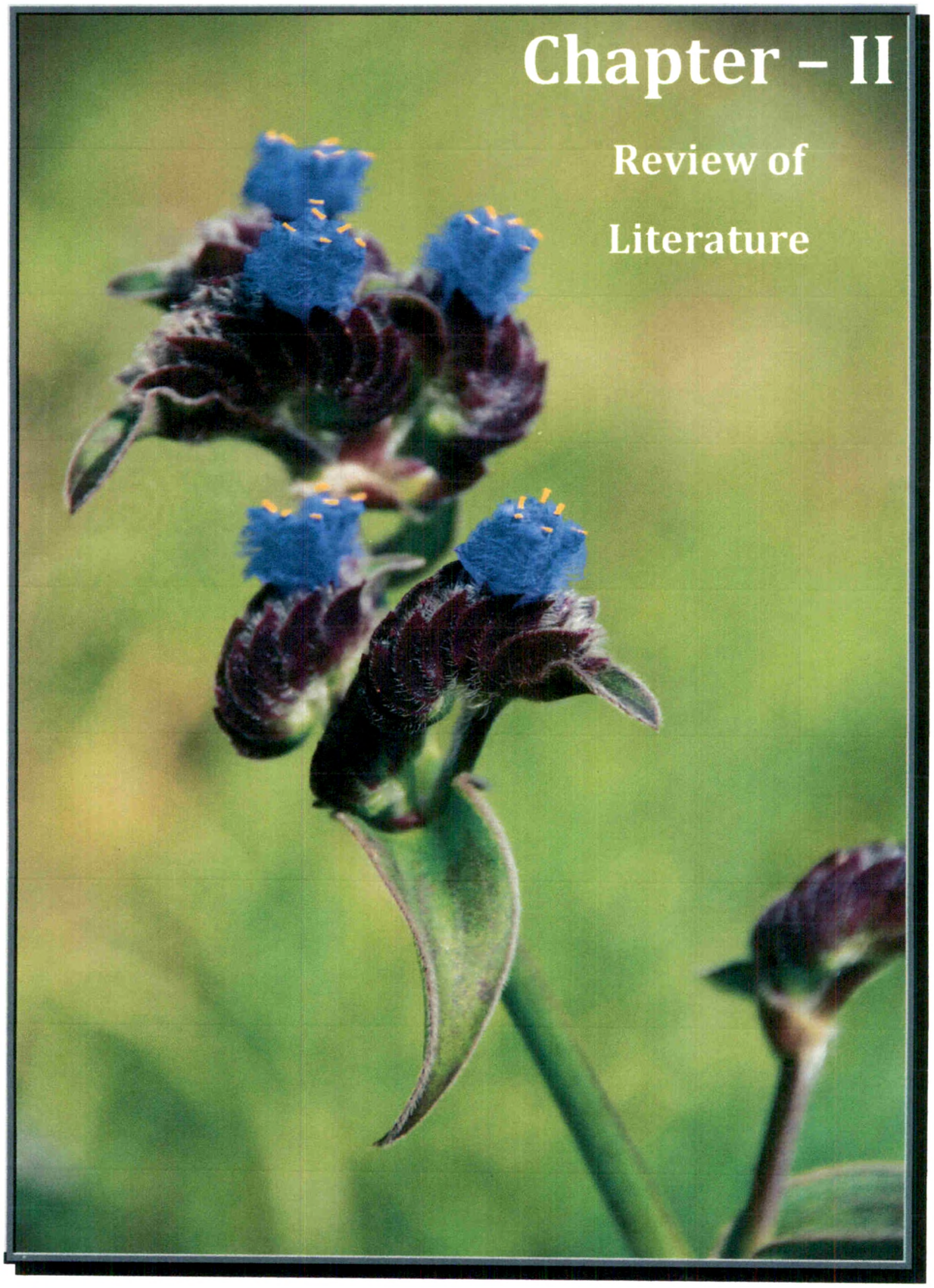

Chapter – II

Review of Literature

A. COLLECTION, IDENTIFICATION, DISTRIBUTION AND PRESENT STATUS OF FAMILY COMMELINACEAE FROM STUDY AREA:

The spiderwort family Commelinaceae comprises about 41 genera and 640 species distributed mostly in the tropical and warm temperate regions of the world (Faden, 2000). Peninsular India and the foothills of Himalayas to Thailand and Southwestern China is major center of diversity for Commelinaceae (Faden, 1998). Hooker (1892) reported 7 genera and 76 species belonging to the family Commelinaceae. However, Karthikeyan and Jain (1989) reported 14 genera and 85 species for India. It includes 19 species endemic to the India (Rao, 1994). Fischer (1931) reported 6 genera and 48 species for Madras Presidency and Cooke (1903) reported 6 genera and 33 species for Bombay Presidency. According to Ahemdulla and Nayar (1987) there are 17 species and 3 infra-specific taxa of the family endemic to Peninsular India. For Maharashtra, Sharma *et al.* (1996) reported 10 genera and 51 species. Recently Almeida (2010) could report 11 genera and 48 species for the state of Maharashtra.

Subsequent to Hooker's (1892) treatment of the family in Flora of British India, which is based on Clarke's (1881) worldwide monograph of the family, there has been no revision of the Indian Commelinaceae. Most of the recent studies pertain to purely cytological or cytotaxonomic aspects of a few species (Sharma, 1955; Sharma and Sharma, 1958; Kammathy and Rao, 1961a, 1961b and 1964; Raghavan and Rao, 1961 and 1965; Shetty and Subramanyam, 1962; Panigrahi and Kammathy, 1963; Rao, 1964 and 1966; Rao and Kammathy, 1962 and 1966 and Rao *et al.*, 1966 and 1972). The other works includes the treatment in regional floras by various authors, like Cooke (1903), Fischer (1931), Gandhi (1976), Matthew (1988 and 1999) and Manilal and Shivarajan (1982). The only other work, after Hooker (1892), that covers the family for the whole India is the

