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Meiotic Studies of *Lactuca serriola* L. From Islamabad

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Abstract: *Lactuca* is an important genus of tribe Lactuceae in Asteraceae. In *Lactuca serriola* the chromosome number, various meiotic stages, formation of pollen grains and pollen morphology is taken into account. Meiotic studies indicated that basic number of chromosomes is nine, n=9, (2n=18). In this species the meiosis was regular and pairing of homologous chromosomes was normal. During anaphase all the chromosomes moved regularly to the opposite poles. The chromosome bivalents are pronounced in diakinesis. Tetrad developed into pollen grains, whose equatorial and polar views were observed. The pollen grain is trizonocolporate in polar view. The pollen grain is echinate or spinate. It is recommended that the techniques like karyological and palynological study in connection with morphology must be carried out in correlation with the taxonomy on larger scale to find the variation and evolution in native species of the genus.

Key words: Meiosis, *Lactuca serriola*, karyology, pollen grain

Introduction

Lactuca serriola L. is a conspicuous plant of waysides and widely distributed in Pakistan. *Lactuca serriola* (prickly lettuce, a member of the Compositae) is a large spring or winter annual herb, which is frequent in different parts of Pakistan. It is a member of the early succession flora of disturbed waste places and, in the absence of continuing disturbance, seldom persists in any one place for more than about 5 years.

Tribe Lactuceae (Cichorieae) comprises 70 genera including *Lactuca* and 2300 species and is the most easily recognized tribe of the family. Early classification were highly artificial and the two most authentic classification by Stebbins (1953) and Jeffrey (1966) represent significant advances toward a natural treatment of the tribe. The tribe is widely distributed but concentrated in the temperate zone of the Northern hemisphere with their major centers of distribution: Central Asia, the Mediterranean Basin and Western North America.

It is a long established species in Britain, first recorded in 1632, and has probably spread throughout its potential range. It has been more fully described by Carter and Prince (1982), have discussed its history in Britain. It is native in North Africa, Western Asia and Europe North to Southern Scandinavia and it has been widely introduced elsewhere. *Lactuca serriola* grows on a wide range of soils. Its distribution limit is correlated with the isolines of diverse synoptic climatic variables including several summer isotherms and several isohyets of summer rainfall. These correlations suggested many hypothesis about how the climate might control the limit but there are no reasons for favoring any one of them. *Lactuca serriola* does not exhibit any readily observable decline in performance towards its limit; it does not, for example, obviously fail to set seed in the Northern part of its range, as many South Eastern species are reported to do (Pigott, 1970).

An ancestral base chromosome number of x = 9 is likely as it is the most frequent number in the tribe; x = 4 and x = 5 have also been suggested and can not be disregarded at the present. Karyotypic evolution has included aneuploid loss, decrease in chromosome size and symmetry and a low frequency of polyploidy.

Qureshi *et al.* (2001) conducted a detailed work on pollen fertility of the Genus *Lactuca* from Pakistan. He considered 10 species namely *Lactuca clarkei, L. dissecta, L. dolichophylla, L. lessertiana, L. orientalis, L. remotiflora, L. saligna, L. serriola, L. serriola var. integrifolia, L. altaica,* showing variation in pollen fertility. Koopman *et al.* (1993) stated that Chromosome banding patterns obtained with C- and N- banding and $AgNO_3$ staining were investigated in somatic metaphase components of four *Lactuca* species. *Lactuca sativa* and *Lactuca serriola* have almost identical chromosome morphology and *Lactuca saligna* differs only slightly from them, but *Lactuca virosa* is quite distinct from the other species. A gross comparison of the banded karyotypes suggested a closer relationship of *Lactuca saligna* to *Lactuca sativa* / *serriola* than to *Lactuca virosa*.

The basic chromosome number for the entire *Lactuca* section. *Lactuca* species was found to be 2n=18. The karyotypes of *Lactuca sativa, Lactuca serriola* and *Lactuca saligna* showed clear morphological similarities. They all have two satellite chromosome pairs, which are the third and the fifth largest in the complement, but *Lactuca virosa* exhibits differences in chromosome morphology. It has two obvious subtelocentric chromosome pairs with centromere indices of less than 25%, where as only one chromosome pair possesses microsatellites.

Compositae (Asteraceae) is the largest and one of the most widely distributed families of flowering plants with 1000 genera and 20,000 species. In the Flora of Pakistan, it is represented by 110 genera and 604 species (Ali, 1978) of these, only 10 species (i.e. 1.6% of the total species) have been subjected to cytological studies by previous workers like Baquar and Askari (1970); Khatoon and Ali (1982) investigated meiotic chromosome numbers of 32 species belonging to 32 genera of the family Compositae.

