

Taxonomic Study of *Salvia lutescens* (Lamiaceae): Lectotype Designations and Proposal for a New Variety, var. *occidentalis*

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Salvia lutescens (Koidz.) Koidz. var. *intermedia* (Makino) Murata (Lamiaceae) has been proved to be divided into two allopatric taxa, one in the Kinki Distr. ("Kinki form") and the other in the Kanto Distr. ("Kanto form") according to the recent molecular phylogenetic and morphological analyses. In this sense, the past lectotypification of var. *intermedia* by Murata & Yamazaki (1993) was incorrectly applied, as the lectotype (*N. Takemura s.n.*, MAK), belonging to the Kinki form, is in serious conflict with the protologue of Makino (1901) which agrees well with the Kanto form. Therefore, I revise the lectotypification of var. *intermedia* in accordance with ICN Art. 9.19(b) to change into a specimen of the Kanto form (*R. Yatabe & J. Matsumura s.n.*, TI), and describe the Kinki form as a new variety, var. *occidentalis*. Furthermore, lectotype of *S. lutescens* var. *crenata* is also designated. A key to the varieties and taxonomic treatment of each taxon of *S. lutescens* is provided.

Key words: lectotypification, *Salvia japonica*, *Salvia lutescens*, *S. lutescens* var. *crenata*, *S. lutescens* var. *intermedia*

Salvia lutescens (Koidz.) Koidz. (Lamiaceae) is a perennial herb, distributed in Honshu and Shikoku in Japan (Murata & Yamazaki 1993). Murata & Yamazaki (1993) recognized three varieties in *S. lutescens*, var. *lutescens*, var. *crenata* (Makino) Murata and var. *stolonifera* G. Nakai, and two formas, f. *lutescens* and f. *lobato-crenata* (Makino) Murata, in var. *lutescens*. In contrast, Yonekura and Kajita (2003 onwards) and Yonekura (2017) raised the two formas to varieties and recognized four varieties: var. *lutescens*, var. *crenata*, var. *stolonifera*, and var. *intermedia* (Makino) Murata. Among the varieties, var. *intermedia* is characterized by lacking stolons and with deep-violet flowers, and it shows disjunct distribution in eastern Japan (Kanto Distr.) and western Japan (Kinki Distr. and Shikoku) (Fukuroka & Kurosaki 1982, Murata & Yamazaki 1993). *Salvia lutescens* var. *intermedia* was originally described as *S. japonica* Thunb. var. *intermedia* by Makino (1897), who found it growing in the mountain regions with beautiful violet flowers.

However, this name was not acceptable at the moment, because the statement was only on habitat, color of flowers, and its aesthetic features, not intended to distinguish from other taxa (ICN Art. 38). This name was validated when Makino gave a detailed description with citing four collections (Makino 1901). Moreover, Makino (1901) recognized two forms: a. *crenata*, and b. *lobato-crenata* within var. *crenata*, the former being usually more robust, with broad, crenate leaflets and primarily light-colored flowers, whereas the latter being "more gracile, with small, pauci-lobato-crenate leaflets and deep-violet flowers".

Recent herbarium studies on the *Salvia lutescens* group at HYO, KYO, MAK, OSA, and TI revealed that *S. lutescens* var. *intermedia* in the Kinki region usually show indumentums at the base of anther connective, whereas those of the plants in the Kanto District were almost glabrous (Takano 2017). Besides, molecular phylogenetic analysis has clarified that var. *intermedia* is polyphyletic in origin; the plants in the Kinki regions

consisted of a clade together with *Salvia lutescens* var. *lutescens*, whereas the plants in the Kanto region were clustered into different clades (Takano 2017). These results suggest that *S. lutescens* var. *intermedia* is actually a mixture of two or more allopatric taxa, in Kanto and Kinki District (Takano 2017). As a next step, taxonomic study whether the plants in Kanto and Kinki can be assigned to “var. *intermedia*”, or whether a new name is necessary for one of these two groups, is necessary. Here, I propose 1) lectotype designation of *S. lutescens* var. *crenata* 2) revised lectotypification of var. *intermedia*, and 3) taxonomic treatment for *S. lutescens*, with description of a new variety, var. *occidentalis*.

