

Revision of *Mosla* (Lamiaceae) in Taiwan

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ABSTRACT: The genus *Mosla* Buch.-Ham. ex Maxim. has long been a source of confusion in Taiwan. Three species, *Mosla chinensis* Maxim., *M. dianthera* (Buch.-Ham.) Maxim. and *M. scabra* (Thunb.) Wu & Li are recognized in Taiwan in this paper. *Mosla formosana* Maxim., which was previously treated as an insufficiently known species, is reduced to synonymy under *M. dianthera* (Buch.-Ham.) Maxim. SEM micrographs of pollen grains and nutlets, chromosome numbers, distribution maps, a key to species and species descriptions are provided. The ornamentation of the nutlet is a good diagnostic character for recognizing plants at specific rank in this genus.

KEY WORDS: *Mosla*, Lamiaceae, Revision, Taiwan.

INTRODUCTION

The genus *Mosla* Buch.-Ham. ex Maxim. comprises about 22 species distributed in eastern and southern Asia (Li and Hedge 1994). According to Huang and Cheng (1978), in Taiwan there are three species and one variety: *Mosla chinensis* Maxim., *M. dianthera* (Buch.-Ham.) Maxim., *M. dianthera* (Buch.-Ham.) Maxim. var. *nana* (Hara) Ohwi and *M. punctata* (Thunb.) Maxim. Plants previously identified as *Mosla punctata* (Thunb.) Maxim. were determined to be *M. scabra* (Thunb.) C.-Y. Wu & H.-W. Li (1974). *Mosla dianthera* and *M. scabra* are similar in morphology as well as in habitat preference and these two species often occur in the same locality and are usually misidentified as herbarium specimens. *Mosla dianthera* (Buch.-Ham.) Maxim. and *M. dianthera* (Buch.-Ham.) Maxim. var. *nana* (Hara) Ohwi are variable in external morphology, such as in plant size, hairiness, corolla size and nutlet size. The small pilose individuals are usually treated as *M. dianthera* var. *nana* (Hara) Ohwi (Murata and Yamazaki 1993; Huang and Cheng 1978), but our results shows that it is difficult to distinguish them. Maximowicz (1875) proposed *M. formosana* based on Oldham 362 (K). It was accepted as a distinct species by Keng (1969), H.-W. Li (1974), C.-Y. Wu and H.-W. Li (1977), and Li and Hedge (1994). Because no specimens of this species were available in Taiwan herbaria, it was treated as an insufficiently known species by Huang and Cheng (1978).

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Based on a numerical analysis, Cheng reported some hybrid populations between *M. dianthera* and *M. scabra* (as *M. punctuata*) (Cheng 1980), meanwhile, Zhang and Hsu reported five species of *Mosla* to be distributed in the same habitat but without any hybrid individuals (Zhang and Xu 1988). Zhang and Xu also reported that the chromosome number of *M. chinensis*, *M. dianthera*, and *M. scabra* to be $2n=18$. So, because of the various treatments, a revision of *Mosla* in Taiwan was needed.

MATERIALS AND METHODS

Both fresh materials collected in the field and herbarium specimens were examined. Vouchers are deposited in the Herbarium of the Department of Botany, National Taiwan University (TAI), except for a few specimens indicated by the herbarium acronyms of their places of deposition.

Pollen grains were acetolyzed according to procedures outlined by Erdtman (1952). The acetolyzed grains were dehydrated in an ethanol series and dried by critical point drying. Dried grains were coated with gold and examined by SEM. The root tips were treated in a solution of 0.002 M 8-hydroxyquinoline for 3-4 hours at a temperature of 18- 20°C, fixed in a 1: 3 acetic: ethanol solution overnight, then hydrolyzed in pectinase and squashed in acetic orcein.

