II - Review of Literature

The family Amaryllidaceae comprises about 85 genera and 1100 species (Ahmedullah and Nayer, 1986), distributed in warm and temperate regions of the world. It is one of the large family of monocotyledons of great horticultural importance. Bentham and Hooker (1883) placed it under series Epigynae, Engler in Liliflorae, Hutchinson (1959) in Amaryllidales, Takatajan in Liliales and Dahlgren in Asparagales. Cronquist (1981), merged the family into Liliaceae and placed under Liliales. According to Cronquist (1981), except position of ovary family Liliaceae and Amaryllidaceae are very close to each other and family Amaryllidaceae does not stand as separate family. others however have recognized it as a separate family. Family Amaryllidaceae is closely related to Liliceae and Iridaceae.

The family is very interesting from cytotaxonomic point of view. Hutchinson (1959) divided the family into 13 tribes. Hutchinson included all the petaloid monocots with umbel inflorescence under the family Amaryllidaceae, which is also supported by other taxonomists, anatomists and cytologists (Mckelvey, 1933, Whitakar, 1934 and Singh, 1972). Important taxonomic works on the family include that of Baker (1878, 1888), Herbert (1837), Pax and

Hoffmann (1930), , Traub (1938, 1963). Considerable amount of work on cytotaxonomy in the family has been done of which important one are that of Bose (1962), Khoshoo and Raina (1971), Flory (1977), Lakshmi (1981). Bose (1962) studied cytology of the family with reference to taxonomy. Khoshoo and Raina (1971), Flory (1977) studied chromosome evolution in Amaryllidaceae and stated that hybridization is playing an important part in the evolution of the Amaryllidaceae. Khoshoo and Raina (1971) studied role of mitotic instability in tracing evolution in Crinum, Hymenocallis and Zephyranthus. Lakshmi (1981) studied karyomorphology of 8 genera of the family to assess the systematic position of those genera. Her studies showed that the genus Alstroemeria and Curculigo are distinctly different from one another and also from rest of the genera suggesting their separation into distinct families.

Arroyo and Culter (1984) studied the anatomical features of over 200 species of Amaryllidaceae to understand evolutionary and taxonomic aspects of the internal morphology of Amaryllidaceae. The cuticular studies on 19 species of Amaryllidaceae (Awasthi and Rawat, 1984) indicated that number of abnormalities like continuous stomata, internal cytoplasmic connections etc. occur in the family.

The genus Crinum belongs to a tribe Crineae of subfamily Amaryllidoideae of Amaryllidaceae (Engler and Prantl 1930; Hutchinson, 1959). The number of species reported for the genus by various workers varies from 60 to 165 viz. 60 (Hooker, 1894), 164 (Koshimizu, 1938), 80-100 (Bailey, 1949), 165 (Wealth of India, 1950), 75 (Cooke, 1958), 148 (Traub, 1962), 100 (Lawerence, 1968), 80-90 (Thistleton-Dyer, 1979), 150 (Wahlstrom and Laane, 1979), 70 (Kirtikar and Basu, 1984), 100-110 (Willis, 1985). It indicate the taxonomic difficulties in delimiting and recognition of the species.

Species of Crinum are mainly distributed in tropical and subtropical regions of both hemispheres. A large concentration of species is found in tropical Africa, Asia, Australia and America. About 57% species occur in Africa while 22% occur in India (Koshimizu,, 1938). According to Laurent (1972) include about 173 species of which 81 species are found in Africa. About 33 species occur in South Africa alone (Verdoorn, 1973). Africa seems to be a centre of origin and dispersal for the genus Crinum.

Recently an interesting species of Crinum, C. trifidum sp.nov. from Angola differs from all other African species in having filaments shorter than the anthers and 3 - cleft stigma (Nordal, 1979). In India, C. brachynema and C. eleonorae have very short filament as that of African C. trifidum, suggesting close affinities and probably common

Table No.1. Distribution of Crinum sp. in India.

