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Pollen morphology of Exotic plant species in District Sriganganagar and Hanumangarh (Rajasthan)

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ABSTRACT:

The district Ganganagar and Hanumangarh is a part of the Thar desert. Indira Gandhi canal, Gang canal and Bharkha canal systems have been introduced in the Thar desert to enhance irrigation in this area. North Rajasthan constitute a part of the Great Indian desert and is under intensive irrigation by a network of canals. The pollen flora of Exotic species of NorthernRajasthanshow a great variation in their morphoforms and in this head the trends of distribution of these morphological characters in various species studied have been analysed out of 108 species, belonging to 94 genera, 41 families and 108 species. almost all type of aperture forms have been reported. The most dominating aperture is Tricolporate representing as much as (37.03%) of total flora. Tricolpate (23.14%), Pentoporate (08.33%), Monocolpate (08.33 %),Monoporate (03.70%),Colporate (02.77%),Polyporate (01.85%), Periporate (1.85%), Hexacolpate (1.85%), Monosulcate (1.85%), 2-aperturate (1.85%), Peripolporate (0.92%), Pentocolpate (0.92%), Monosporate (0.92%), Monosculate (0.92%), Trioblate (0.92%), Ulceroid(0.92%), 2-Porate (0.92%), Operculate (0.92%), Hexaheterocolpate (0.92%), 3-zonocolpate (0.92%), Solitary Ulceroid (0.92%), and 3-Zonocolporate (0.92%) are other representing apertural types.

KEYWORDS: Thar Desert, Canal system, District Ganganagar and Hanumangarh, Exotic plant species, pollen morphology.

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INTRODUCTION

Study area is district Sriganganagar and Hanumangarh, that is a part of the Thar desert. In the North-West of Rajasthan State, the Gang canal, Bhakra canal and Indira Gandhi canal now form a tremendous net-work. Since the soils are rather sandy, the lateral seepage and percolation of water from the irrigated regions into adjoining non-irrigated area has been going on all this time. Due to this process which may be designated as a shadow effect of irrigation, the edaphic condition in the non irrigated area adjoining the irrigated regions have also become more congenial to some of extralimital species. (Nair, P.K.K. 1970) These are now also migrating into the non irrigated region the comparative studies show that a large number of species of irrigated area have also become successfully established in the adjoining non -irrigated regions (Singh & Romana, 1993). Jakhar Ashwani kumar et al (2019) also studied on Exotic plant species in irrigated parts of Division Bikaner. Pandey and Singh (2001) studied the Phytodiversity of the Indira Gandhi canal command area in North-west Rajasthan. The flora of north Rajasthan comprises 680 species belonging to 433 genera distributed among 105 families of flowering plants., out of which 85 belongs to dicotyledones and 20 to monocotyledones. Most characterized and dominating, families among dicots are Papilionaceaehaving 65 species and Asteraceachaving 54 species, among monocotyledons Poaceae family dominant with 86 species. Due to controlled irrigation 108 extralimital or exotic species arc introduced in Ganganagar and Hanumangarh Districts, and 153 species which belongs to Indian Desert have disappeared from irrigated regions but are still present in non-irrigated regions of North Rajasthan. Pollen morphologically most dominating aperture is 3-zonocolporate representing as much as 35.02% of total flora, Kaushik, A .and A, Sharma (2014). In Dicotyledons most dominating aperture type is 3-zonocolporate (43.84%) while in monocotyledons it is 1-porate (62.97%).

MATERIAL AND METHODS:

The material for the present study has been collected either fresh, from the plants growing locally or dry, from herbarium specimens. Polliniferous materials were either anther, mature flower buds or spikes depending upon the nature of the materials.

TECHNIQUE OF POLLEN GRAIN PREPARATIONS

Pollen slides have been prepared by the method given by Erdtman (1952) and Nair (1970).Preparation of both Acetolysed (Ac) and Unacetolysed (Un) grains were made on the same

slides. The detailed method is as under:Thepolliniferous material was collected and placed in 70% alcohal in vials.After about 24 hours the material was crushed with in plastic centrifuge tubes and the dispersion was sieved through a fine brass mesh into a glass centrifuge tube. The whole quantity of the dispersion was divided into two halves, A and B. The part A was stained by safranin, warmed slightly over a flame, centrifuged and kept aside.

