13. Family VITACEAE

The Vitaceae (incl. Leeaceae), a small family of 12 genera and 700 species, are confined to tropical and sub-tropical regions. In India the family is represented by three genera **Vitis, Perisanthes** and **Leea.** The Vitaceae consist of small trees or succulent shrubs with usually climbing habit. The stems are angled, compressed or cylindrical, nodes are swollen with commonly leaf opposed tendrils. The stipulate leaves are alternate, simple or palmately or pinnately compound often bearing specialized, multicellular, stalked deciduous pearl glands. The inflorescence is borne singly opposite the leaves. Flowers are minute, greenish, bisexual or rarely unisexual, regular pentamerous or tetramerous. The calyx is gamosepalous forming a cuplike structure. Corolla free, spreading or sometimes apically connate dropping off like a cap. The well-developed nectariferous disk is intrastaminal. Stamens are equal to petals, introrse arising from the base of the disk. Ovary is superior, bicarpellary incompletely bilocular with two ovules in each locule on parietal placentation. The ovary fuses with the disk resulting in somewhat perigynous condition, style is single and stigma simple. Fruit is a one to four-seeded berry, fleshy and juicy. Seeds are with copious endosperm and rich in proteins (aleurone grains) and oils.

Anatomy :

Tanniferous cells, mucilage cells and raphide-sacs occur frequently in the parenchyma tissues. Some of species of **Vitis** have raphides in staminodes. The anatomical studies by Nair and Mani (1960) showed that the bicarpellary condition is derived from a multicarpellary ovary and this is evidenced by the number of bundles supplied to the ovary. The placentation in the family is considered as axile (Lawrence, 1951) while Puri (1951) described it as parietal. Inversely oriented

placental strands indicate that the parietal condition is derived from axile placentation. Another line of placental evolution is the gradual receding of placenta to periphery and the highly advanced condition is seen in **Cissus quadrangularis** where the septum completely disappears giving rise to a unilocular ovary.

The wood consists of small or rarely large (**Vitis**) vessel segments having simple perforations; imperforate tracheary elements, simple or bordered pits; hetero-cellular wood; paratracheal wood parenchyma and sieve tube cells with p-type plastids having several polygonal protein crystals. Adkinson (1913) found that the erect members of the family retain more primitive characters. In the erect forms, the medullary rays are accompanied by linear rays which have been lost in most of the climbers. However, the linear rays are vestigial in seedlings (the most conservative part) of a few climbing species. He opines that **Ampelocissus** and **Cissus** with xylem dissected and reduced than **Vitis**, are the primitive taxa. The vine habit is regarded as an approach to the herbaceous type of stem.

Embryology

The ovules are anatropous, bitegmic and crassinucellate. The hypostase and nucellar beak are well-developed. Obturator is present. The micropyle is formed by only the inner integument. Embryo sac is Polygonum type and the endosperm is nuclear. **Vitis** produces a number of exembryonic seeds. The development of the embryo is a Gneum variation of Asterad type i.e. the suspensor is absent and the embryo is globular (Mulay et al., 1953; Nair and Parashuram, 1962; Kashyap, 1957).

Palynology :

The pollen grains, as a rule, are tricolporate, oblate spheroidal-prolate. Sexine is equally thick as nexine and with reticulate ornamentation. Amb is often rounded and triangular. The pollen of the family is characteristically binucleate.

