



Research Article

Palynological Studies on Ten Species of Angiosperms from Nepal

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Abstract

Palynological studies on ten species of angiosperms family namely *Hibiscus rosa-sinensis* L. (Malvaceae), *Lilium candidum* L. (Liliaceae), *Petunia axillaris* (Lam.) B.S.P. (Solanaceae) and seven species from family asteraceae namely *Artemisia indica* Willd., *Aster ageratoides* Kitam., *Calendula officinalis* L., *Cerpis japonica* L. (Benth.), *Sonchus asper* (L.) Hill, *Tagetes patula* L., and *Taraxicum officinale* F.H.Wigg. was carried out. Result obtained from this investigation showed that pollen shape is spheroidal in *Artemisia indica*, *Aster ageratoides*, *Calendula officinalis*, *Hibiscus rosa-sinensis* and *P. axillaris*; elliptical in *L. candidum*, hexagonal in *S. asper* and pentagonal in *T. officinale*; tricolpate in *C. japonica*. Pollen aperture is porate in all except in *L. candidum* where it is elliptic. Pollen wall is echinate in *H. rosa-sinensis*, *A. ageratoides*, *T. patula*; spinulate in *P. axillaries*, *T. officinale*, *S. asper*, *C. japonica*, *C. officinalis* and *T. officinale* and smooth in *L. candidum*. The general appearance of the pollen grain is circular in *P. axillaries* but longer than wide in *L. candidum*. The circular, echinate, large and triporate pollens seem to be primitive ones and spheroidal, hexaporate features have been regarded as comparatively advanced ones. Polyporate pollens are considered to be secondarily derived. The nature of the pollen grain in these species could be evolutionary significance. The similarities in structure of the pollen grain showed the inter-species relationships among the species and that's why put in same family while the differences in structures showed reasons for them to exist as distinct species. Only one species namely *L. candidum* from monocot family (Liliaceae) included in this study.

Keywords: Palynology; angiosperms; aceto-carminic; echinate

Introduction

Ten species of angiospermic plants were selected for Palynological studies. Their characteristics were described below.

Artemisia indica Willd.

The plant is commonly known as wormwood and belongs to tribe Anthemideae of the family asteraceae. It is perennial herbs or shrubs, 80-150 cm tall and glabrescent. Leaves short petiolate or sessile, upper surface of blade grey or yellowish, tomentose or glabrescent, lower surface densely

grey arachnoid tomentose, lowermost blades ovate or oblong-ovate, pinnately parted, distal lobes larger, segments 3-4 pairs, winged along midrib, middle cauline leaves ovate or oblong-ovate

Aster ageratoides Kitam.

This taxa belongs to the tribe Astereae of family asteraceae. The plant is a late flowering herbaceous perennial, up to 1 m tall. It is native to eastern Asia. The species *Aster*

Article may be cited as:

P. Karna (Mallick) (2017) Int. J. Appl. Sci. Biotechnol. Vol 5(3): 361-365. DOI: <http://dx.doi.org/10.3126/ijasbt.v5i3.18294>

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Peer reviewed under authority of IJASBT

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ageratoides, commonly known as the Japanese Aster. Leaves hairy, margin serrate. Flowers white capitulum.

Calendula officinalis L.

This plant is belongs to the tribe Calenduleae of the family Asteraceae. The plant is a short living. The plant is aromatic and erect annual herb. The plant is growing up to 80 cm tall and branched stem. The stem is angular, glandular and hairy. The leaves 2.5-7.5 cm, oblong, lanceolate and hairy on both sides, entire margins. The inflorescence is yellow comprising a thick capitulum.

Crepis japonica L. (Benth)

The plant is commonly known as hawksbeard and belongs to tribe Cichorieae of the family asteraceae. The species is an perennial herbs and with milky latex. Leaves mostly rosulate, glabrous. Capitula ligulate, many-flowered, solitary, terminal or in lax corymbs. Florets bisexual, fertile, corolla yellow, tube shorter than lamina, oblong, 5-toothed.

Hibiscus rosa-sinensis L.

It is commonly known as china rose or shoe flower and belongs to Malvaceae family. The taxa *Hibiscus rosa-sinensis* is a bushy and evergreen shrubs or small tree growing 2.5-5 m tall and 1.5-3 m wide and with solitary red flower and glossy leaves. The plant flowers in summer and autumn.

