

TAXONOMY AND POLLEN MORPHOLOGY OF THE FAMILY ROSACEAE FOUND IN SOUTHERN AND NORTHERN SHAN STATE

Aye Myint San¹, Swe Swe Linn² & Soe Myint Aye³

Abstract

The taxonomical and pollen morphological studies of 10 species of the Family Rosaceae were studied. The specimens were collected 1 species such as *Docynia indica* (Wallich) Decaisne. in Pinlaung township and 4 species like *Rubus ellipticus* Smith., *Rubus ellipticus* var. *obcordatus* (Franchet) Focke., *R. molucanus* L. & *Pyrus communis* L. in Aungban township and 5 species namely *Chaenomeles japonica* (Thunb.) Lindley, *Prunus cerasoides* D. Don., *P. ceylanica* (Wight) Miq., *P. communis* Huds. & *P. persica* (L.) Batsch., in Lashio township. The genera *Chaenomeles*, *Docynia* and *Pyrus* were belonging to Maloideae, *Rubus* was belonging to Rosoideae and *Prunus* was belonging to Prunoideae. All the specimens were collected from Southern and Northern Shan State from September 2016 to October 2017. The measurements were based on at least 20 randomly selected, fully developed pollen grains per specimens. All the pollen grains of study species were tricolporate except from *Rubus molucanus* L., which was tri to tetraporate and *Prunus cerasoides* D. Don. that possessing tricolpate in aperture. All pollen grains were prolate spheroidal in shape. The pollen size was small in 4 species such as *Docynia indica* (Wallich) Decaisne., *Pyrus communis* L., *Rubus ellipticus* Smith. & *Prunus communis* Huds. and the remaining 6 species were medium. All investigated pollen grains were characterized by striate type of sculpturing. In this research, taxonomic description, the pollen morphological characters and photographs for every species were stated.

Keywords: Taxonomy, Pollen Morphology, Rosaceae

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Introduction

Rosaceae when first established by Jusseu (1789) was a small family with about 40 genera. The family Rosaceae consists of about 1000 species (Hooker 1879), 124 genera and about 3375 species (Dassanayake 1981) and 85 genera and 2000 sexual species (Kubitzki 2004). Watson (2013) described about 85 – 3000 species, cosmopolitan but most diverse in temperate and warm regions of the North Hemisphere. Kress *et al.* (2003) stated that the family Rosaceae consists of about 24 genera with a total of about 219 known species in Myanmar.

The Rosaceae are generally subdivided into four subfamilies: Prunoideae, Pomoideae, Spiraeoideae and Rosoideae. According to the International Code of Botanical Nomenclature, the Pomoideae should be renamed Maloideae, but the original name is still widely used in the literature (Challice 1974).

Taxonomy can be defined as the science dealing with the description, identification, nomenclature and classification of life (Simpson 2006). Since the time of Linnaeus, comparative analysis of reproductive characters has been the principal morphological technique for identifying and classifying angiosperms (Beth 2009).

Palynology is the science of pollen and spore morphology (Erdtman 1952). Palynology is concerned with both the structure and the formation of pollen grains and spores, also with dispersal and their preservation under certain environmental conditions. Palynology is related with cytology, genetics, taxonomy and so on (Moore *et al.* 1991).

Challice (1974) reported the Rosaceae are family of exceptional horticultural significance, with economically important fruit-bearing plants and ornamentals in the Prunoideae, Pomoideae and Rosoideae and a few ornamental shrubs in the Spiraeoideae. As well known examples the following may be mentioned, Prunoideae: plums, cherries, peaches, apricots, almonds, cherry laurels; Pomoideae: apples, pears, quince and numerous ornamental

trees and shrubs; Spiraeoideae: ornamental shrubs; Rosoideae: strawberries, blackberries and raspberries, roses and other garden plants.

In the floristic studies on various region of Myanmar, taxonomical study of a few species belonging to the Family Rosaceae has been studied by various researchers. However, taxonomy and pollen morphology of Rosaceae has not been studied in Myanmar. therefore, a research on the taxonomy and pollen morphology of this family is selected.

The aims and objectives of this research is to record on pollen morphology of the species of the family Rosaceae and to apply the result of palynological characters for taxonomic purposes.

Materials and Methods

The studied plants were collected from Aungban, Pinlaung and Lashio regions during September 2016 to October 2017. All the collected species were recorded by photographs at flowering times. Location of the collected species were described by Global Positioning System (GPS). Description and Classification of the species were made by fresh specimens. Identification of collected specimens were carried out by using floristic literature of Hooker (1879), Backer (1963), Dassanayake (1981), Lingdi *et al.* (2003), Watson *et al.* (2011). Myanmar names were referred to Hundley and Chit Ko Ko (1987) and Kress *et al.* (2003). Pollen samples were collected from the anther of blooming flowers. Pollen of each species was stored in glass vials with 1cc of glacial acetic acid and the specimen was labelled. Pollen samples were acetolysed by Erdtman method (1960).

Results

Taxonomy and pollen morphology of 10 species belonging to the Family Rosaceae have been studied. The subfamily and general listed according to Lingdi *et al.* (2003) and the species were arranged alphabetically as shown in Table 1.

Table 1. List of collected species

Family	Subfamily	Genus	Species
Rosaceae	Maloideae	<i>Docynia</i>	<i>Docynia indica</i> (Wallich) Decaisne
		<i>Chaenomeles</i>	<i>Chaenomeles japonica</i> (Thunb.) Lindley
		<i>Pyrus</i>	<i>Pyrus communis</i> L.
	Rosoideae	<i>Rubus</i>	<i>Rubus ellipticus</i> Smith.
			<i>R. ellipticus</i> var. <i>obcordatus</i> (Franchet) Focke
			<i>R. molucanus</i> L.
	Prunoideae	<i>Prunus</i>	<i>Prunus cerasoides</i> D.Don.
			<i>P. ceylanica</i> (Wight) Miq.
			<i>P. communis</i> Huds. <i>P. persica</i> (L.) Batsch.