The part B contained in another centrifuge tube was centrifuged, the supernatant alcohol decanted, the sediment was covered by glacial acetic acid and centrifuged. Again after pouring out the glacial acetic acid, the pollen sediment was covered by the acetolysis mixture composed of acetic anhydride and concentrated sulphuric acid mixed in the ratio 9:1. The interaction between the anhydride and the acid produce heat, calculated at about 70° C and therefore the mixture contained in the centrifuge tube was placed in water bath and heated from 70° C to boiling point. The acetolysis mixture was stirred with a glass rod and the tube was left in the hot water for 2-3 minutes to enable the complete dissolution of the protoplasm. The mixture was centrifuged, the liquid decanted and the sediment was again covered with glacial acetic acid followed by centrifuging and finally the sediment was washed many times by centrifugation and brought to dilute 50% glycerin and left aside. In order to prepare pollen slides, the dispersion of A and B was mixed and centrifuged , the glycerine decanted and the centrifuged tube was placed upside down on a filter paper so that the excess glycerine run down. A pellet of glycerin jelly, cut by means of blade was carried at the tip of a needle was taken inside the centrifuge tube kept inverted to touch the pollen sediment. The pollen were caught on the pallet of glycerine jelly, transferred to a microscope slide, warmed and left aside for one or two minutes so that the outer surface of the pallet of glycerine jelly slightly condenses. A cover glass was placed over the jelly and slightly pressed so that a round area of jelly was formed inside the cover slips. A piece of paraffin wax of melting point 60^{o}C was placed on a side of the cover slip, warmed carefully so as to allow the molten wax to flow into the vacant area left by glycerinejelly. The slide was kept aside for a little while so that the wax solidifies. The extra wax was scraped by means of a blade, the slides was cleaned by xylol and made ready for microscopic examination.

RESULT AND DISCUSSION

The pollen flora of Exotic species of District Sriganganagar and Hanumangarh show a great variation in their morphoforms and in this head the trends of distribution of these

morphological characters in various species studied have been analysed out of 108 species, belonging to 94 genera, 41 families and 108 species. almost all type of aperture forms have been reported, Kaushik, A. (1993) and Bhandari, N.M.(1988). The most dominating aperture is Tricolporate representing as much as (37.03%) of total flora. Tricolpate (23.14%), Pentoporate (08.33%), Monocolpate (08.33 %),Monoporate (03.70%), Colporate (02.77%), Polyporate (01.85%), Periporate (1.85%), Hexacolpate (1.85%), Monosulcate (1.85%), 2-aperturate (1.85%), Peripolporate (0.92%), Pentocolpate (0.92%), Monosporate (0.92%), Monosculate (0.92%), Trioblate (0.92%), Ulceroid (0.92%), 2-Porate (0.92%), Operculate (0.92%), Hexaheterocolpate (0.92%), 3-zonocolpate (0.92%), Solitary Ulceroid (0.92%), and 3-Zonocolporate (0.92%) are other representing apertural types and the percentage of their occurancc is mentioned in the brackets.

As in the whole flora dominant apertural type in Dicotyledons are Pentoporate (08.33%), Colporate (02.77%), Polyporate (1.85%), Periporate (01.85%), Hexacolpate (01.85%). These apertural form along, with other apertural forms like Peripolporate (0.92%), Trioblate (0.92%), 2-Porate (0.92%), Operculate (0.92%), Hexaheterocolpate (0.92%), 3- Zonocolpate (0.92%) and 3-Zonocolporate (0.92%) are absent from Monocotyledons. Among the Monocotyledons the dominant types are Monocolpate (08.33%), Monoporate (03.70%) and Monosulcate(01.85%) these arc absent from the Dicotyledons. The Tricolporate (37.03%), Tricolpate (23.14%) aperturecondition is seen in both Monocotyledons and Dicotyledons.