RESULTS

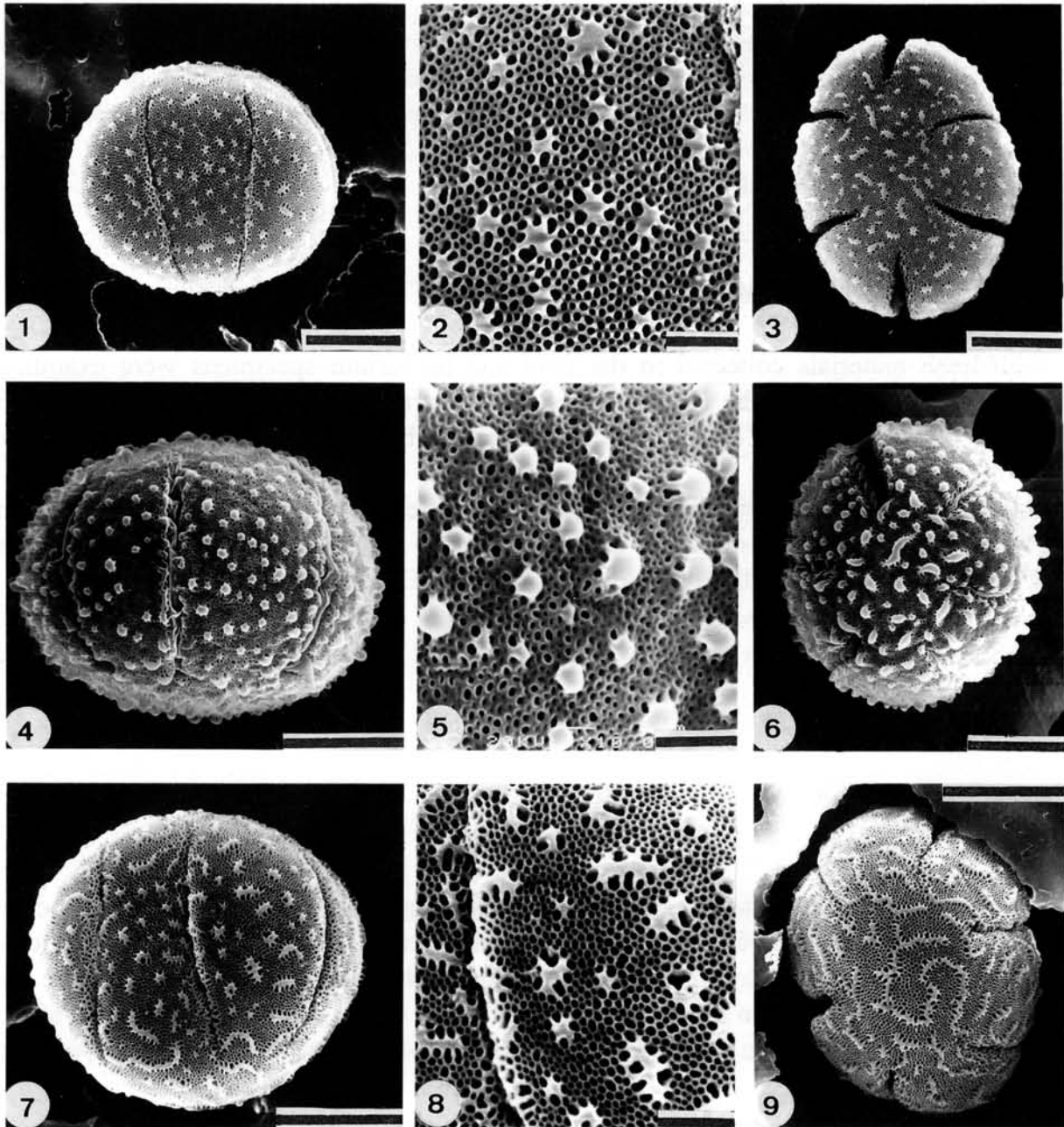
External morphology

The narrow lanceolate leaves and widely overlapping ovate bracts of the inflorescences of *Mosla chinensis* are different from those in other species. *Mosla dianthera* is close to *M. scabra*, but differs from it by having glabrous stems, 4-7 pairs of deep teeth on the leaf margin, short deltoid lobes on the upper lip of the calyx. *Mosla scabra* has pubescent stems, 5-10 pairs of shallow teeth on the leaf margins and ovate-lanceolate lobes on the upper lip of the calyx.