1. *Docynia indica* (Wallich) Decaisne, Nouv. Arch. Mus. Hist. Nat. 10: 131. 1874. . (Figure 1. A)

Pyrus indica Wallich, Pl. Asiat. Rer. 2: 56. 1831.

Local Name - Pin SeinThi

English Name -Unknown

Flowering Period - March to April

Perennial trees; stems and branches terete. Leaves simple, alternate; stipules lanceolate, caducous; leaf blade elliptic or oblong lanceolate, broadly cuneate or subrounded at the base, acute or acuminate at the apex, margin shallowly crenate. Flowers bisexual, actinomorphic, pentamerous, perigynous, white; pedicels short or nearly absent, pubescent; bracts lanceolate. Sepals 5, lanceolate or triangular-lanceolate, acute or acuminate at the apex. Petals 5, free, oblong or oblong-obovate, white, broadly cuneate at the base, ovate at the apex. Stamens numerous, inserted; filaments filiform; anthers dithecal, dorsifixed, dehiscent longitudinally, yellow. Carpels 5, free; ovary superior, ovoid, unilocular with one ovule in each locule on pendulous placentae; styles

slender, as long as stamens; stigma capitate. Fruits pome, subglobose. Seed ellipsoid, glabrous.

Specimens examined: Southern Shan State, Pin Laung Township, 22° 56.998' N and 97° 44.924' E, Elevation 840 m, Aye Myint San, October 6, 2017; collection no. 29.

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

Tricolporate, prolate spheroidal, small, 12.6-13.0x12.5µm in length and breadth; amb triangular, colpi longicollate, 8.8-12.5x5.0-6.3 µm in length and breadth; pori lalongate, 2.5x3.8 µm; exine 1.3-2.5µm thick, sexine thicker than nexine; sculpturing finely striate.

2. *Chaenomeles japonica* (Thunb.) Lindley ex Spach, Hist. Nat. Veg. 2: 159. 1834. (Figure 1. D)

Pyrus japonica Thunb. Nova Acta. Regiae Soc. Sci. Uspal.3: 208. 1780.

Local Name	- Chin saw gar thi
English Name	-Dwraf Japanese quince
Flowering Period	- March to June

Perennial shrubs; stems and branches terete, with slender thorn. Leaves simple, alternate; stipules reniform; leaf blade obovate to broadly ovate, cuneate at the base, obtuse or acute at the apex, margin crenate. Flowers bisexual, actinomorphic, pentamerous, perigynous, dark red; pedicels short or nearly absent, glabrous; Sepals 5, ovate, rarely suborbicular, acuminate at the apex. Petals 5, free, obovate or sub orbicular, dark red, broadly cuneate at the base, ovate at the apex. Stamens numerous, inserted; filaments filiform; anthers ditheous, dorsifixed, dehiscing longitudinally, yellow. Carpels 5, free; ovary superior, ovoid, unilocular with one ovule in each locule on pendulous placentae; styles slender, as long as stamens; stigma capitate. Fruits pome, subglobose. Seed ellipsoid, glabrous.

Specimens examined: Northern Shan State, Lashio Township, Sarsana 2500 Pagoda Hill, 22° 56.998' N and 97° 44.924' E, Elevation 840 m, Aye Myint San, May 12, 2017; collection no. 18.

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

Tricolporate, prolate spheroidal, medium, 25.3-25.6x8.8 μm in length and breadth; amb triangular, colpi $\frac{3}{4}$ way up to the pole, 25.0x10.0-12.5 μm in length and breadth; pori lalongate, 7.5x8.8 μm ; exine 1.3 μm thick, sexine thicker than nexine; sculpturing finely striate.

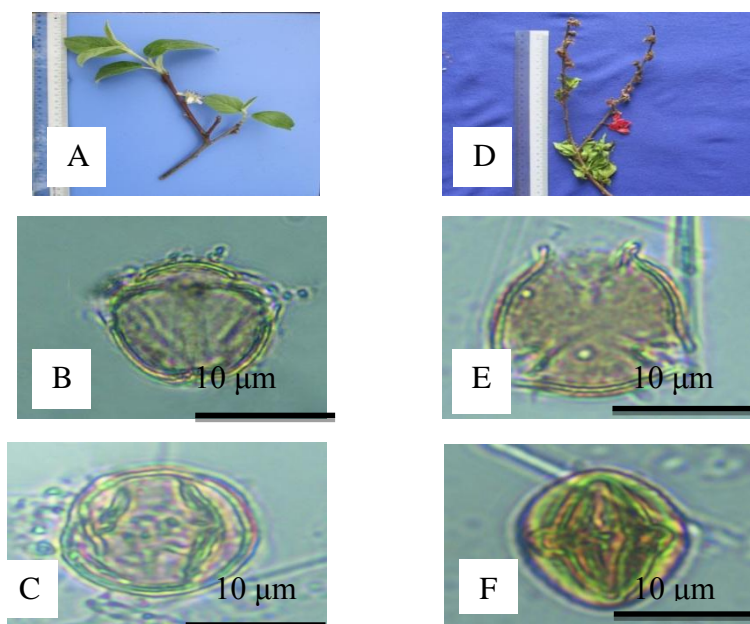


Figure 1. A. Inflorescence of *Docynia indica* (Wallich) Decaisne
 B. Polar view of pollen grain of *D. indica* (Wallich) Decaisne
 C. Equatorial view of pollen grain of *D. indica* (Wallich) Decaisne
 D. Inflorescence of *Chaenomeles japonica* (Thunb.) Lindley
 E. Polar view of pollen grain *C. japonica* (Thunb.) Lindley
 F. Equatorial view of pollen grain of *C. japonica* (Thunb.) Lindley

3. *Pyrus communis* L., Sp. Pl. 479. 1753. (Figure 2. A)*P. domestica* (L.) Ehrn.

