

A Taxonomical Study of the Genus *Medicago* (Fabaceae) from Mt. Hohuan of Taiwan

合歡山苜蓿屬(豆科)植物之分類

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Abstract

The genus *Medicago* (Fabaceae) comprises 83 to 87 species in the world, of which three species have been reported from Taiwan. These are *Medicago lupulina* L. and *Medicago polymorpha* L., two naturalized species to the northern Taiwan at elevations below 700 m, and *Medicago sativa* L., a cultivated species. We conducted a field survey of *Medicago* at Mt. Hohuan of Taiwan at elevations between 2,500 m to 3,000 m. Four weedy species were found, namely *Medicago lupulina*, *M. polymorpha*, *M. arabica* (L.) Huds., and *M. minima* (L.) Bartal., Among them *M. arabica* and *M. minima* are new records to the flora of Taiwan. This paper briefly describes the four species with a key to the species, their photographs, and draws of two newly recorded species for aiding in identification.

摘要

苜蓿屬植物為豆科的一個屬共有 83-87 種。台灣植物誌第二版記載了 2 歸化種及 1 栽培種，紀錄上 2 歸化種皆分布於 700 m 以下的低海拔。本研究報導合歡山區海拔 2,500~3,000 m 的苜蓿屬植物，共記錄有 4 歸化種，分別為褐斑苜蓿(*Medicago arabica* (L.) Huds.)、天藍苜蓿(*M. lupulina* L.)、小苜蓿(*M. minima* (L.) Bartal.)與苜蓿(*M. polymorpha* L.)，其中褐斑苜蓿與小苜蓿為台灣新歸化種。本文提供合歡山區所產野生苜蓿屬的檢索表，新歸化種素描圖，4 歸化種的描述、分布及彩色照片。

Key words: Fabaceae, *Medicago*, *Medicago arabica*, *Medicago minima*, new records, Taiwan

關鍵詞：豆科、苜蓿屬、褐斑苜蓿、小苜蓿、新紀錄、台灣

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Introduction

Urban (1873) first published a comprehensive monograph of the genus *Medicago* that comprised 46 species worldwide. The number of species in the genus has been expanded recently to 83 to 87 (Small and Jomphe 1989; Lewis *et al.* 2005; Steele *et al.* 2010). *Medicago* belongs to the subtribe Trigonellinae of the tribe Trifolieae in the family Fabaceae which includes two more genera *Trigonella* and *Melilotus*. The native ranges of most of the species are in countries bordering to or nearby the Mediterranean Sea, the Arabian Peninsula, Iraq, and the eastern Balkans (Maureira-Butler *et al.* 2008). Using morphological characters of fruits, flowers and seedlings, Small and Jomphe (1989) developed the most recent classification system of *Medicago* and proposed 12 sections and 8 subsections.

In Taiwan three species of *Medicago* have been reported (Huang and Ohashi 1993). Among them *Medicago lupulina* L. and *Medicago polymorpha* L are naturalized to northern Taiwan on open sandy seashores and field lands at elevations of less than 100 m for the former and on the open wastelands at elevations to about 700 m for the latter. *Medicago sativa* L. is native to Europe and the western Asia. It is a cultivated species to Taiwan.

We conducted a field survey of *Medicago* at Mt. Hohuan at elevations of 2,500 m to 3,000 m. Four weedy species were found: namely *Medicago lupulina*, *M. polymorpha*, *M. arabica* (L.) Huds., and *M. minima* (L.) Bartal. Among them the latter two species are newly recorded to the flora of Taiwan, while the latter three and *M. sativa* L. (Small and Jomphe 1989) are common to be encountered most likely. This paper briefly describes the taxonomic accounts of the four species of

Medicago from Mt. Hohuan, and provides with a key to the species, their color field photographs,

and draws of two newly recorded species for aiding in identification.

