



Medicinal uses, phytochemistry and biological activities of *Ehretia obtusifolia* Hochst. ex DC. (Ehretiaceae)

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ABSTRACT

Ehretia obtusifolia Hochst. ex DC. is a shrub or small tree which occurs naturally in tropical Africa and Asia. This study aims to provide some information about the medicinal uses, phytochemistry and biological activities of *E. obtusifolia*. This review examines the existing literature on the medicinal uses, phytochemistry and biological activities of *E. obtusifolia*. This study revealed that the bark, branch, fruit, leaf, root, stem, stem bark and twig decoction or infusion of *E. obtusifolia* are mainly used to treat and manage sore throat, retained placenta in both humans and animals, teething pain, toothache, abdominal pains, menstrual problems and pain. Phytochemical research revealed that the species is characterized by alkaloids, flavonoids, glycosides, phenolics, phlobatannin, saponin, steroids, tannins and terpenoids. Ethnopharmacological research revealed that the extracts and phytochemical compounds isolated from the species showed antibacterial, anti-diarrhoeal, anti-inflammatory, antinociceptive, antioxidant, cytotoxicity and phytotoxicity activities. *Ehretia obtusifolia* should be subjected to detailed phytochemical, biological and toxicological studies.



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INTRODUCTION

The genus *Ehretia* P.Br. is a genus of approximately 40 species belonging to the Ehretiaceae family (Gottschling *et al.*, 2016). Recent molecular and phylogenetic studies based on nuclear (ITS) and plastid loci (rps16, trnL-trnF and trnS-trnG) supported the segregation of the family Ehretiaceae from Boraginaceae sensu lato (Gottschling *et al.*, 2004, 2014). The plant species belonging to the

genus *Ehretia* have been recorded in the Old and New World tropics with centres of diversity in tropical Africa and East Asia (Hilger and Gottschling, 2002). *Ehretia obtusifolia* Hochst. ex DC. (Figure 1) naturally in Afghanistan, Angola, Botswana, Chad, Eritrea, Ethiopia, Eswatini, Gulf States, India, Iran, Kenya, Madagascar, Malawi, Mozambique, Myanmar, Namibia, Oman, Pakistan, Saudi Arabia, Socotra, Somalia, South Africa, South Sudan, Tanzania, Uganda, Yemen, Zambia and Zimbabwe (Riedl, 1967; Riedl *et al.*, 1997; Martins *et al.*, 1990).

The genus name *Ehretia* is in honour of a German botanical artist and entomologist of the 18th century known as Georg Dionysius Ehret (1708-1770) (Palmer and Pitman, 1972). The species name *obtusifolia* means obtuse leaves (Glen, 2004), that is, blunt-leaved in Latin in reference to the often blunt leaf tips of the species as shown in Figure 1. Synonyms of *E. obtusifolia* include *E. braunii* Vatke, *E. caerulea* Gürke, *E. caerulea* var. *glandulosa* Suess., *E. fischeri* Gürke, *E. laevis* (Rottler ex G. Don) Roxb. var. *aspera* C.B. Clarke, *E. mossambicensis* Klotzsch and *E. obovata* R.Br. (Retief and Van Wyk, 2001; Ger-

mishuizen and Meyer, 2003). The English common names of *E. obtusifolia* include “hairy puzzle-bush” and “stamperwood” (Palgrave, 2002).

Ehretia obtusifolia (Figure 1) is a deciduous, multi-stemmed shrub or small tree growing to a height of five metres (Palgrave, 2002). The species has been recorded at medium to low altitudes on sandy loam to stony soil on hill slopes and termite mounds in grassland, bushland, thickets and woodland. The bark of the species is whitish, light brown, light grey to dark grey, smooth and occasionally flaky. The leaves of *E. obtusifolia* are alternate or clustered on short lateral shoots, simple, obovate to oblanceolate in shape, dark green above and paler green below with dense and glandular hairs on the midrib and side veins. The flowers are small, blue and mauve in colour (Figure 1) and sweetly scented.

The fruits of *E. obtusifolia* are spherical in shape, fleshy with glandular hairs, orange in colour and often produced in profusion. The fruits of *E. obtusifolia* are eaten particularly by children (Jabeen *et al.*, 2009; Schmidt *et al.*, 2007). The leaves of *E. obtusifolia* are used as fodder in Pakistan (Sher *et al.*, 2011; Al-Sodany *et al.*, 2013) and Saudi Arabia (Iqbal and Hamayun, 2004; Ajaib *et al.*, 2014). It is therefore, within this context that the current study was undertaken aimed at documenting the ecological, biological and medicinal properties of *E. obtusifolia* in tropical Africa and Asia.

