A COMПENDIUM ETHNOPHARMACEUTICAL REVIEW ON

Euphorbia hirta L.

A.N.M Mamun-Or-Rashid, Shohel Mahmud, Nayeem Md. Towfiq, Monokesh Kumer Sen*

Dept. of Biotechnology and Genetic Engineering, Faculty of Applied Science and Technology, Islamic University, Kushtia, Bangladesh.

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Abstract

Euphorbia hirta Linn. is a common herb belonging to the family Euphorbiaceae, which is frequently seen everywhere in Bangladesh. Though almost all of its parts are used in traditional systems of medicines, aerial parts and leaves are the most important parts which are used medicinally. It is used in different systems of medicine in the treatment of diarrhoea, bronchitis, skin diseases, fever, analgesic, gastrointestinal disorders, vomiting, wound healing, respiratory diseases, pulmonary disorders etc. The plant has been used as antimicrobial, anti-inflammatory, anti-tumor, antiamoebic, antifertility, antimalarial, antioxidant, sedative, cytotoxic, aflatoxin inhibition, larvicidal, immunomodulatory and so on. The aim of current ethnopharmaceutical documentation on this medicinal plant was to pile up the enormous amount of fresh information of scientific research and reports available in different aspects that proves its involvement in pharmacology. This update review also includes reports on taxonomy, morphology, monographs, distribution, phytochemistry and traditional medicinal uses of the plant.

Key Words: Euphorbia hirta; Ethnopharmaceutical; Pharmacology; Phytochemistry; Traditional use.

*Address for correspondence:
Monokesh Kumer Sen,
Department of Biotechnology and Genetic Engineering
Faculty of Applied Science and Technology,
Islamic University, Kushtia-7003, Bangladesh.
E-mail: monokesh@gmail.com

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INTRODUCTION

Infectious diseases are major causes of morbidity and mortality in the developing world and accounts for about 50% of all deaths. In Bangladesh, about 17% of all children admitted to the pediatric wards die of diarrhea.[1] Some 5.8 million deaths each year in infants and children below 5 years are caused by enteric diseases worldwide.[1] In many parts of the world, there is a rich tradition in the use of herbal medicine for the treatment of many infectious diseases.[2][3] In developing countries, it is estimated that about 80% of the population rely on traditional medicine for their primary health care.[4][3][5] Most of the pathogens causing enteric infections have developed resistance to the commonly prescribed antibiotics. Bacterial resistance to antibiotics increases mortality, likelihood of hospitalization and the length of stay in the hospital.[1] Therefore, the demand for new and effective anti-microbial agents with broad-spectrum of activity from natural sources is increasing day by day.[6][7]

E. hirta L. is one of such herbs belonging to the family Euphorbiaceae which is frequently seen occupying open waste spaces and grasslands, road sides, and pathways in many parts of the world.[1][8][9] The leaves of E. hirta are found to contain flavonoids, polyphenols, tannins, sterols, alkaloids, glycosides and triterpenoids.[9][10] The plant has a reputation for increasing milk flow in women because of its milky latex and is used for other female complaints as well as diseases like bronchitis, asthma, eczema, dysentery. It is used as antidiarrheal, antispasmodic, anti-inflammatory, antifungal, anticancer, antimalarial, antiamoebic, antibacterial and antihelmentic etc. The present investigation was carried out to compile the medicinal properties of different plant parts of E. hirta L. and to compare their traditional uses with scientific evidences.

Taxonomy of Euphorbia hirta

The botanical classification of Euphorbia hirta is as following

- **Kingdom**: Plantae
- **Phylum**: Magnoliophyta
- **Class**: Angiospermae
- **Order**: Malpighiales
- **Family**: Euphorbiaceae
- **Genus**: Euphorbia
- **Species**: hirta

Plant parts used

The whole plant is used; especially aerial parts and leaves are commonly used.