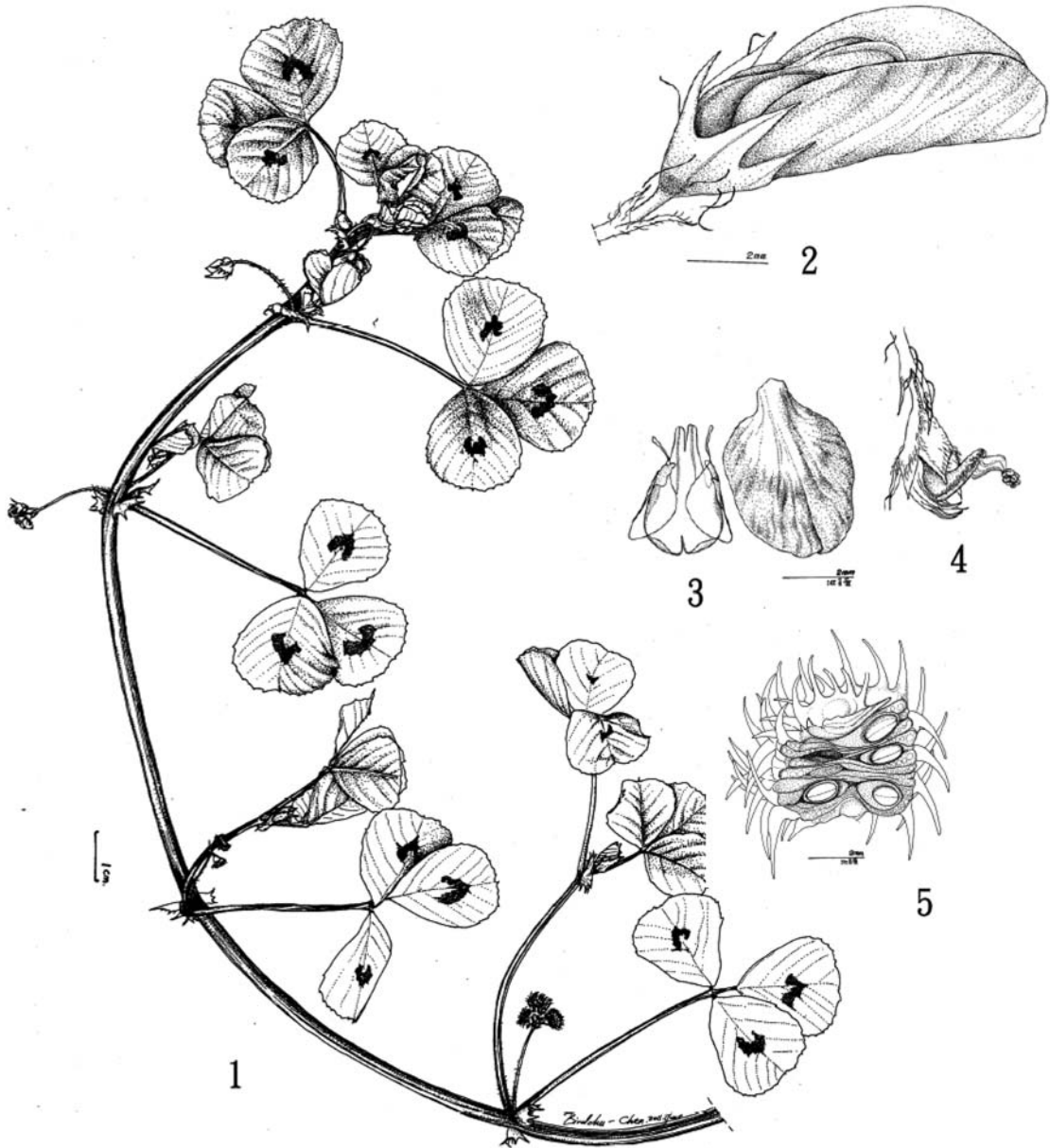


Fig. 1. *Medicago arabica* (L.) Huds. (1, habit; 2, flower; 3, corolla ; 4 and 5, fruits).

