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Synopsis of the thesis entitled

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**SYSTEMATIC STUDIES OF ASTERACEAE  
MEMBERS OF SOUTH GUJARAT**

Submitted to  
**The Maharaja Sayajirao University of Baroda**



For the Degree of  
**DOCTOR OF PHILOSOPHY**

in  
**BOTANY**

By  
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## Chapter 1: INTRODUCTION

Asteraceae is the largest family in Dicots represented by more than 1300 genera and 33,000 species (Funk *et al.*, 2009; GCD, 2023). Family is highly evolved and is economically important as crop, ornamental and medicinal plants.

Asteraceae was first described by Giseke (1792) as Compositae owing to the presence of composite heads. However, the first proper classification of the family at tribe level was given by Cassini (1814-1819). Later on, the other detailed works were given by Bentham (1876), Cronquist (1985), Bremer (1987), Funk *et al.* (2009) etc. The current classification comprises of 12 sub-families and 43 tribes (Funk *et al.*, 2009).

At national level, Asteraceae is represented by 167 genera and nearly 900 species under 12 tribes of Asteraceae family (Hajra *et al.*, 1995). The first monographic work was published by Clarke (1876) in *Compositae Indicae*. Later on, Hooker (1881) gave detail accounts on Asteraceae in Flora of British India in which he has included 127 genera and 607 species in 13 tribes. Some of the major work on Asteraceae by Botanical Survey of India at national level are Hajra *et al.* (1995) and Mao & Dash (2020). The revisionary works at tribes and genus level has been carried out by Bhattacharjee *et al.* (2019), Kasana *et al.* (2021), Shinde & Singh (2014), Kumar & Singh (2001), Bhellum & Magotra (2013), Mamgain (1998), Shekhar *et al.* (2013), Mukherjee (2002), Dakshini (1978) etc.

At regional level Asteraceae has not been studied in details. It was restricted to only to floras like Shah (1978), GEC (1996) and Raghvan *et al.* (1981) with many unresolved species and name. Thus, monographic work will give insight into the present status of Asteraceae in Gujarat.

In South Gujarat, the major works are included in floristic works like Suryanarayan (1968), Yadav (1979), Tadvi (2013). Patel (1971), More (1972), Desai (1976), Contractor (1986), Mac (1982), Reddy (1987).

South Gujarat is an important zone from the perspective of the Western Ghats and it comprises many different types of landscapes and habitat which give possibility to find new plants which may have not been reported or properly identified in earlier works. hence it has been worked out in current study.

The main objectives of the study are:

1. Survey of the members of family Asteraceae in South Gujarat.
2. To describe morphological characters of Asteraceae species.
3. Pollen types and their evolutionary and taxonomic significance.
4. Cladistic analysis for understanding phylogenetic relationship.

## **Chapter 2: STUDY AREA AND SURVEY**

The study area for current research comprises of five district of south Gujarat which are Surat, Tapi, Navsari, Dang and Valsad. Surat District's total area is 4,418 km<sup>2</sup>. Total area of Tapi district is 3139 km<sup>2</sup>. Navsari is an administrative district with its headquarters at Navsari city with area 2,211 km<sup>2</sup>. Dang is a district with the administrative headquarters of the district are located in Ahwa. Dang has an area of 1,764 km<sup>2</sup>. Valsad district covers 3008 km<sup>2</sup>.

Study area comprises of various landscapes like forest, lakes, rivers, grasslands agricultural field, coastal regions etc. There are two protected areas i.e. Vasda National Park and Purna Wildlife Sanctuary.

## **Chapter 3: METHODOLOGY**

Field survey was carried out and the habitat of Asteraceae members were studied. Comparative analysis of diversity in different districts and habitats has been done. Specimens were collected, dried, poisoned and mounted on herbarium sheets. The voucher specimens were deposited to BARO Herbarium.

The specimen was brought to the laboratory and the morphology was studied in detailed. The morphological characters like habit, stem, leaf, capitulescence, capitulum, involucre, florets, anthers, styles and pappus were studied in detail.

Pollens of Asteraceae were collected from specimen and stored in Glacial Acetic Acid which was followed by Erdatmann's Acetolysis method. Acetolysed pollen were mounted on slide in Glycerine Jelly and pollens were studied in light microscope and confocal microscope. Data collected was put to statistical analysis like ANOVA for variable analysis.

Morphological and Palynological data were collected and analysed by UPGMA method in PAUP\* software. The outgroup is *Scavola taccada* because it belongs to Goodeniceae which

is the sister family of Asteraceae. Cladogram was compared with supertree of Asteraceae family prepared by Funk et al (2005).

