I N T R O D U C T I O N

The family Labiatae Juss. (=Lamiaceae Lindl.) known as the 'Mint' family is one of the largest families of Dicotyledons. It comprises about 180 genera and about 3000 species (Goldberg, 1986). These are cosmopolitan in distribution, but are especially abundant in the Mediterranean region and the Orient; they are also abundant in the mountains of the subtropics. The members are predominantly herbs, rarely shrubs or climbers and very few are small trees, usually containing a fragrant oil.

The family is characterized by hypogynous, irregular (rarely regular) and bisexual (rarely unisexual) flowers. The calyx is persistent, of five variously united sepals, often 2-lipped; corolla is sympetalous, tubular, lobes 4-5, imbricate, often forming 2 lips or rarely 1 lip; stamens are epipetalous, four or two, anthers 2-1 locular, loculi often divergent. The hypogynous disc is well developed. Ovary is superior, bicarpellary and deeply 4-lobed, each lobe containing a single ovule, style is gynobasic (rarely terminal) and the stigma is bifid. The fruit consists of four one-seeded nutlets. The seeds are nonendospermous with straight embryos. The 4-angled stem, fragrant oil, 4-lobed ovary, the solitary ovules and the basal style are distinctive features of the family.

The family is of some economic importance on account of the occurrence of fragrant oil and bitter principles in many species. Salvia officinalis and Mentha piperita are used as condiments. Scutellaria lateriflora (skullcap), Marrubium vulgare (hoarhound), Hedeoma pulegiodes (American pennyroyal), Mentha spicata (spearmint) and Mentha piperita (peppermint) are used in the preparation of various tonics, anthelmints, expectorants, carminatives and stimulants. Oil of thyme is obtained from Thymus serphyllum, rosemary from Rosemarinus officinalis, lavender from Lavandula vera and patchouli from Pogostemon patchouli or P. heyneanus. Species of Salvia are cultivated as ornamentals. Coleus parviflorus and C. barbatus yield root tubers and several other species of the genus are of medicinal importance.

The major taxonomic treatments of the family are those of Bentham (1832-'36, 1848, 1876), Briquet (1895-1897) and Erdtman (1945). The only full monographic account of Labiatae is perhaps that of Bentham (1832-'36) which he later modified in De Candolle's Prodromus (1848) and the Genera Plantarum (1876). The classification proposed by Bentham was reorganized by Briquet (1895-'97) in Engler and Prantle's Die Naturlichen Pflanzenfamilien, raising some of Bentham's tribes and subtribes to subfamilial levels. The two systems differ mainly in the grouping of Bentham's tribes 2-5 in the subfamily Stachyoideae

(which as Sanders and Cantino (1984) have shown, should have been called Lamioideae) by Briquet. Briquet also recognized two major groups within the family - one comprising Ajugoideae with Rosemarinus plus Prostantheroideae, and the other including the rest of the family. Though Bentham's system remains the most comprehensive with descriptions for every species then known, Briquet's system remains today the most widely used one for Labiatae. However, neither Bentham nor Briquet provide adequate definitions for the groups. To cite an example, the nutlet characters provide diagnostic features for six of Bentham's eight tribes while nutlet characters of the remaining 2 tribes are not even mentioned. Similarly both Bentham and Briquet placed Hyptis showing (3+2) condition of calyx in Ocimoideae while the rest of Ocimoideae show (1+4) condition. On the other hand, Lavandula vera which shows (1+4) condition is separated from the other members of Ocimoideae. These discrepencies may be, as commented by Santhakumari (1982), due to the fact that both Bentham and Briquet gave importance only to the nature of corolla and stamens. The subsequent systems such as those of Melchior (1964), Dahlgren (1980), Taktajan (1980) and Thorne (1983) are only minor modifications of the treatment of Briquet (1895-'97) and do not contribute much towards a better understanding of the arrangement of genera.

The Labiatae continued to attract the attention of several systematically oriented morphologists, palynologists and

natural product chemists. Data resulting from these studies (Junell, 1934, 1937; Leitner, 1942; Erdtman, 1945, 1952; Risch, 1956; Hegnauer, 1966, 1973; Wunderlich, 1967; El-Gazzar and Watson, 1968, 1970a, 1970b; Kooiman, 1972; Litvinenko et al., 1975; Zoz and Litvinenko, 1979) have already suggested modifications to the taxonomic arrangement suggested by Bentham and especially by Briquet. Erdtman (1945) suggested that the Labiatae is composed of two natural subfamilies (which do not coincide with the 2 major groups of Briquet), the Lamioideae with tricolpate grains that are shed at the 2-celled stage and the Nepetoideae with hexacolpate grains that are 3-celled when shed. This system is highly congruent with Bentham's (1876) classification in that his tribes Ajugeae, Prostantheraeae, Prasieae, and Lamieae except Cleonia and Prunella correspond to the Lamioideae, while the other four tribes - Nepeteae except Hypogomphia, Salvieae, Mentheae except Pogostemon and Ocimeae correspond to the Nepetoideae. The extensive pollen survey made by Wunderlich (1967) lent strong support to Erdtman's groupings. She also noted several embryological characters which exhibit a pattern of variation similar to those of the two pollen characters.

