

Taxonomic Study of Fourteen Wild Species of Subfamily Faboideae in Hinthada University Campus, Hinthada Township

Thant Zaw Win¹, Khin Thandar Hlaing², Ni Ni Lwin³

Abstract

The wild species of Faboideae were investigated in Hinthada University Campus, Hinthada Township. The 14 species belonging to 11 genera and 5 tribes of subfamily Faboideae were identified. There were *Crotalaria humifusa*, *C. pallida*, *C. spectabilis*, *Aeschynomene indica*, *A. villosa*, *Clitoria ternatea*, *Centrosema pubescens*, *Cajanus scarabaeoides*, *Flemingia angustifolia*, *Vigna adenantha*, *Desmodium triflorum*, *Codoriocalyx motorius*, *Alysicarpus vaginalis* and *Sesbania cannabina*. The key to the studied species and the outstanding characters of each species were presented.

Keywords: Taxonomy, Subfamily Faboideae, Hinthada Township, Myanmar

Introduction

The Faboideae are one of the three subfamilies of family Fabaceae. According to the angiosperm phylogeny group (APG III) classification system, subfamily Faboideae were placed in family: Fabaceae, order: Fabales, superorder: Rosanae, subclass: Magnoliidae and class: Equisetopsida (Reveal and Chase, 2011).

The Fabaceae family are classified into three subfamilies: Faboideae (Papilionoideae), Mimosoideae and Caesalpinioideae. The characteristics of Fabaceae are herbs, shrubs, or trees; leaves pulvinate and alternate, pinnate or palmate or simple; flowers hypogynous, bisexual or sometimes unisexual; anthers dithecous, always longitudinal slits; ovary monocarpellary, marginal placentation with short gynophore; ovules one or more on ventral suture (Hooker, 1879). Each subfamily is identified by its flower characters. The Caesalpinioideae are zygomorphic flowers and corolla ascending imbricate in the bud. The Mimosoideae are actinomorphic flowers and corolla valvate in the bud. The Faboideae are 'Papilionaceous' flowers, in which zygomorphic and corolla descending imbricate in bud with five petals consisting of a large, median, usually posterior 'standard', two lateral 'wings' and two anterior, distally fused 'keels' (Simpson, 2006). Faboideae consist of tribes into which the genera can be grouped on features of habit, leaf form, and degree of fusion of the stamens (Heywood, 1978).

The Fabaceae (Leguminosae) is commonly known as the legume, pea or bean family. It is the third-largest family of flowering plants. The Fabaceae comprise 751 genera and 19,500 species in the plant species list worldwide (Christenhusz and Byng, 2016). The Faboideae consist of 400-500 genera and about 10,000 species, and temperate, tropical and sub-tropical in distribution (Heywood, 1978).

Many plants require large quantities of three minerals nitrogen, phosphorus and potassium. Nitrogen is an atmospheric gas that plants cannot use directly. Legumes species are notable in that most of them have symbiotic nitrogen-fixing bacteria (*Rhizobium* spp.) in

¹ Lecturer, Dr., Department of Botany, Hinthada University

² Lecturer, Dr., Department of Botany, Hinthada University

³ Lecturer, Department of Botany, Hinthada University

structures called root nodules. Nitrogen-fixing legumes have higher concentrations of nitrogen compounds in their tissue than non-fixing plants (Simpson, 2006).

The research aims to investigate and identify the wild species of subfamily Faboideae in Hinthada University campus.

Materials and Methods

The 14 species of subfamily Faboideae were collected in Hinthada University Campus from October to April 2021-2022. Hinthada University extends 370085.02 square kilometers in Hinthada township. The morphological features of collected plants were studied and identified by references from Bor (1953), Gavade *et al.* (2020), Hooker (1879), Leeratiwong *et al.* (2017), Rudd (1959) and Wu and Raven (2010). The collected specimens were made the herbarium according to the technique of Lawrence (1964). The herbariums were stored in the Herbarium of the Department of Botany, Hinthada University for references.

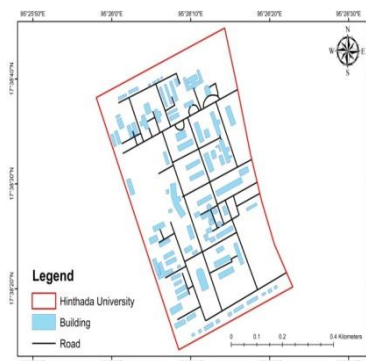


Figure 1. Study Area of Hinthada University Campus

Results

Fourteen species belonging to 11 genera and 5 tribes of subfamily Faboideae were studied and arranged by Lewis *et al.* (2005).

