

TAXONOMY AND POLLEN MORPHOLOGY OF GENUS *DESMODIUM* IN PAPILIONOIDEAE

Thin Thin Aye¹, Swe Swe Lin²

Abstract

Taxonomy and pollen morphology of 8 species belonging to genus *Desmodium* of Papilionoideae were studied. The specimens were collected from Magway Region during 2019-2020. Taxonomic descriptions, artificial key to the species and photographs of each species were presented. According to the resulting data, *Desmodium confertum* DC., *D. jucundum* Thw, are perennial and the remaining species are annual. The unifoliate leaves occurred in *D. renifolium* (L.) Schindl., *D. teres* Wall., *D. velutinum* (Willd.) DC. and the remaining species are trifoliate. Pollen morphology of each species was studied. Pollen grains found are monad and aperture colpate. All study species were found tricolpate and pori lalongate. Pollen of *D. confertum* DC., *D. velutinum* (Willd.) DC. are small sized and the remaining species are medium. Three types of exine sculpture (psilate, reticulate, microreticulate) were found. *D.confertum* DC. is reticulate; *D. griffithianum* Benth. is psilate and the remaining species are microreticulate. Pollen key to the species were constructed on different palynological characters.

Keywords: Taxonomy, pollen morphology, genus *Desmodium*

Introduction

Fabaceae are the third largest family of flowering plants. The species of this family are found throughout the world, growing in many different environments and climates. Fabaceae has been divided into three subfamilies Caesalpinioideae, Mimosoideae and Papilionoideae. The Fabaceae is very large group with worldwide distribution and the important plant groups, being the source of numerous pulses, soil rotation plants, oil, timber trees, gums and dyes (Simpson 2006). Legumes include a large number of crops for human and animal consumption as oil, fiber, fertilization, timber and medicine (Martin *et al.* 2006).

Pollen grains have a number of morphological features. These palynological features have provided characters that have been important in inferring phylogenetic relationship of plants (Simpson 2006). Palynology is the study of pollen, fine structure of their wall, particularly of its outermost layer, the exine. (Erdtman1985). The exine is the outer layer of pollen. It is composed of sporopollenin. Sporopollenin is very chemically stable and it is resistant to almost all kinds of environmental damage (Briggs & Brady 2000). The examination of pollen grains, both recent and ancient, can be of value in scientific studies. Taxonomy, genetic, evolutionary studies, honey studies, forensic science, tracing vegetation history, climate change studies (Moore *et al.* 1991). The palynological research can be either basic or applied. Basic aspects belongs to pollen morphology in relation to taxonomy, applied aspects belong to geopalynology, aeropalynology, iatropalynology and melitopalynology (Bhojwanii &Bhatnagar 2005).

The purpose of this research is to record the taxonomy and pollen morphology of genus *Desmodium* in Papilionoideae, to know palynological features of the *Desmodium* spp. to give the knowledge of pollen features and identification of the key, to fulfill the information concerning with pollen morphology.

¹ Dr, Lecturer, Department of Botany, University of Magway

² Dr, Lecturer, Department of Botany, University of Mandalay

Materials and Methods

The plants were collected from Magway Region 2019- 2020. All the collected species were recorded by photographs during flowering times. Identification of collected specimens was carried out by using floristic literature of Dassanayake (1991, 1997), Kress *et al.* (2003) and Langran *et al.* (2010). Pollen samples were collected from the anther of blooming flowers and were acetolysed by Erdtman method (1952). The pollen samples in a glass vials were crushed with a glass rod and 1cc of acetic acid was added. The mixture of glass vial was transferred into a test tube and drops of concentrated sulphuric acid were added then put into a water bath. The material was transferred to a centrifuge. After centrifuging, the polliniferous material was transferred to be stored in a bottle and labeled. Pollen sample were mounted and observed by Light microscope. The identification of pollen is referred to Erdtman (1969), Erdtman (1971), Erdtman (1985), Paldat (2005), Hesse *et al.* (2009).

Results

Taxonomy and pollen morphology of 8 species in genus *Desmodium* of Papilionoideae has been studied.

A. Artificial key to the species

1. Perennial -----2
1. Annual -----3
 2. Flower white -----1. *Desmodium confertum*
 2. Flower purple-----3. *D. jucundum*
3. Leaves trifoliolate -----4
3. Leaves unifoliolate-----6
 4. Herbs-----2. *D. griffithianum*
 4. Shrub or under shrub -----5
5. Leaflets cuneate at the base -----4. *D. laxiflorum*
5. Leaflets obtuse at the base -----6. *D. spirale*
 6. Flower pale greenish yellow-----7. *D. teres*
 6. Flower pale purple, bluish purple or pale blue-----7
7. Stem glabrous-----5. *D. renifolium*
7. Stem pubescent-----8. *D. velutinum*

B. Artificial pollen key to the species

1. Pollen size small -----2
1. Pollen size medium -----3
 2. Amb rounded -----1. *Desmodium confertum*
 2. Amb triangular -----8. *D. velutinum*
3. Sculpture psilate -----2. *D. griffithianum*
3. Sculpture microreticulate-----4
 4. Shape oblate -----4. *D. laxiflorum*
 4. Shape subprolate or prolate spheroidal-----5
5. Grain size more than 37µm in length -----7. *D. teres*

