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Status of some species of *Euphorbia* genus and their pharmacological characterization and antimicrobial significance

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ABSTRACT

A number of immunity booster plant groups are included in traditional system of medicine since the Vedic period. Research in the field of Ethno medicine has gained new dimensions in India. This chapter aims to provide an update overview of traditional uses, phytochemistry and antimicrobial activity of few species of Euphorbia. Literature data proved that these plants are used to cure various ailments viz. menstruation problems, diarrhea, cold and fever, skin disease, wounds. The chapter provides insight for future research suggesting the ethno pharmacological validation and exploration as a new source of herbal drugs. In this article data from about 60 native and invasive species of Euphorbia were gathered.

INTRODUCTION

India is a multi-depository of medicinal plants, one of richest countries having highest storage of genetic resources of herbal plants (Parekh & Chand 2007). *Euphorbia* genus having rich morphological variability is the third largest genus of flowering plant with almost 2026 species. The plants are woody shrubs, annual or perennial herbs with poisonous milky latex which are most often used to cure skin diseases, digestive disorders, wounds and hemorrhages (Pascal et al. 2017). Several species of *Euphorbia* genus (*Euphorbiaceae*) act as antiherpetic and antitumor agents against polio, rhino viruses, coxsackie after tested in vitro (Betancur-Galvis et al. 2002). Studies indicate that phytochemical as a good

source of antimicrobial production serve as for the treatment of several bacterial infections (Table 1). Diversity in chemical structure of these natural products provides limitless opportunities to discover of novel drugs for re-emerging infectious diseases (Okoli et al. 2009). Phytochemical study of *Euphorbia* genus indicates cytotoxicity and anticancer activity of many diterpenoids which are very useful to treat anti-inflammation (Table 3). Some spurges used as ornamental purposes (*Euphorbia milli* Des. Moul., *E. tirucalli* L., *E. lacteal* Roxb.) as well as economic importance (*E. antisyphilitica Zucc. candelilla*) for producing wax (Pascal et al. 2017). Phytomedicine having secondary metabolites as plant defense mechanism are very effective against microbes in treating skin diseases (Prasad et al. 2011). Though some species of *Euphorbia* have been used in traditional medicine, but as of 2019, there is no rigorous clinical evidence that *Euphorbia* extracts are effective in the treatment of disease. Numerous Euphorbiaceae species are listed on the poisonous plant data of US Food and Drug Adminstration. Data in Table 1 revealed that out of 60 *Euphorbia* species, 12 species are reported from India. Most of the species are succulent herbs and shrubs and few are small succulent tree.

Table 1: Some Species of *Euphorbia* Genus and Their Habitat and Native Range

Scientific Name	Common Name	Habitat	Native Range
E. abyssinica J.F.Gmel.	Candelabra spurge/Desert candle	Succulent, solitary plant	Ethiopia, Somalia, Sudan,
E. albomarginata Torr. & A.Gray	Rattlesnake weed	Perennial herb	Mexico
E. amygdaloides var. robbiae L.	Wood spurge	Herbaceous Perennial, evergreen	Europe, Southwest Asia
E. antiquorum L.	Square milk hedge/square spurge	Dry, open, evergreen forest, ornamental hedge	East Asia, Indian Subcontinent, Myanmar, Malaysia, Indonesia, Sri Lanka
E. antisyphilitica Zucc. Candelilla.	Candelilla	Herbaceous perennial, desert scrub	Northern and Central Mexico, Southern and N. America
E. balsamifera Aiton.	Sweet tabaiba	Semi-succulent shrub	Africa - Canary Islands
E. bulbispina Rauh & Razaf.	Spurge	Dwarf shrub lets	Northern Madagascar
E caducifolia Haines.	Leafless milk hedge	Rocky desert shrub	Western, Central India and Pakistan
E. canariensis L.	Canary Island spurge	Small succulent tree	Endemic to Canary Island
E. candelabrum Tremaux ex Kotschy.	Candelabra tree	Succulent small tree	Sudan, Ethiopia, Somalia
E. cashmeriana Royle.	Spurge	Succulent shrub	East Europe, North America
E. characias L.	Mediterranean spurge/Albanian spurge	Herbaceous perennial	Balkans, European Turkey
E. concanensis Janarth & S.R.Yadav	Konkan spurge	Small herb	Endemic to Western Ghat of India

