APPENDIX

APPENDIX - I

The voucher numbers, as well as the date and the places of collection of the plants screened

Name of the plant	Herbarium No.	Date of collection	Place of collection
Abelia triflora Br.	PJT 66	5.1.87	Ooty (Tamil Nadu)
Adina cordifolia (Roxb.) Benth & Hook.f.	PJT 22	10.10.85	Pavagadh (Gujarat)
Anthocephalus cadamba Miq.	PJT 2	25.8.83	Baroda (Gujarat)
Borreria articularis (L.F.) F.N. Will.	PJT 72	21.1.87	Quilon (Kerala)
B. eradii Ravi	PJT 5	22.10.83	Quilon (Kerala)
B. hispida Schum.	PJT 61	2.1.87	Trivandrum (Kerala)
B. verticillata Meyr.	PJT 62	2.8.87	Trivandrum (Kerala)
Catesbaea spinosa Linn.	PJT 41	5.11.85	Baroda (Gujarat)
Cinchona calisaya Wedd.	PJT 49	5.1.85	Ooty (Tamil Nadu)
C. officinalis Hook.	PJT 50	5.1.85	Ooty (Tamil Nadu)
Coffea liberica Hiern.	PJT 21	5.10.85	Kuzhikala (Kerala)
C. robusta Linden	PJT 20	5.10.85	Kuzhikala (Kerala)
Dentella repens Forst.	PJT 7	25.10.83	Surat (Gujarat)

APPENDIX - I Contd.

Name of the plant	Herbarium No.	Date of collection	Place of collection
Galium aparine Linn.	PJT 24	30.10.85	Gulmarg (Kashmir)
G. asperifolium Wall.	PJT 25	30.10.85	Gulmarg (Kashmir)
G. palustre Linn.	PJT 26	30.10.85	Gulmarg (Kashmir)
G. parisiense Linn.	PJT 27	30.10.85	Gulmarg (Kashmir)
G. verum Linn.	PJT 28	30.10.85	Gulmarg (Kashmir)
Gardenia florida Linn.	PJT 33	1.11.85	Waghai (Gujarat)
G. gummifera Linn.	PJT 36	5.11.85	Baroda (Gujarat)
G. latifolia Ait.	PJT 17	6.6.85	Waghai (Gujarat)
G. lucida Roxb.	PJT 42	5.11.85	Baroda (Gujarat)
Hamelia patens Jacq.	PJT 40	5.11.85	Baroda (Gujarat)
Hymenodictyon excelsum Wall.	PJT 15	6.6.85	Waghai (Gujarat)
Ixora coccinea Linn.	PJT 9	22.10.83	Quilon (Kerala)
I. nigricans Br.	PJT 51	2.1.87	Trivandrum (Kerala)
I. parviflora Vahl.	PJT 4	5.10.83	Baroda (Gujarat)
Knoxia corymbosa Willd.	PJT 35	1.11.85	Waghai (Gujarat)

APPENDIX - I Contd.

Name of the plant	Herbarium No.	Date of collection	Place of collection
Lonicera bicolor Klotzsch.	PJT 29	28.10.85	Pahalgam (Kashmir)
L. japonica Wall.	PJT 67	5.1.87	Ooty (Tamil Nadu)
L. obovata Royle	PJT 34	28.10.85	Pahalgam (Kashmir)
Meyna laxiflora Robyns	PJT 18	6.6.86	Waghai (Gujarat)
Mitracarpum verticillatus (Schum.& Thonn.)Vatke	PJT 8	22.10.83	Quilon (Kerala)
Morinda citrifolia Linn.	PJT 47	25.5.85	Trivandrum (Kerala)
M. reticulata Gamble	PJT 11	4.12.84	Pathanapuram (Kerala)
M. tinctoria Roxb.	PJT 3	5.10.83	Baroda (Gujarat)
Mussaenda erythrophylla Schum. & Thonn.	PJT 46	25.5.85	Trivandrum (Kerala)
M. frondosa Linn.	PJT 10	20.5.84	Cochin (Kerala)
M. laxa Hutch.	PJT 53	2.1.87	Trivandrum (Kerala)
M. luteola Delile	PJT 70	2.1.87	Trivandrum (Kerala)
Oldenlandia alata Koen.	PJT 19	30.9.85	Surat (Gujarat)
O. auricularia Schum.	PJT 54	2.1.87	Trivandrum (Kerala)
O. corymbosa Linn.	PJT 44	20.5.85	Cochin (Kerala)

APPENDIX - I Contd.

