

## *Abroma augusta* (L.) L. f.: An ethno pharmacological review of its traditional uses and modern applications

Rakesh Goswami <sup>1</sup>, Priyajit Chatterjee <sup>2</sup> and Tanmoy Sinha <sup>3,\*</sup>

<sup>1</sup> Department of Biochemistry, Oriental Institute of Science and Technology, Vidyasagar University, Midnapur, Pin.721102, West Bengal, India.

<sup>2</sup> University Science and Instrumentation Centre, The University of Burdwan, Burdwan-713104, West Bengal, India.

<sup>3</sup> Panjipukur Smt. T.D.S Vidyapith, Hooghly, Pin. -712305, West Bengal, India.

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### Abstract

*Abroma augusta* (L.) L. f. has been used as traditional medicine by tribal women in India, Bangladesh forms ancient times. Ayurvedic medicine, derived from herbal plants is used to reduce the gamble effects of the synthetic drugs. In homeopathy, it has been using successfully for a long period. Major Phytochemicals such as, Taraxerol, Friedelin,  $\beta$ -Sitosterol,  $\alpha$ -Amyrin, Lupeol, Octacosanol, have potentialities to control diabetes, anti-inflammation, gynecological disorders etc. Root extract has given fruitful effect in menstrual disorder. It has anti-fertility activity, and it is a prominent uterine tonic. In gonorrhoea treatment, leaf and stem extract in cold water is very effective. Acetone extract of leaf showed high anti-microbial effect against Gram-positive bacteria. Simultaneously, acetone leaf extracts shown anti-fungal activity against *Candida albicans*, *Rhizopus oryzae*, *Aspergillus fumigatus*. According to various reports regarding its phytochemical profiling and medicinal properties, it can be said that *Abroma augusta* should be used broadly for future drug development programmed.

**Keywords:** *Abroma augusta*; Morphology; Phytomedicine; Homeopathy; Phytochemistry

### 1. Introduction

The threat of incurable bacterial infections is increased by the current situation of rising levels of bacteria with multidrug resistance and the recent emergence of strains with reduced susceptibility to even wide range drugs (1). The present scenario throughout the world on phytochemical research, is that the scientists are trying to obtain the novel compounds from plant extracts. Malvaceae member *Abroma augusta* Linn, also referred to as Ulatkambal in bengali and hindi, is widely distributed in Asia, South and Eastern Africa, and Australia. *Abroma* leaves are a highly powerful natural remedy for headaches, rheumatoid joint pain, diabetes, and uterine diseases (2). In gonorrhoea, *Abroma* leaves and stem also proved that it has good nervine properties (3). Extracts from the root and bark have been shown to be effective against uterine and nervous amenorrhoea, sterility, and other menstrual disorders. On the other hand, research revealed that powdered root acts as an anti-fertility and abortifacient (4). Several reports have mentioned that various chemical compounds like alkaloids, steroids, triterpenes, flavonoids, megastigmanes, and phenylethanoid glycosides are all found in the plant (5). The majority of the research review showed that octacosanol, taraxerol, sitosterol acetate, lupeol, an aliphatic alcohol (C<sub>32</sub>H<sub>66</sub>O) and a combination of long chain fatty diols are present in the leaves of *Abroma augusta*. Abromine was revealed recently to be *A. augusta*'s most active ingredient and it is primarily responsible for the plant's antihyperglycemic effect (6). Also, other researchers proved that *A. augusta* phytochemicals are very effective against pest like *Ribolum sp* (7). In modern pharmacological study or drug delivery system nanoparticles play a crucial role. As

\* Corresponding author: Tanmoy Sinha

a result, *A. augusta* bark is also capable of creating gold nanoparticles that are valuable for its usage in nanobiotechnology and pharmaceuticals (8).

A tiny tree or shrub, *Abroma augusta* Linn. has 3 to 5 meter long horizontal and vertical branches. The majority of the branches have downy leaves that are arranged in various ways. The primary characteristics of an *Abroma* root include a brown bark that is 0.5–1.0 mm thick, extremely fibrous, and varies in thickness depending on the root's age and girth. The bark's exterior surface is white yellow and slightly longitudinally striate; the inner surface is dull brown and longitudinally wrinkled with little warty marks. The root bark is stiff but not brittle, test-less, slimy, and smelly. *Abroma* bark produces sticky mucilage that can be properly removed after soaking in cold water for three to four days (3,9).