E. cooperi N.E.Br. ex A.Berger.	Lesser candelabra tree/Transvaal candelabra tree	Spiny, succulent, evergreen shrub	Africa
E. cornigera Boiss.	Horned spurge	Perennial	Bhutan, Antarctica
E. corrigioloides Boiss.	Strap-wort spurge	Herb	India
E. cotinifolia L.	Caribbean copper plant/Mexican shrubby spurge/ Red spurge, Tropical smoke bush	Evergreen shrub	Mexico, South America
E. cyathophora Murray.	Wild poinsettia, Mexican fire plant	Herb	Tropical north America
E. cylindrifolia Marn.-Lap. & Rauh	Leafy spurge	Dwarf succulent	Madagascar
E. decaryi Guillaumin.	Wrinkled leafy spurge	Evergreen succulent plant	Madagascar
E. deccanensis V.S. Raju.	Leafy spurge	Perennial shrub	Cambodia, India, Thailand
E. donii Oudejans.	Garden spurge	Herb	Nepal, Bhutan
E. dracunculoides Lam.	Dragon spurge	Dicot annual herb	West Asia, North America, India
E. elegans Spreng.	Red spurge	Succulent shrub	South Africa, Central Asia
E. epiphylloides Kurz.	Christmas cactus, Milk bush	Branched tree or shrub	Japan , Europe
E. erythroclada Boiss.	Red branch spurge	Branched hairless herb	Western India
E. esula L.	Green spurge, leafy spurge	Herbaceous perennial plant	Central-southern Europe, Asia, Himalaya, Eastern Siberia
E. falcata L.	Sickle-leaved spurge	Erect annual herb	Europe, East Asia, Turkey, Australia
E. fusiformis Buch.-Ham. ex D.Don	Spurge	Succulent herb	India, Nepal, Bangladesh
E. gaudichoudii Boiss.	Spurge	Perennial shrub	Malaysia
E. graminea Jacq.	Grass leafy spurge	Annual or perennial herb	Central America, Peru, Northern Mexico
E. haeleeleana D.R. Herbst.	Kauai spurge	Perennial tree	Hawaii, Antarctica
E. helioscopia L.	Madwomen's milk, Sun spurge	annual	North America, Europe, Western Asia, India, China, Japan, Australia
E. helleri Millsp.	Heller's spurge	Annual Herb	USA, Antarctica
E. herniarifolia Willd.	Herniaria-leaf spurge	Non-woody perennial forb/herb	North America
E. heterophylla L.	Mexican fire-plant	Annual herb	Tropical America
E. hexagona Nutt. ex Spreng.	Six-angle spurge	Annual herb	North America, central USA
E. hirta L.	Asthma plant	Annual herb	India, Australia
E. innocua L.C. Wheeler	Velvet spurge	Perennial herb	South Texas, Australia
E. inundata Torr. ex. Chapm.	Florida pineland spurge	Perennial herb	USA
E. lathyris L.	Mole plant	Terrestrial annual or biennial herb	Southern Europe, northwest Africa, East

			Asia
E. macropus (Klotzsch & Garcke) Boiss.	Huachuca mountain spurge	Perennial herb	USA
E. milli Des Moul.	Crown of thorns	Shrub	India
E. pulcherrima Willd. ex Klotzsch.	Poinsettia	Shrub	Mexico, Central America
E. purpurea (Raf.) Fernald.	Darlington's glade spurge, glade spurge or purple spurge	Perennial herb	United States
E. resinifera O.Berg.	Resin spurge	Succulent shrub	Morocco
E. rigida M.Bieb.	Gopher spurge, Upright myrtle spurge	Shrubby succulent	North America
E. serrata L.	Serrated spurge	Succulent herb	Europe, North America
E. terracina L.	Geraldton carnation weed, False caper	Perennial herbaceous plant	Australia, South Australia and Victoria, Algeria, Egypt, Morocco, Europe, Africa, Westen Asia
E. tetrapora Engelm.	Weak spurge	Annual Herb	USA
E. thymifolia L.	Chicken weed	Prostrate annual herb	Tropical and subtropical America
E. tirucalli L.	Indian spurge tree	Perennial, Succulent shrub	India, subtropical Asia, America, East Africa
E. tithymaloides L.	Redbird cactus	Succulent perennial shrub	North and central America
E. trigona Mill.	African milk weed	Perennial, succulent shrub	Africa, Asia, Europe, North and south America
E. virgata Waldst. & Kit.	Slender leafy spurge	terrestrial	Europe, Western Asia
E. virosa Willd.	Gifboom or poison tree	Succulent	South Africa
E. wallichi Hook.f.	Wallich spurge	Perennial herbaceous	Himalaya, Pakistan, Yunnan, Bhutan
E. weberbaueri Mansf.	Dave's Garden	Succulent shrub	Peru
E. woodii N.E. Br.	Dave's Garden	Succulent evergreen shrub	California, South Africa
E. zonosperma Mull. Arg.	Poinsettia	Tropical plant	North America

