# Pollen Morphology of Genera *Andrographis* and *Hemigraphis*

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## Abstract

The taxonomic description and pollen morphology of five species belonging to two genera of family Acanthaceae have been collected and identified. The specimens were collected from different regions of Mandalay Region. Pollen morphology of all the collected species have been described with their aperture type, number, position, shape, size and sculpture pattern of exine. The aperture type of pollen grains are tricolporate. The exine sculpture of five species are distinctly and obscurely reticulate. The size of the grains are medium or large. The pollen key to the species has been constructed on the basic of palynological data.

Keywords : pollen morphology, palynological data

## Introduction

Acanthaceae is a large family of about 240 genera and 2200 species in the world and widely distributed in the tropical to subtropical and temperate regions (Lawrence 1951). Kress *et al*. (2003) described that there are 43 genera and 280 species in Myanmar.

Most of the species are ornamental plants mainly because of their brightly coloured flowers which are sometimes large and conspicuous inflorescences. The family has little importance in economic, except a few species are cultivated for medicinal purpose: *Andrographis paniculata* are used as effective remedy for stomachache, dysentery, typhus, influenza and bronchitis (Valkenburg 2002).

This family is well known for the remarkable diversity of its pollen in size, shape, pores and exine structure and ornamentation. The term Palynology was introduced by Hyde and Williams in the 1940 and it is derived from the Greek verb palynein, which mean to spread around pollen grains and spores which are often dispersed by wind, insects or other animals (Erdtman 1969).

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Palynology is concerned with both the structure and the formation of pollen grains and spores and also with their dispersal and their preservation under certain environmental conditions. One aspect of palynology is the study of fossil pollen either in prehistoric or recent materials (Moore 1991).

Erdtman (1969) stated that Acanthaceae pollen are similar to those of family Bignoniaceae and Pedaliaceae. Acanthaceae pollen are isopolar, di-polyaperturate, 3- to 5-colporate, 2- to 4-porate; perprolate, peroblate; colporate grains are sometimes provided with pseudocolpi.

The genus *Hemigraphis* is similar to the *Strobilanthes*, *Aechmanthera* and *Stenosiphonium*, which are tricolporate pollen have many pseudocolpi, alternating with the ribs, resembling ribbed pollen (Bremekamp 1994).

Scotland (1992) proposed that, pollen of *Andrographis* is tricolporate, prolate, aperture long and broad at the equator gradually tapering toward the poles; reticulum coarse with each lumina composed of a finer reticulum, continuous with the muri.

The present study is described the morphological characteristics and pollen morphology of five species from genera *Andrographis* and *Hemigraphis* and will be supported to get the valuable information of pollen characters on the systematic study.

## Materials and Methods

### Plant Collection

The five species were collected from some area of Pathein-gyi, Palate and Pyin Oo Lwin Township in Mandalay Region. All the collected specimens were identified by using the literature of flora of British India (Hooker 1978), Flora of Ceylon (Dassanayake 1998) and Kress *et al*. (2003).

### Pollen Collection

The fresh pollen was stored in small glass vials with 1 cc of glacial acetic acid and the specimen was labelled.

**Acetolysis of Pollen Grains (Erdtman 1952)**

The pollen specimens in the glass bottle were crushed with a glass rod and 1 cc acetic acid was added. This was transferred into a test tube and a few drops of concentrated sulphuric acid (depending on the specimens) was added. The test tube was put in a water bath for 15-30 minutes. The mixture was allowed to cool and was diluted with distilled water and centrifuged for 15-30 minutes. This process was repeated at least twice, decanting the distilled water each time. After centrifuging, the distilled water was removed and then the specimen was transferred to the storage bottles.

**Slide Preparation**

The sample bottle was stirred with a glass rod. A drop of sample was taken out and placed on a glass slide and then covered with a cover slip. The mounted slide was examined using light microscope with 40 X and imaged by Canon digital camera, a micrometer using to measure the pollen size. The terminology used in the identification of pollen is according to Erdtman (1952), Erdtman (1969), Moore & Webb (1978), Hoen (1999) and Paldat (2005).

