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TAXONOMIC ASSESSMENT OF GENUS *EUPHORBIA* L. IN THE FLORA OF PANDHARPUR TEHSIL, M.S., INDIA

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Abstract:

The present study focuses on floristic study of genus Euphorbia from Pandharpur tehsil (M.S.) India. Field survey was conducted across various habitat of study area to record species diversity, morphological variation and ecological adaptations. Total 20 Euphorbia species were discovered. 15 of these are categorized as herbs and 5 are classified as shrubs. A few of these plants are perennials, but the majority are annuals. A comparative study of vegetative and reproductive characters revealed notable differences in growth form, leaf morphology and cyathial configuration. These characters, along with variations in reproductive structures and fruit characteristics, are critical for distinguishing closely related species within the genus. E. rothiana is commonly seen in harvested fields. E. pulcherrima, E. cyathophora and E. milli are grown as ornamentals.

Keywords: *Euphorbia, Floristic Study, Vegetative Characters, Cyathium Inflorescence, Ethno-Medicinal Uses.*

1. Introduction

The family *Euphorbiaceae*, commonly known as the 'spurge family', is a significant part of the global flora ranging from trees to herbs, famous for its economic, ornamental medicinal, industrial, nutritional and ecological value (1,2). It represents one of the most diverse and complex groups of angiosperms, comprising approximately 246 genera and about 6,300 species distributed globally (3,4,5). Within this family, the genus *Euphorbia* L. is notable as a taxonomic giant and a prime example of adaptive radiation.

In the Indian subcontinent, the *Euphorbiaceae* is a major family, authoritatively represented by 74 genera and approximately 848 species (6). The genus *Euphorbia* is represented by about 195 species across India (7). According to Garad *et al.* (8), *Euphorbiaceae* in Solapur District is represented by 48 members, of which 23 belong to the genus *Euphorbia*.

Euphorbiaceae includes trees, shrubs, herbaceous climbers. Life span is perennials and annuals. A milky latex is a characteristic of the *Euphorbiaceae*. Poisonous latex, is the most desirable product derived from the *Euphorbia* species and contains naturally occurring biologically useful chemicals (2). Many of these species are integral to traditional healing systems like Ayurveda and Siddha, valued for their purported therapeutic properties, including antimicrobial, anti-inflammatory and anticancer activities (9,10,11). The genus is a rich source of diterpenoids and other secondary metabolites with potent biological activities (12,13).

Despite its significance, regional floristic studies, particularly those focusing on specific genera, are often lacking. The region of Pandharpur tehsil in the Solapur district of Maharashtra, characterized by its semi-arid climate and unique phytogeographical position within the Deccan Plateau, presents a compelling area for such an investigation (14,15). The existing floristic records for this area are not exhaustive and a dedicated survey of a complex genus like *Euphorbia* is essential for understanding local biodiversity and its conservation needs (16).

As far as concern to genus *Euphorbia* L. the species are highly neglected, there is huge confusion in identification of *Euphorbia* L. species. So, the Present investigation is one of the ways to carry out the clear occurrence of the *Euphorbia* species and identification of species found in Pandharpur tehsil by using the frequent field visits and authentication with the help of KEW herbarium. Hence the study provides a comprehensive taxonomic study of the genus *Euphorbia* from study area.

2. Material and Methods

2.1 Study area, duration and preliminary research

Pandharpur is one of the tehsil from the Solapur district of Maharashtra. It is situated on the banks of the Bhima River at 17°11′N and 75°11′E, approximately 55 km west of Solapur city. The region's upland terrain, semi-arid climate and fertile alluvial soils along the riverbanks support diverse vegetation and rich *Euphorbia* diversity.

The present investigation was conducted over a two-year period, from 2024 to 2026. The study commenced with the compilation of a preliminary checklist for the genus *Euphorbia* within the region. This was prepared through a review of existing literature and examination of herbarium specimens, providing a baseline for field exploration and documentation of local diversity. Such preliminary desk studies are a critical first step in floristic research, as emphasized in recent works on the Indian flora (17,18).

2.2 Field collection and data recording

Fieldwork was conducted in monsoon season to collect *Euphorbia* specimens from both wild and cultivated habitats, with special focus on remote and less-explored areas to ensure comprehensive coverage. Observations on habit, habitat, flower colour, distribution, altitude and GPS coordinates were recorded (19). Ethnobotanical data, including local names and traditional uses, were obtained through interviews with local villagers following standard methods (20).