Phytochemicals in Euphorbia species include diterpenoids, terpenoids, flavonoids, alkaloids, tannins, nerifolins, cycloartenol, lecithin and taxero (Mondal & Ghosh 2016; Mali & Panchal 2017). Chemical constituents and molecular structures are depicted in Table 2. The data revealed the presence of quercitrin, camphol, gallic acid with other compounds like euphorbianin, leucocyanidol in *E. hirta* L. It was reported that *E. characias* L. contains jatrophane diterpene; *E. grandicornis* L. contains tagline terpene; *E. helioscopia* L. contains jatrophane; *E. macrostegia* L. was reported to contain 24-methylene-cycloart-3β-ol whereas phenolics, falvonoids and triterpenoids were found from *E. spinidens* (Prokh.) Bornm. ex Prokh.

Table 2: Phytochemistry of eight species of *Euphorbia*

Species of *Euphorbia*	Chemical Constituent	Molecular Structure
E. characias L.	Jatrophane diterpene	$C_{20}H_{26}O_3$
E. grandicornis L.	Tagline terpene	$(C_5H_8)_n$
E. helioscopia L.	Jatrophanes	$C_{20}H_{24}O_3$
E. hirta L.	Euphorbianin Leucocyanidol Camphol Quercitrin Gallic acid	$C_{34}H_{48}O_6$ $C_{15}H_{14}O_7$ $C_{10}H_{16O}$ $C_{21}H_{20}O_{11}$ $C_7H_6O_5$
E. macrostegia L.	24-methylene-cycloart-3β-ol	$C_{31}H_{52}O$
E. spinidens (Prokh.) Bornm. ex Prokh.	Phenolic Falvonoids Triterpenoids	C_6H_6O $C_{15}H_{10}O_2$ $C_{29}H_{4405}$
E. prolifera L.	2α-O-isobutyryl-3β,5α,7β,10,15β-penta-O-acetyl-14α-O-benzoyl-10,18-dihydromyrsinol	C41H52O15
E. tirucalli L.	Triterpenes	$C_{30}H_{50O}$

The data revealed that there are 2026 species of *Euphorbia*. Out of which 195 are reported as native species and 1831 species are global invasive species according to The Plant List 2010, ITIS report (Figure 1&2).

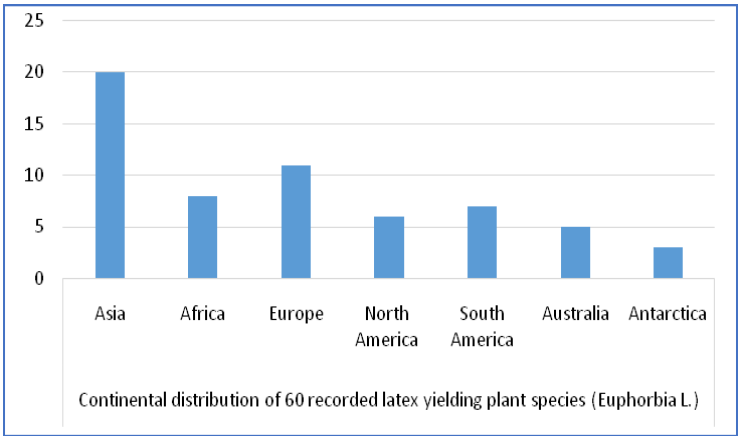

Figure 1: Continental distribution of 60 *Euphorbia* sp.

