Taxon.* 17: 137, 1987; Lee and Kim, *Korean J. Pl. Taxon.* 17: 148, 1987; Tae and Ko, *Korean J. Pl. Taxon.* 21: 107, 1991.

L. sanguinea auct. non Maxim., in Park, *Enum. Kor. Pl.* P. 330, 1949; Yang, *J. Korean Pl. Taxon.* 7: 32, 1976.

L. coreana Lee and Oh, *Kor. Ass. Con. Nat.* P. 81, 1974.

Korean name: Baek-Yang-Got, 백양꽃 (Lee, 1979; Lee and Kim, 1987; Kim and Lee, 1991), 가재무릇 (Park, 1949), 가을가재무릇 (Lee and Oh, 1974).

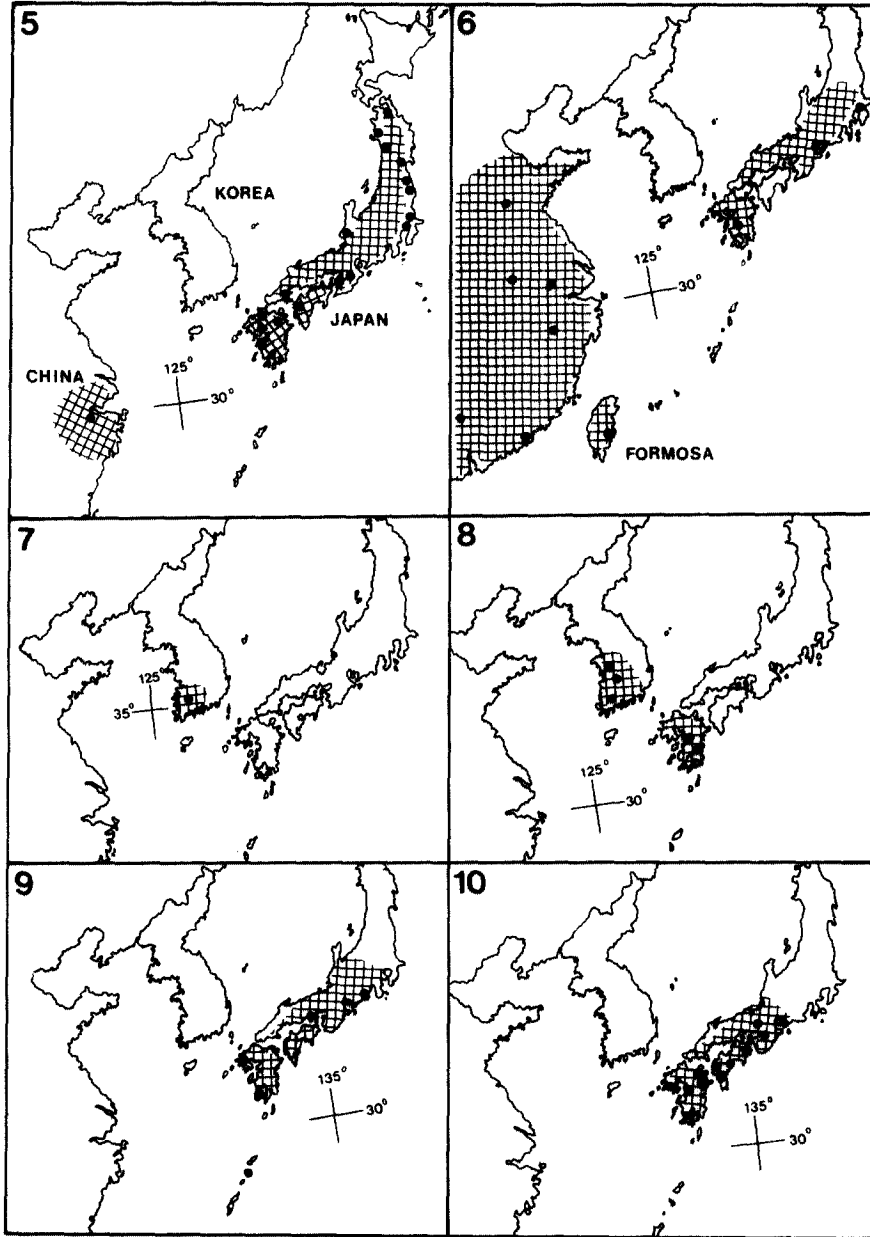
Bulbs circular, tunicate with dark brown color, 1.5–3.5 cm long. Leaves green, grow from late February to May. Peduncle produced from late August to early September, 33.0–40.8 cm tall. Flowers orange to red in color, actinomorphic. Perianths 6, 4.2–4.9 cm long, 0.8–1.1 cm in diameter. Perianth margin smooth. Style 5.3–5.7 cm long. Filaments 3.9–5.5 cm long. Stigma red, papillate. Pedicel 2.4–4.5 cm long. Bracts membranous, about 3.0–5.0 cm in length. Seed black in color, about 6–8 mm in diameter.