Lilium candidum L.

It is commonly called as white lily flower, belongs to monocot family liliaceae. It is a perennial plant growing up to 60-150cm in height. It is a bulb species with large scaly white bulb, 1m. tall stalks and linear leaves with dented margins. Plant is strongly aromatic.

Petunia axillaris (Lam.) B.S.P.

Petunia is an annual herbaceous plant in the family Solanaceae and closely related to tobacco, tomatoes, deadly nightshades, potatoes and chili peppers in the same family, Solanaceae. The plants are herbaceous, generally hairy, and the flowers are funnel-shaped, with petals joined together.

Sonchus asper L. (Hill)

This taxa is belongs to the tribe Cichorieae of the family asteraceae. The plant is annual, erect. Root stalky, vertical. Stem straight, branchy, and glabrous below, 70-80 cm in height. Leaves integral or emarginate-incised, with sharp incisions and prickly marginal denticles, elongate-ovoid, rigid, pointed, less often blunt, radical and lower leaves are narrowed toward winged petiole; middle and upper leaves sessile, with wide amplexicaul base. Inflorescences are calathidia, aggregated at the end of stalk and branches in small umbrella-shaped corymbs. Flower stalks and involucre are covered with dark glandular hairs, sometimes the hairs are absent at the upper parts of flower stalk.

Tagetes patula L.

This plant is belongs to the tribe Helineae of the family asteraceae. The plant is annual herbs, usually erect, glabrous, and strongly aromatic. Stems simple or diffusely branched. Leaves opposite or alternate, sessile, base expanded with several, narrow, linear segments, pinnate or rarely simple, lobes lanceolate to narrowly elliptic, margins sharply serrate. The leaves coated with oily glands that produce a pungent scent. Capitula usually radiate, few-flowered, solitary on long peduncles or corymbosely arranged.

Taraxacum officinale F.H.Wigg.

This taxa also belongs to the tribe Cichorieae of the family asteraceae. The plant is herbaceous perennial with a rosette of jagged, irregularly lobed leaves produced from a long, thick, fleshy taproot that can descend more than 1 m. The leaves may be nearly smooth-margined, saw-toothed, or deeply cut. The single flowering stalks, sometimes over 50 cm tall, and bears a head of tiny yellow flowers. The flowering stalk is hollow and elongates with age.

The main objective of this study is to examine the pollen morphology of ten species of angiosperms. Palynology is the study of plant pollen, spores and certain microscopic plankton organisms, collectively termed palynomorphs in both living and fossil form. The variation in shape, aperture, polar unit, symmetry and difference in wall sculpture of pollen grains has been used by many authors in the delimitation of various taxa (Mbagwu *et al.*, 2009). Nyananyo (1985) on pollen morphology of Talineae showed that palynology provides useful data for the intrageneric classification of the large genera. Nyananyo (1990); Mbagwu and Edeoga (2006) have utilized pollen attributes to establish probable evidence of relationships among certain groups of flowering plants in Nigeria.

Materials and Methods

Mature buds of living plants specimens were collected from central parts of Nepal. Then all buds of each plants stained in solution of 1% aceto-carmin separately and heated it for few seconds over spirit lamp and left it for one hour for proper staining. A single mature anthers were dissected from the buds and teased with a needle in a thin film of 1 % aceto-carmin on a glass slide (Mallick, 2015). After removing the debris the cover slip was placed over it. Excess stain was drained off with blotting paper and observed under 10x eye piece and 100x objective magnification of oil immersion compound microscope. Photomicrographs were taken with the help of digital camera of 12.1 megapixel using 10x eye pieces and 100x objective of compound microscope. Later on photographs were enlarged to suitable sizes. This study was conducted in Central Department Botany of Tribhuvan University as well as Botany Department of Tri-Chandra Multiple Campus, Kathmandu. The methodology was used according to Levan *et al.* (1965).