Sr. No.	Name of the Species	Locality
1.	C. asiaticum Linn.	Throughout India
2.	C. defixum Ker-Gawl	Throughout India
	var. defixum	Throughout India
	var. ensifolium	Throughout India
3.	C. latifolium Linn.	Throughout India
	var. latifolium	Throughout India
	var. zeylanica (L)	West India
4.	C. pratense Herb.	Throughout India
5.	C. amoenum Roxb.	Tropical Himalaya Nepal Eastwords, Sikkim
6.	C. stenophyllum	Chotta Nagpur
7.	C. pusillum Bak.	Andaman, Nicobar Islands
8.	C. wattii Bak.	North East India
9.	C. humile Herb.	Throughout India
10.	C. brachynema Herb.	Western Ghats of India (Sahyadri range, Mahabaleshwar Maharashtra)
11.	C. eleonorae Blatt.	Western Ghats of India (Sahydri-range, Mahabaleshwar Maharashtra)
	Forma eleonorae	
	Forma purpurea	
12.	C. woodrowii Bak.	Western Ghats of India (Sahyadri-range, Mahabaleshwar Maharashtra)

ancestry. The genus Crinum is represented by 12 species in India (Karthikeyan, et al. 1989) of which 3 species are endemic to northern western ghats of peninsular India. Crinum asiaticum, C. defixum, C. latifolium and C. pratense are distributed throughout tropical parts of India of which C. defixum found in swampy river banks and C. pratense grows in grasslands of plateaus. C. amoenum is distributed in tropical Himalaya from Nepal Eastwards ascending to 1800 m in Sikkim, C. stenophyllum is restricted to chotta Nagpur and C. pusillum to Andaman and Nicobar Islands. Crinum watti is found in North-East India at about 1200 m height. Crinum humile is distributed throughout India (Table No.1).

The genus Crinum is represented by 7 species in Maharashtra (Cooke, 1958 , Blatter and McCann 1928) of which C. brachynema, C. eleonorae and C. woodrowii are endemic to the state, restricted to hills of Mahableshwar.

Light microscopic studies on pollen of Crinum revealed that the pollen grains are elliptic, dizonocolpate with echinate wall (Suita, 1937; Dutt 1962; Dahlgren and Clifford, 1982; Zavada, 1983; Nayar, 1990). Although the pollen grains are generally monosulcate in the family Amaryllidaceae (Dahlgren and Clifford, 1982), they are disulcate in the tribe Amaryllideae including all the species of Crinum investigated except for C. americanum (Zavada, 1983). SEM studies on pollengrains of C. flaccidum (Howell and Prakash, 1990) revealed that the grains are released singly and are spheroidal, disulcate and 2-celled, and have an echinate exine with small nodules between echinae of the pollen.

Studies on effect of calcium on pollen germination of *Crinum* (Kwack and Kim, 1967; Kwack, 1967) revealed that Ca ions promote pollen germination and pollen tube growth in *Crinum asiaticum*.

Brantjes and Bos (1980) studied the Hawkmoth behaviour and flower adaptation for reducing self pollination in *Crinum jagus* and *Lilium martagon* L. Hawkmoth body comes in contact with stigma first and then stamens, helping cross-pollination. Stigma surface esterase activity and stigma receptivity through a sequence of developmental stages of the pistil was studied in *C. defixum* by Shivanna and Sastri (1981).

Howell and Prakash (1990) reported that *C. flaccidum* flowers are of the classic phalenophilous (mothpollinated) type as also described by Faegri and Vander-Pijl (1979). Ford *et al.* (1979) record that birds sometimes feed on Australian *Crinum* flowers. In *C. flaccidum*, sucrose formed a significant fraction of nectar solids (Howell and Prakash, 1990). The bagging experiment indicated that *C. flaccidum* is self incompatible (Howell and Prakash, 1990), however, Traub (1963) noted that a form of *C. flaccidum* is self compatible to a limited extent. Similarly Shivanna and Sastri (1981) found that pollentube growth was not arrested in the style of self pollinated flower of C. defixum.

Crinum has many unusal and distinctive embryological features (Merry, 1937; Dutt, 1962; 1970; Toilliez-Genoud, 1965, 1970; Howell and Prakash, 1990). Many unusual and distinctive features of Crinum such as the lack of ovule integuments, apomixis; a differentiated endosperm and naked seed, have been revealed by these embryological studies on African and Asian species of Crinum. Detailed embryological studies (Dutt, 1962; 1970; Howell and Prakash, 1990) revealed that the versatile anthers are tetrasporangiate with secretary tapetum. Successive cytokinesis of microspore mother cells give rise to isobilateral and decussate microspore tetrads. Endothesium develope usual fibrous thickening (Dutt, 1957 a, 1957 b, 1962; Howell and Prakash, 1990). Ovules are ategmic, while female gametophyte development is of polygonum type, endosperm formation is of the nuclear type. In absence of seed coats and the nucellus at maturity, the outer layers of the endosperm become corky following the activity of phellogen. Embryogeny appears to be of Asteroid type. The endosperm is pecular in having developed chlorophyll in cells.