The leaves seem to be polymorphous, measuring 10–30 cm long and 6–18 cm wide. They are repand-denticulate, with a base that is 3–7 lobed and cordately nerved, and an upper portion that is non-lobed and ovate-lanceolate. The petiole is 12–25 mm long, and the stipules are linear, deciduous, and as long as the petiole. axillar, approximately 4 cm long peduncle. (3,10).

Few flowered cymes produce flowers that are 5 cm in diameter and dark crimson, purple, or yellow in color. Lanceolate and practically free to the base, the sepals measure 2.5 cm. Petals that barely surpass the sepals, are imbricate in bud, and are deciduous (3).



Figure 1A

Figure 1 B

**Figure 1** A - Flowering plant of *Abroma* sp. and Figure-1. B Fruit and seed of *Abroma* sp



**Figure 2** Collection area of *Abroma* Sp. in Hooghly District West Bengal, India

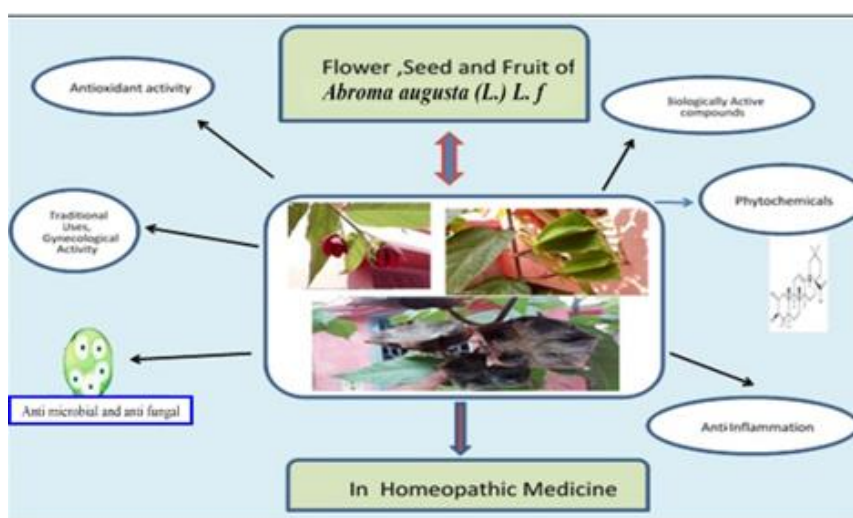
In ayurvedic therapy, *Abroma augusta* has a traditional history for medicinal purpose. It has been successfully utilized in homoeopathic treatment for gynecological diseases. It controls menstrual flow and also functions as an anti-fertility and abortifacient. It is used to cure scabies in Indonesia and it is also used to treat dysmenorrhea in India. Most of the experiments said that *Abroma augusta* leaf, root and bark contain many Phytochemicals. Abromine, Abromaseterol,

betaine,  $\beta$ -sitosterol also present in the root extract of *Abroma*. Some acid groups, such as glucuronic acid, maslinic acid, and caffeic acid, have also been isolated from root bark. Additionally, the root bark contains certain polysaccharides, such as rhamnose, arabinose, xylose, mannose, galactose, and glucose, among others. On the other hand taraxerol and its acetate, b-sitosterolacetate, lupeol, aliphatic alcohol, octacosanol, and probably a mixture of long chain fatty diols present in the alcoholic leaf extracts of *Abroma augusta*. It has been reported that *Abroma augusta* seed oil revealed that it contains palmitic acid and linoleic acid which have capabilities to decrease blood cholesterol level (22,23,24). In this review we are trying to focus on the phytochemical roles on various human welfare.