Materials and Methods

For meiotic studies in *Lactuca serriola* L. inflorescences were fixed out at young appropriate stage. The material was fixed in 3:1 absolute alcohol (C_2H_5OH); glacial acetic acid (CH_3COOH) and stored at 4 ^{0}C until required. After trying different stains, 2% aceto-orcein (La Cour, 1941) proved to be the best.

It was also found satisfactory to dissect the anthers for meiosis directly from the plants on to a slide in 45 % glacial acetic acid (CH_3COOH) without prior fixing. Number of chromosomes was counted from diakinesis stage.

Material was taken from living specimens collected from the various places of Islamabad and Margalla Hills. This research project was conducted during 1999-2000 and voucher specimens were deposited in the Quaid-I-Azam University Herbarium (ISL).

Results and Discussion

Meiosis and pollen morphology has been observed in *Lactuca serriola*. In this study it was observed that meiosis was regular in fertile *Lactuca serriola*. In this species spindle development was good and all the chromosomes occupied position at the equator. During anaphase all the chromosomes moved regularly to the opposite poles (Plate II). The haploid number of chromosomes in *Lactuca serriola* is n=9, 2n=18 in the species distributed in Margalla Hills, Islamabad. The chromosomes are prominent in diakinesis (Plate I). After the completion of karyokinesis, cytokinesis starts to form tetrads (Plate IV). The haploid cells of tetrads produced from single spore mother cell then metamorphosed/develop into pollen grain. Two views of pollen grains were observed under microscope i.e. polar view and equatorial view. The pollen grain of *Lactuca serriola* is trizonocolporate, triangular in polar view and subspheroidal in equatorial view. The surface of pollen grain is echinate or spinate

and interspinal outline is V shaped. It is also concluded that pollen fertility/ karyology/ morphology can not be solely used as the base of taxonomic classification of the family. Hovvever, if it is accepted that pollen morphology, pollen fertility, karyology shovvs evolutionary sequences comparable to those in other organs, then it may be needed to be given us much vveight 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 vvith the recent taxonomic classification proposed by Johnson and Briggs (1975).

Different meiotic stages of *Lactuca serriola* L. shovvn in Plates (I-VII).

