WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 9, Issue 14, 1477-1485. Review Article ISSN 2277– 7105

EUPHORBIA SPP AND THEIR USE IN TRADITIONAL MEDICINES: A REVIEW

[1]Shobha Johari and [2]*Ashwani Kumar

[1]Associate Professor, Department of Botany, L.B.S. Government College, Kotputli- 303018.

[2]Former Head, Department of Botany, University of Rajasthan, Jaipur 302004.

Article Received on
22 Sept. 2020,

Revised on 12 Oct. 2020,
Accepted on 02 Nov. 2020

DOI: 10.20959/wjpr202014-19231

***Corresponding Author**
Ashwani Kumar
Former Head, Department of Botany, University of Rajasthan, Jaipur 302004.

ABSTRACT

Rapid increase in population growth is causing strain on medical resources world wide. Traditional folk medicines are region-specific, local resources based indigenous herb based, village based, and in many cases, community-specific. Different systems of medicine developed accordingly, which have been termed as Ayurvedic, Japanese, Chinese, Korean, Malaysian, Yunani and more recently Homoeopathic. The value of ethnomedicine and traditional pharmacology is nowadays achieving great appreciation in modern medicine, because the search for new potential medicinal plants is frequently based on an ethnomedicinal basis. In order to document the ethnobotanical uses of some medicinal plants of genus *Euphorbia*, survey was carried out during the year 2005, in many districts in Thar Desert. Several plants of family Euphorbiaceae produce valuable chemicals used as biofuels, and are also in traditional medicines. Two important plants *Euphorbia tirucalli* and *Euphorbia antisypilitica* were studied for their use in traditional medicines. A review of literature on Euphorbia sp is presented.

KEYWORDS: Traditional medicines, *Euphorbia tirucalli*, *Euphorbia antisypilitica*, Terpenoids.

1. INTRODUCTION

The World Health Organization (The World Health Report, 2003) has estimated that 80% of the population of developing countries being unable to afford pharmaceutical drugs relies on traditional medicines (Bopana and Saxena 2007). In the Indian system of medicine, most practitioners formulate and dispense their own recipes. (Sharma et al., 2005). Out of the total

4,20,000 flowering plants reported from the world more than 50,000 are used for medicinal purposes. The age-old tribal knowledge of plants is an important aspect of ethno botanical research. The tribal tracts are the storehouse of information and knowledge on the multiple uses of plants (Meena and Kumar 2012; Sharma M and A. Kumar 2015; Sharma and Kumar 2011; 2016).

Euphorbia genus (Euphorbiaceae family), which is the third largest genus of angiosperm plants comprising ca. 2000 recognized species, is used all over the world in traditional medicine, especially in the traditional Chinese medicine. Different plants of Euphorbiaceae are used in traditional medicine include: *E. antiquorum, E. antisyphilitica, E. chamaesyce, E. cyparissias, E. helioscopia E. hypericifolia, E. lathyris, E. longifolia, E. milii, E. neriifolia, E. nivulia E. peplus, E. resinifera, E. royleana* (Upadhyay et al. 2010a and 2010b).

One potential source of biocrude is *Euphorbia,* a large genus of Euphorbiaceae, a family of laticiferous herbs, shrubs and small trees, distributed in the tropical and warm temperature regions of the world. Many of the species are succulent and inhabit dry places, they resemble cacti in appearance but are distinguished from them by the presence of milky latex. About 3000 species have been reported throughout the world, chiefly in tropical regions The chemical composition of essential oils from *Euphorbia* species revealed the presence of more than 80 phytochemicals, mainly oxygenated sesquiterpenes and sesquiterpenes hydrocarbons, while *Euphorbia* extracts contain secondary metabolites such as sesquiterpenes, diterpenes, sterols, flavonoids, and other polyphenols (Salehi et al. 2019). They further suggested that extracts and secondary metabolites from *Euphorbia* plants may act as active principles of medicines for the treatment of many human ailments, mainly microbial infections inflammation, and cancer.