Lectotypification of Salvia lutescens var. *crenata*

Makino (1901) cited four collections for *Salvia japonica* var. *intermedia*: Mt. Hakone (Kana-gawa Pref., Kanto region, R. Yatabe & J. Matsumura, 26 July 1881, TI!), Mt. Tsukuba (Ibaraki Pref., Kanto region, C. Owatari, 8 July 1895; C. Owatari, 25 July 1895, TI!), Mt. Buko (Saitama Pref., Kanto region, T. Makino, 29 July 1888, KYO!, MAK!), and Mt. Hiei (Kyoto Pref., Kinki region, N. Takemura, 16 June 1901, MAK!). These specimens are considered to be syntypes. In the same paper, Makino (1901) further recognized two intraspecific taxa in *S. japonica* var. *intermedia*: a. *crenata* and b. *lobato-crenata*, but did not state to which forms the specimens cited above belonged. Makino (1912) raised *S. japonica* var. *intermedia* f. *crenata* into a variety citing the above-mentioned specimen from Mt. Buko. Makino (1901) characterized the *S. japonica* a. *crenata* as being more robust, with broad, crenate leaflets and primarily light-colored flowers. Among the four collections cited by Makino (1901), only collections from Mt. Buko showed such characteristics. Therefore, here I designate the specimen from Mt. Buko as the lectotype of *S. japonica* var. *crenata*. *Salvia japonica* var. *crenata* is currently known as *S. lutescens* var. *crenata* (Japanese name: Miyama-tamuraso).

Revised lectotypification of Salvia lutescens var. *intermedia*

Nakai (1950) considered *Salvia japonica* f. *lobatocrenata* Makino (1901) as a simple form of *S. lutescens*, differs only by flower color. Murata and Yamazaki (1993) followed Nakai (1950)'s treatment in the taxonomy, and designated the specimen from Mt. Hiei as the lectotype of var. *intermedia* among the four collections cited by Makino (1901). However, it is in serious conflict with the protologue of Makino (1901). Makino (1901) mentioned that the anther connective of var. *intermedia* was glabrous. When Makino (1912) reclassified *S. japonica* var. *intermedia* as *S. japonica* a. *typica*, he cited another specimen from Hakone (T. Makino, July 1911, KYO!, MAK, n.v.), for which the anther connective was glabrous as well. Takano (2017) conducted molecular phylogenetic and morphological analyses, revealed that var. *intermedia* is actually polyphyletic, the plants in Kanto and Kinki Districts fell into different clade, respectively. She also clarified the indumentums at the anther connective can be a diagnostic character, those of var. *intermedia* in the Kanto District ("Kanto form") are almost glabrous while those in the Kinki District ("Kinki form") are pilose. Furthermore, Makino stated that the stalk of the inflorescence becomes declinate toward ground and usually proliferous. The plants of Kanto form show slender stem, inflorescence stalk declinate towards the ground and proliferous after anthesis as often observed by us in the District (Fig. 1), whereas those of Kinki form show erect stem, and inflorescence that are never declinate and proliferous. Among three specimens cited by Makino (1901), the specimens from Mt. Hakone and Mt. Tsukuba show slender and declinate stems, glabrous at the base of the anther connective, whereas those from Mt. Hiei show erect stems, pilose at the base of the anther connective. The former two specimens apparently belong to the Kanto form, and the latter specimen is corresponded to the Kinki form. It is obvious that the Kanto form agrees well with Makino's description. Either of collection from Mt. Hakone or Mt. Tsukuba should be representative for var. *intermedia*. As compared with those, the specimen from Hakone is smaller, more gracile, and has pauci-lobato-crenate leaflets. Based



