Pollen Morphology of Nine Species of Monocots found in Amarapura Township

Khin Htwe Maw*

Abstract

The pollen morphology of 9 species belonging to 6 families of monocots in Amarapura Township was studied. The preparation of pollen samples were studied by acetolysis methods (Erdtman, 1952). The pollen characters were investigated by light microscope. In the present work, pollen grains are generally free (monads unit), mostly radially symmetrical and apolar, but occasionally bilaterally symmetrical and heteropolar. Furthermore, the apertural patterns mostly belong to three different categories; inaperturate, monocolpate (monosulcate) and monoporate (monoulcerate). The shape of pollen grains was spheroidal to ellipsoid. The size of pollen varies from medium to large. The sculpture patterns are microreticulate, gemmate, baculate, psilate to granulate. The morphology of the pollen is an important tool for the identification of species of monocots. Thus, there are no previous reports of pollen morphology of monocots plant from studied area. The study was aimed at improving the general knowledge of pollen morphology of some monocots.

Keywords: Monocots, monad, inaperturate, sulcate, ulcerate

Introduction

The present investigations, pollen morphology of 9 species belonging to 6 genera of 6 families in monocots from Amarapura Township were worked out by during January to December, 2019. The studied families are Alismataceae, Commelinaceae, Pontederiaceae, Cannaceae, Zingiberaceae and Typhaceae.

Palynology is the science that studies pollens. Palynology is a relatively recent science and there are many opportunities for its practical application. Pollen morphology has provided a great wealth of phylogenetically useful information to draw evolutionary trends among the related plant taxa. In angiosperms, the most important trends at the higher taxonomic levels involve the number, position, and structure of pollen apertures, exine structure and stratification and in some cases size (Bose *et al.* 2012).

Simpson (2006) presented, palynology is the study of spores and pollen grains. Spores and pollen grains have a number of morphological and ultrastructural features. The features of spores and pollen grains can often be used to identify a particular plant taxon.

* Lecturer, Dr, Department of Botany, Yadanabon University

Ghosh *et al.* (2017) investigated the pollen morphology of 66 species belonging to 19 families of monocots in Paschim Medinipur District, India. Erdtman (1952) reported that the pollen grains of Cannaceae are nonaperturate, exine provided with scattered spinules; the pollen grains of Pontederiaceae are 2– to 3–sulcate, sexine as thick as nexine or thicker; the pollen grains of Typhaceae are single or united in tetrads, ulcerate; that the pollen grains of Alismataceae are spherical to polyhedral, forate, sexine as thick as nexine, sculpturing reticulate. In the studied area, literature dealing with the pollen morphology of monocots plants is rather scarce. Thus, the present study was carried out to give palynological information and variations in pollen morphology of nine monocots species.

Materials and Methods

The fresh polleniferous materials were collected from Amarapura Township in Mandalay District. Plant specimens were identified by available literatures. These pollen samples were preserved in acetic acid. The preparation of pollen samples was done using acetolysis method (Erdtman, 1952). Firstly, the anthers were crushed and transferred to test tube. And then, acetolysis mixture (acetic acid and sulphuric acid in a ratio of 9:1) was added in the tube containing pollen. After mixing, the mixture containing tube was water bath at 80 ˚C for 10–15 minutes. After cooling, it was centrifuged at 3000 rpm for 15 minutes. The various pollen features were studied by light microscope. Finally, pollen morphology were described using standard terminologies Erdtman (1952), Hoen (1999), Paldat (2005) and Hesse *et al.* (2009).

Results

The collected 9 species belonging to 6 genera of 6 families in monocots were arranged according to APG IV Classification System (Byung *et al*, 2016). The genera and species were also arranged by alphabetically. The list of collected species was presented in Table 1. The different pollen morphological character of studied species was presented in Table 2.