Classification :

The vitaceae, being a small family, are generally treated as one unit. Gilg (1896) classified the family into two subfamilies (1) Vitioideae and (2) Leeoideae (**Leea**). This was followed by Thorne (1976). Later Gilg and Brandt (1912) elevated the subfamily Leeoideae to a separate unigeneric family Leeaceae. **Leea** was included under Vitaceae by Wettstein (1935), Gunderson (1950), Hutchinson (1973) and Dahlgren (1980). The family status of this genus is accepted by most of the recent authors (Cronquist, 1980). **Leea** differs from the rest of the family in its erect habit, sympetalous corolla, staminal tube, lack of nectariferous disk and ovary with 3-8 one-ovulate locules. Nair (1968) and Ridsule (1974) based on a detailed study on the morphology and embryology, favours the separate status of **Leea**. Planchon (1885) had divided the genus **Vitis** into 4 smaller genera (1) **Vitis** - having pentamerous corolla united at the apex; (2) **Ampelocissus** - petals 4 and free; (3) **Cissus** -petals 4 with long style and (4) **Tetrastigma** -petals 4, stigma nearly sessile, inflorescence axillary in position and flowers unisexual (Brandis, 1906).

Kashyap (1957) considers the family Vitaceae as a primitive taxon. Apart from the primitive floral characters which indicate their earlier stages of evolution, other primi-

tive embryological characters the family exhibit are smooth-walled pollen grains, multicellular archesporium, crassinucellate embryo, bitegmic ovule and multilayered integument which is quite separate from nucellus.

The Vitaceae are usually associated with the family Rhamnaceae in the order Rhamnales. According to Cronquist (1969) this order has a close relationship with the Celastrales and Sapindales, probably in having a common ancestor and evolving with them as 3 parallel lines. However, Thorne (1976) places it in Corniflorae because of the little developed calyx, well developed intrastaminal disk, small straight embryo and ruminate endosperm. Recently Behnke (1981), based on the sieve tube plastids, separates Vitaceae and Leeaceae, having P1c"s type of plastids from Rhamnaceae containing S-type and suggests that the former two families are closer to the Gunnerales.

Previous Chemical Reports :

Vitis vinifera being the source of grapes, much of the chemical work is done on the anthocyanins and the organic acids of the fruit. The fruit juices contain caffeic acid and many other cinnamic acids combined with tartaric acid (Harborne, 1967). They contain hydroxy cinnamates, caftaric acid, ferulic acid and chlorogenic acid (Overnone, et al., 1986). The anthocyanins of fruits are principally of acylated forms. They are cyanidin and delphinidin derivatives. The leaf flavonoid reports on **Vitis** include kaempferol, quercetin, myricetin-3-glucoside, quercetin 3-glucuronoside and vitexin (Harborne, 1967;), dihydroflavonol - aromadendrin (Saifah and Vaisiriraj, 1987) and flavones (Moore, 1986; Moore and Giannasi, 1987). Saifah and Vaisiriraj (1987) reported two tetratriterpenoids - vomifoliol and romalea-allene, β-sitosterol and campestrol from **Cissus rheifolia**. Two alkal-

oids cryptopleurine and kayawongine also are reported from the leaves of the same plant (Saifah et al., 1983). A ketosteroid (Sen, 1964) and a stilbene dimer pallidol (Khan et al., 1986) are identified from **Cissus**.

In the present work 18 plants belonging to 6 genera of the family Vitaceae are subjected to a chemical analysis for the taxonomically important compounds.

Materials and Methods :

The mature healthy leaves of the 18 plants were procured from Kashmir, Waghai, Baroda, and Nainital. Standard procedures explained in chapter 2 are followed for the isolation and identification of various chemical compounds.

Results :

The results obtained are presented in Table-13.1. Except for **Cayratia carnosa** all the plants screened contained flavonoids in their leaves. Flavones, glycoflavones and flavonols are the various flavonoid pigments encountered. Flavones-apigenin, 7-OMe apigenin and 6-OMe scutellarein- are located in only two species of **Cissus** i.e. **C.quandrangularis** and C. **rependa** Flavonols are present in all the plants except C. **rependa** Myricetin, kaempferol,4'-OMe kaempferol, quercetin, 3'-OMequercetin, 3'-OMe quercetin, 3',4'-diOMe quercetin are the flavonols identified. Myricetin is restricted to the genus **Leea** and **V.obtecta** while the other flavonols have a wider distribution within the family. Glycoflavones exhibit about 27% incidence. Proanthocyanidins occur frequently (14/18). Ten phenolic acids of both benzoic and cinnamic acids are identified, out of these vanillic, syringic, p-hydroxybenzoic, **cis**-and **trans**-p-Coumaric and ferulic acids occur more frequen-