Table 1. List of the collected 14 species of Hinthada University Campus

Tribe	Scientific name	Local name
Crotalariaeae	1. <i>Crotalaria humifusa</i> Graham ex Benth.	Not known
	2. <i>C. pallida</i> Aiton	Taw pike san
	3. <i>C. spectabilis</i> Roth	Taw pike san
Aeschynomeneae	4. <i>Aeschynomene indica</i> L.	Nay bin
	5. <i>A. villosa</i> Poir.	Not known
Phaseoleae	6. <i>Clitoria ternatea</i> L.	Aung me nyo
	7. <i>Centrosema pubescens</i> Benth.	Not known
	8. <i>Cajanus scarabaeoides</i> (L.) Thouars	Not known
	9. <i>Flemingia angustifolia</i> Roxb.	Phalan phyu
	10. <i>Vigna adenantha</i> (G. Mey.) Maréchal, Mascherpa & Stainier	Not known
Desmodieae	11. <i>Desmodium triflorum</i> (L.) DC.	Not known
	12. <i>Codoriocalyx motorius</i> (Houtt.) H. Ohashi	Say ka myin pin
	13. <i>Alysicarpus vaginalis</i> (L.) DC.	Than ma naing kyauk ma naing
Sesbanieae	14. <i>Sesbania cannabina</i> (Retz.) Poir.	Nyan

Keys to the studied species

1. Anther dimorphic, alternately dorsifixed and basifixed; filaments alternately longer and shorter ----- 2
1. Anthers uniform in size and shape; filaments all equal ----- 4
 2. Stem prostrate; flowers 7-10 mm long ----- 1. *Crotalaria humifusa*
 2. Stem erect; flowers longer than 10 mm ----- 3
3. Leaves trifoliolate; calyx subequal ----- 2. *Crotalaria pallida*
3. Leaves simple; calyx 2-lipped ----- 3. *Crotalaria spectabilis*
 4. Legumes breaking up into 1-seeded segments when mature ----- 5
 4. Legumes not breaking up into separate segments when mature ----- 7
5. Stem prostrate; leaflets trifoliolate ----- 11. *Desmodium trifolium*
5. Stem erect; leaflets numerous ----- 6
 6. Leaflets oblong, 1 costate; legumes straight ----- 4. *Aeschynomene indica*
 6. Leaflets falcate, 2-6 costate; legumes slightly curved -- 5. *Aeschynomene villosa*
7. Leaves digitately 3-foliolate; legumes turgid, not septate ----- 9. *Flemingia angustifolia*
7. Leaves pinnately 1 or numerous foliolate; legumes not turgid, septate ----- 8
 8. Leaves 5 or numerous foliolate ----- 9
 8. Leaves unifoliolate or trifoliolate ----- 10
9. Leaflets 5-7; standards much larger than wings and keels ----- 6. *Clitoria ternatea*
9. Leaflets numerous; standards slightly equal wings and keels ---- 14. *Sesbania cannabina*
 10. Leaves unifoliolate; legumes lomentum ----- 13. *Alysicarpus vaginalis*
 10. Leaves 5-many foliolate; legumes dehiscent along sutures ----- 11
11. Shrub; lateral leaflets reduce when mature ----- 12. *Codoriocalyx motorius*
11. Twining herb; lateral leaflets persistent ----- 12
 12. Inflorescence with swollen nodes; styles bearded ----- 13
 12. Inflorescence without swollen; styles not bearded ---- 8. *Cajanus scarabaeoides*
13. Terminal leaflet rhomboid-ovate; keel spirally incurved ----- 10. *Vigna adenantha*
13. Terminal leaflet elliptic; keel not incurved ----- 7. *Centrosema pubescens*

**1. *Crotalaria humifusa* Graham ex Benth., Lond. J. Bot.2: 476. 1843.
(Figure 2: A1-A4)**

Herb, 20-40 cm tall; stem prostrate, pilose. Leaves simple; blade suborbicular, 0.8-2.5 x 0.7-1.6 cm, base oblique and cordate, apex rounded, pilose on both surfaces; stipules linear-lanceolate. Inflorescence terminal and leaf-opposed racemes, 1-8 flowered. Flower yellow, 5-8 x 3-5 mm. Calyx (5), 2-lipped. Corolla 1+2+(2); standard suborbicular, 4.5-5.0 x 4.0-5.0 mm; keel beak twisted. Stamens (10), monadelphous, dimorphism. Ovary hairy. Legumes oblong-ellipsoid, 7.0-8.0 x 3.0-4.5 mm, inflated, 10-17 seeded.

2. *Crotalaria pallida* Aiton, Hort. Kew. 3: 20. 1789. (Figure 2: B1-B4)

Herb, about 1 m tall; branches terete, ribbed, densely pubescent. Leaves pinnately compound, trifoliolate; leaflet blade elliptic, 1.7-6.0 x 1.0-3.5 cm, base cuneate, apex retuse; stipule acicular, caducous. Inflorescence terminal racemes, 10-40-flowered. Flowers 1.2-1.5 cm. Calyx (5), densely pubescent. Corolla 1+2+(2), yellow, exerted beyond calyx; standard elliptic, 0.9-1.5 x 0.7-0.9 cm. Stamens (10), monadelphous, dimorphism. Ovary densely pubescent. Legumes oblongoid, 3.0-5.0 x 0.5-0.8 cm, inflated, pilose, 20-49 seeded.

