GENERAL DISCUSSION

We have classified, analysed, discussed and catalogued the vegetation and flora of the Bilaspur district, about 45% of whose area is under forests and 60% of forest area comprise highly rugged hills rising to 1,200 m and valleys supporting rich vegetation within the tropical belt enjoying tropical climate in summer and sub-tropical climate in winter.

Temperature and rainfall are credited with a vital role in determining the vegetational types, but Champion and Seth (1968) concede that when both the factors are taken together, it is not possible to analyse the complex factors responsible in explaining the development of any given type found in an area. van Steenis (in the Mountain Flora of Java, Leiden: 17-18. 1972) in his adopted thermal ecological concept, classifies the plants occurring in the sub-tropical (as also in the warm temperate) climatic conditions as MESOTHERM plants and those restricted to tropical zones, as MEGATHERM plants. He equates the Megatherm plants of the equatorial belt with the tropical montane forests (such as found in the Bilaspur district at 1200 m) and assigns the families Anacardiaceae, Burseraceae, Capparaceae, Combretaceae, Dilleniaceae, Dipterocarpaceae, Flacouriaceae etc. as representing the Megatherm plant families characteristic of true tropical
lowlands. He defines the climax vegetation as the richest vegetation, which is in agreement with the original plant cover for each locality in agreement with the climate and soil. Climax vegetation may be inferred if the autecology of each of the component species is adapted to perform its full life cycle in the climax and is capable to perpetuate as long as habitat factors remain constant. It follows that of each individual species specimens of different ages will be present, from the germling to full-grown stages. He concludes from this that germination of seeds of species in a climatic climax forest must be shade-tolerant - a most important point.

While the Moist 'Sal' forests met within the area represent the climatic climax, there is evidence to uphold the Polyclimax theory (Champion & Seth, l.c.) in respect of vegetational types met with in the Bilaspur district, as a whole. viz., any particular type of forest/vegetation cover being determined by a complex of factors depending on the site conditions.

However, a broader correlation seems to exist between the forest types and the soil types supporting it. The red and black soils/red and yellow soils derived from the disintegration of the underlying trap rocks and the Barakar soils in flat areas with deep sandy loam soil support mixed deciduous forests in which 'Sal' is predominant; the laterite and the brown soils
derived from Vindhyan Sandstones or the Gondwana rocks or schists and shales supporting stands of deciduous forests in which 'Sal' is somewhat tolerant and *Cleistanthus collinus* is predominant. While the acidic soils support rich growth of 'Sal', in the basic soils the crop changes to mixed forests, the underlying geological formations playing thus only an indirect role in determining the natural vegetational/floristic cover.

Since we, in India, are familiar with Bentham & Hooker's (1862-1883) system of classification and all Indian herbaria are arranged (even current regional Floras are published) according to this system, the sequence of presentation of the 120 families to which 507 genera from Bilaspur are assigned, is after Bentham & Hooker's system for convenience and study. Yet, in view of the fact that Cronquist's (1968) classification of the Magnoliophyta (angiosperms) is accepted currently as a phylogenetic one, 507 genera are assigned to 120 families as delimited by Cronquist and the position of these families are shown in a hierarchical system which recognises CLASSES, SUBCLASSES and ORDERS and in which the sub-class Magnoliidae are considered more primitive than the sub-class Hamamelidae, the Caryophyllidae representing an evolutionary blind end. But according to some others (see Panigrahi, Jour. Orissa Bot. Soc. 7:1-14, 1984 for a review) the Hamamelidae are more primitive than the Magnoliidae.
Considering the fact that Madhya Pradesh as a whole and South and Eastern Madhya Pradesh in particular, has no FLORA to serve as a handbook or guide to various students and researchers in Botany on one hand and to the foresters and conservationists on the other, Flora of Bilaspur district, lying in the heart-land of India, as it were, and dealing with as many as 852 indigenous and naturalized taxa, with correct nomenclature, basionyms and several important synonyms and citation of relevant literature with up-to-date references wherever necessary, is of value. Attention may be drawn to the fact that in respect of 404 species as dealt with in Flora of British India (1872-1896), of 61 species as in Herbaceous Flora of Dehra Dun (1977), of 34 species as in the Flora of the Hassan District, Karnataka State (1976) and of 47 species as in Enumeration of the Flowering plants of Nepal (1978, 1979, 1982), name changes have been effected after due scrutiny of published literature to conform with the I.C.B.N. (1978). Citation of original literature and type/lectotype in respect of 507 genera (from amongst an estimated total of 2,200 genera of angiosperms for India) in consultation with Farr et al. (1979), is a unique feature of the FLORA OF BILASPUR DISTRICT. All these, together with reference to the types/syntypes/lectotypes/type localities of a number of species, as available, is aimed at setting a new trend in floristic research in
this country, and is designed to have wider impact and stimulate research over a wider area beyond the borders of the district/state. It must be emphasised that 852 species in the Systematic treatment do not include any of the exotic species, maintained purely in cultivation/plantations/gardens, although references to some of them are made here and there in some other context.

