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HOMALIUM ZEYLANICUM BENTH: AN ETHNOPHARMACOLOGICAL REVIEW

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ABSTRACT

Plant *Homalium zeylanicum* Benth. *(H. zeylanicum)* belongs to Flacourtiaceae, of habitat evergreen and semi-evergreen forests, native to South India and Srilanka. The various parts of plant including, bark and leaf having many traditional uses, mainly in diabetes, rheumatism and wound healing. A variety of phytoconstituents are identified and isolated from the *H. zeylanicum* which includes mainly, homalicine, dihydrohomalicine, vacciniin, homaloside A, homaloside D, (–) 5'-methoxyisolariciresinol-3α-O-β-D-glucopyranoside, (+) lyoniresinol-3α-O-β-D -glucopyranoside, (+) isolarisiresinol-3α-O-β-D -glucopyranoside, (–) isolarisiresinol-3α-O-β-D -glucopyranoside, icariside E5, 3-phenylisocoumarin, friedelin, 4-hydroxybenzoic acid, catechol, methyl-α-arabinofuranoside, and uridine. Anthelimintic, anti-diabetic, anti-dyslipidemic and hepatoprotective activities are reported by various extracts of *H. zeylanicum.* An overview and details of the ethnobotanical, phytochemical and pharmacological investigations of *H. zeylanicum* is presented in this review.

KEY WORDS: *Homalium, zeylanicum,* ethnomedicinal, bioactive, homalicine.

INTRODUCTION

Plants are indispensible sources of medicine since time immemorial. The numbers of studies on natural product are aimed to determine medicinal values of plants by investigation of existing scientific knowledge, traditional uses and discovery of potential therapeutic agents (1). Phytochemicals are used as templates for lead optimization programs, which are intended to make safe and effective drugs. In the developed countries, 25% of the medicinal drugs are based on plants and their derivatives (2). Medicinal plants are the major components of all

indigenous or alternative systems of medicine. Medicinal plants are sources and can be a good start for the discovery of new chemical compound (3,4). The genus *Homalium*, based on the single species *H. racemosum*, from Martinique, was established by pharmacognist Mr. Jacquin in the year 1760; and in year 1763, more extended description with a figure of the flower was given in his book entitled 'Selectarum Stirpium Americanarum Historia'. Further in the year of 1775, Aublet described the new genus *Racoubea* from French Guiana, based on a single species, *Racoubea guianensis* and with it the genus *Napimoga*, which has since been considered a more or less doubtful synonym of *Homalium.* Later, Jussieu, in his genera, referred *Racoubea* to *Homalium* as a synonym. Robert Brown in 1818 made the genus *Homalium* the type of a new order, Homalinae, a classification retained by various authors down to 1857 (5). *Homalium* Jacq. is a pantropical woody genus with centers of diversity in Madagascar and Malaysia. The genus has usually been classified within Flacourtiaceae, though older literature occasionally placed it within Samydaceae, a segregate family Homaliaceae or even a greatly expanded and heterogeneous Bixaceae (6).

Genus Homalium And Its Species

There are more than 163 scientific plant names of species rank for the genus *Homalium* and among these 33 are accepted species names (7). The details of other species of *Homalium* are listed in Table 1 with their distribution and description.

Table 1: List of various other species of *Homalium* (5)