3. *Crotalaria spectabilis* Roth, Nov. Pl. Sp. 341. 1821. (Figure 2: C1-C4)

Herbs, 1-2 m tall; stem erect; branches terete, glabrous. Leaves simple; blade narrowly elliptic, 3.3-17.0 x 1.5-9.0 cm, base broadly cuneate, apex obtuse with mucro, lower surfaces silky pubescent; stipule ovate-triangular. Inflorescence terminal racemes, 20-30 flowered. Calyx (5), 2-lipped. Corolla 1+2+(2), yellow; standard suborbicular, 1.7-2.0 cm, apex retuse; keels slightly incurved twisted. Stamens (10), monadelphous, dimorphism. Ovary glabrous. Legumes broadly oblongoid, 2.5-3.0 x 1.0-1.7 cm, glabrous, 20-30 seeded.

4. *Aeschynomene indica* L., Sp. Pl. 2: 713. 1753. (Figure 2: D1-D4)

Shrub, 1-1.5 m tall; stem erect, hollow, glabrous. Leaves pinnately compound, 20-70 foliolate; leaflet oblong, 0.6-1.2 x 0.2-2.5 cm, 1-costate, base oblique, margin entire, apex obtuse with mucro; stipule peltate-appendiculate, base auriculate. Inflorescences axillary racemes. Flower pale yellow with purplish striations, 0.8-1.2 mm. Calyx (5), 2-lipped, glabrous. Corolla 1+2+(2); standard elliptic, 7.0-9.5 x 4.0-6.5 mm. Stamens 5+5, diadelphous. Ovary puberulous. Legume lomentum, linear-oblong, 10-13 x 3-4 mm, straight, 6-10 seeded.

5. *Aeschynomene villosa* Poir., Encycl. Suppl. 4(1): 76. 1816. (Figure 2: E1-E4)

Herb, 0.5-1.0 m tall, stem hispid. Leaves pinnately compound, 20-54 foliolate; leaflet falcate, 0.3-1.3 x 0.9-2.5 mm, ciliate along one margin, 2-6 costate; stipules peltate-appendiculate, hispid, striate. Inflorescences axillary racemes, 3-10 flowered. Flowers reddish, 6-8 mm. Calyx (5), 2-lipped, hispid. Corolla 1+2+(2); standard center yellow spot, suborbiculate, 4-6 x 3-5 mm long, emarginate. Stamens 5+5, diadelphous. Ovary puberulous. Legume lomentum, linear, 8-30 x 2-4 mm, slightly curved, villous-hispid, 3-7 seeded.

6. *Clitoria ternatea* L., Sp. Pl. 2: 753. 1753. (Figure 3: A1-A4)

Twining herb, 1-2 m tall; stems slender. Leaves pinnately compound, 5-7 foliolate; leaflet broadly elliptic, 1.5-6.0 x 1.0-3.5 cm, base obtuse, apex obtuse and slightly emarginated; stipule linear. Flowers large, blue, solitary cymes. Calyx (5), membranous. Corolla 1+2+(2); standard faintly white at middle, broadly obovate, 4.5-6.0 x 3.0-4.0 cm, wings and keels much shorter than standard. Stamens (9)+1, diadelphous. Ovary villous. Legume linear-oblong, 5.0-11.0 x 1.0-1.3 cm, compressed, weakly curved towards apex, with a curved beak, 6-10 seeded.

7. *Centrosema pubescens* Benth., Comm. Legum. Gen. 55. 1837. (Figure 3: B1-B4)

Twining herb; stem slender, villous. Leaves pinnately compound, trifoliolate; leaflet elliptic, 2.0- 8.0 x 1.5-4.0 cm, base rounded, apex acute, sparsely villous on both surfaces; stipule ovate, striate, persistent. Inflorescence axillary racemes, with swollen nodes, 2-6 flowers at apex. Flowers pink, 2.5-3.5 cm. Calyx (5), 2-lipped; lowest longest lobe linear. Corolla 1+2+(2); standard broadly orbicular, 2.9-4.0 x 3.0-3.5 cm. Stamens (9)+1, diadelphous. Disk annular, surrounding the base of ovary. Legume linear, 7.0-13.0 x 0.5-0.7 cm, compressed, with a straight and slender beak, twisting at dehiscence, 7-15 seeded.

8. *Cajanus scarabaeoides* (L.) Thouars, Dict. Sci. Nat. ed. 2, 6: 167. 1817.