Pollen grains

Pollen grains are six-colpate, the columelae are unbranched, the tectum is reticulate with a tectate-perforate to microreticulate exine structure and the surface is ornamented with discontinuous supracteal ridges in the three species of *Mosla* in Taiwan. However, it is easy to distinguish the three species by the supracteal ridges of the surface ornamentation. Pollen grains of *Mosla chinensis* have round or short supracteal ridges both in equatorial and polar view (Figs. 1-3). Pollen grains of *M. dianthera* have round supracteal ridges in equatorial view and round or short supracteal ridges in polar view (Figs. 4-6). Pollen grains of *M. scabra* have round or short supracteal ridges in equatorial view and long supracteal ridges in polar view (Figs. 7-9).

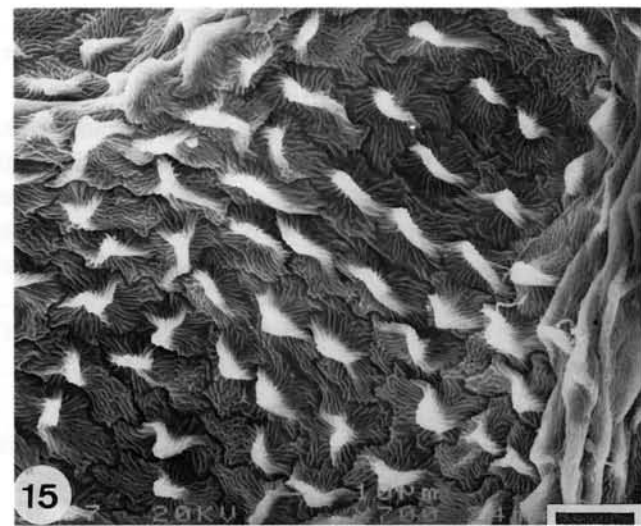
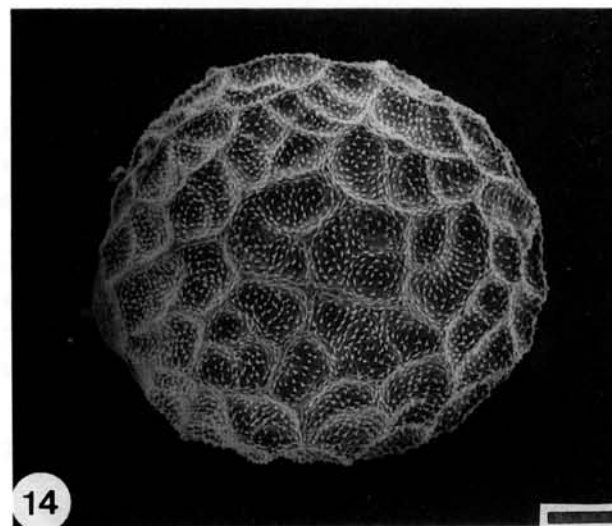
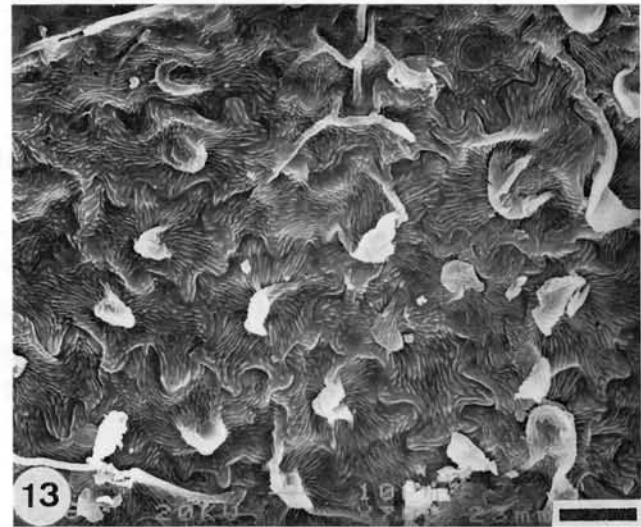
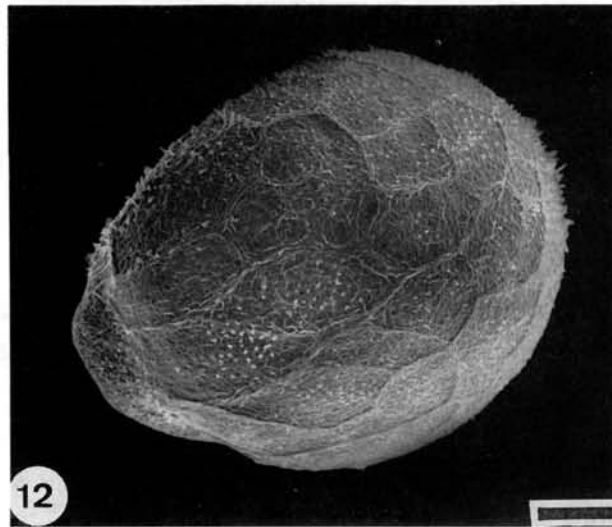
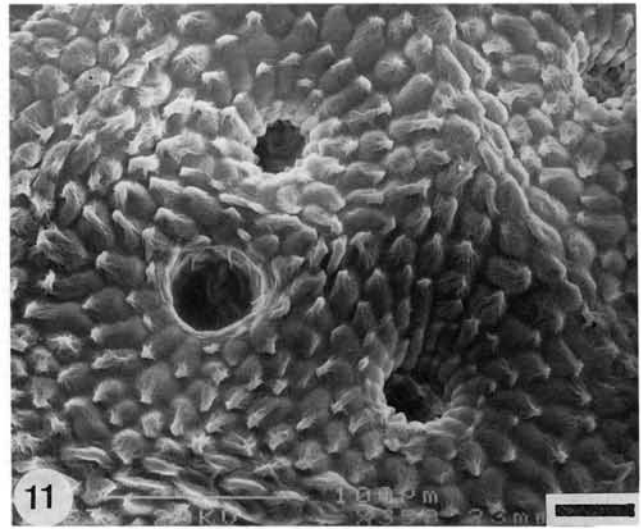
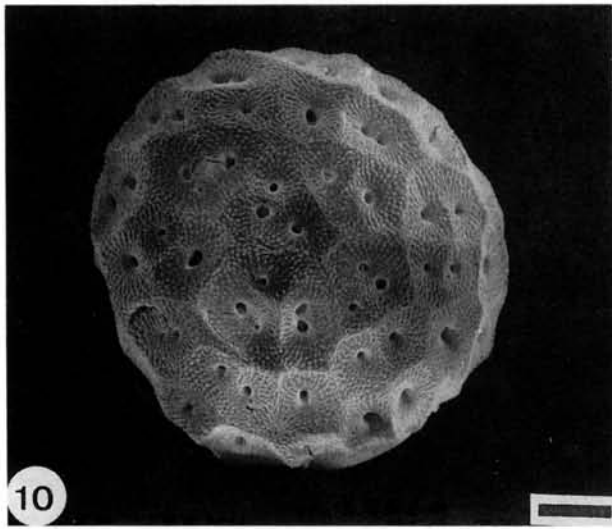
Wagstaff (1992) also reported on the pollen grains of *M. dianthera*, but his SEM micrographs are similar to *M. scabra*.