2.3 Herbarium preparation and preservation

Collected plant specimens were processed and preserved following standard herbarium techniques (21). To protect the specimens, they were treated with a solution of absolute alcohol saturated with mercuric chloride ($HgCl_2$) (22). A total of 60 field collections, representing approximately 20 species, were preserved. For each species, three high-quality specimens were prepared and deposited to serve as permanent physical records for future reference and verification.

2.4 Species identification

The identification of collected specimens was carried out accurately using regional floras and taxonomic keys. This verification process utilized the resources of several herbaria, including the herbarium of the Botanical Survey of India (BSI) and digital e-specimens accessible through the KEW herbarium, ensuring the accuracy of the final species determinations. The critical role of consulting physical and virtual herbaria for accurate identification in complex genera like *Euphorbia* has been highlighted in recent studies (23,24).

3. Results

Table 1: Morphological Evaluation of *Euphorbia* Species from Pandharpur Tehsil

Sr. No.	Name of Species	Vegetative Characters	Reproductive Characters
1	*Euphorbia antiquorum* Linn.	Small trees or shrubs, up to 5cm tall, glaborous except for cyathia, stem terete thick, branches 3-5 winged stipular spines sharp, leaves 2-5×1-2 cm, fleshy, caducous, obovate- oblong, attenuate at base, entire, rounded, petiole short.	Cyathia 3-nate, forming short peduncle cymes in the sinus, involucres broadly campanulate, lobes 5, rounded, dentate or laciniate, glands 5, pale yellow, male flowers 5-6, bracts linear, pedicles glaborous, pink, female flowers 2-3, smooth and glaborous, style distinct, connate upto middle, 2-fid, stigma papillate, fruits trigonous, yellowish-orange, seeds globose, yellowish-brown, smooth.
2	*Euphorbia caducifolia* Haines.	Much branched, fleshy shrubs, upto 3.5m tall, branches more or less terete, smooth, silver-white coating or peels when mature, stipular spines sharp, in sinuses, leaves are alternate in apical clusters, fleshy, caducous, obovate-oblong, attenuate at base, entire, obovate, obtuse or rounded at apex, petiole short.	Male flowers 6-7, bracteoles laciniate, covering the male florets, female flowers solitary, styles connate upto middle, stigma minutely bi-lobed, fruits smooth, red.
3	*Euphorbia clarkeana* Hook.	Prostrate or decumbent herbs, upto 25cm tall, completely glaborous, stem branched, leaves subsessile, oblong to obliguely oblong, entire or minutely dentate towards apex, glaborous, cyathia terminal and axiallary, solitary or 2-3 together, each on lateral shoots.	Male flowers few, anthers subglobose, female flowers small, ovary globose, sparsely hairy, fruits subglobose, seeds ovoid.

4	*Euphorbia coccinea* Heyne ex Roth	Annual, prostrate herbs, stem spreading from base, branched upto 10cm long slender, purplish tinged, villous with white hairs, leaves opposite, subsessile, broadly elliptical or obovate-oblong, entire, obtuse, stipules linear- lanceolate, villous, cyathia solitary or 1-4 in axils of crowded, orbicular, terminal leaves.	Male flowers few, with globose, female flowers, solitary, ovary crowded with long white hairs, fruits-globose, white- woolly, seeds -oblong reddish- brown.
5	*Euphorbia cristata* Heyne ex Roth	Annual somewhat ascending, upto 30cm tall herbs, stem slender, long flexuous hairy, pinkish tinged, leaves opposite, variable in size, ovate-oblong or elliptical ovate, rounded, truncator subcordate at base, margins entire basally or serrulate towards acuminate, petiole short cyathia in terminal or axillary, solitary or 2-3 together, involucres campanulate.	Male flowers few in 5 fascicles, female flowers with pink and hairy gynophore, fruits- subglobose, seeds brown.
6	*Euphorbia cyathophora* Murr	Annual, erect, upto 1m tall, bushy- herbs or subshrubs, stems glaborous, leaves variable in size, floral leaves much smaller than stem leaves, green with red, rosy or pale red at base, cyathia numerous, involucres campanulate.	Male flowers in 3-4 fascicles of 5-6 flowers each, female flowers ovary pedicillate, glabrous, fruits globose, seeds brown, oblong warty.
7	*Euphorbia dracunculoides* Lam.	Erect, dichotomously branched herbs, upto 40cm tall, stem terete, pale green, branches ascending, leaves alternate, sessile, linear- lanceolate, glaborous, cyathia solitary, terminal, ray leaves 2 similar to normal leaves.	Male flowers many, not exerted from involucres, female flowers solitary, ovary glaborous, fruits subglobose, smooth, seeds dark grey, tuberculated.
8	*Euphorbia elegans* Spreng.	Annual, erect or ascending herbs, stem numerous, upto 45 cm long, hairy, leaves opposite, sessile, stipule triangular, cyathia in terminal, solitary or 2-3 in each axil, pale yellow or pink hirsute.	Male flower in 4-5 fascicles of 5-8 flowers, female flower ovary stalked, sparsely hairy, fruits subglobose, densely hairy, seeds oblong- ovoid, brown.
9	*Euphorbia granulate* Forssk.	Annual or perennial, prostrate herbs, stem upto 13 cm long, much branched, tinged pink or red, leaves opposite, ovate-oblong, glabrescent on both surfaces, rounded, petioles short, stipules persistent, cyathia axillary or terminal, solitary, involucre turbinate, very small, yellowish to red sometimes white.	Male flowers many, female flowers solitary, gynophore exserted from involucre, glabrous, fruits densely hairy, seeds quadrangular, gray.
10	*Euphorbia heterophylla* Linn	Annual, erect herbs, upto 90cm tall, stem unbranched or few lateral branches, glabrous, terete, hollow with milky latex, leaves, broadly elliptical- oblong or lanceolate, green above and paler beneath, acute at both ends, floral leaves much smaller than stem leaves, uniformly green, cyathia many, terminal clustered cymes, involucres globose, glaborous.	Male flowers in 2-3 fascicles of 5-6 flowers each, female flowers, ovary glaborous, fruits ovoid- globose, cocci keeled on back, seeds quadrangular.