MATERIALS AND METHODS

Results of the current study are based on a literature search on the ecological, biological and medicinal properties of *E. obtusifolia* throughout its distributional range using information from internet databases. The databases used included Scopus, Google Scholar, PubMed and Science Direct. Other sources of information used included pre-electronic sources such as journal articles, theses, books, book chapters and other scientific articles obtained from the university library.

RESULTS AND DISCUSSION

Medicinal uses of *Ehretia obtusifolia*

The herbal concoctions prepared from the bark, branch, fruit, leaf, root, stem, stem bark and twig decoction or infusion of *E. obtusifolia* are used to treat and manage 17 human and animal diseases and ailments in tropical Africa and Asia (Table 1). The major diseases and ailments treated by *E. obtusifolia* extracts include retained placenta in both humans and animals, sore throat, and teething pain and toothache recorded in two countries based

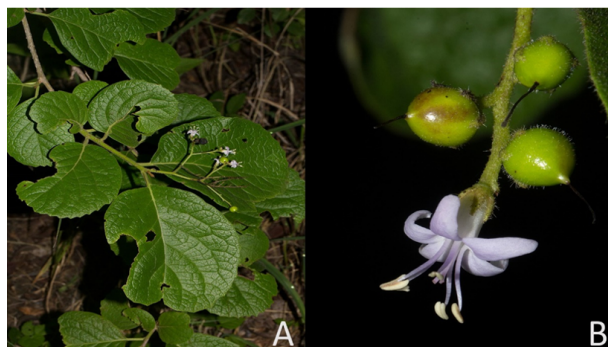


Figure 1: *Ehretia obtusifolia* A: branch showing leaves, flowers and fruits, and B: branch showing flower and fruits (photos: B Wursten)

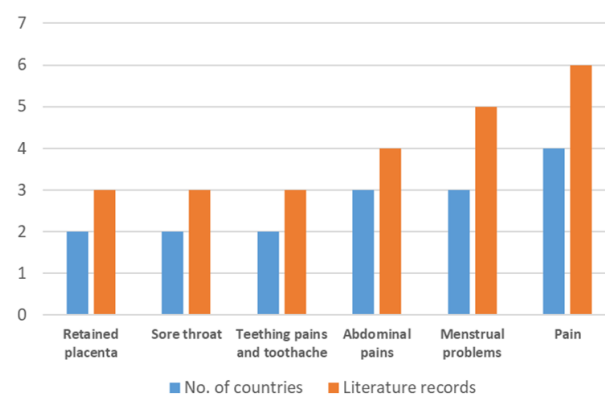


Figure 2: Main diseases and ailments treated and managed by *Ehretia obtusifolia* in tropical Africa and Asia

on three literature records (Figure 2), followed by abdominal pains (three countries, four literature records), menstrual problems (three countries, five literature records) and pain (four countries, six literature records). Other diseases recorded in a single country but based on at least two literature records include diarrhoea, fungal infections, gonorrhoea, skin diseases and wounds (Table 1).

Phytochemical and nutritional composition of *Ehretia obtusifolia*

Researchers identified phytochemical and nutritional elements from the fruits, leaves, stem bark and whole plant parts of and leaves of *E. obtusifolia* (Table 2). The phytochemical compounds identified from the species include alkaloids, flavonoids, glycosides, phenolics, phlobatannin, saponin, steroids, tannins and terpenoids (Iqbal *et al.*, 2005; Huma, 2014; Huma *et al.*, 2018b).

Biological activities of *Ehretia obtusifolia*

The following biological activities have been documented from the leaf, fruit and stem bark of *E. obtusifolia* as well as phenolic compounds isolated from the species: antibacterial, anti-diarrhoeal,

Table 1: Medicinal uses of *Ehretia obtusifolia*

Medicinal uses	Parts used	Country	References
Abdominal pains	Root decoction taken orally	South Africa, Tanzania and Zimbabwe	Watt and Breyer-Brandwijk (1962); Gelfand <i>et al.</i> (1985)
Diarrhoea	Root infusion taken orally	South Africa	Watt and Breyer-Brandwijk (1962); Hutchings <i>et al.</i> (1996)
Eye problems	Root decoction applied topically	Tanzania	Nahashon (2013)
Fungal infections	Stem bark decoction applied topically	Somalia	Hedberg <i>et al.</i> (1982); Hutchings <i>et al.</i> (1996)
Gonorrhoea	Root decoction taken orally	East Africa	Hutchings <i>et al.</i> (1996); Kokwaro (2009)
Infertility in women	Root infusion taken orally	Zimbabwe	Gelfand <i>et al.</i> (1985)
Malaria	Branch and stem decoction taken orally	Pakistan	Shah and Rahim (2017)
Menstrual problems	Bark, fruit and root infusion taken orally	East Africa, Pakistan and Zimbabwe	Schmelzer <i>et al.</i> (2008); Shah <i>et al.</i> (2013)
Pain	Root, stem and twig decoction taken orally	Botswana, South Africa, Tanzania and Zimbabwe	Hedberg <i>et al.</i> (1982); Wentzel and Van Ginkel (2012)
Retained placenta in humans and animals	Root decoction taken orally	Pakistan and Zimbabwe	Gelfand <i>et al.</i> (1985); Shah <i>et al.</i> (2013)
Skin diseases	Stem bark applied topically	Somalia	Hedberg <i>et al.</i> (1982); Hutchings <i>et al.</i> (1996)
Sore throat	Leaf infusion taken orally	Pakistan and Zimbabwe	Gelfand <i>et al.</i> (1985); Shah <i>et al.</i> (2013)
Spleen problems	Root infusion taken orally	East Africa	Kokwaro (2009)
Teething pains in infants and toothache	Leaf decoction taken orally	Pakistan and Zimbabwe	Gelfand <i>et al.</i> (1985); Shah <i>et al.</i> (2013)
Venereal diseases	Root decoction taken orally	Pakistan	Shah and Rahim (2017)
Wounds	Leaf decoction applied topically	Kenya	Hutchings <i>et al.</i> (1996); Kokwaro (2009)