Monograph

- **Bengali Names**: Barokhervi
- **English Names**: bearing spurge, asthma herb, snakeweed
- **Scientific Name**: Euphorbia hirta Linn.
- **Family**: Euphorbiaceae
- **Duration**: Annual
- **Growth Habit**: Multi-branched herb[9]
- **Bangladesh Nativity**: Native

Morphology

E. hirta belongs to the plant family Euphorbiaceae and genus Euphorbia. It is a slender-stemmed, annual hairy plant with many branches from the base to top, spreading up to 40 cm in height, reddish or purplish in color. Leaves are opposite, elliptic - oblong to oblong- lanceolate, acute or subacute, dark green above; pale beneath, 1- 2.5 cm long, blotched with purple in the middle, and toothed at the edge. The fruits are yellow, three- celled, hairy, keeled capsules, 1-2 mm in diameter, containing three brown, four-sided, angular, wrinkled seeds.[1][9][11][12][13][14][15]
Table 1: Chemical constituents of *E. hirta*

<table>
<thead>
<tr>
<th>Parts used</th>
<th>Constituents</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole plant</td>
<td>Afzelin, quercitrin, myricitrin, rutin, quercitin, euphorbin-A, euphorbin-B, euphorbin-C, euphorbin-D, 2, 4, 6-tri-O-galloyl-β-d-glucose, 1, 3, 4, 6-tetra-O-galloyl-β-d-glucose, kaempferol, gallic acid, protocatechuic acid, β-amyrin, 24-methyleneoctaenol, β-sitosterol, heptacosane, nonacosane, shikmic acid, tinyatoxin, choline, camphol, rhamnose and chotolphemic acid</td>
<td>[9][12][16][17][18]</td>
</tr>
<tr>
<td>Leaves</td>
<td>Flavonoids, polyphenols, tannins, sterols, alkaloids, glycosides and triterpenoides</td>
<td>[3][10]</td>
</tr>
</tbody>
</table>

Table 2: Folk remedies and traditional uses of *E. hirta*

<table>
<thead>
<tr>
<th>Type of use</th>
<th>Symptoms</th>
<th>Part used and method</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal Disorders</td>
<td>Diarrhea, dysentery, intestinal parasitosis</td>
<td>-</td>
<td>[1][9][19][20]</td>
</tr>
<tr>
<td>Bronchial and respiratory diseases</td>
<td>Asthma, bronchitis, hay fever</td>
<td>-</td>
<td>[1][9][21][20]</td>
</tr>
<tr>
<td>Conjunctivitis</td>
<td>-</td>
<td>Aqueous extract</td>
<td>[9]</td>
</tr>
<tr>
<td>Hypotensive and tonic properties</td>
<td>-</td>
<td>The stem sap</td>
<td>[9]</td>
</tr>
<tr>
<td>Anxiolytic, analgesic, antipyretic, and anti-inflammatory activities</td>
<td>-</td>
<td>Leaf poultice</td>
<td>[1][9][20]</td>
</tr>
<tr>
<td>Eyelid styes</td>
<td>-</td>
<td>Methanolic extract of leaves</td>
<td>[9]</td>
</tr>
<tr>
<td>Swelling and boils</td>
<td>-</td>
<td>Leaves pounded with turmeric and coconut oil</td>
<td>[9]</td>
</tr>
<tr>
<td>Antifungal and antibacterial activities</td>
<td>-</td>
<td>Latex</td>
<td>[1][9][20]</td>
</tr>
<tr>
<td>Itchy sole</td>
<td>-</td>
<td>Decoction of dry herbs</td>
<td>[1][9][12][20]</td>
</tr>
<tr>
<td>Eye sores</td>
<td>-</td>
<td>Decoction of fresh herbs</td>
<td>[1][9][12][20]</td>
</tr>
<tr>
<td>Skin diseases</td>
<td>-</td>
<td>Root decoction</td>
<td>[9][12]</td>
</tr>
<tr>
<td>Thrush</td>
<td>-</td>
<td>Roots</td>
<td>[9][12]</td>
</tr>
<tr>
<td>Mothers deficient in milk</td>
<td>-</td>
<td>Polyphenolic extract</td>
<td>[9][22]</td>
</tr>
<tr>
<td>Snake bites</td>
<td>-</td>
<td>Decoction of the herb</td>
<td>[1][20]</td>
</tr>
<tr>
<td>Antispasmodic activity</td>
<td>-</td>
<td>Decoction of the herb</td>
<td>[1][23]</td>
</tr>
<tr>
<td>Wound infections</td>
<td>-</td>
<td>Exudates of the stem</td>
<td>[1][24]</td>
</tr>
<tr>
<td>Vomiting, fever, bronchitis and pulmonary disorders</td>
<td>-</td>
<td>Decoction of the plant</td>
<td>[1][20][23]</td>
</tr>
<tr>
<td>Eye and ear infections</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Athletes foot and scorpion bite pains</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Distribution

*E. hirta* is distributed throughout the hotter parts of Bangladesh, India and Australia, often found in waste places along the roadsides. It is widely distributed all over the world.