recent enumeration published by Karthikeyan *et al.* (1989) in the Florae Indicae Enumeratio Monocotyledonae. Thus there has been no real revision this family for whole of India since Hooker.

B. ANATOMICAL STUDIES:

Anatomically Commelinaceae is very isolated group. Shoot construction is unlike that of any other monocotyledon and involves a regular pattern of growth which includes the development of nodal vascular plexi. Anatomical studies on various members of Commelinaceae have been done by many workers like Campbell (1881), Caro (1903), Holm (1906), Rohweder (1963) and Tomlinson (1964). The value of anatomical data in the classification of Commelinaceae has been reviewed by Tomlinson (1964) and according to him anatomical information may be very helpful in genera diagnosis, but subject needs much more detailed investigation. The vegetative anatomy of the family has been summarized by Tomlinson (1966 and 1969).

C. PALYNOLOGICAL STUDIES:

There has been little work on palynology of this family. Pollen wall structure studied earlier for eleven taxa such as *Callisia* and *Rhoeo* (Rowely, 1959), *Tradescantia* (Horvat, 1966; Mepham and Lane, 1969 and 1970; Rowely, 1959 and 1975), *Coleotrype, Commelina* and *Tinantia* (Poole and Hunt, 1980) and *Tripogandra* (Mattson, 1976). The pollen wall structure of *Dichorisandra thyrisiflora* was described by Zavada, (1983). Pollen is predominantly monofalcate; however, triaperturate pollen is known in genera *Commelinata* and *Tinantia* (Rowley, 1959). The pollen wall structure was studied by Rowley (*loc. cit.*) in *Callisia,* Horvet (1966) in *Tradescantia*, and Zavada (1983) in *Commelina.* Poole and Hunt (1980) correlated pollen morphology with taxonomy of the

Commelinaceae. According to them the tectum is periodically transverse by small perforations, the foot layer is thick to very thin and may be interrupted in some taxa. Zavada, (1983) studied evolutionary trends on the basis of comparative morphology and wall structure of pollen in Commelinaceae.