Table 1. List of Collected Species

Class	Order	Family	No.	Scientific name
Monocots	Acorales	Alismataceae	1.	*Alisma plantogo–aquatica* L.
	Commelinales	Commelinaceae	2.	*Commelina benghalensis* L.
			3.	*Commelina diffusa* Burm.f.
		Pontederiacea	4.	*Monochoria vaginalis* (Burm.f.) Presl.
	Zingiberales	Cannaceae	5.	*Canna coccinea* Mill.
			6.	*Canna flaccida* Salisb.
			7.	*Canna glauca* L.
		Zingiberaceae	8.	*Hedychium flavum* Roscoe.
	Polales	Typhaceae	9.	*Typha angustifolia* L.

Pollen morphology of monocots species

Family – Alismataceae

1. *Alisma plantogo–aquatica* L. (Figure 1. A, B)

English name : Water plantin

Myanmar name: Ye hnget pyaw

Pollen grains monad, apolar, radially symmetrical, inaperturate, spheroidal, 25.5–35.0 µm in diameter; exine 1.5–2.5 µm thick; sexine as thick as nexine; sculpturing microreticulate.

Family – Commelinaceae

2. *Commelina benghalensis* L. (Figure 1. C, D)

English names : Spiderwort; Water grass

Myanmar name: Myet cho

Pollen grains monad, apolar, radially symmetrical, inaperturate, spheroidal, 45.0–50.5 µm in diameter; exine 1.5–3.5 µm thick, sexine thicker than nexine; sculpturing baculate, the bacula about 5.0 x 2.5 µm in length and breadth.

3. *Commelina diffusa* Burm.f. (Figure 1. E,F)

English name : Climbing dayflower

Myanmar name: Myet cho

Pollen grains monad, apolar, bilaterally symmetrical, inaperturate, ellipsoid, 30–40 × 60.5–80.5 µm in length and breadth; exine 4.5–5.0 µm thick, sexine as thick as nexine; sculpturing gemmate, each gemma globoid, 1.5–3.0 µm in diameter.

Family–Pontederiaceae

4. *Monochoria vaginalis* (Burm.f.) Presl. (Figure 2. A, B)

English name : Pickerel weed

Myanmar name: Le padauk

Pollen grains monad, heteropolar, bilaterally symmetrical, monocolpate (monosulcate), ellipsoid, 20–25 × 40.0–47.5 µm in length and breadth; sulcus 5.0–7.5 x 25.0–30.5 µm in length and breadth; exine about 5 µm thick, sexine thicker than nexine; sculpturing psilate.

Family – Cannaceae

5. *Canna coccinea* Mill. (Figure 2. C, D)

English name : Canna

Myanmar name: Budatharana

Pollen grains monad, apolar, radially symmetrical, inaperturate, spheroidal, 80–90 µm in diameter; exine 5.0–7.5 µm thick; sexine thicker than nexine; sculpturing gemmate, each gemma globoid, 2.0–3.5 µm in diameter.

6. *Canna flaccida* Salisb. (Figure 2. E, F)

English name : Canna

Myanmar name: Budatharana

Pollen grains monad, apolar, radially symmetrical, inaperturate, spheroidal, 90–110 µm in diameter; exine 5.0–7.5 µm thick, sexine thicker than nexine; sculpturing gemmate, each gemma globoid, 4.5–9.5 µm in diameter.

7. *Canna glauca* L. (Figure 3. A, B)

English name : Canna

Myanmar name: Budatharana

Pollen grains monad, apolar, radially symmetrical, inaperturate, spheroidal, 85–100 µm in diameter; exine 5.0–7.5 µm thick, sexine thicker than nexine; sculpturing gemmate, each gemma globoid, 4.5–9.5 µm in diameter.

Family– Zingiberaceae

8. *Hedychium flavum* Roscoe. (Figure 3. C, D)

English name : Yellow ginger ligy

Myanmar name: Shwe pan

Pollen grains monad, apolar, radially symmetrical, inaperturate, spheroidal, 80–90 µm in diameter; exine 7.5–9.5 µm thick, sexine thicker than nexine; sculpturing psilate.

Family – Typhaceae

9. *Typha angustifolia* L. (Figure 3. E, F)

English name : Reed Mace

Myanmar names: Shin mwe lon; Paik swe

Pollen grains monad, heteropolar, bilaterally symmetrical, monoporate (monoulcerate), subspheroidal, 20–22 x 25–30 µm in length and breadth; pori (ulcus) circular, 5.0–7.5 µm in diameter; exine 2.5– 4.0 µm thick, sexine as thick as nexine; sculpturing granulate.