Dolichos scarabaeoides L., Sp. Pl. 2: 726. 1753. (Figure 3: C1-C4)

Twining vines, 1-2 m; stems woody, slender, pubescent. Leaves pinnately compound, trifoliolate; leaflet elliptic, 1.8-4.3 x 0.8-2.3 cm, apex obtuse, basal 3-veins; stipules ovate, pubescent. Inflorescence axillary racemes, 2-5-flowered. Flower yellow, 0.7-1.0 mm. Calyx (5), pubescent. Corolla 1+2+(2); standard obovate, 6-9 x 5-7 mm, crimson streaks, reflexed. Stamens (9)+1, diadelphous. Ovary tomentose. Legume oblong, 1.4-2.5 x 0.4-0.8 cm, densely villous, transversely constricted between seeds, 2-7 seeded.

9. *Flemingia angustifolia* Roxb., Fl. Ind. 3: 341. 1832. (Figure 3: D1-D4)

Shrub, 1-2 m tall. Leaves palmately compound, trifoliolate; leaflet linear lanceolate, 2.0-8.0 x 0.7-3.0 cm, apex acute, margin ciliate, terminal leaf base cuneate, lateral oblique; stipule lanceolate, apex acuminate, splitting at mature. Inflorescences axillary raceme, longer than the petioles. Flowers 4-7 mm, pink with striations. Calyx (5), hairy. Corolla 1+2+(2); standard elliptic, 4.5-5.5 x 3.0-4.0 mm, apex retuse. Stamens (9)+1, diadelphous. Ovary hairy. Legumes ellipsoid, 0.8-1.4 x 0.4-0.7 cm, dehiscence, turgid, with a short beaked, hairy, 2-seeded.

10. *Vigna adenantha* (G. Mey.) Maréchal, Mascherpa & Stainier, Taxon 27: 202. 1978.

Phaseolus adenanthus G. Mey., Prim. Fl. Esseq. 239. 1818. (Figure 3: E1-E4)

Twining herb; stem creeping. Leaves pinnately compound, trifoliolate; leaflet rhomboid-ovate, 4.0-11.0 x 2.5-7.5 cm, base obtuse, apex acute; stipule lanceolate. Inflorescence axillary raceme, with swollen nodes. Flowers purple, 2.5-4.0 cm. Calyx (5), 2-lipped. Corolla 1+2+(2); standard orbicular; keel spirally incurved for about 3 turns. Stamens (9)+1, diadelphous. Disk annular, surrounding the base of ovary. Legumes linear, 7.5-13.0 x 0.5-1.0 cm, glabrous, 10-15-seeded.

11. *Desmodium triflorum* (L.) DC., Prodr. 2: 334. 1825. (Figure 4: A1-A4)

Hedysarum triflorum L., Sp. Pl. 2: 749. 1753.

Perennial herb, 10-40 cm tall; stem prostrate. Leaves pinnately compound, trifoliolate; leaflet blade obovate, 4-12 x 3-10 mm, base cuneate, apex truncate; stipule ovate, persistent. Flowers purple, 4-6 mm, 1-3 in leaf axils. Calyx (5), densely villous. Corolla 1+2+(2); standard obcordate, 3.0-5.0 x 2.5-3.5 mm, base attenuate. Stamens (9)+1, diadelphous. Ovary hairy. Legume lomentum, narrowly oblong, 9-13 x 2-3 mm, flat, lower suture undulate, 3-5 seeded.

12. *Codoriocalyx motorius* (Houtt.) H. Ohashi, J. Jap. Bot. 40: 367. 1965.

Hedysarum motorium Houtt., Nat. Hist. 246-247.1779. (Figure 4: B1-B4)

Shrub, about 1.5 m tall. Leaves pinnately compound, trifoliolate, 1-foliolate by reduction of lateral leaflets when mature; leaflet lanceolate, 3.0-10 x 0.8-4.0 cm. Inflorescence terminal and axillary raceme. Flowers purplish, 7-9 mm. Calyx (5). Corolla 1+2+(2); standard orbicular, 7.5-8.5 x 7.5-8.0 mm. Stamens (9)+1, diadelphous. Ovary puberulent. Legumes straight, 2.0-4.5 x 0.4-0.6 cm, transversely jointed, dehiscent along lower suture, 5-8 seeded.

13. *Alysicarpus vaginalis* (L.) DC., Prodr. 2: 353. 1825. (Figure 4: C1-C4)

Hedysarum vaginale L., Sp. Pl. 2: 746. 1753.

Perennial herb, 20-70 cm tall; stem procumbent, glabrous. Leaves pinnately compound, unifoliolate; leaf blade ovate-oblong, 0.9-3.8 x 0.7-1.7 cm, base cordate, apex rounded; stipules lanceolate, 6-15 x 2-3 mm, parallel veins, persistent. Inflorescence axillary racemose, 6-14 flowered, binate at each node. Flower reddish, 5-7 mm. Calyx (5), valvate, glume-like. Corolla 1+2+(2), longer than calyx; standard obovate, 5-7 x 4-5 mm. Stamens (9)+1, diadelphous. Ovary pubescent. Legumes lomentum, linear, 2.0-3.0 x 0.2-0.3 cm, terete, surface coarsely reticulate veins, 4-7 seeded.