Distribution: Japan (Gokanosho, Izumi, Kumamoto Pref.; Hoshikura, Nichinan, Miyazaki Pref.), Korea (Fig. 8).

Specimens examined: KOREA. **Chunbuk:** Naejang Temple, 6 Sep. 1986, *Kim s.n.* (JNU); Naejang Temple, 19 Aug. 1987, *Kim s.n.* (JNU); Naejang Temple, 22 Aug. 1987, *Kim s.n.* (JNU); Naejang Temple, 20 Aug. 1989, *Kim s.n.* (JNU); Mt. Naejang, 6 Sep. 1992, *Tae s.n.* (HNU 017456, 7). **Chunam:** Paekyang Temple, 30 Aug. 1986, *Kim s.n.* (JNU); Paekyang Temple, 19 Aug. 1987, *Kim s.n.* (JNU); Mt. Paekyang, 6 Sep. 1992, *Kim s.n.* (HNU 017454); Mt. Duryun, 15 Sep. 1993, *Lee s.n.* (SNU 77983); Mt. Paekyang, 21 Aug. 1966, *Lee & Cho s.n.* (SNUA); Mt. Paekyang, 7 Sep. 1986, *Tae s.n.* (HNU 008096). **Kyunggi:** Suwon, 4 Sep. 1969, *Lee s.n.* (SNUA).

3. *L. sanguinea* Maxim. var. *kiushiana* (Makino) Koyama, *Baileya* 7: 5, 1959; Ohwi, *Fl. Jap.* P. 312, 1984; Kurita, *Cytologia* 53: 308, 1988; Satake *et al.*, *Wild Fl. Jap.* Vol. 1. P. 24, 1988.

L. kiushiana Makino, *Bot. Mag. (Tokyo)* 62: 176, 1948.



Figs. 5-10. Distribution of the genus *Lycoris*. 5. *L. sanguinea* var. *sanguinea*. 6. *L. aurea*. 7. *L. chinensis* var. *sinuolata*. 8. *L. sanguinea* var. *koreana*. 9. *L. albiflora*. 10. *L. sanguinea* var. *kiushiana*.

Bulbs circular, brown, 2.0–3.5 cm long. Leaves pale green, grow from February to early May. Peduncle produced in July, 22–35 cm tall. Umbel 4-or 5-flowered, 6.5–7.1 cm long, 0.8–1.2 cm in diameter. Flowers orange to red in color, actinomorphic. Perianth margin smooth. Style 8.2–10.3 cm long. Filaments 6.2–8.3 cm long. Pedicels 3–8 cm long. Spathe valves 2, lanceolate, 4–6 cm long.

Distribution: Japan (Fig. 10).

Specimens examined: JAPAN. **Kyoto:** Manganji, Nishibetsuin-cho, Kameoka-shi, 5 Aug. 1991, *Tsugaru s.n.* (KYO 14946); Takashaki, 14 Aug. 1940, *Col.?* (KYO). **Oita:** Kyoyomidake, 1 Aug. 1971, *Ichiro s.n.* (TI). **Tokushima:** Ishidateyama, Kitomura, alt. 600 m, 12 Aug. 1976, *Yamazaki s.n.* (TI).

〈Group 2〉

4. *L. chinensis* Traub var. *sinuolata* K. Tae et S. Ko, Korean J. Pl. Taxon. 23: 234, 1993.