There is close resemblence in anatomical structure of the ovules of C. defixum, C. giganteum, C. asiaticum, C. latifolium and C. flaccidum (Tomita, 1931; Swamy 1946; Dutt 1957 a; 1957 b; 1962; 1970, Toilliez Genoud, 1965). Although the orientation of the ovule of *Crinum* has been variously described as being anatropous, hemitropous, ana-campylotropous or hemi-anatropous (Tomita 1931; Swamy 1946; Dutt 1957 a; 1957 b; 1959, 1962; Toilliez- Genoud 1965), it is difficult to say about the shape of ovule in absence of integuments, micropyle and a free funiculus (Howell and Prakash, 1990). Howell and Prakash (1990) interpret the ovule structure to be derived from the confluence of a number of bilaterally paired ategmic, tenui-nucellar ovules on axile placentae.

The monosporic *Polygonum* type of female gametophyte development appears to be common to all species of *Crinum* (Howell and Prakash, 1990). Based on the observations of Stenar (1925) and Tomito (1930, Dahlgren and Clifford (1982) list a bisporic Allium type of gametophyte development in *C. latifolium*, however, reinvestigation of embryology of the species by Dutt (1959) showed the development to be of *Polygonum* type.

Nuclear type of endosperm development seems to be present in all the species of *Crinum* studied (Howell and Prakash, 1990). Similarly differentiation of phellogen in the outermost layers of the endosperm is a unique and well known feature of *Crinum*. Merry (1937) has shown that cork formation also occurs in response to injury in portions of the endosperm even in the absence of the embryo. In addition to protective role played by cork in absence of seed-coat. Howell and Prakash (1990) described the role of cork in water-borne dispersal by providing buoyancy and forming a impermeable barrier. Dutt (1962) found that most of the seeds of C. defixum had a specific gravity of less than one. Toilliez-Genoud (1970) compares the growth of endosperm with that of tissue on culture media which is limited by volume of container. Some seeds grow to very large size due to uncontrolled growth.

Studies on embryo development have shown that the embryogeny is of Asterad type (Dutt, 1957 b; 1962, 1970; Tomita, 1931 ; Howell and Prakash, 1990), however Johansen (1950) reported the onagrad type of embryo development in C. capense.

Some abnormalities such as multiple embryo sacs in C. flaccidum, apomixis and adventive polyembryony have been reported in Crinum species (Dutt 1962; Wahlstrom and Laane, 1979; Howell and Prakash, 1990).

Crinum erubescens produces highly variable seeds (0.1 -66.5 gm) which are dispersed by water (Manasse, 1990). Growth of seeds was found to be positively associated with seed size in different habitat types. The air canal in the seed has been reported in C. giganteum (Toilliez Genoud 1965) which presumably assists in the respiration of the seed. According to Howell and Prakash (1990) the aircanal must be present in the seeds of all Crinum spp., but the feature has been over looked by earlier workers. The

Table No.2. Different Chromosome Number Reported in *Crinum* Species

Sr. No.	Species	Chromosome No.	Reporter
1.	*Crinum abyssinicum* Hochst.	22	Dolcher, 1950, (Darlington & Wylie 1956) Sharma and Bhattacharya 1956
2.	*C. ammocharoides* Bak.	22	Sharma and Bhattacharya 1956
3.	*C. amoenum* Roxb.	22	Sharma and Ghosh 1954, Bose, 1962
4.	*C. asiaticum* L.	22	Sharma and Ghosh, 1954 Bose, 1962, Khoshoo and Raina 1968, Zaman *et al*.. 1977a, Vij *et al*. 1982
5.	*C. asiaticum* var. *japonicum* Bak.	22	Nagao and Takusagawa, 1932 Matsuura and Sato, 1935; Inariyama, 1937; Sato, 1938; Schmidhauser, 1954
		33	Fujishima, 1975
6.	*C. asiaticum* var. *sinicum*	22	Inariyama, 1937
7.	*C. augustum* Roxb.	22	Bose, 1965
		32 or 33	Miege, 1962
		33	Raina and Khoshoo, 1971 a
8.	*C. bulbispermum*	72	Gouws, 1949
9.	*C. bulbispermum* (capense)	22 + 22 F	Sato, 1938
10.	*C. bulbispermum* (Burm.) Mil-Red.et Schw.	66	Fernandes and Neves, 1961

