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POLLEN FLORA OF PAKISTAN – XLI. CUSCUTACEAE

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Abstract

Pollen morphology of 11 species belonging to the genus *Cuscuta* of the family Cuscutaceae from Pakistan have been examined by light and scanning electron microscope. Cuscutaceae is an eurypalynous family. Pollen grains are generally free, radially symmetrical, isopolar or apolar, colpate, oblate-spheroidal – prolate-spheroidal or sub-prolate rarely spheroidal. Sexine is thicker or as thick as nexine. Tectum reticulate, reticulate rugulate, scabrate or punctate-scabrate.

The pollen morphology of the family Cuscutaceae is significantly helpful at specific level. On the basis of exine ornamentation, 3 distinct pollen types viz., *Cuscuta reflexa* - type, *Cuscuta capitata*- type and *Cuscuta campestris* type are recognized.

Introduction

Cuscutaceae is a monotypic family. It is cosmopolitan in distribution. The genus *Cuscuta* has approximately 170 species (Mabberley, 1987). In Pakistan it is represented by 14 species (Rajput & Tahir, 1988). Members of this family are parasitic herbs. Plants of very peculiar vegetative form; filamentous (with threadlike, chlorophyll-less twining stems and short-lived root systems). Leaves much reduced. Flowers small, regular, (3–)5 merous, cyclic, tetracyclic. Previously, the genus *Cuscuta* L. was placed under the family Convolvulaceae, but nowadays it is treated as a distinct family Cuscutaceae under the order Polemoniales near Convolvulaceae (Takhtanjan 1969; Cronquist, 1981; Dahlgren 1989). Several workers examined the pollen of the genus *Cuscuta* while studying the pollen morphology of the family Convolvulaceae (Hallier 1893; Erdtman 1952, 1960, 1969; Ertdman *et al*., 1961; Sengupta 1972; Moore & Webb 1978). There are no reports on the pollen morphology of the family Cuscutaceae from Pakistan. Present study is based on pollen morphology of the 11 species of the genus *Cuscuta* L., by light and scanning Electron microscopy.

Materials and Methods

Pollen samples were obtained from Karachi University Herbarium (KUH) or collected from the field. The list of voucher specimens are deposited in KUH. The pollen grains were prepared for light (LM) and scanning electron microscopy (SEM) by the standard methods described by Erdtman (1952). For light microscopy, the pollen grains were mounted in unstained glycerine jelly and observations were made with a Nikon Type-2 microscope under (E40, 0.65) and oil immersion (E100, 1.25), using 10 x eye piece. For SEM studies, pollen grains suspended in a drop of water were directly transferred with a fine pipette to a metallic stub using double sided cellotape and coated with gold in a sputtering chamber (Ionsputter JFC-1100). Coating was restricted to 150^0A. The S.E.M examination was carried out on a Jeol microscope JSM-T200. The measurements are based on 15-20 readings from each specimen. Polar length, equatorial diameter, colpus length and exine thickness are given in Table 1.

Table 1. General pollen character of taxa studied in the family Cuscutaceae.

