

TAXONOMY AND POLLEN MORPHOLOGY OF SOME CLIMBERS FOUND IN KYAING TONG TOWNSHIP

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ABSTRACT

The present study deals with 10 species, 5 genera from Family Cucurbitaceae. They are collected from study area of Kyaing Tong Township, Eastern Shan State. The Taxonomy and Pollen Morphological studies on both vegetative and reproductive parts of the plants have been investigated. As a result of collection from each of 2 species of Genus *Cucumis*, *Cucurbita*, *Gymnopetalum*, *Luffa* and *Trichosanthes*. Tendrils number simple to many – five tendrils found in study area. Leaves and flowers are variable in shape and size. Fruit types are important for local people. Moreover, an artificial key to the species of the studied plants have been given. Each of one species has been identified and nomenclature. Colored photographs of every species have been presented. For Pollen Morphology, shape, size, aperture type and exine sculpture were studied. Pollen synoptical key to the species was constructed based on aperture type, number, exine ornamentation and size. Finally, color photographs of both equatorial and polar views were presented.

Key words: Taxonomy, Pollen Morphology, Cucurbitaceae, Kyaing Tong Township.

INTRODUCTION

Family Cucurbitaceae belonging to the order Cucurbitales is one of the largest families of flowering plants (Benson 1957). It is a botanically highly specialized family of mainly climbing and trailing plants and is major importance to man as a source of food (Heywood 1978).

Lawrence (1969), from all these views and the evidence on which they are based, it seems probable that Cucurbitaceae will be removed from the Campanulales and be treated as a terminal and advanced taxon of a Polypetalous order. Heywood (1979), about 90 genera, containing about 700 species, have been variously included in the Cucurbitaceae (Heywood, 1979). Brummit (1992) stated that family Cucurbitaceae consists of 120 genera. It is well represented in the moist and moderately dry tropics of both Old and New Worlds, particularly in rain forests, wood lands, grass lands and bush land areas.

Economically the family is important as source of food ornamentales. Prominents among the former are pumpkin and squash (marrow) (*Cucurbita*). Cucumber and muskmelon (*Cucumis*), and water melon and citron (*Citrullus*). In the present study 10 species belonging to 5 genera of family Cucurbitaceae, have been recorded, identified and stated with photographs for taxonomy and Pollen Morphology.

Therefore the aims and objectives of the present studies as follow:

- To collect and identify the wild and cultivated species of family Cucurbitaceae, from Kyaing Tong township.
- To give the knowledge and record of pollen morphological characteristics from the taxonomic point of view.

MATERIALS AND METHODS

The member of the family Cucurbitaceae was collected from Kyaing Tong Township, during December 2018 to November 2019. During the time of flower bloomy, all the species were recorded by photographs. The plants are identified by Hooker (1885), Dassanayake (1983) and Hundley & Chit Ko Ko (1987).

1. Collection of pollen samples

Method of pollen collection is to excise mature anthers and allow them to dehisce under low humidity in desiccators. Debris is then removed with a forceps, or the pollen is sieved through a mesh of suitable pore size. Scientific name of the plant and its locality were labeled on the glass vials.

2. Acetolysis of reference material

Polliniferous material was crushed with a glass rod; 1cc of glacial acetic acid was added to it. Then the mixture was transferred to a test tube and a few drops of concentrated sulphuric acid were added. The test tube was put in a water-bath for 15 to 30 minutes. The fluid in the test tube was stirred frequently and boiled. On cooling, the mixture was diluted with distilled water and to centrifuge for 15-30 minutes. This was repeated twice, decanting the water each time. After centrifuging, the distilled water was removed and glycerine jelly with saffranin was added to the remaining material.

3. Preparation of glycerine jelly

The glycerine jelly was prepared according to half ration of Kisser's formula (Erdtman, 1952).

RESULTS

Key to the species of the genus *Cucumis*

1. Flowers more than 3.0 cm across at anthesis, anther conduplicate;
fruits oblongoid or cylindrical, about 22.0 cm by 8.0 cm.-----*Cucumis sativus*
1. Flowers less than 3.0 cm across at anthesis, anther flexuous;
fruits orbicular-triangular, about 5.0 cm by 3.5 cm. -----*Cucumis trigonus*

Pollen key to the species

1. Pori lolongate-----*Cucumis sativus*
1. Pori lalongate-----*Cucumis trigonus*

1. *Cucumis sativus* L.Sp.Pl. 1:1012.1753.