D. CYTOLOGICAL STUDIES:

Among the monocot families Commelinaceae found to be very ideal for cytological studies, because of their larger nuclei and chromosomes and ease with which material takes the usual cytological stain. It forms classical material for the cytological studies and classroom work. The family is well studied cytologically by Harvey (1900); Darlington (1929); Anderson and Sax (1936); Su-Husen Wu (1942); Islam and Baten (1952); Simmonds (1954); Sharma (1955); Morton (1956); Sharma and Sharma (1958); Rao *et al.* (1961a, 1961b, 1964, 1965, 1968, 1970); Shetty and Subramanyam (1961 and 1962); Panigrahi (1961, 1962, 1963, 1964); Malik (1961); Ganguly (1964); Lewis (1964); Lewis and Tadesse (1964); Rao (1970); Jones and Kukkonen, (1971); Jones and Jopling (1972); Zaman and Ahmed (1972); Bhattacharya, B. (1975) and Faden and Suda (1980). A critical review on the Biosystematics of Indian Commelinaceae with chromosome pattern and evolutionary trends has been discussed by Rao *et al.* (1970). Details of earlier chromosome number report are given in **Table 1**.

E. SEED MORPHOLOGY:

Seed dimorphism structure in African genus *Aneilema* was studied by Faden (1991). Seed variation in East African species of *Aneilema* was studied by Brenan (1952) and Morton (1966). Little work is done on the seed morphology of other genera of Commelinaceae like *Floscopa* (Brenan, 1952 and 1961) and *Tripogandra* (Handlos, 1970). Majority of the Commelinaceae are not studied by any worker for seed morphology.

F. CLADISTIC ANALYSIS OF GENUS MURDANNIA:

The preliminary estimation of evolutionary relationships within the Indian species of genus *Murdannia* was the objective of the present work. The cladistic analysis that includes all the taxa described herein for Western Ghats of Peninsular India and most of them are endemic to the Western Ghats. Although phylogenetic relationships within order Commelinales, subclass Commelinidae (Ginish and Evans *et al.*, 1999) and within the Commelinaceae (Evans *et al.*, 2000 and 2003) have been examined. However, no previous works has evaluated the pantropical genus *Murdannia* in a modern phylogenetic context. Most recently used numerical methods for the estimation of phylogeny are based on principles originally presented by Hennig (1966) and Wagner (1961 and 1962).

Table-1: Details of earlier chromosome number report

PECI S NO.	NAME OF PLANT	*n*	2*n*	REFERENCES
		***Commelina* Linn.**		
1	*C. albescens* Hassk.	30		Lewis and Taddesse (1964; for Ethiopian races)
		15		Raghavan, cf. Rolla Rao, Kammathy and Sundara Raghavan (1968).
2	*C. attenuata* Koen. ex Vahl	24		Kammathy and Rolla Rao, (1968).
3	*C. benghalensis* Linn.	11	22	Ganguly, (1946); Sharma, A. K. (1955); Kammathy, and Rolla Rao, (1961 a); Shetty, and Subramanyam, (1962); Panigrahi, and Kammathy, (1964).
		11+ 0 - 2B		Malik, (1961).
		11, 22		Lewis, (1964); Lewis, and Taddesse, (1964; for African populations)
		24		Anderson, and Sax, (1936).
			28, 56	Morton, (1956).
			30	Harvey, (1966).
			c. 68	Darlington, (1929).
4	*C. clavata* C. B. Cl.	45		Kammathy, and Rolla Rao, (1961a); Raghavan, and Rolla Rao,(1965)
5	*C. diffusa* Burm. f. (*C. nudiflora* auct. Non. Linn)		56	Darlington, (1929).
			30	Simmonds, (1954).
		15	30	Sharma, (1955); Kammathy, and Rolla Rao, (1961 a)
		15		Raghavan, and Rolla Rao, (1961); Panigrahi, and Kammathy, (1964); Kammathy, and Rolla Rao, (1964); Lewis, (1964, African races); Lewis, and Taddesse, (1964; for Ethiopian races)
			28	Morton, (1956).
			35, 42	Sharma, A. K. (1955).
6	*C. ensifolia* R. Br. (*C. undulata* C. B. Cl. Non R. Br.)var. *setosa* C. B. Cl.	45		Kammathy, and Rolla Rao, (1961a, 1964).
7	*C. forskalei* Vahl.		28	Morton, (1956).
		14		Malik, (1961).
		15		Raghavan, and Rolla Rao, (1961); Kammathy, and Rolla Rao, (1961 a); Lewis, (1964, African races)
		15	30	Shetty, and Subramanyam, (1962).
8	*C. hasskarlii* C. B. Cl.	45		Raghavan, and Rolla Rao, (1961); Kammathy, and Rolla Rao, (1964).
9	*C. indehiscens* Barnes	75		Kammathy, and Rolla Rao,(1964).