## Results

Pollen morphology of five species from two genera in the family Acanthaceae have been studied. The result of the species are presented in description and illustrated in Figure 1-2.

**Pollen Key to the Species**

1. Pseudocolpi absent ---------- 2
1. Pseudocolpi present ---------- 3
    2. Lumina more than 3.0 μ wide ---------- *Andrographis echioides*
    2. Lumina less than 2.5 μ wide ---------- *Andrographis paniculata*
3. Perprolate ---------- *Hemigraphis flava*
3. Prolate ---------- 4
    4. Pori more than 13 μ in diameter ---------- *Hemigraphis labebrosa*
    4. Pore less than 9 μ in diameter ---------- *Hemigraphis quadrif*

## Taxonomic Description and Pollen Morphology

**1.** ***Andrographis echioides*** (L.) Nees in Wall., Pl. As. Rar. 3. 117. 1832.

*Justicia echioides* L., Sp. Pl. 16. 1753.

Myanmar name : Se ga gyi hmwe tu

Annual erect herbs. Stems and branches quadrangular, green, densely white hairy. Leaf-blade elliptic-oblong, densely white pubescent on both surfaces; petiolate. Inflorescences terminal or axillary raceme. Flowers white, pedicellate, bracteate, bracteolate. Calyx 5-partite, pale green, glandular hairy, persistent. Corolla 2-lipped, white with dark purple spots on the lower lip; upper lip 2-lobed and lower lip 3-lobed, recurved. Stamens 2, exserted, attached at the tip of corolla tube; filaments filiform; anther dithecous, bearded at the base. Ovary ovoid; bilocular with 4 ovules in each locule on the axile placenta; style filiform; stigma flat. Capsule ellipsoid, beaked, 8-seeded, glandular hairy; seeds oblongoid (Figure 1. A).

Flowering period : June to October

Specimen examined : Mandalay Region, Pathein gyi Township

The pollen morphology are tricolporate, prolate, 53-60 × 43-50 μ in length and breath; pori lolongate, about 8.5 × 6.25 μ in length and breath; colpi longicolpate, 48-55 × 12.5 μ in length and breadth; colpi broad at equator and tapering toward the poles; colpus membrane thicken about 5 μ; exine 2.5 μ thick, sexine thicker than nexine; sculpturing distinctly reticulate, the lumina heterobrochate, 3.5-4.5 μ in width, the muri simplibaculate, about 0.5 μ wide (Figure 1. B).

**2.** ***Andrographis paniculata*** (Burm.f.) Wall. ex Nees in Wall., Pl. As. Rar.

3. 116. 1832.

*Justicia paniculata* Burm.f., Fl. Ind. 9. 1768.

Myanmar name : Se ga gyi

Perennial erect herbs. Stems and branches quadrangular, longitudinally striated, green, glabrous. Leaf-blades lanceolate, glabrous on both surfaces; petiolate. Inflorescences terminal or axillary paniculate raceme. Flowers white, pedicellate, bracteate, bracteolate. Calyx 5-partite, pale green, glandular hairy, persistent. Corolla 2-lipped, white with dark purple spots on the lobes; tube straight, basally swollen; upper lip 2-lobed

and lower lip 3-lobed, recurved. Stamens 2, far exserted, attached at the tip of corolla tube; filaments filiform; anther dithecous. Ovary oblongoid; bilocular with 6 ovules in each locule on the axile placentae; style filiform; stigma minutely bifid. Capsule oblongoid, 12-seeded, glandular hairy; seeds quadrangular (Figure 1. C).