L. aurea auct. non Herb., Chung *et al.*, Nom. Pl. Kor. P. 35, 1937; Park, Enum. Kor. Pl. P. 330, 1949; Chung, Kor. Fl. Vol. 2. P. 984, 1957; Chung, Ill. Enc. Faun. Fl. 5: 1532, 1965; Yang, J. Korean Pl. Taxon. 7: 32, 1976; Lee, Ill. Fl. Kor. P. 223, 1979; Tae and Kim, Korean J. Pl. Taxon. 17: 137, 1987.

L. chinensis auct. non Traub, Kim and Lee, Korean J. Pl. Taxon. 21: 126, 1991.

Korean name: Jin-No-Rang-Sang-Sa-Hwa, 진노랑상사화(Kim and Lee, 1991; Tae and Ko, 1993), 개상사화(Lee, 1976; Lee and Oh, 1974; Lee and Kim, 1987).

Bulbs ovate with long neck, 3.5–5.2 cm long. Leaves glabrous appearing in late February, 32.2–41.8 cm long, 1.4–2.5 cm diameter. Scape erect, produced from late July to early August, 40–70 cm tall, somewhat flattened. Spathe valves 2, lanceolate, 3–4 cm. Umbel 4-to 7-flowered. Perianths 5.5–6.0 cm long, zygomorphic. Pedicels 2.2–4.0 cm long. Flower deep yellow in color. Tepal tube 1.1–1.5 cm, long. Tepal segments oblanceolate, undulated on the margin and reflexed. Seed length 0.9–1.0 cm, black, fertile.

Distribution: Korea (Fig. 7).

Specimens examined: KOREA. **Chunbuk:** Mt. Naejang, 29 July 1990, *Kim s.n.* (JNU); Naejang Temple, 29 July 1990, *Kim s.n.* (JNU); Naejang Temple, 28 July 1990, *Kwan s.n.*

(JNU); Mt. Naejang, 28 July 1990, *Kwan s.n.* (JNU); Mt. Naejang, 16 Aug. 1965, *Lee et al. s.n.* (SNUA); Mt. Naejang, 1 Aug. 1993, *Tae s.n.* (HNU 017452). **Chunnam:** Tamyang, 9 Aug. 1970, *Lee s.n.* (SNUA); Mt. Paekyang, 1 Aug. 1975, *Lee s.n.* (SNUA).

5. *L. albiflora* Koidz., Bot. Mag. (Tokyo) 38: 100, 1924; Creech, Natl. Hort. Mag. 31: 172, 1952; Traub, Pl. Life 14: 42, 1958; Bose, Pl. Life 16: 79, 1960; Yoshida, Sand-Dune Res. 18: 36, 1972.

Bulbs ovate, tunicate with long neck, 4–5 cm long. Leaves glabrous appearing from late February to early May, 34–45 cm long. Scape erect, produced from September to early November. Umbel 5- or 6-flowered. Perianths 3.6–3.8 cm long, zygomorphic. Flowers white, undulated on the margin and reflexed. Sterile (Fig. 3).

Distribution: Japan (Fig. 9).

Specimens examined: JAPAN. **Kagoshima:** Kaseda-shi, Toujinbaru, 15 Sep. 1980, *Ohba & Akiyama s.n.* (TI 2627). **Shizuoka:** Kosai-shi, Umeda 508, 3 Oct. 1983, *Mori s.n.* (TI [2 sheets]). **Tokyo:** Kamimeguro, 5 Mar. 1984, *Hiroshi s.n.* (TI).

CULTIVATED PLANTS: JAPAN. **Kyoto:** Cultivated in Botanical Garden of Kyoto Univ., 21 Sep. 1961, *Murata s.n.* (KYO [2 sheets]); cultivated in Botanical Garden of Kyoto Univ., 12 Oct. 1961, *Murata s.n.* (KYO [2 sheets]).

6. *L. aurea* Herb., in Edwards Bot. Reg. Vol. 4, App. 20, 1819; Hayward, Pl. Life 13: 41, 1957; Koyama, Baileya 7: 16, 1959; Caldwell, Amer. Hort. Mag. 41: 64, 1962; Nishikawa *et al.*, Jap. J. Genet. 5: 389, 1979; Kurita, Cytologia 52: 20, 1987.

Amaryllis aurea L'Hérit., Bot. Mag. 409 (1821), according to Koyama (1959).

