6. SUMMARY

Systematics must be perceived as a science that can hold its own image in the current information era, rather than as an old fashioned stamp collecting exercise and this perception must be presented to both the general and public. To build up a natural system of classification of plants, it is necessary to compare one form with another, such parts like stem, leaf, root, flower, fruits and seeds. These superficial examinations are helpful to a certain extent in indentifying and classifying the plants. The phenotype of each and every taxon is unique and this uniqueness itself is a clear identifying feature for a taxon. To a certain extent molecular, palynological and anatomical features seem to go hand in hand with the external morphological features.

Evolutionary biologists began to apply experimental methods like molecular, palynology, biochemistry, hybridization, phenotypic plasticity and other phenomena to classify species having complications. Much of the important biosystematics work on plants was done in California, especially by Bay area botanists from Berkeley, Davis and Stanford originally in 1930s. The term ‘Biosystematics’ is referred as the use of biological criteria in refining the system of classification. Biosystematics uses experimental data in order to understand patterns of organizational variation in fundamental biological level. Biosystematics is the science through which life forms are discovered, identified, described, named, classified and catalogued, with their diversity, life histories, living habits, roles in an ecosystem and spatial and geographical distributions. In essence, it is the science that provides indispensable information to support many fields of research and beneficial applied programs. Biosystematics is a
synthetic study which depends on the contribution from specialists in the various fields such as molecular biochemistry and palynology. By recognizing and accounting for correlations of diagnostic features, it will be possible to establish how variation in one character is influenced by or influences other characters.

Biosystematics is defined as “the study and description of the variation of organisms”. The investigation of the causes and consequences of this variation and the manipulation of data obtained helps to produce a system of classification. Biosystematics is an experimental taxonomical study of organisms from the standpoint of evolutionary processes which occur within population. It is largely concerned with morphological, anatomical, genetical, molecular, biochemical and palynological aspects. Biosystematics may therefore be considered as the taxonomic application of these types of experimental disciplines. Biosystematics although difficult to define precisely, is the consideration of the natural relationships among taxa. It includes the description, naming and classification of organisms together with their evolution and phylogeny. Systematics is mainly based on detailed examination of the floral and vegetative parts lead to a broad based evolutionary understanding of the origin and interrelationship of groups of population. Hence systematic study includes traditional taxonomy with the addition of theoretical and practical aspects of evolution, genetics and speciation.

In the present investigation, detailed analysis of various aspects such as morphological, anatomical epidermal, palynological, biomolecular and biochemical aspects of 15 South Indian species of Solanum were carried out. The study of differences between species was properly documented and their significance can be fully grasped by their expression. The present systematical study aims at for utilizing data from
morphology, biomolecular, anatomy, palynology and biochemistry for a better taxonomic understanding and interrelationship of species of *Solanum* and also establishing a modern system of classification and also preparing a plant identification key by utilizing these data.

**MAJOR FINDINGS OF THE STUDY**

1. Most of the species studied were shrub or herbs having stem with spiny hairs.

2. In the majority of species, shape of entire leaves was ovate, some species have lanceolate and other species have ob lanceolate leaves.

3. Most of the species studied have acute, obtuse or acuminate type of leaf apex.

4. Sinuate, entire, dentate and lobed types of leaf margin were observed and subcordate, cordate and attenuate type of leaf base were noticed.

5. All the selected species have alternate type of leaf arrangement.

6. Cymose, axillary cymes, corymbose cyme and helicoid cyme types of inflorescence were observed in the species studied.

7. Sepals were gamosepalous and five in number in all the species.

8. Petal colour varied from white to purple. Gamopetalous corolla was observed in all the 15 species.
9. As far as the stamens were concerned, each flower have five, free, small or large sized stamens. The length of anther ranged from 0.1 cm to 2 cm, whitish or yellow coloured anthers were observed. Length of filaments ranges from 0.1 cm to 0.9 cm. Colour of filament varies from white, green or yellow.

10. All the species studied have two carpels, the gynoecium contains two locules.

11. Another remarkable feature observed in all the species under the present study was superior syncarpous ovary and axile placentation.

12. Simple – style and capitate stigma was observed in all the species.

13. Majority of the species have many seeds and the seeds are smooth walled without hairs.

14. All the species under study have berry type of fruits.

15. Flowering seasons varied from January to December and some species are concerned flowering was observed throughout the year.

16. The stamata are anisocytic in leaves, calyx and corolla

17. In the leaves, the stomatal frequency was highest in the lower epidermis of Solanum nigrum and Solanum aculeatissimum.

18. The stomatal index was highest in the lower epidermis of Solanum aculeatissimum and it was lowest in the upper epidermis of Solanum aculeatissimum.
19. The leaves are amphistomatic in most of the species studied, except in *S. seaforthianam*, where it is of hypostomatic.