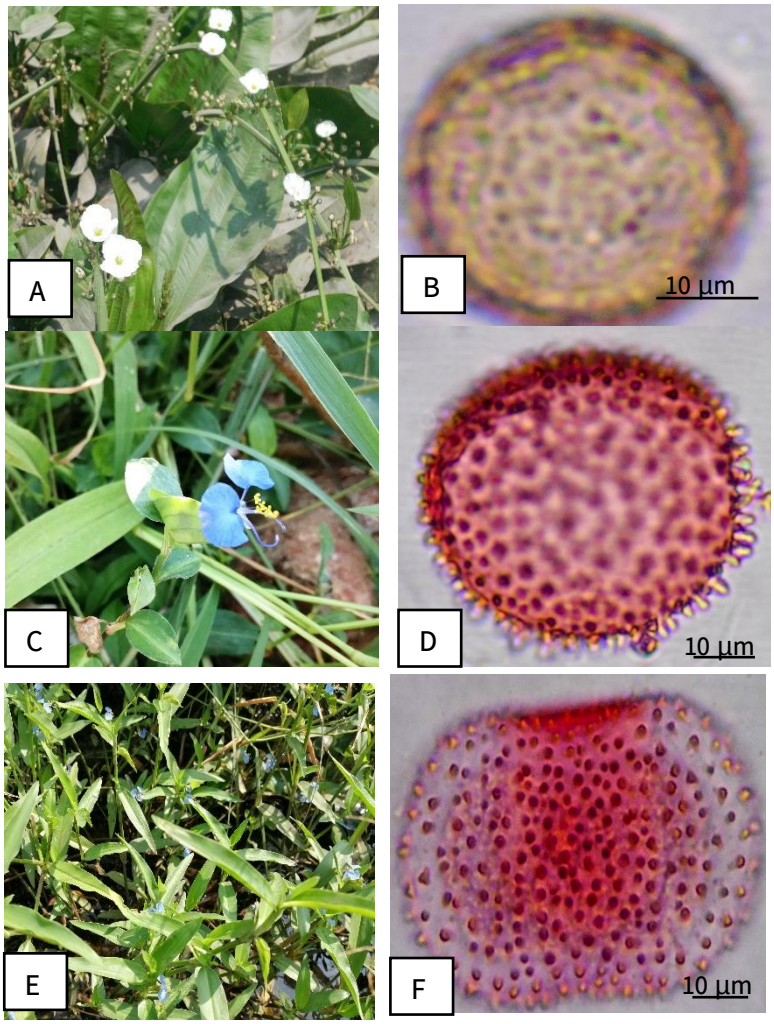

Figure 1. A. Habit of *Alisma plantogo–aquatica* L.

