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Review Article

A Comprehensive Review on False Amaranth

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Abstract: *Digera muricata* (False amaranth, Amaranthaceae) is growing as a weed in tropical and subtropical region of the world. Traditionally all the parts of the plant are used. It possesses antioxidant capacity and is locally used for various disorders such as inflammation, urination, as refrigerant and in sexual anomalies. Boiled root infusion given to mother after child birth for lactation purpose. Morphologically, alternately arranged petiolate leaves, central and letral flowers are present. Various chemical constituents like α- & β-spinasterol, β-sitosterol, superoxide, peroxidase, rutin, hyperoside, palmitic acid have been isolated and identified from the entire twig of *Digera muricata.* The present review article is focused on phytochemical, pharmacological and other important aspects of false amaranth.
Keywords: *Digera muricata*, Phytochemical, Pharmacological review.

INTRODUCTION

During the fourth International Conference of Drug Regulatory Authorities (ICDRA) held in Tokyo in 1986, World Health Organization (WHO) was requested to compile a list of medicinal plants and to establish international specifications for the most widely used medicinal plants and simple preparations. Guidelines for the assessment of herbal medicines were subsequently prepared by WHO and adopted by the sixth ICDRA in Ottawa, Canada, in 1991. As a result of ICDRA's recommendations and in response to requests from WHO's member states for assistance in providing safe and effective herbal medicines for use in national health-care systems, WHO is now publishing this first volume of 28 monographs on selected medicinal plants; a second volume is in preparation [2]. Herbal medicine is used to treat many conditions, such as asthma, eczema, premenstrual syndrome, rheumatoid arthritis, migraine, menopausal symptoms, chronic fatigue, and irritable bowel syndrome, among others [3].

Digera muricata is an annual herb, growing to 20-70 cm tall. It can be seen growing wild in waste areas. Their stems are simple or branched from the base, nearly hairless. Alternately arranged leaves, 1-9 cm long and 0.2-5 cm broad, are narrowly linear to broadly ovate. Leaf stalks are long, up to 5 cm, base is narrowed, and the tip pointed. Flowers are borne on slender spike-like racemes, which can be as large as 30 cm long. The racemes are on a stalk that can be up to 14 cm long. Flowers are hairless, white mixed with pink to carmine or red, usually becoming greenish-white in fruit. Fruit subglobose, slightly compressed, 2-2.5 mm, bluntly ribbed along each side, surmounted by a thick rim. In India, the young leaves and shoots of False Amaranth are made into curries, or the entire plant is boiled and seasoned. Flowering is done during August-September [4, 5]. This review paper encompasses phytochemistical, pharmacological and pharmacognostical data on *Digera muricata.*

Introduction to Family Amaranthaceae (6-10)

A Family is a group of genera which have general resemblance mainly in their floral organ.

Classification

Table 1: Scientific classification of Amaranthaceae family

Kingdom	*Plantae*
Subkingdom	*Tracheobionta*
Superdivision	*Spermatophyta*
Division	*Magnoliophyta*
Class	*Magnoliopsida*
Subclass	*Caryophyllidae*
Order	*Caryophyllales*
Family	*Amaranthaceae*

Morphological characters

Annual or perennial herbs or subshrubs.
Leaves: simple, alternate or opposite, ex-stipulate, entire.
Inflorescence: a dense head, loose or spike, spike, raceme or panicle, basically cymose, bracteates, bracts white or coloured, one or more flowers.
Flowers: hermaphrodite or unisexual (plants dioecious or monoecious), actinomorphic, commonly bibracteolate, frequently in ultimate 3-flowered cymules; lateral flowers of such cymules sometimes modified into scales, spines or hooks.
Perianth: uniseriate, membranous to firm and finally indurate, usually falling with the ripe fruit included,

tepals free or somewhat fused below, frequently pilose or lanate, green to white or variously coloured.
Stamens: opposite to the petals, filaments free or commonly fused into a cup at the base, alternating with variously shaped pseudo-staminodes or not, sometimes almost completely fused and 5-toothed at the apex with entire or deeply lobed teeth, some occasionally anantherous.
Ovary: superior, unilocular; ovules 1-many, erect to pendulous, placentation basal; style very short to long and slender; stigmas capitate to long and filiform.
Fruit: an irregularly rupturing or circumscissile capsule (utricle) usually with thin, membranous walls, rarely crustaceous or a berry.
Seeds: round to lenticular or ovoid, embryo curved or circular, surrounding the endosperm.

