CHAPTER- I.

INTRODUCTION

AND

REVIEW

OF

LITERATURE
The science of taxonomy is now not simply based on vegetative & floral characters, as in the older times. Many new data such as Anatomical, Cytological, Physiological, Biochemical, Palynological, Epidermal appendages are regarded as very important in determining the relationship and affinities of the plants. Taxonomy now is a transcedental disciplines which comprehends and use information from all other disciplines of science.

Angiosperms show diverse epidermal characters often correlated with taxonomic delimitation. Solereder (1908) in his “Systematic Anatomy of dicotyledons” writes “The systematic value of the hair covering is very great.....:

Prat (1948) recognised such epidermal characters viz. stomata, epidermal cells and hairs. Cowan (1950) adopted the term “TRICHOME” from Greek meaning “a hairy covering”. According to Carlquist (1961) Trichomes are useful tools for systematic comparision of angiosperms because of their almost universal occurence, their variety, diversity and their easy preparation for study.

Trichomes which are common on almost all the Angiospermic plant parts in a multitudes of forms and size, have attracted the attention of Botanists from the early days. But the interest in trichomes taxonomy has long been quite superficial in earliers days. Linnaeus (1735) distinguished the trichome as a subsidiary organs alongwith stipules, bracts, spines thorns and tendrils of the plant. Henstein (1868) gave due consideration to trichome characters for taxonomic delimitations. He figured glandular hairs on the leaf of Azalea india L. The first Scientific definition of trichome was given by Jung (Sachs, 1890, P.61) According to him” Trichomes are the Structure born by the upper parts of plants and are secondary rank as compared to stem, leaf, flower and fruits.
The Botanical literature contains more than 300 descriptions of trichome types in order to characterize their great variation. The trichome appendages arise from a series of anticlinal and periclinal divisions of epidermal cells to form specialized trichomes that function as glandular or non-glandular trichomes. Such integral elements of the plant surface, which are all outer growths of the epidermis are termed Trichomes. They are taxonomically very useful and functionally, trichomes protect the plant from herbivores, from heat and sunlight (Werker, 2000).

The term trichome is used in a very broad sense to designate collectively all diversified unicellular and multicellular appendages that develop from epidermal as well as sub-epidermal cells.

In recent past, Carlquist (1958, 59a, 59b) studied the structure and ontogeny of glandular trichomes of *Macineae, Calydenia* and *Holocarpa*. Cown (1950) has emphasized that trichomes provide excellent criteria for distinguishing Sub-generic and specific levels in Rhododendrons. Recently Levin (1973) has defined the terms trichome as a hair-like appendage extending from the epidermis of an aerial tissue. Similarly, forms and distribution of trichomes was correlated with specific and Sub-generic distinction in *Nicotiana* by Good Speed (1954).


The surface of leaves and of other plant organs are commonly covered by various non glandular and glandular trichomes. Recently an extensive work has been done on different aspects of trichomes. Scientific interest in plant trichomes is based on their functional and taxonomic importance and on the economic usefulness of some trichome generated products. Trichome play an important role in plant defence, especially in relation to phytophagous insects. When non glandular trichomes form a dense indumentum, they may serve as mechanical barrier against various external factors, such as herbivores and pathogens, UV-B radiations, extreme temperatures and excessive water loss. In a number of taxa there is a negative correlation between trichome density and insect feeding, oviposition response and nutrition of larvae (Levine, 1973). A relationship between pubescence and pest resistance has already been established by Poole (1929), Poole & Smith (1931) Further, the glabrous varieties are the sufferers of high infestation and oviposition than the pubescent varieties. Johnson (1953) reported that larva or adult of Aphis craccivora may be permanently impaled or die by the presence of hooked trichomes on French bean
(Phaseolus vulgaris). In some plant groups protection against large mammals is achieved by the presence of stinging trichomes (Levine, 1973). In this regard, detailed study of morphology and toxicology of stinging hairs has been carried out by many workers on various plants viz. Jatropha (Haberlandt, 1914), Tragia voluvillis (Knoll, 1905), Urtica dioica and u. arenst (Wicke, 1861; Rauter, 1872), Tragia cannabina (Rao & Sundra Raj, 1951) and Tragia saxicola and Urtica dioica (Thurston, 1969, 1974). Recently impact of trichome density on the infestation of virus disease in Benincasa hispida was studied studied by Khan et. al. (2000). According to him trichome density was found to have a significant negative influence on the number of aphids.

Similarly, Sharma & Tyre (1973) have studied the role of trichomes in relation with environmental pollution. They have suggested that trichomes can be used as indicator of environmental pollution. Wegenor (1975) found that the trichome density and length is changed in highly polluted area.

Classification of trichomes based on their structure has been attempted by many workers. Among them Weiss (1867) was the first who divided plant hairs into three major groups viz. (I) all the constituent cells of hair are of same kind, (II) all the constituent cells are not of the same kind (III) cells provided with a secretion. Router in 1872 (cf.upof, 1962 P.11) proposed possibly the first ever classification of trichomes based on ontogeney. He divided them into two groups:

(a) those derived from epidermal cells and (b) other which have their origin in epidermal as well as sub epidermal cells. (emergence). De Bary (1884) classified trichomes in to the following six types:

(a) papillose (b) hairs (c) scales (d) shaggy hairs (e) worts (f) prickles.
In recent years a good number of papers have been published which deal with trichomes and their systematic classification. Some noteworthy ones are those of Metcalf & Chalk 1950, Hummel & Staesche (1962), Ramayya (1962), Inamdar & Patel (1973), Singh & Jain (1975), Alleykutty & Inamdar (1978) and Leela Vathi & Ramayya (1983).