FIG. 1. A specimen of *Salvia lutescens* var. *intermedia* collected in Kanagawa Pref. (Y. Hasegawa 14844, 10 Sep. 1994, KPM-106878). Arrows indicate adventitious buds on the inflorescence axis.

on ICN Art. 9.19(b), I rejected the choice of Mt. Hiei, Kinki region, Japan (*N. Takemura s.n.*, MAK) as the lectotype of var. *intermedia* designated by Murata & Yamazaki (1993), and proposed here that the specimen from Mt. Hakone,

on 26 July 1881 (TI), be used as the new lectotype for *Salvia japonica* var. *intermedia* Makino [\equiv *S. lutescens* var. *intermedia* (Makino) Murata] (Fig. 2). There was no collector's name on the sheet, however, it is sure that it was collected by Ryo-

kichi Yatabe and Jinzo Matsumura, because they went to Hakone in July 1881 and conducted plant collections, as mentioned by Nakai (1915).

Since the description of Makino (1901) suggests that the plants in the Kanto region belong to var. *intermedia*, a new scientific name is needed for “var. *intermedia*” from the Kinki District. The plants in the Kinki District can be distinguished from the “true” var. *intermedia* by the lack of declinate inflorescence stalk, and the pilose base of the anther connective. Here I propose a new variety of *S. lutescens*, var. *occidentalis*. It is similar to *S. lutescens* var. *lutescens*, but differs with respect to the flower color (deep violet vs. pale yellow). Although both the distributions are sometimes parapatrically, especially in Shiga,

Mie, and Nara Prefectures, no populations have been found where these two taxa grow together.

Taxonomic treatment of *S. lutescens*, with description of a new variety, var. *occidentalis*

***Salvia lutescens* (Koidz.) Koidz.** in Acta Phytotax. Geobot. **3**: 151 (1934). —*Salvia japonica* Thunb. var. *lutescens* Koidz. in Bot. Mag. (Tokyo) **37**: 40 (1923). —Type: Japan. Prov. Ise (Mie Pref.), Gozaishoyama June 1922, *G. K & S. F. s.n.* (holo- KYO).

Distribution. Japan (Honshu and Shikoku). Endemic.

Key to the varieties of *Salvia lutescens*

- 1a. Base of anther connective pilose 2
- 1b. Base of anther connective usually glabrous, sometimes scattered hairs 3
- 2a. Flowers pale yellow var. *lutescens*
- 2b. Flowers deep purple, rarely white var. *occidentalis*
- 3a. Stems erect at anthesis, usually decumbent after anthesis often producing adventive buds at nodes but not stoloniferous 4
- 3b. Stems decumbent at base at anthesis, producing several stolons after anthesis from the base var. *stolonifera*
- 4a. Flowers deep purple; terminal leaflets ovate to oblong, sometimes rhomboid; apex acute var. *intermedia*
- 4b. Flowers pale purple; terminal leaflets widely ovate or orbicular-ovate; apex obtuse or rounded var. *crenata*

var. *lutescens*

Japanese name. Usugi-natsunotamurasō

Distribution. Japan, Honshu (Mie, Nara and Shiga Prefs.).

Notes. This variety show limited distribution within and around Suzuka Mountain Range, and is closely related to var. *occidentalis* with the exception of its flower color.

var. ***intermedia*** (Makino) Murata in Acta Phytotax. Geobot. **14**: 129 (1952), emend. here. —*Salvia japonica* Thunb. var. *intermedia* Makino [in Bot. Mag. (Tokyo) **11**: 108 (1897), *nom. seminud.*] in Bot. Mag. (Tokyo) **15**: 108 (1901). —*Salvia japonica* Thunb. var. *intermedia* Makino b. lobato-crenata Makino in Bot. Mag. (Tokyo) **15**: 110 (1901), *in nota*, *nom. superfl.* —*Salvia lutescens*