10	*C. imberbis*Ehrenb. ex Hassk. (=*C. jacobii* Fischer)	15	30	Kammathy and Rolla Rao, (1961 a)
		15		Shetty, and Subramanyam, (1962).
		15		Lewis, (1964, African population).
			30	Lewis, and Taddesse, (1964; for African races)
11	*C. kotschyi* Hassk.	15		Kammathy, and Rolla Rao, (1964).
12	*C. longifolia* Lamk. (= *C. salicifolia* Roxb.)	45	75	Sharma, (1955); Kammathy, and Rolla Rao, (1964).
13	*C. maculata* Edgew. [*C. paludosa* Bl. Var. *viscida* (C. B. Cl) *Rao et Kammathy, pro parte]*	15	30	Panigrahi, and Kammathy, (1964; under *C. paludosa* var. *viscida*)
14	*C. paleata* Hassk.	45		Kammathy, and Rolla Rao, (1961a, 1964).
15	*C. paludosa* Bl. (*C. obliqua* Buch.- Ham.)		100, 150	Sharma, (1955)
			45	Sharma, A. K. and Sharma, A. (1958)
		30	60	Sharma, A. K. and Sharma, A. (1958)
		30		Kammathy and Rolla Rao, (1961a, 1964); Panigrah and Kammathy, (1964)
16	*C. sikkimensis* C. B. Cl.	30	60	Sharma, A. K. and Sharma, A. (1958)
		45		Panigrahi, and Kammathy, (1964); Kammathy, anc Rolla Rao, (1964).
17	*C. subulata* Roth.	15		Lewis, and Taddesse, (1964; for African races)
		30		Raghavan, and Rolla Rao, (1961); Kammathy, and Rolla Rao, (1961a)
18	*C. suffruticosa* Bl.	30		Kammathy, and Rolla Rao, (1961a, 1964); Panigrah and Kammathy, (1964)
19	*C. erecta* Linn. [*C.undulata* R. Br.; *C. Kurzii* C. B. Cl.; *C. paludosa Bl. var. mathewii* (C. B. Cl.) Rolla Rao, et Kammathy; *C. livingstonii* C. B. Cl.]	16		Malik, (1961; under *C. paludosa*); Raghavan, and Rolla Rao, (1961; under *C. paludosa*)
		45, 60		Kammathy, and Rolla Rao, (1961a, under *C. kurzii*)
		45		Kammathy, and Rolla Rao, (1964, under *C. kurzii)*
			56	Morton, (1956, for African races under *C. livingstonii*)
		30		Lewis, (1964, African races under *C. livingstonii*).
Amischophacelus Rolla, Rao et Kammathy				
1	*A. axillaris* (Linn.) Rolla, Rao et Kammathy [*C. axillaris* (L.) Schult. f.]	10		Murthy, (1934); Raghavan, and Rolla Rao, (1961); Kammathy, and Rolla Rao, (1961b).
		10	20	Islam and Baten, (1952); Sharma, (1955); Shetty, and Subramanyan, (1962).