Local Name : Thittaw

English Name : Pear

Flowering Period : January to March

Perennial small tree; stems and branches terete, glabrous or slightly pubescent when young. Leaves simple, alternate; stipules linear, caducous; leaf blade broadly ovate or elliptic, rounded at the base, acute at the apex, margin finely serrulate. Inflorescences terminal and axillary, corymbose raceme; peduncles glabrous/. Flowers bisexual, actinomorphic, pentamerous, epigynous, white; bracts lanceolate, caduceus; pedicels terete, glabrous; Calyx campanulate, pubescent, 5-lobed; lobes broadly ovate, acuminate at the apex, pubescent, persistent. Petals 5, free, obovate, white, broadly cuneate at the base, obtuse at the apex. Stamens numerous, inserted; filaments filiform; anthers ditheous, dorsifixed, dehiscing horizontally, yellow. Carpels 5, free; ovary inferior, ovoid, pentalocular with two ovule in each locule on anatrophus placentae; styles 5, free, slender; stigma capitate. Fruits pyriform, rounded. Seed ellipsoid, glabrous.

Specimens examined: Southern Shan State, Pinlong Township, Yeoo village, 20° 12.177' N and 96° 45.001' E, Elevation 1302 m, Aye Myint San, September 13, 2016; collection no. 2.

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

Tricolporate, Prolate spheroidal, small, 21.3 – 25.0 x 18.8 – 21.3µm in length and breadth; amb convex triangular, colpi ¾ way up to the pole, 16.3 – 20.3 x 6.3µm in length and breadth; pori lolongate, 6.3-7.5 x about 6.3µm; exine 1.3-2.5µm thick, sexine thicker than nexine; sculpturing finely striate, muri 0.5 – 0.9 µm wide, groove 0.5 – 0.9 µm wide.

4. *Rubus ellipticus* Smith in Rees, Cyclop. 30: no. 16. 1819. (Figure 2. D)

Local Name	- Unknown
English Name	- Unknown
Flowering Period	- January to June

Perennial erect shrubs; stems and branches terete, woody below, flexuous, densely shaggy with spreading rad-brown hair; prickly; prickles stout, hooked, scattered, compress. Leaves pinnately trifoliate compound, alternate; stipules paired, subulate; leaflets elliptic or obovate, unequal; rough, acute at the apex, serrate along the margin, rounded at the base, dark green and glabrous above, pale green beneath, pubescent midrib prominent, minute prickly. Inflorescences axillary or terminal, paniculate cymes; peduncles red-brown shaggy hairy. Flowers, bisexual, actinomorphic, pentamerous, epigynous, white; bracts linear, densely white villous; pedicels subsessile; hypanthium subglobose, pubescent. Sepals 5, free, ovate, persistent, green, densely white bristles within and without. Petals 5, free, obovate, white, caducous, cuneate at the base, glabrous. Stamens numerous, inserted; filaments filiform; anthers dithecal, dorsifixed, dehiscent longitudinally, small, glabrous, yellow. Carpels many, free; ovary inferior, reniform on distinct receptacle, unilocular, one ovule per locule in basal placentation; styles curved and short; stigma simple, persistent. Fruits aggregate of numerous drupelets, globose, orange, succulent, green at first, orange-yellow when ripe. Seed minute.

Specimens examined: Southern Shan State, Aungban Township, 20° 38.443' N and 96° 36.507' E, Elevation 1297 m, Aye Myint San, September 12, 2016; collection no.4.