(Koidz.) Koidz. f. *lobato-crenata* (Makino) Murata in Acta Phytotax. Geobot. **14**: 65 (1950). —Type: Japan, Honshu, Prov. Sagami (Kanagawa Pref.), Mt. Hakone, 26 July 1881, *R. Yatabe & J. Matsumura*, (**Lecto- TI, designated here**; Fig. 2); Prov. Hitachi (Ibaraki Pref.), Mt. Tsukuba, 8 July 1895, *C. Owatari s.n.*, (syn- TI); *ibid.*, 25 July 1895, *C. Owatari s.n.*, (syn- TI); Prov. Musashi (Saitama Pref.), Mt. Buko, 20 July 1888, *T. Makino s.n.*, (syn- TI, also the lecto- of *S. japonica* f. *crenata*); Prov. Yamashiro (Kyoto Pref.), Mt. Hiei 16 June 1901, *N. Takemura s.n.*, (syn- MAK = *S. lutescens* var. *occidentalis*).

Distribution. Japan. Honshu (Kanagawa, Yamanashi, and Shizuoka Prefs.).

Notes. In Kanto region, var. *intermedia* and var. *crenata* are sometimes difficult to be distin-



FIG. 2. Newly designated lectotype of *Salvia japonica* var. *intermedia* (R. Yatabe & J. Matsumura s.n., 26 July 1881, TI).

guished. Flower color could be changed from deep to light purple. Further study including var. *crenata*, var. *intermedia*, and var. *stolonifera* is needed. Details are discussed below.

var. **crenata** (Makino) Murata in Acta Phytotax. Geobot. **14**: 129 (1952). —*Salvia japonica* Thunb. var. *intermedia* Murata a. *crenata* Makino in Bot. Mag. (Tokyo) **15**: 110 (1901), *in nota*. —*Salvia lutescens* (Koidz.) Koidz. f. *crenata* (Makino) G. Nakai in Acta Phytotax. Geobot. **14**: 66 (1950). —*Salvia lutescens* (Koidz.) Koidz. var. *crenata* (Makino) Murata in Acta Phytotax. Geobot. **14**: 129 (1952). —**Lectotype**: Japan, Honshu, Prov. Musashi (Saitama Pref.), Mt. Buko, 20 July 1888, T. Makino s.n. (**TI**, designated here).

Distribution. Japan (Central to Northern Honshu).

Note. This variety shows the widest distribution area in the species, and has wide morphological variation (mentioned below).

var. **occidentalis** A. Takano, var. nov. —Fig. 3

Similar to *Salvia lutescens* var. *lutescens*, but differing by virtue of deep violet corollas (vs. pale yellow corollas). Plants with white flowers occasionally also found. Also resembling *S. lutescens* var. *intermedia* in flower color, but differing in terms of pilose base of anther connective (vs. almost glabrous base of anther connective) and erect inflorescence stalk (vs. proliferous stalk occasionally generating new shoots after flowering).

Typus. JAPAN, HONSHU. Prov. Yamashiro (Kyoto Pref.), Mt. Hiei, 16 June 1901, N. Takemura s.n., MAK70418 (holo- MAK!).

Salvia lutescens (Koidz.) Koidz. var. *intermedia* (Makino) Murata f. *albiflora* Murata in Acta Phytotax. Geobot. **14**: 129 (1952).

Distribution. Japan. Honshu, Kinki Distr. (Kyoto, Hyogo, Nara, Osaka, Wakayama, Shiga and Mie Prefs.) and Shikoku (Kochi Pref.).

Japanese name. Nishino-tamuraso.

Etymology. The specific epithet refers to the distribution of the taxon (western part of Japan).