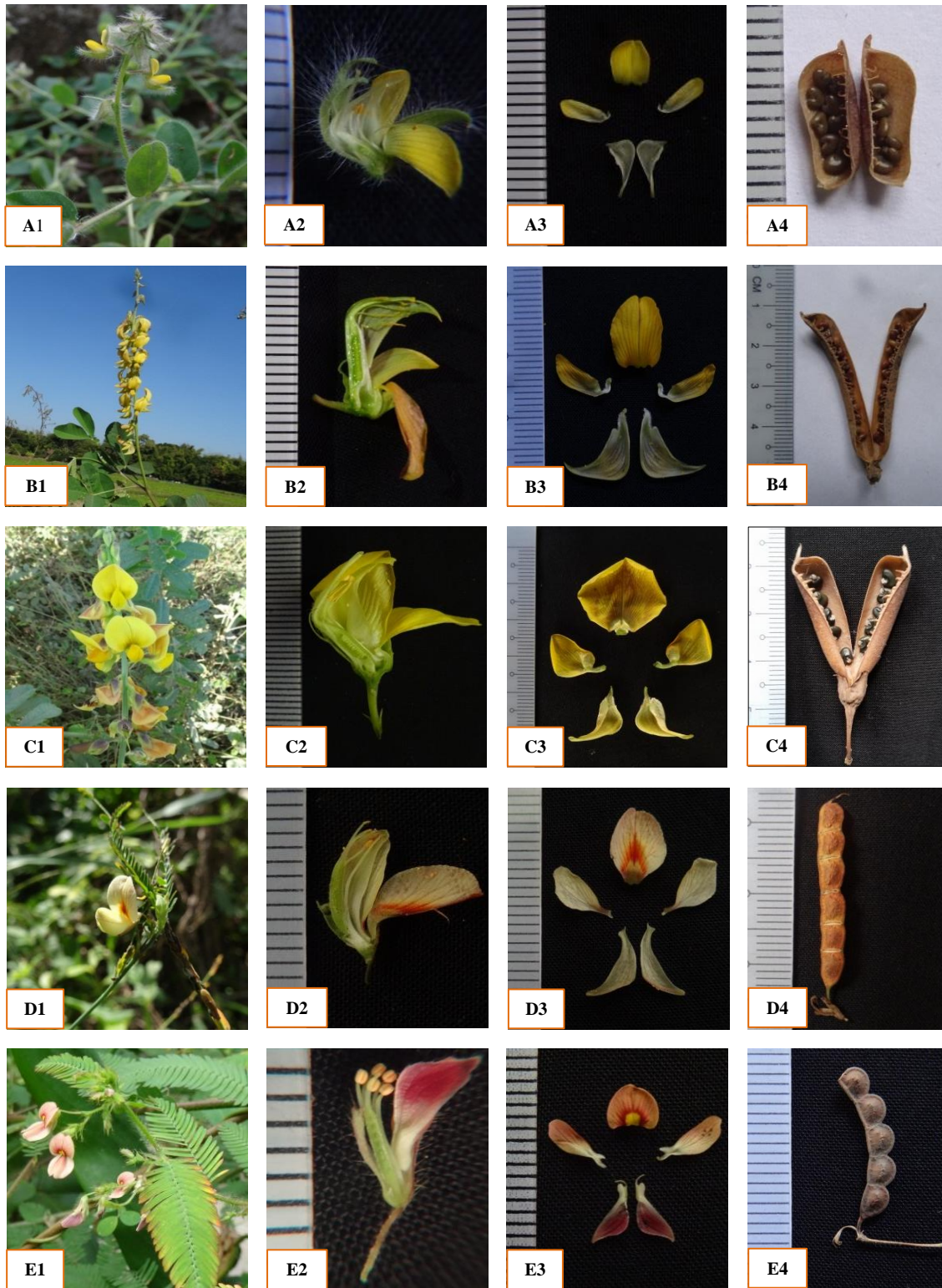


Figure 2. A. *Crotalaria humifusa*, B. *C. pallida*, C. *C. spectabilis*, D. *Aeschynomene indica*, E. *A. villosa*