Bulbs ovate, tunicate with dark brown, 6.2–6.6 cm long. Leaves glabrous appearing from October to early April. Pedicels 0.5–2.0 cm long, green. Bracts 2, membraneous, lanceolate, 3–7 cm long. Scape erect, in September to October, 31–52 cm tall. Umbel 4- to 8-flowered, 4–7 cm long, 0.7–1.0 cm in diameter. Flower yellow, zygomorphic, undulated on the margin and reflexed. Style 9.0–10.0 cm long. Filaments 6.6–8.8 cm long. Somatic chromosome number 12 or 14 for fertile and 13 or 15 for sterile plants (Fig. 4).

Distribution: China, Japan, Taiwan (Fig. 6).

Specimens examined: CHINA. **Hupei:** 10 Aug. 1925, *Steward s.n.* (K). **Kwangsi:** 27 Aug. 1933, *Steward & Cheo s.n.* (P 374). **Yunnan:** Sep. 1923, *Forrest s.n.* (K); without date, *Henry s.n.* (K).

TAIWAN. Without specific locality, Aug. 1881, *Hancock s.n.* (K).

CULTIVATED PLANTS: JAPAN. **Tokyo:** Univ. of Tokyo campus, cult., 25 Oct. 1965, *Hiroshi s.n.* (TI). **Kyoto:** Cultivated in Botanical Garden of the Kyoto Imperial University, 3 Oct. *Col.?*

〈Group 3〉

7. *L. chejuensis* K. Tae et S. Ko, Korean J. Pl. Taxon. 23: 233, 1993.

L. albiflora auct. non Koidz., Nakai, Bull. Natl. Sci. Mus. 31: 148, 1952; Makino, Makino's Ill. Fl. Col. P. 971, 1983; Hayashi and Furusato, Ill. Fl. Col. P. 497, 1986.

Korean name: Che-Ju-Sang-Sa-Hwa, 제주상사화 (Tae and Ko, 1993).

Bulbs globose with short neck, 2.6–6.4 cm long. Leaves linear, green, 50–60 cm long, 1.6–2.4 cm in diameter. Scape appearing in August, 50–60 cm tall. Spathe valves 2, lanceolate. Umbel 5- to 8-flowered, zygomorphic. Perianths 5.9–6.8 cm long, yellowish white and red line along the midrib of segments. Pedicel 1.3–3.7 cm long. Ovary up to 5–8 mm long, 5–7 mm in diameter. Tepal tube 1.7–2.2 cm long. Sterile.

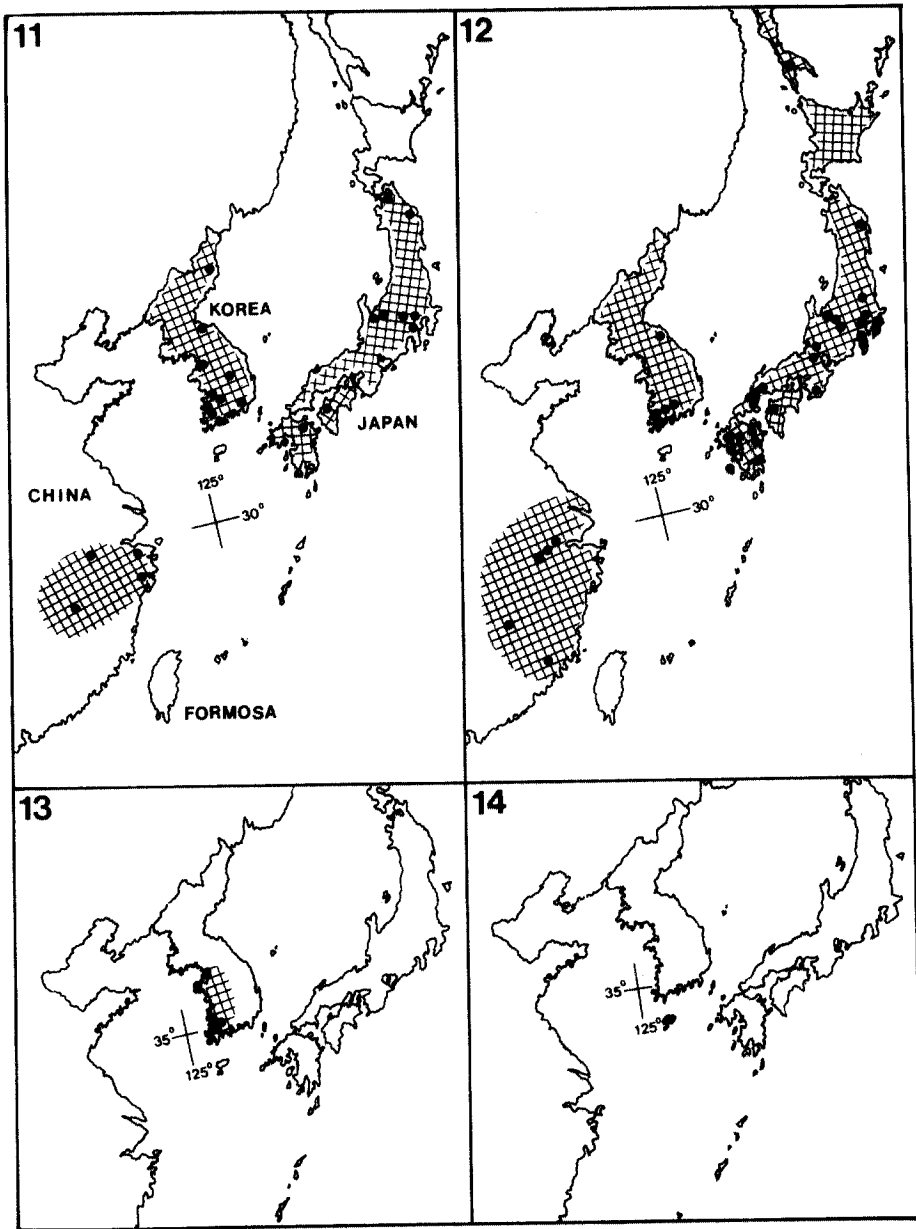
Distribution: Korea (Fig. 14).