Local names : **Tha-kwa-thi, Sein-sa-thakwa**

English name : **Cucumber**

Annual, monoecious, climbing herbs; tendrils simple. Leaves broadly ovate in outline. Staminate flowers axillary fascicles with 3 to 7 flowers with shortly peduncle; pistillate ones axillary, solitary. Flowers about 3.5 cm across at anthesis. Calyx 5-lobed; lobes linear-subulate. Corolla 5-lobed; obovate-elliptic. Stamens 3 in staminate flowers, inserted within the calyx - tube; anthers conduplicate, one monotheous, the other two ditheous. Ovary inferior, stigmas 3, bi-lobes. Fruits oblongoid -cylindrical, about 22.0 cm by 8.0 cm, indehiscent, tuberculate, young fruits warty or echinate, ripe ones often smooth. Seeds embedded in greenish white pulp, ovate to elliptic.

Flowering and fruiting : July to November.

Pollen Morphology

Triplicate, large, oblate, 50-57 x 55-62 in length and breadth; amb rounded-triangular, angulaperturate; pori lolongate, about 8 x 6 in length and breadth, rim about 2.5 wide; sexine as thick as nexine; sculpturing obscurely reticulate.

2. *Cucumis trigonus* Roxb., Hort. Beng. 70. 1814.

Local name : **Ka-sit-tha-kwa**

English name : **Unknown**

Perennial or annual, monoecious, trailing herbs; tendrils simple. Leaves are simple and alternate, shallowly 3- 7 lobed, exstipulate; blades reniform. Flowers epigynous and yellow, about 2.0 cm across at anthesis, epigynous. Calyx 5-lobed, tube campanulate, lobes subequal, linear. Corolla campanulate, deeply 5-lobed, lobes ovate

– oblong. Stamens 3 in staminate flowers, inserted within the calyx-tube; filaments short; anthers flexuous, one monothealous, the other two dithealous. Ovary inferior; style base surrounded by an annular disk; stigmas 3. Fruit orbicular-trigonous, about 5.0 cm by 3.5 cm, indehiscent, pale green to yellow when ripe. Seeds many, oblong.

Flowering and fruiting : July to December.

Pollen Morphology

Triporate, large, oblate, 50-62 x 40-55 in length and breadth; amb rounded-triangular, angulaperturate; pori lalongate, about 8 x 10 in length and breadth, rim about 3 wide; exine 2-3 in thick, sexine as thick as nexine, sexine thicker towards the pore; sculpturing obscurely reticulate.

Key to the species of the genus *Cucurbita*

1. Flowers more than 14.0 cm across at anthesis; fruits more than 20.0 cm by 25.0 cm, sulcate more than 15 grooves, depressed globoid, about 23.0 cm by 28.0 cm.-----*Cucurbita maxima*

1. Flowers less than 14.0 cm across at anthesis; fruits less than 15.0 cm by 13.0 cm; sulcate less than 15 grooves, sub-globoid about 10.0 cm by 11.5 cm. -----*Cucurbita maxima* cv. Golden ball

Pollen key to the species

1. Exine more than 5 thick-----*Cucurbita maxima*

1. Exine less than 3.5 thick-----*Cucurbita maxima* cv. Golden ball

3. *Cucurbita maxima* Duchesne in Lamk. Dict. 2 . 151. 1786

Local name : **Shwe-pha-yon**

English name : **Pumpkin**

Annual, monoecious; tendrils 2- to 5-fid. Leaves simple, blades reniform. Staminate and pistillate flowers axillary and solitary, yellowish orange. Flowers unisexual, about 15.0 cm across at anthesis. Calyx campanulate, 5-lobed. Corolla 5-lobed, equal, ovate. Stamens 3 in staminate flowers, inserted at the base of the calyx-tube; anthers conduplicate, basifixed, one monothealous, the other two dithealous yellow. Ovary globoid, inferior; style columnar; stigmas 3, each bi-lobed. Pepo very large, depressed globoid, about 22.0 cm by 26.0 cm, indehiscent, longitudinal groove, about 20 grooved, yellow, hard-shelled; fruits stalk stout, corky. Seeds many, ovate.