anti-inflammatory, antinociceptive, antioxidant, cytotoxicity and phytotoxicity activities.

Antibacterial activities

Huma (2014) evaluated the antibacterial activities of the methanolic extracts of leaf, fruit, stem bark of *E. obtusifolia* against *Staphylococcus aureus*, *Clavibacter michiganensis*, *Proteus vulgaris* and *Xanthomonas perforans* using disc-agar diffusion with streptomycin (0.05 mg/kg) as the positive control. The extracts exhibited weak activities with a zone of inhibition ranging from 2.0 mm to 7.0 mm in com-

parison to the zone of inhibition of 26.2 mm to 32.1 mm exhibited by the positive control (Huma, 2014).

Anti-diarrhoeal activities

Huma (2014) evaluated the anti-diarrhoeal activities of the methanolic extracts of leaf, fruit, stem bark of *E. obtusifolia* using the gastrointestinal motility model with atropine as a positive control. The extracts showed activities with anti-diarrhoeal effects ranging from 56.9% to 79.2% in comparison to 86.0% exhibited by the positive control (Huma, 2014).

Table 2: Phytochemical and nutritional composition of *Ehretia obtusifolia*

Chemical and nutritional components	Value	Plant part	Reference
Nutritional component			
Amino acids		Leaves, fruits and stem bark	Huma (2014) ; Huma et al. (2018b)
Ash (%)	3.0 – 8.0	Fruits, leaves and stem bark	Huma (2014)
Cadmium (ppm)	0.002 – 0.01	Fruits, leaves and stem bark	Huma (2014)
Carbohydrates (%)	40.2 – 41.1	Fruits, leaves and stem bark	Huma (2014)
Chromium (ppm)	0.08 – 0.1	Fruits, leaves and stem bark	Huma (2014)
Cobalt (ppm)	0.001	Fruits, leaves and stem bark	Huma (2014)
Copper (ppm)	0.1 – 0.2	Fruits, leaves and stem bark	Huma (2014)
Crude fibre (%)	9.7 – 20.9	Fruits, leaves and stem bark	Huma (2014)
Fats (%)	6.8 – 8.8	Fruits, leaves and stem bark	Huma (2014) ; Huma et al. (2018b)
Iron (ppm)	1.6 – 6.5	Fruits, leaves and stem bark	Huma (2014)
Lead (ppm)	0.001 – 0.2	Fruits, leaves and stem bark	Huma (2014)
Magnesium (ppm)	43.7 – 280.0	Fruits, leaves and stem bark	Huma (2014)
Manganese (ppm)	0.1 – 0.4	Fruits, leaves and stem bark	Huma (2014)
Moisture (%)	17.7 – 26.3	Fruits, leaves and stem bark	Huma (2014)
Nickel (ppm)	0.1 – 0.2	Fruits, leaves and stem bark	Huma (2014)
Protein (%)	7.0 – 11.4	Fruits, leaves and stem bark	Huma (2014) ; Huma et al. (2018b)