Specimens examined: KOREA. **Cheju:** Andok Valley, 18 Mar. 1990, *Kim s.n.* (JNU); Andok Valley, 16 Aug. 1990, *Kwan s.n.* (JNU); Sogwangsori, 30 Aug. 1992, *Tae s.n.* (HNU 017467); Andok Valley, 13 Aug. 1993, *Tae s.n.* (HNU 017468); Sogwangsori, 13 Aug. 1993, *Tae s.n.* (HNU 017469); without specific locality, Aug. 1911, *Taquet s.n.* (TI).

8. *L. flavescens* M. Kim et S. Lee, Korean J. Pl. Taxon. 21: 127, 1991; Tae and Ko, Korean J. Pl. Taxon. 23: 238, 1993.

L. aurea auct. non Herb., Mori, Enum. Pl. Cor. P. 96, 1922; Chung, Kor. Fl. Vol. 2. P. 984, 1957; Chung, Ill. Enc. Faun. Fl. 5: 1532, 1965; Lee and Oh, Kor. Ass. Con. Nat. P. 82, 1974.

L. albiflora auct. non Koidz., Lee and Kim, Korean J. Pl. Taxon. 17: 147, 1987; Tae and Kim, Korean J. Pl. Taxon. 17: 135, 1987.



Figs. 11-14. Distribution of the genus *Lycoris*. 11. *L. squamigera*. 12. *L. radiata*. 13. *L. flavescens*. 14. *L. chejuensis*.

Korean name: Buk-No-Rang-Sang-Sa-Hwa, 북노랑상사화(Kim and Lee, 1991), 가마귀마늘(Chung et al., 1937), 개상사화(Chung, 1957, 1965; Lee and Oh, 1974), 흰상사화(Lee, 1979; Lee and Kim, 1987; Tae and Kim, 1987).

Bulbs ovate with long neck, 4.5–5.2 cm long. Leaves glabrous appearing in February to May, green, 4–6 cm long. Scape erect, appearing in August. Umbel 5- to 8-flowered, 5.2–5.8 cm long. Flowers yellow or yellow with red tints along the margin of segments. Perianth margin smooth, zygomorphic. Bracts 2, lanceolate, 3.5–5.0 cm long. Style 7.1–9.6 cm long. Filaments 4.8–6.3 cm long. Stigma red. Sterile.

Distribution: Korea (Fig. 13).