1. Flowering branch, 2. L.S. of Flower, 3. Corolla opened 4. Legume

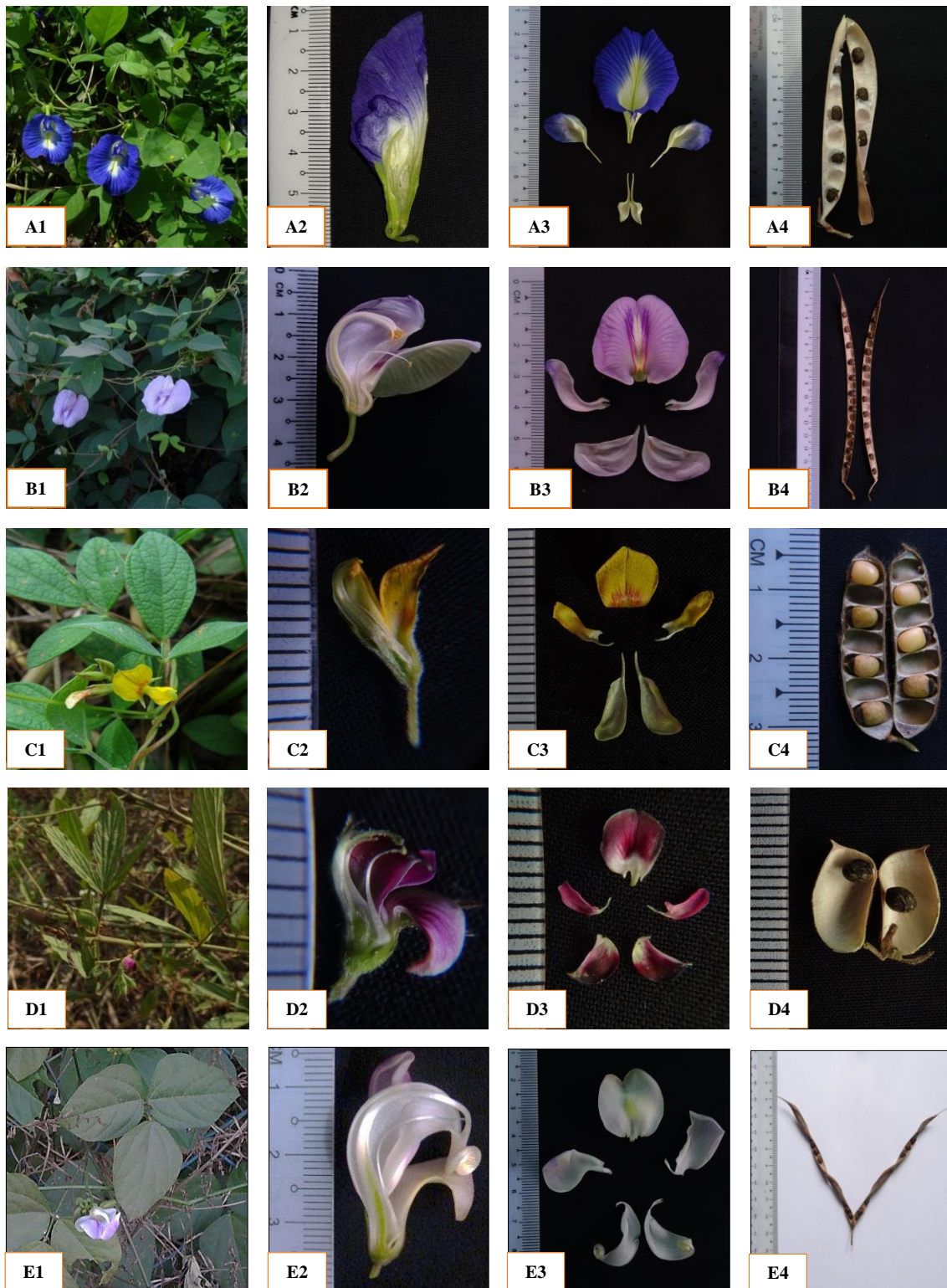


Figure 3. A. *Clitoria ternatea*, B. *Centrosema pubescens*, C. *Cajanus scarabaeoides*, D. *Flemingia angustifolia*, E. *Vigna adenantha*