Ernst et al. (2015) reviewed Global medicinal uses of Euphorbia L. (Euphorbiaceae), Salehi et al. (2019) reviewed *Euphorbia*-Derived Natural Products with Potential for Use in Health Maintenance. Members of this taxa are promptly recognizable by their specialized inflorescences and latex. In this review, an overview of *Euphorbia*-derived natural products such as essential oils, extracts, and pure compounds, active in a broad range of biological activities, and with potential usages in health maintenance, is described. The extracts and secondary metabolites from *Euphorbia* plants may act as active principles of medicines for the treatment of many human ailments, mainly inflammation, cancer, and microbial

infections. Besides, *Euphorbia*-derived products have great potential as a source of bioactive extracts and pure compounds, which can be used to promote longevity with more health.

2. MATERIAL AND METHODS

A 5 hectare petro crop farm (Fig. 1) was raised in the University of Rajasthan, Jaipur, under the DNES project. Initial cuttings of *Euphorbia antisyphilitica* Zucc. plants, obtained from National Botanical Research Institute, Lucknow, were used to raise stock plants. Plants were multiplied by cuttings raised at close spacing of 2.5 cm x 4 cm in beds, and separately in polythene bags. Sprouting began after 10-15 days. Experiments were performed in pots as well as in beds starting with two-month old plants. Plants were irrigated at weekly intervals. At the time of harvest entire plants were harvested by uprooting. Finally, the plants were cut into aboveground and underground parts which were weighed separately on a sensitive electrical balance (K. Roy). The length and fresh weight were determined for aboveground as well as underground parts separately. These plant parts were dried separately in an incubator at 55^0C for 3-4 days, till their weights became constant. They were used for chemical analysis and bioactivity.

Fig 1: *E. antisyphilitica* in bed experiment.

3. *Euphorbia antisyphilitica*

E. antisyphilitica is a native of Chihuahuan desert of Mexico. Its productivity has been increased by using growth regulators (Johari and Kumar 2013).The Chihuahuan lies to the

east of the Great Sierra Madare Occidental, spreading north to South-West Texas, southern New Mexico and South-West corner of Arizona. Reports and information from various sources indicate that *E. antisyphilitica* occurs in wild and cultivated form only in Mexican region and nowwhere else. It does not occur in wild form in India but had been introduced in India in *1965* (Personal communication with Dr. Kopper). Now it grows well in and semi-arid regions of India. This species is also dendroid and profuse amount of latex remains present in its stem. This plant possesses an important place not only in the field of botanochemical substitutes of petroleum, but also in the commercial field of waxes. It has been used in Mexico for its waxes for at least last 50 years. (Campos-Lopez and Roman-Alemany, 1980). It is also being utilized as remedy for venereal diseases, in Mexico.

Euphorbia antisyphilitica Zucc stalks (E. antisyphilitica) (commonly known as "candelilla") are rich in polyphenol components, mainly ellagitannins which help to protect the trees against predators and pathogens (Ascacio-Valdés et al. 2009) Candelilla stalks are of great economic importance in Northern Mexico. They are used for wax extraction which is used for various purposes in the food industry and also for traditional use in ornaments and therapeutic applications. However, candelilla wax extraction generates 140 tons of waste per year. Previous reports showed that EA is present in candelilla stalks (De Leon-Zapata 2010). In order to assess the importance of candelilla stalks as a source of EA, it is important to characterize the isolation of the EA precursors (ellagitannins) in this plant. To study antifungal activity of a new ellagitannin isolated from the plant residues of *Euphorbia antisyphilitica* (*E. antisyphilitica*) Zucc in the wax extraction process. It can be concluded that the new ellagitannin (860.7 g/mol) isolated from *E. antisyphilitica* Zucc is an effective antifungal agent against *Alternaria alternata, Fusarium oxyzporum, Colletotrichum gloeosporoides and Rhizoctnia solani.*

Plants produce EA to protect themselves from microbial infection and pests. Interests in ellagitannin (EA) have increased during the past few years due to its possible antimutagenic, antiviral and anticarcinogenic effects, proved by several studies, especially in laboratory animals, while a few works were reported in humans (Aguilera-Carbó et al 2008; Reddy et al. 2007). EA has also shown antioxidant activity as an inhibitor of in vitro lipid peroxidation and, because of its combined actions, it is used in the food industry. Ellagitannins have also been shown to possess anti-tumor promoting activity, antibacterial and antiviral properties and host-mediated antitumor effects.