As concerning the exine ornamentation, percentage of various types mentioned in brackets are reticulate (31.48%), Smooth (08.33%), Tectate (06.48%), Echinoid (05.55%), Microreticulate (03.70%), Spinulate (2.77%), Granular (2.77%), Echnolophate (2.77%), Rough (02.77%), Collumelate (02.77%), Granulose (1.85%), Psilate (01.85%), Semitectate (01.85%), Striate (0.92%), Microechinate (0.92%), Rugulate granulate (0.92%), Tubliferous (0.92%), Microtubulate (0.92%), Cerebroid Perforate (0.92%), Verrucate (0.92%), Smooth Granulate (0.92%), Tuberculate (0.92%), Scabrate (0.92%), Punctate (0.92%), Fossulate foveolate (0.92%), Stenopalynous (0.92%), Thick (0.92%), Subpsilate (0.92%), Perforate (0.92%), Textuered (0.92%), Intectate (0.92%), Eutectate (0.92%), Areolate (0.92%), Microechinate perforate and(0.92%) and regulate(0.92%). Reticulate, Smooth, Tectate, Echinoid, Microreticulate, Granular, columellate and Granulose exine ornamentation present both in Dicotyledons and

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Monocotyledon (Table-5) whereas Spinulate, Echinolophate, Rough, Psilate, Semitectate, Striate, Microechinate, Tubliferous, Cerebroid perforate, Smooth granulate, Tuberculate, Punctate, Fossulate foveolate, Subpilate, Perfprate, Intectate, Eutectate, Areolate and Rugulate Exine ornamentation are present in dicots but absent from Monocots. Rugulate Granulate, Microtubulate, Verrucate, Scabrate, Stenopalynous, Thick and Textured type of Exine ornamentations are present only in monocots and absent in Dicots.

As concerning with the shape, in Exotic plants the percentage of various shape types are spheroidal (34.25%), Prolate (08.33%), Oblate-spheroidal (07.40%), Subprolate (04.62%), Spherical (06.48%), Radial (03.70%), Glabose (04.62%), Prolate spheroidal (03.70%), Oblate (03.70%), Circular (04.62%), Ellipsoidal (01.85%), Psilate (01.85%), Spheroidal oblate (00.92%), Suboblate spherical (00.92%), Subcircular (00.92%), Subulate (00.92%), and Round (01.85%). In Dicotyledons majority of grains are from spheroidal (32.94%) to Prolate (10.58%), oblate-spheroidal (09.41%). In Monocotyledons majority of grains are spheroidal (39.13%) and other shapes (in lateral view) are Sperical (13.04%) and Circular (08.69%).

Spheroidal-oblate, Oblate- spheroidal, Radial, Suboblate-spherical, Oblate, Subcircular, Subulate, Prolate, Psilate, Ellipsoidal, Semiangular and Prolate-spheroidal pollen shapes are Present only in Dicotyledons whereas absent in Monocotyledons. Spheroidal, Circular, Spherical, Suboblate, Subprolate, Glabose Shaped pollen present in both Dicotyledons and Monocotyledons.

Table Showing Pollen morphology of Exotic plants

S. No.	Botanical Name	Family	Aperture	Shape	Exine	Dicot /Monocot
1	*Amaranthus viridis*L.	Amranthaceae	Pantoporate	Spheroidal	Reticulate	DC
2	*Ammi majus L.*	Apiaceae	Tricolporate	Circular	Tectate and Collumelate	DC
3	*Anagallis arvensis*	Primulaceae	Tricolporate	Spheroidal to Oblate	Striate	DC
4	*Anethum graveolens L.*	Apiaceae	Tricolporate	Circular	Microreticulate	DC
5	*Antirrhinum orontium L.*	Plantaginaceae	Tricolporate	Spheroidal	Reticulate	DC
6	*Arenaria serpyllifolia*	Caryophyllaceae	Pantoporate	Spherical	Microechinate to Perforate	DC

