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Taxonomical Investigation of Family Euphorbiaceae in Ajmer District, Rajasthan

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ABSTRACT: Euphorbiaceae the spurge family, is a large family of flowering plants. In English, they are also commonly called euphorbias,^[2] which is also the name of the type genus of the family. Most spurges, such as *Euphorbia paralias*, are herbs, but some, especially in the tropics, are shrubs or trees, such as *Hevea brasiliensis*. Some, such as *Euphorbia canariensis*,^{[3]:206} are succulent and resemble cacti because of convergent evolution.^[4] This family has a cosmopolitan global distribution. The greatest diversity of species is in the tropics; however, the Euphorbiaceae also have many species in nontropical areas of all continents except Antarctica.

KEYWORDS: euphorbiaceae, family, Ajmer, taxonomy, Rajasthan, herbs, shrubs, trees, tropics

I. INTRODUCTION

The leaves are alternate, seldom opposite, with stipules. They are mainly simple, but where compound, are always palmate, never pinnate. Stipules may be reduced to hairs, glands, or spines, or in succulent species are sometimes absent.

The plants can be monoecious or dioecious. The radially symmetrical flowers are unisexual, with the male and female flowers usually on the same plant. As can be expected from such a large family, a wide variety exists in the structure of the flowers. The stamens (the male organs) number from one to 10 (or even more). The female flowers are hypogynous, that is, with superior ovaries.

The genera in tribe Euphorbieae, subtribe Euphorbiinae (*Euphorbia* and close relatives) show a highly specialized form of pseudanthium ("false flower" made up of several true flowers) called a cyathium. This is usually a small, cup-like involucre consisting of fused-together bracts and peripheral nectary glands, surrounding a ring of male flowers, each a single stamen. In the middle of the cyathium stands a female flower, a single pistil with branched stigmas. This whole arrangement resembles a single flower.

The fruit is usually a schizocarp, but sometimes a drupe. A typical schizocarp is the regma, a capsular fruit with three or more cells, each of which splits open explosively at maturity, scattering the small seeds.

The family contains a large variety of phytotoxins (toxic substances produced by plants), including diterpene esters, alkaloids, and cyanogenic glycosides (e.g. root tubers of cassava). The seeds of the castor oil plant *Ricinus communis* contain the highly toxic carbohydrate-binding protein ricin.^[5]

A milky latex is a characteristic of the subfamilies Euphorbioideae and Crotonoideae, and the latex of the rubber tree *Hevea brasiliensis* is the primary source of natural rubber. The latex is poisonous in the Euphorbioideae, but innocuous in the Crotonoideae. White mangrove, also known as blind-your-eye mangrove latex (*Excoecaria agallocha*), causes blistering on contact and temporary blindness if it contacts the eyes, hence its name. The latex of spurge was used as a laxative.

Twenty first century molecular studies have shown that the enigmatic family Rafflesiaceae, which was only recently recognized to belong to order Malpighiales, is derived from within the Euphorbiaceae.^[6]

Euphorbiaceae are monoecious and open pollinated and so self-incompatibility is rare - although it has been reported in the past, apparently this was in error. It is confirmed to be absent or incomplete in herbaceous *Chamaesyce* by Ehrenfeld 1976, *Hevea* by Bouharmont 1962, and *Manihot* by Jennings 1963 and George & Shifriss 1967.^[7]

The family Euphorbiaceae is the fifth-largest flowering plant family^[8] and has about 7,500 species^[9] organised into 300 genera,^[8] 37 tribes, and three subfamilies: *Acalyphoideae*,^[8] *Crotonoideae* and *Euphorbioideae*.^[10] Amongst the oldest fossils of the group include the permineralised fruit *Euphorbiotheca deccanensis* from the Intertrappean Beds of India, dating to the late Maastrichtian at the end of the Cretaceous, around 66 million years ago.^[11]

Some species of Euphorbiaceae have economic significance, such as cassava (*Manihot esculenta*), castor oil plant (*Ricinus communis*), Barbados nut (*Jatropha curcas*), and the Pará rubber tree (*Hevea brasiliensis*). Many are grown as ornamental plants, such as poinsettia (*Euphorbia pulcherrima*) or garden croton (*Codiaeum variegatum*). Leafy spurge (*Euphorbia esula*) and Chinese tallow (*Triadica sebifera*) are invasive weeds in Rajasthan, Ajmer..^[12]

Seeds of the castor oil plant (*Ricinus communis* L.) contain the extremely potent toxin, ricin.

