REVIEW OF LITERATURE

Among monocotyledons family Liliaceae is found to be very ideal for various types of studies especially cytology (Taylor, 1925; Newton, 1927; Raghavan, 1935; Jones and Smith, 1967-68), Palynology (Nair and Sharma, 1965; Diez and Pastor, 1984) and embryology (Davis, 1966). A fund of work has been done on Liliaceae and therefore, in present account the most relevant literature on genus Urginea is reviewed.

Most of the botanists like Bentham and Hooker (1883), Engler and Prantle (1892), Rendle (1959), Hutchinson (1959) have treated family Liliaceae as a separate family from Amaryllidaceae, however, Cronquist (1981) has merged family Amaryllidaceae into Liliaceae because of close similarities between the two families except that the latter family have inferior ovary. Baker (1673) has arranged family Liliaceae into two series as gamophyllous and polyphyllous. A critical account on the importance of the order Lilifforae from phylogenetic point of view has been reviewed by Mitra (1955).

The genus Urginea was first proposed by Steinhill (1834) after Ben Urgin an Arabian tribe of the region. Steinhill distinguished this genus from allied genera for its sepal like petals being slightly larger and membranous seeds. With this limitations of genus Urginea, some species of genus Scilla L., Ornithogalum L., Albuca L.; Anthericum L. and Phalarigium Lam.

were replaced under this genus. Steinhill (Loc.cit.) described 7 species under this genus on the basis of leaves, bulb scales and scapes. Lindley (1836) placed this genus under tribe Scilleae near Scilla L., Bellevalia Lap., Barnardia Lindl. etc. for its bulbs and smaller flowers. Enderlicher (1836) did not recognise tribe Scilleae and placed this genus in the tribe Hyacintheae Endl. in between Scilla L. and Ornithogalum L. Kunth (1843) placed genus Urginea under the tribe Hyacintheae inbetween the genera Scilla and Ledebouria Roth. Baker (1871, 1873) subdivided the bulbous Liliaceae with racemose inflorescence into two groups as gamophyllous Hyacintheae and polyphyllous Scilleae and placed this genus under the polyphyllous Scilleae near Eucomis L. Baker added 12 more species to the genus Urginea. Bentham (1883) did not recognise the group and kept all the genera under Scilleae placing the genus Urginea near Albuca L. and Whiteeheadia Harv. Jessop (1977) treats Urginea Steinh. as synonymous to Drimia Jacq. ex. Willd. and put all the African species under genus Drimia Jacq.ex.Willd.

Hooker (1892) described 5 species from India viz. U.indica, U.coromandeliana, U.wightiana, U.polyphylla and U.congesta. The former three species were placed under hysteranthus group, while latter 2 species were placed under synanthus group (Hooker, 1892; Gamble, 1928). Blatter and Mc Cann (1928) described U.polyantha from Maharashtra. On the basis of cytomorphological characters, Boraiah and Fatima (1970) described

U.govindappae from Bangalore (Karnataka). Deb and Dasgupta (1974) in revision of the genus Urginea in India reduced U.coromandeliana, U.wightiana and U.govindappae to U.indica and reported only 4 species from India. Following Jessop (1977), Ansari and Raghvan (1980) suggested a new combination for the Indian species and transferred all the Indian species to genus Drimia. Ansari (1978) also described a new species Drimia razii from Diva Ghat of Maharashtra. However, Deb and Dasgupta (1981, 1987) do not agree with Jessop as well as with Ansari and Raghavan in transfer of Indian species to genus Drimia. By the time Hemadri and Swahari (1982) described U.nagarjunae from Andhra Pradesh. Boraiah and Fatima (1982) do not agree with Deb and Dasgupta (1981) in merging U.govindappae into U.indica. Deb and Dasgupta (1983) reviewed the generic status of Urginea and placed all the Indian species under this genus. Rajagopal and Reddy (1987) rediscovered U.congesta from Andhra Pradesh and found that the species belongs to hysteranthus group as against synanthus described by Hooker (1892), Gamble (1928), Deb and Dasgupta (1981), however, they agree with Deb and Dasgupta (1981) in not to transfer Indian species to genus Drimia. Recently Deb and Dasgupta (1987) have reduced U.nagarjunae, to U.indica and transferred Drimia razii, sp.nov. (Ansari, 1981) to U.razii (Ansari) Deb and Dasgupta comb.nov. Thus according to Deb and Dasgupta (1987) there are 5 species of Urginea in India.

