INTRODUCTION

Biosystematics or biosystematy as it was originally defined by Camp and Gilly in 1943 "seeks (1) to delimit the natural biotic units and (2) to apply to these units a system of nomenclature adequate to the task of conveying precise information regarding their defined limits, relationships, variability and dynamic structure". The types of studies they advocated were to provide a system of classification which was to form a basis for organisation of information of all types concerning living organisms and ultimately to provide solutions to questions concerning biological diversity within the framework of evolution. In brief history of this discipline, biosystematics have used a wide variety of techniques, in addition to those traditional to classical taxonomy, in an attempt to resolve these issues (Vickery, 1984). These are:

1) **Cytological studies** - including chromosome numbers, karyotypes, genome analysis and chromosome pairing.

2) **Genetical studies** - including physical gene map position (*in situ* hybridisation); Gene linkage maps.

3) **Hybridisation** - which is observed in wild populations; or carried out artificially which depicts information on reproductive barriers.
4) **Numerical taxonomy** - which covers all aspects of quantitative taxonomy but primarily concerned with those that are multivariate methods.

5) **Chemotaxonomy** - which seeks to utilize chemical information of primary metabolites, secondary metabolites and semantides.

6) **Molecular and Cytochemical techniques** - including DNA amount per genome/ per chromosome; Base composition and AT:GC ratios; DNA density; Amounts of unique and repeated sequences in the genome and their ratio; Repeated sequence copy number; Repeated sequence length; Interspersion patterns of repeated sequence; Order of bases in a coding or noncoding DNA sequence.

The Genus *Bidens* (Asteraceae, Tribe: Heliantheae, Subtribe: Coreopsidineae) includes approximately 280 species whose distribution encompasses Africa, the New World and Polynesia and Eurasia to Australia (Sherff, 1937). In India three species of *Bidens* section Psilocarpacea namely *B. pilosa L.*, *B. bipinnata L.*, and *B. biternata* (Lour.) Merr. and Sherff have been reported and their taxonomic treatments have been varied from time to time, and understanding of their circumscription is still disputed. According to Chavan and Oza 1961, 1966; Maheshwari, 1963; Oomachan and Billore 1969; Rao and Joseph 1965; Rau 1968; Santapau 1953; Saldanha
and Nicolson 1976, *Bidens biternata* (Lour.) Merr. and Sherff is the most common representative of this group, the Linnean *B. pilosa* is either absent or very rare and *B. bipinnata* L. is infrequent in its distribution. However, Babu (1977) reported that *B. pilosa* L. and *B. bipinnata* L. are frequently distributed in the Northwest Himalayas and remarked that *B. biternata* “may occur within this area as a weed”. A similar observation on the distribution of *B. pilosa* L. in South India was made by Matthew (1981).

Further, the taxonomic distinctness of these three species has been influenced by the views on the synonyms assigned to each taxon. The following brief resume of the available literature illustrates the various views on the circumscription and delimitation of taxa within the section Psilocarpaeas. Clarke (1876) listed *Bidens pilosa* L. and *Bidens decomposita* DC. in his ‘Compositae Indicae’. Hooker (1882) segregated *B. pilosa* L. into three varieties *B. pilosa* var.1 *pilosa* proper, var.2 *bipinnata* and var. 3 *decomposita*. Additionally, in his notes Hooker (1882) listed *B. wallichii* DC. as a synonym of *B. pilosa* var.2 *Bipinnata*. Duthie (1903) recognised only *B. pilosa* L. and *B. bipinnata* (i.e. *B. pilosa* var.2 *Bipinnata* sensu Hooker) as its synonym. Cooke (1906) considered Hooker's var. 2 *bipinnata* as 'scarcely worth distinction' in the Bombay presidency, and thus recognised only *B. pilosa* as the common Indian member of the genus *Bidens*. Collett (1921), on the other hand, recognised *B. pilosa* L. and *B. wallichii* DC.
as two distinct species, thus not following Hooker (1882) who considered the latter as a synonym of

\textit{B. pilosa} var. 2 \textit{bipinnata}.

Sherff (1937) in his monograph on the genus \textit{Bidens} pointed out the erroneous treatment by Hooker (1882) of \textit{B. bipinnata} as a variety of \textit{B. pilosa} and instead established \textit{B. bipinnata} L. as a distinct species with the following names as its synonyms: \textit{B. pilosa} var.2 \textit{bipinnata} (L.) Hook; \textit{B. pilosa} var.3 \textit{decomposita} (Wall.ex.DC.) Hook; and \textit{B. decomposita} Wall.ex.DC. Sherff (1937) also removed \textit{B. wallichi} DC. from the synonymy of \textit{B. pilosa} var.2 \textit{bipinnata} of Hooker, and considered it as conspecific to \textit{B. biternata} (Lour.) Merr. and Sherff. Further in his notes under \textit{B. bipinnata} (Sherff 1937 P :372) and \textit{B. biternata} (Sherff 1937 P :399) he commented that due to the superficial intermediate leaves, '\textit{B. biternata} (= \textit{B. wallichi} DC.), a species very common in British East India', was erroneously equated by Hooker with \textit{B. bipinnata}. Santapau (1953) overlooked 'British East India' in the above statement of Sherff (1937) and remarked: This (i.e. \textit{Bidens biternata}) is a plant known to the writers of the Indian Floras as \textit{B. pilosa}. Sherff in his recent monograph on the genus \textit{Bidens} has shown that the common Indian plant is not the Linnean plant. Subsequently all the floristic accounts published by Indian taxonomists dealt with \textit{B. biternata} (Lour.) Merr. and Sherff as the common Indian \textit{Bidens} with \textit{B. pilosa} auct. non Linn. as its synonym.
In the recent years some taxonomists who regard the common Indian plant as *Bidens biternata* (Lour.) Merr. and Sherff also reported the occurrence of the Linnean *B. pilosa* as a rare plant from several parts of the country (Chavan and Oza, 1961, 1966; Oomachan and Billore, 1969; Panigrahi at al, 1964; Saldanha and Nicolson, 1976; Santapau, 1961). *B. bipinnata* L. has been reported as a new record from different parts of the country (Babu, 1977; Chavan and Oza, 1966; Dakshini and Prithipalsingh, 1971; Raizada, 1976; Saldanha and Nicolson, 1976). Dakshini and Prithipalsingh, (1984) have critically examined the herbarium specimens and established that *Bidens* Sect. Psilocarpacea in India is represented by *B. pilosa* var. *β. minor* (Bl.) Sherff and *B. bipinnata* Linn. Inspite of this conclusion recently, Manilal (1988) and Ramachandran and Nair (1988) have reported *Bidens biternata* from Kerala state. Similarly, Raju and Raju (1995) have reported *Bidens cynapifolia* H.B.K. as new species from peninsular India. Thus the taxonomy and nomenclature of *B. pilosa*, *B. bipinnata* and *B. biternata* in India are in a confusing state. Therefore to resolve these issues we have undertaken the biosystematic studies of *Bidens* section Psilocarpacea from South India with the following objectives.
1. Analysis of distribution patterns and diversity of various *Bidens* species section Psilocarpacea from South India.

2. Critical morphological analysis of the population in nature as well as from the plants which were raised in uniform conditions.

3. Detailed cytological analysis i.e. Analysis of chromosome number, karyotypes, and meiotic behaviour of chromosomes.

4. Quantification of nuclear DNA amounts in various populations to correlate with systematics.

5. Detection of breeding systems of each species and interspecific hybridisation to verify the genetic barriers between the species.

6. Seed protein profile, obtained by electrophoresis of different populations to correlate with systematics.