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OBSERVATIONS ON THE CHEMOTAXONOMY OF THE BURSERACEAE

I. UMADEVI, M. DANIEL and S D. SABNIS

Phytochemistry Lab., Department of Botany, Faculty of Science, The M.S. University of Baroda, Baroda-390002, India.

A study of ten members of the Burseraceae reveals that the family is morphologically and chemically homogenous. It contains quercetin and its methoxylaed derivatives, myricetin and gallic acid. The three tribes are not chemically identifiable. The genus *Commiphora* is the most advanced taxon of the family in containing flavones and absence of pyrogallol systems, proanthocyanidins and tannins. The placement of *Protium caudatum* W. & A. in *Protium* rather than in *Commiphora* (*C. caudata* Engl.) is supported. *Filicium decipiens* Thw. which is included in the Burseraceae is chemically more closer to the Sapindaceae and therefore its placement in the latter family is supported, Chemically the family is closely related to the Anacardiaceae. The presence of primitive flavonoids such as biflavones, myricetin, proanthocyanidins and tannins keep this as one of the primitive families of the Rutales,

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Introduction

The family Burseraceae with 20 genera and 600 species is widely distributed in tropics and the subtropics. This family characteristically shows the presence of alternate compound leaves, stamens twice the number of petals, a single style, two ovules per locule and intercellular canals or ducts in all parts of the plant body. Many species are economically valuable on account of their resins. The resins of *Commiphora*, are medicinally important while that of *Canarium* species (elemi) are used for varnish, printer's ink and for the preparation of ointments. Frankincense is obtained from the various species of *Bursera*. The seeds and fruits of *Canarium* and *Garuga* are edible. The family is a source of softwoods also,

Most of the systematists (Dahlgren *et al.*, 1981; Hutchinson , 1969; Takhtajan, 1980 and Thorne, 1976) placed the Burseraceae in the order Rutales alongwith the Rutaceae, Meliaceae, Anacardiaceae and Simaroubaceae, which are considered to be very closely related. Cronquist (1981) inclu-

ded this family in his Sapindales (which include most of the families of the Rutales) while Bentham and Hooker (1862) kept them in the Geraniales.

Hallier (1912) kept both Burseraceae and Anacardiaceae in the same family Terebinthiaceae. The Burseraceae are very closely related to the family Anacardiaceae and they differ mainly in the orientation of the ovules. In Burseraceae the ovules are epitropous while in Anacardiaceae they are apotropous. On the basis of the nature of the fruit Engler (1931) subdivided the family Burseraceae into 3 tribes, Protieae *(Garuga* and *Protium)*, Boswellieae *(Boswellia, Bursera* and *Commiphora)* and Canarieae *(Canarium)*. The position of *Filicium decipiens* Thw. is controversial. Though it was placed in the Burseraceae, it is shifted to Sapindaceae by Radlkofer (1897).

Chemically this family is a rich storehouse of terpenes. The volatile oils of the resins are predominantly monoterpenoid and/or sesquiterpenoid. While monoterpenes are omnipresent, sesquiterpenes are reported from *Canarium, Boswellia* and *Commiphora* only. Diterpenes also are located from the latter two genera. The Burseraceae accumulate both tetracyclic and pentacyclic triterpenes. Of these, one triterpene, sapelin, is considered to be precursor of quassinoids and limonoids (Khalid, 1983). Among the flavonoids, biflavones (Amentoflavone) are reported from *Garuga pinnata* (Ansari *et al*, 1978); quercetin and kaempferol glycosides from *Protium* (Pernett, 1972) and *Commiphora* (Kakrani, 1982).

In the present work ten members belonging to the Burseraceae have been analysed for pnenolic compounds such as flavonoids and phenolic acids. These plants are also screened for tannins, soponins, alkaloids and iridoids.

Materials and Methods

The plants were collected from various localities of Panchamarhi, Kashmir, Kerala and Calcutta. Voucher specimens are deposited in the Herbarium of the M. S. University of Baroda. Mature leaves were used for the studies and the standard procedures (Daniel and Sabnis, 1977; Harborne, 1984)were followed for isolation and identification of various compounds.

Result

The distribution of various flavonoids, phenolic acids, saponins and tannins in ten members of the Burseraceae is presented in Table-1.