4. *Euphorbia tirucalli* L.

E. tirucalli is a succulent cactus-like plant growing to a height of about 10 m. The main trunk and branches are woody and brown, but the younger branches are green and cylindrical, looking like many pencils and earning the plant its common name - pencil tree (Upadhyay et al. 2010b). Leaves are minute and are shed early, and the function of the leaves is taken over by the green branches. All parts of the plant ooze a caustic milky white sap when damaged, like many other *Euphorbia* spp. Since the latex contains rubber, whole plant harvesting seems most advisable from energy point-of-view (if the tree coppices well) with rubber, petroleum, and alcohol as energy products, and resins, which may find use in the linoleum, skin oil, and leather industries. *E. tirucalli* has recently made popular headlines as a potential "cancer cure" and more important, as an energy source. *E. tirucalli* is also called "petroleum plant" because it produces a hydrocarbon substance very much like gasoline. Petrobas, the national petroleum company in Brazil, is studying this plant. It is thought that the hydrocarbon produced by the plant could be used directly in existing gasoline refineries; estimates of 10 to 50 barrels of oil per acre of cultivated *E. tirucalli* with cost estimates of $3-10 per barrel have been postulated Duong et al. (2019) conducted phytochemical investigation of *Euphorbia tirucalli L.* (Euphorbiaceae) and reported four new compounds, including a rare cadalene-type sesquiterpene (tirucadalenone), two tirucallane triterpenoids, euphorol L and euphorol M, with the latter being described as an epimeric mixture, and a euphane triterpene, namely, euphorol N in addition to with 7 known compounds. They tested these compounds for cytotoxicity against K562, MCF-7 and/or and HepG2 tumor cell lines. Only tirucadalenone displayed a mild cytotoxic activity.

In *E. tirucalli* lower levels of salinity were found to promote growth and hexane extractables, although inhibition was noted at higher salinity conditions. In a separate experiment, 100 percent field capacity irrigation produced maximum biomass but hexane extractables were best in 50 percent field capacity irrigation (Kumar and Kumar, 1986). These reports show effect of agronomical factors on laticiferous plants.

5. *Euphorbia micractina*

Xu et al. (2009) isolated nine minor new tirucallane (1-7) and euphane (8 and 9) triterpenoids including five hydroperoxides from an ethanolic extract of the roots of *Euphorbia micractina*.

6. *Euphorbia neriifolia*

L. is a spiny herb native to Southeast Asia and currently cultivated in southern Taiwan. From the ethanolic extract of E. neriifolia leaves, 22 triterpenoids and 23 compounds were isolated, including and one flavonoid glycoside. Chang et al. (2012) studied the anti-human coronavirus (HCoV) activity of the separated triterpenoids 3beta-Friedelanol exhibited more potent anti-viral activity than the positive control, actinomycin D, which implies the importance of the friedelane skeleton as a potential scaffold for developing new anti-HCoV-229E drugs. Toume et al. (2012) isolated seven new cycloartane triterpenes, euphonerins A-G , and 3-O-acetyl-8-O-tigloylingol , a new ingol diterpene, were isolated from the MeOH extract of *Euphorbia neriifolia* leaves.