Flowering and Fruiting : July to January.

Pollen Morphology

Polyporate, very large, spheroidal, 145-160 in diameter; pori circular, about 18 in diameter, interporal space 26-32; exine 5-6 thick, sexine as thick as nexine; sculpturing echinate, obscurely reticulate in between, spines not pointed.

4. *Cucurbita maxima* Duchesne in Lamk. Dict. 2 . 151. 1786. cv. Golden ball

Local name : **Shwe-pha-yon**

English name : **Squash or Pumpkin or Gourd**

An annual, monoecious, creeping; tendrils 3-5 fid. Leaves broadly orbicular ovate in outline, exstipulate. Staminate and pistillate flowers solitary, axillary, yellow. Flowers unisexual, epigynous, about 11.0 cm across at anthesis. Calyx campanulate, 5-lobed. Corolla 5-lobed. Stamen 3 in staminate flowers, inserted at the base of the calyx - tube; anthers 3 or 4, conduplicate, basifixed, one with one monothealous, the other two dithealous or two with one monothealous. Ovary inferior, globoid; style clavate; stigma 3, bilobed, reniform. Pepo subgloboid, about 10.0 cm by 11.0 cm, dark yellow with creamy lines, about 8 to 10 lines. Seeds many, ovate-oblong.

Flowering and fruiting : December to April.

Pollen Morphology

Polyporate, very large, spheroidal, 137-152 in diameter; pori circular, about 16 in diameter, interporal space 27-33; exine 2.5-3.5 thick, sexine as thick as nexine; sculpturing echinate, obscurely reticulate in between, spines slightly blent.

Key to the species of the genus *Gymnopetalum*

1. Pepo ovate - oblong, acuminate at the apex, red when ripe, dehiscent;
seeds oblong----- *Gymnopetalum cochinchinense*
1. Pepo globoid, rounded at the apex, orange when ripe, indehiscent;
seeds ovate, ----- *Gymnopetalum integrifolium*

Pollen key to the species

1. Obscurely reticulate, prolate, pori lalongate-----*Gymnopetalum cochinchinense*
1. Distinctly reticulate, spheroidal, pori circular-----*Gymnopetalum integrifolium*

5. *Gymnopetalum cochinchinense* (Lour.) Kurz, Journ. As. Soc. Beng. xl.1871.

Local name : **Taw-kin-mon**

English name : **Unknown**

Annual, monoecious, tendrils simple. Leaves 5- angular; blades reniform in outline. Staminate and pistillate flowers axillary, solitary. Flowers epigynous, white, about 5.0 cm across at anthesis. Calyx 5- lobed. Corolla deeply 5-lobed. Stamens 3, inserted deeply within swollen part of the calyx tube; anthers 3, conduplicate, one monothealous, the other two dithealous. Ovary inferior, oblongoid, 8 - 10 longitudinal stripes; style long; stigmas 3, each bi-fid. Pepo ovate - oblongoid, acuminate at the apex, about 10 longitudinal-ribbed, red when ripe, dehiscent. Seeds many, oblong.

Flowering and fruiting : July to December.

Pollen Morphology

Triporate, large, prolate, 77-92 x 62-77 in length and breadth, amb rounded; pori lalongate, about 6.5 x 9 in length and breadth, rim about 2.5 wide, transverse furrows present; exine 3.0-3.5 thick, sexine thicker than nexine; sculpturing obscurely reticulate.

6. *Gymnopetalum integrifolium* (Roxb). Kurz, J. Asiat. Soc. Bergal 40, 1:58.1871.