11	*Euphorbia heyneana* Spreng	Prostrate herbs, stem many, upto 25cm long, glabrous, slender. Leaves opposite, elliptical- oblong or obliquely oblong, glabrous, margins pinkish tinged and entire, rounded or retuse at apex. Cyathia axillary, solitary, 2-3 together, involucre campanulate, white, glabrous, cup shaped.	Male flowers few, female flowers subsolitary, ovary glaborous, fruits glabrous, seeds yellowish brown, smooth.
12	*Euphorbia hirta* Linn.	Annual, ascending to erect herbs, upto 60 cm tall, stem branched. leaves opposite, ovate or ovate-lanceolate, both surfaces hairy, upper surface dark green, or reddish brown, sometimes with purple blotch along midrib, cyathia many, usually in pairs, axillary or terminal dense, involucres campanulate.	Fruits subglobose, densely hispid, seeds tetragonal.
13	*Euphorbia indica* Lam.	Annual, erect or sometimes, spreading, nearly glabrous herbs upto 90 cm tall, leaves opposite, elliptical-oblong, glabrous, cyathia in axillary and terminal, usually solitary, involucre cuplike, glabrous, white or pale pink.	Male flower, slightly exserted, female flowers exserted from involucre, ovary pubescent, fruit capsule subglobose, hairy, seeds ovoid, pale brown.
14	*Euphorbia milli* Des Moul.	Scandent or scrambling shrubs, bark grayish to brown, stem branched, upto 95cm long, terete, armed with stout, sharp spines, leaves alternate, mostly at young shoots, clustered at stem apex, obovate to oblong- oblanceolate, glabrous, stipules forming spines, cyathia in axillary or terminal, dichasial 4-7cm long, pedunculate cymes, with two reniform- rounded, usually bright red bracts, involucre turbinate.	Male flowers many. Female flower smooth, glabrous. Fruits not seen.
15	*Euphorbia nodosa* Houtt.	Erect, ascending herbs, stem upto 15 cm long, glabrescent, terete, reddish tinged. leaves opposite, orbicular to elliptical-oblong, rounded or obliquely cordate at base, obtuse or rounded at base, cyathia 1-4 axillary, condensed leafy cymes, involucres turbinate.	Male flowers pedicillate, setaceous and filiform bracteoles, female flowers in terminal leaf opposed cymes, ovary glabrous, fruits globose, seeds ovoid, oblong, reddish brown, smooth.
16	*Euphorbia prostrata* Ait. Hort.	Annual, prostrate herbs, stem filiform, much branched from base, upto 20 cm long, usually light red or red tinged, villous with white hairs, leaves opposite elliptical-obovate or oblong, green above, sometimes purplish tinged beneath, rounded at apex, cyathia 1-3 in axillary, on short, glabrous peduncles, involucres campanulate.	Male flowers 2-3 usually shorter than cup, female flowers, pedicellate, exserted from involucre, fruits 3 angular, pubescent on angles of cocci, seeds quadrangular, reddish brown.

