TAXONOMY AND POLLEN MORPHOLOGY OF NINE SPECIES IN FABACEAE

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Abstract

Taxonomy and pollen morphology of 9 species belonging to 7 genera of the family Fabaceae were studied. The specimens were collected from Magway Region during 2017- 2018. The collected species are two species of *Acacia, Caesalpinia* and one species of *Aeschynomene, Butea, Clitoria, Mucuna, Vigna*. Taxonomic descriptions, artificial key to the species was presented. According to the resulting data, perennial tree are *Acacia, Butea*; small tree is *Caesalpinia sappan* L.; shrubs is *Aeschynomene americana* L.; lianas is *Caesalpinia bonduc* (L.) Roxb and rest species are herbs. The types of leaves are compound. The trifoliolate leaves also occurred in *Butea, Mucuna, Vigna* and the remaining species are uni or bipinnate. The pollen grains were found as polyads and monads. Polyads was observed in *Acacia* and the other species were monads. The shape, size and sculpture are important criteria for the study of pollen morphology. There are two types of aperture and three types of exine ornamentation. Psilate pollens are observed in *Acacia catechu* (L.f) Willd., *Clitoria ternatea* L., and the other species are reticulate. The sizes of pollens are small, medium and large.The smallest pollen was found in *Aeschynomene* and largest pollen observed in *Mucuna*. Pollen of each species was presented in polar view and equatorial view.

Keywords: Taxonomy, pollen morphology

Introduction

Fabaceae is the third largest family of flowering plants. Fabaceae includes three subfamilies: Mimosoideae, Caesalpinioideae, and Faboideae (Anonymous 2012). The Fabaceae is very large group with worldwide distribution. Legumes are one of the important plant groups, being the source of numerous pulses, soil rotation plants, oil, timber trees, gums and dyes (Simpson 2006). The Mimosaceae is 17 genera and 93 species. Caesalpiniaceae is 26 genera and 124 species. Papilionaceae is 84 genera and 510 species in the checklist of Myanmar (Kress *et al.* 2003). Fabaceae is about 650 genera and 18,000 species worldwide distribution (Langran *et al*. 2010).

The word "Palynology" was coined by Hyde and Willams as a suitable for "the science of pollen grains and spores". It comes from the Greek work palynein meaning "to spread". Palynology is the morphology of pollen, fine structure of their wall, particularly of its outermost layer, the exine. (Erdtman 1985). The exine is the outer layer of living pollen grain. 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 a range of scientific studies. Taxonomy, genetic, evolutionary studies, honey studies, allergy studies, forensic science, tracing vegetation history, climate change studies (Moore *et al.* 1991). The palynological research can be either basic or applied. To the basic aspects belongs the pollen morphology in relation to taxonomy and the applied aspects belong to geopalynology, aeropalynology, iatropalynology and melitopalynology (Bhojwanii &Bhatnagar 2005). Angiosperms have two basis pollen grains, monosulcate and tricolpate. Palynologists agree that the first flowering plants probably had monosulcate pollen grains. Tricolpate types are characteristics of the advanced dicotyledons (Walker & Doyle 1975).

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Materials and Methods

The plants were collected from Magway Region 2017- 2018. All the collected species are recorded by photographs during flowering times. Identification of collected specimens was carried out by using floristic literature of Dassanayake (1991), Kress *et al*. (2003) and Langran *et al*.(2010).Pollen samples were collected from the anther of blooming flowers. Pollen samples were acetolysed by Erdtman method (1952). The pollen samples in a glass vials were crushed with a glass rod and acetic acid was added. The mixture of glass vial was transferred into a test tube. The test tube was put in 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. The identification of pollen is referred to Erdtman (1952), Erdtman (1969), Erdtman (1971), Moore *et al.* (1991), Hoen (1999), Paldat (2005), Pascoe (2007), Hesse *et al*. (2009).

Results

Pollen morphology of nine species in Fabaceae has been studied in this paper.

A. Artificial key to the species

1. Flowers actinomorphic ----------2
1. Flowers zgyomorphic----------3
    2. Bark brown, inflorescence pedunculate spike----------1.*Acacia catechu*
    2. Bark pale yellow, inflorescence globose head----------2.*Acacia leucophloea*
3. Perennial ----------4
3. Annual----------6
    4. Flower reddish orange, stamen diadelphous----------4. *Butea monosperma*
    4. Flower yellow, stamen free----------5
5. Lianas, pods spiny----------5. *Caesalpinia bonduc*
5. Small tree, pods glabrous----------6.*Caesalpinia sappan*
    6. Stipules peltate, anther basifixed----------9. *Vigna trilobata*
    6. Stipules lanceolate, anther dorsifixed----------7
7. Trifoliolate, seed elliptic-oblong----------8. *Mucuna hirsuta*
7. Unipinnate, seed reniform----------8
    8. Twinning herbs, flower bright blue ----------7.*Clitoria ternatea*
    8. Erect shrubs, flower pinkish yellow ----------3.*Aeschynomene americana*

B. Artificial pollen key to the species

1. Grain polyads ----------2
1. Grain monads---------- ----------3
    2. Sculpture psilate ----------1.*Acacia catechu*
    2. Sculpture reticulate----------2.*Acacia leucophloea*