Name of Species	Description and distribution
H. densiflorum Spruce.	The older branches are gray, glabrous; younger branches fuscous gray, lenticellate. Leaf blades 7-10 cm long, 3.5-4 cm wide, oval or ovate-oval to elliptic-obovate, short-pointed, acute at tip, rounded at base. Long and many flowered, the upper flowers solitary and crowded. Widely distributed in Brazil.
H. guianense Warb. (*H. spicotum* Lam and *H. racoubea* Swartz)	The older branches glabrous or lightly puberulous, the bark grayish brown; young branchlets incurved-puberulous and sparsely pilose; leaf blades 6.5-13.3 cm long, 3.5-6.8 cm. wide, obovate-oval to elliptic or oval, short-pointed but the apex blunt, cuneate to rounded at base. Inflorescences spike like and simple, or sometimes conic-paniculate, loosely flowered, 8-17 cm long; widely distributed in the provinces Amazonas, Para, Goyaz and Brazil.
H. nicaraguense Blake.	Tree of medium size; branchlets fuscous gray, lenticellate, finely incurved-puberulous and sparsely pilose; leaf blades 14.5-17.5 cm long, 5.0-6.5 cm wide, elliptic-oblong or obovate-oblong, short-acuminate, at the base rounded or cuneate-rounded. Inflorescences axillary, 1 or 2 branches at base, 1-4 cm long. Widely distributed in the

	United Nations.
H. puberulum Klotzsch.	The older branches grayish, at length glabrate; branchlets densely griseous-puberulous and short-pilose; leaf blades 5.0-10 cm long, 3-5 cm wide, elliptic, oblong-elliptic, short-pointed with blunt tip, cuneate to rounded at the base. Racemes simple, spike like, loosely flowered, the rachis 4-5.5 cm long, lower pediceles 0.8 mm long, the upper obsolete. Corolla 11 mm wide in fruit, fruiting calyx tube depressed-turbinate. Widely distributed in the Banks of the River Sururu, British Guiana.
H. mollicellum Blake.	The older branchlets glabrate, lenticellate, grayish barked; newer branchlets are brownish gray, puberulous with short spreading hairs, some longer spreading hairs intermixed. Leaf blades 5.5-9.5 cm long, 3.0-4.0 cm wide, elliptic or oblong-elliptic, short-pointed with blunt tip, rounded at base. Racemes nearly simple, puberulous, rather loosely flowered. Widely distributed in Coquillo, Guerrero and mexico.
H. pleiandrum Blake.	The older branches grayish, the younger fuscous, glabrous. Leaf blades 4.5-9.0 cm long, 3.0-4.0 cm wide, oval, normally short-pointed and acute at tip, rarely rounded or obtuse, rounded at base. Racemes axillary and subterminal, simple, loosely or somewhat densely flowered. Widely distributed in Pastures near Rio Piedras, Porto Rico.
H. leiogynum Blake	The branches of plant having gray- brown bark. Leaf blades 6-9.5 cm long, 3-4 cm wide, elliptic to oval, gradually pointed, acute at tip, rarely obtuse, at base rounded or rounded cuneate. Racemes simple, the rachis sparsely puberulous, 1.2-4.5 cm long, rather loosely flowered. Widely distributed in dry woods at Fajardo, Porto Rico.
H. hemisystylum Blake.	The older branches grayish, glabrous, the younger fuscous or fuscous gray, glabrous or very finely puberulent. Leaf blades 4.5-8.8 cm long, 2.3-6.0 cm wide, oval or elliptic, short-pointed, rounded at base. Racemes simple loosely flowered. Widely distributed in Fajardo.
H. racemosum Jacq.	The older branches gray-barked, the younger fuscous, glabrous, marked with whitish lenticels. Leaf blades 8-12 cm long, 4-6 cm wide, elliptic, acuminate to a blunt tip, cuneate to round at base. Loosely flowered. Widely distributed in Pastures, mouth of the River Capot, Martinique.
H.integrifolium Britton.	Tree is about 15 m high, older branchlets dull gray, the younger fuscous, dotted with whitish lenticels, glabrous. Leaf blades 7-14.5 cm long, 2.5-4.8 cm wide, elliptic, oblong-elliptic, acuminate or acute, with obtuse tip, rounded and in-equilateral at base. Racemes axillary, solitary, simple and loosely flowered. Widely distributed in Woodlands, eastern slopes of southern end of John Crow Mountains, Jamaica.
H. pittieri Blake.	Tree is about 15-20 m high; older branches grayish, lenticellate, younger fuscous, glabrous. Leaf blades 5.5-11 cm long, 3-6 cm wide, oval to ovate-oval, short-pointed, acutish tip, rounded or cuneate-rounded at base. Inflorescences conic-cyclindric, paniculate at base. Flowers whitish. Widely distributed in Venezuela.
H. trichocladum	The older branchlets grayish, glabrous, the younger fuscous, densely incurved-puberulous with griseous hairs. Leaf blades 4-9 cm long, 3-5 cm wide, elliptic, oblong-elliptic, short-pointed, with obtuse tip, rarely