.....Contd..2

11.	*C. buphanoides* Bak.	22	Gouws, 1949 (Darlington and Wylie, 1956)
12.	*C. capense*	22	Sato, 1938
13.	*C. crispum* Phillips.	22	Gouws, 1949 (Darlington and Wylie, 1956)
14.	*C. careyanum*	22	Raina and Khoshoo, 1971 a
15.	*C. aff. crassicaule* Bak.	22	Jones and Smith, 1967
16.	*C. campanulatum* Herb.	22,32, 33,34	Raina and Khoshoo, 1971 a Walt *et al*. 1970
17.	*C. defixum* Ker-Gawl	22	Tandon and Mathur, 1966; Raina and Khoshoo, 1971 a; Subramanian, 1979
18.	*C. delagoense* Verdoorn (*C. forbesianum*)	22,54 55,56	Jones and Smith, 1967; Walt *et al*. 1976
19.	*C. erubescens* Ait.	22	Raina and Khoshoo, 1971 a
20.	*C. fimbriatulum* Herb.	22	Raina and Khoshoo, 1971 a
21.	*C. forbesianum* Herb.	22	Gouws, 1949
22.	*C. forbesii* (Lindl) Schult. f.	22	Walt *et al*. 1970
23.	*C. glaucum* A. Chev.	22	Wahlstrom and Laane, 1979
24.	*C. grandiflorum*	22	Sato, 1942
25.	*C. graminicola* Verdoorn	22	Gouws, 1949; Jones and Smith, 1967; Walt *et al*., 1970
26.	*C. gigas* Nakai	22	Inariyama, 1937; Suita, 1937; Sato, 1938; Fujishima, 1975
		24	Suguira, 1936
27.	*C. kirkii* Bak.	22	Raina and Khoshoo, 1971 a
28.	*C. kunthianum* M. Roero.	22	Sharma and Bhattacharya, 1956; Raina and Khoshoo, 1971 a
29.	*C. lineare* Linn. f.	22	Suita, 1937; Sato, 1938; Raina and Khoshoo, 1971 a; Walt *et al*. 1970

.....Contd..3

30.	*C. lineare* var. *album*	22	Sato, 1938
31.	*C. longifolium* Roxb.	22	Sharma and Bhattacharya, 1956; Fujishima, 1975
32.	*C. longifolium* var. *album* Hort.	22	Fujishima, 1975
33.	*C. macowanii* Bak.	22	Jones and Smith, 1967; Nordal *et al*. 1977; Wahlstrom and Laane, 1979
		44	Walt *et al*. 1970
34.	*C. moorei* Hook.	22	Sato, 1938; Dolcher, 1950; Raina and Khshoo, 1971 a, Walt *et al*. 1970; Lakshmi, 1980
35.	*C. moorei* var. *album*	22	Sato, 1938
36.	*C. macrantherum*	33	Sato, 1938
		18	Suguira 1931 (Flory and Yarnen 1937)
		24	Suguira, 1931 (Flory and Yarnen 1937)
37.	*C. Mrs. Bosanquot* (hybrid)	22	Sharma and Bhattacharya, 1956
38.	*C. namaquense* Bak.	22	Sharma and Bhattacharya, 1956
39.	*C. natans* Bak.	22	Wahlstrom and Laane, 1979
40.	*C. octobilis* (*C. macrantherum*)	22	Sato, 1942
41.	*C. ornatum* (Linn.f) Bury	24,44	Nawankiti, 1985
		66,87 88	Jonesand Smith, 1967
42.	*C. papillosum* Nord.	22	Nordal *et al*. 1977
43.	*C. podophyllum* Bak.	22	Jones and Smith, 1967
44.	*C. polyphyllum* Bak.	22	Gouws, 1949; Walt *et al*. 1970
		44	Raina and Khoshoo, 1971 a
45.	*C. powellii* Hort.	22	Dokher, 1950; Raina and Khoshoo, 1971 a; Fujishima, 1975