Specimens examined: KOREA. **Chunbuk:** Naebeansan, Gikso Falls, 15 Aug. 1991, *Chung & Son s.n.* (JNU); Naebeansan, Junggae-Naeso Temple, 12 July 1990, *Ko & Sin s.n.* (JNU); Naebeansan, Gikso Falls, 16 Aug. 1991, *Lee & Yu s.n.* (JNU); Naebeansan, Paekchonae, 25 Aug. 1990, *Yu & Han s.n.* (JNU); Naebeansan, Paekchonae, 25 Aug. 1990, *Yu & Sin s.n.* (JUN). **Chunnam:** Paekyang Temple, 20 Aug. 1992, *Kang s.n.* (HNU 017447); Paekyang Temple, 30 Aug. 1986, *Kim s.n.* (JNU); Naeso Temple, 20 Aug. 1987, *Kim s.n.* (JNU); Paekyang Temple, 18 Mar. 1989, *Kim s.n.* (JNU); Naeso Temple, 19 Mar. 1989, *Kim s.n.* (JNU); Naeso Temple, 5 Mar. 1990, *Kim s.n.* (JNU, Holotype); Mt. Paekyang, 1 Aug. 1975, *Lee s.n.* (SNUA); Paekyang Temple, 20 Aug. 1992, *Lee s.n.* (HNU 017446); Mt. Paekyang, 16 Aug. 1965, *Lee et al. s.n.* (SNUA); Mt. Paekyang, 11 Sep. 1986, *Tae s.n.* (HNU 008100). **Kyunggi:** Kanghwa Isl., 28 Aug. 1992, *Tae s.n.* (HNU 017451).

9. *L. squamigera* Maxim., Engl. Bot. Jahrb. 6: 79, 1855; Nakai, J. Coll. Sci. Imp. Univ. Tokyo 31: 234, 1911; Mori, Enum. Pl. Cor. P. 96, 1922; Koyama, Baileya 7: 6, 1959; Nishikawa et al., Jap. J. Genet. 5: 389, 1979; Tae and Kim, Korean J. Pl. Taxon. 17: 137, 1987.

Amaryllis hallii Horey ex Baker, Bot. Mag. 123: 7547, 1897.

Korean name: Sang-Sa-Hwa, 상사화(Chung et al., 1937; Park, 1949; Chung, 1957, 1965; Lee, 1976; Yang, 1976; Lee, 1979; Chang, 1986; Lee and Kim, 1987; Kim and Lee, 1991), 개가재무릇(Lee and Oh, 1974).

Bulbs ovate, tunicate with long neck, 4.9–6.0 cm long. Leaves green, grow from late February to May. Peduncle produced from late July to August. Umbel 5- to 8-flowered with pale purple color, zygomorphic. Perianths 6, 7.2–7.8 cm long, 1.5–1.7 cm in diameter.

Perianth margin smooth. Style 10.9–12.6 cm long. Filaments 5.7–7.4 cm long. Pedicels 1.7–3.7 cm long, green. Bracts 2, membraneous, 4–5 cm long. Sterile.

Distribution: China, Japan, Korea (Fig. 11).

Specimens examined: JAPAN. Aichi: Mikawa, 3 May 1952, *Torii s.n.* (KYO). Gumma: Mt. Myogisan, Usuigun, 19 Aug. 1962, *Murata s.n.* (KYO 27409); Sindoji Amakuse Tomioka, 31 July 1936. *Toh, s.n.* (SNU 20805); Sindoji Amakuse Tomioka, 31 July 1936. *Toh, s.n.* (SNU 20806).

KOREA. Chunbuk: Sunun Temple, 15 Aug. 1986, *Kim s.n.* (JNU); Sunun Temple, 3 Aug. 1989, *Kim s.n.* (JNU); Sunun Temple, 5 Aug. 1988, *Kwan s.n.* (JNU); Naejang Temple, 20 Aug. 1989, *Kwan s.n.* (JNU); Mt. Naejang, 1 Aug. 1975, *Lee s.n.* (SNUA). Chunnam: Paekyang Temple, Aug. 1987, *Kim s.n.* (JNU); Paekyang Temple, 4 Aug. 1989, *Kwan s.n.* (JNU); Paekyang Temple, 17 Aug. 1989, *Kwan s.n.* (JNU); Mt. Paekyang, 21 Aug. 1966, *Lee & Cho s.n.* (SNUA); Naro Isl., 17 Aug. 1964, *Lee et al. s.n.* (SNUA); Paekyang Temple, 3 Aug. 1986, *Tae s.n.* (HNU 008095); Mt. Paekyang, 8 Aug. 1939, *Toh s.n.* (SNU 20207). Kyunggi: Kanghwa Isl., 5 May 1935, *Toh s.n.* (SNU 20802); Ongjin-gun, Taechong-myon, Taechong Isl., 2 Aug. 1984, *Yinger et al. s.n.* (K 2160). Kyungnam: Mt. Bulmo, 8 Aug. 1977, *Lee s.n.* (KNU); Sangju, 1 Aug. 1992, *Tae s.n.* (HNU 017453).