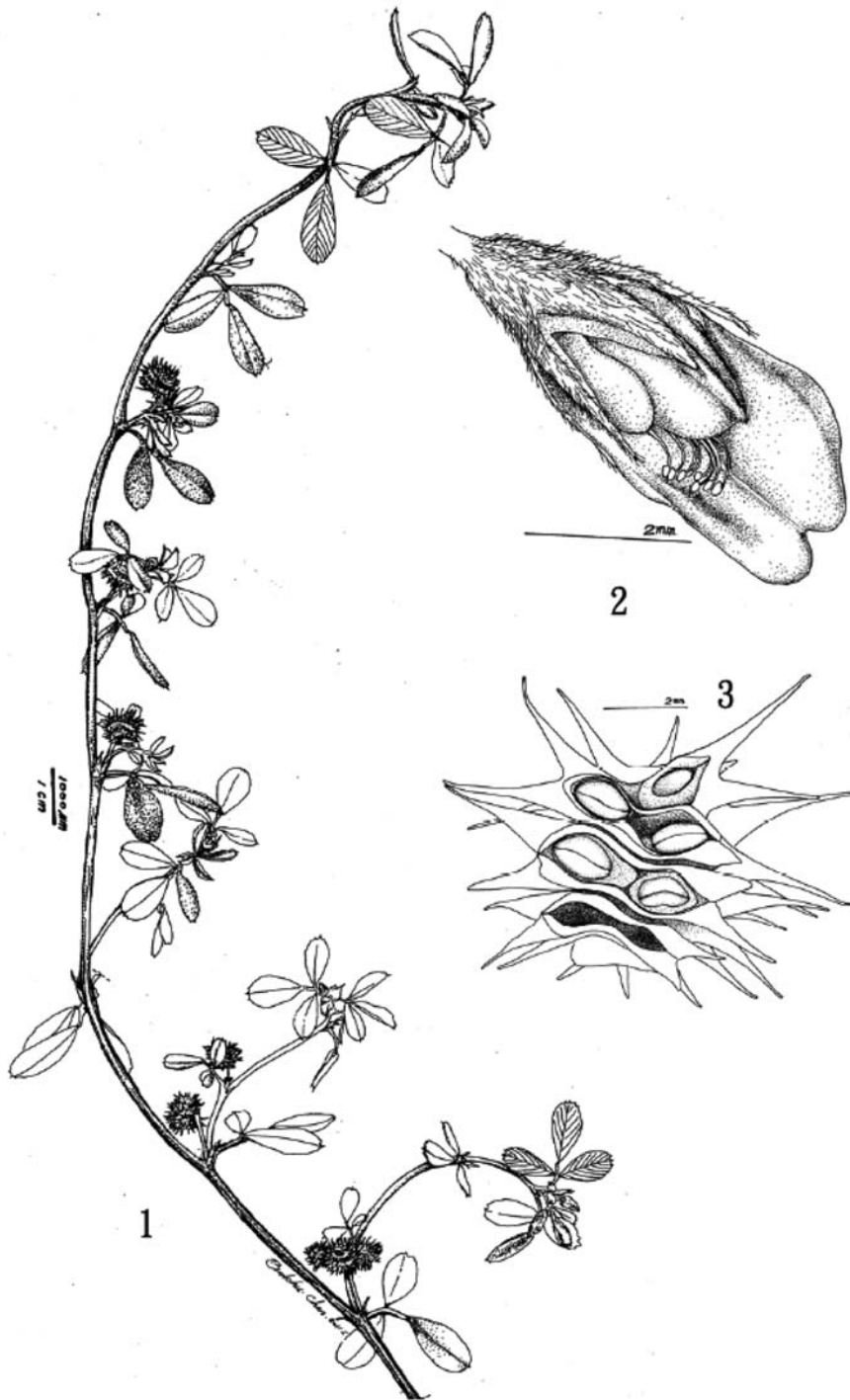


Fig. 2. *Medicago minima* (L.) Bartal. (1, habit; 2, flower; 3, fruit).

Taxonomic Treatment

Medicago L. 苜蓿屬

Medicago L., Sp. Pl. 2: 778. 1753, *nom. et typ. cons.* Type: *Medicago sativa* L.

A key to the species of the genus *Medicago* from Mt. Hohuan of Taiwan

- 1. Pod s spineless; invariably 1-seeded.....section *Lupularia*
*M. lupulina*
- 1. Pods spiny; 2-several-seeded.....section *Spirocarpos*
 - 2. Plants pubescent; stipules entire.....*M. minima*
 - 2. Plants glabrous; stipules dissected.
 - 3. Leaflets unblotched; spines on pods straight.....*M. polymorpha*
 - 3. Leaflets often anthocyanin blotched; spines on pods retrorse.....*M. arabica*

***Medicago arabica* (L.) Huds.**, Fl. Angl. 288.

1762. 褐斑苜蓿 Figs.1, 3 (A,B), 4A, 5A

Medicago polymorpha var. *arabica* L., Sp. Pl. 2: 780. 1753.

Lectotype: "*Medica cochleata minor polycarpus annua capsula majore, alba, folio cordato, macula fusca notato*" in Morison, Pl. Hist. Univ. 2: 154. s.2, t.15, f. 17. 1680.

Description: Procumbent herbs. Young stems glabrous, light green, brown pubescent, 4-angled, 2-2.8 mm diameter. Petioles green, cylindrical, ridged, shallowly grooved adaxially, 3-4.5 cm long, 0.7-1 mm diameter. Stipules 2, lanceolate, 8.3-9.5 mm long, 4.3-5 mm wide, margin deeply serrate. Leaves ternate, 5-7.5 cm long, 3.5-4.9 cm wide; leaflets obovate, chartaceous, green on both surfaces, with a V-shaped black blotch at center adaxially, glabrous adaxially, sparsely brown pubescent abaxially, 1.5-2.3 cm long, 1.5-2 cm wide; apex rounded or retuse, mucronate at tip; base cuneate; margin entire 1/2-2/3 proximal to base, obtuse-serrate for the rest; midrib impressed adaxially and elevated abaxially, lateral veins pinnate, ca. 5-7 pairs. Inflorescences axillary, cyme, 14-22 mm long. Peduncles cylindrical, green,

slender, brown pubescent, 9.3-14.8 mm long. Pedicels cylindrical, green, slender, ca. 0.6 mm long. Bract 1, lanceolate, green, glabrous, ca. 1 mm long. Buds elongate-columnar, slightly deplanate, slightly oblique, yellow, 5-5.4 mm long, 1.3-1.6 mm wide, ca.1.2 mm high.

Flowers yellow, papilionaceous. Calyx cupulate, green, sparsely brown pubescent, ca. 1.3 mm long, ca.1.5 mm across; qinate, each part linear, ca. 1.3-1.4 mm long, green, sparsely light brown pubescent. Standard 1, orbicular, yellow, white at base, ca. 4.8 mm long, ca. 3.4 mm wide, retuse at apex, subsessile at base; wings 2, subobovate, slightly oblique, yellow, ca. 2 mm long, ca. 1.4 mm wide, base white and stalked, stalk ca. 1 mm long. Keel 1, yellow, base white, ca. 3.6 mm long, ca. 2.7 mm wide. Stamens diadelphous, borne inside petals; filaments fused into tube, white, glabrous, ca. 3.5 mm long; anthers yellow. Ovary 1, deplanate-columnar, green, hypogynous, ca. 2.3 mm long, ca. 0.6 mm wide, densely and finely white pubescent; style green-white, slightly curved, ca. 0.7 mm long; stigma capitate; parietal placentation; ovules few, globose, translucent.