46.	C. powellii Hort. var. album	22	Sharma and Bhattacharya; 1956
47.	C. purpurascens Herb.	22	Wahlstrom and Laane, 1979
48.	C. rattrayii Hort.	22	Sato, 1938; Sharma and Bhattacharya, 1956
		33	Bose, 1965
49.	C. rautenianum Schinz .	22	Jones and Smith, 1967
50.	C. spp. n	22	Gouws, 1949
51.	C. sp.	22	Sharma and Ghosh, 1954
52.	C. sp.	22	Jones and Smith, 1967
53.	C. sp.	22	Jones and Smith, 1967
54.	C. sp.	22	Jones and Smith, 1967
55.	C. sp.	22	Jones and Smith, 1967
56.	C. sp. nova	22	Walt et al. 1970
57.	C. stenophyllum Bak.	22	Zaman et al. 1977 b
58.	C. stuhlmannii Bak.	22	Nordal et al. 1977
59.	C. superbum Roxb.	22	Sharma and Ghosh, 1954
60.	C. scabrum Herb.	22	Schmidhauser, 1954; Raina and Khoshoo, 1971 a
		44	Jones and Smith, 1967
61.	C. variabile (Jacq.) Herb.	22	Walt et al. 1970
62.	C. yamense Defl.	22	Snoad, 1952
63.	C. zeylanicum	22	Sharma and Bhattacharya, 1956; Raina and Khoshoo, 1971 a; Nordal et al. 1977; Wahlstrom and Laane, 1979, Patwary and Zaman, 1981
		33	Wahlstrom and Laane, 1979
64.	12 Cultivars	22,33 44,66	Raina and Khoshoo, 1971 a,

Table No.3. B-Chromosome Reports in Crinum Species

Sr. No.	Species	Chromosome No. + B Chromosome	Reporter
1.	C. asiaticum L. var. japonicum Bak. (albino)	22 + 0 - 6B 22 + 1 - 4B	Fujishima, 1975 Fujishima, 1975
2.	C. capense Herb.	22 + 2B	Sato, 1938
3.	C. graminicola verdoorn	22 + 3 - 4B	Jones and Smith, 1967
4.	C. longifolium Roxb. (C. Capense)	22 + 2B	Inariyama, 1937
5.	C. macowanii Bak.	32 + 3B 33 + 2B 33 + 3B 44 + 3B 44 + 6B	Wahlstrom and Laane, 1979
6.	C. pedicellatum Pax. (C. johnstonii Bak.)	22 + 1 - 2B 44 + 2B	Jones and Smith, 1967
7.	C. sp.	22 + 1B	Jones and Smith, 1967
8.	C. sp.	44 + 1B	Jones and Smith, 1967
9.	C. sp.	44 + 2B	Jones and Smith, 1967
10.	C. sp.	66 + 2B	Jones and Smith, 1967
11.	C. zeylanicum L.	22 + 9B	Wahlstrom and Laane, 1979

non-dormancy and water storing ability of seed of Crinum species is reported since long back (ISaac and McGillivary, 1965).

Extensive amount of cytological work has been done on Crinum species. About 50% species (53 spp.) of Crinum have been studied cytologically. Chromosome numbers reported for various species by different workers is shown in Table No.2. Acessary chromosomes reported for various species is shown in Table No.3.

About 50 species of Crinum showed somatic chromosome 2n = 22 (Table No.2). The diploid chromosome complement and gross similarity in the morphology of the Crinum species investigated indicate that the genus Crinum represent a homogeneous assemblage (Sharma and Bhattacharya, 1956). In fairly stable genus Crinum with base chromosome numbers X = 11, (Sharma and Bhattacharya, 1956), diploid species predominate (Sato, 1938; Sharma and Ghosh, 1954; Mangenot and Mangenot, 1958; Bose, 1965; Raina, 1978; Vijayavalii and Mathew, 1992).