Flowering period : October to March

Specimen examined : Mandalay Region, Pathein gyi Township

The pollen morphology are tricolporate, prolate, 45-50 × 35-40 μ in length and breadth; pori lolongate, about 13 × 10 μ in length and breadth; colpi longicolpate, 40-45 × 10 μ in length and breadth, colpi broad at equator and tapering toward the poles; colpus membrane thicken about 5 μ; exine about 1.25 μ thick, exine thicker than nexine; sculpturing distinctly reticulate, the lumina heterobrochate, 1.25-2.0 μ in width, the muri simplibaculate, about 0.25 μ wide (Figure 1. D).

**3.** ***Hemigraphis flava*** Kurz, As. Soc. Beng. 11. 74. 1871.

Myanmar name : Kyit pa sit, Phon so gale

Perennial erect shrub. Stems and branches quadrangular, green, glabrous. Leaf-blades broadly elliptic, scabrous and glabrous on both surface, petiolate. Inflorescence terminal paniculate dense spike. Flowers yellow, sessile, bracteate, bracteolate. Calyx 5-partite, creamy white, persistent. Corolla 5-lobed, lobes 5, subequal. Stamens 4, didynamous, included, attached at the middle of corolla tube; filaments filiform, the longer two with bearded in the upper half; anthers dithecous. Ovary oblongoid, bilocular with three ovules in each locule on the axile placentae; style filiform; stigma unequally bifid. Capsule oblongoid, 6-seeded; seeds discoid (Figure 1. E).

Flowering period : January to March

Specimen examined : Mandalay Region, Pyin Oo Lwin Township

The pollen morphology are tricolporate, perprolate, 52-62 × 28-38 μ in length and breadth; pori lalongate, about 15 × 20 μ in length and breadth; colpi longicolpate, 49-58 × 5 μ i n length and breadth, distinctly pseudocoli present, the number of pseudocolpi 9; exine about 1.5 μ thick, sexine as thick as nexine; sculpturing obscurely reticulate (Figure 1. F).