**Table 1** Bioactivity role of *Abroma augusta* on medicinal aspect

Role on Medicinal Aspects	Activity	Reference
Anti-Inflammation	Shows strong anti-inflammation by carrageenan induced paw edema method.	Das, S et al., 2014
Anti-Microbial and anti-Fungal	Acetone extract of leaf, root and bark shows potent antimicrobial activity	Md. Zia Uddin et al., 2012
Diabetes	Methanol extract of leaf and water extract of leaf also showed significant result in fasting glucose level	Khanra, R et al., 2015. Eshrat, H, et al., 2001.
Gynaecological	Ethanol extracts of leaf and root as good phytomedicine for gynecological disorder	Rahman, A. H. M. M., 2014.
Antioxidant activity	combined activity of <i>A. augusta</i> and <i>C. longa</i>	Nahar N et al., 1994. Eshrat M.H et al., 2001,
Wound healing activity	Leaf extract	Hossan S Md et al., 2010
Hypolipidemic activity	combined activity of <i>A. augusta</i> and <i>C. longa</i>	Eshrat, M.H et al., 2001.
Phytotoxic activity	<i>A. augusta</i> seed oil extract	Khan, T et al., 2003.
Thrombolytic activity	<i>A. augusta</i> leaf and bark extract	Bhuiya et al., 2013.
Homeopathic	<i>A. augusta</i> leaf, stem, root and bark	Boericke W et al., 2002.

### 1.1. Anti-inflammatory activity



**Figure 3** Schematic diagram of role of *Abroma augusta* in human health

It has been reported that the anti-inflammatory properties of methanolic extracts from various *Abroma augusta* extract using a carrageenan-induced paw edema method. Experimental results revealed strong anti-inflammatory efficacy comparable to that of diclofenac, which was probably caused by the presence of alkaloids and flavonoids. (11). Another

research regarding wound healing in wistar rats, revealed a positive role by using alcoholic extract of *Abroma augusta* that is comparable with dexamethasone (21).

### 1.2. Anti- microbial and anti -fungal activity

Acetone extract of leaves of *A.augusta* showed potent antimicrobial activity against both Gram negative and Gram positive bacteria like *Bacillus subtilis*, *Bacillus megarratium*, *Staphylococcus aureus* and *Shigella sonnei*. Our plant of interest has also shown anti-fungal activity against *Candida albicans*, *Rhizopus oryzae* etc. (12). Another study found that *Abroma augusta* root extracts had the strongest antibacterial effects against clinical isolates of *Escherichia coli*, *Staphylococcus epidermis*, *Micrococcus luteus*, *Pseudomonas aeruginosa*, *B. cereus*, *B. pumilis*, and *B. subtilis* (13). According to a comparative study, *Abroma* bark extract (400 g/disc) demonstrated moderate antibacterial activity (zone of inhibition: 8–15 mm) when compared to standard kanamycin (30 g/disc). However, the extract also demonstrated positive antifungal activity (zone of inhibition: 10–18 mm), with griseofulvin (1.0 g/disk) serving as the standard antifungal agent (14). *Abroma augusta* ethyl acetate extract showed high antifungal activity against *Candida albicans* (11 mm) (25).

### 1.3. Gynecological Activity

A developing field called ethno-gynecology treats disorders that affect indigenous women, such as abortion, menstruation problems, menopause syndrome, morning sickness, leucorrhoea, infertility, parturition etc. (15). In ayurveda, it has been reported that *A. augusta* should be used as an efficient phytomedicine in gynecological disorder. At a dose of 50 mg/kg body weight, the petroleum-ether extract of the *Abroma* ideal abortifacient and anti-fertility agent's leaves and stems demonstrated anti-implantation as well as abortifacient effect in mice. Alcoholic extracts significantly increased the abortifacient activity in this experiment. The roots' aqueous extract demonstrated oxytocic activity. On lactating albino rats, it has also been claimed to have galactotrophic effects (5). Another ethno-botanical research shown that *Abroma* extract is used as an important medicine in gynecological disorder among Santals community (16). In rural areas *Abroma* is commonly used in termination of pregnancy and inducing uterine contractions during postpartum period. *In vitro* study of *Abroma* showed most potent uterine stimulant (17).