3. Aperture porate----------4
3. Aperture colporate----------5
    4. Operculum absent----------7. *Clitoria ternatea*
    4. Operculum present ----------9. *Vigna trilobata*
5. Angulaperturate----------6
5. Planaperturate----------8
    6. Pori lolongate----------4.*Butea monosperma*
    6. Pori lalongate----------7
7. Grain size small----------3.*Aeschynomene americana*
7. Grain size large ----------8.*Mucuna hirsuta*
    8. Amb triangular, sexine as thick as nexine ----------5.*Caesalpinia bonduc*
    8. Amb circular, sexine thicker than nexine ----------6. *Caesalpinia sappan*

1. *Acacia catechu* (L.f) Willd., Sp. Pl. 4: 1079. 1806. (Figure 1. A)

***Mimosa catechu* L. f, Sp. Pl. 439. 1782**

Myanmar name : Sha

English name : Black Catechu

Flowering period : June-September

Perennial, tree, woody; stems and branches terete, recurved prickles just below the nodes, tannin present, bark brown, pubescent. Leaves bipinnately compound, paripinnate, alternate, green, glabrous; stipules spinous, acute and curved at the apex, glabrous; petioles terete, with gland near the first pair of pinnae, glabrous, pulvinous; rachis terete, 6.0-8.0 cm long, pale green, glabrous; leaflets linear, 0.2-0.5 cm by 0.1-0.2 cm, obtuse at the base, entire along the margin, retuse at the apex, glabrous on both surfaces. Inflorescences axillary pedunculate spike, many-flowered. Flowers bisexual, actinomorphic, pentamerous, hypogynous, pale greenish-yellow, sessile; bracts minute; bracteoles absent. Calyx 5-lobed, campanulate. Corolla 5-lobed, campanulate; tube slightly pubescent, pale greenish-yellow, lobes oblong, cream color. Stamens numerous, free, exserted; filament filiform; anther dithecous, dorsifixed, longitudinal dehiscence. Ovary superior, linear-oblong, unilocular, one ovules in each locule on marginal placentae; style filiform; stigma simple. Pods oblong, compressed, brown, dehiscent.

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

Polyads, 12-celled, bilateral, flattened, medium, 45.0-47.5×43.8-50.0 µm in length and breadth; each grain triporate, small, 13.8-16.3×11.3-18.8 µm in length and breadth; amb tri-quadrangular; exine 1.3-2.5µm thick, sexine thicker than nexine; sculpturing psilate.

2 *Acacia leucophloea* (Roxb.) Willd., Sp. Pl. 4(2): 1083. 1806. (Figure 1. D)

***Mimosa leucophloea* Roxb., Pl. Corom. 2: 27, t. 150.1798.**

Myanmar name : Hta naung

English name : White-barked Acacia

Flowering period : June-September

Perennial, tree, pale yellowish bark, broadly umbelliform crown, trunk of young tree often thorny sucker; stem woody; branches cylindrical, pubescent. Leaves bipinnately compound, alternate; stipule spinous, straight or recurved, dark or brown; petiole terete, with gland above near the first pair of pinnae, tomentose; rachis 2.0-9.0 cm long, pubescent; leaflets linear, 0.3-0.8 cm by 0.1-0.3 cm, oblique at the base, entire along the margin, obtuse at the apex, sparsely pubescent on both surfaces; stipel absent. Inflorescences globose head, aggregate into terminal panicles, 18-28 cm long, tomentose. Flower bisexual, actinomorphic, pentamerous, hypogynous, pale yellow, pubescent; involucres bracts, pale brown, glabrous within, pubescent without. Calyx 5-lobed, campanulate; lobes triangular, yellowish green, pubescent. Corolla 5-lobed, campanulate; lobes very short; yellowish-green, puberulous. Stamen numerous, free, exserted, pale yellow, anther dithecous, dorsifixed, longitudinal dehiscence, yellow. Ovary superior, linear, puberulous, one ovules in each locule on the marginal placentae; style short; stigma simple. Pods linear falcate, compressed, straight or slightly curved, pale yellowish-brown.

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

Polyads, 16-celled, bilateral, medium, 43.8-47.5×46.3-56.3 µm in length and breadth; each grain triporate, small, 10.0-16.3×11.3-17.5 µm in length and breadth; amb tri-quadrangular; exine 1.3-2.5 µm thick, sexine as thick as nexine; sculpturing reticulate, the lumina heterobrochate about 0.6-1.3 µm in width, the muri simplibaculate about 0.6 µm wide.

3. *Aeschynomene americana* L. Sp. Pl, 2: 713. 1753. (Figure 2. A)