1. Flowering branch, 2. L.S. of Flower, 3. Corolla opened 4. Legume

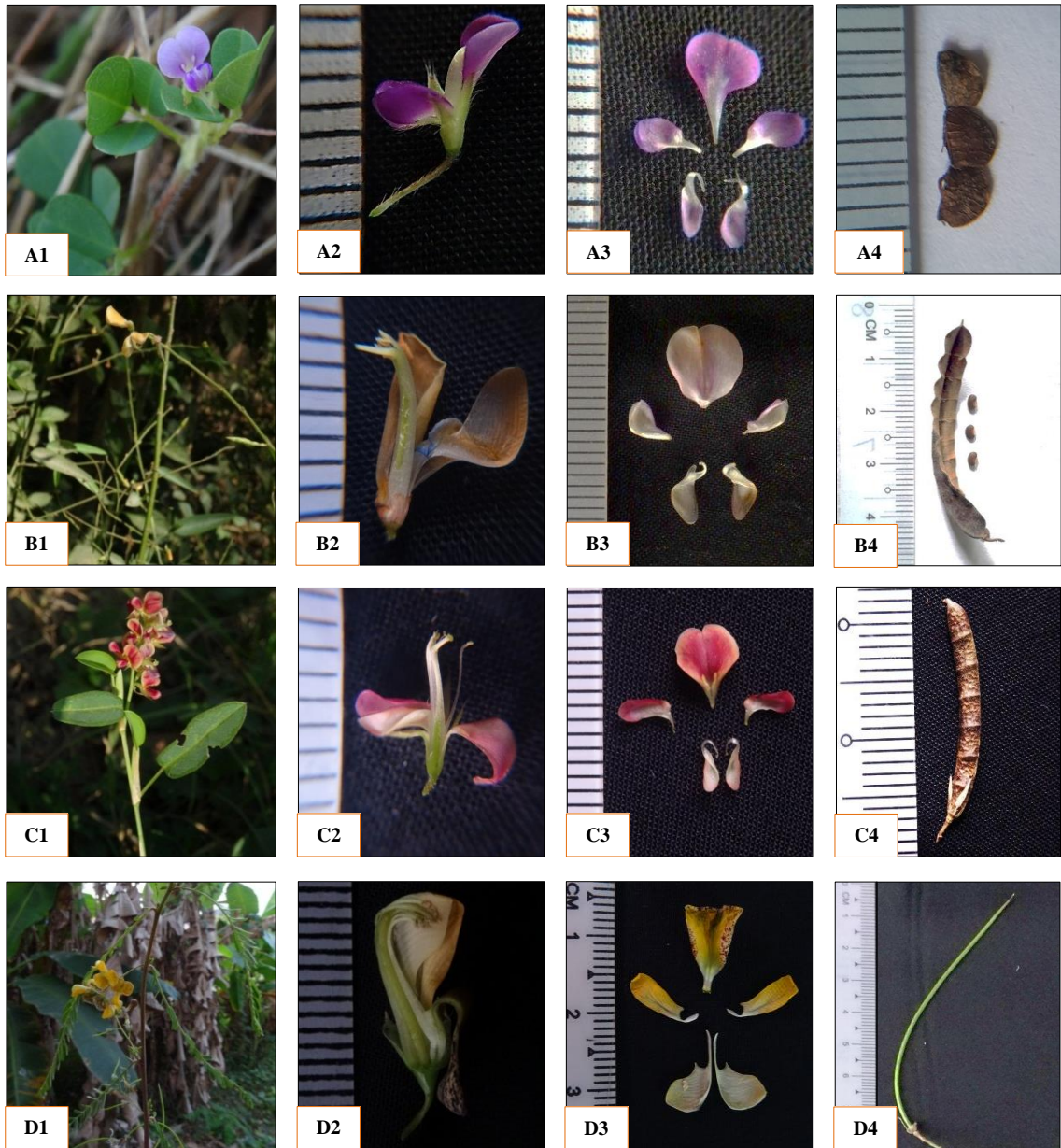


Figure 4. A. *Desmodium triflorum*, B. *Codoriocalyx motorius*, C. *Alysicarpus vaginalis*, D. *Sesbania cannabina*

1. Flowering branch, 2. L.S. of Flower, 3. Corolla opened 4. Legume

14. *Sesbania cannabina* (Retz.) Poir., *Encycl.* 7: 130. 1806. (Figure 4: D1-D4)
Aeschynomene cannabina Retz., *Observ. Bot.* 5: 26:1789.

Shrub, 2-3 m tall. Leaves paripinnately compound, 40-72 foliolate; leaflets linear-oblong, 0.8-2.3 x 0.3-0.6 cm, base rounded, apex truncate with mucro; stipules lanceolate, caducous. Inflorescence axillary raceme, 2-6 flowered; peduncle pendulous. Flower yellow, 1.2-1.5 cm. Calyx (5). Corolla 1+2+(2); standard grayish brown streaked on the back, suborbicular, 0.8-1.1 x 0.9-1.2 cm, base subrounded, apex retuse. Stamens (9)+1, diadelphous. Ovary glabrous. Legume slender, 9.0-18.0 x 0.2-0.4 cm, terete, with a beak, 18-35 seeded.

Discussion and Conclusion

The present study deals with the taxonomic study of wild species of Faboideae. In the checklist of Myanmar, 456 species and 84 genera of Faboideae (formerly Fabaceae) were recorded (Kress *et al.*, 2003). Fourteen species, 11 genera and 5 tribes of this subfamily were investigated in Hinthada University Campus.

In the study area, *Crotalaria humifusa*, *C. pallida*, *C. spectabilis*, *Aeschynomene indica*, *A. villosa*, *Clitoria ternatea*, *Centrosema pubescens*, *Cajanus scarabaeoides*, *Flemingia angustifolia*, *Vigna adenantha*, *Desmodium triflorum*, *Codoriocalyx motorius*, *Alysicarpus vaginalis* and *Sesbania cannabina* were recorded.

Legumes not jointed and dehiscent were found in genera *Cajanus*, *Centrosema*, *Clitoria*, *Crotalaria*, *Flemingia*, *Sesbania* and *Vigna*. Among them, stamens of the members of genus *Crotalaria* are monadelphous but other genera are diadelphous. Styles of *Vigna adenantha* and *Clitoria ternatea* are bearded below the stigma. Styles of *Cajanus scarabaeoides*, *Centrosema pubescens* and *Flemingia angustifolia* are not bearded. Stigmas of *Vigna adenantha* are oblique and *Clitoria ternatea* is terminal. Then, *Cajanus scarabaeoides* and *Centrosema pubescens* are present 3 or more seeds but 2 seeds in *Flemingia angustifolia*.