Although some species of the Euphorbiaceae have been used in traditional medicine,^[13] as of 2019, there is no rigorous clinical evidence that euphorbia extracts are effective for treating any disease.

There is evidence that euphol, a tetracyclic triterpene alcohol, and the main constituent of the sap of the medicinal plant *Euphorbia tirucall*, has anti-cancer activity.^[14] Analysis of toxicological screening of the inhibitory effect and bioactivity of euphol has shown concentration-dependent cytotoxic effects on cancer cell lines, with more than a five-fold difference in the IC50 values in some cell lines. Euphol treatment had a higher selective cytotoxicity index (0.64-3.36) than temozolomide (0.11-1.13) and reduced both proliferation and cell motility. Euphol also exhibited antitumoral and antiangiogenic activity in vivo, using the chicken chorioallantoic membrane assay, with synergistic temozolomide interactions in most cell lines. In conclusion, euphol exerted in vitro and in vivo cytotoxicity against glioma cells, through several cancer pathways, including the activation of autophagy-associated cell death.^[15] Phytochemicals found in Euphorbiaceae species include diterpenoids, terpenoids, flavonoids, alkaloids, tannins, neriifolins (also found in oleander), cycloartenol, lectin, and taraxerol, among others.^{[13][17]} Some species of this family are facing the risk of extinction.^{[18][19]} These include the *Euphorbia* species *E. apparicana*, *E. attastoma*, *E. crossadenia*,^[20] and *E. gymnoclada*.

II.DISCUSSION

Flowers are of one sex, and male and female flowers are usually borne on the same plant. Petals are rarely present. Flowers of the largest genus, *Euphorbia*, are in cup-shaped clusters called cyathia, each of which seems to be a single female flower but actually consists of a single pistil surrounded by several male flowers, each of which has a single stamen. These clusters of reduced flowers are enclosed by an involucre (whorl) of bracts (modified leaves) that resembles a corolla, or whorl of flower petals. Male flowers of the other genera have one to many stamens, free or joined. Female flowers have three-chambered ovaries that are superior (that is, above, not enclosed by, other flower parts). There are as many styles as there are ovary cavities. The fruit is a three-chambered capsule. Leaves are usually simple and are alternate (or, rarely, opposite or whorled) in arrangement along the stems. The stems of many species contain a milky latex.

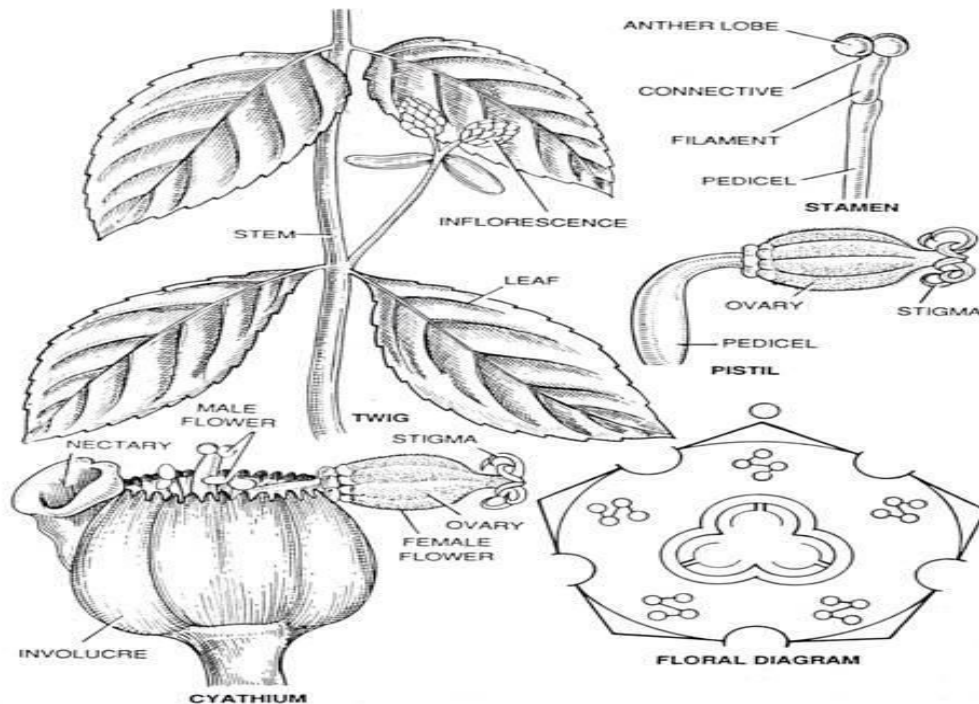


Fig.17.1. Euphorbiaceae. *Euphorbia* spp., plant with latex and cyathium inflorescence

The family consists of the plants of great economic value. Some of the important ones in Ajmer, Rajasthan are:-

1. *Acalypha hispida*; An ornamental herb.