	rounded, at base rounded. Racemes simple, loosely few-flowered. Widely distribute in the Province of Barahona, Santo Domingo.
H. pedicellatum Spruce.	The older branchlets fuscous brown, glabrate, the younger fuscous, griseous-puberuluous and spaesely hispid-pilose with spreading hairs. Leaf blades 7-12 cm long, 2.5-5 cm wide, oblong-elliptic, short-pointed, with an obtuse tip, rounded or sometimes cuneate at base. Racemes axillary, loosely flowered, simple. Widely distributed in Southern shore of the Rio Negro, Brazil.
H. eleutherostylum Blake.	The branchlets fuscous, subterete, in youth finely puberulous with incurved, dull, wide spreading hairs 0.5-1 mm long, in age glabrescent. Leaf blades 8-14 cm long, 3-5 cm wide, oblong-ovate, short-acuminate, with obtuse tip, rounded at base. Inflorescences simply racemose, cylndric, sparsely flowered. Widely distributed in Barra, Province of Rio Negro, Brazil.
H. hondurense Donn	The tree about 10 m high. Branchlets slender, gray, lenticellate. Leaf blades 12-16 cm long, 5.5-9 cm wide, oval or broadly obovate-oval, short-pointed, with acutish tip, at base cuneate or rarely rounded-cuneate, thin, papery-membranaceous. Inflorescences conic-cylindric, paniculate to about the middle, then simply racemose. Widely distributed in San Pedro Sula, Honduras.
H. columbianum Blabe.	Tree grows about 13 m high, and trunk 30 cm in diameter. Older branchlets fuscous gray, the younger fuscous brown, marked with whitish lenticels, glabrous, slender. Leaf blades 9-12 cm long, 4-6 cm wide, elliptic or oval, short-pointed, with obtuse tip, rounded or cuneate at base, comparatively thin, papery-membranaceous. Inflorescences slenderly conic-cylindric, paniculate. Widely distributed in Colombia.
H. stenosepalum Blake.	Large tree grows about 25-30 m high. Older branches grayish, dotted with raised lenticels, glabrous, the younger grayish fuscous or fuscous, dotted with whitish lenticels, glabrous or sometimes puberulous and short-villous. Leaf blades 8-14 cm long, 3-6 cm wide, elliptic or oval, short-pointed or acuminate, cuneate or rounded at base. Inflorescence simply racemose. Widely distributed in Panama.
H. eurypetalum Blake.	A tree about 10 m high. Older branchlets glabrous, grayish, the younger griseous-puberulous with incurved hairs, dull grayish brown. Leaf blades normally 13-14 cm long, 4.5-5 cm wide, elliptic or obovate-elliptic, short-pointed, with obtuse tip, cuneate at base. Inflorescences axillary and subterminal, branched below, simply racemose above, densely griseous-puberulous. Widely distributed in the United Nations.
H. trichostemon Blake.	Tree grows about 12 m high. Older branchlets gray-barked, the younger fuscous, dotted with whitish lenticels, glabrous. Leaf blades 6-11.5 cm long, 3-4.5 cm wide, elliptic to oval or obovate-oval, obtuse, short-pointed, or acuminate with blunt tip, cuneate or rounded at base. Racemes axillary and subterminal, simple, solitary or in pairs, the rachis loosely or somewhat densely flowered. Widely distributed in Mexico.
**H. letestui, H. africanum, H. albiflorum, H. axillare, H. brachystylum, H. breviracemosum, H. cochinchinensis, H. dentatum, H. erianthum, H. fagifolium, H. involucratum, H. kainantense, H. kwangsiense, H. laxiflorum, H. micranthum, H. mollissimum, H. nudiflorum, H. oppositifolium, H.*	

paniculatum, H. paniculiflorum, H. perrieri, H. phanerophlebium, H. planiflorum, H. rufescens, H. sabiifolium, H. sanguineum, H. stenophyllum, H. thuarsianum, H. trigynum, H. viguieri.