Myanmar name : Tawpe

English name : Unknown

Flowering period : October - December

Annual, erect shrubs; stems and branches cylindrical, slightly ribbed, reddish-green, velutinous. Leaves unipinnately compound, paripinnate, alternate; stipules lanceolate, green, velutinous, base auriculate, apex acute, caducous; petioles terete, 0.3-0.5 cm long, reddish-green, velutinous; racheae terete, 3-7 cm long, reddish-green, villous; stipels absent; petiolule terete, pale green, velutinous; leaflets linear-oblong, 0.6-1.0 cm by 0.1-0.2 cm, oblique at the base, entire along the margin, obtuse at the apex with mucronate, green, margin reddish, velutinous on both surfaces. Inflorescences axillary racemes; peduncle terete, 1-3 cm long, green, velutinous. Flowers bisexual, zygomorphic, pinkish-yellow, about 0.8 cm in diameter at anthesis; pedicels terete, green, velutinous; bracts paired, ovate to acute, serrate with red margin, velutinous, persistent; bracteoles linear-ovate, striate, green, velutinous; lobes very short, serrate along the margin, pale green, velutinous. Corolla papilionaceous; standard orbicular, large, 0.5-0.8 cm by 0.3-0.4 cm, pink with yellow bloth at base, glabrous; wings obliquely obovate, 0.5-0.7 cm by 0.2 -0.3 cm, pinkish yellow, glabrous; keels obtuse, slightly incurved, 0.3-0.5 cm by 0.2-0.3 cm, pinkish yellow, glabrous. Stamens 10, diadelphous, anther uniform, dithecous, dorsifixed,

yellow, longitudinal dehiscence. Ovary superior, linear, velutinous, unilocular with few ovules on the marginal placentae; style filiform, incurved, about 0.2cm long, white, glabrous; stigma simple. Pods linear, compressed, 4-8 jointed, slightly curved, lower suture incised, flattened, brown, velutinous. Seeds reniform, small, brown, glabrous.

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

Tricolporate, oblate, small, 12.5-16.3×17.5-22.5 μm in length and breadth; amb rounded, angulaperturate; colpi syncolpate; pori lalongate, 5.0-6.3×6.3-7.5 μm in length and breadth; exine 1.3-2.5 μm thick, sexine as thick as nexine; sculpturing reticulate, lumina heterobrochate, 0.6 -1.3 μm width, muri simplibaculate, about 0.3 μm wide.

4. *Butea monosperma* (Lam.)Taub in Engler&Prantl, Nat, Pflanzenfam. 3(3)366. 1894. (Figure 2. D)

***Erythrina monosperma* Lam., Enc. 2: 391.1786**

Myanmar name : Pauk

English name : Flame of the forest, Parrot tree

Flowering period : February-March

Perennial trees bark grayish-black; stems and branches terete, pubescent. Leaves trifoliolate compound, alternate; stipules linear-lanceolate, green, caducous, pubescent; petioles terete, 7-18 cm long, green, pubescent; stipels subulate, green, pubescent; petiolules terete, green, pubescent; leaflets 3, obovate or suborbicular, 10-16 cm by 8-14 cm, unequal, broadly cuneate at the base, entire along the margin, rounded or emarginate at the apex, coriaceous. Inflorescences axillary or terminal fasiculate raceme, many-flowered; peduncles terete, 8-40 cm long, green, with many tubercles, tomentose. Flowers bisexual, zygomorphic, pentamerous, hypogynous, reddish orange, about 2 cm in diameter at anthesis, showy; pedicel terete, rusty densely velutinous; bracteoles linear, rusty velutinous, caducous. Calyx 5-lobed; tube campanulate, dark green, velutinous; lobes acute, the upper one completely united, dark green, velutinous or densely silvery gray on both surfaces. Corolla papilionaceous; standard ovate-oblong, recurved, 3.5-4.5 cm by 1.6-2.5 cm, reddish-orange, densely white pubescent, clawed; wings narrowly falcate, 4.0- 4.5 cm by 1.2-1.5 cm, reddish-orange, pubescent; keel broadly falcate, beaked, 4.5-5.0 cm by 1.7-2.0 cm, connate into an ridge, densely silvery gray velutinous. Stamens 10 diadelphous; filaments filiform, glabrous; anther dithecous, dorsifixed, oblong, longitudinal dehiscence. Ovary superior, linear, villose, densely velutinous, curved, unilocular with one ovules on the marginal placentae; style filiform, pale yellow, glabrous; stigma subcapitate. Pods oblong, flat, dehiscent, brown, densely silvery gray pubescent. Seeds reniform, pale brown, compressed, glabrous.

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

Tricolporate, oblate spheroidal, medium, 33.8-47.5×35.0-48.8 μm in length and breadth; amb rounded triangular, angulaperturate; colpi longicolpate, 28.8-43.8×5.0-8.8 μm in length and breadth; pori lolongate, 8.8-12.5×7.5-11.3 μm in length and breadth; operculum about 1.3 μm thick; exine 1.3-2.5 μm thick, sexine thicker than nexine; sculpturing reticulate, lumina heterobrochate, 0.6 -1.0 μm width, muri simplibaculate, about 0.3 μm wide.