〈Group 4〉

10. *L. radiata* (L' Hérit.) Herb., Bot. Mag. 47: 5, 1819; Herb., in Edwards Bot. Mag. Reg. Vol. 4. App. 20, 1821; Mookerjea, Caryologia 7: 40, 1955; Bose, Nature 197: 1229, 1963; Fukuda *et al.*, Sci. Rep. Women's Christ. Univ. 48: 621, 1980; Kurita, Cytologia 52: 137, 1987.

Amaryllis radiata L' Hérit., pro parte, Sert. Angl. 15, 1788.

Orexis radiata Salisb., Gen. Pl. Fragm. P. 117, 1866, according to Kim and Lee (1991).

Nerine japonica Miquel, Ann. Mus. Lugd.-Bat. 2: 139, 1866, according to Koyama (1959).

Lycoris terraccianii Dammann, Cat. 44: 4, 1889, according to Kim and Lee (1991).

Nerine radiata Sweet, Hort. Brit. 1st Ed. P. 403, 1930, according to Kim and Lee (1991).

Korean name: Sok-San, 석산(Yang, 1976; Lee, 1979; Lee and Kim, 1987; Kim and Lee, 1991), 가을가재무릇(Park, 1949; Lee and Oh, 1974; Yang, 1976), 꽃무릇(Lee, 1976).

Bulbs circular, tunicate with short neck, 2.5–4.0 cm long. Leaves dark green in color,

grow from September to late April. Peduncle produced in early September. Umbel 5- to 7-flowered with red color, zygomorphic. Perianths undulated on the margin and reflexed. Perianth segments 6, 3.3–4.3 cm long, 5–7 mm in diameter. Bracts 2, membraneous, 3–4 cm long. Pedicel 0.6–1.2 cm long, green. Style 7.2–9.5 cm long. Filaments 5.5–8.0 cm long. Sterile.

Distribution: China, Japan, Korea (Fig. 12).

Specimens examined: CHINA. Anhwei: 11 Aug. 1934, *Fan & Li s.n.* (K). Fukien: in 1912, *Prioe s.n.* (K). Kiangsi: Lu Shan (Kuling-Gebirge), Sep. 1908, *Schindler s.n.* (K).

JAPAN. Kyoto: Takao, 30 Sep. 1935, *Col?* (SNU 20803, 20804); Yagi-cho, Hunai-gun, 23 September 1965, *Col?* (K); Omuro, Kyoto, October 1920, *Koidzumi s.n.* (TI); Yagi-cho, Kunai-gun, 23 Sep. 1965, *Murata s.n.* (TI 19657); Kawarajiri, Kawarabayashi-ho, Kameoka-shi, 26 Sep. 1991, *Tsugaru s.n.* (KYO 15417); Shoninbuchi, Hozu-cho, Kameoka-shi, 19 Oct. 1991, *Tsugaru & Takahashi s.n.* (KYO 15663). Miyagi: Near Akiu Spa, E of Sendai City, alt. 320 m, 12 Jun. 1960, *Ohashi s.n.* (TI). Oita: Yabakei, 4 Oct. 1961, *Togashi s.n.* (TI 7451). Saitama: Kawagoe-shi, Ikenobe, Irimagawa, 23 Sep. 1973, *Ohashi s.n.* (P, TI).