Studies on karyomorphology of various species of Crinum (Sharma and Ghosh, 1954; Sharma and Ghosh, 1954, Mangenot and Mangenot, 1958; Bose, 1965; Raina, 1978; Vijayavalii and Mathew, 1992) have revealed a basic similarity in their chromosome phenotypes. All the species of diploid Crinum possess a pair of large metacentric chromosomes, five pairs of medium sized submedian chromosomes, a single and highly characteristic submedian Sat chromosome pair and four pairs of median and submedian chromosomes. A general karyotype formula for the genus can be represented as 1L + 5 M + 1 M(Sat) + 4S (Sato, 1938; Dolcher, 1950; Jones and Smith, 1966). This formula represent a basic constitution of chromosomes.

The principal basic chromosome number x=11 is reported for all the species investigated (Inariyama 1937; Sato, 1938; Gouws, 1949; Dolcher 1950; Sharma and Ghosh, 1954; Sharma and Bhattacharya, 1956; Fernandes and Neves, 1961; Bose, 1965; Raina 1968; Raina and Khoshoo, 1971; Raina, 1978; Lakshmi, 1980 and Vijayavalli and Mathew, 1992); however, Jones and Smith (1967) have shown that in C. ornatum 2n = 24 and X = 12, the only other base number for the genus, derived from X = 11 by chromosome repatterning, probably centromere and mid-division.

Polyploidy have been reported for about 8 species of Crinum viz. C. asiaticum 2n = 33 (Fujishima, 1975; Vijayavalli and Mathew, 1992), C. augustum 2n = 32-33 (Miege, 1962; Raina and Khoshoo 1971 a), C. bulbispermum 2n = 66 (Fernandes and Neves, 1961), C. campanulatum 2n = 33-34 (Walt et al. 1970), C. macrantherum 2n = 33 (Sato, 1938), C. rattrayii 2n = 33 (Bose, 1965), C. scabrum 2n=44 (Jones and Smith, 1967 and C. zeylanicum 2n=33 (Wahlstrom and Laane, 1979). Triploids are observed in 5 species while C. scabrum is tetraploid and C. bulbispermum is hexaploid. Chromosome for the 2n = 72 is reported in C. bulbispermum (Gouws, 1949) Jones and Smith (1967) brought-out wide spread chromosomal discontinuity within species in euploid series and reported common occurence of polyploids and B-chromosomes in the Crinum.

B-chromosomes ranging from 1 to 9 have been reported in different species of Crinum viz. C. asiaticum L. var. Japonicum, 2-6 B (Fujishima, 1975), C. capense 2B (Sato, 1938), C. graminicola 3-4B (Jones and Smith, 1967), C. macowanii 2-6B (Wahlstrom and Laane, 1979), C. pedicellatum 2B (Jones and Smith, 1967), and C. zeylanicum 9B (Wahlstrom and Laane, 1979).

Aneusomaty is a common feature in bulbous Liliaceae and Amaryllidaceae. Aneusomaty is reported in number of Crinum species (Sharma and Bhattacharya, 1956; Sharma, 1956; Jones and Smith, 1967; Khoshoo and Raina, 1970; Raina and Khoshoo, 1970).

All the species are used medicinally by the people of India; but the best understood species is Crinum asiaticum Linn. The bitterish leaves extract mixed with Castor-oil, useful for repelling whitelows and other inflammations. The juice of the leaves is employed for the ear-ache (Ainslie, 1826; Watt, G., 1972; Ambasta, 1986). The bulbs of the C. asiaticum (Kirtikar and Basu, 1984) are pungent, bitter, vulnerary, laxative, carminative, antipyretic, useful in biliousness, strangury, snakebite, urinary troubles, toothache bad smell of perspiration. The fresh root is alone directed to be used in the 2 official preparations of pharmacopoeia of India, namely "succus crini" and "Syrupus crini".

The bulbs of Crinum defixum ker-Gawl are emetic, nauseant, emollient and diaphoretic. It is used in the treatment of burns, witlow and carbuncle. Poisonous to cattle (Kirtikar and Basu, 1984; Ambasta, 1986).

The bulbs of C. latifolium are highly acrid. Crushed and roasted bulbs are used as tubefacient in rheumatism (Kirtikar and Basu, 1984). Leaf juice is used in ear-ache (Ambasta, 1986).

The bulbs of C. zeylanicum are extremely acrid and are used for blistering cattle (Watt, G. 1972). However, dried sliced roots of Crinum sp. are also an efficient emetic (Watt, G; 1972).