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7	*Argemone ochroleuca*	Papaveraceae	Tricolpate	Oblate Spheroidal	Reticulate	DC
8	*Aristida plumosa L.*	Poaceae	Monosporate	Spherical	Reticulate	MC
9	*Asphodelus tenuifolius*	Asphodilaceae	Tricolporate	Suboblate	Rugulate-Granulate	MC
10	*Bacopa monnieri*	Plantaginaceae	Tricolporate	Radial	Tectate and Collumelate	DC
11	*Bidens biternate*	Asteraceae	Tricolporate	Suboblate to Spheroidal	Microechinate	DC
12	*Blumealacera (Burm.f.) DC.*	Asteraceae	Tricolporate	Spheroidal	Echinoid	DC
13	*Boerhaviadiffusa*	Nyctagenaceae	Pentoporate	Spheroidal	Tubliferous	DC
14	*Carexfedia Nees*	Cyperaceae	Solitary ulceroid	Ovoid	Microtubulate	MC
15	*Carthamus oxycantha DC.*	Asteraceae	Coplorate	Oblate	Spiny	DC
16	*Catabrosa aquatic (L.)*	Poaceae	Tricolporate	Subprolate	Echinoid	MC
17	*Centaurium centaurioides*	Gentianaceae	Tricolpate	Spheroidal	Smooth	DC
18	*Centella asiatica (L.)*	Apiaceae	3-Zonocolporate	Sub circular	Cerebroid perforate	DC
19	*Chenopodium giganteum*	Amranthaceae	Peripolporate	Spheroidal	Reticulate	DC
20	*Chenopodium murale*	Amranthaceae	Perioporate	Spheroidal	Smooth to Granulate	DC
21	*Chloris barbata Sw.*	Poaceae	Monoporate	Spheroidal	Verrucate	MC
22	*Cichorium intybus L.*	Asteraceae	Tricolporate	Radial	Tuberculate	DC
23	*Cirsium wallichii DC.*	Asteraceae	Tricolporate	Subulate	Micro reticulate	DC
24	*Commelinadiffusa Burm. f.*	Commiinaceae	Monosculate	Heteropolar	Thick	MC
25	*Convolvulus arvensis*	Convolvulaceae	Tricolpate	Spheroidal	Micro reticulate	DC
26	*Coronopusdidymus*	Brassicaceae	Tricolpate	Subprolate	Reticulate	DC
27	*Cotulaanthemoides L.*	Asteraceae	Trilobate	Spherical	Reticulate	DC
28	*Cuscuta capitata Roxb.*	Convolvulaceae	Tricolpate	Spheroidal	Reticulate	DC
29	*Cyperus exaltatus Retz.*	Cyperaceae	Ulceroid	Spheroidal	Scabrate	MC
30	*Cyperus iria L*	Cyperaceae	Monocolpate	Spheroidal	Granular	MC
31	*Digitaria bicornis (Lam.) Roem.*	Poaceae	Tricolpate	Spherical	Reticulate	MC
32	*Digitaria stricta Roth ex Roem.*	Poaceae	Monoporate	Spheriodal	Tectate	MC
33	*Dilophia salsa Thoms*	Brassicaceae	Tricolpate	Glabose	Reticulate	MC