Figs. 1-9. SEM micrographs of pollen grains of *Mosla* in Taiwan. *M. chinensis* Maxim (Figs. 1-3), *M. dianthera* (Buch.-Ham.) Maxim. (Figs. 4-6), *M. scabra* (Thunb.) Wu & Li (Figs. 7-9). Scale bar = 10 μm , except 2 μm in 2, 5 and 8.

Nutlet

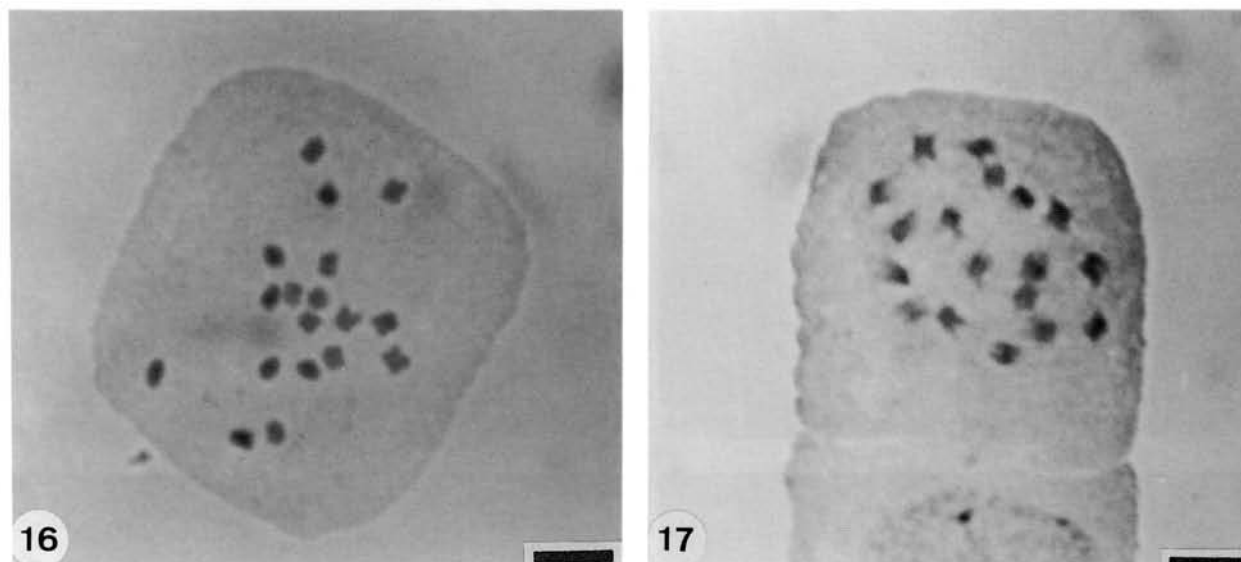
The pitted nutlet surface with small depressions in *Mosla chinensis* is very different from the others (Figs. 10 and 11). The nutlet of *M. dianthera* has a sparsely netted surface (Figs. 12 and 13), but the nutlet of *M. scabra* has dense depressions on the netted surface (Figs. 14 and 15). Li and Hedge (1994) described the nutlet surface of *M. scabra* as being pitted with small depressions, but their observations are not supported by our results. The ornamentation of the nutlet is a good diagnostic character for recognizing plants at specific rank in the genus *Scutellaria* L. (Hsieh and Huang, 1995) as well as the genus *Mosla*.



Figs. 10-15. SEM micrographs of nutlets of *Mosla* in Taiwan. *M. chinensis* Maxim. (Figs. 10 and 11), *M. dianthera* (Buch.-Ham.) Maxim. (Figs. 12 and 13), *M. scabra* (Thunb.) Wu & Li (Figs. 14 and 15). Scale bar = 200 μ m, except 40 μ m in 11, 13, and 15.

Chromosome number

The chromosome number of *M. dianthera* (Fig. 16) and *M. scabra* (Fig. 17) is $2n=18$.



Figs. 16-17. Chromosome number of *M. dianthera* (Buch.-Ham.) Maxim. (Fig. 16), and *M. scabra* (Thunb.) Wu & Li (Fig. 17). Scale bar = 5 μ m.

Distribution

Mosla chinensis is distributed in northern Taiwan in Ilan and Taipei Hsien. *Mosla dianthera* is distributed in northern and central Taiwan in Ilan, Taipei, Hsinchu and Taichung Hsien. *Mosla scabra* is distributed throughout the island (Fig. 18).

TAXONOMIC TREATMENT

Key to Species

1. Flowers solitary in upper leaf axils or in short spike-like racemes; bracts leaf-like, ovate or widely ovate, longer than pedicels; leaves narrowly lanceolate; nutlet with ornamentation pitted 1. *M. chinensis*
1. Flowers in slender racemes; bracts lanceolate or narrowly lanceolate, as long as or shorter than pedicels; leaves narrowly ovate to widely ovate; nutlet ornamentation netted
 2. Leaves ovate to widely ovate, margins with 4-7 pairs of deep teeth; upper lip of calyx shallowly toothed, teeth broadly triangular; nutlets loosely netted 2. *M. dianthera*
 2. Leaves narrowly ovate, margins with 5-10 pairs of shallow teeth; upper lip of calyx deeply toothed, teeth narrowly triangular; nutlets densely netted 3. *M. scabra*

1. *Mosla chinensis* Maxim. in Bull. Acad. Imp. Sci. Saint-Petersbourg. 29: 177. 1883; Huang & Cheng in Fl. Taiwan 4: 488. 1978.