Results and Discussion

Palynological study has been utilized to indicate relationships among the different taxa of asteraceae family (Mallick, 2015). Zafer *et al.* (2007) have mentioned that palynological research has proved useful in dealing critical and disputed taxonomic problems and quantity or/and quality of the pollen produced by a plant is an important component of reproductive success. Table 1 and 2 shows that the pollen shape is spheroidal in *Artemisia indica*, *Aster ageratoides*, *Calendula officinalis*, *Hibiscus rosa-sinensis* and *P. axillaries*; elliptical in *L. candidum*, hexagonal in *S. asper* and pentagonal in *T. officinale*; tricolpate in *C.japonica*. Pollen aperture is porate in all except in *L.candidum* where it is elliptic. Pollen wall is echinate in *H. rosa-sinensis*, *A. ageratoides*, *T. patula*; spinulate in *P. axillaries*, *T. officinale*, *S. asper*, *C. japonica*, *C. officinalis*

and *T. officinale* and smooth in *L. candidum*. The general appearance of the pollen grain is circular in *P. axillaries* but longer than wide in *L.candidum*.

The circular, echinate, large and triporate pollens seem to be primitive ones and spheroidal, hexaporate features have been regarded as comparatively advanced ones. Pollen aperture plays an important role in demarcating definite evolutionary levels and used for the establishment of interspecies relationships (Mallick, 2015). The species where the pollen grains are longer than wide as in *Lilium candidum* in present study this is attributed as a structural adaptation for effective dispersal by wind while the circular nature of some of the pollen grains are related to structural adaptation for effective pollination by insects as found in *Tagetes patula*, *Crepis japonica*, *Calendula officinalis* and *Hibiscus rosa sinensis* in present study (Fig 1 & 2).

Table 1. Pollen morphology of the five species of angiosperms studied

Pollen Characters	<i>A. indica</i>	<i>A. ageratoides</i>	<i>C. officinalis</i>	<i>C. japonica</i>	<i>H. rosa-sinensis</i>
Pollen shape	Spheriodal	Spheriodal	Spheriodal Porate	Tricolpate	Spheriodal
Pollen aperture	Porate	Porate	Polyporate	Porate	Porate
No. of aperture	Polyporate	Polyporate	Echinate	Triporate Echinate	Polyporate
Pollen wall Appearance of pollen grains	Echinate Circular	Echinate Circular	Circular	Circular	Circular

