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Study of Pollen Fertility of the Genus *Launaea* from Pakistan

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Abstract: Pollen fertility of seven different species, *Launaea secunda*, *L. acualis*, *L. aspeliniifolia*, *L. capitata*, *L. procumbens*, *L. residifolia* and *L. secunda* belonging to genus *Launaea* of family Asteraceae was studied from Pakistan. Morphology of pollen grains of each of the species is based on specimens selected at random. At species level, micro-morphological characters like pollen fertility differences and distribution of surface pattern, shape and size of pollen have been considered found to exist. Pollen fertility data shows that *L. residifolia* is having the highest value 98.84 while the least value was found in the *Launaea acuais* 78.41%. Further cytological studies are required in taxonomy to determine the fertility status in different species. This study demonstrates the potential of pollen studies in distinguishing some taxonomic groups in the Asterasceae.

Key words: Pollen fertility, *Launaea*, Lactuceae, Asteraceae

Introduction

Pollen fertility data is a valuable tool for the taxonomists in attempting to distinguish putative hybrids from the parent plants and is also useful to determine the degree of fertility/satiability in those plants that are grown under unfavorable conditions (Lawrence, 1951). This is actually based on the fact that pollen of many hybrids is shrunken and flaccid, therefore neither satiable nor fertile. In contrast, fertile pollen grains posses intact nuclear and cytoplasmic material and stain readily with acetocarmine and anline (cotton) blue in lactophenol. Cytological, a hybrid is a product of the union of two unlike gametes. There is a wide range of hybrids in the wild. There are about 75,000 synthetic hybrids in family Orchidaceae alone, 30-70 % species of angiosperms are of polyploid origin. Indeed, one is forced to the conclusion that in general, the ability to hybridize is the usual situation in angiosperms (Raven, 1979). The taxonomist may recognize inter-generic hybrids, inter-specific hybrids and intra-specific hybrids. The constitution of artificial hybrids is known to be more precise than that of spontaneous hybrids from the wild.

The degree of fertility of hybrids may give some indication of the degree of genetic relationship between its parents. In general, hybrids between species of a genus that are not closely related (as determined by comparative morphology, ecology etc.) tend to be sterile or of low fertility, whereas hybrids between taxonomically more closely related species or infra-specific taxa tend to be more fertile. Thus there is a correlation between hybrid fertility and taxonomic relationship. Many workers tried to correlate *in vitro* pollen fertility with existence of a plant under its natural habitat. The genetic variation of a flora can be observed by studding their pollen fertility (Tellaria, 1991).

Pollen fertility results of *Brachypodium* revealed that except for *B. pinnatum* (n=9) and in various intermediates in all other species, fertility was quite high (81 - 97.8%). In *B. pinnatum/sylavaticum* intermediates it ranged from 0.3-96.5%, 8=thus distinguishing these intermediates from normal *B. pinnatum* and *B. phonenicoides*. It was suggested that the intermediate taxa in the genus *Brachypodium* would by hybrids (Khan, 1991).

Feuer (1974) examined the pollen grains of microseridinae, which, in contrast with the stephanomeriinae, were predominantly echinolophate. Skvarla *et al*. (1977) summarized much that was taken about pollen structure in the Asteraceae, where two major pollen types were categorized, namely, anthemoid and helianthoid, with various subtypes. Taxonomic, evolutionary and functional studies of the Asteraceae pollen grain on the basis of ultra-structure and sculpture were made by Bolick (1978) who noted two basic exine patterns. The caveate helianthoid and non-caveate anthemoid. El Ghazaly (1980) studied the pollen grains of 35 species of the sub-tribe Hypochoeridinae. Regarding the sub tribe Scorzonerinae with reference to its taxonomic significance. Blackmore (1982) recorded seven pollen types, which could be distinguished by a key constructed on the basis of the number and arrangement of the lacunae of the grains. Blackmore (1984) further dealt with pollen morphology of a large number of taxa of the tribe Lactuceae and recognized seven distinct pollen types, which were further subdivided into smaller groups on the basis of distinguishing characters.

According to Clark *et al*. (1980) Pollen grains of the Astereae have been characterized as basically helianthoid, spherical or slightly flattened, tricolporate and uniformly echinate, having internal foramina, with varying proportions of abnormalities in size and colpus number (Wodehous, 1930, 1935; Skvarla and Turner, 1966; Skvarla *et al*., 1977). However, in conjunction with systematic studies of *Haplopappus* and related genera in the sub tribe. Solidaginae, we have found a few cases of significant variation in pollen size, spine length, and the number of spine rows between colpi. These characters indicate a potential for utilizing pollen characters in at least some systematic studies in the Astereae.

Pollen morphologists have responded to the need, created by the widespread application, for a more critical comparative analysis of pollen wall structure and for an expansion in the number of recognized systematically and phylogenatically significant wall characteristics. In this response, successful use has been made of phase and ultraviolet microscopy in addition to more sophisticated light microscopy. Page (1978) in his scanning electron microscopic survey of grass pollen further divided these two basic types on the basis of the proximity of granules, whether they are closely or widely spaced while the fused type are differentiated on the basis of height of granules. Chaturvedi (1971) has reported 4 types of grains in *Saccharum robustum* viz., (I) normal monoporate grains (ii) double grains with two pores on either side of the dumbbell shaped pollen grains (iii) single diporate grains and (iv) double grains with single pore.