7. *Euphorbia portlandica*

Madureira et al. (2006) isolated two new tetracyclic diterpene polyesters, euphoportlandols A and B have been isolated along with 12 known tetracyclic triterpenes from an acetone extract of *Euphorbia portlandica*. Madureira et al. (2006) further evaluated these compounds for their ability to inhibit multidrug resistance in cancer cells. Both compounds were found to be inhibitors of P-glycoprotein activity.

8. *Euphorbia mellifera*

Valente et al. (2012) isolated three new macrocyclic jatrophane diterpenes, named euphomelliferine, and euphomelliferenes A and B, from the methanolic extract of Euphorbia mellifera and one new tetracyclic triterpene, 19(10→9)-abeo-8α,9β,10α-tirucalla-5,25-diene-3β,24-diol (6, C-24 epimers).

9. CONCLUSION

Euphorbia plants are easily distinguishable by their toxic and highly skin irritant milky latex and particular inflorescences, designated as cyathia. They are widely used as ornamental plants, such as *E. milii* Des Moul., *E. tirucalli* L., and *E. lactea* Roxb. The latex is the most valuable product obtained from *Euphorbia* species despite being toxic, it contains several biologically active natural compounds, such as triterpenoids. Besides, latex is used in commercially valuable products like paints and natural rubber (intisy rubber obtained from *E. intisy* Drake). They also have antifungal value. Further studies are needed to be conducted on them.

10 REFERENCES

1. Ascacio-Valdés J, Burboa E, Aguilera-Carbo AF, Aparicio M, Pérez-Schmidt R, Rodríguez R, Aguilar CN. (2013) Antifungal ellagitannin isolated from *Euphorbia antisyphilitica* Zucc. Asian Pac J Trop Biomed, Jan; 3(1): 41-6. doi: 10.1016/S2221-1691(13)60021-0. PMID: 23570015; PMCID: PMC3609384.
2. Ascacio-Valdés JA, Aguilera-Carbó AF, Martínez-Hernámdez JL, Rodríguez-Herrera Aguilar CN. Euphorbia antisyphilitica residues as a new source of ellagic acid. Chem Pap, 2010; 64: 528-532.
3. Aguilera-Carbó A, Augur C, Prado-Barragán LA, FavelaTorres E, Aguilar CN. Microbial production of ellagic acid and biodegradation of ellagitannins. Appl Microbiol Biotechnol, 2008; 78: 189-199.
4. Bopana N. Saxena S. (2009) *Asparagus racemosus*—Ethnopharmacological evaluation and conservation needs. Journal of ethnopharmacology, 2007; 110(1): 1-15.
5. Chang FR, Yen CT, Ei-Shazly M, Lin WH, Yen MH, Lin KH, Wu YC. Anti-human coronavirus (anti-HCoV) triterpenoids from the leaves of Euphorbia neriifolia. Nat Prod Commun, 2012 Nov; 7(11): 1415-7. PMID: 23285797.
6. De Leon-Zapata MA, Saucedo-Pompa S, Contreras-Esquivel JC, Jasso-Cantú D, Sáenz-Galindo A, Rodríguez R, et al. Technological improvements for candelilla (Euphorbia antisyphilitica Zucc.) wax extraction. In: Soto-Cruz O, Peggi MA, Gellegos-Infante A, Rodriguez-Herrera R, (edirs.) Advances in food science and food biotechnology in developing countries. New Delhi: Asiatech Publishers Inc, 2010; 272-280.
7. Duong TH, Beniddir MA, Genta-Jouve G, Nguyen HH, Nguyen DP, Nguyen TA, Mac DH, Boustie J, Nguyen KP, Chavasiri W, Le Pogam P. (2019) Further terpenoids from *Euphorbia tirucalli*. Fitoterapia, Jun; 135: 44-51. doi: 10.1016/j.fitote.2019.04.001. Epub 2019 Apr 14. PMID: 30995563.
8. Ernst M., O. M. Grace, C. H. Saslis-lagoudakis, N. Nilsson, H. T. Simonsen et al., (2015) Global medicinal uses of Euphorbia L. (Euphorbiaceae), J. Ethnopharmacol, 176: 90-101.
9. Ferreira MJ. Jatrophane diterpenes from Euphorbia mellifera and their activity as P-glycoprotein modulators on multidrug-resistant mouse lymphoma and human colon adenocarcinoma cells. J Nat Prod, 2012 Nov 26; 75(11): 1915-21. doi: 10.1021/np3004003. Epub 2012 Oct 25. PMID: 23098168.
10. Johari S. and Kumar A (2013) *Euphorbia antisyphilitica:* Effect of growthregulators in improving growth and productivity of hydrocarbon yielding plant International Journal of Life Science and Pharma Research, 3(4): 25-28.