Study of the Flora of Bilaspur district has also proved to be of phytogeographical interest, in as much as it forms the northern fringe of the Indian Region (Good, 1947) and lies within the parameters of the Bihar - Orissa endemic centre (Clayton and Panigrahi, 1974). An analysis of the 852 species from the district shows that it shares as many as 795 species with Bihar and Orissa (vide Haines, 1922-1925), 728 species with the Upper Gangetic Plain (vide Duthie, 1903, 1922), 757 species with Madras Presidency (vide Gamble and Fischer, 1915-1935) and Karnataka (vide Saldanha and Nicolson, 1976) and 619 species with Nepal Himalayas (vide Har et al., 1978, 1979, 1982). It is evident then, Bilaspur district provided a cradle, a meeting ground of many of the indigenous taxa met with in the eastern, northern, western and southern India.

It is of further interest to record that 26 monotypic genera of which eight are endemic in India,
have also been collected from the district. Again, 35 species reported as endemic to India and which include some monotypic genera, such as *Soymida*, *Chloroxylon*, *Schleichera*, *Spermadictyon* etc. have also turned up here. *Cucumis setosus* known to be endemic to Maharashtra and Rajasthan and *Euphorbia perbracteata* Gauge, endemic to Maharashtra, extend their range to Bilaspur district. *Limnophila chinensis* var. *clarkei* (Haines) S.K.Murti, earlier known from Chhotanagpur in Bihar, also occurs here.

All the same, presence, in Bilaspur flora, of as many as 46 species not recorded by Haines, 11 species not recorded by Hooker *et al.*, 99 species not recorded by Duthie, 88 species not recorded by Gamble & Fischer/Saldanha and Nicolson and as many as 220 species not recorded by Hara *et al.* from Nepal, may suggest that Bilaspur district harbours a number of species (although not endemic) not yet known to have been recorded from the adjoining areas of the Indian region. On the other hand, as many as 10 species as new records for 1976,1979) Madhya Pradesh ( Murti, 1972$,^2$ and more than 60 species as new records of species for the district have been collected from the area under study.

Plants of higher elevations such as *Argostemma sarmentosum*, *Begonia picta*, *Clematis smilacifolia*, *Conyza stricta*, *Cymbidium macrorhizon*, *Hypericum japonicum*,
Lepidagathis purpuricaulis, Laggera alata, Rorippa indica, Reinwardtia indica, Rhamnus purpureus, Swertia angustifolia, and Thalictrum foliolosum etc. and some temperate genera, such as Senchus, Dumasia, Pimpinella, Geranium, Swertia and Gerardinia etc. descend down to the tropical latitudes and find shelter in the higher altitudes in the North Bilaspur Forest Division.

Of the 120 families, 507 genera and 852 species, 10 families rich in number of species (vide Table 4) account for 248 genera and 470 species, thus accounting for about 50% of genera and species. In contrast, 37 families are represented by only one genus and one species each - thus accounting only for about 4% of the known species from the area.

An attempt has been made to enumerate plants of economic importance and of medicinal value with notes on their local names, parts of plants used and for the purpose for which they are used. It is hoped that planned cultivation of some of these plant species on a larger scale may be considerable help to young entrepreneurs interested in starting small-scale industries. For example, Hyptis suaveolens yields an aromatic oil which is mosquito-repellant. This can be profitably exploited. Eichhornia crassipes may be substitute for cow-dung in operating "Gobar-Gas plants", for which there is popular demand throughout the country.

E. crassipes may also be grown in vivo for purifying
industrial affluents of hard metals such as Cobalt and Magnesium which prove health-hazards.

It is also hoped that this Flora, when published, would stimulate chemotaxonomic and phytochemical studies, comparatively recent areas of investigations. A phytochemical study of the hitherto uninvestigated taxa of medicinal importance, may unravel new compounds and potential drugs of great therapeutic value, and in the years ahead, may bring to market newer drugs of enormous utility in alleviating human suffering. Discovery of the alkaloid reserpine in the roots of Rauvolfia serpentina as late as 1956 and of colchicine from the seeds of Iphigenia stellata (endemic in the Western ghats) only in 1978, speak volumes to commence similar investigations of various other species listed elsewhere in the Thesis. Panigrahi (Bull. Reg. Res. Lab. Jammu 1(2):111-116, 1963) listed more than 200 species of medicinal plants of local use in the Gandhamardan Parbat of Orissa, of these Curculigo orchidides, Asparagus racemosus and Pueraria tuberosa regarded as plants for rejuvenation etc. and Radermachera xylocarpa as a snake-bite cure. All these species occurring within the district, may need to be phytochemically investigated.

The Flora of Bilaspur district not only would enable one to know about the vegetation and flora of
the area, but would give an integrated view of the physical, ecological and biotic factors that condition the composition of the vegetation. Of late, the natural ecosystems are being drastically altered by human interference in the form of deforestation, industrialisation, urbanization, extension of agriculture, construction of huge dams over rivers etc. For achieving balanced ecosystem, conducive to better life of the people of the region, such rapid inroads of modern civilisation should be checked/moderated.