Distribution: A large and almost exclusively tropical family of some 65 genera and over 1000 species, including many cosmopolitan "weeds" and a large number of xerophytic plants. Some of the following below:

Table 2: List of Genera of Amaranthaceae family

Achyranthes Achyranthus	*Gomphrena*
Aerva	*Gossypianthus*
Alternanthera	*Guilleminea*
Amaranthus	Hermbstaedtia
Blutaparon	Iresine
Celosia	Lithophila
Chamissoa	Nototrichium
Charpentiera	*Pfaffia*
Cyathula	Philoxerus
Deeringia	Psilotrichum
Digera	*Tidestromia*

Introduction to Genus (*Digera*) [11]

A genus is a collection of species which bear a close resemblance to one another as far as the morphological characteristics of the floral or reproductive parts are concerned.

Description of *Digera* genus (Family: Amaranthaceae)
Annual herb with alternate branches and leaves; leaves entire.
Flowers small, in long-pedunculate, axillary, spike-like bracteate racemes, each bract subtending a very shortly pedunculate partial inflorescence consisting of a central fertile flower and two highly modified, sterile, unibracteolate lateral flowers.
Perianth segments 4-5, the outer pair opposite and sheathing the remaining flower parts, the inner segments much more delicate and hyaline.
Stamens 4-5, free, without intermediate staminode-like teeth, filaments filiform. Style filiform; stigmas 2, divergent.
Ovary with a single ovule lateral on a curved funicle, radicle descending.
Fruit a hard, indehiscent nutlet enclosed by the persistent perianth and falling together the sterile flowers and bracteoles.
Seed: Endosperm copious.

Introduction to species

It consists of the entire herb of *Digera muricata*, belonging to family Amaranthaceae.. *Digera muricata* is also known as *Digera arvensis*, *Digera alternifolia* and *Digera angustifolia*. Traditinally whole plant particularly leaves & stem are used for its therapeutic effect like inflammation, urination, as refrigerant and in sexual anomalies [9-11].

False amaranth is an annual herb, 15-20 upto 50-70 cm tall. Stem is simple or with ascending branches from near the base; glabrous or very sparingly pilose, with pale ridges. Leaves are alternate**,** leaf-blade narrowly linear to broadly ovate or rarely subrotund, 12-20 upto 60-90 x 2-6 upto 30-50 mm, glabrous or the petiole and principal veins of the lower surface of the leaf spreading - hairy, acute or acuminate at the apex, longly or (in broader-leaved forms) rapidly narrowed to the base; petiole slender, in the lower leaves up to 5 cm, shortening in the upper leaves. Flowers are glabrous, white tinged with pink to carmine or red, usually becoming greenish-white in fruit, in long and slender or shorter and denser axillary racemes, long - pedunculate, up to 30 cm long, laxer below; peduncles slender, the lower up to 14 cm in length, both they and the inflorescence axis glabrous or sparingly spreading-hairy; bracts persistent, deltoid-lanceolate, acuminate, 1-2.75 mm, glabrous, membranous with a green or brownish percurrent midrib, each subtending a very shortly pedunculate partial inflorescence of 3 flowers.

Central flower: fertile, 2 membranous, navicular outer perianth segments 3-4.5 mm long, oval or oblong, 7-12-nerved, acute; the 2-3 inner segments slightly shorter, more delicate, blunt, 1-3-nerved, hyaline, with a darker central vittae; stamens sub-equalling or shorter than the style; style 1.5-4 mm, the 2 stigmas finally recurved.

Lateral flowers: appressed, 1-bracteolate, these flowers much reduced and increasingly so in the upper part of the spike (sometimes absent), modified into accrescent, antler-shaped scales, these scales with the lateral lobes narrow to broad and wing-like. Fruits are subglobose, slightly compressed, 2-2.5 mm, bluntly keeled along each side, surmounted by a thick rim or a corona of short, firm processes furnished throughout with ridges, style persistent. Flowering period is form August to September in the year [12-15].

Fig-1: Flower of *Digera muricata*

Table 3: Scientific Classification of *Digera muricata* [9, 10]

Kingdom	*Plantae*
Subkingdom	*Tracheobionta*
Superdivision	*Spermatophyta*
Division	*Magnoliophyta*
Class	*Magnoliopsida*
Subclass	*Caryophyllidae*
Order	*Caryophyllales*
Family	*Amaranthaceae*
Genus	*Digera*
Species	*muricata*

Distribution [11, 13]

Digera muricata is most common on disturbed and waste ground, but occurs in many kinds of habitate, from dry Savanna and semi-desert to moist localities on deep clay and mud soils, from sea level up to 1500 m altitude. It also occurs as a weed in fields, sometimes being troublesome.