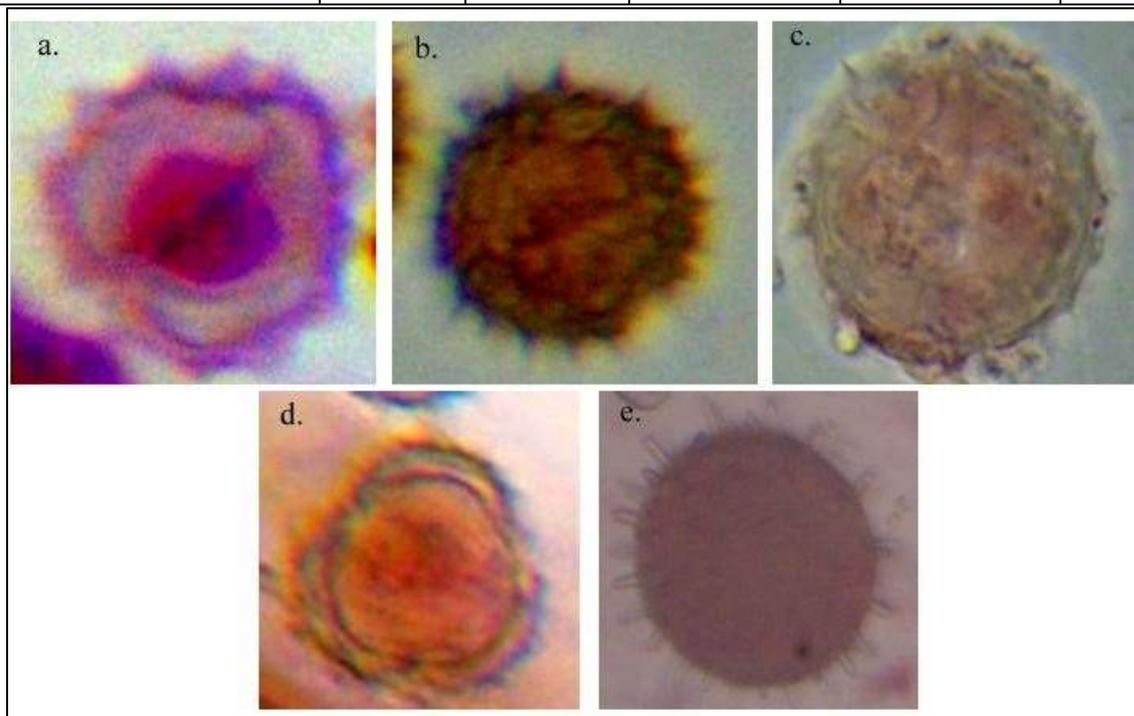


Fig. 1: a. *A. indica* with polyporate aperture and echinate pollen wall; b. *A. ageratoides* with echinate pollen wall; c. *C. officinalis* with polyporate aperture and spinule pollen exine; d. *C. japonica* with triporate aperture and spinule pollen exine; e. *H. rosa-sinensis* with echinate pollen wall and polyporate aperture.

Table 2: Pollen morphology of the another five species of angiosperms studied

Pollen Characters	<i>L. candidum</i>	<i>P. axillaris</i>	<i>S. asper</i>	<i>T. patula</i>	<i>T. officinale</i>
Pollen shape	Elliptical	Spheriodal	Hexagonal	Spheriodal	Pentagonal
Pollen aperture	Elliptical	Porate	Porate	Porate	Porate
No. of aperture	Polyporate	Polyporate	Hexaporate	Triporate	Polyporate
Pollen wall Appearance of pollen grains	Smooth	Echinate	Echinate	Echinate	Echinate
	Circular	Circular	Hexahedral	Circular	Pentahedral