Hooker (1892) reported 5 species out of which U.indica is widely distributed. He reported U.coromandelina from

Coromandel Coast, U.wightiana from South Deccan, U.congesta and U.polyphylla from Deccan peninsula. Only U.indica was reported by Cooke (1907) from Bombay presidency. Blatter and Mc Cann (1928) described U.polyantha from Maharashtra. U.congesta is recorded by Santapau (1965) from Vagir-gad Fort in Poona district. U.razii (Ansari) Deb and Dasgupta (1987) is described by Ansari from Diva Ghat in Maharashtra. Thus almost all Indian species of Urginea except U.polyphylla are represented in Maharashtra. U.polyphylla has been reported by Hooker (1892) from Deccan Peninsula, however, after him nobody has reported it from India, and most of the descriptions are based on original harbarium specimens.

Cytotaxonomy of different taxa belonging to several genera of Liliaceae have been studied by Neves (1973) to establish their somatic chromosome numbers. On the basis of morphology and karyomorphology, Battaglia (1957 c) suggested that U.maura must be regarded as species instead of sub-species of U.maritima. Boraiah and Fatima (1970) described U.govindappae sp.nov. on the basis of cytotaxonomical details, however, Deb and Dasgupta (1987) do not agree with them and reduced the species to U.indica. Naik (1976) studied cytotaxonomy of U.indica and U.coromandeliana and on the basis of meiosis, karyomorphology and pollen fertility concluded that U.coromandeliana is autotetraploid of U.indica and should be merged into U.indica. Nwankiti (1983) studied cytotaxonomy of U.altissima and classed genus Urginea as highly advanced

genus of the family Liliaceae on Levitzky's (1931) theory. Oyewole (1975) has studied the cytotaxonomy of U.altissima, U.gigantea and U.viridula from West Africa. Oyewole (1987 a,b,c) studied the cytotaxonomy with reference to population differentiation and karyotype variation in U.indica. He also studied (1987 a) the karyotype evolution in U.altissima. Table 1 represents summarised account of cytotaxonomical studies in Urginea species.

Family Liliaceae is always found to be very ideal for cytological work. Fairly good amount of cytological work has been done on members of Liliaceae (Taylor, 1925; Newton, 1927; Jones and Smith, 1967-68; Sharma, 1972; Stedje and Nordal, 1987). Recently Stedje and Nordal (1987) have studied cytogeography of Hyacinthaceae in Africa.

Genus Urginea is represented by about 100 species (Airy-Shaw,1966). Chromosome numbers are reported in about 30 species of the genus. Most of the cytological work is related to U.maritima and U.indica (Ayyangar, 1962, 1964-a,b, 1965, 1966, 1969; Battaglia 1957-a, 1957-b, 1957-c, 1964; Capoor, 1937; Carmela, 1950; Datta, 1966; Jha and Sen, 1980-a, 1983-a, 1983-b, 1984; Jones and Smith, 1967; Kishore, 1951; Love, 1964; Maugini, 1953; 1956, 1960; Maugini and Maleci, 1974; Martinoli, 1949; Moorthi and Sampathkumar, 1968; Naik, 1976; Neves, 1973; Patil, 1981; Patil, 1984; Oywole, 1975, 1987-a,b,c; Raghavan, 1935; Raghavan and Venkatasubban, 1940 a,b; Sato, 1942; Sen, 1973, 1974; Subramaniam 1972, 1978 and Zaman and Khaleque, 1978).

Table 1 : Showing Cytotaxonimical studies done in different species of Urginea

Sr.No.	Name of the species	Authors
1.	U. maritima Bak.	Battaglia (1957 a)
2.	U. maritima Bak.	Takholns and Drar (1954)
2.	U.govindaoppae Baraiaha Fatima	Boraiah & Fatima (1970)
3.	U.altissima Bak.	Oyewole (1975, 1987 a,b,c)
4.	U.gigantea Jac	"
5.	U.viridula Bak.	"
6.	U.coromandeliana Hook.	Naik (1978)
7.	U.indica Kunth.	Oyewole (1987 a,b,c)