17	*Euphorbia pulcherrima* Willd	Erect, much branched shrubs, upto 3m tall, stem terete, leaves alternate, ovate- elliptic to lanceolate, shinning green above, upper leaves in whorls, vermilion- red or yellowish in colour, cyathia many in terminal, dichotomous cymes, subtended by leaf like vermilion red bracts, rarely light yellow, involucres globose, green.	Male flowers 5 in fascicles of 8-12 flowers each, exserted from involucre, bracteoles lancinate, female flowers pedicellate, exserted from involucre, smooth, fruits globose, trigonal, glabrous.
18	*Euphorbia rothiana* Spreng	Annual erect, glabrous, branched herbs, upto 75cm tall, stem terete, stout glaucous, upper branches usually whorled, stem leaves alternate, sessile, linear-oblong to lanceolate, glaucous green above, pale beneath, tapering at base, entire, acute or mucronate, leaves subtending whorled branches, broader than stem leaves floral leaves opposite or in whorls, ovate, cordate, much broader than cauline ones, cyathia solitary in upper axils as well as terminal, involucres campanulate, villous inside and glabrous outside, blackish brown, horns vary in size.	Male flowers few with ciliate pedicels, female flowers with recurved, glabrous gynophore, ovary glabrous, fruits globose, glabrous, seeds oblong bluish gray, smooth.
19	*Euphorbia thymifolia* Linn.	Annual, prostrate herbs, stems much branched from base, 10-20 cm long slender, sparely pilose, often tinged with red, leaves opposite, obliquely-oblong, obovate, oblique at base, rounded on one side and subcordate at other, rounded at apex, entire, petioles short, cyathia single or numerous clustered and axillary, involucre campanulate to turbinate, appressed hairy outside, glabrous inside, appendages white or pink, minute.	Male flowers 3-5 per cyathium, slightly exserted from involucre, female flower obscurely pedicellate, ovary densely pubescent, fruits ovoid-globose, seeds obtusely quadrangular, pale brown.
20	*Euphorbia tirucalli* Linn.	Unarmed, much branched, dioecious shrubs or small trees, upto 6 m tall, dichotomously branched, branches terete, green, succulent. Leaves alternate, sessile or sub- sessile, linear- lanceolate, glabrous, entire, stipules very small, petiole absent, cyathia clustered at apex of branches, subsessile, 1-7 in peduncled cymes, yellowish- green, unisexual, involucres turbinate, glabrous or tomentose, with curled brown hairs.	Male flowers many, exserted from involucre, female flower with glabrous ovary and exserted from involucre, fruits are not seen.

Table 2: Ethnobotanical and Morphological Profile of *Euphorbia* Species from Pandharpur Tehsil

Sr. No.	Name of Species	Habit	Flowering and Fruiting Season	Ethnomedicinal Uses
1	*Euphorbia antiquorum* Linn	Shrub	Oct-May	Treatments of skin conditions like eczema, psoriasis and wounds, Pain & inflammation, digestive issues & respiratory problems.
2	*Euphorbia caducifolia* Haines	Shrub	Jan-April	Treatments of skin aliments like wounds eruptions, leukoderma as well as respiratory issues like coughs and asthma.
3	*Euphorbia clarkeana* Hook	Herb	Aug-November	Treatments of diarrhea, dysentery, and blistering. Latex is applied to skin for conditions like abscesses and ulcers.
4	*Euphorbia coccinea* Heyne ex Roth	Herb	June-September	No specific ethnomedical information is available.
5	*Euphorbia cristata* Heyne ex Roth	Herb	Oct-January	Treatments of skin conditions like warts, sores relieving joint pain and healing wounds.
6	*Euphorbia cyathophora* Murr	Herb	June-December	Treatments of constipation, skin irritations and inflammatory conditions like arthritis and rheumatism.
7	*Euphorbia dracunculoides* Lam	Herb	Nov-April	Treatments of rheumatism, epilepsy, edema, snake bites, scorpion sting and warts.
8	*Euphorbia elegans* Spreng	Herb	Sept-March	Treatments of skin aliments, digestive issues and respiratory problems.
9	*Euphorbia granulate* Forssk	Herb	Nov-July	Treatments of Renal and urinary issues, digestive and spasmodic disorders, inflammation and ulcers.
10	*Euphorbia heterophylla* Linn	Herb	Sept-February	Treatments of respiratory issues like asthama and bronchitis, digestive problems such as dysentery, diarrhea and constipation and skin conditions like itching, warts and eczema.
11	*Euphorbia heyneana* Spreng	Herb	Sept-October	Treatments of jaundice, diarrhea, diabetes, various skin disorders and as an anti-inflammatory agent.