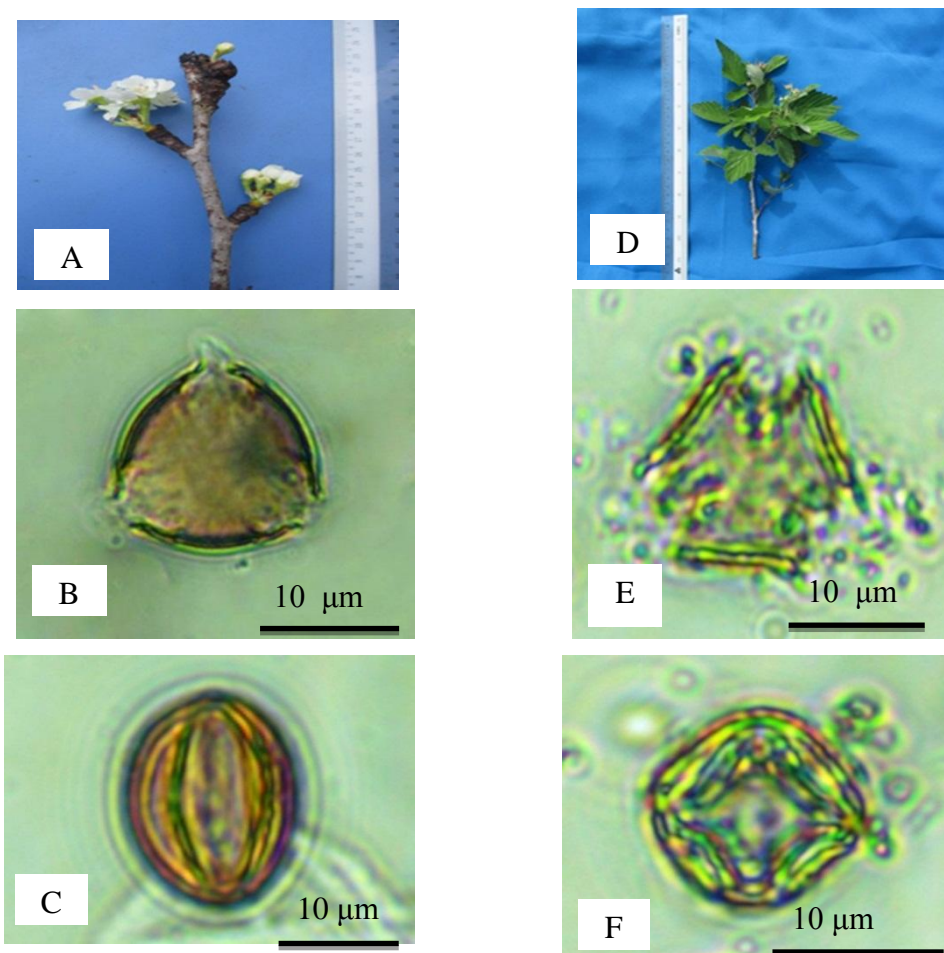


Figure 2. A. Inflorescence of *Pyrus communis* L.
 B. Polar view of pollen grain of *P. communis* L.
 C. Equatorial view of pollen grain of *P. communis* L.
 D. Inflorescence of *Rubus ellipticus* Smith.
 E. Polar view of pollen grain of *R. ellipticus* Smith.
 F. Equatorial view of pollen grain of *R. ellipticus* Smith.

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

Tricolporate, Prolate spheroidal, small, 18.8 – 25.0 x 15.0 – 17.5µm in length and breadth; amb convex triangular, colpi $\frac{3}{4}$ way up to the pole, 15.0

– 18.8 x 5.0 - 0.6µm in length and breadth; pori lolongate, 2.5-5.0 x 2.5-5.0µm; exine 1.3 – 2.5µm thick, sexine thicker than nexine; sculpturing finely striate muri about 0.9µm and groove about 0.5µm wide.

5. *Rubus ellipticus* var. *obcordatus* (Franchet) Focke, Biblioth. Bot. 17 (Heft 72): 199. 1911. (**Figure 3.A**)

Local Name	- Unknown
English Name	- Unknown
Flowering Period	- January to June

Perennial erect shrubs; stems and branches terete, woody below, flexuous, densely shaggy with spreading rad-brown hair; prickly; prickles stout, hooked, scattered, compress. Leaves pinnately trifoliate compound, alternate; stipules paired, subulate; leaflets obovate or obcordate, unequal; rough, truncate or emarginated at the apex, serrate along the margin, obtuse-cuneate at the base, dark green and glabrous above, pale green beneath, pubescent midrib prominent, minute prickly. Inflorescences axillary or terminal, paniculate cymes; peduncles red-brown shaggy hairy. Flowers, bisexual, actinomorphic, pentamerous, epigynous, white; bracts linear, densely white villous; pedicels subsessile; hypanthium subglobose, pubescent. Sepals 5, free, ovate, persistent, green, densely white bristles within and without. Petals 5, free, obovate, white, caducous, cuneate at the base, glabrous. Stamens numerous, inserted; filaments filiform; anthers dithecal, dorsifixed, dehiscing longitudinally, small, glabrous, yellow. Carpels many, free; ovary inferior, reniform on distinct receptacle, unilocular, one ovule per locule in basal placentation; styles curved and short; stigma simple, persistent. Fruits aggregate of numerous drupelets, globose, orange, succulent, green at first, orange-yellow when ripe. Seed minute.

Specimens examined: Southern Shan State, Aungban Township, 20° 38.443' N and 96° 36.507' E, Elevation 1297 m, Aye Myint San, September 12, 2016; collection

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

Tricolporate, Prolate spheroidal, medium, 30.0 – 35.0 x 20.0 - 27.5µm in length and breadth; amb convex triangular, colpi $\frac{3}{4}$ way up to the pole, 18.8 – 28.8 x 5.0µm in length and breadth; pori circular, 2.5-5.0 x 2.5-5.0µm; exine 2.5µm thick, sexine thicker than nexine; sculpturing finely striate muri about 0.9µm and groove about 0.5µm wide.

6. *Rubus moluccanus* Smith in Rees, Cyclop. 30: no. 16. 1819. (Figure 3. D)

Local Name - Unknown

English Name - Unknown

Flowering Period - October to January

Perennial scrambling shrubs; stems and branches solid, terete, woody below, densely white tomentose, prickly; prickles stout, hooked, small, scattered. Leaves simple, alternate; stipules oblong; blades broadly ovate and deeply 5 – lobed, rugose, acute at the apex, serrulate along the margin, deeply cordate at the base, dark green and densely woolly beneath, palmately 5 – 7 nerved, prickly on the nerve beneath. Inflorescences axillary or terminal cymes, densely white tomentose, minut prickly; peduncles densely white tomentose. Flowers bisexual, actinomorphic, pentamerous, epigynous, white; bracts oblong, lacinate, densely white villous; pedicels subsessile; hypanthium subglobose, pubescent. Calyx 5 – lobed, campanulate tube, teeth triangular, lanceolate, acute at the apex, persistent, yellowish green,