Local name : **Kha-nwe**

English name : **Unknown**

Annual, monoecious, tendrils simple. Leaves angular 3-5 lobed. Staminate flowers axillary, solitary or solitary with raceme 1 to 4 flowers at the same axil; the pistillate ones axillary, solitary. Flowers white, about 5.5 cm across at anthesis; bracts ovate - oblong. Calyx 5- lobed. Corolla 5 - lobed. Stamens 3, inserted in the middle of the calyx tube; anthers conduplicate, basifixed, yellow. Ovary ovoid; style stout; stigma 3 fid. Pepo globoid, rounded at the apex, about 5.0 cm long and 4.5 cm wide, indehiscent, pale green when young to orange when ripe, the pulp greenish. Seeds many, ovate, 5.0 mm by 3.0 mm compressed, brown.

Flowering and fruiting : June to November.

Pollen Morphology

Triporate, large, spheroidal, 75-77 in diameter; pori circular, about 8 in diameter; exine 2.5-3.5 thick, sexine thicker than nexine; sculpturing distinctly reticulate, the lumina heterobrochate, 2.0-2.5 in width, the muri simplibaculate.

Key to the species of the genus *Luffa*.

1. Flowers less than 4.0 cm across at anthesis; Stamens 3, anthers flexuous one monothealous, the other two dithealous; Fruits elongated, narrow toward the base, 7-10-ribbed; Seeds oblong, compressed, verrucose.

-----*Luffa acutangular*

1. Flowers more than 7.0 cm across at anthesis; stamens 5, anther conduplicate, all monothealous, fruits cylindrical; light stripes, 8 to 10 dark green stripes; seeds ovate, smooth, marginally winged

-----*Luffa cylindrica*

Pollen key to the species

1. Striato-reticulate, pori lolongate, longicolpate -----*Luffa acutangular*
 1. Retipilate, pori circular, Parasyncolpate-----*Luffa cylindrica*

7. *Luffa acutangular* (L.) Roxb. Hort. Beng. 70.1814.

Local name : Kha-wai- thi

English names : Ribbed luffa, angled loofah

Annual, climbing herbs, monoecious; tendrils 3- to 5-fid. Leaves simple, 5 to 7 triangle lobes; blades broadly ovate, gland-dotted at the apex of the lobes. Staminate flowers in axillary racemes with 15 to 25 flowers; pistillate ones axillary, solitary, arise from the same axil. Flowers yellow, about 4.0 cm across at anthesis, bracteate; bracts ovate. Calyx 5-lobed. Corolla rotate. Stamens 3 in staminate flower, inserted at the mouth of the calyx-tube; anthers flexuous, pollen pale yellow. Ovary oblong, conspicuously 10 longitudinal rib; style slender; stigmas 3, each bi-lobed, reniform. Fruits elongated, narrow toward the base, 18.0 - 25.0 cm by 5.0 - 7.0 cm indehiscent, 7-10-ribbed, green. Seeds many, oblong, compressed, verrucose.

Flowering and fruiting : August to January.

Pollen Morphology

Tricolporate, large, prolate, 80-90 x 77-87 in length and breadth; amb rounded; colpi longicolpate, 75-82 x 2-3 in length and breadth; pori lolongate, sexine thinner than nexine; sculpturing striato-reticulate, the lumina heterobrochate.

8. *Luffa cylindrica* (L.) M. Roem. , Syn, Monogr, 2: 63. 1846.

Local name : Tha-byut

English name : Sponge gourd.

Annual, monoecious or dioecious; tendrils 3- to 5- fid. Leaves orbicular reniform in outline; Staminate flowers axillary racemes with 5- to 28- flowers; the pistillate ones axillary, solitary. Flowers yellow, about 8.5 cm across at anthesis, bracteates, pedicellate. Calyx 5-lobes; lobes lanceolate. Corolla rotate, obovate. Stamens 5, inserted at the mouth of the calyx-tube; anther conduplicate, all monothealous. Ovary inferior, cylindrical; style columnar; stigma 3, each bi-lobed. Fruits cylindrical, 20 - 30 cm by 4.5 - 6.0 cm, normally with light stripes, 8 to 10 green stripes, network of fibrous when dry. Seeds ovate, smooth; marginally winged.

Flowering and fruiting : August to January.

Pollen Morphology

Tricolporate, large, prolate, 87-92 x 77-82 in length and breadth; amb rounded; colpi parasyncolpate, the apocolpium about 4.5 in diameter; pori circular; sexine thicker than nexine; sculpturing retipilate, the lumina heterobrochate.