5. *Caesalpinia bonduc* (L.) Roxb., FL.Ind, ed. Carey. 2: 362. 1832. (Figure 3.A)

***Guilandina bonduc* L., Sp. Pl. 1: 381. 1753.**

***Caesalpinia crista* L., Sp. Pl., ed. 2, 1:545 . 1762.**

Myanmar name : Kalein

English name : Unknown

Flowering period : August to October

Perennial, aculeate lianas; stems and branches terete, with straight or recurved prickles, pubescent, prickle hard, falcate. Leaves bipinnately compound, paripinnate, alternate; stipules leafy, large, 3-5 lobed, ovate, persistent; petioles terete, 9.5-12.0 cm long, green, pulvinate, spiny pubescent; racheae eglandular, with incurved pairs of prickles beneath; primary rachis terete, 35-60 cm long, with hooked spine, green, 6-8 pairs of pinnae, pubescent; secondary rachis terete, 6-13 cm long, green, pubescent, with recurved prickles; leaflet numerous, oblong, 6-12 paired per pinna, opposite, 2.0-3.8 cm by 1.2-2.0 cm, oblique at the base, entire along the margin, rounded to acute at the apex, mucronate, pubescent on both surfaces. Inflorescences axillary racemes, many-flowered, densely flower at upper part and sparsely in lower part; peduncles 17-35 cm long, with densely straight spines, green, pubescent. Flowers unisexual, zygomorphic, yellow; pedicel terete, yellowish-green, pubescent; bracts subulate, yellowish-green, pubescent, caducous. Sepals 5, elliptic, 5-7 mm by 3-4 mm, ferruginous hairy on both surfaces, yellowish-green; petals 5, Caesalpinaceous, free, oblong or oblanceolate, 8-10 mm by 3 mm, yellow, clawed. Stamens 10, free, inserted; filaments filiform, pale green, wolly hairy at the base; staminodes in female flowers, anther dithecous, dorsifixed, yellow. Ovary hairy, unilocular with 1-2 ovules on the marginal placentae, with spine, shortly stipitate; style hairy; stigma ciliate; sterile pistil in male flower, flower rudimentary, hairy. Pods obovoid, spiny, 5-7 cm by 3.0 -4.5 cm, apex rounded with style rement, beaked, dehiscent, hairy spine. Seeds subglobose, 1 or 2, smooth, grey.

Description of pollen morphology (Figure 3. B, C)

Tricolporate, suboblate, medium, 28.8-33.8× 37.5-42.5 μm in length and breadth; amb triangular, planaperturate; colpi longicolpate, 25.0-31.3×13.8-18.8 μm in length and breadth; pori lolongate, 7.5-15.0×3.8-7.5 μm in length and breadth; operculum 1.3-2.5 μm thick; exine 2.5-3.8 μm thick, sexine as thick as nexine; sculpturing reticulate, lumina heterobrochate, 1.3-2.5 μm thick; muri simplibaculate, about 0.6 μm wide.

6. *Caesalpinia sappan* L. Sp. Pl. L: 381.1753. (Figure 3. D)

Myanmar name : Tein nyet

English name : Unknown

Flowering period : July-September

Perennial; small tree; stems and branches terete, brownish green, recurved prickles, glabrous. Leaves bipinnately compound, paripinnate; alternate; stipules spiniform, pale green, caducous; petioles terete, 3-5 cm long, green, sparsely pubescent; racheae 15-25 cm long, green, pinnae 8-13 pairs, armed with recurved prickles at the base; stipel absent; petiolules terete, green, pubescent; leaflets elliptic-oblong, rhomboid, 1.0-1.5 cm by 0.5-0.8 cm, oblique at the base,

entire along the margin, retuse or rounded at the apex, glabrous above, sparsely hairy beneath, green. Inflorescences axillary or terminal raceme, many-flowered; peduncles terete, 10-30 cm long, green, glabrous, recurved prickles. Flowers bisexual, zygomorphic, pentamerous, 1.5-2.0 cm in diameter at anthesis, yellow; bracts lanceolate, green, puberulent, caducous; pedicels terete, yellowish-green, sparsely pubescent; bracteoles absent. Sepals 5, unequal, ovate, 0.5-1.0 cm long, yellowish-green, tomentose. Petals 5, Caesalpinaceous, broadly obovate, 0.8-1.2 cm by 0.5-0.9 cm, yellow, glabrous, red striated. Stamens 10, free, slightly exserted, all fertile; filaments filiform, unequal, pale yellow, glabrous top, ciliated at the base; anthers dithecous, dorsifixed, longitudinal dehiscence. Ovary superior, oblong, unilocular with few ovules on the marginal placentae, glabrous; style slender, curved, yellow, glabrous; stigma truncate. Pods obliquely oblong, compressed, beaked, 2- 4 seeded, 4-5 by 2.0-2.5 cm, glabrous. Seeds oblong, slightly compressed, pale brown, glabrous.

Description of pollen morphology (Figure 3. E, F)

Tricolporate, suboblate, medium, 35.0-43.8 × 40-45 μm in length and breadth; amb circular, planaperturate; colpi longicolpate, 25-35 × 12.5-18.8 μm in length and breadth; pori lolongate, 6.3-10.0 × 2.5 -5.0 μm in length and breadth; operculum 1.3-2.5 μm thick; exine 3.8-50 μm thick, sexine thicker than nexine; sculpturing coarsely reticulate; lumina heterobrochate, 1.3-3.8 μm width; muri simplibaculate, 0.6-1.8 μm wide.