5. Grain size less than 32µm in length -----6
 6. Colpi less than 19 µm in length -----3. *D. jucundum*
 6. Colpi more than 22 µm in length -----7
 7. Pori less than 8 µm in length -----6. *D. spirale*
 7. Pori more than 11 µm in length -----5. *D. renifolium*

1. *Desmodium confertum* DC., Ann. Sc. Nat. Ser. 1.4:101.1825. (Fig.1, A)

Myanmar name : Unknown

English name : Unknown

Flowering period : June-September

Perennial, small tree; stems and branches terete, green, pubescent. Leaves trifoliolate compound, alternate; stipules linear-lanceolate, 0.5-0.9 cm long; petioles 1.5-3.0 cm long, green, pubescent, pulvinate; stipels lanceolate, 0.3-0.5 cm long, pubescent; leaflets ovate-oblong, 5.0-12.0 cm by 7.0-8.5 cm, terminal leaflets large, acute at the base, entire along the margin, rounded or mucronate at the apex, glabrous above, pubescent beneath. Inflorescences axillary racemes, few-flowered; peduncles terete, pale green, pubescent. Flowers bisexual, zygomorphic, pentamerous, white, 1.2-1.5 cm in diameter at anthesis, pedicels terete, 0.2-0.4 cm long, pale green, pubescent; bracts lanceolate, deciduous, pale green, pubescent; bracteoles lanceolate, pubescent. Calyx campanulate, 5-lobed; tube 0.1-0.2 cm, pubescent; lobes lanceolate, 0.2-0.3 cm long, green, pubescent. Corolla papilionaceous; standard obovate to nearly orbicular, 1.0-1.2 cm by 0.9-1.0 cm; clawed 0.1-0.2 cm long; wings oblong lanceolate, 0.8-0.9 cm by 0.3-0.4 cm, adherent to the keel; keels oblong, 0.8-1.0 cm by 0.4-0.5 cm, clawed, glabrous. Stamens 10, diadelphous, staminal tube 0.8-1.0 cm long; anthers dithecal, basifixed, longitudinal dehiscence. Ovary oblong, superior, unilocular with few ovules on the marginal placentae; style terminal, stigma simple. Pods compressed, 1-4 jointed, indehiscent, 1-2 cm long, hairy.

Description of pollen morphology (Figure 1. B, C)

Tricolporate, subprolate, small, 21.25-25.0 × 18.75-22.5 µm in length and breadth; amb rounded, angulaperturate; colpi longiculate, 18.75-22.5 × 2.5-3.75 µm in length and breadth; pori lalongate, 5.0-6.25 × 7.5-10.0 µm in length and breadth; exine 2.5-3.75 µm thick; sexine thicker than nexine; sculpturing reticulate; lumina heterobrochate, 0.6-1.25µm width; muri simplibaculate, about 0.3 µm wide.

2. *Desmodium griffithianum* Benth., in Miq., PL. Fungh. 222. 1825. (Fig.1, D)

Myanmar name : Unknown

English name : Unknown

Flowering period : September to November

Annual, erect herbs; stems and branches terete, appressed white hairs. Leaves trifoliolate compound, alternate; stipules lanceolate, 0.5-1.0 cm long, green, tomentose; petioles terete, 1-3 cm long, green, tomentose, slightly canaliculate above; stipels linear, green, tomentose; petiolules terete, green, tomentose; leaflets obovate, 1.5-5.5 cm by 1-2 cm, green, obtuse at the base, entire along the margin with ciliate, truncate or emarginate at the apex, glabrous above, appressed tomentose beneath. Inflorescences terminal and axillary raceme, many-flowered; peduncles terete, brownish, appressed tomentose. Flowers bisexual, zygomorphic, pentamerous, pale purple, 0.5-0.8 cm in diameter at anthesis; bracts lanceolate, brownish, tomentose, deciduous;

pedicels 0.3-0.5 cm long, brown, tomentose, deflexed at the tip; ebracteolate. Calyx campanulate, 4-lobed; tube 0.2-0.3 cm long, green, sparsely pubescent; lobes deltoid, 0.2-0.3 cm long, green, setaceous. Corolla papilionaceous; standard obovate, 0.5-0.8 cm by 0.3-0.5 cm, pale purple, glabrous; wings oblong, 0.4-0.6 cm by 0.3 cm, pale purple, glabrous; keels oblique, 0.4-0.6 cm by 0.3 cm, whitish purple, glabrous. Stamens 10, diadelphous, filaments filiform, white, glabrous; anthers uniform, ditheous, basifixed, longitudinal dehiscence. Ovary oblongoid, green, tomentose, unilocular with few ovules on the marginal placentae; style filiform, white, sparsely pubescent; stigma subcapitate. Pods linear-oblongoid, 1.5-3.5 cm long, 4-8 jointed, indehiscent, green, densely tomentose, lower suture straight the upper slightly indented. Seeds kidney-shaped, small, glabrous, brown.

Description of pollen morphology (Fig. 1, E, F)

Tricolporate, suboblate, medium, 25.0-31.3×30.0-37.5 μm in length and breadth; amb triangular, angulaperturate; colpi longicollate, 18.8-23.8×2.5-5.0 μm in length and breadth; pori lalongate, 12.5-15.0×16.5-22.5 μm in length and breadth; exine 1.3-1.9 μm thick, sexine as thick as nexine, sculpturing psilate.