2	*A. cucullata* (Roth.) Rolla, Rao et Kammathy [*C. cucullata* (Roth) Kunth.]	10		Raghavan, and Rolla Rao, (1961); Kammathy, and Rolla Rao, (1961b).
		Belosynapsis Hassk		
1	*B. kewensis* Hassk.	26		Raghavan, and Rolla Rao, (1965)
2	*b. vivipara* (Dalz.) Fischer	26		Raghavan, and Rolla Rao, (1965)
		Cyanotis D. Don		
1	C. adscendens Dalz. [C. tuberosa (Roxb.) Schult. var. adscendens (Dalz.) C. B. Cl.; C. sarmentosa Wt.]	24		Raghavan, and Rolla Rao, (1961, under var. adscendens); Kammathy, and Rolla Rao, (1961b) (under *C. tuberosa*, Gajanoor population)
2	*C. arachnoidea* C. B. Cl. var. *arachnoidea*	12		Kammathy, and Rolla Rao, (1961b).
		12	24	Shetty, and Subramanyan, (1962).
3	*C. arachnoidea* C. B. Cl. var. *thwaitesii* Rolla Rao et Kammathy	11		Kammathy, and Rolla Rao, (1961b), under *C. archnoidea*, bulbiferous form.
		11, 13		Raghavan, and Rolla Rao, (1965).
4	*C. arcotensis* Rolla, Rao (*C. papillionacea* auct., pro parte)	8		Shetty, and Subramanyan, [1962, under *C. papillionacea* (Linn.) R. and S.]
		12		Raghavan, and Rolla Rao, (1965)
5	*C.burmanniana* Wt.	12		Kammathy, and Rolla Rao, (1964)
6	*C.cerifolia* Rolla Rao et Kammathy	12		Kammathy, and Rolla Rao, (1964); Raghavan, and Rolla Rao, (1965)
7	*C.concanensis* Hassk.(*C.sahyadrica* Blatter;C.stocksii Hassk.	36		Raghavan, and Rolla Rao, (1961, under *C.tuberosa* R.and S.);Kammathy, and Rolla Rao,(1961b, under *C.tuberosa*;1964,under *C.sahyadrica*)
8	*C.cristata* (Linn.)Don	12	24 + 0 -1B	Islam and Baten, (1952)
		12	24	Sharma, (1955); Shetty, and Subramanyan, (1962).
		12		Raghavan, and Rolla Rao, (1961); Kammathy, and Rolla Rao, (1961b).
9	*C.fasciculata* (Heyne ex Roth) Schult.f.var.*fasiculata*	12		Raghavan, and Rolla Rao, (1961); Shetty, and Subramanyan, (1962); Kammathy, and Rolla Rao, (1964).
10	*C.fasciculata* (Heyne ex Roth) Schult.f.var.*glabrescens* C.B.Cl.	12		Kammathy and Rolla Rao, (1964)
11	*C.obtusa* Trimen	12		Kammathy and Rolla Rao, (1961b, under *C. arachnoidea* Herb. Sheet BSI 73296)
12	*C.pilosa* Schult. f.	12		Kammathy, and Rolla Rao, (1961b).

13	*C.tuberosa* (Roxb.) Schult. f.	12		Raghavan, and Rolla Rao, (1961); Shetty, and Subramanyan, (1962);Kammathy, and Rolla Rao, (1961b).
14	*C.vaga* (Lour.)Schult. f.(*C.barbata* Don)	12		Sharma, A. K. and Sharma, A. (1958);Kammathy and Rolla Rao, (1964).
		11		Lewis, (1964,for Kenya races)Lewis, and Taddess (1964; for Ethopian races)
15	*C.villosa* Schult. f.	12	24	Shetty, and Subramanyan, (1962)
		13		Raghavan, and Rolla Rao, (1965)
16	*C.wightii* C.B.Cl.	12		Kammathy, and Rolla Rao, Cf.Rolla Rao, Kammathy, and Raghavan, (1968)
Dictyospermum Wight (*Aneilema* R.Br.)				
1	*A.montanum* Wt.	14		Kammathy, and Rolla Rao, (1961b); Shetty, and Subramanyan, (1962).
2	*A.ovalifolium* (Wt.)C.B.Cl.	14		Kammathy, and Rolla Rao, (1964)
Rhopalephora Hassk.(Anelima R.Br.)				
1	*A.scaberrimum* (Bl.) Kunth(*A.protensun* Wall.ex C.B.Cl.)	59,29		Panigrahi, and Kammathy, (1963); Kammathy, and Rolla Rao, (1964)
Murdannia Royle				
1	*M.dimorpha* (Dalz.) Bruckn.	10		Kammathy, and Rolla Rao, (1961b)
2	*M.divergens* (C.B.Cl.) Bruckn.	30		Panigrahi, and Kammathy, (1963)
3	*M.elata* (Vahl) Bruckn. (Aneilema herbaceum Wall.)		40	Sharma, A. K. and Sharma, A. (1958)
		32		Kammathy, and Rolla Rao, (1961b)
		21	42	Panigrahi, and Kammathy, (1963)
4	*M.esculanta* (Wall.ex C.B.Cl.)Rolla Rao et Kammathy	10		Kammathy, and Rolla Rao, (1961b)
5	*M.gigantea* (Vahl)Bruckn.	11		Panigrahi, and Kammathy, (1963)
		22		Kammathy, and Rolla Rao, (1961b)
6	*M.hookeri* (C.B.Cl.)Bruckn	10		Kammathy, and Rolla Rao, (1964)
7	*M.juncoides* (Wt.) Rolla Ro et Kammathy	12		Kammathy, and Rolla Rao, (1964)
8	*M.loriformis* (Hassk.) Rolla Rao et Kammathy[*Aneilema nudiflorum* R.Br. var. *terminale* (Wt.)C.B.Cl.]	20		Kammathy, and Rolla Rao, (1961b)