Legumes jointed and stamens diadelphous were found in genera *Aeschynomene*, *Alysicarpus*, *Codoriocalyx* and *Desmodium*. Among them, only legumes of *Codoriocalyx motorius* are dehiscent along the lower suture but legumes of other genera are lomentum. Stipellate are present in leaflets of *Alysicarpus vaginalis*, *Codoriocalyx motorius* and *Desmodium triflorum*, but not present in the members of *Aeschynomene*. Legumes jointed of *Desmodium triflorum* and *Codoriocalyx motorius* are flattened and legumes jointed of *Alysicarpus vaginalis* are turgid.

Legume plants are notable in that most of them have symbiotic nitrogen-fixing bacteria in structures called root nodules. For that reason, they play a key role in crop rotation. When these legume plant parts decompose, they produce substantial amounts of organic nitrogen fertilizer in the soil. Although the wild species are weeds, these plants are responsible for extracting the nutrients which are essential for the main crops, and feed for domestic and wild herbivore animals. So, they provide soil fertile for other agricultural plants in local area.

The International Union for Conservation of Nature (IUCN) Red List reported *Aeschynomene indica*, *Cajanus scarabaeoides*, *Vigna adenantha* and *Sesbania cannabina* are Least Concern (LC). Thus, the wild legumes should be conserved in their distributed region.

Acknowledgements

We are greatly indebted to Rector Dr. Theingi Shwe, Pro-Rectors Dr. Yee Yee Than and Dr. Aye Lwin, Hinthada University, for allowing us to undertake this research. We would like to thank Professor Dr. Khin Thu Zar Myint, Head of the Department of Botany, Hinthada University, for her encouragement. We acknowledge our gratitude to Professor Dr. Aye Aye Mar, Department of Botany, Hinthada University, for her precious advice and suggestions.

References

- Bor, N.L. (1953). Manual of Indian Forest Botany. Geoffrey Cumberlege. Oxford University Press, Bombay.
- Christenhusz, M. J. M. and Byng, J. W. (2016). The Number of Known Plants Species in the World and Its Annual Increase. *Phytotaxa*, 261 (3), 201-217, Magnolia Press.
- Cronquist, A. (1981). An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.

- Gavade, S. K., Laurentius, J. G. and M. M. Lekhak. 2020. Taxonomic revision of the genus *Flemingia* (Leguminosae: Papilionoideae) in India. *Webbia. Journal of Plant Taxonomy and Geography*. Vol. 75, No. 2, pp. 141-218.
- Heywood V. H. (1978). *Flowering Plants of the World*. Oxford University Press, Oxford. , pp. 239-240.
- Hooker, J. D. (1879). *The Flora of British India*. Vol. II. London: L. Reeve & Co., Ltd.
- IUCN. (2022). *The IUCN Red List of Threatened Species*. Version 2022-2.
<https://www.iucnredlist.org>. Accessed on (9 October 2023).
- Kress, W. J., A. D. Robert, E. Farr and D. Yin Yin Kyi. (2003). A Checklist of the Trees, Shrubs, Herbs, and Climbers of Myanmar. The United States National Herbarium, Department of Systematic Biology-Botany, National Museum of Natural History, Washington, USA, Vol. 45, pp. 1-590.
- Lawrence, G. H. M. (1964). *Taxonomy of Vascular Plants*. 9th printing. The Macmillan Company, New York.
- Leeratiwong, C., S. Sathaphorn and P. Chantaranothai. (2017). The genus *Alysicarpus* Neck. ex Desv. (Leguminosae) in Thailand. *Thai Forest Bulletin (Botany)*. Vol. 45, No. 2, pp. 125-133.
- Lewis G., B. Schrire, B. MacKinder and M. Lock. (2005). *Legumes of the World*. Royal Botanic Gardens, Kew: Richmond, London, UK.
- Reveal, J. L. and M. W. Chase. (2011). APG III: Bibliographical Information and Synonymy of Magnoliidae. *Phytotaxa*, Magnolia Press, Vol. 19, pp. 71-134.
- Rudd, V. E. (1959). The genus *Aeschynomene* in Malaysia (Leguminosae-Papilionatae). *Reinwardtia*, Herbarium Bogoriense, Kebun Raya Indonesia, Vol. 5, Part 1, pp. 23-36.
- Simpson, M. G. (2006). *Plant Systematics*. Elsevier Academic Press, USA.
- Wu, Z.Y. and P. H. Raven. (2010). *Flora of China: Fabaceae*. Missouri Science Press, Beijing and Missouri Botanical Garden, St. Louis. Vol. 10, pp. 1-577.