3. *Desmodium jucundum* Thw., Enum. Pl. Zeyl. 411. 1864. (Fig. 1, G)

Myanmar name : Unknown

English name : Unknown

Flowering period : October to December

Perennial, erect shrubs; stems and branches subterete, green, sparsely pubescent. Leaves trifoliolate compound, alternate; stipules lanceolate, 1.0-1.9 cm long, green, ribbed, pubescent, persistent; petioles 2-4 cm long, green, canaliculate above, densely velutinous; stipels linear, 0.5-0.6 cm long, green, pubescent, persistent; petiolule terete, 0.2-0.3 cm long, green, pubescent; rachis 1.0-1.5 cm long, green; leaflets obovate, terminal one longer than lateral, 6-22 cm by 3-11 cm, obliquely acute at the base, entire and ciliate along the margin, acute at the apex, densely appressed sericeous above, glabrous beneath, green. Inflorescences axillary or terminal raceme, many-flowered; peduncles terete, green, densely pubescent. Flowers bisexual, zygomorphic, pentamerous, 0.7-0.8 cm in diameter at anthesis, pale purple; bracts lanceolate, 0.5-0.7 cm long, green, pubescent, deciduous; pedicel very short, green, pubescent; bracteoles linear, 0.2-0.3 cm long, green, pubescent. Calyx campanulate, 5-lobed; tube 0.1-0.2 cm long, green, pubescent; lobes linear, 0.2-0.3 cm long, green, pubescent. Corolla papilionaceous; standard elliptic or obovate, 0.6-0.7 cm by 0.7 cm, pale purple; wings obliquely oblong, 0.6-0.7 cm by 0.3 cm, pale purple, adnate to the keel, wholly clawed; keel beaked, 0.5-0.6 cm by 0.2 cm, white, connate above, long spurred at the base. Stamens 10, diadelphous, inserted; staminal tube 0.5-0.7 cm long, glabrous, white; anthers uniform, ditheous, basifixed, longitudinal dehiscence. Ovary superior, oblong, 0.5-0.6 cm long, green, 5-10 ovules on the marginal placentae; style curved, 0.2-0.3 cm long, white; stigma simple. Pods linear, fattened, constrict, 5-10 seeded, tip linear, 2.5-4.0 cm long, 4-6 jointed, indehiscent, dark brown, densely white appressed. Seeds minute, sericeous, dark brown, densely white appressed, smooth.

Description of pollen morphology (Fig.1, H, I)

Tricolporate, prolate spheroidal, medium, 27.5-30.0×25.0-28.75 μm in length and breadth; amb triangular, angulaperturate; colpi $\frac{3}{4}$ way up to the pole, 16.25-18.75 × 3.8-5.0 μm in length and breadth; pori lalongate, 6.25-8.75×13.8-16.25 μm in length and breadth; exine 1.25-1.85 μm thick, sexine thicker than nexine; sculpturing microreticulate.

4. *Desmodium laxiflorum* DC. in Ann., Sci. Nat. Paris 1, 4:100. 1825. (Fig.1, J)

Myanmar name : Ywet kat
 English name : Unknown
 Flowering period : August- November

Annual, under shrub; stems and branches obscure angular, pubescent. Leaves trifoliolate compound, alternate; stipules lanceolate, about 0.1 cm long; petioles terete, 2-3 cm long, canaliculate above, with longitudinal ribs, sericeous, densely yellowish brown hairy; leaflets ovate-elliptic, 5-10 cm by 3.5-8.5 cm, nearly cuneate at the base, entire or sinuate along the margin, acuminate at the apex, sparsely pubescent above, densely pubescent beneath. Inflorescences axillary or terminal racemes, with fascicles of flowers, 2-7 flowered. Flowers bisexual, zygomorphic, pentamerous, hypogynous, pale purple, about 0.6 cm in diameter at anthesis; pedicel 0.5-1.0 cm long, green, densely hair pubescent; bracts lanceolate, minute, caducous. Calyx campanulate, 5-lobed, with dense hooked hairs; tube 0.2 cm long, green; lobes setaceous, deltoid, densely villous. Corolla papilionaceous; standard broadly obovate or orbicular, 0.5-0.6 cm by 0.3-0.4 cm, yellowish brown hairy, short clawed; wings auriculate, oblong, about 0.4 cm long, tomentose, clawed, keel oblong, about 0.4 cm long, violet, clawed, tomentose. Stamens 10, diadelphous; staminal tube 0.3-0.4 cm long; anthers uniform, basifixed, longitudinal dehiscence. Ovary superior, densely white pubescent, green; style long, slightly hairy at the base, glabrous at the apex; stigma capitate. Pods linear, with dense minute short hairs, 2.5-3.0 cm long, 4-12 jointed, slightly constricted lower suture, densely hooked hairy. Seed globose, dark brown.

Description of pollen morphology (Fig.1, K, L)

Tricolporate, oblate, medium, $25.0-31.25 \times 28.75-35.0 \mu\text{m}$ in length and breadth; amb rounded triangular, angulaperturate; colpi $\frac{3}{4}$ way up to the pole, $17.5-23.75 \times 2.5-5.0 \mu\text{m}$ in length and breadth; pori lalongate, $3.75-6.25 \times 8.75-12.5 \mu\text{m}$ in length and breadth; exine 0.6-1.3 μm thick, sexine as thick as nexine; sculpturing microreticulate.