S. No.	Name of taxa	Shape	Aperl No.	Polar length in µm (P)	Equatorial diamter µm (E)	Colpus length (L)	Exine thickness µm	Tectum
1.	*Cuscuta reflexa* Roxb.	Ob-Sp	5	28.7(30.6±1.19) 35.9	28.7(31.71±1.2) 35.9	21.53(23.1±1.2) 26.9	2.87(3.55±0.09) 3.94	Coarsely-reticulate
2.	*Cuscuta hyaline* Roth.	Pr-Sp	3	21.5(24.4±0.71) 25.13	17.01(21.89±1.43) 25.17	17.9(18.5±0.59) 19.74	1.07(1.48±0.10) 1.70	Densely punctate with granules
3.	*Cuscuta capitata* Roxb.	Sub-Pr	3	22.5(24.13±0.57) 27.25	20(20.29±0.51) 23.75	17.5(20.65±0.61) 22.5	2.25(2.41±0.05) 2.5	Scabrate
4.	*Cuscuta violaceae* Rajput and Tahir	Ob-Sp	3-5	26.4(31.24±0.6) 33	26.4(31.9±0.61) 33	13.2(14.5±1.01) 19.8	3.63	Reticulate with scabrate muri
5.	*Cuscuta epithymum* (L.) L	Pr-Sp	3	18.15(21.08±05) 23.1	18.15(20.72±0.35) 21.54	6.6(10.12±0.50) 13.7	-	Scabrate
6.	*Cuscuta gigantea* Grill	Ob-Sp	4-5	27.5(29.17±0.35) 30	30(32.40±0.54) 35	12.5(20.2±1.1) 22.5	3.75(4.27±0.15) 5	Coarsely reticulate
7.	*Cuscuta monogyna* Vahl	Ob-Sp	3	29.7(31.97±0.60) 35	26.25(32.2±0.32) 35	22.5(23.9±0.39) 26.25	2.75(2.95±0.04) 3.75	Coarsely reticulate
8.	*Cuscuta lehmanniana* Bunge	Ob-Sp	3	32.5(34.88±1.97) 38.7	32.5(35.12±0.00) 37.5	22.5(25.7±0.64) 25	2.5(3.41±0.18) 3.75	Coarsely reticulate
9.	*Cuscuta europea* L.	Sp	3	25	25	15	1.25(1.50±0.18) 2.25	Scabrate
10.	*Cuscuta pulchella* Engelm.	Sp	3	17.5(21.27±0.18) 22.5	17.5(21.18±0.65) 25	12.5(17.19±0.47) 20	2.25(2.30±0.01) 2.5	Densely scabrate
11.	*Cuscuta campestris* Yunck.	Ob-Sp	3	27.5(28.75±0.5) 30	24.5(28.9±1.89) 33.75	2.25(2.34±0.08) 2.5	2.25(2.34±0.06) 2.5	Coarsely punctate scabrate

Abbreviations: Ob-Sp = oblate-Spheroidal, Pr-Sp = Prolate-Spheroidal, Sub-Pr = Sub-Prolate, Sp = Spheroidal

The terminology used is in accordance with Erdtman (1952); Faegri & Iversen (1964); Kremp (1965) and Walker & Doyle (1976).

Observations

General pollen characters of the family Cuscutaceae

Pollen grains usually radially symmetrical, isopolar, rarely apolar, oblate-spheroidal to prolate-spheroidal or sub-prolate, rarely spheroidal. Colpate. Colpi vary from 3-7. Sexine thicker or as thick as nexine. Tectum generally reticulate or reticulate –rugulate scabrate rarely punctate-scabrate.

Key to the pollen types

1 + Tectum reticulate or reticulate-rugulate ……..…….... *Cuscuta reflexa* -type
- Tectum not as above ……...…… 2

2 + Tectum scabrate ……..……..… *Cuscuta capitata* -type
- Tectum punctate-scabrate ……...……..… *Cuscuta campestris* -type

***Cuscuta capitata*–** type
Pollen class: Tricolpate.
P/E ratio: Sub - erect to semi- erect or adequate.
Shape: Prolate-spheroidal or sub-prolate or spheroidal.
Aperture: Small to long elliptic, acute ends.
Exine: Sexine thicker or thinner than nexine.
Ornamentation: Tectum scabrate
Outline: Oblate or circular.
Measurements: Polar axis (P) 17 (21.5 ± 1.0) 25.5 um long, Equatorial diameter (E) 17.5 (21.0 ± 1.25) 25 µm, colpi 6 (14.25 ± 0.11) 22.5 µm long. Sexine thicker than nexine. Exine 2(2.15) 2..2 5 µm thick.
Species included: *Cuscuta capitata* Roxb., *C. epithymum* (L.) L., *C. europaea* L., *C. pulchella* Engelm.