Phytochemistry

The whole plant contains quercitrin, myricitrin, shikmic acid, tinyatoxin and choline. Other constituents of the whole plant are euphorbin-ABCD, 2, 4, 6-tri-O-galloyl-β-d-glucose, 1, 3, 4, 6-tetra-O-galloyl-β-d-glucose, kaempferol, gallic acid, protocatechuic acid, β-amyrin, 24-methyleneoctaenol β-sitosterol etc. Leaf of plant contains flavonoids, tannins, sterols, alkaloids etc. The major constituents of various plant parts are shown in Table 1.

Folk remedies and traditional uses

*E. hirta* is a very popular herb amongst practitioners of traditional medicine and the herb is widely used in traditional medicine to...
Table 3: Pharmacological activities of *E. hirta*

<table>
<thead>
<tr>
<th>Pharmacological activity</th>
<th>Plant parts and methods used</th>
<th>Organisms</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibacterial activity</td>
<td>Ethanolic extract of aerial parts, methanolic extracts of leaves, flowers, stems and roots</td>
<td><em>E. coli</em>, <em>S. aureus</em>, <em>P. vulgaris</em>, <em>P. aeruginosa</em>, <em>S. typhi</em>, <em>Micrococcus</em> sp., <em>K. pneumonia</em>, <em>P. aeruginosa</em>, <em>P. mirabilis</em>, <em>B. cereus</em>, <em>B. subtilis</em> and <em>B. thuringensis</em></td>
<td>[20][25][26]</td>
</tr>
<tr>
<td></td>
<td>Aqueous and chloroform leaf extracts</td>
<td><em>K. pneumonia</em></td>
<td>[9][15]</td>
</tr>
<tr>
<td>Antimalarial activity</td>
<td>Methanolic extract of aerial parts</td>
<td><em>P. falciparum</em></td>
<td>[9][18][31][32]</td>
</tr>
<tr>
<td>Anti-inflammatory activity</td>
<td><em>N</em>-hexane extract of aerial parts</td>
<td>Mice, rat</td>
<td>[9][31][33][34]</td>
</tr>
<tr>
<td>Galactogenic activity</td>
<td>Powdered <em>E. Hirta</em></td>
<td>Guinea pig</td>
<td>[9][35]</td>
</tr>
<tr>
<td>Antiasthmatic activity</td>
<td>Powdered <em>E. Hirta</em></td>
<td>Guinea pig</td>
<td>[9][21]</td>
</tr>
<tr>
<td>Effect on urine output</td>
<td>Ethanolic and aqueous leaf extracts</td>
<td>Rat</td>
<td>[9][36]</td>
</tr>
<tr>
<td>and electrolytes</td>
<td>Herb decoction, aqueous leaf extract</td>
<td>Mice, rat</td>
<td>[9][19][25][31][37]</td>
</tr>
<tr>
<td>Antidiarrheal activity</td>
<td>Aqueous extract</td>
<td><em>E. histolytica</em></td>
<td>[9][25][31]</td>
</tr>
<tr>
<td>Galactogenic property</td>
<td>Aqueous extract</td>
<td><em>C. capsici</em>, <em>C. albicans</em>, <em>F. pallidoseum</em>, <em>B. theobromae</em>, <em>P. caricae-papayae</em>, <em>A. niger</em>, <em>A. fumigatus</em>, <em>A. flavus</em>, and <em>R. oryzae</em>.</td>
<td>[9][15][27]</td>
</tr>
<tr>
<td>Acute toxicity effect</td>
<td>Ethanolic extract of whole aerial parts</td>
<td>C. saline</td>
<td>[9][15][27]</td>
</tr>
<tr>
<td>Sedative effects</td>
<td>Leaves and stems</td>
<td>Mice and A. salina</td>
<td>[39]</td>
</tr>
<tr>
<td>Anxiolytic properties</td>
<td>Aqueous extract</td>
<td>Mice</td>
<td>[40]</td>
</tr>
<tr>
<td>Deleterious effects on</td>
<td>Aqueous extract</td>
<td>Mice</td>
<td>[40]</td>
</tr>
<tr>
<td>the serum Chemistry</td>
<td>Ethanol and ethyl acetate</td>
<td>Rat</td>
<td>[41]</td>
</tr>
<tr>
<td>Anti-allergic activity</td>
<td>Ethanol and ethyl acetate</td>
<td>Rat and mice</td>
<td>[31][42][43]</td>
</tr>
<tr>
<td>Antitumor activity</td>
<td>Extract of leave, flower, and stem</td>
<td>Swiss albino mice, hep-2 cells from human epithelioma of the larynx</td>
<td>[31][47][48][49]</td>
</tr>
<tr>
<td>Antidiabetic activity</td>
<td>Ethanol and ethyl acetate</td>
<td>Diabetic mice</td>
<td>[31][50]</td>
</tr>
<tr>
<td>Antidiabetic activity</td>
<td>Extracts of leaf, flower, and stem</td>
<td>Diabetic mice</td>
<td>[31][50]</td>
</tr>
<tr>
<td>Antihypertensive</td>
<td>Methanol extract of the leaves and aerial part</td>
<td>Rat, mice</td>
<td>[31][40][51]</td>
</tr>
<tr>
<td>Anthelmintic and</td>
<td>Ethanol and ethyl acetate</td>
<td>Rat, mice</td>
<td>[31][40][51]</td>
</tr>
<tr>
<td>larvicidal activity</td>
<td>Extract from leaves and stems</td>
<td>Helminths in Nigerian dogs</td>
<td>[31][52][53][54]</td>
</tr>
<tr>
<td>Immunomodulatory</td>
<td>Whole plants</td>
<td>Fish</td>
<td>[31]</td>
</tr>
</tbody>
</table>
activity

