Research in Plant Biology, 2(4): 16-21, 2012 ISSN : 2231-5101
www.resplantbiol.com

Short communication

Pollen fertility estimation of selected taxa of Kaghan valley, Pakistan

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Pollen fertility estimation of selected taxa of Kaghan Valley was surveyed. A total 51 species belonging to 22 different families i.e., Acanthaceae, Apiaceae, Asteraceae, Berberidaceae, Brassicaceae, Caprifoliacaeae, Caesalpinaceae, Hippocastanaceae, Lythraceae, Malvaceae, Oleaceae, Paplionaceae, Podophylaceae, Polygonaceae, Rosaceae, Ranunculaceae, Salicaceae, Scrophulariaceae, Solanaceae, Urticaceae Valerianaceae and Poaceae were investigated for their pollen fertility. The dominant families regarding number of species were Asteraceae having 8 species and then Poaceae and Rosaceae having 6 species. Highest pollen fertility 100% value was observed in *Phragmites communis* Trin. and *Solanum surattense* Burm.f., while the lowest 58.49% value was observed in *Sorbaria tomentosa* (Lindl.) Rech. Most of the species showed a range of pollen fertility as 70-80 %, indicated that the flora of Kaghan Valley is well-established and stable.

Key words: Palynology, Pollen fertility, flora, district Mansehra.

Pollen fertility investigation is an important feature of palynology and shows the fertility status of plants, which indicates the viability of pollen grains to develop into male gametophyte to continue their generation through fertilization. It may indicate the adaptability of pollen grains to the environment and it is also suggested that their ploidy level may exist due to higher level of pollen fertility (Awan et al., 2001).

The Kaghan Valley is situated in the district Mansehra, Hazara division, NWFP. Mansehra is the district headquarter and a major city at a height of 3500 feet. It was created on 1st October 1976. It is located between 34° – 14′ and 35° – 11′ North latitudes and 72° – 49′ and 74° – 08′ East longitude. It is bounded in the North by Batagram and Kohistan districts, in the East by Muzafarabad district of Azad Jamu and Kashmir, in the South by Abbottabad and Haripur districts and in the West by Swat district. The total area of the district is 4,579 square kilometres (Annonymous, 1998).

The flora of the Kaghan is very interesting. Variety of bryophytes and pteridophytes are present in the area. *Marchantia polymorpha, Anthoceros, Funaria hygrometrica* and *Polytricum densifolium* are common bryophytes found in Kaghan Valley, and among pteridophytes *Botrychium lunaria, Adiantum capillus, Petris excels,* and *Dryopetris ramosa* etc are included. There is wide range of monocots in the district Mansehra but common grasses of the Kaghan Valley includes *Lolium perrene, Brachypodium*

distachyon, Brachypodium sylvaticum, Clamogrotis epigejos, and *Featuca altaica* etc.

The general vegetation is of the scrub type which includes the shrubs or medium size trees. Tree species are well represented by the deciduous and evergreen types. Among the conifers there are pine, deodar, blue pine spruce and silver fir (Mustafa, 2003).

The palynological data have proven taxonomically useful at all taxonomic levels (Erdtmann, 1966). For the taxonomists pollen fertility is valuable in attempting to distinguish putative hybrids from the parent plants and is also useful to determine the degree of fertility in those plants that are grown under unfavorable conditions (Lawrence, 1969). Pollen fertility may provide additional information of taxonomic importance when correlated with morphological traits and may help to determine whether a plant species adapted to certain ecological condition (Qureshi, 2002). In the present study medicinal plants are investigated for pollen fertility estimation. There are many closely related disciplines which have been applied to study the medicinal plants of the Kaghan Valley especially ethnobotany but the area is neglected for palynological studies like pollen morphology and fertility. The present studies can be used as a valuable data for recognizing variation existing among plant species and for evaluation of stability of flora under its natural habitat.

Pollen fertility is a significant determinant of whether in a population there will be enough regeneration through sexual reproduction to ensure the survival of that species (Reijieli et al., 2002).

Materials & Methods

The present study was conducted in the experimental Taxonomy Laboratory and Herbarium of Department of Plant Sciences, Quaid-e-Azam University Islamabad. The pollen material of fresh specimens of plant species for determination of pollen fertility was collected Kaghan Valley. The list of plants studied is presented in Table 1.