Continued on next page

Table 2 continued

Reducing sugar		Leaves, fruits and stem bark	Huma (2014) ; Huma et al. (2018b)
Sodium (ppm)	5.0 – 5.3	Fruits, leaves and stem bark	Huma (2014)
Starch		Leaves, fruits and stem bark	Huma (2014) ; Huma et al. (2018b)
Zinc (ppm)	0.2 – 0.4	Fruits, leaves and stem bark	Huma (2014)
Chemical component			
Alkaloids		Leaves, fruits and stem bark	Huma (2014) ; Huma et al. (2018b)
Caffeic anhydride		Whole plant	Iqbal et al. (2005)
Flavonoids (mg/g)	24.4 – 34.1	Leaves, fruits and stem bark	Huma et al. (2018b)
Glycosides		Leaves, fruits and stem bark	Huma (2014) ; Huma et al. (2018b)
Methyl 2-O-feruloyl-1a-O-vanillactate		Whole plant	Iqbal et al. (2005)
Methyl rosmarinate		Whole plant	Iqbal et al. (2005)
Phenolic content (mg/g)	34.1 – 38.0	Leaves, fruits and stem bark	Huma et al. (2018b)
Phlobatannin		Leaves, fruits and stem bark	Huma (2014) ; Huma et al. (2018b)
Rosmarinic acid		Whole plant	Iqbal et al. (2005)
Saponin		Leaves, fruits and stem bark	Huma (2014) ; Huma et al. (2018b)
Steroids		Leaves, fruits and stem bark	Huma (2014) ; Huma et al. (2018b)
Tannins		Leaves, fruits and stem bark	Huma (2014) ; Huma et al. (2018b)
Terpenoids		Leaves, fruits and stem bark	Huma (2014) ; Huma et al. (2018b)
Trans 4-hydroxycyclohexyl-2-O-p-coumaroyl β -D-glucopyranoside		Whole plant	Iqbal et al. (2005)

Anti-inflammatory activities

Iqbal *et al.* (2005) evaluated the anti-inflammatory activities of the phenolic compounds methyl 2-O-feruloyl-1 α -O-vanillactate, caffeic anhydride, trans 4-hydroxycyclohexyl-2-O-p-coumaroyl β -D-glucopyranoside, methyl rosmarinate, rosmarinic acid isolated from whole plant parts of *E. obtusifolia* using the in vitro lipoxygenase inhibition assay with baicalein as the positive control. All the compounds exhibited activities with half maximal inhibitory concentration (IC₅₀) values ranging from 0.3 μ M to 55.7 μ M in comparison to IC₅₀ value of 22.7 μ M exhibited by the positive control (Iqbal *et al.*, 2005). Huma (2014) evaluated the anti-inflammatory activities of the methanolic extracts of leaf, fruit, stem bark of *E. obtusifolia* at three different dose levels of 100.0 mg/kg, 200.0 mg/kg and 300.0 mg/kg using the carrageenan-induced mice paw edema method with diclofenac sodium as the positive control. The extracts exhibited dose and time dependent activities, which were comparable to activities exhibited by the positive control (Huma, 2014).

Antinociceptive activities

Huma (2014); Huma *et al.* (2018a) evaluated the antinociceptive activities of methanolic extracts of leaves, fruits and stem bark of *E. obtusifolia* in Albino mice using the hot plate assay with diclofenac sodium as a positive control. The responses of latency of the tested mice were noted in a hot plate for the total duration of three hours with 30 minute intervals after each treatment. The extracts exhibited dose dependent activities by showing analgesic effects in mice by reducing duration and intensity of pain in all assessment times (Huma, 2014; Huma *et al.*, 2018a).

Antioxidant activities

Huma (2014); Huma *et al.* (2018b) evaluated the antioxidant activities of methanolic extracts of leaves, fruits and stem bark of *E. obtusifolia* using the 1,1-diphenyl-2-picryl hydrazyl (DPPH) free radical scavenging assay with ascorbic acid as a positive control. The extracts exhibited activities with the best inhibition activity of 98.6% and IC₅₀ value of 0.03 μ g/ml (Huma, 2014; Huma *et al.*, 2018b).

Cytotoxicity activities

Huma (2014) evaluated the cytotoxicity activities of the methanolic extracts of leaf, fruit, stem bark of *E. obtusifolia* using the brine shrimp (*Artemia salina*) cytotoxicity assay with tamoxifen as the positive control. The extracts exhibited activities with median lethal dose (LD₅₀) values ranging from 16.1 μ g/mL to 180.0 μ g/mL, which was much higher

than LD₅₀ value of 6.6 μ g/mL exhibited by the positive control (Huma, 2014).

Phytotoxicity activities

Huma (2014) evaluated the phytotoxicity activities of the methanolic extracts of leaf, fruit, stem bark of *E. obtusifolia* using the *Lemna minor* phytotoxic bioassay with atrazine as the positive control. The fruit extract exhibited moderate activities with frond inhibition of 40.0% and FI₅₀ value of 4048.3 μ g/mL, which were higher than 87.8% frond inhibition and FI₅₀ value of 8.9 μ g/mL exhibited by the positive control Huma (2014).

CONCLUSIONS

The present review summarizes the ecological, medicinal and biological properties of *E. obtusifolia* in tropical Africa and Asia. Detailed studies focusing on pharmacological and phytochemical evaluations, including toxicological, *in vivo* and clinical studies to corroborate the traditional medical applications of the species are recommended.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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