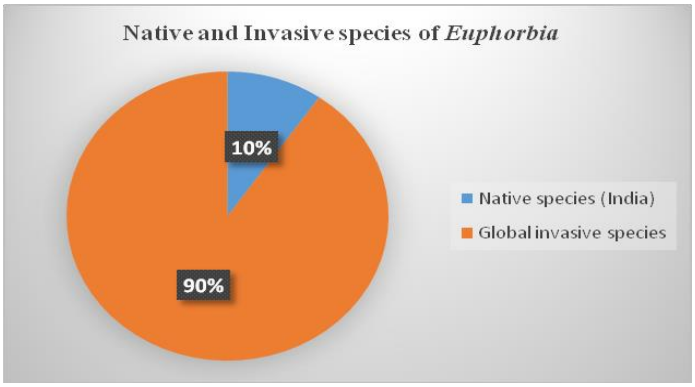

Figure 2: Native and Invasive species of *Euphorbia*

Table 3 revealed the antibacterial and antifungal activity of nine *Euphorbia* species against various bacteria and fungi.

Table 3: Pharmacological activities of some *Euphorbia* species against different microbes

Binomial Name	Pharmacological Activities	Antimicrobial Activity against the Microbes
E. antiquorum L.	Antibacterial	*Escherichia coli, Klebsiella pneumonia, Bacillus subtilis, Staphylococcus aureus* (Sumathi et al. 2011)
E. esula L.	Insecticidal, antibacterial	*B. subtilis, E. coli, S. aureus* (Cataluñ & Rates 1999; De Araújo et al. 2014)
E.granulata Forssk.	Antifungal, antibacterial	*Aspergillus niger* *(De Araújo et al. 2014; Kumar et al. 2010)
E. helioscopia L.	Anthelmintic, antimicrobial	*S. aureus, K. pneumoniae, Pseudomonas multocida and E. coli* and two fungal strains viz. *Aspergillus flavus and Candida albicans* (Okoli et al. 2009; Pascal et al. 2017)
E. heterophylla L.	anti-inflammatory, antimicrobial	Two gram positive bacteria viz. *S. aureus and Enterococcus faecalis* and two gram negative bacteria viz. *E. coli and P. aeruginosa)* (Sumathi et al. 2011)
E. hirta L.	Antiinflammatory, sedative, sperm motility, antioxidant, antidiabetic, antioxytic, burn wound healing, immune stimulatory, antiviral, antimicrobial, herbicidal, antimalarial, larvicidal property, antihelmintic	*E. coli, S. aureus, P. aeruginosa, B. subtilli, P. falsiparum, Entamoeba histolytica, A. niger* (Kumar et al. 2010)
E. prostrata Ait.	antibacterial	*Salmonella Typhi, S. paratyphi* A, *S. paratyphi* B *and S. typhimurium* (Okoli et al. 2009; Rauf & Muhammad 2013)
E. pulcherrima Willd. ex Klotzsch.	Antibacterial	*Xanthomonas* Spp. (Gewali et al.1999; Wal et al. 2013)
E. tirucalli L.	Rubefacient, vesicant, purgative, emetic, anti-syphilitic, carminative Oxytoxic, antiarthritic, Molluscicide, antimicrobial, antiherptic, antioxidant, hepatoprotective, Immunomodulatory, cytotoxic and antiviral	*C. albicans, A. niger, A. fumigatus, B. subtilis, E. coli, Proteus vulgaris, S. aureus, E. faecalis,* HSV-2 (Mondal & Ghosh 2016; Wal et al. 2013)

Data depicted in Table 4 showed the endangered native and invasive species of nine *Euphorbia* Species. Nine native species viz. are endangered *E. acaulis* Roxb., *E. fusiformis* Buch.-Ham. ex D.Don, *E. hirta* L., *E. humilis* C.A.Mey. Ex Ledeb., *E. nana* Royle, *E. panchganiensis*, Blatt.&Mc Cann, *E. tirucalli* L., *E. woodi* N.E.Br. and *E. khandallensis* Blatt. & Hallb. *E. graminea* Jacq., *E. thymifolia* L., *E. zonosperma* Mull. Arg., *E. xylacantha* Pax., *E. xylopoda* Greenm., *E. stenoclada* Baill., *E. reptans* P.R.O. Bally & S. Carter and *E. inculta* P.R.O. Bally were reported as endangered invasive species.

Table 4: Distribution of some endangered *Euphorbia* Species

Native Species (India)	Global Invasive Species
E. acaulis Roxb.	*E. graminea* Jacq.
E. fusiformis Buch.-Ham. ex D.Don.	*E. thymifolia* L.
E. hirta L.	*E. zonosperma* Mull. Arg.
E. humilis C.A.Mey. Ex Ledeb.	*E. xylacantha* Pax.
E. nana Royle	*E. xylopoda* Greenm.
E. panchganiensis Blatt.&Mc Cann.	*E. stenoclada* Baill.
E. tirucalli L.	*E. esula* L.
E. woodi N.E.Br.	*E. reptans* P.R.O. Bally & S.Carter.
E. khandallensis Blatt. & Hallb.	*E. inculta* P.R.O. Bally.