20. The stomata are absent in the calyx of *Solanum macranthum* and they are also absent in the corolla of *S. aculeatissimum, S.macranthum, S.melongena, S.melongena var. esculentum, S. peruvianam, S. seaforthianam* and *S. tuberosum*.

21. The foliar trichomes are absent in five species studied. In other species they are of either eglandular multicellular unbranched or eglandular multiradiate tufted.

22. The trichomes are absent in the calyx of five species studied. In other species, the trichomes are of eglandular unbranched unicellular, eglandular unbranched bicellular, eglandular unbranched tricellular, eglandular multicellular unbranched, eglandular multiradiate tufted and multicellular glandular.

23. The trichomes are absent in the corolla of four species studied. In other species it is of eglandular unbranched bicellular, tricellular, unbranched multicellular and unbranched multiradiate tufted.

24. The major foliar venation is of simple craspedodromous, mixed craspedodromous, camptodromous brochidodromous, eucamptodromous and kladodromous types.

25. The minor foliar venation is of either simple linear or simple curved with once or twice branched.

26. In all the species studied, the shape of areole is of polygonal type.
27. The aperture morphotype in most of the species studied are of either dizonoporate or trizonoporate, but in few species both type of aperture morphotype has been recorded.

28. The exine ornamentation in all the species studied are of smooth type and the shape of pollen grain is of spherical type.

29. The size of pollen grain varies greatly among the species studied.

30. The fertility of pollen is highest in *Solanum viarum* and lowest in *Solanum melangena var. esculentum*.

31. The qualitative phytochemical studies of methanol extracted leaf powder reveals that, the content of phenol, flavonoids and tannins showed maximum quality, alkaloids and saponin showed moderate quality and the content of glycosides, steroids and anthraquinone showed minimum quality or absent in the species studied.

32. The qualitative phytochemical studies of methanol extracted root powder reveals that, the content of flavonoids and saponin showed maximum quality, phenol, alkaloids and tannins showed moderate quality and glycosides, steroids and anthraquinone showed minimum quality or absent in the species studied.

33. The quantitative phytochemical studies of methanol extracted leaf powder reveals that, the content of flavonoids and tannins showed maximum quantity and phenol, alkaloids and saponin showed moderate quantity.
34. The quantitative phytochemical studies of methanol extracted root powder reveals that, the content of flavonoids and saponin showed maximum quantity, phenol and tannin showed moderate quantity, and alkaloid showed minimum quantity.

35. The quantitative analysis of DNA in leaf powder reveals that, the content of DNA was maximum in *Solanum macranthum* and minimum in *Solanum nigrum*.

36. The quantitative analysis of RNA in leaf powder reveals that, the content of RNA was maximum in *Solanum nigrum* and minimum in *Solanum melangena var. esculentum*.

37. The quantitative analysis of DNA in root powder reveals that, the content of DNA was maximum in *Solanum melongena* and minimum in *Solanum nigrum*.

Based on the results obtained from the present investigation, a biosystematical identification key was prepared in order to solve problems related to identification and cataloging of South Indian species of *Solanum*. In recent years, sufficient interest has been revived on the role of phytomorphological, anatomical epidermal, biomolecular and phytochemical characters in the solution of taxonomic and phylogenetic problems. Hence, further detailed studies are required regarding the various features of characters in the family Solanaceae in the solution of taxonomic and phylogenetic problems.

**CONCLUSION**

In the present investigation, certain characters are similar among the species of *Solanum* and other characters vary mostly from species to species. The number and nature of stamens are similar in all the species. The species of *Solanum* showed a remarkable variation in morphological, anatomical, epidermal, palynological,
biochemical and biomolecular aspects. Phytomorphological, anatomical, epidermal biochemical and biomolecular characters differ considerably among the species of *Solanum*, that may be due to the external environmental factors such as light intensity and atmospheric humidity which often have a marked effect on these characters.

Through the present investigation most of the species of *Solanum* in South India have been catalogued and classified. The problems related to their identification was solved to a great extent by adopting keys pertaining to morphological, anatomical epidermal, palynological, biomolecular and biochemical aspects. Eventhough there was variation in certain characters among some species of *Solanum*, a close resemblance has been observed in the morphological, palynological, epidermal biomolecular and biochemical features. The variation in biochemical quantity of different species of *Solanum* has a great evolutionary significance. It is also noted that the biomolecular quantity has a great influence on evolutionary trends in each and every species that will affect all other characters. The present investigations also support the view of placing the genera *Solanum* as separate genera under the family Solanaceae. The investigator would feel grateful if the findings of the study would lead to the better understanding of the biosystematics of South Indian species of *Solanum*. 