Pods coiled into globose, ca. 4.8 mm long,

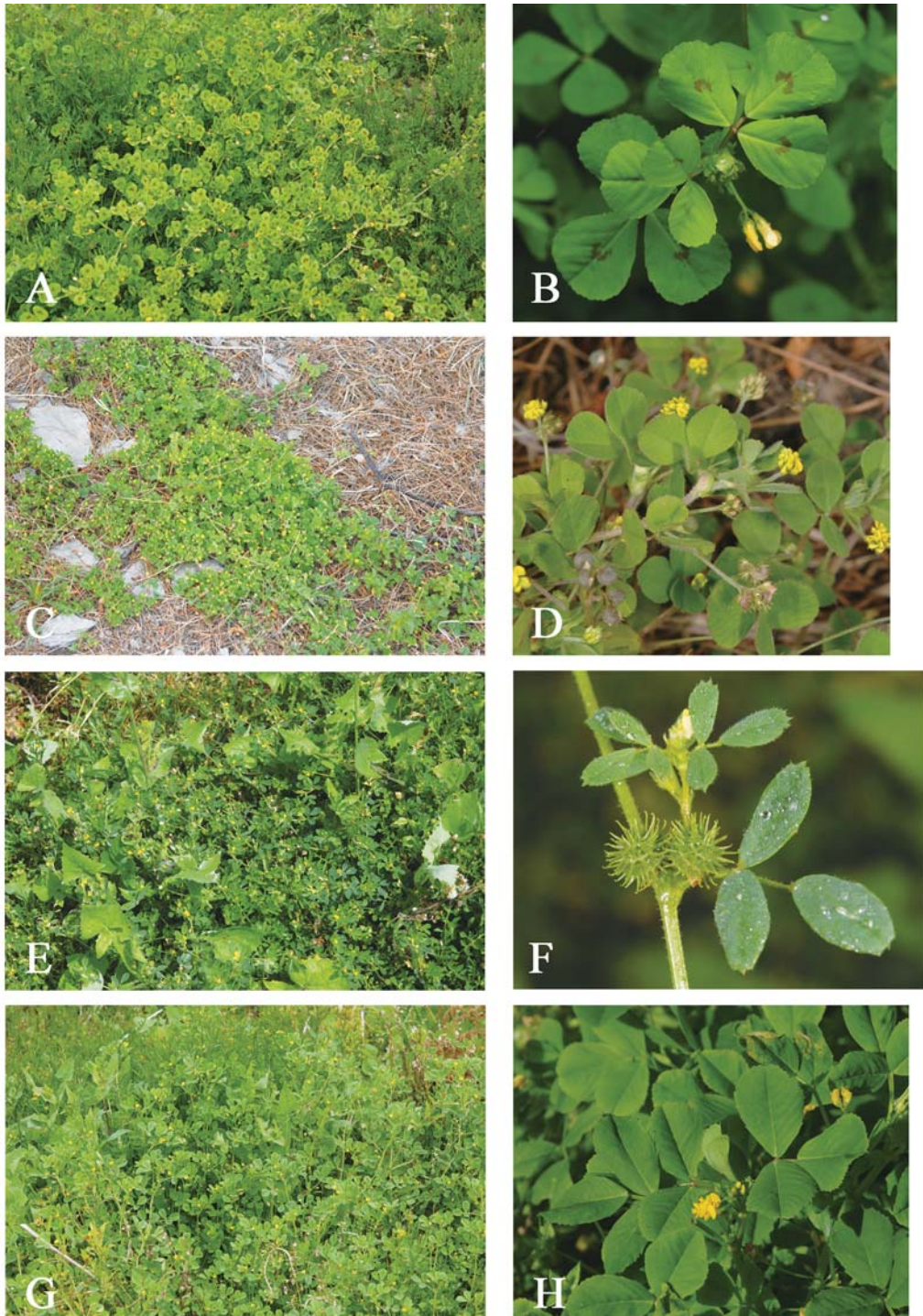


Fig. 3. Habitats of the *Medicago* species (A and B, *Medicago arabica* (L.) Huds.; C and D, *Medicago lupulina* L.; E and F, *Medicago minima* (L.) Bartal.; G and H, *Medicago polymorpha* L.).