CONCLUSION

Though some species of *Euphorbia* have been used in traditional medicine, but as of 2019, there is no rigorous clinical evidence that *Euphorbia* extracts are effective in the treatment of disease. Numerous Euphorbiaceae species are listed on the poisonous plant data of US Food and Drug Adminstration. This chapter will help the researcher to get the information about the chemical constituents and antimicrobial activity of some *Euphorbia* species along with their present status in the ecosystem.

REFERENCES

Betancur-Galvis L, Morales G, Forero J and Roldan J. (2002). Cytotoxic and Antiviral Activities of Colombian Medicinal Plant Extracts of the *E.* genus. Memórias Do Instituto Oswaldo Cruz. 97(4): 541–546.

Cataluña P and Rates SMK. (1999). The traditional use of the latex from *E. tirucalli linnaeus* (Euphorbiaceae) in the treatment of cancer in south brazil. Acta Horticulturae. (501): 289–296.

De Araújo K, de Lima A, Silva J, Rodrigues L, Amorim A, Quelemes P and da Trindade R. (2014). Identification of Phenolic Compounds and Evaluation of Antioxidant and Antimicrobial Properties of Euphorbia Tirucalli L. Antioxidants. 3(1): 159–175.

Gewali MB, Hattori M, Tezuka Y, Kikuchi T and Namba T. (1990). Constituents of the latex of *E. antiquorum*. Phytochemistry. 29(5): 1625–1628.

Kumar S, Malhotra R and Kumar D. (2010). *E. hirta*: Its chemistry, traditional and medicinal uses, and pharmacological activities. Pharmacognosy Reviews. 4(7): 58.

Mali PY and Panchal SS. (2017). *Euphorbia neriifolia* L.: Review on botany, ethnomedicinal uses, phytochemistry and biological activities. Asian Pacific Journal of Tropical Medicine. 10 (5): 430–438.

Mondal S and Ghosh De (2016). A complete profile on blind-your-eye mangrove *Excoecaria agallocha* L. (Euphorbiaceae): Ethnobotany, phytochemistry, and pharmacological aspects. Pharmacognosy Reviews. 10 (20): 123–138.

Okoli RI, Turay AA, Mensah JK and Aigbe AO. (2009). Phytochemical and Antimicrobial Properties of Four Herbs

from Edo State, Nigeria. Report and Opiniom.1(5).

Parekh J, Chand SV. (2007). In vitro Antimicrobial Activity and Phytochemical Analysis of Some Indian Medicinal Plants. Turk J Biol. 31: 53-58.

Pascal OA, Bertrand AE, Esaïe T, Sylvie HAM and Eloi AY. (2017). A review of the ethnomedical uses, phytochemistry and pharmacology of the *E.* genus, The Pharma Innovation Journal. 6(1): 34-39.

Pascal OA, Bertrand AEV, Esaïe T, Sylvie HAM and Eloi AY. (2017). A review of the ethnomedical uses, phytochemistry and pharmacology of the *E.* genus, The Pharma Innovation Journal. 6(1): 34-39.

Prasad SHKR, Swapna NL and Prasad M. (2011). Efficacy of *E. tirucalli* (L.) towards microbicidal activity against human pathogens. International Journal of Pharma and Bio Sciences. 2(1).

Rauf A and Muhammad N. (2013). Phytochemical and pharmacological evaluation of aerial parts of *E. pulcherrima* L.,Wudpecker Journal of Pharmacy and Pharmacology. 2(2): 015 - 020.

Sudhakar M, Rao CV, Rao PM, Raju DB and Venkateswarlu Y. (2006). Antimicrobial activity of *Caesalpinia pulcherrima*, *E. hirta* and *Asystasia gangeticum*. Fitoterapia. 77(5): 378–380.

Sumathi S, Malathy N, Dharani B, Sivaprabha J, Hamsa D, Radha P. and Padma PR. (2011). Antibacterial and antifungal activity of latex of E*uphorbia antiquorum*. African Journal of Microbiology Research. 5(27).

Wal A, Wal P, Gupta N, Vishnoi G and Srivastava RS (2013). Medicinal Value of *E. tirucalli*. International Journal of Pharmaceutical & Biological Archives. 4(1):31- 40.