Africa

Northeast Tropical Africa: Ethiopia; Somalia; Yemen – Socotra

East Tropical Africa: Kenya; Tanzania; Uganda

Western Indian Ocean: Madagascar

Asia-temperate

Arabian Peninsula: Oman; Saudi Arabia; Yemen

Western Asia: Afghanistan; Iran

Asia-tropical

Indian Subcontinent: India; Pakistan

Malesia: Indonesia - Celebes, Java, Moluccas; Malaysia

Vernacular name [9, 10]

Table 4: Vernacular names

Local name	Lulur
Common name	False Amaranth
Hindi	Latmahuria, Lesua, Gangatiya, Khanjru, Leshua, Lolaru
Marathi	Gitana, Getna
Tamil	Toyakeerai, Kaatukeerai, Kecani, Kiraittoyili, Kutiraiccali Toyil, Toyyili, Tuyili, Ventoyili
Telugu	Chenchali koora, Chanchalikoora, Chencheli-kura
Kannada	Chenchali soppu, Goraji palya, Kankali soppu
Sanskrit	Aranya, Aranyavastuka, Kunanjara, Kuranjara

Chemical constituents [12]

This plant consists of

Primary metabolites: Proteins, Carbohydrates, Chlorophylls, Amino acids, Reducing sugar, Lipids, Prolines.

Secondary metabolites: Phenols, Flavonoids, Alkaloids, Terpenoids, Saponins, Tannins.

Leaves: lipid and fatty acids (Palmitic acid being the major one), mineral salts, vitamins (ascorbic acid), fiber etc.

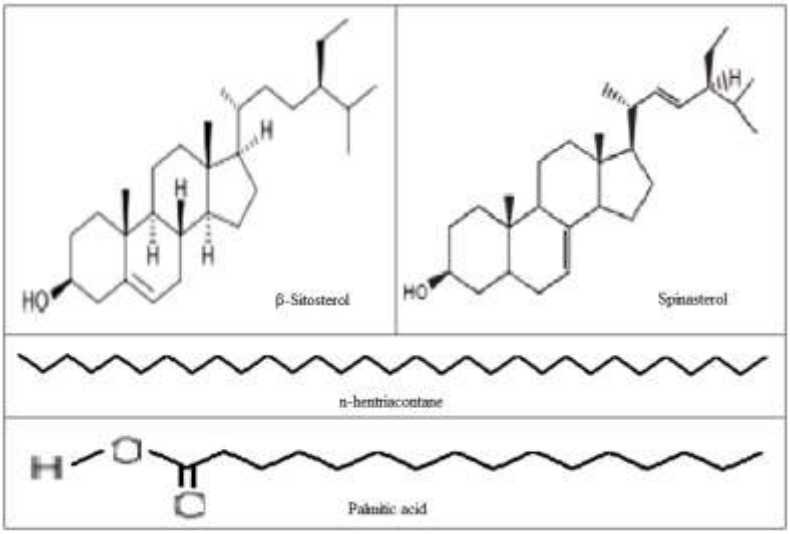
Sterol: α- & β-spinasterol, β-sitosterol, stigmasterol.

Acid: tetracosanoic acid, stearic acid, palmitic acid, octacosanoic acid and betulinic acid.

Enzyme: superoxide, peroxidase.

Others: tinosporin, n-hentriacontane, petulin, ceryl alcohol, rapanone, lupeol, luteolin, hordenine, ancistrocladine and mannitol, rutin, hyperoside.

Chemical Structures



Uses [9-15]

- Potherb/fodder: The plant is used as potherb and fodder to sheep and goats.
- Leaves and young shoots are locally used as a vegetable and given to relieve constipation.
- It possesses antioxidant capacity and is locally used for various disorders such as inflammation, urination, as refrigerant, aperient and in sexual anomalies.
- It is also used internally against digestive system disorders and in India flowers and seeds are used to treat urinary discharges.
- Ethanolic (50%) extract of the plant is diuretic.
- Leaf paste is applied locally to prevent pus formation.
- Boiled root infusion given to mother after child birth for lactation purpose.
- It is also used to treat the nephrotoxicity & hepatotxicity.
- Plant also contains antimicrobial activity.

Other uses [16-18]

D. muricata is considered as a famine food because of rich source of nutrients. In Kenya they are particularly popular as a cooked vegetable amongst coastal tribes. In India the leaves are made into curries or the entire plant is boiled in water and seasoned with salt and chilli. The whole plant is also commonly grazed as forage, particularly by sheep and goats. The flowers are rich in nectar which is sometimes sucked by children in Kenya.