7. *Clitoria ternatea* L. Sp. Pl. 2: 753, 1753. (Figure 4. A)

Myanmar name : Aung me' nyo

English name : Butterfly pea, Blue pea, Asian pigeon-wings

Flowering period : June-October

Annual, twinning herbs; stems and branches terete, green, pubescent. Leaves unipinnately compound, imparipinnate, alternate; stipules linear-lanceolate, green, pubescent, persistent; petioles 2.0-3.0 cm long, cylindrical, green, pubescent; rachis 5.0-10.0 cm long, cylindric, pale green, pubescent; petiolule pale green, pubescent; leaflets 5-7, ovate-elliptic, 2.5-5.0 cm by 2.0-4.0 cm, obtuse at the base, entire along the margin, retuse at the apex, pubescent on both surfaces. Inflorescences axillary solitary cyme; peduncles cylindric, green, pubescent. Flowers bisexual, zygomorphic, pentamerous, bright-blue, 2-3 cm in diameter at anthesis; pedicel cylindric, pale green, pubescent; bracts lanceolate, with 2 minute bracts at the junction; bracteoles ovate-orbicular, pale green, persistent, pubescent. Calyx 5-lobed; tube campanulate, pale green, pubescent without, glabrous within, sub equal. Corolla papilionaceous, standard broadly obovate, 4.0-4.5 cm by 3.0-3.5 cm, bright-blue, with a pale yellow bloth, pubescent; wings oblong, 2.0 cm by 1.3 cm, claw long, bright blue at the apex, glabrous; keel boat-shaped 2.0 cm by 0.5 cm pale yellowish-green, pubescent without, glabrous within. Stamens 10, diadelphous; free, inserted; filaments filiform, pubescent, yellowish-green; anther dithecous, dorsifixed, uniform, pale yellow, longitudinal dehiscence. Ovary superior, linear, unilocular with few-ovules in the locule on the marginal placentae; style long, filiform, curved, stigma simple. Pods linear and compressed, green, tapering to a point, dehiscent, 6- to-10 seeded, pale yellow, pubescent. Seed reniform, brown, glabrous.

Description of pollen morphology (Figure 4. B, C)

Triporate, oblate, medium, 28.8-35.0×50.0-58.8 µm in length and breadth; amb rounded triangular, angulaperturate; pori lolongate, 11.3-20.0×7.5-12.5 µm in length and breadth; exine 1.3 -2.5 µm thick, sexine as thick as nexine; sculpturing psilate.

8. *Mucuna hirsuta* Wight & Arn., Prod. 254. 1834. (Figure 4. D)

Myanmar name : Khwe la ya

English name : Velvet bean

Flowering period : October to December

Annual, twining herbs; stems cylindrical, densely brownish pubescent, green. Leaves trifoliolate compound, alternate; stipules lanceolate, green, tomentose, caducous; petioles terete, canaliculate above, 5-25 cm long, green pubescent; stipels acute, tomentose, green, caducous; petiolules terete, hirsute, pale brownish-green; leaflets 3, ovate rhomboid, 10.0-17.5 cm by 7.5 -14.0 cm, oblique or obtuse at the base, entire along the margin, acuminate at the apex, brownish pubescent on both surfaces, green. Inflorescences axillary pendulous racemes; many flowered; peduncles terete, 8-17 cm long, tomentose, green. Flowers bisexual, zygomorphic, pentamerous, 0.6-0.9 cm in diameter at anthesis, deep purple; pedicels terete, green tomentose; bracts lanceolate, caducous; bracteoles minute, fugacious, caducous. Calyx fused, campanulate, 5-lobed; tube reddish-green, tomentose; lobes acuminate, upper 2 lobes united, reddish-green, pubescent. Corolla papilionaceous; standard obovate, auriculate, 1.8 cm by 1.7 cm, deep purple; wings oblong, incurved, 2.3-2.5 cm by 1.0 cm, adherent to keel, glabrous, deep purple; keels linear-oblong, slightly longer than or equal to wings, apex beaked, 2.5 cm by 0.5 cm, glabrous, deep purple. Stamens 10, diadelphous, exserted, staminal sheath purplish-white, glabrous; anthers dimorphic, dithecous, longitudinal dehiscence. Ovary villous, oblong, about 0.5 cm long, unilocular, one ovules in each locule on the marginal placentae, brownish pubescent, green; style filiform, glabrous, white; stigma small, capitate. Pods oblong, thick, 7.5-10.5 cm by 1.2-1.5 cm, dehiscent, slightly curved at the tip, covered with densely golden hair. Seeds elliptic-oblong, glabrous, black, shining.

Description of pollen morphology (Figure 4. E, F)

Tricolporate, subspheroidal, large, 57.5-70.0×56.3-68.8 µm in length and breadth; amb triangular, angulaperturate; colpi ¾ way up to the pole, 31.3-40.0×5.0-7.5 µm in length and breadth; pori lalongate 12.5-15.0×21.3-25.0 µm in length and breadth; exine 2.5-3.8 µm thick, sexine as thick as nexine; sculpturing reticulate; lumina heterobrochate, 3.8-7.5 µm width; muri simplibaculate, 0.6-1.3µm wide.