After identification of plants, undehised anthers were separated from the flowers for fertility test and kept in 70% alcohol and placed at 4 °C until required. It was then dissected in a drop of Muntz's acetocarmine. The anther wall debris were removed and for each plant species 5 to 10 slides were prepared and observed at low magnification (10 X) under (Model: MX5200H, Meiji, Techno. Ltd; Japan). The number of stained and unstained pollen grains was counted. Fully stained pollens were considered fertile while the lightly stained or unstained and deformed pollen grains were considered sterile. The methodology for pollen fertility estimation was adapted according to (Khan and Stace, 1999). Percentage of pollen fertility was determined by the formula given below:

No. of total pollen/ No. of fertile pollen = Percentage Pollen fertility.

Results & Discussion

The results of pollen fertility estimation of 51 medicinal plant species belonging to 22 families from Kaghan Valley, District Mansehra are presented in Table 1, showing botanical name, family name, sterile, fertile pollen count and percentage fertility estimation.

This work was carried out by the inspiration of work of Matin and Khan, (1999) who estimated the pollen fertility of 50 medicinal plants of Shogran Valley. Fertility ratio of the plants ranged from 98-100%, which indicated that flora of Shogran was well established and stable.

Table 1. List of plant species investigated for pollen fertility showing family name, No. of fertile and sterile pollen and % of pollen fertility.

S No.	Plant Species	Family	No. Total Pollens	No. Fertile Pollen	No. Sterile Pollen	Percent-age of Fertility
1	*Abeli triflora* R. Br. ex. Wall.	Caprifoliacae	52	40	12	76.92
2	*Achellia millefolium* Linn.	Asteraceae	46	40	06	86.95
3	*Aconitum heterophyllum* Wall,ex Royle.	Ranunclucaeae	37	31	06	83.78
4	*Adhatoda vesica* Nees.	Acanthaceae	41	35	06	85.36
5	*Aesculus indica* (Wall. ex Camb.) Hk.f.	Hippocastanaceae	113	87	26	76.99
6	*Agrimonia eupatoria* Linn.	Rosaceae	22	17	05	77.27
7	*Althea rosea* Linn.	Malvaceae	22	16	06	72.72
8	*Aquilegia vulgaris* Bth.	Ranunculacae	139	133	06	87.78
9	*Arabis hirsuta* Linn.	Brassicaceae	77	57	20	74.02
10	*Berberis lycium* Royle in Trans. Linn.	Berberidaceae	48	39	09	81.25
11	*Berberis orthobotyrs* Bien. Ex Aitch.	Berberidaceae	62	50	12	80.64
12	*Brachypodium sylvaticum* (Huds.) P.Beauv.	Poacaeae	118	112	06	94.91
13	*Caesalpina bonduc* Linn.	Caesalpinaceae	31	24	07	77.41
14	*Chrysanthemum leucanthemum* Linn.	Asteraceae	42	27	15	64.28
15	*Clematis grata* Wall.	Ranunculaceae	87	80	07	91.95
16	*Conyza Canadensis* (Linn.) Cronquist	Asteraceae	69	68	01	98.55
17	*Dicliptera bupleuroides* Nees.	Acanthaceae	104	93	11	89.42
18	*Duchesnea indica* (Andrews) Focke	Rosaceae	44	38	06	85.71
19	*Fragaria vesca* Lindl. Ex Lacaita in J.L.S	Rosaceae	26	21	05	80.76
20	*Gerbera gossypina* (Royle) Beauv.	Asteraceae	57	47	10	82.45
21	*Hibiscus rosa- sinensus* Linn.	Malvaceae	18	12	06	66.66
22	*Jasminum humile* Linn.	Oleaceae	51	40	11	78.43
23	*Lolium perenne* Linn.	Poaceae	87	80	07	91.95
24	*Nerium indicum* Mill.	Oleaceae	80	68	12	85
25	*Pennisetum lanatum* Klotzsch in Bot.	Poaceae	60	57	03	95
26	*Pennisetum orientale* L.C. Rich.	Poaceae	72	65	07	90.27
27	*Phragmites communis* Trin.	Poaceae	85	85	-	100
28	*Pimpiinella stewartii* (Dunn.) E. Nasir	Apiaceae	75	62	13	82.66
29	*Piptatherum laterale* (Munro ex Regel)	Poacaeae	101	92	9	91.08
30	*Podophyllum emodi* Wall.ex Royle	Podophylaceae	17	12	05	70.58
31	*Polygonatum multiflorum* Linn.	Polygonaceae	43	35	08	81.39
32	*Prunus cornuta* (Wall. ex Royle) Stued.	Rosaceae	56	49	07	87.5
33	*Ranunculus laetus* Wall.	Ranunculaceae	88	64	24	72.72
34	*Robinia pseudo-accasia* Linn.	Papilionaceae	21	20	1	95.23
35	*Rubus ellipticus* Smith in Ress.	Rosaceae	23	20	03	86.95