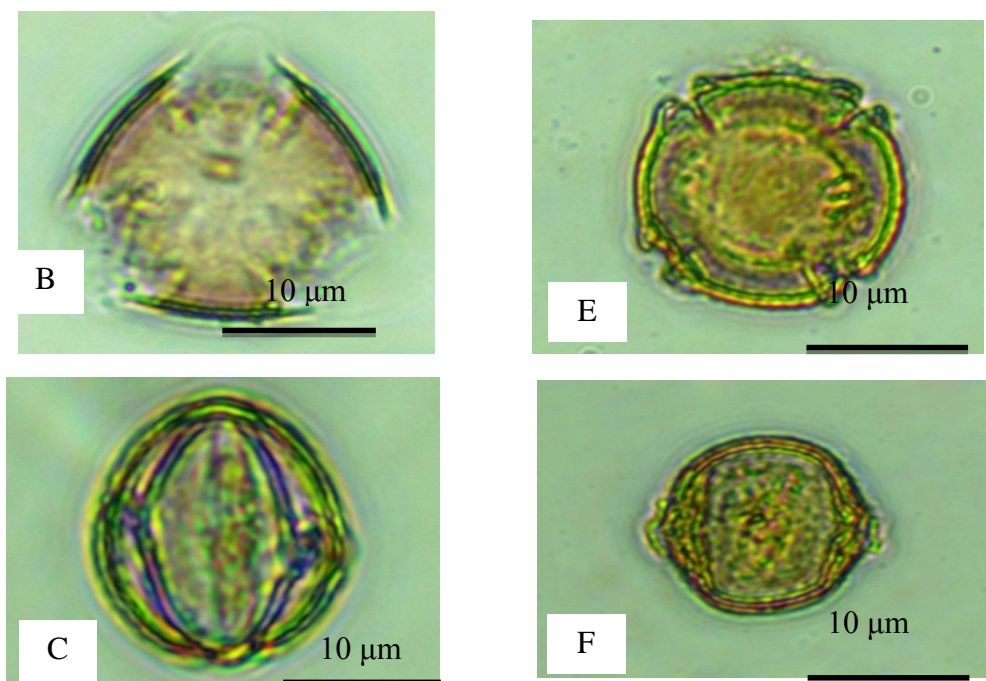


Figure 3. A. Inflorescence of *Rubus ellipticus* var. *obcordatus* (Franchet) Focke,
 B. Polar view of pollen grain of *R. ellipticus* var. *obcordatus* (Franchet) Focke,
 C. Equatorial view of pollen grain of *R. ellipticus* var. *obcordatus* (Franchet) Focke,
 D. Inflorescence of *R. moluccanus* Smith.
 E. Polar view of pollen grain of *R. moluccanus* Smith.
 F. Equatorial view of pollen grain of *R. moluccanus* Smith.

entire along the margin, enlarged accrescent calyx in fruits, densely villous or white bristles within and without. Petals 5, free, obovate, white, shorter than the calyx-lobes, rounded at the apex. Stamens numerous, inserted; filaments slender, unequal in length; anthers dithecal, dorsifixed, dehiscing longitudinally. Carpels many, free; ovary inferior, bilocular, two ovule per locule in basal placentae; styles filiform; stigma simple, persistent. Fruits aggregate of small drupelets, globose, succulent, green at first, orange-yellow when ripe. Seed minute.

Specimens examined: Southern Shan State, Aungban Township, 20° 54.324' N and 96° 36.213' E, Elevation 1474 m, Aye Myint San, September 13, 2016; collection no.6.

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

Tri to tetracolporate, prolate spheroidal, medium, 37.5 – 46.3 x 26.3 – 33.8µm in length and breadth; amb convex tri to tetraangular, colpi $\frac{3}{4}$ way up to the pole, 27.5 -35.0 x 6.3 µm in length and breadth; pori circular, 6.3-7.5 x 6.3-7.5 µm; exine 2.5 µm – 3.8 thick, sexine thicker than nexine; sculpturing finely striate muri about 0.9µm and groove 0.9- 1.8µm wide.

7. *Prunus cerasoides* (L.) D. Don, Prod. Fl. Nep: 239. 1825. (Figure 4. A)

P. puddum Roxb. ex Wall.Pl. As rar. 2: 37. 1831.

Local Name - Cherry

English Name - Cherry

Flowering Period - December to March

Perennial tree; stems and branches woody, glabrous. Leaves simple, alternate; stipules linear; leaf blade obovate, rounded at the base, acuminate at the apex, margin serrate. Inflorescences terminal and axillary, 2-3 flowered fascicles; peduncles glabrous. Flowers bisexual, actinomorphic, pentamerous, perigynous, pink; scaly bracts; pedicels terete, glabrous; Sepals 5, ovate-oblongate, acute to obtuse at the apex. Petals 5, free, obovate, pink, broadly cuneate at the base, emarginate at the apex. Stamens numerous, inserted; filaments filiform; anthers ditheous, dorsifixed, dehiscing longitudinally, yellow. Carpels 1, free; ovary superior, ovoid, unilocular with one ovule in each locule on pandulous placentae; styles slender; stigma discoid. Fruits a drupe, ovoid. Seed ellipsoid, glabrous.

Specimens examined: Northern Shan State, Lashio Township, Naung Mon Village, 22° 46.934' N and 97° 39.007' E, Elevation 733 m, Aye Myint San, December 3, 2016; collection no. 20.

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

Tricolpate, Prolate spheroidal, medium, $26.3 - 35.0 \times 18.8 - 27.5 \mu\text{m}$ in length and breadth; amb convex triangular, colpi $\frac{3}{4}$ way up to the pole, $21.3 - 27.5 \times 1.3 - 5.0 \mu\text{m}$ in length and breadth; pori circular; exine $1.3 - 2.5 \mu\text{m}$ thick, sexine thicker than nexine; sculpturing finely striate muri about $0.9 \mu\text{m}$ and groove $0.5 \mu\text{m}$ wide..

8. *Prunus ceylanica* (Wight) Miq. Fl. Ind. Bat. 1(1): 366. 1855.