11. Madureira AM, Gyémant N, Ascenso JR, Abreu PM, Molnar J, Ferreira MJ. Euphoportlandols A and B, tetracylic diterpene polyesters from Euphorbia portlandica and their anti-MDR effects in cancer cells. J Nat Prod, 2006 Jun; 69(6): 950-3. doi: 10.1021/np060046r. PMID: 16792416.
12. Meena R, and Kumar A. (2012) Ethnobotanical survey of medicinal plants from Baran District of Rajasthan, India. The Journal of Ethnobiology and Traditional Medicine. Photon, 117: 199-203.
13. Reddy MK, Gupta SK, Jacob MR, Khan SI, Ferreira D. Antioxidant, antimalarial and antimicrobial activities of tannin-rich fractions, ellagitannins and phenolic acids from Punica granatum L. Planta Medica, 2007; 73: 461-467.
14. Sharma, A and A. Kumar (2016) Pharmacognostic studies on medicinal plants: *Justicia adhatoda*. World Journal of Pharmaceutical Research, 5(7): 1674-1704.
15. Sharma, H. and Kumar, A. (2011): Ethnobotanical studies on medicinal plants of Rajasthan (India): A review. Journal of Medicinal Plants Research, 5: 1107-1112.
16. Salehi B, Iriti M, Vitalini S, et al. *Euphorbia*-Derived Natural Products with Potential for Use in Health Maintenance. *Biomolecules*, 2019; 9(8): 337. Published 2019 Aug 2. doi:10.3390/biom9080337.
17. Sharma M and A. Kumar (2015) Tribal medicines of India. Annals of Plant Sciences, 2015; 4(02): 954-959.
18. Toume K, Nakazawa T, Hoque T, Ohtsuki T, Arai MA, Koyano T, Kowithayakorn T, Ishibashi M. Cycloartane triterpenes and ingol diterpenes isolated from Euphorbia neriifolia in a screening program for death-receptor expression-enhancing activity. Planta Med, 2012 Aug; 78(12): 1370-7. doi: 10.1055/s-0032-1314975. Epub 2012 Jun 14. PMID: 22700046.
19. Upadhyay, B., Singh, K.P. and Kumar, A. (2010): Pharmacognostical and antibacterial studies of different extracts of *Euphorbia hirta* L. Journal of Phytology, 2: 55–60.
20. Upadhyay, B., Singh, K.P. and Kumar A. (2010): Ethno-medicinal, phytochemical and antimicrobial Studies of *Euphorbia tirucalli* L. Journal of Phytology, 2: 65–77.
21. Valente I, Reis M, Duarte N, Serly J, Molnár J, Ferreira MJ. Jatrophane diterpenes from Euphorbia mellifera and their activity as P-glycoprotein modulators on multidrug-resistant mouse lymphoma and human colon adenocarcinoma cells. J Nat Prod, 2012 Nov 26; 75(11): 1915-21. doi: 10.1021/np3004003. Epub 2012 Oct 25. PMID: 23098168.

22. Xu W, Zhu C, Cheng W, Fan X, Chen X, Yang S, Guo Y, Ye F, Shi J. Chemical Constituents of the Roots of Euphorbia micractina. J Nat Prod, 2009 Sep; 72(9): 1620-6. doi: 10.1021/np900305j. PMID: 19702283.