36	*Rumex dentatus* Linn.	Polygonaceae	66	58	08	87.87
37	*Rumex hastatus* D. Don, Prodr.	Polygonaceae	69	63	06	91.30
38	*Salix denticulate* Andersson in King.	Salicaeae	32	28	04	75
39	*Scrophularia nodusa* Linn.	Scrophulariaceae	79	62	17	78.48
40	*Senecio chrysanthemoides* DC. Prodr.	Asteraceae	67	59	08	88.05
41	*Solanum surattense* Burm.f.,	Solanaceae	77	77	-	100
42	*Sonchus asper* Linn.	Asteraceae	75	65	10	86.66
43	*Sorbaria tomentosa* (Lindl.) Rech.	Rosaceae	53	31	18	58.49
44	*Tagetes erecta* Linn.	Asteraceae	22	14	08	66.63
45	*Thlapsi arvensis* Linn.	Brassicaeae	114	108	06	94.73
46	*Trifolium pratense* Linn.	Paplionaceae	45	34	11	75.55
47	*Urtica dioica* Linn.	Urticaceae	56	49	07	87.5
48	*Valeriana jatamansi* Jones, As Res.	Valerianaceae	22	18	04	81.81
49	*Verbascum Thapsus* Linn.	Scrophulariaceae	71	67	04	94.36
50	*Woodfordia fruticosa* (Linn.) S.	Lythraceae	190	166	24	87.36
51	*Xanthium strumarium* Linn.	Asteraceae	54	50	04	92.59

In the present research a total 51 plant species were investigated for pollen fertility (viability) test. 46 dicotylednous plant species belonging to 21 different families i.e., Acanthaceae, Apiaceae, Asteraceae, Berberidaceae, Brassicaceae, Caprifoliacaeae, Caesalpinaceae, Hippocastanaceae, Lythraceae, Malvaceae, Oleaceae, Paplionaceae, Podophylaceae, Polygonaceae, Rosaceae, Ranunculaceae, Salicaceae, Scrophulariaceae, Solanaceae, Urticaceae and Valerianaceae and 5 species from monocotyledonous family i.e., Poaceae were investigated from the study area (Figure 1). The dominant families regarding number of species were Asteraceae having 8 species and then Poaceae and Rosaceae having 6 species.

The fertility data shows that highest pollen fertility 100% value was observed in *Solanum surattense* of Solanaceae and *Phragmites communis* Trin. of Poaceae and the lowest 58.49 % value was observed in *Sorbaria tomentosa* of Rosaceae (Table 1). These results have similarity with findings of Banaras et al., (2006) who determined the pollen fertility of Islamabad flora that showed highest value 99.9 % in *Cynoglossum lanceolatum* and least value 51.85 % in *Boerhaavia diffusa*. The reason for low fertility could be environmental or physical factors such as production of late season pollen grains (Banaras, 2006).

Interesting results were observed that the species belonging to single family showed different values of pollen fertility. In Asteraceae among 8 species the pollen fertility ranged from 64.28- 98.55 % in all 8 species.

Overall among all 51 species only 13 showed the value of 90 to 98% and 2 species showed 100% pollen fertility value. In case of Rosaceae lowest value was found in *Sorbaria tomentosa* 58.49 % and highest as 87.5% in *Prunus cornuta*. Among 2 species of Malvaceae 66.66-72.72 % in *Hibiscus rosa-sinesus* and *Althea rosea* respectively. Ranunculaceae 72.72-91.95 %, Scophulariaceae 78.48-85.71 %.