5. *Desmodium renifolium* (L.) Schindl. Repert. Spec.Nov. Regni Veg.22: 262.1926(Fig.2, A)

Hedysarum renifolium L. Syst. Nat. ed. 10, 2:1169. 1759

Myanmar name : Unknown
 English name : Unknown
 Flowering period : October-January

Annual herbs; stems and branches terete, green, glabrous. Leaves unifoliate, alternate; stipules linear, about 0.2 cm long, pubescent, caducous; petioles terete, 1-2 cm long, green, glabrous, slightly canaliculate above; stipels green, glabrous; blades oval-reniform, 2-4 cm by 3.5-5.0 cm, subcoriaceous, slightly cordate at the base, entire along the margin, truncate or emarginate at the apex, green, glabrous on both surfaces. Inflorescences axillary racemes, many-flowered; peduncles terete, green, glabrous. Flowers bisexual, zygomorphic, pentamerous, pale blue, 0.2-0.3 cm in diameter at anthesis; pedicels terete, 0.6-0.8 cm long, green, pubescent; bracts linear, green, glabrous, deciduous. Calyx campanulate, 5-lobed; tube 0.2-0.3 cm long, subglabrous, green; lobes setaceous, glabrous. Corolla papilionaceous; standard obovate, 0.3-0.4 cm long, bluish-white, glabrous; wings oblong, 0.2-0.3 cm long, adherent to keel, glabrous; keel obovate, about 0.2 cm long, glabrous. Stamens 10, diadelphous, filaments filiform, 0.3-0.4 cm long, glabrous; anthers dithecous, basifixed, uniform, longitudinal dehiscence, Ovary superior, oblongoid, glabrous, unilocular with marginal placentae; style filiform, 0.2-0.3 cm long, glabrous,

green; stigma capitate. Pods compressed, lomentum, 3-5 jointed, indehiscent, 1.5-2.5 cm long, glabrous. Seeds compressed, about 0.2 cm long, black.

Description of pollen morphology (Fig.2, B, C)

Tricolporate, subprolate, medium, $28.75-31.25 \times 25-30 \mu\text{m}$ in length and breadth; amb rounded triangular, angulaperturate; colpi $\frac{3}{4}$ way up to the pole, $21.25-23.75 \times 2.5-5.0 \mu\text{m}$ in length and breadth; pori lalongate, $11.25-15.00 \times 12.5-18.75 \mu\text{m}$ in length and breadth; exine 1.3-2.5 μm thick, sexine thicker than nexine; sculpturing microreticulate.

6. *Desmodium spirale* DC., Prod. 2:332.1825. (Fig.2, D)

Myanmar name : Unknown

English name : Unknown

Flowering period : September to November

Annual, erect shrubs; stems and branches terete, brownish green, longitudinal ribs, hirsute. Leaves trifoliolate compound, alternate; stipules linear-lanceolate, 0.5-0.8 cm long, green, brownish pubescent; petioles terete, 2-4 cm long, canaliculate above, green, pubescent; stipels filiform, green, pubescent; petiolules terete, brownish green, pubescent; leaflets obovate, 3-8 cm by 2-4 cm, green, obtuse at the base, entire along the margin with ciliate, emarginate at the apex, terminal leaflets larger than lateral, sparsely pubescent above, short hooked hairs beneath. Inflorescences axillary and terminal racemes, many-flowered; peduncles terete, brownish green, densely hooked hairs. Flowers bisexual, zygomorphic, pentamerous, bluish purple, 0.7-1.0 cm in diameter at anthesis; bracts lanceolate, deciduous, pubescent; pedicels filiform, 0.4-0.9 cm long, brown, sparsely pubescent; bracteoles minute, fugacious, caducous. Calyx campanulate, 5-lobed; tube 0.1-0.2 cm long, brownish green, puberulous; lobes deltoid, 0.2-0.4 cm long, brownish green, puberulous. Corolla papilionaceous; standard obovate, 1.0-1.2 cm by 0.9-1.0 cm, bluish purple, with white tinged base, glabrous; wings oblong, 0.3-0.4 cm by 0.5-0.6 cm, bluish purple, adhering to the keel, glabrous; keel obtuse, 0.3-0.4 cm by 0.6-0.7 cm, violet, glabrous. Stamens 10, diadelphous, inserted; filaments filiform, white, glabrous; anthers uniform, ditheous, basifixed, longitudinal dehiscence. Ovary oblongoid, pale green, sparsely pubescent, unilocular, marginal placentae; style curved; white; stigma capitate. Pods 3-6 jointed, 0.8-1.0 cm long, elliptic, curved, indehiscent, sparsely hooked hairs, brown when mature. Seeds terete, small, brown, glabrous.

Description of pollen morphology (Fig.2, E, F)

Tricolporate, prolate spheroidal, medium, $28.75-31.25 \times 26.25-30.0 \mu\text{m}$ in length and breadth; amb triangular, angulaperturate; colpi $\frac{3}{4}$ way up to the pole, $22.5-23.75 \times 2.5-5.0 \mu\text{m}$ in length and breadth; pori lalongate, $5.0-7.5 \times 11.25-15.0 \mu\text{m}$ in length and breadth; exine 1.3-1.9 μm thick, sexine thicker than nexine; sculpturing microreticulate.