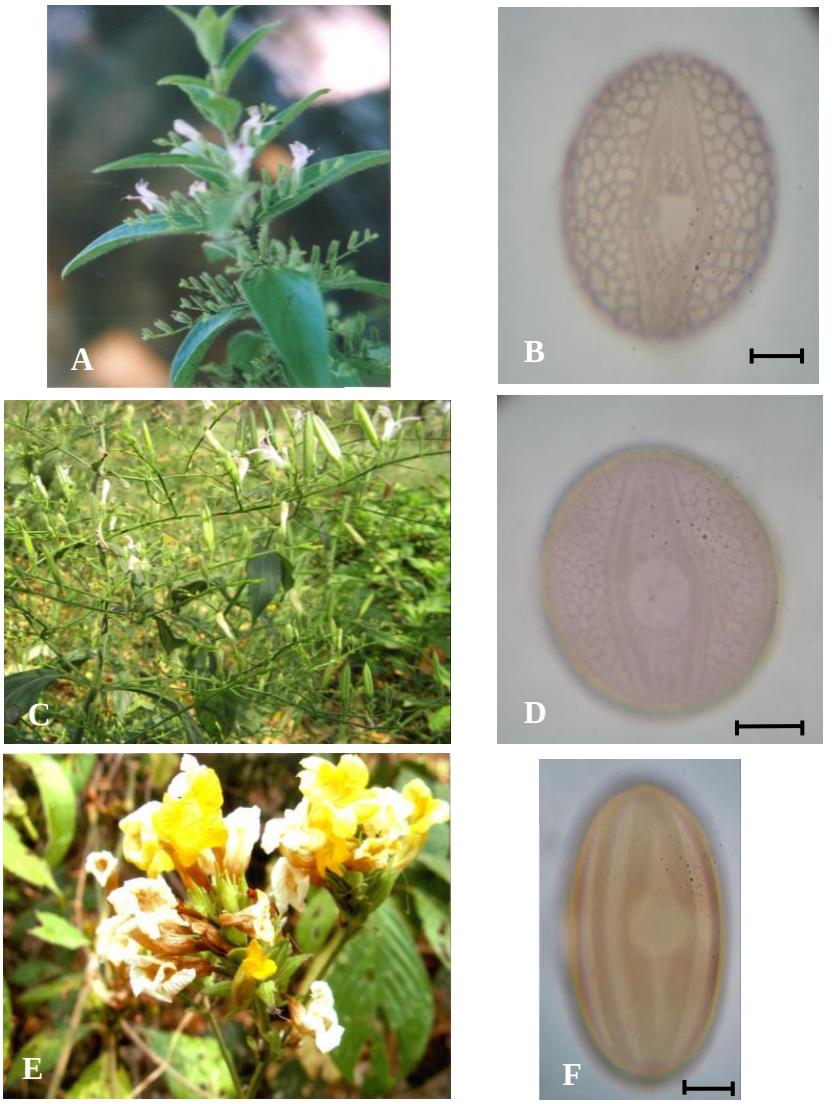


Figure 1. A. Inflorescences of *Andrographis echioides*
B. Equatorial view of *Andrographis echioides*
C. Inflorescences of *Andrographis paniculata*
D. Equatorial view of *Andrographis paniculata*
E. Inflorescences of *Hemigraphis flava*
F. Equatorial view of *Hemigraphis flava*

**4.** ***Hemigraphis latebrosa*** Nees in DC., Prodr. 11. 723. 1847.

*H. elegans* T. Ander., Journ. Linn. Soc. 9. 463. 1867.

Myanmar name : Unknown

Perennial prostrate herbs. Stems and branches quadrangular, green, soft patent white hairy. Leaf-blade ovate, densely hairy on both surface, petiolate. Inflorescences terminal head. Flowers blue, sessile, bracteate, ebracteolate. Calyx 5-partite, pale green, pubescent, persistent. Corolla 5-lobed, tube cylindric base, widened at the middle, lobes 5, subequal. Stamens 4, didynamous, included, attached at the near the tip of corolla tube; filament longer with bearded; anthers dithecous. Ovary oblongoid, bilocular with four ovules in each locule on the axile placentae; style filiform; stigma unequally bilobed. Capsule oblongoid, 8-seeded; seeds discoid (Figure 2. A).

Flowering period : November to March

Specimen examined : Mandalay Region, Palate Township

The pollen morphology are tricolporate, prolate, 58-68 × 48-58 μ length and breadth; pori circular, about 15 μ in diameter; colpi longicolpate, 50-63 × 2.5 μ in length and breadth, distinctly pseudocolpi present, the number of pseudocolpi 12 × exine about 2.5 μ thick, sexine thicker than nexine; sculpturing obscurely reticulate (Figure 2. B).

**5.** ***Hemigraphis quadrifaria*** T. Anders., Journ. Linn. Soc. 9. 463. 1867.

Myanmar name : Unknown

Perennial shrub. Stems and branches quadrangular, green, hirsute. Leaf blades elliptic, hirsute on both surface, petiolate. Inflorescences terminal and axillary dense head. Flowers purple, sessile, bracteate, bracteolate. Calyx 5-partite, green, persistent. Corolla 5-lobed, tube lower cylindric and upper ventricose; lobes 5, subequal. Stamens 4, didynamous, included, attached at the near the tip of corolla tube; longer filaments with densely white hairy; anthers dithecous. Ovary oblongoid, bilocular with 4 ovules in each locule on the axile placentae; style filiform; stigma 2, one linear and one very short lobe. Capsule oblongoid, 8-seeded; seeds compressed (Figure 2. C).

Flowering period : November to February

Specimen examined : Mandalay Region, Pyin Oo Lwin Township

The pollen morphology are tricolporate, prolate, 65-75 × 53-63 μ in length and breadth; pori circular, about 7.5 μ in diameter; colpi longicolpate, 62-71 × 6 μ in length and breadth, distinctly pseudocolpi present, the number of pseudocolpi 20; exine about 2-17 μ thick, sexine thicker than nexine; sculpturing obscurely reticulate (Figure 2. D).