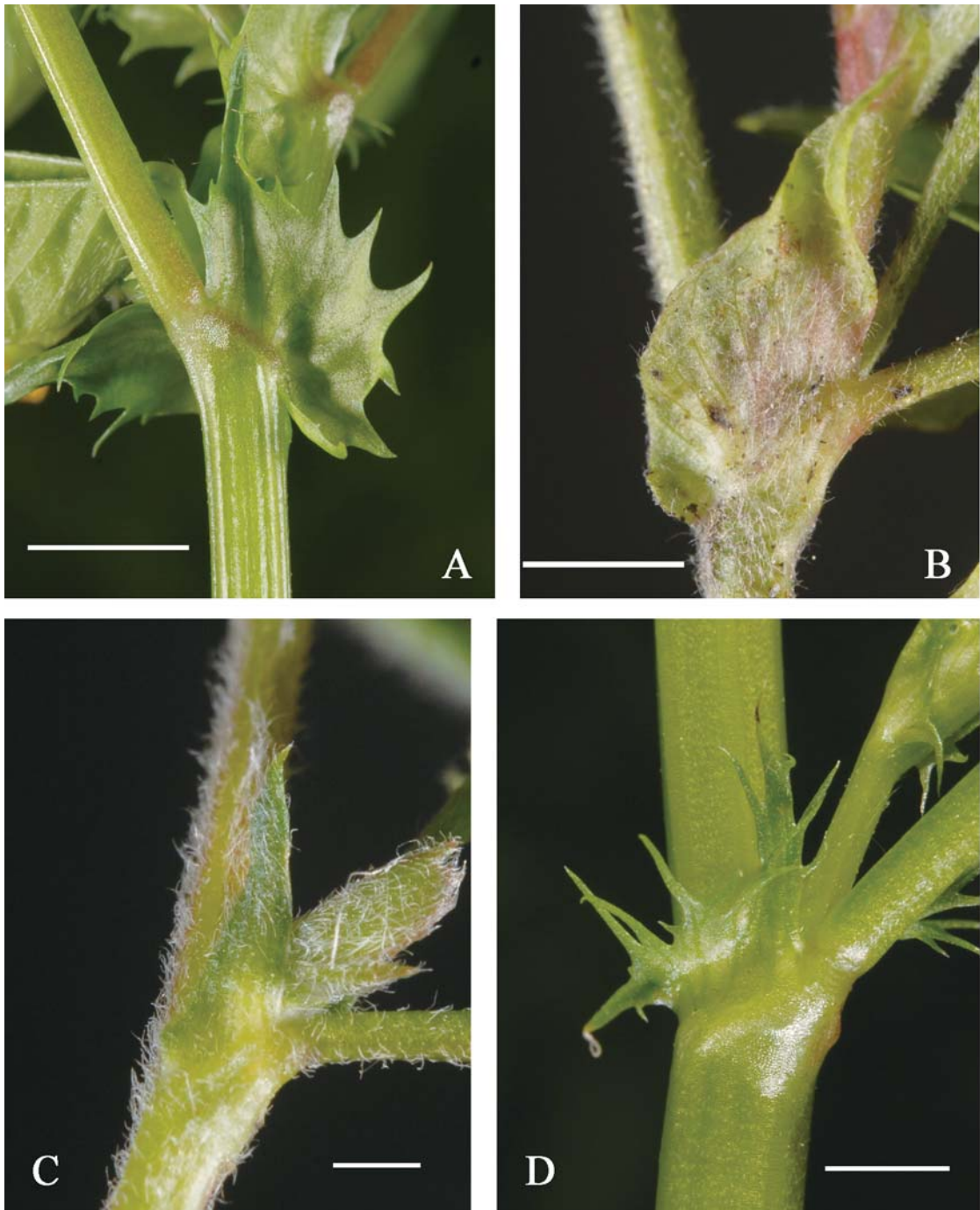


Fig. 4. Stipules of the *Medicago* species (A, *Medicago arabica* (L.) Huds, bar=4 mm; B, *Medicago lupulina* L., bar=3 mm; C, *Medicago minima* (L.) Bartal, bar=1 mm; D, *Medicago polymorpha* L., bar=3 mm).