Name of the plant	Herbarium No.	Date of collection	Place of collection
O. gracilis DC.	PJT 71	2.1.87	Trivandrum (Kerala)
O. herbacea Roxb.	PJT 55	2.1.87	Trivandrum (Kerala)
O. stylosa O. Kze.	PJT 56	2.1.87	Trivandrum (Kerala)
Ophiorrhiza mungos Linn.	PJT 57	2.1.87	Trivandrum (Kerala)
Pavetta indica Linn.	PJT 13	20.5.85	Kuzhikala (Kerala)
P. indica Linn. Var. tomentosa Roxb.	PJT 58	2.1.87	Trivandrum (Kerala)
Pentas carnea Benth.	PJT 39	5.11.85	Baroda (Gujarat)
Plectronia didyma Kurz.	PJT 43	4.11.85	Waghai (Gujarat)
P. parviflora Bedd.	PJT 63	2.1.87	Trivandrum (Kerala)
Psychotria elongata Wight.	PJT 65	5.1.87	Ooty (Tamil Nadu)
P. flavida Talb.	PJT 64	2.1.87	Trivandrum (Kerala)
Randia dumetorum Lamk.	PJT 1	27.1.83	Pavagadh (Gujarat)
R. macrophylla Br.	PJT 45	25.5.85	Trivandrum (Kerala)
R. rugulosa Thw.	PJT 59	2.1.87	Trivandrum (Kerala)
Rondeletia speciosa Lodd.	PJT 68	10.1.87	Baroda (Gujarat)
Rubia cordifolia Linn.	PJT 23	28.10.85	Pahalgam (Kashmir)

APPENDIX - I Contd.

Name of the plant	Herbarium No.	Date of collection	Place of collection
Sambucus wightiana Wall.	PJT 30	28.10.85	Pahalgam (Kashmir)
Serissa foetida Commers.	PJT 69	10.1.87	Baroda (Gujarat)
Spermacoce latifolia Aubl.	PJT 60	2.1.87	Trivandrum (Kerala)
Spermadictyon suaveolens Roxb.	PJT 12	4.12.84	Saputara (Gujarat)
Stephegyne parvifolia Korth.	PJT 6	25.10.83	Baroda (Gujarat)
S. tubulosa Hook. f.	PJT 52	2.1.87	Trivandrum (Kerala)
Viburnum cottinifolium Don	PJT 31	28.10.85	Pahalgam (Kashmir)
V. foetens Dcne.	PJT 32	28.10.85	Pahalgam (Kashmir)
V. tinus Linn.	PJT 48	5.1.87	Ooty (Tamil Nadu)
Wendlandia lawii Hook. f.	PJT 37	4.11.85	Waghai (Gujarat)
W. notoniana Wall.	PJT 38	4.11.85	Waghai (Gujarat)
Xeromphis spinosa (Thumb.) Keay	PJT 16	6.6.85	Waghai (Gujarat)
X. uliginosa (Retz.) Maheshwari	PJT 14	6.6.85	Waghai (Gujarat)

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CHEMOSYSTEMATICS OF SOME MEMBERS OF CAPRIFOLIACEAE

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Eight taxa belonging to the Caprifoliaceae have been screened for flavonoids, coumarins and phenolic acids. The family contained both flavones and flavonols. The tribe Sambuceae is characterised by flavonols and the tribe Loniceae by flavones. The higher frequency of flavones and the reduction in flavonols and proanthocyanins keep the Caprifoliaceae advanced over Rubiaceae. *Viburnum* possessing scopoletin and proanthocyanins is close to Rubiaceae. The presence of flavonols keep Sambuceae primitive. The tribe Loniceae with their variety of flavones is the most advanced taxon and *Viburnum* with both flavones and flavonols occupies an intermediate position

The Caprifoliaceae are distinguished from most of the associated families (except Rubiaceae) by the inferior multicarpellate ovary and opposite leaves. The absence of interpetiolar stipules and colleters, and cellular pattern of endosperm development keep this family distinct from Rubiaceae. Most of the members of this family are ornamentals, though the flowers of *Sambucus nigra* and root bark of *Viburnum prunifolium* are known for their medical properties. Bentham and Hooker (1862–1883) included the Caprifoliaceae alongwith Rubiaceae in their order Rubiales Engler and Diels (1936) added three more families Adoxaceae, Dipsacaceae and Valarianaceae in this order Hutchinson (1926) separated these three families and kept them in Asterales and retained the Rubiales and Caprifoliaceae in Rubiales. Later on he modified his own view and removed Adoxaceae, Dipsacaceae and Valarianaceae into a new order, the Valarianales (Hutchinson 1948). But Cronquist (1981) groups all these three families with Caprifoliaceae in his order Dipsacales Caprifoliaceae are considered the most archaic family of the order Dipsacales with a putative origin from 5-carpellate Rubiaceae. Some of the genera like *Alseuosmia*, *Cylanthus* and *Periomphale* are excluded from Caprifoliaceae and recognised as a family Alseuosmiaceae in the order Rosales (Cronquist 1981).