Annual erect herbs, 10-40 cm tall. Stems square, much branched from base, white pilose. Petiole 3-5 mm long, sparsely pubescent; blade linear-oblong to linear-lanceolate, 1.3-2.8 cm long, 2-4 mm wide, impressed brown glandular, base attenuate to cuneate, apex acuminate to

acute, margin remotely shallowly serrate. Racemes terminal, capitate, 1-3 cm long; bracts overlapping, rarely lax, ovate to widely ovate, 4-7 x 3.0-3.5 mm, long pilose on margin, palmately 5-veined from base, apex caudate. Calyx campanulate, ca. 3 mm long in flower, 7 mm long in fruit, long pilose, subequally 5-lobed; lobes linear-lanceolate, acuminate. Corolla tubular, bilabiate, ca. 7 mm long, punctate-puberulent outside; upper lip widely orbiculate, emarginate, ca. 1 mm long; lower lip ca. 1.5 mm long, 3-lobed. Stamens 2, included. Staminodes 2, anterior. Nutlets gray-brown, globose, ca. 1.2 mm long, glabrous, pitted with small depressions.

Distribution: Japan, S. Korea, Taiwan and C. to S. China

Specimens examined: Taipei: Hsintien, Suzuki 4453; Tari Farm, Chung & Kao 2882; Nankang, Cheng 1548. Ilan: Chiaoichi, Nakamura 4778; Mohpo, Faurie 805.

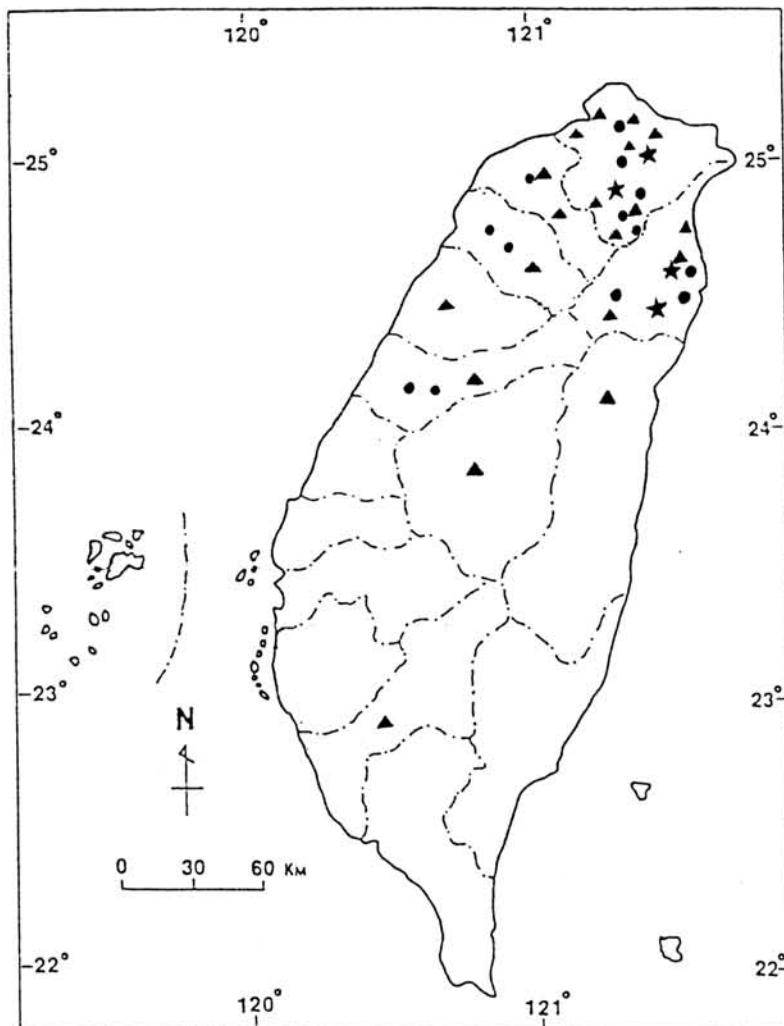


Fig. 18. Distribution map of *Mosla* in Taiwan. *Mosla chinensis* Maxim (★), *M. dianthera* (Buch.-Ham.) Maxim. (●), and *M. scabra* (Thunb.) Wu & Li (▲).