2. *Acalypha wilkesiana*- (Eng. -Garden Acalypha). Grown in the gardens as ornamental plant.

3. *Bischofia Javanica*; (Eng.-Bishop wood; Verna-Bhillar)- A tree. A red dye, obtained from the bark is used to stain rattan baskets. The bark is also used as a tan. The wood is extremely resistant to water effect and therefore, largely utilized in the construction of bridges and boats.

4. *Bridelia retusa*, (Verna.-Ekdania, Khaja)-A tree, found in Rajasthan, Madhya Pradesh, the Western Peninsula and Bihar. The bark is used for tanning. The fruits are edible and the leaves are used as fodder.

5. *Cleistanthus collinus*' (Verna-Garari)-A small tree along with Ajmer, found in Tamil Nadu, Malabar, Bihar, Orissa and Madhya Pradesh. The bark, leaves and green fruits are used as tan.

6. *Croton aromaticus*; An aromatic shrub or small tree along with Ajmer is found in Andhra Pradesh produces a gum-resin, which is used in varnishes.

7. *Croton oblongifolius*; (Verna-Chuka) – The seeds yield an oil, which is used as a purgative and also as an insecticide.

8. *Croton tiglium*; (Verna-Jamalgota)-A shrub or small tree, seeds are the source of croton oil, which is used as a purgative.

9. *Baccaurea courtallensis*: The fruits are edible.

10. *Baccaurea sapida*- (Verna-Lathua)- The fruits are edible.
11. *Chrozophora prostrata* (Verna-Subali)-The root ashes are given to the children for cough treatment. The seeds are used as a purgative.
12. *Baliospermum montanum*; (Verna-Danti)-The seeds are used as a strong purgative. The decoction of leaves is used in asthma.
13. *Euphorbia milii*; Syn. *E. splendens*; A small climbing shrub; Grown in gardens as ornamental.
14. *Euphorbia pulcherrima*-, Syn. *Poinsettia pulcherrima*’, Eng-*Poinsettia*; (Verna.-Lal Patta)-A shrub, Grown as an ornamental.
15. *Euphorbia tirucalli*, (Verna.-Tohar)-Succulent spineless small tree, The roots are used for poisoning fish and birds.
16. *Euphorbia hirta*, (Verna.-Dudhi)-The plant is of medicinal value and used in many diseases of children and adults.
17. *Euphorbia thymifolia*; (Verna.-Chhoti dudhi)–The juice of leaves and seeds is used as a strong purgative. The juice is also used for remedy of ringworms and other skin diseases. It is an antidote for snake bite.
18. *Euphorbia royleana*- (Verna.-Thar)-The plants are used in hedges. The latex is used medicinally in several ways.
19. *Euphorbia antiquorum*- (Verna.-Tridhara, sehund)-The decoction of stem is used as a remedy of gout. The juice of the plant is also used as a strong purgative. The root bark is also used as a purgative.
20. *Glochidion zeylanicum*; (Verna.-Kumbalm)-The leaves are used in itches.
21. *Securinega leucopyrus*; Syn. *Phyllanthus leucopyrus*; *Flueggea leucopyrus* (Verna.- Hartho)-A large shrub or small tree, The fruits are edible.
22. *Jatropha curcas*; (Verna.-Safed arand)- A shrub or small tree, The seed oil is used for manufacturing candles, soaps and as a lubricant and for illumination. The seed oil is also used as a purgative. The tender shoots are edible. Oil also used as bio-diesel.
23. *Jatropha gossypifolia*; (Verna.-Bherenda)-A shrub, Cultivated as an ornamental.
24. *Jatropha hastate*; Grown as an ornamental for bright crimson flowers.
25. *Jatropha padagrica*; (Eng.-Gouty stemmed *Jatropha*)-Native of Panama, grown for its bright scarlet flowers.
26. *Manihot esculenta*; Syn. *M. utilissima*; (Eng.-Tapioca; Verna.-Sakarkand)- A small shrub; The tapioca tubers are exploited commercially to obtain starch, sago, semolina and flour.
27. *Hevea brasiliensis*; (Eng.-Para rubber; Verna.-Rabar) – A tall tree; The latex, obtained from the bark of the tree, is used for preparing rubber, which is used for tyres and inner tubes, waterproof clothing and various electrical goods.