7. *Desmodium teres* Wall., Cat. 5694.1832. (Fig.2, G)

Myanmar name : Unknown

English name : Unknown

Flowering period : September to November

Annual, erect herbs; stems and branches angles, solid, woody, pubescent. Leaves unifoliolate; alternate; stipules linear lanceolate, 0.7-1.2 cm long, green, pubescent, persistent; petioles terete, about 0.7 cm long, green, slightly canaliculate above, pubescent; stipels linear,

green, pubescent; leaf blades oblong-lanceolate, 6-15 cm by 2.3-6.5 cm, green, obtuse or rounded at the base, wavy and ciliate along the margin, acuminate at the apex, sparsely pubescent on both surfaces. Inflorescences terminal racemes, many-flowered; peduncles angular, green, hispid. Flowers bisexual, zygomorphic, pentamerous, pale greenish yellow, 0.3-0.4 cm in diameter at anthesis; bracts linear, pale green, caducous, pubescent; pedicel terete, 0.2- 0.3 cm long, green, with hooked pubescent; bracteoles absent. Calyx campanulate, 5-lobed; tube about 0.2 cm long, green, pubescent; lobes deltoid, green, setaceous. Corolla papilionaceous, exserted; standard obovate, 0.5-0.6 cm by 0.4-0.5 cm, pale greenish-yellow, glabrous; wings oblong, about 0.4 cm by 0.2 cm, white, glabrous; keel oblong, about 0.4 cm by 0.2 cm, purplish white, glabrous. Stamens 10, diadelphous; filaments filiform, white, glabrous; anthers ditheous, uniform, dorsifixed, longitudinal dehiscence. Ovary superior, oblongoid, unilocular with many-ovuled on the marginal placentae; with hooked hairs; style white, glabrous; stigma capitate. Pods 5-10 jointed, 2-5 cm by 0.2-0.4 cm, compressed, indehiscent, very narrowly turgid, acute at the tip, with hooked hairs, slightly constricted at both suture. Seeds small, pale brown, elliptic.

Description of pollen morphology (Fig.2, H, I)

Tricolporate, prolate spheroidal, medium, 37.5-42.5×32.5-38.75 µm in length and breadth; amb triangular, angulaperturate; colpi $\frac{3}{4}$ way up to the pole, 18.75-22.5×2.5-5.0 µm in length and breadth; pori lalongate, 6.25-7.5×10-15 µm in length and breadth; exine 1.25-1.85 µm thick, sexine as thick as nexine; sculpturing microreticulate.

8. *Desmodium velutinum* (Willd.) DC. Prodr. 2:328. 1825. (Fig.2, J)

Desmodium latifolium (Roxb.) DC., Prodr. 2:328. 1825.