More recently a number of chemical characters have also been found to correlate with Erdtman's groupings (Hegnauer, 1966*, 1973*; Kooiman, 1972; Litvinenko et al., 1975*; Novitskaya and

* These works were not available to the author for reference in spite of her best attempts to procure them. The given information is cited from Cantino and Sanders (1986).

Kristopa, 1971*; Zoz and Litvinenko, 1979*). El-Gazzar and Watson's (1970a) computational analyses based on anatomical and morphological characters involving 116 genera of Labiatae, 17 of Verbenaceae, three of Dicrastylidaceae and two of Stilbaceae have yielded two primary groups in the Labiatae - Group A with tricolpate or tricolporate pollen and Group B with hexacolpate pollen. The Group A corresponded to Erdtman's Nepetoideae and the group B to Erdtman's Lamioideae. According to them systems of Bentham and Briquet seem seriously defective in terms of tribes, subtribes and even genera.

Cantino and Sanders (1986) made a detailed palynological survey of 108 genera of the family and discussed the subdivision of the family based on 11 contrasting characters of Erdtman's subfamilies such as number of pollen nuclei (cells) and colpi, occurrence of endosperm, shape of embryo and cotyledon, volatile turpenoid content, occurrence of rosemarinic acid, occurrence of irridoid glycosides, degree of unsaturated fatty acids in the seed oil and mixospermy. In their view Erdtman's subfamilies appear to be the primary phenetic groupings of the Labiatae. In the light of the strong character support for Erdtman's subfamilies and their incompatibility with Briquet's system Cantino and Sanders have also recommended that the latter system may be abandoned.

By about the first quarter of the current century importance of cytological data in solving taxonomic questions was accepted by at least some taxonomists and the history of cytological work on the Labiatae goes as far back as 1919 when chromosome numbers of two unidentified species of Coleus were reported by Haberlandt. Since then a large number of contributions have been made on the cytology of the family. But most of the data available for a few decades to follow were confined to chromosome number reports and that too mostly from the temperate regions of Europe (Jorgensen, 1927; Muntzing, 1930a; Junell, 1934, 1937; Bushnell, 1936). By about the middle of this century cytological information was accepted as an important evidence in taxonomy and the general interest in cytology resulted in more extensive cytological survey of the Labiatae from different parts of the world. Love (1954), Morton (1956, 1973), Strid (1965, 1971), Bothmer (1970), Buyukli (1970), Fugita (1970), Majovsky et al. (1970), Vakar and Leshukova (1970), Chuksanova and Kaplenbeckova (1971), Dahlgren et al. (1972), Markova and Ivanova (1974), Gill (1977, 1979, 1980a, b, c, 1981a, b, c, 1983, 1984), Cantino (1982, 1985) and Queiros (1983, 1985) are some of such studies.

The chromosome number report of four species of Coleus (Reddy, 1952) marked the beginning of chromosome studies on Indian Labiatae. Later North Indian members were studied chiefly

by Sharma and Bhattacharya (1959), Sobti (1965, 1971a,b), Mehra and Gill (1968, 1972), Gill (1970, 1971a,b,c, 1972), Bhattacharya (1975, 1976, 1978a,b), Pushpangadan et al. (1975, 1977), Vij and Kashyap (1975, 1976), Singh (1978, 1979, 1980, 1987) Singh and Sharma (1981a,b, 1982, 1983, 1986), Bir and Saggoo (1982a,b,c), Khosla and Sobti (1985), Saggoo and Bir (1986) and Kundu and Sharma (1988).

Tropical South India hosts about 134 species of the family distributed in about 29 genera (Gamble, 1924; Rani and Mathew, 1983). Cytological studies on South Indian Labiatae were initiated by Gajapathy (1962) and Ramachandran (1967). Cytological survey of the Labiatae in South India was subsequently taken up by Vembu and Sampathkumar (1978, 1980, 1981), Sanjappa (1979), Vembu (1979a,b,c), Krishnappa and Basavaraj (1982), Saggoo and Bir (1982), Bir and Saggoo (1985) and Basavaraj and Krishnappa (1988). As a result chromosome numbers in about 70 species are so far known and the number was very much less in 1979 when this study was undertaken. The observations reported in this study were made during the period 1979-'83. Cytology of 88 accessions belonging to 70 species under 22 genera is reported here. Based on the available cytological data attempts are also made to elucidate the trend of cytological evolution in the Labiatae and to extend our present day taxonomic understanding of the family.