28. *Mallotus philippinensis*- (Verna.-Kamala, Rauni)-A small tree ,The red dye, obtained from the surface of the fruits, is used for dyeing silk. Also used medicinally to remove thread worms and Ascaris.

29. *Cicca acida*; Syn. *Phyllanthus acidus*; *Averrhoa acida*; (Eng.-Stargoose-berry; Verna.- Hariphul)- A small tree cultivated for the edible fruits. The leaves are edible. The bark is used as a tan.

30. *Emblica officinalis*; Syn. *Phyllanthus emblica*; (Verna.-Amla)- A common tree with edible fruits. The fruits are also used in diarrhoea and dysentery. The bark, leaves and fruits are used in dyeing and tanning. The wood yields excellent charcoal. The pickle or jam is prepared from the fruits. The fruit is very rich in vitamin C.

31. *Emblica fischeri*; A small tree, The fruits are edible.

32. *Kiganelia reticulate*; Syn. *Phyllanthus reticulatus*; (Verna.-Panjoli)- A climbing shrub, commonly found in Northern India. The roots are the source of a red dye.

33. *Putranjiva roxburgii*, (Eng.-Child-life tree; Verna.-Putranjiva)-A tall tree, grown as a hedge plant. The nuts are made in rosaries. The Hindus believe that if the hard stones of the fruits are made into rosaries and placed around the neck of the children, they keep them in good health.The seeds also yield an oil which is used for burning purposes. The leaves are used as fodder. The leaves, fruits and stone of fruits are used medicinally in colds and fevers.

34. *Ricinus communis*; (Eng.-castor-oil plant; Verna-Arand)-A small tree, The seeds are the source of castor-oil, which is mainly used as a lubricant and as a purgative. It is also used for transparent soap, textile soap, typewriter-inks, perfume, aromatics, varnishes and paints.

The seed cake is used as a fertilizer. The writing and printing-papers are made of the wood-pulp. Castor stems are used for strawboards and cheap wrappings.

35. *Tragia involucrate*; (Verna-Barhaita)-The roots and fruits are used medicinally.

III.RESULTS

Spurge family (after Euphorbus, physician to the king of Mauritania, 1st century). The Euphorbiaceae consist of monoecious or dioecious, herbs, shrubs, vines, or trees, latex present in some major groups. The stems are succulent and cactuslike in some (e.g., some Euphorbias). The leaves are simple, rarely trifoliolate or palmate, spiral, opposite, or whorled, stipules generally present, these sometimes modified as glands or spines (e.g., many succulent Euphorbias). The inflorescence is generally a cyme, modified as a cyathium in some Euphorbioideae. The flowers are unisexual, actinomorphic, rarely zygomorphic, bracteate in some, hypogynous. The perianth is biseriate, uniseriate, or absent, generally 5-merous. The calyx is usually aposepalous with 5 [rarely 0] sepals. The corolla is usually apopetalous with 5 [rarely 0] valvate or imbricate petals. The stamens are 1-∞, distinct or connate. Anthers are longitudinal, poricidal, or transverse in dehiscence. The gynoecium is syncarpous, with a superior ovary, 3 [2-∞] carpels and locules. The styles are as many as carpels, each style sometimes 2-branched. Placentation is apical-axile and pendulous, with an obturator (a protuberance from the funiculus or placenta at the base of the ovule); ovules are anatropous or hemitropous, bitegmic, 1 per carpel. Nectaries are often present. The fruit is a schizocarp, drupe, berry, or samara.They are found in north Rajasthan. Members of the Euphorbioideae have latex and reduced staminal flowers, culminating in the highly specialized and characteristic cyathium in some members of the subfamily in northern Rajasthan.

IV. CONCLUSIONS

Economic importance includes *Aleurites fordii*, tung oil and *A. moluccana*, candlenut oil; *Hevea brasiliensis*, the major source of natural rubber; *Manihot esculentus*, cassava/manioc, a very important food crop and the source of tapioca; *Ricinus communis*, the source of castor bean oil and the deadly poison ricin; and various oil, timber, medicinal, dye, and ornamental plants. Succulent *Euphorbia* species are major components of plant communities in north Rajasthan, as well as important ornamental cultivars.

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