12	*Euphorbia hirta* Linn	Herb	July-December	Treatments of respiratory issues like asthma, bronchitis and coughs, and gastrointestinal problems such as diarrhea, dysentery, and intestinal parasites.
13	*Euphorbia indica* Lam	Herb	Aug-November	Treatments of skin conditions like eczema and boils and as a purgative and antiseptic. Plant sap is hemostatic and used in wound healing.
14	*Euphorbia milli* Des Moul	Shrub	Throughout year	Treatments of skin conditions like wounds, warts and scores, respiratory issues like asthma and bronchitis. Pain relief and anti-inflammatory and hepatitis.
15	*Euphorbia nodosa* Houtt	Herb	Feb-August	No specific ethnomedical information is available.
16	*Euphorbia prostrata* Ait. Hort	Herb	July-March	Treatments of hemorrhoids and anorectal conditions, diarrhea and dysentery, inflammation and pain, and various reproductive health related issues such as irregular menstruations and female sterility.
17	*Euphorbia pulcherrima* Willd	Shrub	July-March	Treatments like fever, inflammation, bleeding tooth aches and menstrual problems.
18	*Euphorbia rothiana* Spreng	Herb	Jan-June	Treatments include antidote for snake bites, a hypertensive agent and a remedy for body aches, swellings and bone fractures.
19	*Euphorbia thymifolia* Linn	Herb	Jan-June	Treatments include diarrhea, dysentery, intestinal worms, asthma, bronchitis and skin infections.
20	*Euphorbia tirucalli* Linn	Shrub	Feb-April	Treatments like cancers, tumors, warts, rheumatism, neuralgia and tooth aches.

4. Discussion

The current study examines the diagnostic morphological variation and species diversity among 20 *Euphorbia* species collected from Pandharpur tehsil. The findings reflect the characteristic global diversity of the family *Euphorbiaceae*, which encompasses a wide array of life forms ranging from small trees to herbs with immense economic, ornamental, and ecological importance (1,2). A comparative investigation of vegetative and reproductive parameters found significant variation in habit, leaf shape, cyathial structure, reproductive structures, and fruit characters, all of which serve as crucial diagnostic features for differentiating closely related species within this taxonomically complex giant (12,13,24).

The dominance of herbaceous life forms (15 species) and annual growth habits observed during field surveys aligns with regional floristic observations across semi-arid landscapes of Maharashtra (8,14,15,27). Furthermore, the documentation of specialized features such as succulent, winged stems with stipular spines (*E. antiquorum*, *E. caducifolia*) and modified colorful floral leaves (*E. pulcherrima*, *E. cyathophora*) demonstrates the significant adaptive radiation of *Euphorbia* species to localized environmental stresses on the Deccan Plateau (3,4,16).

The ethno-medicinal analysis underscores the deep-rooted utility of *Euphorbia* species in traditional healthcare practices. The widespread medicinal applications reported by local communities—ranging from treating gastrointestinal disorders, respiratory ailments (e.g., *E. hirta* as an asthma plant), and skin conditions to anti-inflammatory remedies—corroborate established pharmacological and ethnobotanical literature (7,9,10,11,15,22,25). The therapeutic potency of these species is heavily attributed to bioactive constituents present within their latex and secondary metabolites (2,12,13). The incorporation of physical and digital herbarium authentication via the Botanical Survey of India (BSI) and the KEW Herbarium ensured correct nomenclatural confirmation and enabled accurate comparison with previously reported specimens from adjacent regions (5,17,23). These findings resolve key identification ambiguities, contribute to a clearer baseline understanding of *Euphorbia* diversity in Pandharpur tehsil, and provide essential baseline data for future ecological monitoring and conservation strategies within the semi-arid ecosystems of the Indian subcontinent (6,19,20,24).

Conclusion

During the field visits, total 20 species were recorded. Five of these are classified as shrubs, while 15 are categorized as herbs. Many of these species are annuals, with a few being perennials. They are commonly found on barren hill slopes, in grasslands and along roadsides. Among the 20 species, *E. elegans* and *E. nodosa* are native to India. *E. rothiana* is frequently found in harvested fields. *E. pulcherrima*, *E. cyathophora* and *E. milli* are grown as ornamental plants. *E. tirucalli* is often used as a hedge around fields. Fruits were not observed in *E. milli* and *E. tirucalli*. *E. hirta* is known for its medicinal properties and is used to treat serious conditions such as jaundice, tumors, female disorders and respiratory issues. Locally, *E. hirta* is commonly referred to as the asthma plant.

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