2. *Mosla dianthera* (Buch.-Ham. ex Roxb.) Maxim. in Bull. Acad. Imp. Sci. Saint-Petersbourg 20: 457. 1875; Huang & Cheng, Fl. Taiwan 4: 489. 1978.

- Lycopus diantherus* Buch.-Ham. ex Roxb., Fl. Ind. 1: 145. 1820.
Mosla dianthera (Buch.-Ham. ex Roxb.) Maxim. var. *nana* (Hara) Ohwi, Fl. Jap. Engl. ed.: 780. 1965; Huang & Cheng, Fl. Taiwan 4: 489. 1978.
Mosla formosana Maxim. in Bull. Acad. Imp. Sci. Saint-Petersbourg 20: 459. 1875; Hayata, Icon. Pl. Formosan. 8: 804. f. 35-1. 1919. Keng in Gard. Bull. Singapore 24: 122. 1969. *syn. nov.*
Mosla lysimachiflora Hayata, Icon. Pl. Formosan. 8: 104. f. 35-3. 1919.

Annual erect herbs, 30-70 cm tall. Stems loosely branched, quadrangular, glabrous or sparsely pubescent. Leaves chartaceous; petioles 0.3-1.8 cm long; blade ovate to rhombic-lanceolate, 1.2-33.5 x 0.5-1.8 cm, adaxially glabrous or subglabrous, abaxially gray, glabrous, sparsely impressed glandular, base cuneate, attenuate into petiole, apex acuminate to acute, margins of remotely acute serrations, 4-7 pairs. Inflorescences terminal and axillary racemes, 3-15 cm long. Bracts narrowly lanceolate, acuminate, 2-3 mm long, glabrous or sparsely pubescent. Pedicel ca. 1 mm long in flower, 2 mm long in fruit, pubescent. Calyx campanulate, bilabiate, ca. 2 mm long in flower, 4-5 mm long in fruit, subdensely spreading pilose near base; upper lip 3-lobed, lobes deltoid, acute to obtuse; lower lip deeply bilobed, lobes triangular-lanceolate; acuminate. Corolla tubular, bilabiate, ca. 4-6 mm long, pinkish, punctate puberulent outside. Stamens 2, included; staminodes 2, anterior. Nutlets globular, 1-1.5 mm long, loosely netted. Chromosome number $2n=18$.

Distribution: Japan, Korea, Manchuria, Ussuri, Amur, Taiwan, China, Indochina, Malaysia and N. India.

Specimens examined: **Ilan:** Nanao, T. C. Huang & S. F. Huang 13365; Chiaochi, Kao 4002; Taipingshan, Kao 7654. **Taipei:** Hsinchu, Wo 1129; Tatumshan, Kuo 10211; Wangtan, Cheng 592; Chichu, Cheng & Kao 3092; Pinglin, Yang 1412. **Taoyuan:** Suzuki, T. 21371. **Hsinchu:** Wuchihshan, Hsu 15093; Henshan, C. I. Peng 12143 (HAST). **Taichung:** Shunkuan, T. C. Huang & S. F. Huang 7301; Peichung, C. M. Wang 1814 (HAST).

This species is variable in external morphology such size, hairiness, corolla size, and nutlet size. Small, pilose individuals are usually treated as *M. dianthera* var. *nana* (Hara) Ohwi, but our observations show that it is difficult to distinguish them. We therefore treat *M. dianthera* as a single, variable species. Maximowicz (1875) proposed *M. formosana* based on Oldham 362 (K). Because no specimens of this species were available in Taiwan herbaria, it was treated as an insufficiently known species by Huang and Cheng (1978). Based on the photo of the type specimen (K!), it is difficult to distinguish it from *M. dianthera* and we treat it as a synonymy of the latter.

3. *Mosla scabra* (Thunb.) C.-Y. Wu et H.-W. Li in Acta Phytotax. Sin. 12: 212. 1974.