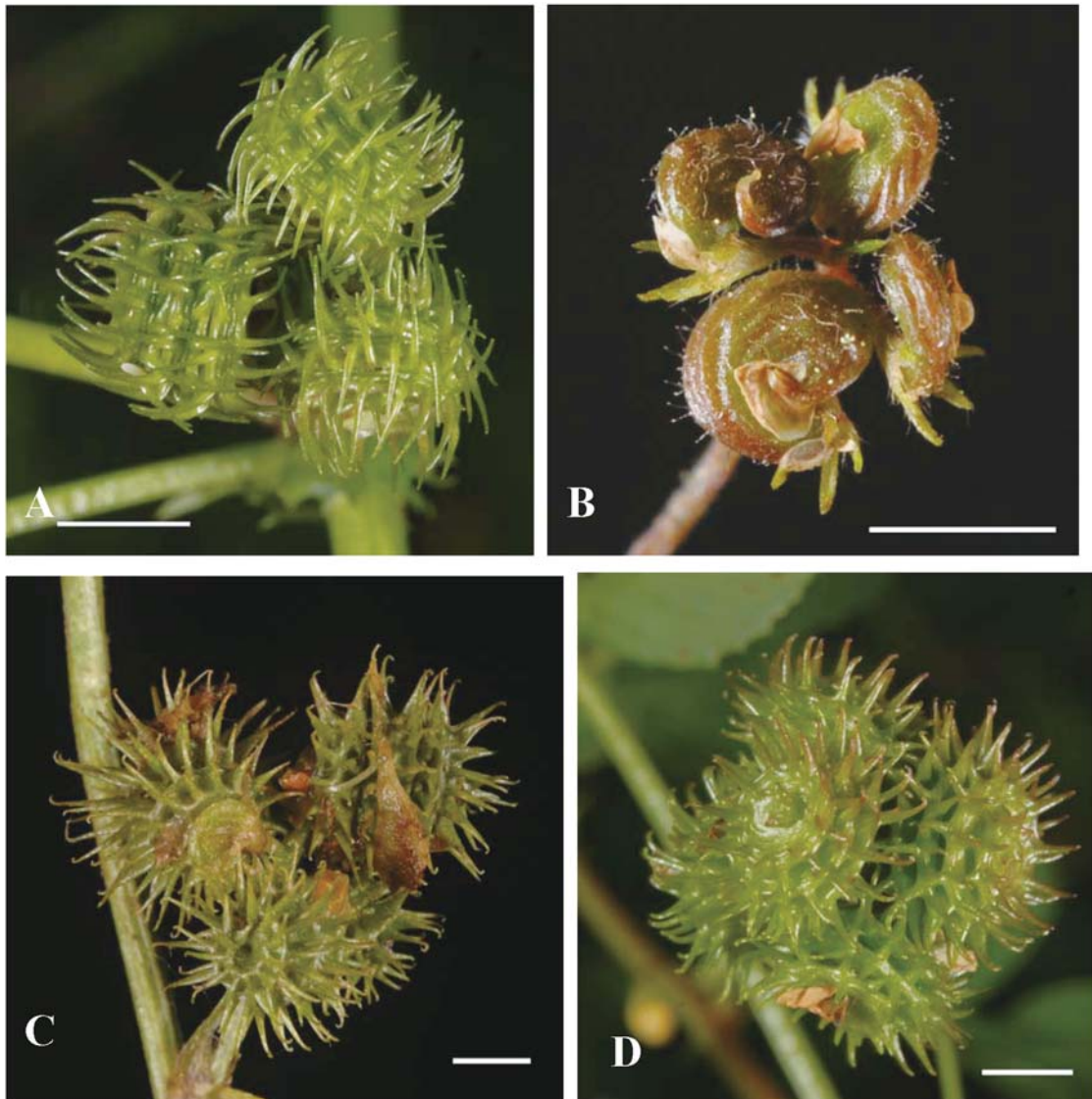


Fig. 5. Fruits of the *Medicago* species (A, *Medicago arabica* (L.) Huds., bar=5 mm; B, *Medicago lupulina* L., bar=3 mm; C, *Medicago minima* (L.) Bartal, bar=2.5 mm; D, *Medicago polymorpha* L., bar=2.5 mm).

ca. 6.4 mm wide; style, calyx, and bract persistent; exocarp green spinose, spines ca. 2.4 mm long. Fruit peduncle ca. 16.5 mm long, ca. 0.6 mm across, sparsely brown villous. Carpodium ca. 1.3 mm long, ca. 0.6 mm across, green, subglabrous. Seeds ca. 6-7, reniform, glabrous, 2.5-3 mm long,

1.5-1.9 mm wide, ca.0.8 mm high.

Specimen examined: TAIWAN. Hualien County: Hsiulin, Hohuan Farm, , 31 May 2011, *Hsu 16913* (TAIE).

Distribution and notes: *Medicago arabica* is widely distributed in Eurasia and Africa (Small and Jomphe 1989). It was collected from the open wasteland at Mt. Hohuan: a new record to the flora of Taiwan. It has been speculated that it was probably introduced accidentally to the Hohuan farm with vegetable seeds. The plants associated with it at its habitat were *Medicago polymorpha* L., *Capsella bursa-pastoris* (L.) Medic., *Rorippa sylvestris* (L.) Besser, *Artemisia indica* Willd., and *Sonchus oleraceus* L.

Medicago lupulina L., Sp. Pl. 2: 779. 1753; Huang & Ohashi, Fl. Taiwan, ed. 2. 3: 332. 1993. 天藍苜蓿 Figs. 3 (C,D), 4B, 5B

Lectotype: Herb. Linn. No. 933.10 (LINN)

Description: Procumbent herbs. Stem 4-angled, green, densely light-brown pubescent, ca. 1.6-2 mm in diameter. Leaves ternate, 1.5-2 cm long, 2-2.5 cm wide. Petioles cylindric, grooved adaxially, densely light-brown pubescent, 2.7-4.5 mm long, ca. 0.8 mm diameter; petiolules brown, subsessile. Stipules 2, sublanceolate, 4.5-8 mm long, ca. 3-3.4 mm wide, margin green, grading to lighter color inward, 2/3-1/2 basal part fused with petioles. Leaflets orbicular or suborbicular, green on both surfaces, all brown pubescent, 1-2 cm long, 1-1.5 cm wide; Apex rounded and mucronate; base rounded or cuneate; margin entire from base to ca. 2/3, the rest shallowly serrate; midrib impressed adaxially and elevated abaxially, lateral veins pinnate, ca. 5-9 pairs.