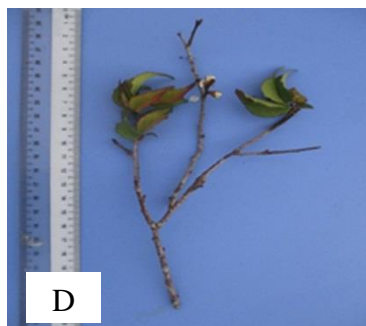
(Figure 4. D)

Local Name - Unknown

English Name - Unknown

Flowering Period - November to February

Perennial small tree; stems and branches woody, glabrous. Leaves simple, alternate; stipules linear; leaf blade ovate or elliptic-lanceolate, cuneate at the base, acute at the apex, margin serrate. Inflorescences terminal and axillary, peduncles glabrous. Flowers bisexual, actinomorphic, pentamerous, perigynous, white; scaly bracts, persistent; pedicels terete, glabrous; Sepals 5, ovate, obtuse at the apex. Petals 5, free, spatulate, white, broadly cuneate



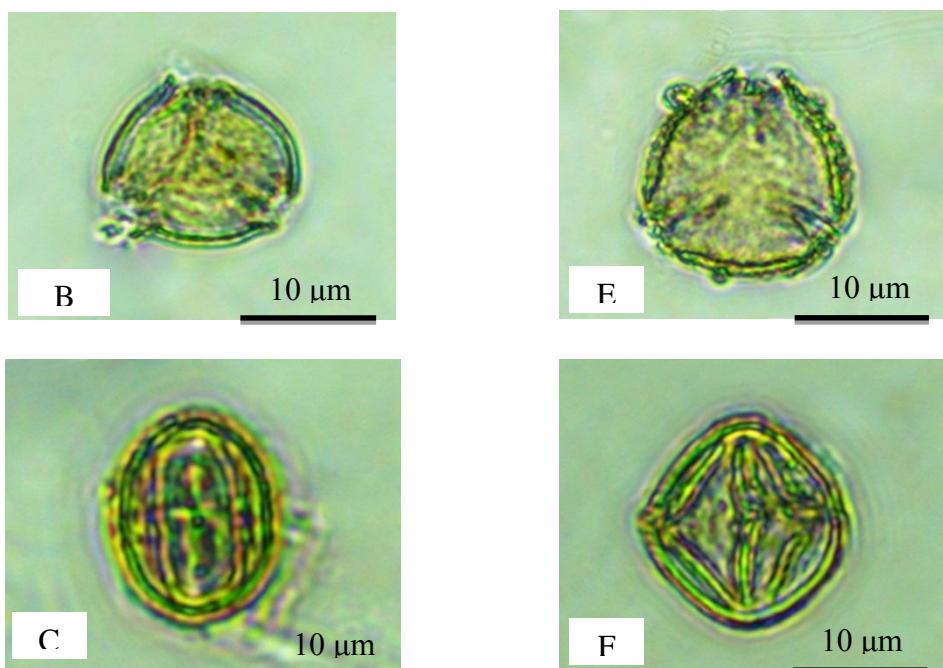


Figure 4. A. Inflorescence of *Prunus cerasoides* D.Don.
 B. Polar view of pollen grain of *P. cerasoides* D.Don.
 C. Equatorial view of pollen grain of *P. cerasoides* D.Don.
 D. Inflorescence of *P. ceylanica* (Wight) Miq.
 E. Polar view of pollen grain of *P. ceylanica* (Wight) Miq.
 F. Equatorial view of pollen grain of *P. ceylanica* (Wight) Miq.

at the base, acute at the apex. Stamens numerous, inserted; filaments filiform; anthers ditheous, dorsifixed, dehiscing longitudinally, yellow. Carpels 1, free; ovary superior, ovoid, unilocular with two ovule in each locule on pandulous placentae; styles slender; stigma disc-shaped. Fruits a drupe, ovoid to globose. Seed ellipsoid, glabrous.

Specimens examined: Northern Shan State, Lashio Township, Naung Mon Village, 22° 46.784' N and 97° 38.944' E, Elevation 728 m, Aye Myint San, December 3, 2016; collection no. 10.

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

Tricolporate, prolate spheroidal, medium, $27.5 - 47.5 \times 18.8 - 25.0 \mu\text{m}$ in length and breadth; amb convex triangular, colpi $\frac{3}{4}$ way up to the pole, $21.3 - 43.8 \times 5.0 - 8.8 \mu\text{m}$ in length and breadth; exine $1.3 - 2.5 \mu\text{m}$ thick, sexine thicker than nexine; sculpturing finely striate muri about $0.9 \mu\text{m}$ and groove $0.9 - 1.8 \mu\text{m}$ wide.

9. *Prunus communis* Huds. FL. Angl. (Hudson), ed. 2, 1: 212. 1778.

(Figure 5. A)

Local Name	- Metmann
English Name	- Unknown
Flowering Period	- November to February

Perennial small tree; stems and branches woody, glabrous. Leaves simple, alternate; stipules linear; leaf blade ovate, obtuse at the base, acuminate at the apex, margin serrate. Inflorescences terminal and axillary, 2-3 flowered fascicles; peduncles glabrous. Flowers bisexual, actinomorphic, pentamerous, perigynous, white; scaly bracts; pedicels terete, glabrous; Sepals 5, ovate, acute at the apex. Petals 5, free, obovate, white, broadly cuneate at the base, acute at the apex. Stamens numerous, inserted; filaments filiform; anthers ditheous, dorsifixed, dehiscing longitudinally, yellow. Carpels 1, free; ovary superior, ovoid, unilocular with one ovule in each locule on pandulous placentae; styles slender; stigma discoid. Fruits a drupe, ovoid to globose. Seed ellipsoid, glabrous.

Specimens examined: Southern Shan State, Lashio Township, Naung Mon Village, $22^\circ 46.934' \text{ N}$ and $97^\circ 39.007' \text{ E}$, Elevation 733 m, Aye Myint San, December 3, 2016; collection no. 12.