Various workers have reported chromosome number in other species of Urginea such as U.altissima (de-Wet, 1957; Miege, 1960; Jones and Smith, 1967; Nwankiti, 1983), U.aurantica (Battaglia, 1958), U.burkei (de-Wet 1957, Jones and Smith, 1967), U.congesta (Dixit and Yadav unpublished), U.coromandeliana (Datta, 1966; Naik, 1973, 1974, 1976), U.depressa and U.epigea (de-Wet, 1957), U.fugax (Martinoli, 1949; Battaglia, 1957-a,1964; Battaglia and Guanti, 1968), U.govindappae (Boraiah and Fatima, 1970), U.langii and U.lydenburgensis (de-Wet, 1957), U.maura (Battaglia, 1957-c), U.mouretii (Neves, 1958), U.multisetosa (de-Wet, 1957), U.nigritiana (Miege, 1960), U.polyantha (Kambel & Ansari, 1976), U.polyphylla (Raghavan and Venkatasubban, 1940-a), U.pretoriensis and U.rubella (de-Wet, 1957), U.razii (Dixit and Yadav - unpublished), U.scilla (Sato, 1934, 1942), U.tenella (de-Wet, 1957), U.undulata (Martinoli, 1949, Battaglia, 1957-a), U.viridula (Oyewole, 1975) and U. volubilis (Jones and Smith, 1967).

B-chromosomes varying in number from 1-8 have been reported by several workers in some species of Urginea such as U.aurantiaca (Battaglia, 1958), U.epigea (de-Wet, 1957), U.fugax (Martinoli, 1949; Battaglia, 1957 a, 1964; Battaglia and Gaunti 1968), U.indica (Raghavan and Venkatasubban, 1940-a; Ayyangar, 1969; Sen, 1974), U.lydenburgensis (de-Wet, 1957), U.maritima (Geitler, 1929); Raghavan and Venkatasubban, 1940-a), and U.rubella (de-Wet), 1957).

Various degrees of polyploidy and the geographical distribution of polyploids of U.maritima have been reported by Battaglia (1957 b, 1964). Maugini and Maleci (1974) and Maugini (1953, 1956, 1960) reported diploid, triploids, tetraploids, pentaploids and hexaploids of U.maritima from different localities in Africa. Similarly diploids, triploids, tetraploids and hexaploids have been reported in U.indica from different localities in India (Raghavan, 1935; Raghavan and Venkatasubban, 1940 a,b; Sen, 1973; 1974; Jha and Sen, 1983 b, Naik, 1973, 1976). Naik (1976) is of opinion that U.coromandeliana is an autotetraploid of U.indica and it should be reduced to latter species as has been done by Deb and Dasgupta, (1974, 1981).

Table No.2 represents the summarised account of number of chromosomes in different species of Urginea.

From the Table 2, it is clear that out of 30 species 25 species have 2n = 20 chromosome number, 5 have 2n = 40 chromosome number and about 7 species showed β chromosomes. Triploidy is recorded in two species. Among the species U.indica and U.maritima showed high degree of polyploidy.

Family Liliaceae consists of 280 genera and about 4000 species. There have been number of studies of pollen with light microscope (Nair and Sharma, 1965; Radulesen, 1972, 1973 b,c; Diez and Pastor, 1984) however, for the size and importance of the family, it is little known palynologically. Literature survey shows that there is little or no work on palynological aspects of genus Urginea.

Table 2 : Showing Chromosome number report in different species of Urginea.

Sr. No.	Name of the species	Chromosome number	Authors
1.	U.altissima Bak.	2n = 20	de Wet (1957) Jones & Smith (1967) Mieqe (1960) O.C. Nwankiti (1983)
2.	U.aurentiaca Lindberg	2n = 20, 20 + 1, 20 + 2	Battaglia (1958)
3.	U.burkei Bak.	2n = 20	de Wet (1957) Jones & Smith (1967)
4.	U.coromandeliana Hook.	2n = 20 4n = 40	Datta (1966) Naik (1973)
5.	U.congesta wt.	2n = 20	Dixit & Yadav (Unpublished)
6.	U.depressa Bak.	2n = 20, 40	de Wet (1957)
7.	U.epiquea Dyer.	2n = 30 + 2B	de Wet (1957)
8.	U.fugax (Mon's) Steinh.	2n = 20,21(20 + 1B) 2n = 20,21,22,24	Martinoli (1949, 1954) Battaglia (1957)
	U.fugax var. major.	2n = 20 + 4B	Martinoli (1949)
	U.fugax var. typica	2n = 20 + 1B	Martinoli (1949)
	U.fugax var. typica	2n = 20 + 2B	Battaglia (1957 a)
	U.fugax var. typica	2n = 20 + 0 - 2B	Battaglia and Guanti(1968)
9.	U.gigantea (Jacboyewde)	2n = 20 + 2B	Oyewole (1975)

Table 2 : (Contd.....)