Hedysarum velutinum Willd., Sp. Pl. 3:117. 1803

Myanmar name : Kyo pan

English name : Unknown

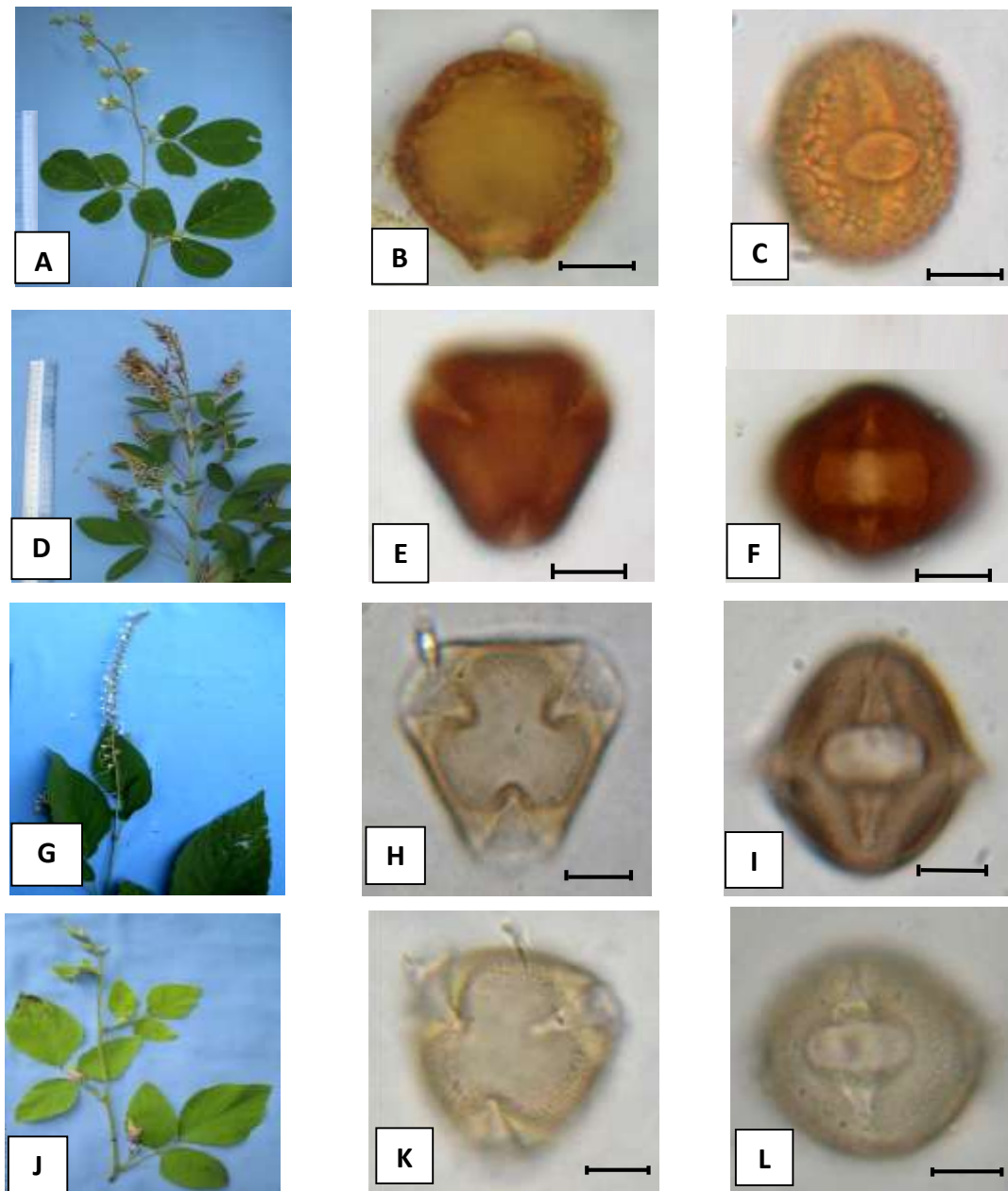
Flowering period : October to December

Annual, erect herbs; stems and branches terete, green, brownish pubescent. Leaves unifoliolate; alternate; stipules linear, 0.2-0.3 cm long, brown, tomentose; stipels linear, tomentose; petiolules terete, 0.2-0.4 cm long, brown, tomentose; petioles terete, 0.5-1.0 cm long, greenish brown, tomentose; leaf blades broadly ovate, 4-10 cm by 2.5-7.5 cm, obtuse or truncate at the base, entire along the margin with ciliate, rounded to acute at the apex, pubescent on both surfaces. Inflorescences terminal or axillary dense racemes, many flowered; peduncles terete, green, brown pubescent. Flowers bisexual, zygomorphic, pentamerous, pale purple, 0.2-0.4 cm in diameter at anthesis; bracts lanceolate, caducous, densely hispid; pedicels terete, 0.1-0.2cm long, green, pubescent; ebracteolate. Calyx campanulate; tube about 0.2 cm long, green, pubescent; lobes lanceolate, green, pubescent. Corolla papilionaceous; standard ovate, 0.5-0.6 cm by 0.4-0.5 cm, pinkish purple, shortly clawed, pubescent; wings oblong, 0.3 - 0.4 cm by 0.2 cm, pinkish purple, pubescent; keel obtuse, 0.3-0.4 cm long, purple, glabrous. Stamens 10, diadelphous; filaments filiform, white, glabrous; anthers ditheous, uniform, basifixed, longitudinal dehiscence. Ovary superior, linear-oblong, densely white pubescent, unilocular, marginal placentae; style filiform, brownish white, glabrous, stigma capitate. Pods lomentum, 3-6 jointed; indehiscent, pubescent, the lower suture straight, the upper suture slightly indented. Seeds small, elliptic, pale brown.

Description of pollen morphology (Fig.2, K, L)

