

# Palynological Studies in Some Species of Helianthoideae (Asteraceae)

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The family Asteraceae is stenopalynous. Three types of pollen have been recognized; 2-3 zonocolporate with echinate type of exine ornamentation, 3-zonoporate with echinate type of exine ornamentation and 3-zonoporate with scabrate type of exine ornamentation. Exine consisted of sexine and nexine. Sexine is usually two layered, inner columellate foot layer is known as endosexine and the outer one, ectosexine. The surface of the exine was echinate type in general except in *Xanthium* where it was scabrate.

Key Words - Asteraceae Exine Ornamentation Pollen Stenopalynous.

The morphological studies on pollen with special reference to their role in taxonomy have been made by several workers (Bhaduri, 1944; Saad, 1960, 1962; Pant, 1962; Bamzai & Randhawa, 1965 a, b; Basak, 1967).

Although Asteraceae is an important family of angiosperms, there is substantial gap in our knowledge of palynological data. Hence some species belonging to the tribe Helianthoideae of the family Asteraceae were selected for detailed palynological investigations.

**MATERIALS & METHODS** Fourteen species of the tribe Helianthoideae, i.e., *Bidens biternata* (Lour.) Merr. & Sherff ex Sherff, *Chrysanthellum indicum* DC., *Coreopsis tinctoria* Nutt., *Cosmos bipinnatus* Cav., *Cosmos sulphureus* Cav., *Dahlia rosea* Cav., *Eclipta alba* (L.) Hassk., *Helianthus annuus* L., *Parthenium hysterophorus* L., *Spilanthes acmella* (L.) Murr., *Pithonia diversifolia* Gray., *Tridax procumbens* L., *Xanthium strumarium* L. and *Zinnia elegans* Jacq. were collected from the botanical garden of the University of Gorakhpur. Closed and mature flowers were used. The collection and preservation of the material were according to Rao & Jain (1977). The acetolysis method of Erdtman (1952, 1960) was followed for the preparation of permanent slides of pollen grains.

**OBSERVATION** The pollen grains in relation to their size, shape, exine thickness, ornamentation

and number of apertures and length and width of spine were studied. Average values were calculated on the basis of at least 10 observations. The information about the pollen morphology of the taxa studied is presented in the Table 1.

**Bidens biternata** Grains 3-zonoporate, spheroidal, diameter 30  $\mu\text{m}$  with spine and 23.7  $\mu\text{m}$  without spine; exine 4.5  $\mu\text{m}$  thick, sexine thicker than nexine, exine echinate, spines prominent with pointed apex, ratio of length and width of the spine-2.

**Chrysanthellum indicum** Grains 2 to 3-zonoporate, prolate spheroidal, size 22.5 x 27.5  $\mu\text{m}$  with spine and 18.7 x 20.5  $\mu\text{m}$  without spine, exine 3.1  $\mu\text{m}$  thick, sexine as thick as nexine, exine echinate, spines with pointed apex, ratio of length and width of spine 4.

**Cosmos bipinnatus** Grains 2 to 3-zonocolporate, colpi well developed, spheroidal, diameter 30.5  $\mu\text{m}$  with spine and 22.5  $\mu\text{m}$  without spine, exine 5  $\mu\text{m}$  thick, sexine thicker than nexine, exine echinate, spines with pointed apex, length and width ratio - 2.

**Cosmos sulphureus** Grains 3-zonocolporate, spheroidal, diameter with spine 30.3  $\mu\text{m}$

Table 1 Morphological Details of Pollen Grains

Name of taxa	Pollen aperture	Pollen shape	Pollen size without spine ( $\mu\text{m}$ )	Length of spine ( $\mu\text{m}$ )	Width of spine ( $\mu\text{m}$ )	Exine thickness ( $\mu\text{m}$ )	Ornamentation type
<i>Bidens biternata</i>	3-Zono- porate	Spheroidal	24	7.8	3.9	4.5	Echinate
<i>Chrysanthellum indicum</i>	2 (3)- Zono- porate	Prolate spheroidal	19 x 21	3.9	2.6	3.1	Echinate
<i>Coropis tinctora</i>	3(4)- Zono- colporate	Spheroidal	14	5.2	1.3	3.7	Echinate
<i>Cosmos bipinnatus</i>	2(3)- Zonocol porate	Spheroidal	29	7.8	3.9	5.0	Echinate
<i>C. sulphureus</i>	3-Zono- colporate	Spheroidal	22	9.1	5.2	3.9	Echinate
<i>Dalhia rosea</i>	3-Zono- colporate	Spheroidal	24	10.4	5.2	3.0	Echinate
<i>Eclipta alba</i>	3-Zono- colporate	Spheroidal	25	7.8	2.6	3.0	Echinate
<i>Helianthus annuus</i>	3-Zono- colporate	Spheroidal	25	9.1	1.3	4.0	Echinate
<i>Parthenium hysterophorus</i>	3-Zono- colporate	Spheroidal	11	2.6	2.6	3.8	Echinate
<i>Spilanthes acmella</i>	3 (4) - Zono- sporate	Spheroidal	25	5.2	2.6	2.8	Echinate
<i>Tithonia diversifolia</i>	3-Zono- colporate	Spheroidal	25	7.8	2.6	3.8	Echinate
<i>Tridax procumbens</i>	3 (4) - Zono- colporate	Spheroidal	23	5.2	1.3	3.5	Echinate
<i>Xanthium strumarium</i>	3- Zono- colporate	Prolate Spheroidal	29x 27	4-	-	4.0	Scabrate
<i>Zinnia elegans</i>	3-Zono- colporate	Prolate Spheroidal	20x 19	6.5	2.6	3.8	Echinate



and  $21.5\ \mu\text{m}$  without spine, exine  $3.0\ \mu\text{m}$  thick, sexine thicker than nexine, exine echinate, spines prominent with pointed apex, length and width ratio of spine - 1.8.