9. *Vigna trilobata* (L.) Verdc, Taxon 17:172. 1968. (Figure 5. A)

***Dolichos trilobatu*s L., Mant. Pl. 1:101. 1767.**

Myanmar name : Taw mat pe

English name : Unknown

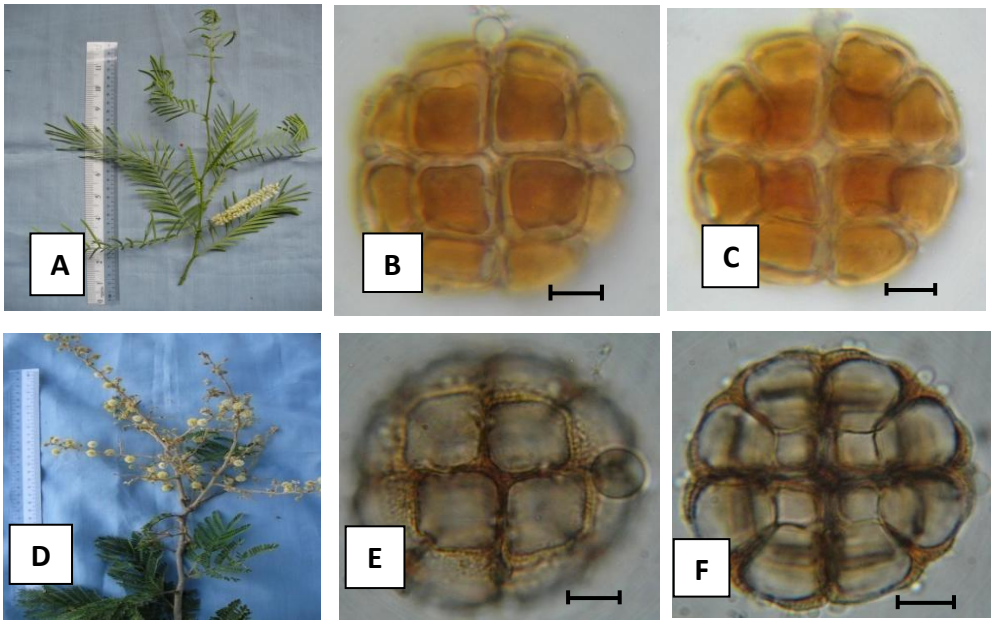
Flowering period : January-April

Annual, procumbent herbs; stems and branches slender, terete, ribbed, reddish-green, sparsely pubescent. Leaves trifoliolate compound, alternate; stipules peltate, green, pubescent,

persistent; petioles laterally compressed, 4-9 cm long, canaliculate, green, sparsely pubescent; stipels minute, ovate, green, glabrous; petiolules terete, green, pubescent; leaflets usually with shallow lobes, rhomboid or ovate, 3-lobed, 2.5-5.0 cm by 1.5-4.0 cm, green, obtuse at the base, entire along the margin, obtuse at the apex, sparsely pubescent on both surfaces. Inflorescences axillary raceme, erect, few-flowered; penducles terete, 12-28 cm long, green, sparsely pubescent. Flowers bisexual, zygomorphic, pentamerous, hypogynous yellow, about 8 mm in diameter at anthesis, showy; pedicel very short, green, pubescent; bracts ovate, green, pubescent; bracteoles obliquely lanceolate, green, glabrous. Calyx campanulate, 5-lobed; tube campanulate, green, glabrous; lobes minute, linear, pale green, glabrous. Corolla papilionaceous; standard orbicular, 4-6 mm by 5-8 mm, yellow above, brownish-green beneath; wings obliquely oblong, 4-7 mm long, yellow, clawed, glabrous; keel falcate, beaked, 6-7 mm by 2-3 mm, pale yellowish-white, glabrous, clawed, adhering to the wings. Stamens 10, diadelphous; filament filiform, white, glabrous; anther dithecous, basifixed, uniform, longitudinal dehiscence. Ovary superior, linear, green, pubescent, unilocular with one ovules in each locule on the marginal placentae; style filiform, white, glabrous; stigma globose. Pods linear, straight, 6-12 seeded, dehiscent, glabrous. Seeds brown, cylindric, truncate at both ends, glabrous.

Description of pollen morphology (Plate 5. B, C)

Triporate, oblate spheroidal, medium, 22.5-30.0×23.8-31.3 µm in length and breadth; amb rounded triangular, angulaperturate; pori lolongate, 5.0-7.5×3.8-6.3 µm in length and breadth; operculum about1.3 µm thick; exine 2.5-3.8 µm thick, sexine thicker than nexine; sculpturing coarsely reticulate, lumina heterobrochate, 2.5-5.0 µm width, muri simplibaculate, about 1.3 µm wide.