Note. The plants from Kochi Pref. previously recognized as *S. lutescens* var. *intermedia* are also identified as var. *occidentalis*, since they have erect stems, deep purple corolla, and pilose hairs at the base of the anther connective. *Salvia lutescens* var. *intermedia* forma *albiflora* is considered to be a white floral morph of var. *occidentalis*. The type (G. Murata 5214, 30 May 1951, KYO!) showed indumentums at the base of the anther connective and erect inflorescence. No morphological differences were found between var. *occidentalis* with exception of floral color. Occasionally, a few individuals bearing white flowers were found in the var. *occidentalis* population. At the type locality of forma *albiflora*, Murata also collected var. *occidentalis* (G. Murata 5213, KYO!), on the same day.

Additional specimens examined. JAPAN. HONSHU: **Kyoto Pref.**: Rakuhoku, Ohara, Otonashi W. F., *S. Hajacava* s.n. (TI); Kyoto, Ohara, T. Tsuyama s.n. (TI); Kiyo-taki-Takao, Ukyo-ku, Kyoto, S. Tsugaru & T. Takahashi 26448 (KYO); Mt. Hyotankuzure-yama, near Ohara, G. Nakai 5401 (KYO); *ibid.*, G. Nakai s.n. (KYO); Kadonogun, Nakagawa-mura, M. Tagawa 887 (KYO, two sheets); Maesaka Takanomine to Shimosugisaka, S. Okamoto s.n. (KYO); Bodai W. F., Nakagawa, G. Nakai 6305 (KYO); Mt. Kibune, *unknown collector* (KYO); Kyoto-shi, Nakagawa to Bodai no Taki, M. Hutoh 10515 (OSA); *ibid.*, M. Hutoh 9264 (OSA); *ibid.*, M. Hutoh 10528 (OSA); *ibid.*, M. Hutoh 3465 (OSA); Mt. Hiei-san, S. Tanaka s.n. (OSA). **Hyogo Pref.**: Taki-gun, Nishiki-cho, T. Kobayashi 23369 (HYO); Youtakuji, Sanda, T. Makino 62583 (KYO); Moshi, Sanda, A. Takano 140813-1 (HYO). **Nara Pref.**: Yamato, Sanjo-ga-dake to Gyojagaeri, Y. Momiyama s.n. (TI) (three sheets); *ibid.*, H. Hara s.n. (TI); *ibid.*, T. Kobayashi 30611 (OSA); near the temple Kongo, Kashiwagi, Yamato, K. Kondo s.n. (TI); Kosei River, Tenkawa Village, K. Seto 44248 (OSA); Mt. Omine to Mt. Sanjogadake, H. Hara 4683 (TI); en route from Wasamata hut to Mt. Nihon-dake, Kamikitayama-mura, M. Okamoto 1966 (OSA); Mt. Daifugendake, T. Kodama 10833 (OSA); Shonoiwaya-Mt. Wasamata Kamikitayama-mura, K. Kodama 14356 (OSA); Irinami, Yamato, S. Sakaguchi s.n. (KYO); Mt. Ohmine, S. Sakaguchi s.n. (KYO); en route from Mt. Sanjo to Mt. Daihugen, T. Kodama s.n. (KYO); Mt. Sanjo, G. Koidzumi s.n. (KYO); Mt. Yamatokatsuragi, Gose, A. Takano 140819-1 (HYO). **Osaka Pref.**: Mt. Izumi-katsuragi, S. Nakanishi s.n. (OSA); *ibid.*, T. Nakajima s.n. (OSA); *ibid.*, C. Satonaka s.n. (OSA). **Wakayama Pref.**: Ryujin-Mura, Koya, T. Nakajima s.n. (two sheets, TI); Doro Hacho, G. Nakai 5213 (KYO); *ibid.*, T. Kodama s.n. (OSA); *ibid.*, M. Hori s.n. (OSA); Hidaga-gun, Ooze,



FIG. 3. Holotype of *Salvia lutescens* var. *occidentalis* A. Takano, collected in Shiga Pref. (*N. Takemura s.n.*, 16 June 1901, MAK-70418). A close-up photo of a flower of the specimen is inset at upper-right. Open circles indicate the hairy base of the anther connective.