**Dahlia rosea** Grains 3-zonocolporate, spheroidal, diameter with spine  $36\ \mu\text{m}$  and without spine  $28\ \mu\text{m}$ , exine  $3\ \mu\text{m}$  thick, sexine thicker than nexine, exine echinate, spine prominent with pointed apex, length and width ratio of spine - 2.

**Eclipta alba** Grains 3 zonocolporate, spheroidal, diameter with spine  $30\ \mu\text{m}$  and without spine  $25\ \mu\text{m}$ , exine  $3\ \mu\text{m}$  thick; exine ornamentation echinate; spines well developed, length and width ratio of spine - 3.

**Helianthus annuus** Grains 3-zonocolporate, spheroidal, diameter with spine  $35\ \mu\text{m}$  and without spine  $25\ \mu\text{m}$ , exine  $4\ \mu\text{m}$  thick, sexine thicker than nexine, exine echinate, spines prominent and thin, length and width ratio of spine 7.

**Parthenium hysterophorus** Grains 3-zonoporate, spheroidal diameter with spine  $16.3\ \mu\text{m}$ , exine  $3\ \mu\text{m}$  thick, sexine thicker than nexine, exine echinate, spine apex not pointed, length and width ratio of spine - 1.

**Spilanthes acmella** Grains 3 to 4-zonoporate, spheroidal diameter with spine  $29.4\ \mu\text{m}$  and without spine  $25\ \mu\text{m}$ , exine  $2.8\ \mu\text{m}$  thick, sexine as thick as nexine, exine echinate, spines prominent with pointed apex, length and width ratio of spine-2.

**Tithonia diversifolia** Grains 3-zonocolporate, spheroidal, diameter with spines  $32.5\ \mu\text{m}$  and without spine  $25\ \mu\text{m}$ , exine  $3.8\ \mu\text{m}$  thick, exine thicker than nexine, exine echinate, spines prominent and clear with pointed apex, length and width ratio of spine-3.

**Tridax procumbens** Grains 3 to 4-zonocolporate, spheroidal diameter with spine  $27.5\ \mu\text{m}$

and without spine  $22.5\ \mu\text{m}$ , exine  $3.5\ \mu\text{m}$  thick, sexine as thick as nexine, exine echinate, spines prominent and clear with blunt apex, length and width ratio of spine 4. This confirms with the earlier report by Jain & Nanda (1966).

**Xanthium strumarium** Grains 3-zonocolporate, prolate, spheroidal size of pollen grain  $28.6 \times 27.3\ \mu\text{m}$ , exine  $4\ \mu\text{m}$  thick, sexine three layered two unculptured enclosing bacculate layer and third outer layer with wavy surface, exine ornamentation scabrate type, granule like structure present on the outer surface, no clear spine was found.

**Zinnia elegans** - Grains 3-zonocolporate, prolate spheroidal, size of pollen grains  $23.8 \times 21.0\ \mu\text{m}$  with spine and without spine  $20.3 \times 19.2\ \mu\text{m}$ , exine  $3.8\ \mu\text{m}$ , exine ornamentation echinate type, spines prominent with pointed apex, length and width ratio of spine - 2.5.

**DISCUSSION** Morphological variations in pollen shape, size, number of apertures, exine stratification and ornamentation were observed in 14 taxa of Helianthoideae. Pollen size varied from  $16.3\ \mu\text{m}$  in *Parthenium* to  $36.0\ \mu\text{m}$  in *Dahlia*. However, this variation was not of much taxonomic significance because the selected plants represent different taxonomic units. Such variations could be of interest if studied within a species because pollen size increases with an increase in ploidy level.

Only 2 types of pollen, spheroidal and prolate spheroidal have been recognised in the taxa studied. According to Nair & Kapoor (1974) slight variations in pollen shape are of no taxonomic significance. Spheroidal shaped pollen is the most dominant one. Prolate spheroidal shaped pollen are noticed only in *Chrysanthellum*, *Xanthium* and *Zinnia*.

On the basis of number and distribution of pores and colpi, two types of pollen grains-zonoporate and zonocolporate have been recognised. The number of colpi varies from 2 to 4 but 3-zonocolporate condition is most common. The genera can be divided into 3 groups: *Xanthium* with prolate spheroidal shape and absence of spines; *Parthenium* without colpi and smallest size of pollen; the remaining genera with spheroidal, trizono-colporate pollen with prominent spines.

The exine excrescence with regard to spine length, width, L/W ratio, shape of tips and density has revealed significant variation. In almost all the species echinate type of excrescence is present. Scabrate type of exine excrescence is observed in *Xanthium* only.

It is apparent that pollen variations are very specific for a particular taxon. In all of them the thickness of the wall, length and width of spine and aperture exhibit considerable variation. Prominent spines are present in almost all cases except in *Parthenium* and *Xanthium*. Hence *Xanthium* can be easily identified on the basis of its unique pollen characteristics. The palynological data provide some support for the separation of *Xanthium* from other members of the tribe Helianthoideae.

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