The members of Caprifoliaceae are known to contain various phenolic heterosides (especially glycosides), iridoids, saponins, tannins, proanthocyanins and ellagic acid. Alkaloids are rare in this family. Bohm and Glennie (1971) surveyed a number of european taxa representing 11 genera for leaf flavonoids. They found both flavones and flavonols in this family. In the present work 8 members belonging to 4 genera of Caprifoliaceae have been screened for flavonoids, phenolic acids, alkaloids, iridoids, tannins and saponins. The patterns of distribution of these compounds are used in assessing the relationships existing among the various taxa.

MATERIAL AND METHOD

All the plants screened were collected from Kashmir and Ooty. They were properly identified and the voucher specimens were deposited in the herbarium, Deptt. of Botany, the M S University, Baroda. Standard methods are followed for isolation and characterisation of chemical markers (Mabry *et al.* 1970; Harborne 1984).

RESULTS

The distribution of chemical markers in the leaves of 8 members of Caprifoliaceae is presented in Table 1. All the plants screened contained flavonoids in the leaves. The flavonoids encountered were flavones, flavonols and proanthocyanins. The various flavones detected were apigenin, acacetin, and 3'–, 4'– and 7–methoxylated luteolins. The different flavonols identified were kaempferol, quercetin and their mono- and dimethoxylated derivatives. Flavonols were located in all species of *Viburnum* and *Sambucus* screened. One species of *Viburnum*, *i.e. V. cottinifolium* contained flavones also in addition to the flavonols. All the species of *Lonicera* and *Abelia* screened contained flavones. Proanthocyanins were present in *V. cottinifolium* only. A coumarin (scopoletin) was located in *V. foetens*. All together 8 phenolic acids were located in the members of this family. They were p-hydroxy benzoic acid, gentisic acid, protocatachuic acid, vanillic acid, syringic acid, p-coumaric acid, melilotic acid, and ferulic acid, of

TABLE 1. The distribution of various chemical markers in the leaves of 8 members of Caprifoliaceae.

Name of the plant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Tribe I. Sambuceae																						
1. *Sambucus wightiana* Wall.									+					+	+	+		+			+	
Tribe II. Viburneae																						
2. *Viburnum cottinifolium* Don.		+			+			+				+		+	+			+	+			
3. *V. foetens* Dcne						+	+							+				+	+			
4. *V. tinus* L.									+	+	+			+		+		+	+	+	+	+
Tribe III. Loniceae																						
5. *Abelia triflora* Br.		+												+		+		+				+
6. *Lonicera bicolor* Klotzsch	+	+												+				+	+			
7. *L. japonica* Wall.	+	+			+									+				+	+	+		
8. *L. obovata* Royle		+	+											+	+	+		+			+	+

(1) Apigenin, (2) Acacetin, (3) 3'—OMe Luteolin, (4) 4'—OMe Luteolin, (5) 7-OMe Luteolin, (6) Kaempferol, (7) 4'—OMe Kaempferol, (8) 3, 7-di OMe Kaempferol, (9) Quercetin, (10) 3'—OMe Quercetin, (11) 3'—4'-di OMe Quercetin, (12) Proanthocyanins, (13) Scopoletin, (14) Saponins, (15) p-Hydroxybenzoic acid, 16) Gentisic acid, (17) Protocatachuic acid, (18) Vanillic acid, (19) Syringic acid, (20) p-coumaric acid, (21) Melilotic acid, (22) Ferulic acid.

which vanillic acid was common to all. Syringic acid was present in 5 members and gentisic acid in 4 members. Other phenolic acids were having a low incidence in the family. Saponin was present in all members screened. Glycoflavones, alkaloids, tannins and iridoids were absent in the family.

DISCUSSION

The family Caprifoliaceae is peculiar in containing both flavones and flavonols equally distributed among its members Both the tribes Sambuceae and Loniceraeae are chemically distinct. Sambuceae is characterised by flavonols and Loniceraeae by flavones. *V. cottinifolium* with both flavones and flavonols forms the intermediate taxon. The predominance of flavones (5/8) and the reduction in frequency of occurrence in the flavonols (4/8) and proanthocyanins (1/8) keep the Caprifoliaceae advanced over Rubiaceae which are characterised by flavonols and proanthocyanins. The absence of alkaloids and iridoids in the plants screened keep the family chemically distinct from Rubiaceae. *Viburnum*, possessing scopoletin; flavonols, and proanthocyanins is more closer to Rubiaceae than any other genus screened. The presence of flavonols and proanthocyanins keep the tribe Sambuceae primitive. Due to the absence of flavonols and in having flavones uniformly distributed, the tribe Loniceraeae is the advanced tribe of the family.

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