### 1.4. Anti-diabetic activity

Type-I Diabetic patients are treated with ulatkambal mother tincture, a conventional homoeopathic treatment. It is reportedly effective at controlling high blood sugar. (18). Another study revealed that methanolic leaf extract protects experimental rats against type-II diabetes mellitus (T2DM), as well as the condition's nephropathy and cardiomyopathy (19). Water extract of *Abroma* showed significant hypoglycemic and hypocholesterolemic effects in alloxan diabetic rats. In this experiment, 4 ml water extract of *Abroma* leaf showed significant fall in fasting blood glucose and improvement in glucose tolerance (20). An additional study revealed that the combined aqueous extracts of *Abroma augusta* and *Curcuma longa* are used to treat STZ (60 mg/kg)-induced diabetic rats at a dose of 300 mg/kg of body weight, while *Coccinia indica* is also utilized in conjunction to treat diabetes. (5).

### 1.5. Antioxidant activity

Methanolic extract possesses anti-oxidant action, with an IC50 value of 51.9785 mg/ml, according to a hydrogen donation test experiment. By suppressing thiobarbituric acid reactive substances (TBARS) and increasing reduced glutathione (GSH), superoxide dismutase (SOD), and catalase, the combination activity of *A. augusta* and *C. longa* also exhibited antioxidant potential (CAT) (26,27).

### 1.6. Wound healing activity

Devil's cotton is the potent phytomedicine for traditional sores treatment. Another experiment based on wistar rats, showed that alcoholic extract of *Abroma augusta* has potent wound healing activity which is similar to dexamethasone. (28,29)

### 1.7. Hypolipidemic activity

Combining the aqueous extracts of *A. augusta* and *C. longa* can result in a total reduction in body weight, cholesterol, and creatinine compared to rats who had been treated with streptozotocin to become diabetic. (27)

### 1.8. Phytotoxic activity

*Lemna aequinoctailis* Welve is highly susceptible to the phytotoxic effects of *A. augusta* seed oil extract. This seed extract shows antifungal properties against both human pathogenic fungi (*Trichophyton schoenleinii*, 56%) and animal pathogenic fungi (*Microsporium canis*, 50%) (29).

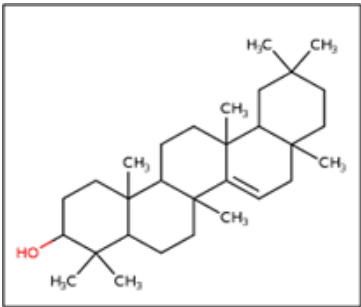
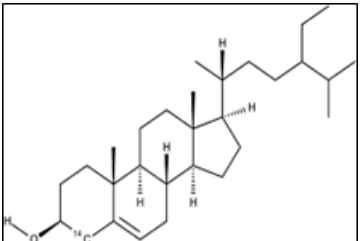
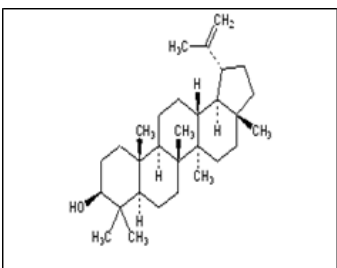
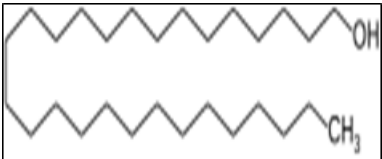
### 1.9. Thrombolytic activity

