

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

Most of the workers in taxonomy consider the family Leguminosae as a very natural (homogeneous) assemblage of three closely related sub-families viz. Caesalpinoideae, Mimosoideae and Papilionoideae (or Lotoideae as validated by Rehder, 1945). Jones (1955) considers the family Leguminosae as an order (- Leguminales) including the families Mimosaceae, Caesalpinaceae and Papilionaceae or Fabaceae and also a fourth family viz. Krameriaceae. However, opinion is still divided and both systems continue to be in vogue, with their own relative merits and demerits. Hutchinson (1967) recognised 690 genera and 17,600 species in the order Leguminales, which are distributed in most parts of the world. Among the three families of the order, the zygomorphic flowered Fabaceae is considered to be more advanced and a climax group. It is the largest family of the order containing 482 genera and 1,200 species (Hutchinson, 1967). The family Fabaceae is characterised by gamosepalous calyx, papilionaceous corolla, androecia of usually 5 or 10 stamens, commonly mono or diadelphous and monocarpellary pistil.

Bentham and Hooker (1865) classified various genera of

Fabaceae into categories like tribes and subtribes. Later taxonomists like, Warming (1879); Taubert (1894); Rydberg (1928); Metcalf and Chalk (1950); Rendle (1959); Hutchinson (1967) etc. have followed the same classification with some modifications. Only in the work of Hutchinson all the subtribes are raised to the level of tribes. Dormer (1946) considering vegetative morphology as a guide to the classification of papilionatae has remarked that "Some of the tribes contain genera which are not closely related to each other and also that certain species have been variously assigned to either genus by different workers". This is true with certain species of the genera Desmodium and Alysicarpus. Evidences from other disciplines also differ among themselves, and support one or the other classifications proposed by taxonomists, thus creating confusion regarding delimitation of various taxa within the family.

Today's taxonomy is not just a source of recognition of similarities and dissimilarities between the individuals with common characters and geographic distribution. There is now growing consciousness among workers to interpret a large number of anomalies crept into the so called "Natural classification" of seed plants, for which the answer must naturally be sought in the experimental science, variously

known as experimental taxonomy (Clements and Hall, 1920) Genecology (Turrell, 1923) and Synthetic taxonomy (Turrill, 1954). Similarly the role of cytology in modern taxonomy (i.e. cytotaxonomy) is best exemplified by classical works of Babcock (1942) in Crepis, Goodspeed (1954) in Nicotiana, Chennaveeraiah (1960, 1962) in Aegelops etc. and a similar attempt has been made in the present work.

A good deal of investigations have been carried out in the family Fabaceae in particular and Leguminosae (now Leguminales) in general. Some prominent workers among them are Techechow (1933, 1935); Senn (1938); Atchison (1951); Delay (1950-51); Frahm-lelivelid (1953, 1962, 1966); Turner (1956, 1959); Berger et al. (1958); Turner and Fearing (1959, 1960); Bir and Sidhu (1967); Singh and Roy (1970); Bhatt (1974); Bandel (1974) etc.. Most of these works were confined to reports of chromosome number and their bearing on phylogeny of the taxa studied. However, Singh and Roy (1970) have studied the karyomorphology of 17 species of Indigofera. They have indicated the need for meiotic and breeding works to draw the relationships among the species. Frahm-lelivelid (1966), while working with the species of Indigofera from Africa has emphasized the need for cytological

research in the wild species of the genus growing in India. Bhatt (1974) has attempted to describe the karyotypes of some species of Indigofera, Alysicarpus and Desmodium. There is no consensus in the conclusions drawn regarding the basic number or numbers and envisaged phylogenetic relationships among the taxa studied.

A perusal of literature on taxonomy and cytology of the family, together with its great many economic importances, demands a thorough cytological study of its members, for proper understanding of their phylogenetic relationships. Considering the need of such a study, the present investigation was undertaken.

The present work is confined to 102 collections of the genera Indigofera, Desmodium, Dendrolobium and Alysicarpus. Of the four genera, Indigofera belongs to the tribe Indigoferae and Desmodium, Dendrolobium and Alysicarpus to the tribe Desmodiae. Genera belonging to two different tribes are selected for comparison and better understanding of the delimitation of tribes.

The present work was planned as follows :-

- I. Collection of populations of different species were

made from different habitats and localities. Materials were also obtained from other parts of India and abroad. Field notes were maintained for plants collected in India. The seeds of the populations collected were grown in identical conditions to check the morphological behaviour and to compare them with earlier observed morphological features. The striking morphological characters and their variations encountered in different populations of a taxon are represented in a polygram, for simultaneous expression of similarities and dissimilarities.

- II. Cytological study pertaining to karyotypes and meiotic behaviour of different populations is made. This is done with a view to decide the basic number and to understand the inter-relationships and mode of speciation of the taxa studied.
- III. Data concerning variations observed in morphological characters and karyotypes were used to detect the presence of ecotypes or cytotypes, within the circumscriptions of a species, if any.
- III. Pollen fertility was determined for each population.

IV. Estimation of total DNA content was carried out for some of the taxa investigated (Appendix).

All the above mentioned aspects of the study are presented in the following pages in different parts of the thesis.

Part I.

This part includes materials and methods used in taxonomical and cytological studies.

Part II.

This part deals with taxonomical and cytological observations, in which, a brief history of the genera, their taxonomic position, (i.e. delimitation of genera, subgenera, sections and subsections) as suggested by different taxonomists. The species investigated presently are arranged following the classifications of Gillett (1958) for Indigofera, Ohashi (1973) for Desmodium and Dendrolobium and Baker (1876) for Alysicarpus. The necessary nomenclature and a brief description of the individual species are given. Wherever the variations are observed in different populations, they are subjected to polygraphic study.

The taxonomic treatment is followed by cytological

observations viz. chromosome morphology, meiotic behaviour and pollen fertility for each population. The present observations are compared with the earlier available cytological investigations for a species. Data regarding exomorphological and karyomorphological differences, were taken into consideration, to detect the existence of ecological or cytological races present, if any.

Part III.

In this part, based on the above mentioned observations, a detailed discussion concerning basic chromosome number, karyotypic inter-relationships and their probable course of evolution is made.

In the cytotaxonomical considerations, the relationships between different taxa investigated are evaluated on the basis of cytological findings. These relationships are discussed in light of the known classifications (Gillett, 1958; Ohashi, 1973 and Baker, 1876).

Part IV.

In this part, summary of the observations, conclusions drawn and their importance for understanding the phylogenetic relationships at various levels of classification are given.