Key to the species of the genus *Trichosanthes*

1. Flowers white, less than 5.0 cm across at anthesis;
bracts obovate, green with greenish glands scattered

without. -----*Trichosanthes palmata*

1. Flowers pink or reddish, more than 5.0 cm across at anthesis;
bracts reniform, , scarlet red with reddish glands

scattered without -----*Trichosanthes tricuspidata*

Pollen key to the species

1. Spheroidal, sexine as thick as nexine -----*Trichosanthes tricuspidata*

1. Prolate, sexine thicker than nexine -----*Trichosanthes palmata*

9. *Trichosanthes palmata* Roxb., Fl. Ind. iii. 704. 1815.

Local name : **Kyi-ah-kyi**

English name : **Unknown**

Perennial, dioecious. Staminate flowers axillary racemes with 7 to 15 flowers; pistillate flowers axillary, solitary. Flowers epigynous, white, about 4.0 cm across at anthesis, pedicellate; bracts obovate, few greenish glands scattered without. Calyx tubular-campanulate, 5-lobed, lanceolate. Corolla rotate; lobes elliptic-ovate. Stamens 3 in staminate flowers, inserted at the mouth of the calyx tube; filaments free, short; anthers long, one monothecous, the other two ditheous. Ovary inferior, ovate-oblong; style linear; stigmas 3, each bifid, glabrous. Pepo globoid. Seeds ovate.

Flowering and fruiting : August to December.

Pollen Morphology

Triplicate, large, prolate, 65-72 x 60-67 in length and breadth; amb rounded; pori circular, 8-10 in diameter, rim about 2 wide; sexine thicker than nexine; sculpturing distinctly reticulate, the lumina heterobrochate, muri simplibaculate.

10. *Trichosanthes tricuspidata* Lour. Fl. Cochinch. 589. 1790.

Local name : **Kyi-ah**

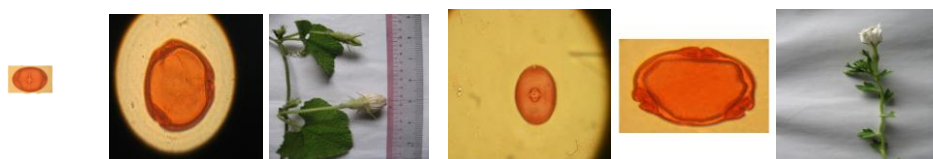
English name : **Unknown**

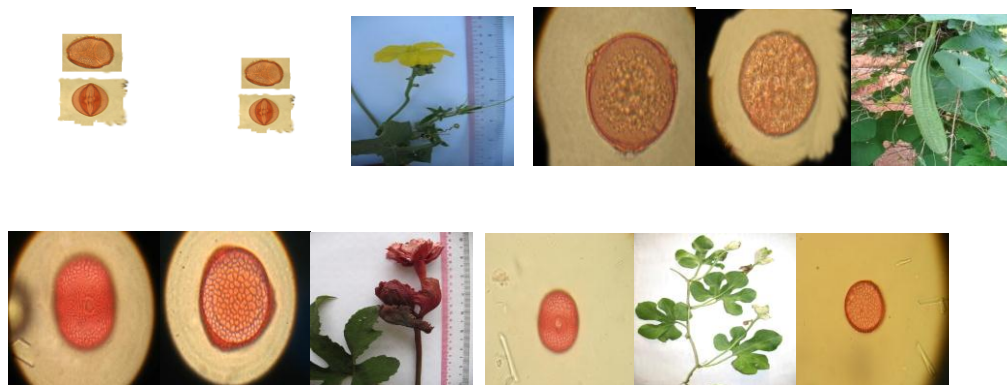
Perennial, dioecious, tendril tri-fid. Leaves blades broadly ovate in outline. Staminate flowers axillary racemes with 10 to 30 flowers. Flowers unisexual, epigynous, actinomorphic, reddish, showy about 6.0 cm across at anthesis, bracteate, pedicellate; bracts reniform with reddish glands scattered without; of pistillate flowers lanceolate. Calyx tubular-campanulate. Corolla 5-partite; lobed elliptic ovate. Stamens 3, inserted in the calyx tube; anthers conduplicate, one monothecous, the other two ditheous. Ovary inferior, oblogoid; stigmas 3, each bifid. Pepo globoid. Seeds many.