34	*Diplachnefusca (L.) P. Beauv*	Poaceae	Two aperturate	Spheriodal	Collumelar	MC
35	*Eclipta alba*	Asteraceae	Tricolporate	Prolate	Reticulate	DC
36	*Ecliptaprostrata*	Asteraceae	Tricolporate	Prolate	Reticulate	DC
37	*Eleusine indica (L.) Gaertn.*	Poaceae	Monosulcate	Spheriodal	Granulose	MC
38	*Emex spinosa*	Polygonaceae	Colporate	Circular	Tectate	DC
39	*Euphorbia geniculate*	Euphorbiaceae	Tricolporate	Prolate	Reticulate	DC
40	*Euphorbia helioscopia L.*	Euphorbiaceae	Tricolporate	Prolate	Reticulate	DC
41	*Euphorbia parviflora L.*	Euphorbiaceae	Tricolporate	Prolate	Reticulate	DC
42	*Euphorbia serpens H.B. & K.*	Euphorbiaceae	Tricolporate	Prolate	Reticulate	DC
43	*Ficus palmata Forssk.*	Moraceae	2 – Poarate	Ellipsoidal	Punctate	DC
44	*Fumaria indica*	Papaveraceae	Operculate	Oblate Spheroidal	Fossulate-Foviolate	DC
45	*Gnaphalium luteo-album*	Asteraceae	Tricolporate	Spheroidal	Echinate	DC
46	*Heliotropiumcurrasavicum L.*	Boraginaceae	HexaHeterocolpate	Psilate	Psilate	DC
47	*Hypecoum procumbens L.*	Papaveraceae	Tricolpate	Glabose	Echinate	DC
48	*Kochia indica Wt*	Amranthaceae	Tricolpate	Spheroidal	Reticulate	DC
49	*Koeleria argentea Griseb*	Poaceae	Pentocolpate	Apolar	microreticulate	MC
50	*Lactulaserriola L.*	Asteraceae	Pentoporate	Round	Tectate	DC
51	*Lantana camara L.*	Verbenaceae	Tricolporate	Semiangular	Psilate	DC
52	*Launaea fallax*	Asteraceae	Tricolpate	Suboblate	Echinolophate	DC
53	*Launaea procumbens*	Asteraceae	Tricolporate	Prolate	Spinate	DC
54	*Leptochloachenensis (L.)*	Poaceae	Monocolpate	Spheroidal	Grnulose	MC
55	*Linum usitatissimum*	Linaceae	Tricolpate	Shperoidal	Semitectate	DC
56	*Lolium temulentum L*	Poaceae	Monoporate	Round	Stenopalynous	MC
57	*Lophochloaphleoides Vill*	Poaceae	Monocolpate	Sub-Spheroidal	Smooth	MC
58	*Lophochloa pumila (Desf.) Bor*	Poaceae	Monocolpate	Sub-Spheroidal	Smooth	MC
59	*Lotus corniculatus L.*	Fabaceae	Tricolporate	Spheroidal	Smooth	DC
60	*Lyciumeuropaeum L.*	Solanaceae	Tricolporate	Oblate spheroidal	Reticulate	DC
61	*Malcolmia Africana R. Br*	Brassicaceae	Tricolpate	Sub prolate	Reticulate	DC
62	*Malva sylvestris Linn.*	Malvaceae	Colporate	Spheroidal	Echinate	DC
63	*Martyniaannua Linn.*	Pedaliaceae	Tricolpate	Ellipsoidal	Rugulate	DC