B. Surface view of pollen

C. Habit of *Commelina benghalensis* L.

D. Surface view of pollen

E. Habit of *Commelina diffusa* Burm.f.

F. Distal equatorial view of pollen

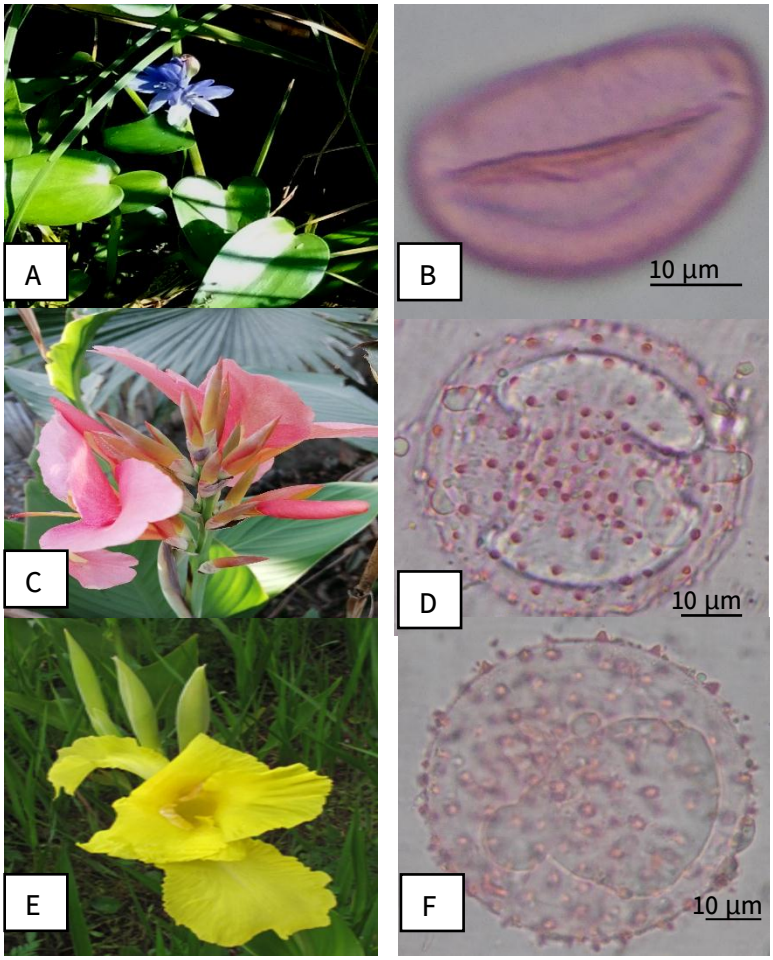

Figure 2. A. Habit of *Monochoria vaginalis* (Burm.f.) Presl.

B. Distal equatorial view of pollen

C. Habit of *Canna coccinea* Mill.

D. Surface view of pollen

E. Habit of *Canna flaccida* Salisb.

F. Surface view of pollen

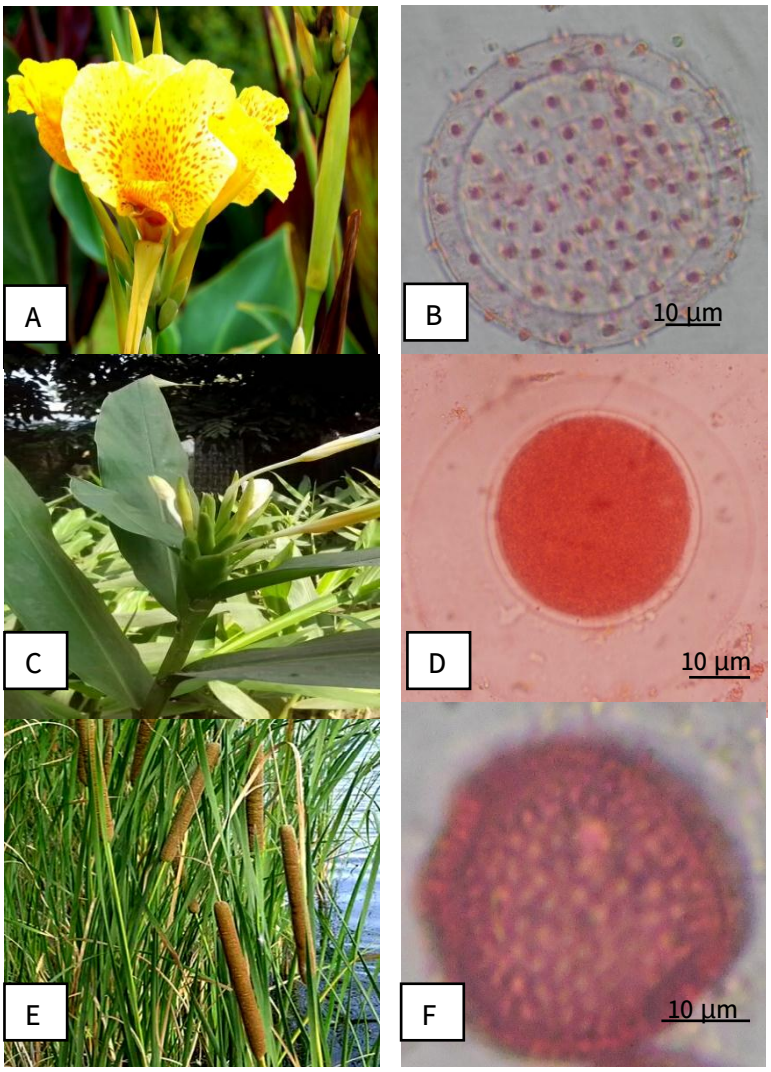

Figure 3. A. Habit of *Canna glauca* L.