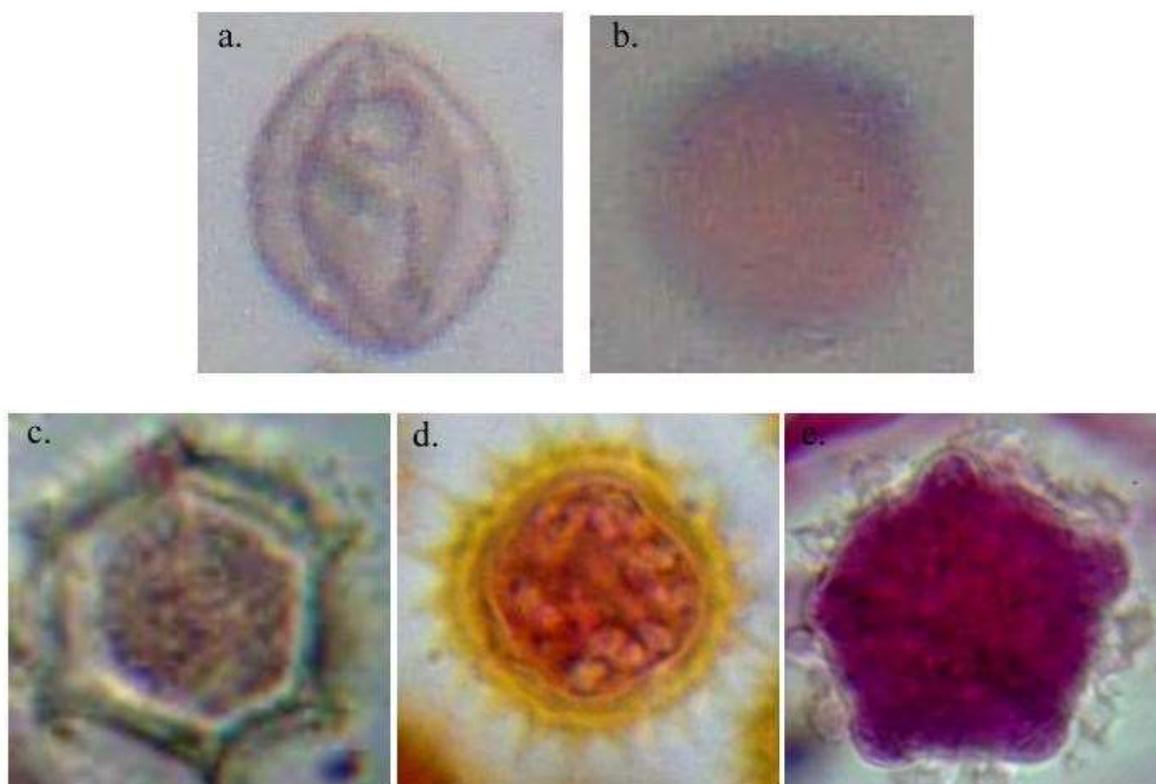


Fig. 2: a. *L. candidum* with elliptical pollen aperture and smooth pollen wall; b. *P. axillaris* with polyporate aperture and spinule pollen wall, c. *S. asper* with hexaporate echinate pollen exine; d. *T. patula* with triporate aperture aperture and echinate pollen; e. *T. officinale* with pentaporate aperture and echinate pollen wall and exine

Tricolpate and pentacolpate with variable number of pores (triporate and polyporate) found by Vaidhya (2005) in family Ranunculaceae. Tricolpate and triporate pollens are considered to be most primitive pollen types Vaidhya (2005). Polyporate pollen grains are considered to be secondarily derived one (Hoot, 1991). In most of the studied taxa are triporate, echinate exine wall. Palynomorphology of the taxa has played an important role in the formulation of phylogenetic groups (Manandhar, 2005). Vishnue-Mitre and Sharma (1962) have reported more than three types of pollens in leguminous plants on the basis of pollen apertures and exine patterns. Reddy (1992) have reported palynological studies of 20 species of genus Indigofera.

From the present palynological studies it is concluded that the nature of the pollen grain in these species could be

evolutionary significance and they are useful in classification of family at specific and generic levels.

Acknowledgement

The Department Head of Botany, Associate Professor Mr. Prakash Bahadur Shrestha, Teachers and staffs of Tri-Chandra Multiple Campus, Tribhuvan University, Kathmandu are highly acknowledged.

References

- Hoot SB (1991) Phylogeny of the Ranunculaceae Based on Epidermal Micro characters and Macromorphology. *Systematic Botany* **16** (4): 741-755. DOI: [10.2307/2418876](https://doi.org/10.2307/2418876)
- Mallick PK (2015) *Cytogenetical studies on some members of the family Asteraceae of Nepal* (Unpublished doctoral dissertation). Central Department of Botany, Institute of

- science and technology, Tribhuvan University Kathmandu, Nepal.
- Manandhar L (2005) *Cytogenetical studies in genus Desmodium Desv. And its allies of Nepal Himalayas*, (Unpublished doctoral dissertation). Central Department of Botany, Institute of Science and Technology, Tribhuvan University, Kathmandu, Nepal.
- Mbagwu FN, Chime EG and Unamba CIN (2009) Palynological studies on five species of Asteraceae. *African Journal of Biotechnology* **8**(7): 1222-1225. DOI: [10.3923/ajbs.2006.1122.1125](https://doi.org/10.3923/ajbs.2006.1122.1125)
- Mbagwu FN Edeoga HO (2006) Palynological studies on some Nigerian species of *Vigna savi*. *J Biol Sci* **6**(6): 1122-1125.
- Nyananyo BL (1985) Pollen Morphology in Talineae (Portulacaceae) Sensu McNeill. *Biol Afr* **2**: 41-46.
- Nyananyo BL (1990) Tribal and generic relationships in Portulacaceae (Centrospermae). *Feddes Report* **101**: 237-241. DOI: [10.1002/fedr.19901010504](https://doi.org/10.1002/fedr.19901010504)
- Reddy VRK (1992) Palynological studies in the genus *Indigofera* Linn. *J Swamy Bot Club* **9**: 57-62.
- Vaidhya BL (2005) *Study of Cytogenetic Diversity in Ranunculaceae*. (Unpublished doctoral dissertation). Central Department of Botany, Institute of Science and Technology, Tribhuvan University, Kirtipur, Kathmandu, Nepal.
- Vishnu-Mitre and BD Sharma (1962) Studies of Indian pollen grains, I. Leguminosae. Pollen et spores. **4**: 6-45.
- Zafer M Ahmad M & Khan MA (2007) Palynology of Family Asteraceae from Flora of Rawalpindi- Pakistan. *Int J Agric Biol* **1**: 156-161.