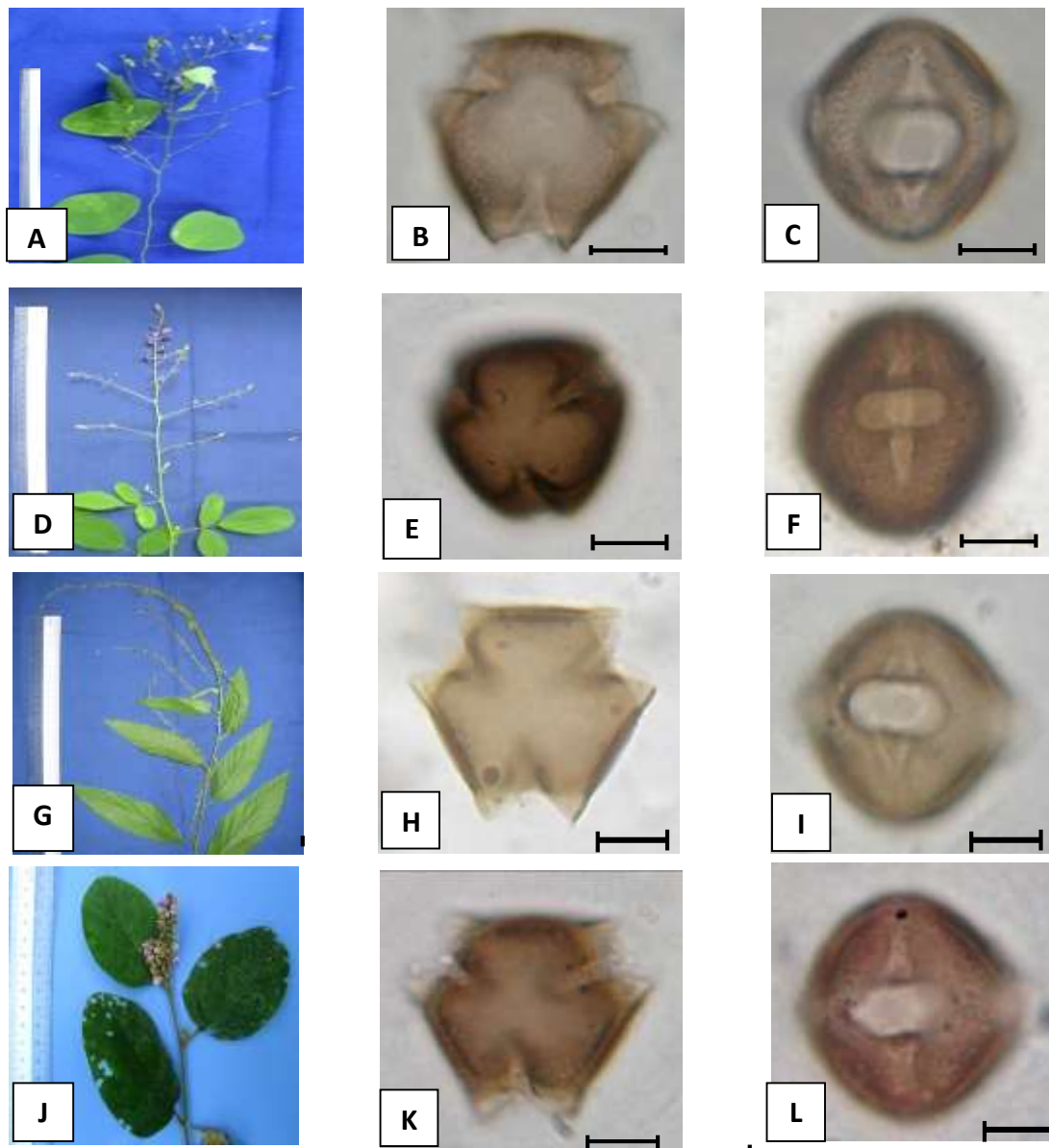
Tricolporate, subprolate, small, 17.5-22.5×15.0-18.75 µm in length and breadth; amb triangular, angulaperturate; colpi longicolpate, 15.0-18.75 ×2.5-3.75 µm in length and breadth; pori

lalongate, $6.25-8.75 \times 8.75-12.5 \mu\text{m}$ in length and breadth; exine $1.3-1.9 \mu\text{m}$ thick, sexine thicker than nexine; sculpture microreticulate.



Scale bar = $10 \mu\text{m}$

Figure 1 A. Inflorescences of *Desmodium confertum* DC.
 B & C Polar & Equatorial view pollen of *D. confertum* DC.
 D. Inflorescences of *Desmodium griffithianum* Benth.
 E & F Polar & Equatorial view pollen of *D. griffithianum* Benth.
 G. Inflorescences of *Desmodium jucundum* Thw.
 H & I Polar & Equatorial view pollen of *D. jucundum* Thw.
 J. Inflorescences of *Desmodium laxiflorum* DC.
 K & L Polar & Equatorial view pollen of *D. laxiflorum* DC.



Scale bar = 10 μ m

Figure 2 A. Inflorescences of *Desmodium renifolium* (L.) Schindl.
 B & C Polar & Equatorial view pollen of *D. renifolium* (L.) Schindl.
 D. Inflorescences of *Desmodium spirale* DC.
 E & F Polar & Equatorial view pollen of *D. spirale* DC.
 G. Inflorescences of *Desmodium teres* Wall.
 H & I Polar & Equatorial view pollen of *D. teres* Wall.
 J. Inflorescences of *Desmodium velutinum* (Willd.) DC.
 K & L Polar & Equatorial view pollen of *D. velutinum* (Willd.) DC.

Discussion and Conclusion

In this research, taxonomy and pollen morphology of 8 species belonging to genus *Desmodium* of the subfamily Papilionoideae were studied. According to the resulting data, *Desmodium confertum* DC., *D. jucundum* Thw. are perennial and the remaining species are annual. *D. confertum* is small tree and remaining species are herbs or shrubs. The unifoliolate leaves occurred in *D. renifolium* (L.) Schindl., *D. teres* Wall., *D. velutinum* (Willd.) DC. and the remaining species are trifoliolate. The inflorescences types of studied species are raceme and Papilionaceous flowers. Stamens are found in diadelphous, ovary marginal placentation and indehiscent fruits.

Pollen morphology was classified on the basic of size, shape and sculpturing pattern. The resulting data of the pollen morphology were presented Figure 1- 2.

