# SUMMARY AND CONCLUSIONS

So far nine species of Urginea have been reported from India, however, according to Deb and Dasgupta (1987) there are only five species. Almost all the Indian species of Urginea are reported from Maharashtra. Similarly diploid, triploid and tetraploid populations of U.indica have been observed in Maharashtra. Diploid and triploid populations of U.indica are usually found along seacoast while tetraploid (former U.coromandeliana) populations of U.indica are found in dryer parts of Eastern Maharashtra. U.congesta, U.razii and U.polyantha are also found in drier parts of Eastern Maharashtra. U.razii seems to be endemic to Maharashtra and is known only from its type locality. U.congesta has restricted distribution and is most slow growing species in India. It has also been confirmed that U.congesta is a hysteranthus species as against synanthus reported by Hooker (1892), Gamble (1928) and Deb and Dasgupta (1974, 1981). U.polyantha seems to be widely distributed in Maharashtra. All the Indian species except U.polyphylla are hysteranthus and after Hook (1892) no body has collected U.polyphylla and its occurrence today seems to be doubtful.

Based on time of flower opening and closing the Indian species of Urginea could be grouped into two groups (1) Night flowering : diploid, triploid and tetraploid populations of U.indica and (2) Day flowering : U.congesta, U.razii and

U.polyantha. The time of flower opening seems to be one of the important mechanism in reproductive isolation and speciation in the genus Urginea.

Among the species U.congesta could be identified by its short congested inflorescence, U.razii by its narrowly linear fleshy leaves, U.polyantha can only be distinguished from U.indica by quantitative characters. U.polyantha is smaller in all quantitative characters than U.indica. Secondly U.polyantha is a day blooming species while U.indica is a night-blooming.

All the Indian species of Urginea showed 20 as somatic chromosome number, however, U.indica in addition to 20, it also showed 30 and 40 as somatic chromosome number. Thus among Indian species, polyploidy has been observed in U.indica. Probably U.indica exploits various habitats through ploidy. Triploids are well adapted to saline conditions while tetraploids grow well in dry arid regions of Maharashtra. β chromosomes have been observed in U.polyantha and diploid populations of U.indica. In general chromosomes are Telocentric or subtelocentric in all Indian species of Urginea.

Hooker's U.coromandeliana has been now considered to be tetraploid populations of U.indica. However, in addition to differences in morphological characters with diploid population of U.indica, the tetraploid populations show geographical isolation, equally high pollen fertility as that of diploid

U.indica, production of fairly good number of viable seeds and propagation by sexual means suggest the separate status of the species or it probably represents a species complex.

On the basis of pollen morphology Indian species of Urginea could be divided into two groups (1) comparatively smaller pollen grains with fine reticulate ornamentation as in U.congesta, U.razii and U.polyantha and (2) larger pollen grains with coarse reticulate ornamentation diploid, triploid and tetraploid populations of U.indica. Pollen grains are monocolpate in all 4 species of Urginea. Pollen grains of U.congesta, U.razii, U.polyantha, diploid and tetraploid populations of U.indica are uniform in size and showed high pollen fertility (90-98%), however, triploid population of U.indica showed great size variations and high pollen sterility which could be used to assess cytological status of populations of U.indica during flowering.

Gross scape anatomy is similar in all 4 species of Urginea however, the size and shape of epidermis, thickness of outer cortex, Number of vascular bundles per scape etc. differed in different species and these differences in anatomy could be used to identify different species.

Cuticular studies showed same gross structure of epidermis and stomata and did not showed marked differences, however, variations in epidermal cell size, stomatal density and stomatal size were observed. All species showed same gross leaf anatomy never-

theless the size and thickness of leaf, number of vascular bundles per leaf varied greatly from species to species.

There were no significant differences in embryological events of U.razii and U.polyantha. Embryology of both species closely resembled with that of U.indica (Maheswari, 1932; Capoor, 1937).

Anthers are tetrasporangiate, Anther wall consists of single layered epidermis, endothecium, single middle layer and inner most tapetum. Middle layer is ephemeral and degenerates very early. Tapetum is glandular type and becomes binucleate when microspore mother cells undergo meiotic divisions. Endothecium becomes prominent and develops fibrous thickenings before anther dehiscence. Anther dehisces by longitudinal slit. The microspore mother cells undergo normal meiotic divisions and form isobilateral tetrads. The microspore mother cells divide by successive type of cell divisions. Pollen grains are liberated in 2-celled condition. They are monocolpate with fine to coarse reticulate wall ornamentation.

Pollination is entemophilous which is brought about in between 12 noon to 3 p.m. by small insects.

Gynoecium consists of tricarpellary, syncarpous, superior triloculed ovary with single hallow style and trilobed wet stigma. Ovules are anatropous, bitegmic and crassinullate. The micropyle of ovule is formed by inner integument. For pollen

tubes, obturator at the base of funiculus serves as a bridge between placental tissue and micropyle.

Archesporial cell usually cuts a parietal cell and archesporial initial. Archesporial initial undergoes normal meiotic division and usually forms a linear or T-shaped tetrad. It is the chalazal megaspore which gives rise to normal type of embryosac. Two synergids show filiform apparatus. Two polar nuclei fuse soon and form secondary nucleus which moves towards chalazal end of embryosac and lies above three antipodal cells. Fertilization is porogamous.

Endosperm formation is of helobial type however, the first wall between two endosperm nuclei is difficult to observe. After several free nuclear divisions in micropylar region the cell-wall formation starts from periphery and procedes towards centre and cellular endosperm surrounds the embryo.

Zygote undergoes a transverse division forming Ca & Cb. Cb undergoes 1 or more transverse divisions forming suspensor while terminal cell undergoes two vertical division and one transverse division and then further periclinal divisions forms globular embryo which grows towards chalaza digesting cellular endosperm.

Mature seed consists of a cylindrical embryo surrounded by cellular endosperms which is covered by seed coat. Epidermal cells of seed coat become black and develop reticulation. Seeds are nondormant.