*The other species of *Homalium* are listed since these species have been identified but there is lack of information regarding their description and distribution.

Fig. 1: Different parts of *H. zeylanicum* Benth.

DISTRIBUTION AND DESCRIPTION

H. zeylanicum Benth. (HZB) is the plant of genus *Homalium* of habitat evergreen and semi-evergreen forests, native to South India and Srilanka (11). It is cultivated for ornament; and its wood is used commercially (9). Plant bears simple, alternate leaves, generally greenish white flowers while fruits are capsules (11). Flowering and fruiting period is February to May (12). The detailed taxonomy and morphological features of HBZ are given in Table 2 and 3 respectively.

Table 2: Common names for *H. zeylanicum* Benth. (8,9,10)

Language names	Common names
English	*Liyan, Blackwellia zeylanica Gard, H. ceylanicum Gardner*
Kannada	*Hulikaddi mara, kala, kalamattiga*
Malayalam	*Kalavaram, kalladamba, kaluvaluka, manthalamukki*
Marathi	*Homali*
Telugu	*Manthralamukhi*

Table 3 : Taxonomy of *H. zeylanicum* Benth (11)

Kingdom	*Plantae*
Phylum	*Magnoliophyta*
Class	*Magnoliatae*
Order	*Violales*
Family	*Flacourtiaceae*
Genus	*Homalium*
Species	*Zeylanicum*

Table 4: The morphological features of *H. zeylanicum* Benth (11)

Part	Macroscopic features
Tree	Trees up to 25 m tall. Bark smooth, grey; blaze white with orange speckles. Branchlets slender, terete, glabrous. Tree Diameter: 30cm.
Leaves	Leaves simple, alternate, distichous; stipules caducous; petiole 0.5-1.3 cm long, glabrous; planoconvex in cross section; lamina 7.5-13 x 3.6- 7.6 cm, elliptic, apex abruptly acuminate, base acute or rounded to subattenuate, margin crenate, chartaceous, glabrous; midrib flat above; secondary nerves 6-8 pairs, gradually curved; tertiary nerves reticulo-percurrent.
Flowers	Flowers long, slender spikes with interrupted clusters of small flowers; flowers generally greenish white, sometimes few clusters crimson red in the same spike.
Fruits	Capsule
Seeds	Seeds small, many, oblong or angular.

Traditional Uses

The bark and leaf of the plant having many traditional uses in diabetes, rheumatism and wound healing activities (13).

Ornamental Uses

HZB is cultivated for ornament, and its wood is used commercially (9). Its wood tough, fine-grained, origins as a good source of commercial use for building and furniture (14).

Phytochemical Constituents

A variety of phytoconstituents are isolated from the HZB which includes, vacciniin (15), homaloside A (15), homaloside D (15), (–)-5'-methoxyisolariciresinol 3α-O-β-D-glucopyranoside (16), (+)-lyoniresinol 3α-O-β-D –glucopyranoside (16), (+)-isolarisiresinol 3α-O-β-D –glucopyranoside (17), (–)-isolarisiresinol 3α-O-β-D –glucopyranoside (16), icariside E5 (18), 3-phenylisocoumarin (19,20), friedelin (21), 4-hydroxybenzoic acid (22), catechol (23), methyl-α-arabinofuranoside (24), and uridine (25,26). Homalicine and dihydrohomalicine can isolate from acetone extract of root (27,28,29).