Pharmacological activities

Hepatoprotective activity [19-24]

The methanolic extract of *D. muricata* shows hepatoprotective effect against acryl amide induced hepatocellular injuries. Acryl amide (AA) is a water soluble vinyl monomer used in the production and synthesis of polyacrylamides. It has been documented that AA is formed during the cooking of starchy foods at high temperature. Daily exposure to AA might present a risk factor for neurotoxicity and reproductive toxicity as well as carcinogenicity in humans AA can also cause glutathione depletion, resulting in intracellular oxidative stress36. The methanolic extract of *D. muricata* was given to acryl amide induced Sprague-Dawley rats and found that Hepatic lesions induced with AA were reduced with DME treatment. The results suggest that the hepatoprotective effects of DME against AA-induced oxidative injuries could be attributed to the phenolics and flavonoids.

Antimicrobial activity

The different solvent extracts shows antifungal and antibacterial activity against selected bacteria and fungi. The organic successive Soxhlet extracts of D. muricata i.e., petroleum ether, chloroform, ethanol and distilled water, have shown significant zone of inhibition of bacterial growth at the concentrations of 200 and 400 µg/well against test pathogens [25]. It is also reported that the methanol extract shows maximum activity against test bacteria and fungi [26].

Antioxidant activity

The plant has shown antioxidant activity in different investigations. Mety et al., 2011 analysed free radical scavenging and antioxidant activity of different solvent extract like hexane, petroleum ether, chloroform, methanol, ethanol and aqueous [27]. The maximum activity recorded in methanol and least activity was recorded in hexane. The methanolic crude extracts of *D. muricata* was screened for their free radical scavenging properties by DPPH (1,1-diphenyl-2-picryl hydrazyl) radical scavenging assay. The maximum activity was observed in roots of *D. muricata* [28]. Antioxidant properties of *Digera muricata* methanol extract against the CCl4-induced toxicity in kidneys and testis had been well documented [29].

Anti-diabetic activity

The methanolic extract of *D. muricata* (MEDM) leaves exhibited antidiabetic activity in alloxan induced diabetic rats. These results suggest that MEDM (200mg/kg) showed antihyperglycemic activity in diabetic rats. The other parameters like blood glucose

level, HDL level in serum decreases and body weight increases [30].

Anthelmintic activity

The crude extract from leaves was preliminary screened for anthelmintic activity when tested against earthworms (*Pheretima posthuma*) [30].

Anti-testicular toxicity

The study suggested the protective potential of hexane extract of *D. muricata* against the CCl4-induced liver and testicular toxicity. CCl4 can rapidly lead to both oxidative stress and acute liver injuries [31, 32]. Liver cirrhosis causes Hypogonadism in male rats which are cured by Hexane extract of D. muricata. DMH treatment ameliorated the hepatic injuries with consequent increase in the antioxidant status of various enzymes and compounds. Level of testosterone was elevated with DMH in addition to the repairing of testis and accessory organs. These protective effects of DMH against the CCl4 toxicity may be attributed due to the presence of various bioactive groups and specifically the rutin and hyperoside in DMH [33].

Renal disorders

D. muricata is used in renal disorders in folk medicine. The extract of this plant is administered daily in kidney stone treatment [34]. Generation of reactive radicals has been implicated in carbon tetrachloride-induced nephrotoxicity, which are involved in lipid peroxidation, accumulation of dysfunctional proteins, leading to injuries in kidneys. Nephrotoxicity is a poisonous effect of some substances on kidneys. The n-hexane and methanolic extract of D. *muricata* shows protective role against Carbon tetrachloride which is induced nephrotoxicity in rats [29].

Allelopathic effect

The aqueous extract of stem, root and leaf of *D. muricata* shows allelopathic effect on in vitro seed germination of *Pennisetum typhoideum* (bajra). Different concentrations of various parts of weed showed inhibitory effects on shoot and root growth of *Pennisetum typhoideum*. The leaf extract proved inhibitory in nature than stem and root [34].

Protective effect

The methanolic and hexane extract of *D muricata* shows protective effect against oxidative stress caused by ccl4 in rats. It is able to ameliorate oxidative stress in adrenal gland induced by CCl4 in rat. The protective potential may also involve the preventive effects of *D. muricata* methanolic extract by the inhibition of CCl4 metabolism [33]. This study further supports the scientific evidence in favor of its pharmacological use in oxidative stress diseases [34].

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