Among the several classifications of trichomes available in the literature, the one presented by Ramayya (1962a, 1962b) is the most natural. It stresses the basic structural patterns of trichomes and it is also very close to the ontogenetic classification presented by the same author in 1972. He divided trichomes into five phyletic systems (a) unicellular (b) Uniseriate filiform, (c) Uniseriate macrofomm (d) M-multiseriate, and (e) P-multi seriate. Hence, in order to consider the value of trichome in classification and phylogeny, it is necessary that trichome types and trichome systems should be thoroughly studied. In this regards, Pyne (1978) was the first to publish “A Glossary of plant hair terminology” having most concised terminology. The glossary is divided into two sections. Part I includes terms for types and attributes of individual hair kinds and hair clusters. Part II deals with kinds and characteristics of indumenta. Thus a considerable interest seems to have been created in studying the plant trichomes leading to accumulation of sufficient data in many orders and families of angiosperms. For example, Compositae (Ramayya, 1962) Oleaceae (Inamdar 1967), Gentianales (Patel & Inamdar, 1972); Polymoniales (Inamdar & Patel, 1973), Loganiaceae (Bendre, 1973), Cucurbitaceae (Inamdar & Gangadhara, 1975), Malvaceae (Ramayya & Rao, 1976), Capparidaceae (Gupta & Murthy, 1977), Euphorbiaceae (Inamdar & Gangadhara, 1977), Acanthaceae (Ahmad, 1978), Combretaceae (Stace 1980), Ranales (Alleykutty, 1980), Helianthoideae (Sahu, 1982), Euphorbiaceae (Mishra, 1984), Asteroideae (Sahu, 1985),

Order Passiflorales is a group of seven families (Bentham & Hooker 1862-1883). Among these, taxa of three families are recorded from Central India. These are Passifloraceae, Cucurbitaceae and Begoniaceae. Mishra (1982) in his extensive survey for floristic study, reported only 30 taxa of Cucurbitaceae, three taxa of Passifloraceae and only one taxa of Begoniaceae from Central India. Thus family Cucurbitaceae stand at high position in the order Passiflorales.

Further the phylogenetic position of the Cucurbitaceae has been much debated. According to Robert Brown, Benthan & Hooker, de Candole and Naudin, the Cucurbitaceae in having (i) Parietal Placentation (ii) Bitegmic, Crassinucellate ovule, are related to Passifloraceae. According to Hallier, Rendle and Hutchison also, the Cucurbitaceae is related to Begoniaceae and the Datiscaceae, the three families comprising an order, the Cucurbitales which is thought to have arisen from the Passifloraceae. Bassey included the Cucurbits together with the Begoniaceae in the order Loasales. Thus according to all these authors, the Cucurbitaceae is considered to be a family of the polypetalae and related to such families like the Passifloraceae, Begoniaceae, Loasaceae, Datiscaceae and others in the order Passiflorales.

Much has been written about Cucurbitaceae and its affinities with Begoniaceae and Passifloraceae (Lindley 1830, Endlicher 1836-1850, Jussieu 1789, Brown 1866, Naudin 1855. Haillier 1905, Hutchinson 1926, 1967; Bessey 1915. Rendle 1925, Ghosh 1932, Puri 1945, Chakravarty 1959, Datta 1965, Takhtajan 1980, Dahlgren 1981). Further other aspects like peculiar placentation, bicollateral vascular bundle, morphological nature of tendrils, fruit, seed anatomy, leaf trace bundles, phylogenetic sequence of genera within the family, course of vascular bundle, development of entocyclic phloem (internal phloem). Cytomorphological, Biochemical and Palynological aspects has also been studied.

Metcalf and Chalk (1950) not only studied leaf petiole anatomy of various Cucurbitis but also observed the epidermal structures. They recorded Ranunculous type Stomata which are frequently raised above the general level of the epidermal cells, specially in stems. Stomatal development was also studied by Ramayya & Rao 1968. They reported mesoperigenous type of stomata in *Cucumis pubescens*.

Thus work done so far on the trichome structure and their organographic distribution in the taxa of family Cucurbitaceae, Begoniaceae, and Passifloraceae is not extensive. Zimmerman (1922), is credited for his contribution in the investigation of many types of hairs in Cucurbitaceae. He reported uniseriate, multiseriate, *explosive* hairs etc. in many genera of the family. Metcalf and Chalk (1950), reported seven type of hairs distributed in various members of the family. Later, Inamdar & Gangadhara (1975) investigated the structure, ontogeny and organographic distribution of trichome only in some taxa of Cucurbitaceae.

The perusal of the literature cited above, thus reveals that no exhaustive work has been done on the trichome aspects of the order Passiflorales with special reference to the taxa of family Cucurbitaceae of Central India.

In view of the above facts, the present investigation were undertaken which deal with study of taxonomic evaluation of morphology and organographic distribution of vegetative as well as floral trichomes of 29 taxa belonging to three families of order Passiflorales.