B. Surface view of pollen

C. Habit of *Hedychium flavum* Roscoe.

D. Surface view of pollen

E. Habit of *Typha angustifolia* L.

F. Distal equatorial view of pollen

Table 2. The apertural pattern, size, shape and surface features of the studied monocot taxa

No.	Taxa names	Apertural pattern	Size (μm)	Shape	Surface features
1.	*Alisma plantogo–aquatica* L.	Inaperturate	25.5–35.0	Spheroidal	Microreticulate
2.	*Commelina benghalensis* L.	Inaperturate	45.0–50.5	Spheroidal	Baculate
3.	*Commelina diffusa* Burm.f.	Inaperturate	30–40 × 60.5–80.5	Ellipsoid	Gemmate
4.	*Monochoria vaginalis* (Burm.f.) Presl.	Monocolpate (Monosulcate)	20–25 × 40.0–47.5	Ellipsoid	Psilate
5.	*Canna coccinea* Mill.	Inaperturate	80–90	Spheroidal	Gemmate
6.	*Canna flaccida* Salisb.	Inaperturate	90–110	Spheroidal	Gemmate
7.	*Canna glauca* L.	Inaperturate	85–100	Spheroidal	Gemmate
8.	*Hedychium flavum* Roscoe.	Inaperturate	80–90	Spheroidal	Psilate
9.	*Typha angustifolia* L.	Monoporate (Monoulcerate)	20–22 x 25–30	Subspheroidal	Granulate

Discussion and Conclusion

Pollen morphological studies of 9 species belong to 6 monocotyledonous families in Amarapura Township has been worked out. Among these, three species belong to Cannaceae followed by two species of Commelinaceae. The rest of families are represented by a single species. Pollen grains are apolar and radially symmetrical in Alismataceae, Cannaceae, one species of Commelinaceae and Zingiberaceae while as heteropolar and bilaterally symmetrical in one species of Commelinaceae, Pontederiaceae and Typhaceae. These characters are also matching with the previously authors. The apertural types can also be important characters in classification of plant taxa. The apertural patterns are either inaperturate or monoporate (ulcerate) or monocolpate (sulcate). Among these, *Monochoria vaginalis* having pollen grains with sulcus apertures while as *Typha angustifolia* having grains with ulcerate apertures. These characters are agreed with previous studied. The resting pollen grians possess inaperturate pattern. The exine ornamentation of investigated pollen grains include granulate, microreticulate, gemmate, baculate to psilate.

The shape of a pollen grain can also be useful in identification of species. Shape is defined by the ratio between the length of polar axis and the equatorial axis (P/E ratio). The pollen grains are mostly spheroidal. However, other shapes like subspheroidal and ellipsoid are also observed. The size of a pollen grain can sometimes be useful in identification of species, but not always. The size of pollen grains varies between 25–110 μm in spheroidal grains and 20–25 x 25.0–47.5 μm in

other shapes. The largest grain is found in *Canna flaccida* (90–110 µm in diameter) and the smallest one is observed in *Typha angustifolia* (20–22 x 25–30 µm in length and breadth).

In conclusion, the pollen morphological character in plant classification was used in present trends. It is hoped that, this paper is useful for identification of some monocots species for further studies.

Acknowledgements

I wish to express my thank to Rector Dr Maung Maung Naing, Yadanabon University, for his permission the research programme. I would like to thanks to Pro–Rectors Dr Si Si Khin and Dr Tint Moe Thuzar, Yadanabon University, for their encouragement over the research programme. I am sincerely grateful to Dr Htar Lwin, Professor and Head, Department of Botany, Yadanabon University, for her permission to undertake this research and for providing the facilities in the making of this research. I would like to express my thank to Dr Pyone Yi, Professor, Department of Botany, Yadanabon University, for her valuable suggestion and kind help.

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