Table 5: Details of phytochemical constituents of *H. zeylanicum* Benth (15-30)

Phytochemical constituent	Part of the plant
Alkaloids	Stem
Glycosides	Stem
Tannins	Stem
Flavoniods	Stem
Carbohydrates	Stem
Homalicine	Root, Stem

Dihydrohomalicine	Root, Stem
Vacciniin	Stem
Homaloside A	Stem
Homaloside D	Stem
(–)-5'-methoxyisolariciresinol 3α-O-β-D-glucopyranoside	Stem
(+)-lyoniresinol-3α-O-β-D–glucopyranoside	Stem
(+)-isolarisiresinol 3α-O-β-D –glucopyranoside	Stem
(–)-isolarisiresinol 3α-O-β-D –glucopyranoside	Stem
Icariside E5	Stem
3-phenylisocoumarin	Stem
Friedelin	Stem
4-hydroxybenzoic acid	Stem
Catechol	Stem
Methyl-α-arabinofuranoside	Stem
Uridine	Stem

Pharmacological Activity

In recent years, the use of herbal products has been increasing in developing countries. Plants have always been an attractive source of drugs. On the other hand, intricate ways of molecular interactions and bioactivity mechanisms of the extracts or their bioactive constituents provide a challenge to the scientists. A brief overview of HZB pharmacological activities has been presented here.

Anthelimintic activity

Gnananath K *et al*., isolated various phytochemical constituents and investigated antihelmintic activity in the ethylacetate and methanol extracts of bark of HZB. The ethylacetate and methanol extracts showed significant activity in the dose dependent manner against albendazole as a reference standard. Especially methanol extract showed significant activity than that of standard drug albendazole. The investigators also suggested that, the antihelmintic property of this plant was due to the presence of secondary metabolite tannins (30).

Antidiabetic activity

The antidiabetic activity of stem bark ethanol extract of HZB against alloxan induced diabetes was evaluated against standard metformin. The doses of ethanol extract of HZB stem bark were administered 250 and 500mg/kg, p.o. for 28 days. It was concluded that ethanol extract of the stem bark of HZB possesses significant antidiabetic activity (31).

Antidyslipidemic activity

The antidyslipidemic activity of stem bark ethanol extract of HZB against alloxan induced diabetes was evaluated against standard metformin. The doses of ethanol extract of HZB stem bark were administered 250 and 500mg/kg, p.o. for 28 days. It was concluded that ethanol extract of the stem bark of HZB possesses significant antidyslipidemic activity (31).

Hepatoprotective activity

The hepatoprotective activity of methanol extract of stem bark of HZB was evaluated against carbon tetrachloride (CCl_4) induced hepatotoxicity and the doses administered are 250 and 500mg/kg, p.o. for 14 days. Silymarin was used as standard hepatoprotective. It was concluded that methanol extract of the stem bark of HZB possesses significant hepatoprotective activity (31,32).

CONCLUSION

The people in developing countries depend on the traditional medicine because it is cheaper and more accessible than orthodox medicine. In India, extensive studies about the medicinal plants are being carried out and large numbers of wild species are available. Since the demand for the herbal medicine is increasing more due to their lack in side effects. It is important to protect and preserve endangered species (33). HZB is widely available tree. The manifestations can be made on the basis of this comprehensive perusal of literature, that the plant HZB is being used traditionally, due to their immense therapeutic potential to treat/cure various diseases. It is a rich source of bioactive compounds like, homalicine, dihydrohomalicine, vacciniin, homaloside A and others are present in plant and exhibit wide range of health benefits. A very few pharmacological activities has been investigated including anthelimintic, anti-diabetic, anti-dyslipidemic and hepatoprotective activities which are reported in the extracts of different parts and its phytoconstituents of this plant. These pharmacological activities and identified compounds provide solid scientific evidence for some of the traditional therapeutic claims. A variety of phytoconstituents has been isolated

from the different parts of it. Thus, there remains a tremendous scope for further scientific exploration of HZB to establish their therapeutic efficacy and commercial exploitation.

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