Inflorescences axillary, short raceme, ca. 1.3-3 cm long, with flowers ca. 15-18, small. Peduncles slender, cylindric, green, densely brown pubescent, 12.3-22.9 mm long. Pedicels ca. 0.5 mm long, slender, green, pubescent. Bract 1,

linear-lanceolate, ca. 0.6 mm long. Buds deplanate-subcylindric, slightly oblique, yellow, ca. 2 mm long, ca. 1 mm wide, ca. 0.8 mm high. Calyx tube elongate-cupulate, green, tinged brown at base, ca. 0.9 mm long, ca. 0.7 mm across; lobes 5, partite, linear, green, 1-1.4 mm long. Standard 1, suborbicular, yellow, tinged green at base, ca. 2.1 mm long, ca. 1.8 mm wide, glabrous; wings 2, suboblong, yellow, white-stalked at base, total length ca. 1 mm, ca. 0.4 mm wide, glabrous; keel 1, ca. 1 mm long, yellow, white at base, glabrous. Stamens diadelphous, borne inside petals; filaments fused into a white tube, ca. 0.6 mm long; anthers yellow. Ovary 1, oblate, green, glabrous, hypogynous, ca. 0.4 mm long, ca. 0.3 mm wide; style white-green, cylindric, slightly curved and hooked, ca. 0.7 mm long, ca. 0.3 mm wide; stigma discoid; ovule 1, ellipsoid, light green, glabrous. Infructescence raceme. Carpopodium ca. 1 mm long, slender, finely pubescent.

Pods slightly curved, discoid, green, exocarp crisp, finely pubescent, ca. 2.9 mm long, ca. 3.2 mm wide, ca. 1.2 mm high, calyx and style persistent. Seed 1, depressed ellipsoid, green, glabrous, 1.5-2 mm long, ca. 1.3 mm wide, ca. 0.6 mm high.

Specimen examined: TAIWAN. Hualien County: Provincial Road 14A, 38 Km, 31 May 2011, *Hsu 16910* (TAIE).

Distribution and notes: *Medicago lupulina* is native to Europe and West Asia (Small and Jomphe 1989). It is naturalized to low elevation areas of Taiwan (Huang and Ohashi 1993). In Mt Hohuan it was found along roadsides.

Medicago minima (L.) Bartal., Cat. Piante Siena

61. 1776. 小苜蓿 Figs. 2, 3 (E,F), 4C, 5C
Medicago polymorpha var. *minima* L., Sp. Pl. 2:
780-781. 1753.

Lectotype: "*Medica echinata, minima*" in Bauhin
& Cherler, *Historia plantarum universalis* 2:
386. 1651.

Description: Procumbent herbs. Stems slender, green, cylindric, 4-ridged; white to light-brown pubescent the whole plant. Leaves ternate, 1.5-2 cm long, 1.5-2.2 cm wide. Petioles hemicylindric, slightly grooved adaxially, green, 2.7-3.2 mm long, ca. 0.8 mm diameter; petiolules yellow, ca. 0.6 mm long, ca. 0.5 mm across, all pubescent. Stipules 2, lanceolate, green, 3.5-4 mm long, ca. 1.3 mm wide. Leaflets elongate-ovate or elliptic, chartaceous, green on both surfaces, ca. 1 cm long, ca. 0.5 cm wide, white pubescent on both surfaces; apex rounded; base cuneate; margin subentire, mucronate and 1-2-fids at apex, 1st fid deeper than 2nd fid; lateral veins pinnate, ca. 6-7 pairs. Inflorescences axillary, umbel, flowers 2-3. Peduncles cylindric, green, white pubescent, ca. 1.7-2.7 mm long, ca. 0.4 mm across. Pedicels slender, cylindric, green, white pubescent, ca. 0.5 mm long. Bract 1, ovate, minute, tripartite, green, white pubescent. Buds ellipsoid, yellow, ca. 3.4 mm long, ca. 1.2 mm wide.

Flowers papilionaceous, yellow. Calyx tube cupulate, green, ca. 1.5 mm high; qinate, each part linear, green, hairy, 2-2.8 mm long, ca. 1.5 mm wide. Standard obovate, yellowish white, ca. 3.4 mm long, ca. 2 mm wide, retuse at apex, glabrous; wing subovate, stalked at base, upper half yellow, lower half white, glabrous, ca. 2.5 mm long, ca. 1 mm wide; keel yellow, glabrous, ca. 2.7 mm long, ca. 1.2 mm wide. Stamens diadelphous; fused filaments ca. 2.2-2.8 mm long,

tube ca. 1.5 mm long, white, glabrous; separate filament ca. 1.5 mm long; anthers yellow. Ovary 1, deplanate-columnar, green, densely white pubescent at central part; style white, slightly hooked; stigma discoid; parietal placentation, ovules ca. 5, green, translucent, globose.