Mechanical extracts of freshgreen leaves of C. bulbispermum and C. defixum were tested for their antifeeding, repellent and insecticidal properties against 3rd instar larvaeof mustard sawfly (Sudhakar et al. 1978; Pandey et al. 1977, 1979).

Table No.4. Phytochemical Analysis of Crinum Species

Sr. No.	Species	Alkaloid Extracted	Reporter
1.	*C. asiaticum*	N-demethylgalanthamine; Lycorine; Crinamine, Methyl linoleate; Stigmasterol; 4; 5- etheno-8; 9-methylenedioxy-6-phenanthridone	Kobayashi *et al.* 1976. Takagi, Shizshuzo *et al.* 1977.
		Palmilycorine; Lycoriside	Ghosal *et al.* 1985
		Isocraugsodine	Ghosal *et al.* 1988
2.	*C. americanum*	Oxocrinine, Crinine; Flexinine O-acetylcrinine; Lycorine; hippadine Pratorinine; Pratorimine; Pratosine, Ungeremine, Trispheridine.	Ali *et al.* 1986
		LinoLeic and Palmitic acids	EL-Hafiz *et al.* 1986
3.	*C. augustum*	Lycorine, buphanisine augustine; 6-α and 6-β-hydroxybuphanisine and 6-B-hydroxycrinine Crinamine.	Ali *et al.* 1981, 1983; Frahm *et al.* 1981; Ali *et al.* 1981.
		Linoleic and Palmitic acids 2,4'4' trihydroxychalcone; (-)-4^{+}-hydroxy-7 methoxy-8-methyl-8 methyl flavan	EL-Hafiz *et al.* 1986; 1991

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	Tricontanol, Sitosierol-B-D-glucoside alcohols	EL-Hafiz et al. 1991
4. C. bulbispermum	Crinamine, Powelline Hippadine, Crinidine, Vittatine, Crinamine, Powelline; Hippacine, Lycorine, B-II 1-0-acetyllycorine(6), Hamayne (8), Undulatine (13), and Cherylline (14) Crinamidine (16), 0-acetylorinine (17); bowldensine (19)	EL-Moghizi and Ali, A.A., 1976, 1977; Amico et al. 1979; Kobayashi, Shiger U. et al. 1984
5. C. defixum	5- -hydroxyhomolycroine	Mathur et al. 1982; Jeffs, Peter, 1985
6. C. erubenscens	Criwelline; Coranicine; Powelline, buphanidrine; Flexinine; Crinamidine, Nerbowdine; N-demethylmacronine; Macronine; deacetylbowdensine	Wildman et al. 1969
7. C. latifolium	3-0-acetylhamayne (11) Crinamine (3); Powelline (4); Crinine (5); 1-0-acetyllycorine (6); hamayne (8); Undulatine (13); Cherylline (14)	Kobayash, Shiger et al. 1984
	Glucan 'A', Glucan 'B'	Tomoda Masashi, et al. 1985; Jeffs,Peter,1985
	Lycorine, 2-epilycorine; 2-epipancrassidine	Ghosal et al. 1989
8. C. zeylanicum	Lycorine(I); 3-acetylhamayne(III); 6-hydroxycrinamine(IV); Hamayne (V)	Tsuda et al. 1984

Considerable amount of phytochemical and Pharmacognocial work has been done in genus Crinum (Wildman et al. 1967; EL Moghazi and Ali, 1976, 1976; Rogues et al, 1976; Kobayashi et al 1976; Takagi and Masal, 1977; Tanaka et al. 1979; Amico et al. 1979; Rogues et al. 1980, Ali et al. 1981; Frahm et al. 1981; Ali et al. 1981; Mathur et al 1982; Ali et al. 1981, Kametani et al. 1982; Ali et al. 1983; Singh, and Maheshwari, 1983; Kobayashi et al. 1984; Tsuda et al. 1984; Ali et al. 1984; Tomoda et al. 1985; Peter et al. 1985; Ghosal et al. 1985; Ali et al. 1986; EL-Hafiz et al. 1986; Ghosal et al. 1988a, 1988b; 1989; Muraveva and Popova, 1989; EL-Hafiz et al. 1990; 1991). The different alkaloids extracted from Crinum species is depicted in Table No.4.

Few diseases on Crinum have been reported by Selochnik (1974); Sharma (1975), Pares (1979).