KOREA. Chunbuk: Sonun Temple, 8 Apr. 1986, *Kim s.n.* (JNU); Naebeansan, Paekchonae, 28 Sep. 1991, *Kim & Kim s.n.* (JNU); Sonun Temple, 16 Sep. 1987, *Kwan s.n.* (JNU); Naebeansan, Woulmyungam, 24 Sep. 1990, *Lee & Lee s.n.* (JNU); Naebeansan, Woulmyungam, 24 Sep. 1990, *Sin & Yu s.n.* (JNU); Mt. Sonun, 20 Sep. 1987, *Tae s.n.* (HNU 008099); Mt. Sonun, 3 Sep. 1991, *Tae s.n.* (HNU 016824); Naebeansan, Paekchonae, 27 Apr. 1991, *Yu & Ko s.n.* (JNU). Chunnam: Bulgap Temple, 31 Aug. 1990, *Kim s.n.* (JNU); Mt. Paekyang, 1 Oct. 1992, *Kim & Tae s.n.* (HNU 017466); Paekyang Temple, 20 Sep. 1989, *Kwan s.n.* (JNU). Kyungnam: Ssanggye Temple, 13 Sep. 1992, *Kim s.n.* (HNU 017463); Ssanggye Temple, 13 Sep. 1992, *Tae s.n.* (HNU 017464).

CULTIVATED PLANTS: JAPAN. Kyoto: Botanical Garden of Kyoto Univ., 17 Sep. 1950, *Hiroe s.n.* (TI).

Discussion

In this study, 10 taxa of *Lycoris* examined can be classified into four groups. Group 1 is composed of *L. sanguinea* var. *sanguinea*, *L. sanguinea* var. *koreana*, and *L. sanguinea* var. *kiushiana*. Although *L. sanguinea* var. *sanguinea* and *L. sanguinea* var. *koreana* have different bract length and perianth width, their morphological similarity makes it difficult to identify them and often lead to a confusion. Nakai (1930, 1952) and Lee (1979, 1984) regarded

L. sanguinea var. *koreana* as an endemic species in Korea, *L. koreana*, which is also distributed in Japan (Fig. 8). *Lycoris sanguinea* var. *sanguinea* and *L. sanguinea* var. *kiushiana* are not found in Korea (Figs. 5, 10). Group 2 consists of *L. chinensis* var. *sinuolata*, *L. albiflora*, and *L. aurea*, and they have a common characteristic of undulate and reflexed perianth margin. *Lycoris chinensis* var. *sinuolata* is endemic to Korea (Fig. 7). For *L. aurea* and *L. albiflora*, Lee (1979) reported that they are distributed in Korea. However, Kim and Lee (1991) and Tae and Ko (1993) insisted that they are not distributed in Korea. The latter opinion is regarded as more appropriate (Figs. 6, 9). Group 3 includes *L. squamigera*, *L. flavescens*, and *L. chejuensis*, and are grouped under a common character of the smooth and not reflexed perianth margin. All of them are distributed in Korea, and especially *L. flavescens* and *L. chejuensis* are endemic plants in Korea (Figs. 11, 13, 14). Group 4 consists of only one species, *L. radiata*. However its distribution range is the widest of 10 taxa examined in this study (Fig. 12). Morphologically, it is characterized by perianth color, whitish stripe on midrib of leaves, and chromosome number of $2n=33$.

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상사화속에 대한 분류학적 연구

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적 요

상사화속 10분류군에 대하여 형태학적 형질과 분포를 재검토하였고 이를 토대로 검색표를 작성하여 정리하였다. 그 결과, 취급된 10분류군은 모두 4 group으로 정리되어, group 1에 *L. sanguinea* var. *sanguinea*, *L. sanguinea* var. *koreana*, *L. sanguinea* var. *kiushiana*, group 2에 *L. aurea*, *L. albiflora*, *L. chinensis* var. *sinuolata*, group 3에 *L. squamigera*, *L. flavescens*, *L. chejuensis*, group 4에 *L. radiata*가 각각 포함되었다. 형태학적으로 가장 유사한 *L. sanguinea* var. *sanguinea* 와 *L. sanguinea* var. *koreana*는 포 길이와 화피 폭에 의해 분류되었다. *Lycoris flavescens*, *L. chejuensis* 및 *L. chinensis* var. *sinuolata*의 3분류군은 한국 특산식물이다. 또한, *L. albiflora* 와 *L. sanguinea* var. *kiushiana*는 일본에만 분포하고, *L. sanguinea* var. *sanguinea*는 중국과 일본, 그리고 *L. aurea*는 중국, 대만 및 일본에 분포한다.

주요어: 상사화속, 분류, 검색표, 정리, 분포

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