## Chapter 4: OBSERVATION AND DISCUSSION

Total of 70 species belonging to 51 genera and 11 tribes were collected from South Gujarat. Additionally, the study shows the doubtful existence of *Blumea lacera*, *Centratherum phyllonaeum*, *Erigeron asteroides*, *Flaveria trinervia*, *Gnaphalium luteo-album*, *Acmella calva* and *Tricholepis amplexicaulis* probably owing the deficient data or wrong identification.

The proper identification keys for the genus and species was provided as this family is very complicated. It is followed by the detail description of the plant which includes accepted names, synonyms, morphological characters, flowering and fruiting and distribution. Along with above, taxonomic notes are also provided to avoid the confusion between related species. Photo plates are also provided. The largest tribe in genera is Heliantheae (12 genera, 16 species) while the largest tribe in the species is Inuleae (9 genera, 19 species) followed by Vernonieae (6 genera, 6 species), Cardueae (4 genera, 4 species), Astereae (4 genera, 4 species), Coreopsidae (3 genera, 5 species), Millereae (3 genera, 3 species), Eupatorieae (3 genera, 3 species), Senecioneae (3 genera, 3 species), Cichoreae (2 genera, 4 species) and Gnaphalieae (2 genera, 3 species).

For pollen studies, the detail description of pollen morphology was provided which includes: symmetry, shape, number of apertures, types of aperture, exine ornamentation and the presence of cavea with the measurements. Four types of pollens were observed. Type 1 found in the members of Cichoreae and Vernonieae. Type 2 found in *Xanthium strumarium*. Type 3 found in the *Echinops echinatus* and *Oligochaeta divaricata*. Type 4 found in the rest of the members of Asteraceae. After running the ANOVA, it was found that in all the 6 variables i.e. size of pollen, length of ornamentation, polar axis, equatorial diameter, PA/ED ratio, width of aperture the p-value is <0.001 and hence the variation is significant.

A cladogram prepared from the morphological and palynological data has been given along with explanation. It shows generic compatibility with recent classification among different species. The tribes like Heliantheae, Inuleae and Cichoreae show the monophyly. *Xanthium strumarium* is polyphyletic to Heliantheae tribe.

## SUMMARY AND CONCLUSION

The survey resulted in one species which is new to the world i.e. *Thespis thakeri* JJ Sharma and Nagar. Additionally, *Lipochaeta lobata* was a new generic record to Asia and *Crassocephalum crepidioides* is a new generic record to Gujarat. New records for south Gujarat are *Acmella uliginosa*, *Pullicaria aungustifolia*, *Blumea virens*, *Blumea obliqua*, *Blumea sinuate*, *Pluchea ovalis*, *Pluchea wallichiana*, *Gamochoeta pensylvanica*, *Pseudoconyza viscosa*, *Sonchus asper* and *Tithonia diversifolia*.

In depth studies shows that, *Blumea malcolmii* has been confused as *Blumea lacera* and *Centratherum punctatum* as *Centratherum phylloneum*.

## PUBLICATIONS

### Articles

1. SHARMA, J.J., PATEL, P.R., THORAT, A.B. & NAGAR. P.S. (2023). *Emilia javanica* (Asteraceae): A new weed record for Gujarat state, India. *Journal of Economic and Taxonomic Botany* 47(1): 32–34.
2. SHARMA J.J. & NAGAR P.S. (2023). *Thespis thakeri* (Asteraceae): a new species from Gujarat, India. *Rheedea*. 33(3): 193–198.
3. SHARMA, J.J., PATEL, P.R., THORAT, A.B. & NAGAR. P.S. (2023). *Crassocephalum crepidioides* is The Correct Identity of *Emilia javanica* (Asteraceae) Reported as New Weed Record for Gujarat State, India. *Journal of Economic and Taxonomic Botany* 47(3): 134–135.
4. SHARMA J.J. & NAGAR P.S. *Lipochaeta* DC. (Asteraceae): A New Generic Record for Asia. *Rheedea*. (Under communication).

### Presentations

1. Alien Plant Species of Asteraceae found in Dang District. International Symposium on Plant Taxonomy and Ethnobotany.
2. Evolutionary Aspect of Capitulum at Generic Level in Some Members of Asteraceae. IAAT 2021.
3. Taxonomic Paradox behind Subtribe Ambrosiinae Less.: A Case Study on *Xanthium* and *Ambrosia*. IAAT 2023.

4. Vernoniae (Asteraceae) Diversity and Systematics of South Gujarat. Fundamental and Applied Dimensions in Plant Sciences.
5. *Blumea* DC. (Asteraceae) of South Gujarat. IAAT 2022.

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Guide