Most of the flora of the area showed the range of pollen fertility as 70-89 % it indicated that medicinal flora of Kaghan Valley is genetically stable.

The present study is providing new information to taxonomists because medicinal plant species of Kaghan Valley and its allied

areas mostly have been investigated for ethano-botanical research mostly. Jan et al., **(**2008) highlighted 46 medicinal plants of Kaghan Valley used to treat gastrointestinal disorder. These plants include *Justicia adhatoda* L., *Amaranthus viridis* L., *Artemesia maritime* (Linn), *Foeniculum vulgare* Hill. *Calotropis procera* (Willd) R. Br. and *Chenopodium album* Linn. etc He has provided basic information about Valley and plants; like local and english names of plants, their description, distribution and ethano-medicinal uses of plants. Hussain et al., (2006) prensented palynological and ethanobotanical studies on *Adhatoda vesica* from Kaghan valley and similar studies on *Alnus nitida.*

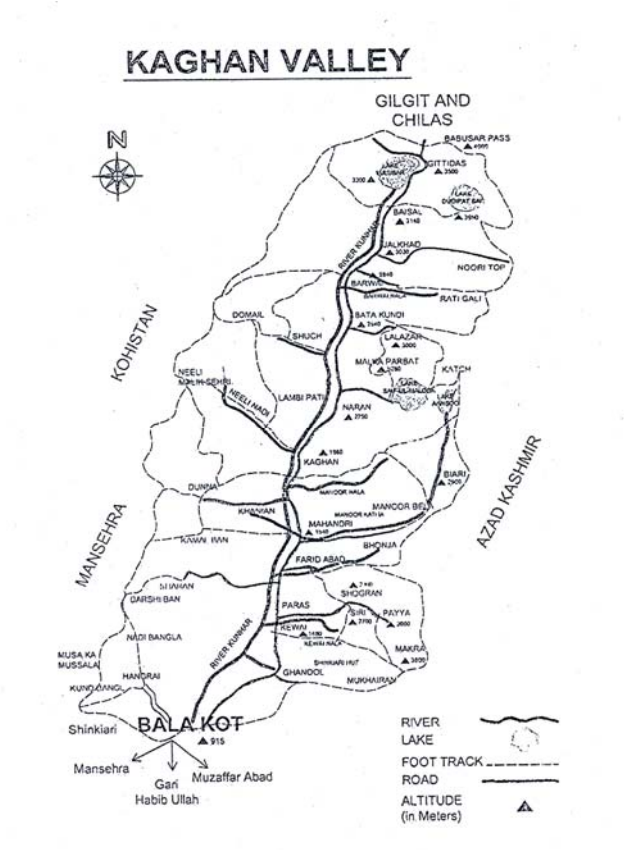

Figure 1. Map of the study area, Kaghan valley, Pakistan.

Many research workers have investigated pollen fertility of different areas including the work of Zafar et al, (2007) on flora of Lamiaceae from Rawalpindi. They investigated 3 species belonging to 3 genera of Lamiaceae. The pollen fertility estimation ranged from 96.05-97.87 %. Qureshi et al, (2002) studied the pollen fertility of the genus *Launaea* from Pakistan. Qureshi et al., (2009) also investigated the pollen fertility (viability) status in Asteraceae species from Pakistan. Banaras et al., (2006) determined the pollen fertility of Islamabad flora. They estimated the pollen fertility of 29 species and most of the flora of the area is genetically stable and showed 81-86% of pollen fertility. Pollen fertility test are currently used to an advantage in the interpretation of cytological situation in the plants and are of particular importance to draw attention towards the fact that studies involving hybrids and their parents have provided interesting data (Ravi, 1979).

This research can also provide data for comparative studies of pollen fertility of flora with plants of other areas.

Conclusion

Pollen fertility studies have been modified helpful for the recognized wide range of variation existing with plant species and differentiating plant species with genera. This investigation is helpful in identifying the genetic variation and stability of species existing in this area.

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