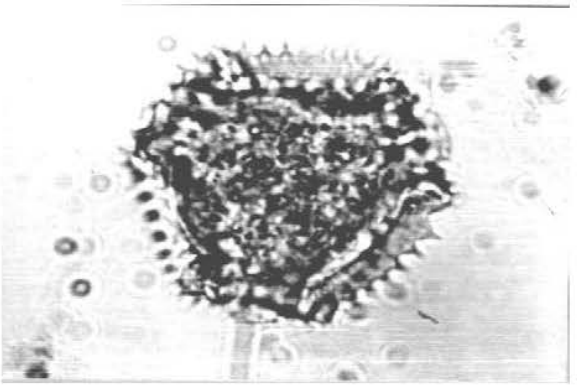

Plate I: Ist meiotic division, diakinesis

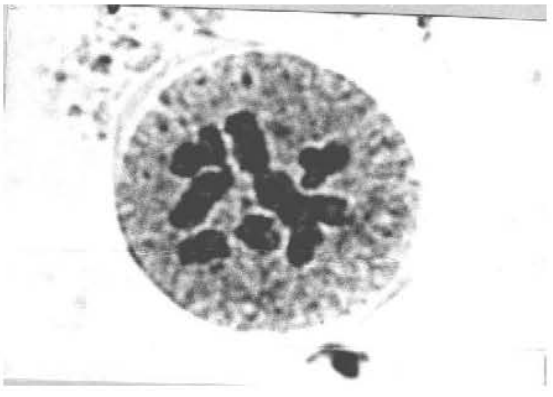

Plate II: Late telophase I

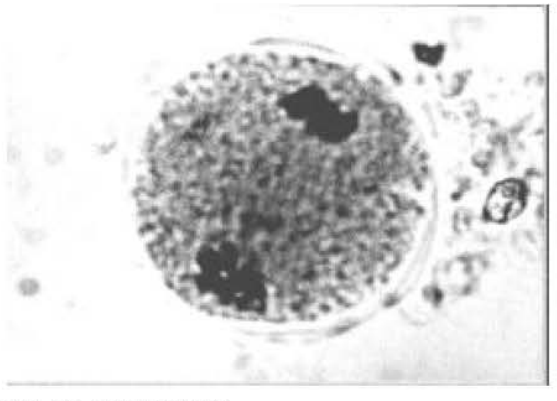

Plate III: Late telophase II

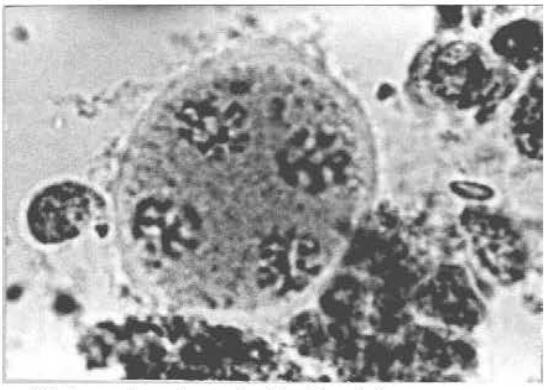

Plate IV: Formation of tetrads (Cytokinesis)

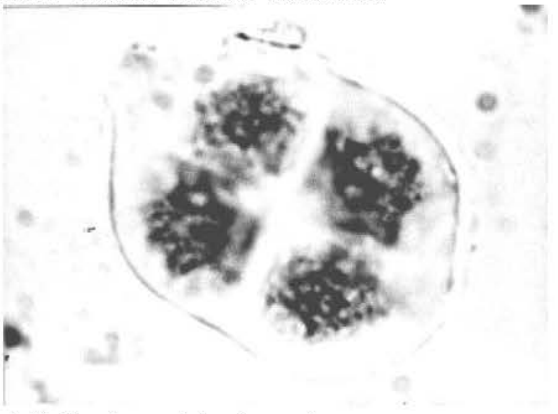

Plate V: Development of pollen grains

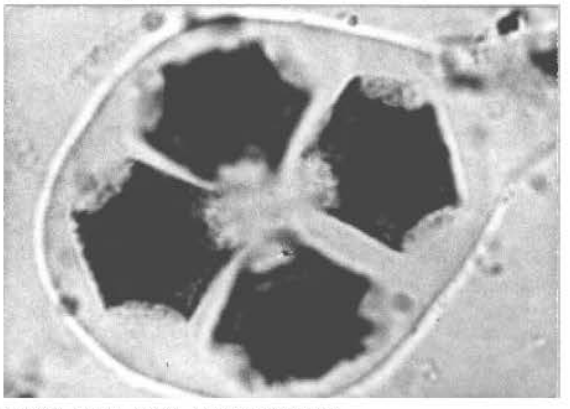

Plate VI: Pollen grain, equatorial view

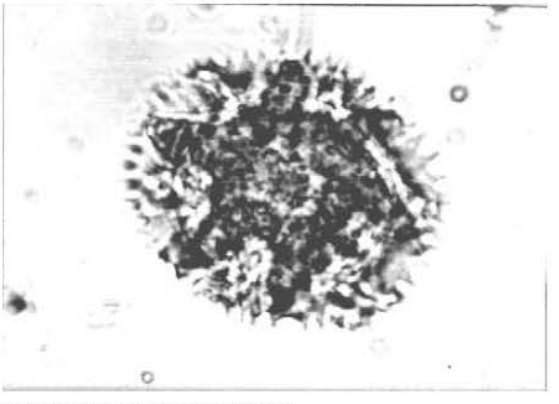

Plate VII: Pollen grain, polar view

According to Qureshi *et al.* (2001) pollen fertility data shows that *L. saligna* is having the highest value of pollen fertility i.e. 98.42 % while the least value was found in the *Lactuca dolichophylla* 56.6.2 %. Lindqvist (1960) suggested that the latter chromosome pair in *Lactuca virosa* correspond to the shorter satellite pair of the other three species. Turner *et al.* (1961) suggested x = 4 and 5 as ancestral base numbers for the tribe and family, pointing out the number of genera with x = 4, 5 and 9 (the x = 9 derived via amphiploidy) and the presence of several lengths describing aneuploid series at the lower numbers. Chromosome base number, x = 9 is found in 27 genera and five of Stebbins's sub-tribes (being absent in the Scolyminae, Scorzonerinae and Hypochoeridinae). Eight genera in the tribe are yet to be counted; most of these are small genera of limited phyletic importance. As far as the ancestral base number for the tribe is concerned, x = 9 is most likely, although x = 5 can not be excluded at the present time. It is suggested that further cytological studies are needed in taxonomy at broader level, which in relation to morphological parameters must be given weightage and considered in taxonomic decisions.

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