Soon after Khan and Memon (1970) gave an account of the pollen morphology of certain Leguminous plants of Jamshoro, Sind. Taking into account the applied form of Palynology it was found desirable to produce series of papers dealing with the Palynology of the plants growing in the Punjab. The fundamental Palynology will certainly help the applied aspects.

According to Ali (1988), in most of the plant groups in Angiosperms, at maturity, all the pollen grains are free from each other. As the prime function of the pollen grains is to provide the male gametes to the female counter part, in order to facilitate fertilization and ultimately the formation of the seed such as category seems logical. However, it is also well known that in some plant groups, the pollen grains do not separate at maturity and remain associated together. The term pollen aggregate is used for all types of compound pollen grains and for various types of situations where pollen grains are dispersed in-groups. Char *et al*. (1973) reviewed the evolutionary trends in pollen organization and discussed their adaptive significance. The present study was undertaken to evaluate the fertility differences in the pollen grains of family Asteraceae.

Materials and Methods

Pollen fertility: For the assessment of pollen fertility the following methods were used.

Method (1): Anthers were dissected in a drop of Munoz's

acetocarmine/glycerin solution (Mixed equal amounts of 1% acetocarmine and neutral glycerine). Anther wall material was removed and coverslip was placed on the preparation. The percentage of full, well-stained grains in total of at least 300 grains was calculated. This figure was taken as a rough guide to pollen fertility.

Method (2): For testing pollen fertility another stain aniline blue in lactophenol was used. The stain was prepared according to the following formula of Maneval (1963).
20 ml phenol crystals (melted)
20 ml lactic acid (Ca 85 %)
40 ml glycerin
20 ml distilled water
5ml of 1-% aqueous solution of aniline blue was added to above medium. Samples were examined under light microscope after 24 hours. The stained grains were considered to be fertile and non-stain grains as sterile. This method was proved to be better than the first one.

Results and Discussion

Pollen fertility data shows that *Launaea residifolia* is having the highest value 98.84 while the least value was found in the *L. acualis* 78.41% (Table 1)

Table 1: Study of percentage pollen fertility of *Launaea*

Name of taxa	% Pollen fertility
L. acualis (Roxb.) B.	78.41
L. aspleniifolia (DC.) Hk.	78.62
L. capitata (Spreng.) Dandy	91.42
L. procumbens (Roxb) Ramayya & Rajagopal	92.44
L. resiifolia (L.) O.	98.84
L. secunda (C. B. Clarke) Hk	91.44

The pollen fertility can not be solely used as the base of taxonomic classification of the family. However, if it is accepted that pollen morphology shows evolutionary sequences comparable to those in other organs, then it may need to be given as much weight as any other morphological character. On this assumption, in the pollen morphology of the species examined, some inconsistencies and alternative relationships have been suggested in correlation with the recent taxonomic classification proposed by Johnson and Briggs (1975).
The general features of the Asteraceae, taken together are not repeated in other families. This gives Asteraceae (Composite) a unique taxonomic status. To quote Wagenitz (1976), "Combined efforts of systematic, evolutionary and ecological studies are still necessary to help understand the evolution of this fascinating family". The pollen fertility characters not only provide the additional information but are also helpful to improve the systematic position of species with its respective family. It can be concluded that not only the general morphology but also the pollen morphology is of significance in species delimitation (Wodehouse, 1935). In the present investigation the genus *Launaea* characteristic pollen fertility were observed.
Although the micro-morphological study of pollen surface pattern, shape and size of Composite/Asteraceae has demonstrated striking diagnostic features similar to the flora chromosomal and vegetative characters of the family, these features show some inconsistencies with the taxonomic classification of the family into subfamilies, tribes and sub tribes. However some genera retain individually unique surface pattern and some tribes and sub tribes with a small number of genera show homogeneity in their pollen surface pattern, though other characters such as shape and size range of pollen do not distinguish them from mother members of the family.
Light microscopic observations could not clearly indicate the exine sculpturing. Bolick (1978) suggested that scanning electron microscopic (SEM) studies should be carried out for obtaining many characters of great taxonomic importance. Not only the general morphology but also pollen morphology is of significance in species delimitation and pollen characters are correlated with morphological features (Six, 1960). Pollen fertility can play a very important role in solving the taxonomic problems if the pollen characters are co-related with morphological characters to become a qualitative character Pollen fertility tests are currently used to an advantage in the interpretation of cytological situation in plants and are of particular importance to draw attention towards the fact that studies involving hybrids and their parents have provided interesting data (Rav, 1979). Further cytological studies are required in taxonomy to determine the fertility status in different species.
It is concluded that pollen fertility is an important aspect, which help in determining the successful adaptation of plant species. In this research project *L. residifolia* has maximum pollen fertility i.e., 98.84 %. Pollen fertility also helps in discovering a new species if it is associated with other sound characters.

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