- Ocimum punctatum* Thunb., Fl. Jap. 249. 1784. *non* L. (1781).
Ocimum punctulatum J. F. Gmel., Syst. Nat. 2: 917. 1791. Sphalm.
Ocimum scabrum Thunb. in Trans. Linn. Soc. Bot. 2: 338. 1794.
Mosla punctata (Thunb.) Maxim. in Bull. Acad. Imp. Sci. Saint-Petersbourg 20: 460. 1875.
Mosla leucantha Hayata, Icon. Pl. Formosan. 8: 104. f. 35-2. 1919.
Mosla punctulata (J. F. Gmel.) Nakai in Bot Mag. Tokyo 42: 475. 1928; Huang & Cheng, Fl. Taiwan 4: 489. 1978.

Annual erect herbs 30-70 cm tall. Stems loosely branched, quadrangular, recurved puberulent. Leaves opposite, chartaceous; petiole 0.3-1.6 cm long; blade narrowly ovate, 1.5-3.5 x 1-1.7 cm, subglabrous or sparsely pubescent, densely impressed glandular, acute at both ends, attenuate into petiole, with 5-10 pairs of shallow teeth, both surfaces glabrous and glandular dotted. Inflorescences terminal and axillary racemes, 2.5-15 cm long, rachis subdensely puberulent. Bracts narrowly ovate to narrowly lanceolate, 2-3 mm long, densely fine white pilose. Pedicel ca. 1 mm long in flower, 2 mm long in fruit, subdensely puberulent. Calyx campanulate, bilabiate, ca. 2 mm long in flower, 4 mm long in fruit, pilose outside, glandular dotted; upper lip 3-lobed, lobes ovate-lanceolate, apex acuminate; lower lip deeply bilobed, lobes triangular-lanceolate, acuminate. Corolla tubular, bilabiate, ca. 3-4 mm long, pinkish or whitish. Stamens 2, included; staminodes 2, anterior. Nutlets globular, 1.2 mm long, densely netted. Chromosome number $2n=18$.

Distribution: Japan, Korea, Taiwan, C. to S. China and Vietnam.

Specimens examined: **Ilan:** Chiaochi, *Kao* 4002; Nanshan, *Chuang & Kao* 2428; Tungao, *T. C. Huang* 5062; Taipingshan, *Suzuki s. n.* Aug. 1. 1928. **Taipei:** Inhotung, *Cheng* 1578; Wangtan, *Cheng* 1496; Siaokotou, *Hsu* 1033; Kueishan, *T. C. Huang* 7538; Wulai, *Hsieh* 881; Tanshui, *Cheng* 1568; Tatunshan, *Kuo* 8962 & 8992, *Kao* 9292; Chishingshan, *Hsu* 5080; Yangmingshan, *Cheng* 1030. **Taoyuan:** Tachih, *Fujita s. n.* Sep. 1937; Jenmei, *Kuo* 6456. **Hsinchu:** Kuanwu, *T.-C. Huang* 6607. **Miaoli:** Tunglo, *T. C. Huang* 13136. **Taichung:** Sungmao, *Kuo et al.* 8756. **Nantou:** Lushan, *Cheng* 1563. **Kaohsiung:** Tengchih, *T. C. Huang* 15870. **Hualien:** Tienhsiang, *Shimizu & Kao* 10602.

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台灣產石薺寧屬植物(唇形科)之訂正

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摘 要

台灣產石薺寧屬 (*Mosla* Buch.-Ham. ex Maxim.) (唇形科) 之分類地位長期以來十分混亂，在標本鑑定上常生混淆，實需進行分類訂正工作。根據外部形態、小堅果和花粉等特徵，可將臺灣產本屬植物分為3種，分別為乾汗草 (*Mosla chinensis* Maxim.)、粗鋸齒薺寧 (*M. dianthera* (Buch.-Ham.) Maxim.)、石薺寧 (*M. scabra* (Thunb.) Wu & Li)。本文比較3種之上述特徵，可明顯予以區分，並提供檢索表便於鑑定之用。另查對 *Mosla formosana* Maxim. 原始發表和模式標本與粗鋸齒薺寧相符合，將前者處理為後者之異名。本文並認為小堅果的表面微細構造為區分種階級的良好特徵。

關鍵詞：石薺寧屬、唇形科、分類訂正、臺灣。

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