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64	*Mazus pumilus (Burm. F.)*	Scrophulariaceae	3- zonocolpate	Oblate	Areolate	DC
65	*Medicago lupulina*	Fabaceae	Tricolporate	Suboblate	Reticulate	DC
66	*Medicago minima Lam.*	Fabaceae	Tricolporate	Suboblate	Reticulate	DC
67	*Medicago polymorpha Linn.*	Fabaceae	Tricolporate	Suboblate	Reticulate	DC
68	*Myriophyllum spicatum L.*	Holoragaceae	Tricolporate	Oblate spheroidal	Smooth	DC
69	*Ocimum americanum L.*	Lamiaceae	Hexacolpate	Subprolate	Reticulate	DC
70	*Oenanthe javanica (BI.) DC.*	Apiaceae	Tricolporate	Prolate spheroidal	Reticulate	DC
71	*Oligomerislinifolia (Vahl) Macbride*	Resedaceae	Tricolpate	Subprolate	Reticulate	DC
72	*Orobanche aegyptiaca Pers.*	Orobenchaceae	Tricolpate	Oblate spheroidal	Microreticulate	DC
73	*Oxalis latifolia H.B. & K.*	Oxalidaceae	Tricolpate	Prolate-spheroidal	Microreticulate	DC
74	*Panicum austroasiaticumOhwi*	Poaceae	Monocolpate	Spheroidal	Smooth	MC
75	*Panicum miliaceum L*	Poaceae	Monoporate	Spheroidal	Microechinate	MC
76	*Parkinsonia aculeata*	Fabaceae	Tricolporate	Prolate spheroidal	Reticulate	DC
77	*Parthenium hysterophours L.*	Asteraceae	Tricolporate	Psilate	Reticulate	DC
78	*Phalaris minor Retz.*	Poaceae	Monoporate	Circular	Granular	MC
79	*Phyllanthus niruri*	Phyllanthaceae	Tricolporate	Spheroidal	Reticulate	DC
80	*Plantago amplexicaulis Cav.*	Plantaginaceae	Pentoporate	Spheroidal	Semitectate	DC
81	*Polygonum lanigerum R. Br*	Polygonaceae	Pentoporate	Spheroidal	Spinulose	DC
82	*Portulaca grandiflora Hook.*	Portulacaceae	Pentoporate	Spheroidal	Eutectate	DC
83	*Portulaca pilosa L.*	Portulacaceae	Pentoporate	Spheroidal	Intectate	DC
84	*Pouzolzia pentandra (Roxb.) Benn.*	Urticaceae	Tricolpate	Prolate	Reticulate	DC
85	*Prosopis juliflora*	Fabaceae	Tricolporate	Spheroidal	Smooth	DC
86	*Pycreuspolystachyos P. Beauv.*	Cyperaceae	Two aperture	Circular	Textured	MC
87	*Ranunculusaquatilis*	Ranunculaceae	Tricolpate	Glabose	Rough	DC

88	*Ranunculuscantoniensis DC*	Ranunculaceae	Tricolpate	Glabose	Rough	DC
89	*Ranunculusscleratus L.*	Ranunculaceae	Tricolpate	Glabose	Rough	DC
90	*Rhynchosia capitata DC.*	Fabaceae	Tricolporate	Spheroidal	Reticulate	DC
91	*Rumex dentatus*	Polygonaceae	Tricolporate	Spheroidal	Microechinate	DC
92	*Salsola baryosma*	Amranthaceae	Pentopolyporate	Spherical	Tectate	DC
93	*Salvia plebeian R. Br.*	Lamiaceae	Hexacolpate	Oblate	Reticulate	DC
94	*Silene conoidea*	Caryophyllaceae	Periporate	Spherical	Perforate	DC
95	*Solanum nigrum*	Solanaceae	Tricolporate	Spheroidal	Granular	DC
96	*Sonchus oleraceus*	Asteraceae	Tricolporate	Spheroidal	Echinolophate	DC
97	*Sonchus asper*	Asteraceae	Tricolporate	Spheroidal	Echinolophate	DC
98	*Spergula arvensis*	Caryophyllaceae	Tricolpate	Prolate	Tectate	DC
99	*Sphenoclea zeylanica Gaertn.*	Sphenocleaceae	Tricolpate	Oblato-spheroidal	Sub psilate	DC
100	*Sporobolus fertilis (Steud.)*	Poaceae	Monosulcate	Spherical	Smooth	MC
101	*Stellaria media*	Caryophyllaceae	Pentoporate	Spheroidal	Microechinate	DC
102	*Tamarixaphylla*	Tamaricaceae	Tricolpate	Spheroidal	Reticulate	DC
103	*Tamarixpasserinoides*	Tamaricaceae	Tricolpate	Spheroidal	Reticulate	DC
104	*Trigonella pubescens*	Fabaceae	Tricolporate	Radial	Reticulate	DC
105	*Vaccaria pyramidata*	Caryophyllaceae	Polypentoporate	Radial	Tectate	DC
106	*Verbesinaencelioides*	Asteraceae	Tricolporate	Oblate spheroidal	Echinate	DC
107	*Verbscumthapsus L.*	Scrophulariaceae	Tricolporate	Oblate spheroidal	Tectate	DC
108	*Vicia sativa*	Fabaceae	Tricolporate	Oblate	Smooth	DC

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