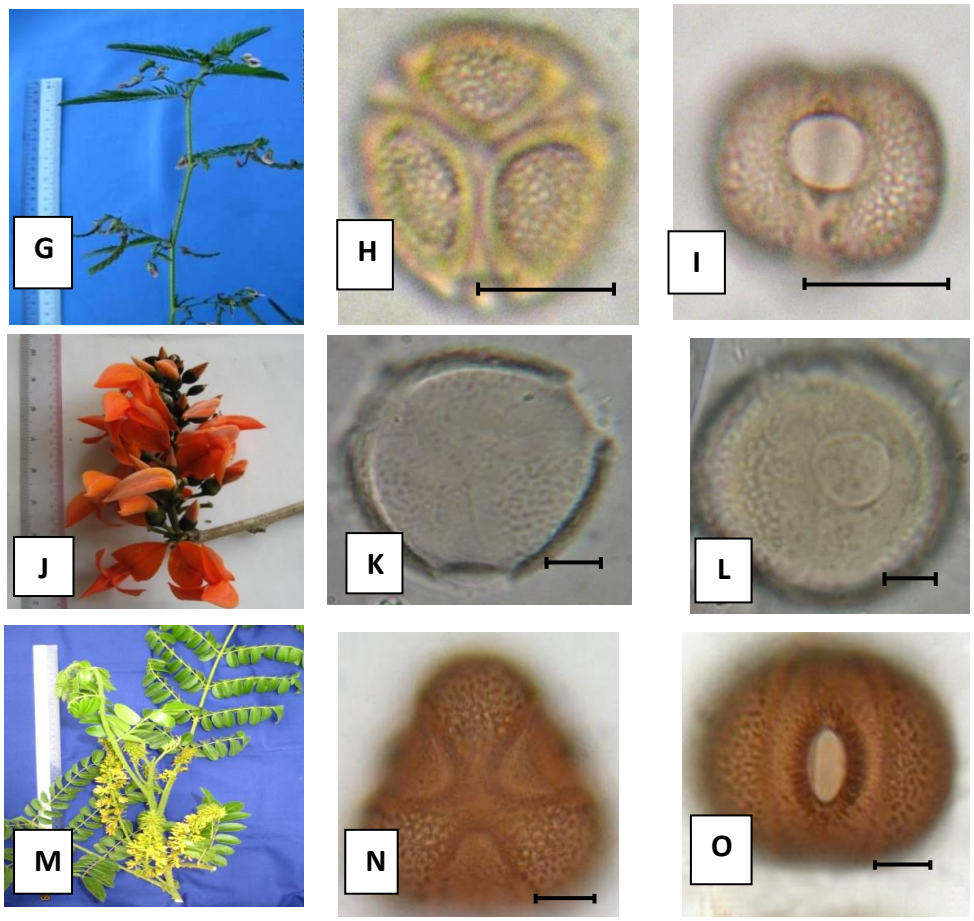
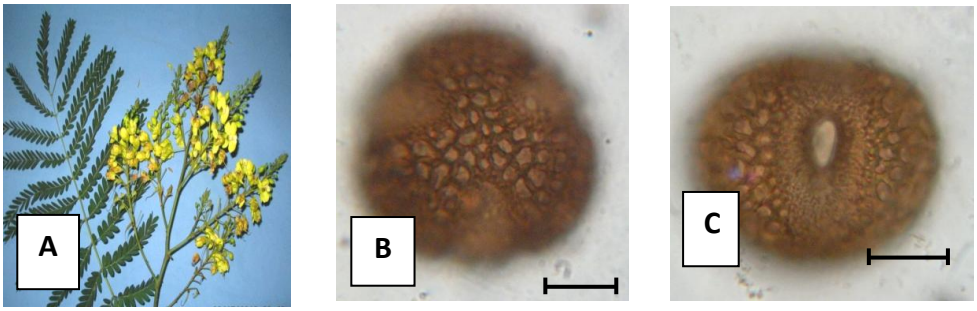


Figure 1 A. Inflorescences of *Acacia catechu* (L.f) Willd.
B &C Polar & Equatorial view pollen of *A. catechu* (L.f) Willd.
D. Inflorescences of *Acacia leucophloea* (Roxb.) Willd.
E &F Polar & Equatorial view pollen of *A. leucophloea* (Roxb.) Willd.
G. Inflorescences of *Aeschynomene americana* L.
H & I Polar & Equatorial view pollen of *A. americana* L.
J. Inflorescences of *Butea monosperma* (Lam.) Taub
K &L Polar & Equatorial view pollen of *B. monosperma* (Lam.) Taub
M Inflorescences of *Caesalpinia bonduc* (L.) Roxb.
N &O Polar & Equatorial view pollen of *C. bonduc* (L.) Roxb.
Scale bar = 10 µm