Cytotoxic activity

Ethanolic extract of the whole plant

Brine shrimp larva

[55]

Aflatoxin inhibition activity

Aqueous extract

Rice, wheat, Maize and groundnut

[56]

Cardiovascular activity

Petroleum ether phase of the methanolic extract

-

[57]

Vasodepressor activity

Ethanol extract

Adult Male, Wistar Albino rats

[57]

Toxic effects

Aqueous stem, bark, and leaf extracts

Rat, brine shrimp

[31][58][59]

 treat a variety of diseased conditions including asthma, coughs, diarrhea and dysentery. Various traditional uses of the E. hirta are mentioned in Table 2.

Pharmacology

Following the folk and traditional uses of the plant, it has been investigated scientifically to validate the potential of the plant in cure of variety of ailments. Some of the reported pharmacological activities of E. hirta are mentioned in Table 3.

DISCUSSION AND CONCLUSION

Phytochemical and pharmacological investigations carried out in the plant reveals its multidisciplinary usage. While some of the reported scientific uses include its use as an antispasmodic, antiasthmatic, expectorant, anticatarrhal and antisyphilitic.[1][11][41][60]

Most of the activities of the plant were believed to be due to the presence of choline, shikimic acid and the quercetin. [1][23][60] The plant was found to be very useful as an antibacterial, antifungal[29][30][51] and also anti-diabetic.[50][31] Antitumour potential was the exciting aspects of the plant. [47][48][49][31]

It is very essential to have a proper documentation of medicinal plants and to know their potential for the improvement of health and hygiene through an eco-friendly system. A detailed and systematic study is required for identification, cataloguing and
documentation of plants, which may provide a meaningful way for the promotion of the traditional knowledge of the herbal medicinal plants. The present review reveals that the E. hirta is used in treating various ailments.

Although E. hirta has been used wildly to treat various diseases in many countries, most of the involved molecular mechanisms have not been fully explored. However, the anti-infection of E. hirta is due to its direct bactericidal activity. Anti-inflammatory and antioxidative activities of E. hirta can also be expected to use in treating scald, preventing sepsis or other chronic inflammatory diseases. Aflatoxin inhibition activity can be used in detoxifying the toxin from grains. Anti-tumor activity of methanol extract of E. hirta can be used in the treatment of cancer.

Further investigation should carried out by modern instruments like HPLC, HPTLC and NMR in order to isolate and elucidate the active ingredients present in different parts as an aid to the preliminary phytochemical analysis. The pharmacological experiments conducted in this plant need to run in future to develop a novel drug that has limited side effects.

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REFERENCES


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