Flowering and fruiting : August to December.

Pollen Morphology

Triplicate, large, spheroidal, 63-68 in diameter; amb rounded; pori circular, 9-10 in diameter; exine 5.0-6.5 thick, sexine as thick as nexine; sculpturing distinctly reticulate, the lumina heterobrochate, the muri simplibaculate.





DISCUSSION AND CONCLUSION

Family Cucurbitaceae is very interesting family, composed of edible fruits and it is called 'gourd' family because of their large and fleshy fruits. Simple tendrils are found in the genera *Cucumis* and *Gymnopetalum*. These tendrils are shortly bi-fid at the tip. Tri- to many-fid tendrils are found in the genera *Cucurbita*, *Luffa* and *Trichosanthes*. Flowers about 3.5 cm across at anthesis, anther conduplicate; fruits oblongoid or cylindrical found in *Cucumis sativus*. The size of flowers, ovary, fruits and seeds are smallest found in *Cucumis trigonous*.

Two species of the genus *Cucurbita* were found in study area. These genera have similar characters but differences are found in flowers size and fruits types. Among them, the largest fruit is found in *C. maxima* (shwe-pha-yon) and bright yellow with creamy lines are found in *C. maxima* (cv. Golden ball). Among 10 species, the largest flowers and the largest fruits are found in genus *Cucurbita*. In genus the *Gymnopetalum* have same characters of monoecious plants, 3- to 5- lobed leaves; axillary and solitary or racemes at the same axil; flowers are white, conduplicate anthers within swollen part of the calyx tube. Oblongoid ovary with about 10 longitudinal ribs are found in *G. cochinchinense* while *G. integrifolium* has ovoid ovary and sub globoid, indehiscent, orange fruits.

In genus *Luffa*, flowers less than 4.0 cm across at anthesis; stamens 3, anthers flexuous, fruits elongated, 7-10-ribbed; seeds oblong, verrucose found in *Luffa acutangular*. Flowers more than 7.0 cm across at anthesis; stamens 5, all monotheous; fruits cylindrical, 8 to 10 dark green stripes, network of fibrous when dry; seeds ovate, marginally winged found in *Luffa cylindrical*. In genus *Trichosanthes*, interesting plant is *T. tricuspidata*, because the flowers are showy and reddish; bracts reniform, scarlet red with reddish glands scattered without and glabrous fruits. Palmately or shallowly 3- to 5- lobed leaves and bracts obovate, green with greenish glands scattered without are found in *T. palmata*.

Characters of pollen are shape, size, polarity, apertures type, number, position and exine structure. The most characteristic feature is found in the pattern of the exine and the type of apertures (Erdtman 1952). In this study, polyporate grains are found in 2 species of genus *Cucurbita*; triporate and zonoporate pollens found in 2 species of *Gymnopetalum* and 2 species of *Trichosanthes* genera; and the rest of the 2 species of *luffa* genera possess tricolporate and zonocolporate grains.

The shape of pollen varied from 4 spheroidal seen in 2 species of genus *Cucurbita*, *Gymnopetalum integrifolium*, *Trichosanthes tricuspidata*; prolate found in 4 species of *Gymnopetalum cochinchinense*, *Luffa acutangular*, *L. cylindrical* and *Trichosanthes palmata*; oblate found in two species of *Cucumis*. Five types of exine sculpture have been recorded: striato-reticulate found in one species of *Luffa acutangular*; retipilate seen in one species of *Luffa cylindrical*; echinate type occurred

in 2 species of *Cucurbita*; obscurely reticulate occurred in 2 species of *Cucumis* and one species of *Gymnopetalum cochinchinense*; distinctly reticulate seen in one species of *Gymnopetalum integrifolium* and 2 species of *Trichosanthes*. The muri were simplibacculate and lumina heterobrochate found in study area. The size of muri and lumina are variable.

Palynology has been an important aid in various fields of science, both academic and applied. So, it is hoped that this research were further contribute towards the progress in advance the economic value and horticultural interest of this family, their cultivation, cultivars and varieties.

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