Table : 13.1 Distribution of Flavonoids, Phenolic Acids, Tannins and Saponins Among 18 Members of the Vitaceae

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. **Ampelocissus latifolia** Planch.						+		+					+	+					+	+				
2. **A. rugosa**						+		+				+		+							+			
3. **Cayratia carnosa** Gagnep.													+	+					+	+				
4. **Cissus pallida** Planch.				+		+		+					+	+	+		+		+	+				
5. **C. quadrangularis** L.	+	+					+				+			+	+				+	+				
6. **C. rependa** Vahl.		+	+	+							+		+	+	+				+	+	+			
7. **Parthenocissus quinquifolia**								+	+		+	+	+	+					+	+	+		+	
8. **P. himalayana** L.								+	+	+	+	+		+	+	+								
9. **Vitis latifolia** Roxb.						+		+			+		+		+	+					+			
10. **V. obtecta** Roxb.					+			+	+	+	+						+		+	+				
11. **Vitis** sp				+			+				+		+	+			+					+		
12. **Vitis** sp				+		+		+		+	+		+	+			+					+	+	
13. **V. semicordata** Wall.									+	+		+		+	+							+		
14. **V. vinifera** L.						+		+	+		+		+	+	+		+		+	+				
15. **Leea herbaceum**				+	+			+	+	+	+			+	+	+		+			+	+		
16. **L. indica** Merrill.					+	+			+		+		+	+	+			+				+		
17. **L. macrophyla** Roxb.					+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
18. **L. sambucina** Willd.					+			+		+	+	+	+	+				+	+	+	+	+		

1) Apigenin, 2) 7-OMe Apigenin, 3) 6-OMe Scutellarein, 4) Glycoflavone, 5) Myricetin, 6) Kaempferol, 7) 4'-OMe Kaempferol, 8) Quercetin, 9) 3'-OMe Quercetin, 10) 3',4'-DiOMe Quercetin, 11) Proanthocyanidins, 12) Gentisic acid, 13) p-Hydroxy benzoic acid, 14) Vanillic acid, 15) Syringic acid, 16) Melilotic acid, 17) Protocatechuic acid, 18) Gallic acid, 19) **cis-p-**Coumaric acid, 20) **trans p-**Coumaric aci

tly while gallic acid is restricted to the genus **Leea**. Tannins are rare (5/14). Alkaloids are found in **Leea macrophylla, Parthenocissues** and **Vitis.**

Discussion :

The Vitaceae are a flavonol-dominated family. The controversial genus **Leea** differs from other genera in containing trihydroxy compounds myricetin and gallic acid. It also has a higher frequency of 3',4'-diOMe quercetin. Therefore, the concept of the unigeneric family Leeaceae is considered valid on the chemical grounds. The separation of **Vitis** into 4 genera by Planchon (1884) also gains support from the present study. **Cissus** is characterised by the flavones and higher concentratrion of cinnamic acids. **Ampelocissus** does not contain proanthocyanidins. **Vitis** is peculiar in possessing only flavonols and contain tannins and alkaloids in a majority of its species.

Between the two families, the Leeaceae is primitive in containing myricetin, proanthocyanidins, tannins and gallic acid and the absence of flavones and glycoflavones. These characters correlate well with the woody habit of the family. Flavone-containing genus **Cissus** is advanced over the other genera of the family, which are rich in flavonols, proanthocyanidins and tannins. The Leeaceae are related to the myricetin-containing families of Sapindales and Vitaceae to the flavonol-rich Sapindales and . Celastrales. However the lack of triterpenes in Vitaceae keep the family distinct from these orders.