S. Sakaguchi s.n. (KYO); Mt. Sukuyama, Katsuragi-cho, Ito-gun, K. Seto 29839 (KYO, OSA); Mt. Kurosawa, Sayiki-mura, Y. Ogawa *s.n.* (KYO). **Shiga Pref.:** Omi,

Tochu, *M. Togashi* 1205 (TI); Tochu to Ikadachi, *M. Umebayashi* 737 (KYO); Mt. Hiei, *G. Murata* 11415 (KYO); Ukawa, Shiga-cho, *M. Tanimoto s.n.* (KYO); Benzaiten to

Sakamoto, Mt. Hiei, *S. Tanaka s.n.* (KYO). **Mie Pref.:** Wada, Kiwa-cho, Minami-murogun, *H. Takahashi 21040* (KYO); Taki-gun, Miyagawa-mura, Shimomate (cult.), *K. Seto 17303* (OSA). **Shikoku:** **Kochi Pref.:** Tosa-gun, Tosa-cho, Mt. Mitsuji, *H. Sasaki et al. FOS-003347, 3348* (MBK); *ibid.*, *A. Sakamoto FOS-003335, FOS-003336* (MBK); *ibid.*, *A. Sakamoto FOS-005121, FOS-005122, FOS-005124* (MBK); *ibid.*, *A. Takano 140729-8, 140729-10, 140729-21* (HYO); Tosa-gun, Tosa-cho, Akaragi Pass, *T. Yamawaki M61-074* (MBK); *ibid.*, *A. Takano 140729-28* (HYO).

var. **stolonifera** G. Nakai in Acta Phytotax. Geobot. 14: 66 (1950).

Type: Japan, Honshu, Prov. Mikawa (Aichi Pref.), Mt. Dando, 21 June 1933, *T. Suzuki s.n.* (holo- KYO).

Note. Variety *stolonifera* was established as a separate variety based on the emerging stolons after anthesis (Nakai 1950). With the exception of the stolons, however, it is almost impossible to distinguish this variety from var. *intermedia* and var. *crenata*. Further study, including stability of the characteristics, is needed.

Distribution. Japan. Honshu (Aichi and Shizuoka Prefs.).

Other specimens examined. Japan, Honshu, Prov. Mikawa (Aichi Pref.), Mt. Dando (*T. Suzuki s.n.*, 23 July 1932, KYO-paratype); *ibid.*, 29 Sep. 1933, *T. Suzuki s.n.* (KYO-paratype).

Molecular phylogenetic analyses using nrDNA revealed close relationships among the three varieties of *Salvia lutescens* in eastern Japan: var. *crenata*, var. *intermedia*, and var. *stolonifera*, together with *S. isensis* (Takano 2017). These three taxa are distinguished by their floral color (deep violet in var. *intermedia* vs. pale purple in var. *crenata* and var. *stolonifera*), the shape of the terminal leaflets (rounded in var. *crenata* vs. acute in var. *intermedia*), and the bearing of either several emerging stolons (var. *stolonifera*) or no stolons (var. *intermedia* and var. *crenata*) after anthesis. However, recent surveys revealed that wide morphological variations in the leaf shape of var. *crenata* (Sakurai 2003). Sekiguchi (2001)

mentioned that some var. *crenata* plants showed an intermediate morphology with respect to leaflet shape. There are also floral color variations in var. *intermedia*, ranging from pale blue to deep violet in Kanagawa and Yamanashi Prefectures (T. Katsuyama and T. Kobayashi, pers. comm.). Furthermore, short stolons are sometimes found in var. *intermedia* and var. *crenata* (Sekiguchi 2001). Some individuals of var. *crenata* from Niigata have adventitious buds on the inflorescence stem, similar to the var. *intermedia* individuals, as recorded by Makino (1912) (Sakurai 2003). These diagnostic characters might not be stable and useful as previously thought; therefore, they should be carefully re-examined for these three taxa in eastern Japan, as well as *S. isensis*, for future revisions in the classification of these taxa.

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