		20	40	Shetty, and Subramanyan, [1962, under *M.sinicum*]
			39	Panigrahi, and Kammathy, (1963,under *M.nudiflora* var. *terminalis*)
9	*M.nudiflora* (Linn.) Brenan	10		Simmonds, (1954);Kammathy, and Rolla Rao, (1961b),Panigrahi, and Kammathy, (1963)
10	*M.ochracea* (Dalz.)Bruckn.	18,30		Raghavan, and Rolla Rao, (1961)
11	*M.scapiflora* (Roxb.)Royle	9		Kammathy, and Rolla Rao, (1961b)
12	*M.semiteres* (Dalz.)Santapau	7,10,20		Raghavan, and Rolla Rao, (1961)
		12		Kammathy, and Rolla Rao, (1961b)
		6		Kammathy, and Rolla Rao, (1964)
13	*M.simplex* (Vahl.)Brenan	20		Lewis, (1964, African races);
		30		Raghavan, and Rolla Rao, (1961); Malik,(1961,under M.nudiflora);Kammathy, and Rolla Rao, (1961b)
		40		Panigrahi, and Kammathy,(1963)
			40	Morton, (1966,for African races)
14	*M.spirata* (Linn.)Bruckn.	20		Murthy, (1934);Panigrahi, and Kammathy, (1963); Kammathy, and Rolla Rao, (1961b)
		9		Raghavan, and Rolla Rao, (1961)
			20	Sharma, A. K. and Sharma, A. (1958)
15	*M.triquetra* (Wall.ex C.B.Cl.)Bruckn.		40	Panigrahi, and Kammathy, (1963)
16	*M.vaginata* (Linn.)Bruckn.(*Aneilema vaginatum* R.Br.)	20		Kammathy, and Rolla Rao, (1964)
17	*M.wightii* Rolla Rao et Kammathy [*M.pauciflora* (Wt.)Bruckn.]	10		Raghavan, and Rolla Rao, (1961)
		9		Kammathy, and Rolla Rao,(1964)
			Pollia Thunb.	
1	*P. hasskerlii* Rolla Rao (P. aclisia Hassk.)	16		Kammathy,and Rolla Rao, (1964)
2	*P. secundiflora* (Bl.) Backer [*P. sorzogonensis* (Miq.) Mey.]	16		Kammathy, and Rolla Rao, (1964)
3	*P. subumbellata* C. B. Cl.		10	Darlington, and Wylie, (1955)
		16		Kammathy, and Rolla Rao, (1964)
			Streptolirion Edgew.	
1	*S. volubile* Edgew. var. *volubile*		12 or 11	Sharma, A. K. and Sharma, A. (1958)
		6		Kammathy, and Rolla Rao, (1964)

2	*S. volubile* Edgew. var. *khasiana* C. B. Cl	5	10	Panigrahi, and Kammathy Cf.Rolla Rao, Kammath and Raghavan, (1968)
		Floscopa Lour.		
1	*F. scandens* Lour.	12		Kammathy, and Rao Rolla (1961a)
		Amischotolype Hassk. (*Forrestia* Less et A. Rich.)		
1	*A. mollissima* Hassk. var. *marginata* (Bl.)Rolla Rao (*Forrestia marginata* Hassk.)		c. 36	Kammathy, Cf. Rolla Rao,Kammathy, and Raghavan, (1968)