Flavonols are widespread in the Burseraceae. The various flavonols encountered were kaempferol, quercetin and their methoxylated derivatives and myricetin. All the ten plants screened contained quercetin and/or its

Table 1. Showing the distribution of various flavonoids, phenolic acids, tannins and saponins in 10 members of the family Burseraceae.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Tribe Protieae																					
1. *Garugu pinnata* Roxb.		+			+		+		+	+	+		+	+	+	+	+	+	+	+	
2. *Protium caudatum* W. & A.		+	+		+		+			+	+		+			+				+	
3. *P. serratum* Engl.		+	+		+	+	+			+	+		+	+		+				+	
Tribe Boswellieae																					
4. *Boswellia serrata* Roxb.						+	+		+	+				+		+	+			+	
5. *Bursera citronella* Linn.		+	+			+	+			+	+		+	+		+		+	+	+	
6. *B. delpechiana* Poiss.		+	+	+	+	+				+	+		+	+						+	
7. *Commiphora wightii* Bhandari	+					+					+	+	+								
Tribe Canarieae																					
8. *Canarium commune* Linn.		+			+	+		+	+	+	+		+	+			+	+	+	+	
9. *C. strictum* Roxb.		+				+		+		+	+		+	+			+	+	+	+	
10. *Filicium decipiens* Thw.							+			+	+		+		+					+	+

1. Acacetin 2. Biflavones 3. Kaempferol 4. 4 '-OMe Kaempferol 5. Quercetin 6. 3'-OMe Quercetin 7. 3',4'-DiOMe Quercetin 8. 3, 3', 4'-TriOMe Quercetin 9. Myricetin 10. Proanthocyanidins 11. p-Hydroxybenzoic acid 12. Protocatechuic acid 13. Vanillic acid 14. Syringic acid 15. Melilotic acid 16. Gentisic acid 17. Gallic acid 18. *cis* p-Coumaric acid 19. *trans*. p-Coumaric acid 20. Tannins 21. Saponins.

methoxylated derivatives. Kaempferol is less frequent, present in five plants. The only flavone located, acacetin, is restricted to *Commiphora*. Biflavones are located in *Garuga*, *Protium* *Bursera* and *Canarium*. Except *Commiphora* all the taxa possessed proanthocyanidins. Altogether nine phenolic acids were located, of which 7 were benzoic acids and two, cinnamic acids. Tannins were present in all the plants except *Commiphora*. Saponins were locatad only in *Filicium*. Alkaicids and iridoids are absent in the family.

Discussion

The family Burseraceae is chemically homogenous and is characterised by presense of highly hydroxylated phenolics such asquercetin, myricetin and gallic acid. All the plants screened contained quercetin and/or its methoxylated derivatives. The three tribes Protieae, Bosweilleae and Canarieae are not chemically identifiable and therefore the subdivision of the family does not get any support form the chemical evidences.

The genus *Commiphora* is distinct from the other taxa of the family in the presence of flavones and in the absence of proanthocyanidins and tannins. The absence of primitive proanthocyanidins and the presence of advanced flavones as will as the unisexual flowers (in polygamous conditions) keep this taxan a most advanced member of the family.

Gamble (1967) treated *Protium caudatum* W. & A. in the genus *Commiphora* (*C. caudata* Engl.). *P. caudatum* is strikingly different from the *Commiphora* (*C. wlghtii*), which is screened in the present work. *P. caudatum* contains kaempferol, quercetin, 3'-OMe quercetin and proanthocyanidins which are not located in *Commiphora wightii* and also flavones isolated from *Commiphora* were absent from *P. caudatum*. Therefore, the placement of *P. caudatum* in *Protium* seems to be chemically valid.

Eventhough *Filicium decipiens* is similar to the members of the Burseraceae in flavonoid chemistry it does not contain the di/triterpenes prevalent in in the family . Moreover the presence of saponins provides another feature of dissimilarily with the Burseraceae. In containing the saponins and in the absence of typical terpenes of the Burseraceae, *Filicium* is similar to the members of Sapindaceae and therefore its inclusion in this family seems justified.

The two families Anacardiaceae and Burseraceae are closely reiated in morphological as well as chemical grounds. The chemical characters which they share are the presence of biflavones, similar types of flavonols, proanthocyanidins and tannins, But the Burseraceae is distinct from Anacardiaceae in containing wide range of terpenes.

The Burseraceae possess a number of primitive chemical characters such

as biflavones, myricetin, gallic acid, proanthocyanidins and tannins. The family shows a strong ability for oxidative modification of a number of triterpenes which may reflect the early stages of the limonoids of Rutaceae and Meliaceae and quassinoids of Simaroubaceae (Khalid, 1983). With all these primitive chemical characters and morphological characters such as numerous stamens; bi—or pentacarpellary ovary and more than one ovule in single locule, the Burseraceae are considered as one of the primitive families of the Rutales. This view gains support also from wood anatomy (Metcalfe and Chalk, 1950).

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