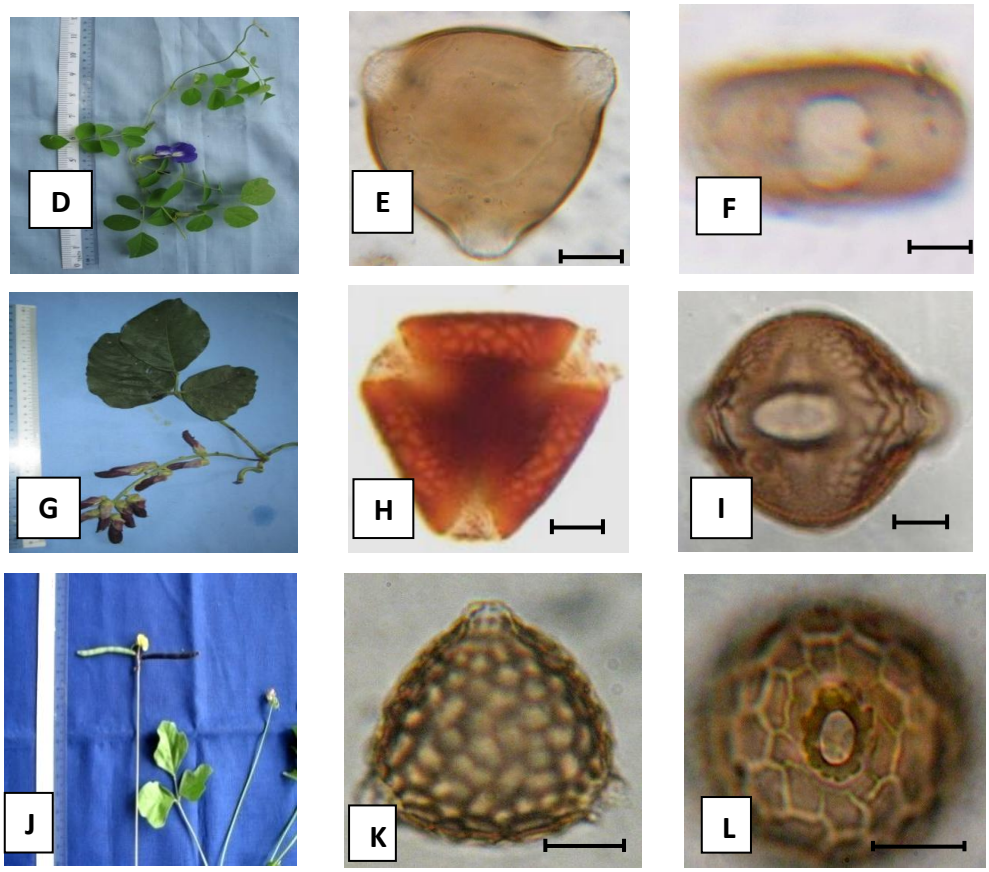


Figure 2 A. Inflorescences of *Caesalpinia sappan* L.
B &C Polar & Equatorial view pollen of *C. sappan* L.
D. Inflorescences of *Clitoria ternatea* L.
E &F Polar & Equatorial view pollen of *C. ternatea* L.
G. Inflorescences of *Mucuna hirsuta* Wight & Arn.
H & I Polar & Equatorial view pollen of *M. hirsuta* Wight & Arn
J. Inflorescences of *Vigna trilobata* (L.) Verdc
K &L Polar & Equatorial view pollen of *V. trilobata* (L.) Verdc

Scale bar = 10 µm

Discussion and Conclusion

In this research, taxonomy and pollen morphology of 9 species belonging to 7 genera of the family Fabaceae were studied. According to the resulting data, habits of this species are tree *Acacia*, *Butea*, small tree is *Caesalpinia sappan* L.; shrubs is *Aeschynomene americana* L.; lianas is *Caesalpinia bonduc* (L.) Roxb. and remaining species are herbs. The trifoliolate leaves also occurred in *Butea*, *Mucuna*, *Vigna* and the remaining species are uni or bipinnate. The inflorescences types of studied species are mostly raceme, rarely cymose *Clitoria ternatea* L.; pedunculate spike and globose head. Flowers are actinomorphic in *Acacia* and the other species are zygomorphic. Stamens are found in diadelphous and free.

Pollen morphology was classified on the basic of aperture, size, shape and sculpturing pattern.The resulting data of the pollen morphology were presented Figure 1- 5. In this research, the types of pollen are found polyads and monad. *Acacia* is polyads and the remaining species

are monad. The types of aperture in monad are mostly colporate and rarely porate. Porate pollen occurs in *Clitoria ternatea* L., *Vigna trilobata* (L.) Verdc and the rest species are colporate. Perveen and Qaiser (1998) stated that family Fabaceae is a eurypalynous. The pollen grains are mostly colporate, rarely colpate or porate. Sculpture reticulate type is most common.

In this study, the shapes of pollen grains are oblate spheroidal, subspheroidal, oblate and suboblate. Suboblate are found in *Caesalpinia*; oblate are *Aeschynomene americana* L., *Clitoria ternatea* L.; one species of subspheroidal is *Mucuna hirsuta* Wight & Arn.and the remaining species are oblate spheroidal. In polar view is triangular, rounded triangular and circular. The sculpturing patterns of the pollen are psilate, reticulate and coarsely reticulate; psilate is found in *Acacia catechu* (L.f) Willd., *Clitoria ternatea* L.; coarsely reticulate is occurred in *Caesalpinia sappan* L., *Vigna trilobata* (L.) Verdc and other species are reticulate pollen.

Walker and Doyle (1975) stated that the sculpture patterns on appearance are also varied significantly from one species to another species. Inaperturate pollen is relatively more primitive character than that of mono-, di-, tri- and polyaperturate.

Pollen grains of the genus *Caesalpinia* is tricolporate, amb circular, triangular, aperture reticulate. Graham (1998) mentioned that pollen characters of genus *Caesalpinia* are tricolporate, amb circular and aperture reticulate which characters are agreed with present result. Pollen grains of *Caesalpinia sappan* L. is tricolporate, amb circular and coarsely reticulate. Rao and Lee (1970) stated that the pollen grain of *Caesalpinia sappan* L. is tricolporate, triangular in polar view, coarsely reticulate, which characters are agreed with present result.

Walker and Doyle (1975) described that angiosperm have two basic pollen grains, monosulcate and tricolpate. Pollen of the monosulcate type is characteristics of primitive dicotyledons, majority of monocotyledons, cycads and pteridosperms. Palynologists agree that the first flowering plants probably had monosulcate pollen grains. Tricolpate types are characteristics of advanced dicotyledons. 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.

These pollen characters will be supported for identification and classification. All these interesting pollen features are undoubtedly important and beneficial for the future taxonomic studies. Moreover, this research is provided the knowledge of pollen morphology of Fabaceae to botanist and others scientists who are interested.

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