Key to the species

1 + Pollen grains spheroidal ……..…… 3
- Pollen grains prolate-spheroidal to sub-prolate ..…… 2

2 + Pollen grains sub-prolate ……..…….. *Cuscuta capitata*
- Pollen grains prolate-spheroidal ……..…….. *Cuscuta epithymum*

3 + Polar length of pollen grains c. 22.5 µm ……..…….... *Cuscuta pulchella*
- Polar length of pollen grains c. 25 µm ……..…….. *Cuscuta europaea*

***Cuscuta campestris*–** type (Fig. 1. A)
Pollen class: Tricolpate or pantocolpate.

Fig. 1 Scanning micrographs: *Cuscuta hyaline*: A , Pollen grain. Cuscuta reflexa: B&C, Pollen grains. D, Exine pattern.
Scale bar = B & C = 10; A & D= 1 µm.

P/E ratio: Sub-transverse to sub- erect.
Shape: Oblate-spheroidal to prolate-spheroidal
Aperture: Small to long elliptic, acute ends.
Exine: Sexine thicker than nexine.
Ornamentation: Tectum punctate-scabrate/granulate..
Outline: More or less circular.
Measurements: Polar axis (P) 21 (25.2 ± 1.1) 30 µm long, Equatorial diameter (E) 20 (26.5.0 ± 1.22) 33 µm, Colpi 2.2 (9.8 ± 0.21) 17.5 µm long. Sexine thicker than nexine. Exine 1.2- (3.1) 5 µm thick.

Species included: *Cuscuta campestris* Yunk, *Cuscuta hyaline* Roth.
***Cuscuta reflexa*–** type (Fig.1. B-D).
Pollen class: Tricolpate.or 4-7
P/E ratio: Sub-transverse.
Shape: Oblate-spheroidal
Aperture: Small to long elliptic, acute ends.
Exine: Sexine thicker than nexine or as thick as nexine.
Ornamentation: Tectum coarsely reticulate or reticulate-rugulate with scabrate muri.
Outline: ± circular
Measurements: Polar axis (P) 26.6 (32.1 ± 0.1) 38.7 um long, Equatorial diameter (E) 26 (31.0 ± 1.22) 37.5 µm, colpi 12.5 (19.8 ± 0.21) 26.9 µm long. Sexine thicker than nexine. Exine 2.5 (3.12) 3.75 um thick.
Species included: *Cuscuta gigantea* Griff., *C. lehmanniana* Bunge, *C. monogyna* Vahl, *C. reflexa* Roxb., *C. violacea* Rajput & Tahir.

Key to the species and species group

1 + Tectum coarsely reticulate-rugulate ……..... *Cuscuta reflexa*
- Tectum not as above ……...……. 2

2 + Muri scabrate …….……. *C. violacea*
- Muri psilate ……...…….. 3

3 + Pollen grains 4-5 colpate ..…….…….…… *C. gigantea*
- Pollen grains 3-colpate ……. group-1
C. monogyna, C. lehmanniana

Discussion

Cuscutaceae is an europalynous family (Erdtman, 1952). Pollen data is based on 11 species belonging to the genus *Cuscuta*. The genus is extremely variable in their pollen characters. Most striking variation is found in the tectum types, number of aperture (3 (4) 7-colpate) and exine ornamentation. Sengupta (1972) reported that polyploidy is a common feature in these species which perhaps causes the increase in number of apertures and different exine pattern. On the basis of tectal surface, family can easily be divided into 3 distinct pollen types viz., *Cuscuta campestris* - type, *Cuscuta reflexa*- type and *Cuscuta capitata* type. Pollen type: *Cuscuta reflexa* is easily distinguished by its coarsely reticulate tectum. Five species are included in this type, these species are easily distinguished on the basis of polar length, pollen shape class (see key to the species). Pollen type: *Cuscuta capitata* is delimited by its scabrate tectum. In this type 4 species are included i.e *Cuscuta capitata* Roxb., *C. epithyum* (L.) L. *C. europaea* L., *C. pulchella* Engelm. However, the species of this type can be delimited on the basis of pollen shape (see key to the species). *Cuscuta campestris* is readily distinguished by its punctate – scabrate tectum.

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