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

Tricolporate, prolate spheroidal, small, $23.8 - 25.0 \times$ about $18.8 \mu\text{m}$ in length and breadth; amb convex triangular, colpi $\frac{3}{4}$ way up to the pole, $17.5 - 20.0 \times 3.8 \mu\text{m}$ in length and breadth; pori circular; exine $1.3 - 2.5 \mu\text{m}$ thick,

sexine thicker than nexine; sculpturing finely striate muri about 1.8-2.7 μm and groove 0.9-4.5 μm wide.

**10. *Prunus persica* (L.) Batsch, Beitr. Entw. Pragm. Gesch. 1: 30. 1801
(Figure 5. D)**

Amygdalus persica L., Sp. Pl. 472. 1753.

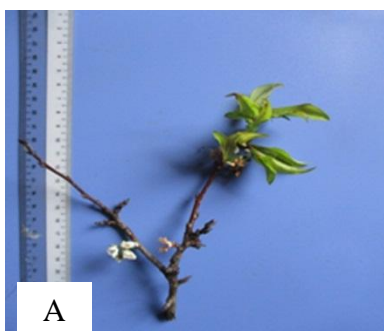
Persica vulgaris Mill., Gard. Dict. ed. 8. 465. 176

Local Name - Met mon

English Name - Peach

Flowering Period - January to March

Perennial small tree; stems and branches terete, glabrous. Leaves simple, alternate; stipules subulate; leaf blade lanceolate, obtuse at the base, acuminate at the apex, margin finely serrate. Inflorescences terminal and axillary, 2-3 flowered fascicles; peduncles glabrous. Flowers bisexual, actinomorphic, pentamerous, perigynous, pink; scaly bracts; pedicels terete, glabrous; Sepals 5, ovate-oblongate, acuminate at the apex. Petals 5, free, obovate, pink, broadly cuneate at the base, ovate at the apex. Stamens numerous, inserted;



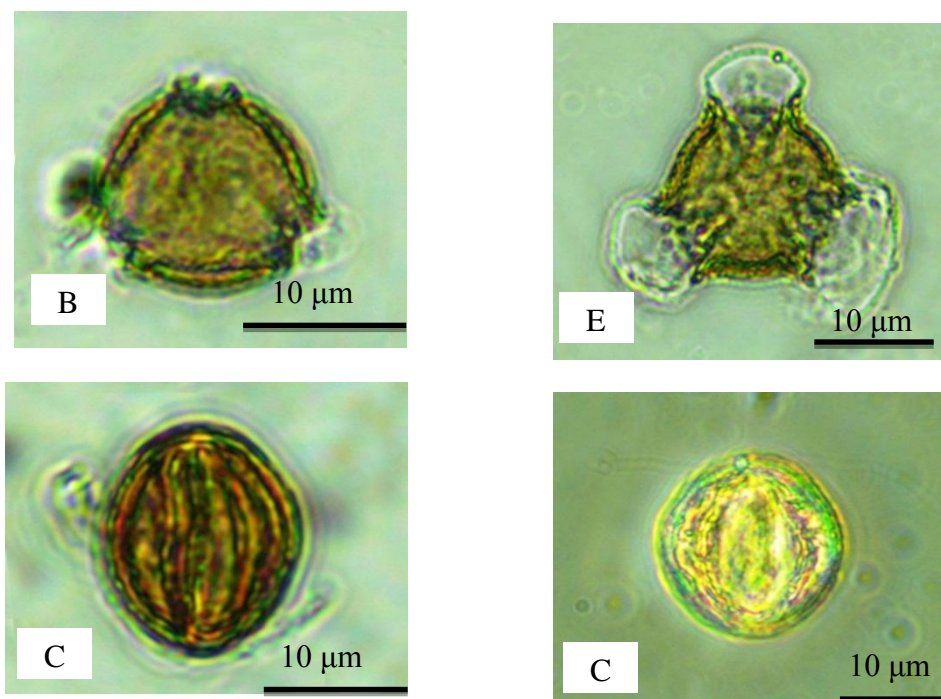


Figure 5. A. Inflorescence of *Prunus communis* Huds.
 B. Polar view of pollen grain of *P. communis* Huds.
 C. Equatorial view of pollen grain of *P. communis* Huds.
 D. Inflorescence of *P. persica* (L.) Batsch.
 E. Polar view of pollen grain of *P. persica* (L.) Batsch.
 F. Equatorial view of pollen grain of *P. persica* (L.) Batsch.

filament filiform; anthers dithecous, dorsifixed, dehiscing longitudinally, yellow. Carpels 5, free; ovary superior, ovoid, unilocular with one ovule in each locule on pandulous placentae; styles slender; stigma capitate. Fruits a drupe, rounded. Seed ellipsoid, glabrous.

Specimens examined: Southern Shan State, Lashio Township, Sarsana 2500 Pagoda Hill, 22° 56.998' N and 97° 44.924' E, Elevation 840 m, Aye Myint San, December 2, 2016; collection no. 8.

Description of pollen morphology (Figure 5. E, F)

Tricolporate, prolate spheroidal, medium, 26.3 – 33.8 x 20.0 – 22.5µm in length and breadth; amb convex triangular, colpi $\frac{3}{4}$ way up to the pole, 18.8 – 25.0 x 5.0µm in length and breadth; pori lolongate; exine 2.5µm thick, sexine thicker than nexine; sculpturing finely striate muri about 0.5-0.9 µm and groove 0.5-0.9µm wide.

Discussion and Conclusion

The present study deals with the pollen morphology of the Family Rosaceae found in Southern and Northern Shan State region. Dassanayake (1981) stated that a family of 124 genera and about 3375 species and this family is widely distributed in all parts of the world, mostly in the northern temperate regions. There are about 1000 species, found in all climates and countries, but chiefly in the temperate (Hooker 1879). Worldwide about 85 – 3000 species, cosmopolitan but most diverse in temperate and warm regions of the North Hemesphere (Watson 2013). The family is represented by about 24 genera with a total of about 219 known species in Myanmar (Kress *et al.* 2003). In the present study, taxonomy and pollen morphology of 10 species belonging to the Family Rosaceae have been studied.