Pod solitary, axillary, coiled into globose, white pubescent, ca. 6.4 mm long, ca. 7 mm across; green spinose, ca. 2.2 mm long; calyx persistent. Carpopodium green, cylindric, white pubescent, ca. 4 mm long, ca. 0.5 mm across. Seeds 3-4, reniform, green to brown, glabrous, 2.8-3.3 mm long, ca. 1.5 mm wide.

Specimen examined: TAIWAN. Taipei County: Tamshui, Shalun Beach, 26 April 2000, *Chia-Hua Lin 164* (HAST); Hualien County: Hsiulin, Hohuan Farm, 18 May 2011, *Hsu 16895* (TAIE).

Distribution and notes: *Medicago minima* is widely distributed in Europe, Asia, Africa, and parts of the New World (Small and Jomphe 1989). It was collected from open wastelands at Mt. Houhuan: a new record to the flora of Taiwan.

***Medicago polymorpha* L.,** Sp. Pl. 2: 779. 1753;
Huang & Ohashi, Fl. Taiwan, ed. 2. 3: 332.
1993. 苜蓿 Figs. 3 (G, H), 4D, 5D

Lectotype: Herb. Clifford: 378, *Medicago 11*
(BM-000646786)

Description: Procumbent herbs. Stems green, 4-ridged; glabrous the whole plant. Leaves ternate, alternate, 2.5 cm long, ca. 4 cm wide. Petioles 1.2-3.1 cm long; petiolule of terminal leaflets 2.0-6.2 mm long; petiolule of lateral leaflets 0.5-1.3 mm long; all green and grooved adaxially.

Stipules 2, ovate, green, glabrous, fused on petiole, 5.6-6.6 mm long, 6.2-8.3 mm wide, margin deeply serrate. All leaflets chartaceous, green adaxially, pale green abaxially, margin entire from base to ca. 1/2, irregularly obtuse-serrate the rest 1/2; midrib impressed adaxially, elevated and sparsely white pubescent abaxially; lateral veins pinnate, ca. 13 pairs. Terminal leaflets obovate, 1.4-2.2 cm long, 1-1.6 cm wide; apex obtuse or sometimes truncate; base cuneate. Lateral leaflets elliptic, 1.3-2.2 cm long, 0.7-1.4 cm wide; apex rounded, base cuneate. Inflorescences axillary and terminal, short raceme, 2-4 flowers clustered. Peduncle slender, green, 12-23 mm long, ca. 0.15-0.26 mm across. Pedicels green, 0-0.8 mm long, ca. 0.16 mm across. Bracts light green, narrowly deltoid, 0.9-1.7 mm long, ca. 0.5 mm wide. Buds curved fusiform, yellow, 4.9-5.9 mm long, 1.9-2.5 mm wide.

Flowers papilionaceous, yellow, semiopen. Calyx tube campanulate, green, 3.3 mm long, 3.3 mm wide, 5-lobed; lobes deltoid, 1.8 mm long, 0.7 mm wide. Standard yellow, folded in half, falcate, 5.6 mm long, 2.6 mm wide; wings 2, yellow, elliptic, bipartite at base, 3.5 mm long, 1.8 mm wide; keel 1, white and bipartite (linear) at base, yellow and bipartite at apex. Stamens diadelphous, filaments white translucent. Basal 1/2 of the nine grouped-stamens fused into a translucent concave sheet, 0.2-0.3 mm long; Filament of the separate stamen slender, white translucent, 1.7 mm long; anthers translucent, punctiform. Ovary 1, curved and slightly helicoid, green, 1-celled, hypogynous; style white, ca. 0.4 mm long; stigma punctiform, light brown; parietal placentation; ovules 5-7, ellipsoid.

Pods solitary or 2-4 in short raceme, clustered. Fruit peduncle green, 2.5-3.5 cm long; carpopodium green, 2.6-4.2 mm long, ca. 0.5 mm across. Pods

spiral-shaped, 2-4-turns overlapped into a cylinder, densely deltoid spinose on abaxial suture; spines 1.3-1.5 mm long, hooked at apex. Pods 6-7.5 mm across, 3-4.6 mm high, turning from green to light brown when ripe, indehiscent. Seeds 4-7, deplanate-ovoid or deplanate-ellipsoid, green, 4-5.1 mm long, 2.1-2.5 mm wide, 1.2-1.7 mm thick.

Specimen examined: TAIWAN. Hualien County: Hsiulin, Hohuan Farm, 21 June 2011, *Hsu 16987* (TAIE).

Distribution and notes: *Medicago polymorpha* is an indigenous to Eurasia and Africa, and widely introduced to be adventive elsewhere (Small and Jomphe 1989). It is naturalized to open wastelands at elevations below 700 m in the northern Taiwan (Huang and Ohashi 1993). In this study it was collected at open wasteland of Mt. Hohuan at an elevation above 2,500 m.

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