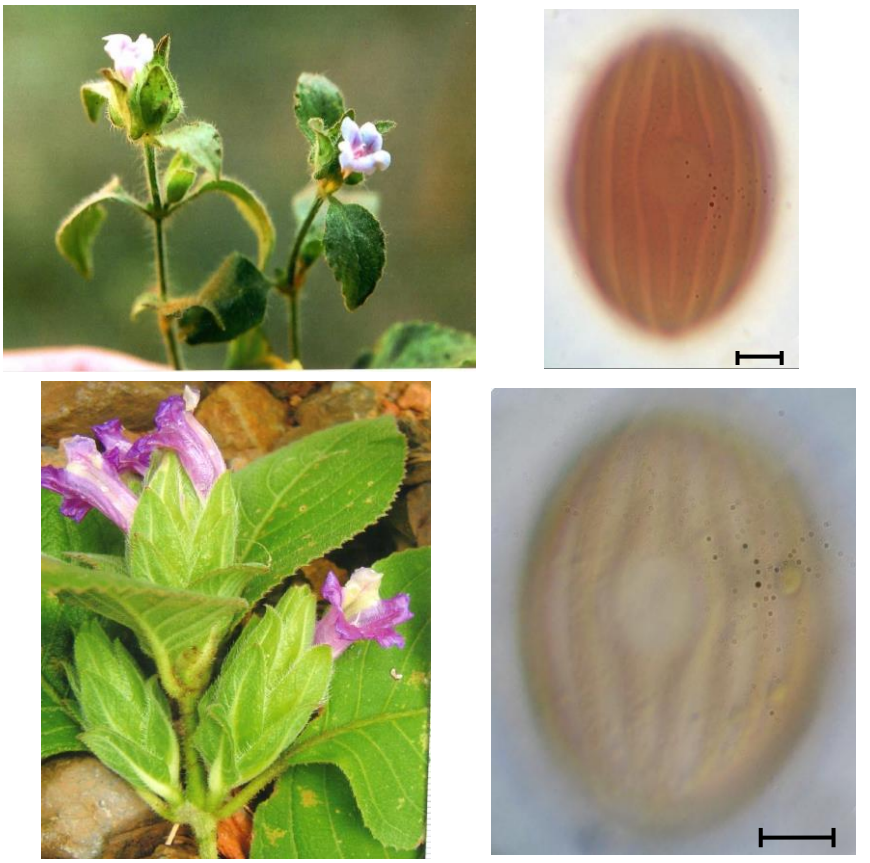

Figure 2. A. Inflorescences of *Hemigraphis latebrosa*

B. Equatorial view of *Hemigraphis latebrosa*

C. Inflorescences of *Hemigraphis quadrifaria*

D. Equatorial view of *Hemigraphis quadrifaria*

## Discussion and Conclusion

In the present study, the taxonomic description and pollen morphology of five species of family Acanthaceae have been studied and described.

Many species of family Acanthaceae are wild and a few are cultivated. *Andrographis paniculata* is cultivated as ornamental and *A. echioides*, *Hemigraphis flava, H. latebrosa* and *H. quadrifaria* are wild plant.

Acanthaceae is an eurypalynous family, thus the pollen characters show great variation.

In the present study all the pollen grains are tricolporate type. The sizes of pollen grains are medium in *Andrographis paniculata* and *A. echioides*, large in *Hemigraphis spp*. The shapes of the pollen grain are perprolate in *Hemigraphis flava* and prolate in the rest of four species.

In this study, exine sculpture is distinctly and obscurely reticulate. This type of exine sculpture have wall like structure (muri) and depressed areas (lumina) between the walls thus the types are very distinctly muri and lumina. The obscurely reticulate exine sculpture is found in genus *Hemigraphis* while the other genus *Andrographis* exine sculpture is distinctly reticulate.

So, these pollen characters will be supported for identification and classification of flowering plants. It is sincerely hoped that the present result will support valuable information for the further studies in other family.

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