Among the collected species 1 species such as *Docynia indica* (Wallich) Decaisne. in Pinlaung township and 4 species like *Rubus ellipticus* Smith., *Rubus ellipticus* var. *obcordatus* (Francact) Focke, *R. molucanus* L. & *Pyrus communis* L. in Aungban township and 5 species namely *Chaenomeles japonica* (Thunb.) Lindley, *Prunus cerasoides* D. Don, *P. ceylanica* (Wight) Miq., *P. communis* Huds. & *P. persica* (L.) Batsch in Lashio township. The genera *Chaenomeles*, *Docynia* and *Pyrus* were belonging to Maloideae, *Rubus* was belonging to Rosoideae and *Prunus* was belonging to Prunoideae. According to the collected data, all studied species were shrubs, unipinnately compound leaves. The flowers were bisexual, actinomorphic, pentamerous and perigynous ovary and the stamens were numerous in all collected species. According to the resulting data, the fruit types were found in achene. These characters were agreed with Hooker

(1879), Backer (1963), Dassanayake (1981), Lu *et al.* (2003), Watson *et al.* (2011).

In the present study, all pollen grains were monad; the aperture types of the pollen grains were mostly tricorporate except from *Rubus moluccanus* Smith; and all species were found in prolate spheroidal in shape. Therefore, these pollen characters were agreed with Erdtman (1971). The pollen size were small in 4 species, *Docynia indica* (Wallich) Decaisne, *Pyrus communis* L., *Rubus ellipticus* Smith, and *Prunus communis* Huds. and the remaining 6 species were medium. Faghir (2015) reported the the Rosaceae pollen grain sizes were small to medium in size however Garaci *et al.* (2012) stated that the pollen grains were medium to large-sized. In the present study, the grains were not found in large size. Therefore the present study were agreed with Faghir (2015). The pori shape of the investigated pollen grains were found to be 2 species of *Docynia indica* (Wallich) Decaisne and *Chaenomeles japonica* (Thunb.) Lindley were found in lalongate; 3 species of *Pyrus communis* L., *Rubus ellipticus* Smith and *Prunus ceylanica* (Wight) Miq. were found in lolongate; and the remaining 4 species were circular in shape. The sexine thicker than nexine. The pollen sculpture of all species were finely striate. These pollen characters were agreed with Erdtman (1971) and Moore *et al.* (1991).

According to the resultting data, the pollen pollen morphological characters were formed to be different within the species. Therefore, these present study was not only for the palynological point of view but also to provided the valuable pollen characters that can be support in classification and identification of the Family Rosaceae.

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References

- Backer, C.A & C.Bakhuizen Van Den Brink. JR . (19650) . Flora of Java. Vol. III. Noordhoff, Itd. Groningen.
- Dassanayake M. D. and F. R. Fosberg. (1981). A Revised Handbook to the Flora of Ceylon. Vol. III. Amerind Publishing Co. Pvt. Ltd., New Delhi.
- Eide F. (1981). Key for nothwest European rosaceae pollen. Grana.
- Erdtman G. (1952). Pollen and Spore Morphology Plant Taxonomy. (An introducton to palynology II. Gymnospermae, Pteridophyta, Bryophyta) Almqvist and wicksell. Stockholm.
- Erdtman G. (1971). Pollen Morphology and Plant Taxonomy. An introduction to Palynology I. Hafner Publishing Company. New York.
- Faghir M.B. , Farideh A., Robabeh S.S.&Atefeh M.(2015). Pollen morphology of the genus *Alchemilla* L. (Rosaceae) in Iran. Department of Biology, Faculty of Science, University of Guilan, Rasht, Iran.
- Garaci A., Vincenza P., Pasquale M., Rosario S. (2012). Polished Botanical Society.
- Hooker, J.D. (1894). Flora of British India. Vol.V & Reeve & Co, London.
- Hundley, H.G and Chit Ko Ko. (1961). List of Trees, Shrubs, Hebrs and Principle Climbers of Myanmar. Supdt., Govt. Printing and Stady. Hesse, M., H. Halbritter, R. Zetter, M. Weber, R.Buchner, A. Frosch-Radivo & S.Ulrich. 2009. Pollen Terminology An Illustrated Ilandbook, University of Vienna, Austria.
- Heywood, V.H., R.K. Brummitt., A.Culham & O. Seberg. (2007). Flowering plant families of the World. United States by Firefly Books (U.S.) Inc., New York.
- Jussieu., James B. P. (1789). Flora of Noth America. Vol IX.
- Kress, J., A. Robert, 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.
- Kubitzki K. (2004). The Family and Genera of Vascular Plants. Verlag Berlin Heidelberg. New York.

- Lingdi L., Gu C., Li C., Crinan A. Bruce B., Anthony R. B., David E. B., Hiroshi I., Hideaki O., Kenneth R. R., Steven A. S.. (2003). Flora of China. Vol. IX. Republic of China.
- Moore P. D., Webb J. A., Collinson M. E. (1991). Pollen Analysis. Blackwell Scientific Publications. Oxford.
- Reitsma T.J. (1966). Pollen Morphology of Some European Rosaceae. Acta Bot Neerl. 1966; 15: 290-379.
- Watson M. F. (2013). Flora of Nepal. Vol. III. Mass Printing Press, Kathmandu, Nepal.
- Zamani A., Attar F.a Marooti H.(2010). Pollen Morphology of the genus *Pyrus* (Rosaveae) in Iran. Central Herbarium of University of Tehran, School of Biology, Faculty College of Science, University of Tehran, Tehran, Iran.