Sr. No.	Name of the species	Chromosome number	Authors
10.	U.govindappae Boraiah Fatima	2n = 20	Boraiah & Fatima (1970)
11.	U.indica Kunth.	2n = 20 + 1 - 4B, 30	Raghavan and Venkatasubban (1940)
		2n = 20 + 0 - 7B	Ayyangar (1969)
		2n = 20 + 6 and 7B	Sen (1974)
		2n = 20, 30	Raghavan (1935)
		2n = 20	Capoor (1937)
		2n = 20	Harikishore (1951)
		2n = 20	Battaglia (1957 a)
		2n = 20, 30	Mieqe (1960 a)
		2n = 20	Zaman & Khaleque (1978)
		2n = 20, 21, 22, 24	Battaglia (1957)
		2n = 30	Marvey (1966)
		2n = 40	Sato (1934)
		2n = 40	Sumitra Sen (1974)
12.	U.langii Broom.	2n = 10	de Wet (1957)
13.	U.lydenbarcensis Dyer.	2n = 30 + 2B	de Wet (1957)
14.	U.macranthum Wr.	2n = 30	de Wet (1957)

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Table 2 : (Contd.....)

Sr. No.	Name of the species	Chromosome number	Authors
15.	U.maritima	2n = 20, 40	Heitz. (1926)
		2n = 10 + 1B	Geitter (1929)
		2n = 20 + 1 - 4B	Raghavan and Venkatasubban (1940)
		2n = 20, 30, 40	Griffrida (1950)
		2n = 20	Mugini (1953, 1956)
		2n = 20, 30, 40, 60	Battaglia (1957, 1964)
		2n = 40	Sato (1934)
		2n = 40	Martinoli (1949)
		2n = 40	Larsen (1960 b)
		2n = 40	Waisel (1962)
		2n = 50	Mogini (1974)
16.	U.manura Maire	2n = 20	Battaglia (1957 a)
17.	U.mouretii Bat. et.	2n = 54	Neves (1958)
18.	U.multisetosa Bak.	2n = 20	de Wet (1957)
19.	U.nigritiana Bak.	2n = 20	Mieqe (1960 b)
20.	U.polyantha Blatt.	2n = 20	Kamble & Ansan (1976)
21.	U.polyphylla E.K.F.	2n = 20	Raghavan (1940)
22.	U.pretoriensis Bak.	2n = 20	de Wet (1957)
23.	U.razii (Ansari) Deb et. Lasgupta	2n = 20	Dixit and Yadav (unpublished)
24.	U.rubella Bak.	2n = 40	de Wet (1957)

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Table 2 : (Contd.....)

Sr. No.	Name of the species	Chromosome number	Authors
25.	U.scilla	2n = 40	Sato (1942)
26.	U.tenella Bak.	2n = 20	de Wet (1957)
27.	U.undulata (D.E.S.F.) Steinh.	2n = 20	Martinoli (1948)
28.	U.viridula Bak.	2n = 20	Oyewole (1975)
29.	U.volubilis	2n = 10 + 4 (14)	Jones & Smith (1967/1968)
30.	U.wightiana H.K.F.	2n = 20	

Family Liliaceae forms an ideal material both for cytological and embryological work. Schnarf (1931) have reviewed the embryological literature on this family upto the year 1930. After that Eunus (1950) has given full review of embryological work in Liliaceae. Fairly good amount of embryological work has been done in family Liliaceae which is reviewed by Davis (1966). In family Liliaceae sub-family Scilloideae has been receiving keen attention from both the embryological and the taxonomic point of view (Wunderlich, 1937; Cave, 1953). However, less attension is paid to genus Urginea. Maheshwari (1932) Capoor (1937) studied the embryology of U.indica, however, other species have been neglected embryologically in India as well as outside the country.

Jha, Mitra and Sen (1984) studied in vitro regeneration from bulb explants of U.indica. In 1986, Jha and Sen studied development of U.indica through somatic embryogenesis from long term cultures. Johri (1966) studied the structure of stigma, style and nectaries of U.indica. Thus most of embryological work has been done in U.indica.

As compared to cytological and pharmaceutical work, little work has been done on anatomy of the genus Urginea. The unidimensional growth pattern of the flowering shoot of U. maritima has been reported by Mitrahos et al. (1974). Anatomy of scape and leaf of four species of Urginea has been studied by Kamble and Ansari (1977). No cuticular studies have been done in genus Urginea.