In this research, the types of pollen are found monad and aperture colpate. The sizes of pollen grains are small and medium. *Desmodium confertum* DC., *D. velutinum* (Willd.) DC., are small sized and the remaining species are medium sized. All study species are tricolpate pollen and pori alongate. Colpi of *Desmodium confertum* DC., *D. griffithianum* Benth., *D. velutinum* (Willd.) DC. are longicolpate and the other species are colpi $\frac{3}{4}$ way up to the pole. The shapes of pollens are prolate spheroidal, subprolate, suboblate, oblate and oblate spheroidal. Oblate shape is found in *D. laxiflorum* DC.; suboblate in *D. griffithianum* Benth.; subprolate are *D. confertum* DC., *D. velutinum* (Willd.) DC., *D. renifolium* (L.) Schindl and the remaining species are prolate spheroidal. Sculpture patterns are reticulate, psilate and microreticulate. Reticulate sculpture occurred in *Desmodium confertum* DC.; psilate is *D. griffithianum* Benth. and the remaining species are microreticulate.

In the present research, pollen grains of *Desmodium* species are tricolpate, small to medium sized, pori alongate, suboblate, subprolate, oblate spheroidal, prolate-spheroidal, oblate shape; amb triangular, rounded; sculpture psilate, microreticulate and reticulate. Mitra & Mondal (1982) mentioned that pollen grains of *Desmodium* are tricolpate, medium to large sized, spheroidal to oblate-spheroidal, amb subangular and sculpture rugulose, verrucose, obscure or microreticulate to reticulate; which characters are similar to the present research. Butt (1989) stated that the pollen grains of *Desmodium* spp. are tricolpate, small to medium, psilate to finely granulate, granulate to finely reticulate, which characters are agreed with present research.

Faegri *et al.* (1964) stated that the structure and sculpturing of the exine provide characters of great diagnostic value. There are many other characters which may be of equal or even greater importance in the identification of pollen grains.

In this research is provided the knowledge of pollen morphology of genus *Desmodium* to botanist and others scientists who are interested. Pollen characters will be supported for identification and classification of the plants. Pollen characters are now being used as important taxonomic tool for reassessing different types of plant groups. The present research, to give the taxonomic information and pollen morphological data for the future studies.

Acknowledgements

I would like to thank Dr Aye Aye Kyi, Professor and Head, Department of Botany, University of Magway, for her kind permission. I wish to express my sincere thank to Dr Thandar, Professor, Department of Botany, University of Magway for her kind suggestions. I also would like to express my heartfelt sincere gratitude to Dr Nwè Nwè Yi, Professor, Department of Biology, Sagaing University of Education, for her guidance, valuable advice for taxonomical point of view and my research.

References

- Bhojwani, S.S & S.P. Bhatnagar. (2005). The embryology of angiosperm. Vikas publishing house PVT LTD., Masjid Road, Jangpura, New Delhi.
- Briggs, D. & J. Brady. (2000). Correlation between the structure and function of pollen grains of four species of angiosperm. Smith College.
- Butt, M. Q. (1989). Palynological studies of leguminous plants growing in the Punjab, Pakistan. PhD Thesis. Department of Botany, University of Punjab, Pakistan.
- Dassknayake, M.D. (1991-1997). A revised handbook of Flora of Ceylon Vol 1 and 7 Fabaceae. Department of Agriculture, University of Peradeniya. Sri Lanka.
- Erdtman, G. (1952). Pollen morphology and plant taxonomy. Angiosperms. An introduction to palynology. Almquist & Wiksell, Stockholm. The Chronica Botanica Co. Waltham. Mass. U.S.A.
- Erdtman, G. (1969). Handbook of palynology, morphology, taxonomy, ecology. Hafner Publishing Co., Inc. New York.
- Erdtman, G. (1971). Pollen morphology and plant taxonomy. Hafner Publishing Co., Inc. New York.
- Erdtman, G. (1985). Palynology. Vol 22. Advances in Botanical Research. Academic Press.
- Fægri, K., J. Iversen, & H.T. Waterbolk. (1964). Text book of pollen analysis. International booksellers & Publishers Limited. Denmark.
- Hesse, M., H. Halbritter., R. Zetter., M. Weber., R. Buchner., A. Frosh-Radiva & S. Ulrich. (2009). Pollen Terminology. University of Vienna, Austria.
- Kress, J., R. A. Defilipps., E. Farr. & Yin Yin Kyi. (2003). A checklist of the trees, shrubs, herbs and climbers of Myanmar. Department of Systematic Biology- botany. National Museum of Natural History Washington, DC. U.S.A.
- Langran, X., C. Dezhao., Z. Xiangyun & H. Puhua. (2010). Flora of China. Vol 10 Fabaceae. MBG Press and Science Press, Beijing. China.
- Martin, F., Wojciechowshi., J. Mahn. & B. Jones. (2006). Fabaceae. Trees of life web project. Arizona State University. Arizona, U.S.A.
- Mitra, K & M. Mondal. (1982). Pollen morphology of exstipellate and stipellate Hedysareae (Leguminosae). Palynology laboratory, Central National Herbarium, Howrah 711103.
- Moore, P. D., J. A. Weeb. & M.E. Collinson. (1991). Pollen analysis. Second edition. Oxford Black well Scientific Publications London.
- Paldat. (2005). Illustrated handbook on pollen terminology. University of Vienna, Rennweg 14.A 1030 Wein. Austria.
- Perveen, A. & M. Qaiser. (1998). Pollen flora of Parkistan VIII. Leguminosae. (Subfamily: Papilionoideae). Department of Botany, University of Karachi. Karachi-Parkistan.
- Simpson, M. G. (2006). Plant Systematic. Elsever academic press. 84 Theobald's Road, London. WCIX 8RR.UK.