Stray (1954) studied the range of U.maritima in Albania and discussed the practical questions of crop cultivation and the taxonomic quality of its white and red varieties. The phytochemical work on Indian squill suggest that the bufadienolide, glycosides are different in their detailed structure from those of European squill (Seshadri and Subramanian, 1950; Rangaswami and Subramanian, 1954, 1955, 1956; Rao and Deri, 1964 and Krishna Rao and Rangaswami, 1967). But Seshadri and Subramanian (1950) and Chopra and Chopra (1958 a,b) have reported that the commercial samples of the Indian squills are mixtures of U.indica and Scilla indica and most of the above phytochemical investigations are based upon the mixture of two species. Therefore, Jha and Sen (1980 b) analysed bufadienolides of pure samples of U.indica and reported that the Scillarin A is a principal bufadienolides of U.maritima and U.indica and not of Scilla indica.

The developmental cycle and resistance of U.maritima in regard to drought were studied by Pontieri (1957). The factors affecting the seed germination of U.indica are studied by Khare (1978, 1978-a). Patil (1981) studied the agronomical aspects of U.indica. Gentry et al. (1987) have studied the chemistry, propogation and marketing of U.maritima (Red squill). Their studies indicate that U.maritima could be a profitable crop on the dry farmed grain lands of Southern California.

Gene mutations in U.maritima were studied by Carmela (1950). Effect of various treatments on meiosis were studied by

Ayyangar (1962, 1964 a,1965, 1966, 1969). The artificial induction of polyploidy by low and high temperatures in U.indica was noted by Murthy and Sampathkumar (1968).

The pigments of the U.maritima have been studied by Vega (1963), Vega & Fernandez (1964 a,b, 1969 and 1972) and Fernandez et al. (1972, 1974, 1975, 1976, 1977). Vega (1976) detected some 35 flavonoids from U.maritima. Some of them have been identified by Fernandez et al. (1977) and for the first time reported glycoflavons and dihydroflavonols from the family Liliaceae. The flavonoids and the cardiotonic compounds of U.maritima were separated by Vega and Fernandez (1969).

Stoll et al. (1927) have described the isolation of two substances from squills, one apparently pure crystaline Scillaren A and the other an amorphous complex consisting probably a mixture of two glycosides, scillaren B. Fairly good amount of phytochemical work has been done on U.maritima an European squill and U.indica, Indian squill.

Pharmacological studies of U.maritima, U.maritima var. pancratium and U.undulata have been carried out by El-Kiey et al. (1964). They have also studied glycosides, carbohydrates and lipid contents of the above species (El-Kiey et al. 1965, 1967).

Wartburg et al. (1968) have reported two other glycosides as Scilliphaeoside and glycoscilliphaeoside from U.maritima. Louw (1949) reported two new cardiac glycosides as rubellin and

transvaalin in U.rubella and U.burkei respectively. Shimada et al. (1979) isolated six cardiotonic steroids from U.altissima.

Karawya et al. (1973) have given two colorimetric and one spectrophotometric methods for the quantitative estimation of cardic glycosides of squill. Rangaswami and Rao (1974) gave a more elaborate method for isolation of Scillarin A from Indian squill. Steidle (1965) have described a method for the isolation of proscillaridin from Scillarin A. Casado et al. (1977) have given a method to increase the yield of proscillaridin from U.maritima. Crabtree et al. (1942, 1947) have described a method for the fortification of red squill powder. A TLC spectrophotometric method for the essay of scillaroside and scillaren A have been given by Balbaa et al. (1979).

Dhar et al. (1968) studied the antiprotozoal, hypoglycaemic and anticancer properties of U.indica. Seth (1949) have given the process to prepare sizing gum from U.indica. The properties of mucilage of U.indica bulbs have been studied by Beri and Pharsi (1974). Patil (1981), and Patil (1984) have analysed the organic and inorganic constituents of U.indica. Patil and Torne (1980, 1981, 1981 a,b) have studied seasonal variation of total glycosidal content and vitamin content of U.indica. Jha and Sen (1981, 1982, 1983-c and 1984-a) have studied the principal bufadienolide, their seasonal variations with respect to cytotypes and chromosomal races of U.indica in in India.

Medicinal uses of *Urginea* species are known since long back. Squill was valued as a medicine in early classic times and has eversince been employed by physicians. Oxymel of squill used for coughs was invented by Pythagoras who lived in the sixth century before christ. It is mentioned by Theophrastus in third century before christ and was known to ancient Greek physicians. The different properties and medicinal uses of different species have been described by many workers such as Kirtikar and Basu (1934), Stoll and Keris (1952), Seth (1949), Rossi (1952), Agharkar (1953), Chopra and Chopra (1958 a,b), Upholf (1959), Dhar *et al*. (1968), Malhotra and Moorthy (1973), Lewis (1977), Martindale (1977), Bhandari (1978), Grieve (1978), *U.maritima* is a good rodenticide (Gentry and Verbiscar, 1987).