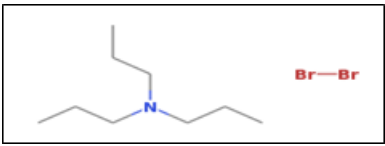
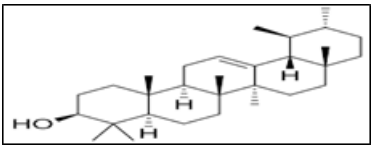
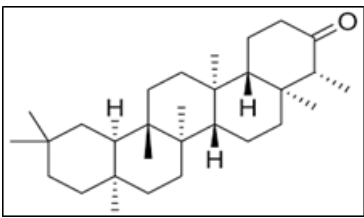
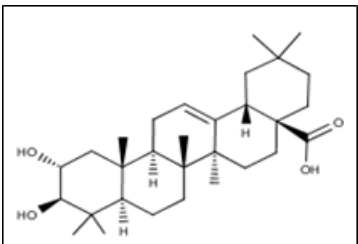
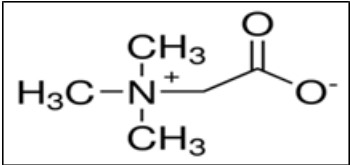
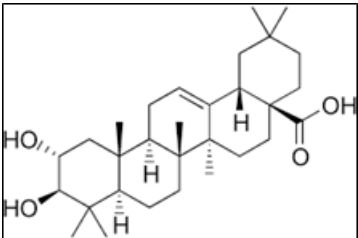
For thrombolytic action, the Devil's cotton extract has been chosen. Here, 100 µl of streptokinase has been used as a positive control; after 90 minutes at 37°C, it results in 86.2 % clot lysis. As opposed to water, which was used as a negative control, 100 µl of the *A. augusta* extract demonstrated a considerable clot lysis (50.1 percent) (30).

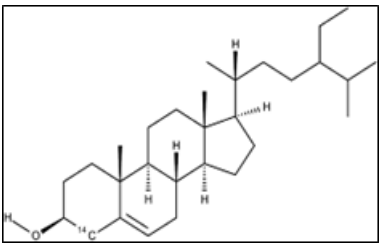
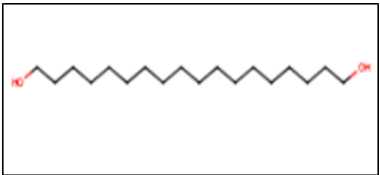
### 1.10. Homeopathic

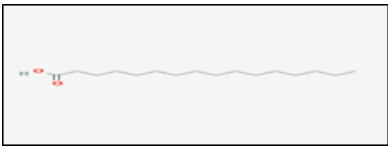
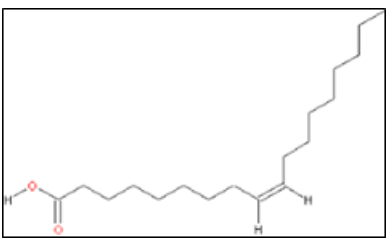
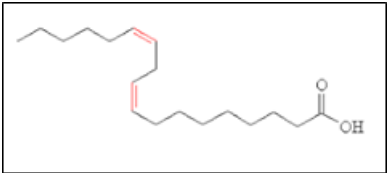
In Homeopathy medicine mother tincture of *A.augusta* used for diabetes treatment. DR. D.N. Ray was the first practitioner of *A. augusta* extract for treatment of diabetes mellitus. Homeopathic report suggest that *Abroma* leaves can be used in various clinical aspects like - sleeplessness or weakness of brain, forgetfulness, depression, morose, anxious, unable to moody etc. (31).

**Table 2** Phytochemicals of *Abroma augusta* with special reference on chemical structure with their medicinal properties

Plant Parts	Name of The Phytochemicals	Chemical Structure of the compound	Activity	Ref
Leaf	Taraxerol		anti-cancer activity via induction of apoptosis and inhibition of Nf-kB signalling pathway.	26,27
	β-sitosterolacetate		anticancer, antifertility, antidiabetic, antinociceptive etc	28
	Lupeol		Anti-cancer, anti-inflammation, skin damage repairing etc.	29,30
	Octacosanol		Prevent high-fat diet-induced obesity and metabolic disorders, Control cellular stress	31,32

Root	Abromine		Anti-diabetic, anti-inflammation, gynaecological	35
	$\alpha$ -amyrin		Anti-ulcer, anti -inflammation	33
	Friedelin		Potent Anti-microbial activity ,	34
	Abromasterol		Anti-diabetic , anti-inflammation , gynaecological	35
	Betaine		Improve vascular risk factors , anti-inflammatory function	36,37
	Maslinic acid		Anti-Leukemic properties , Antiinflammation .	38, 39

Stem Bark	$\beta$ -sitosterolacetate		Anti-bacterial and anti - fungal activity,	41
	Octacosne-1		Anti-diabetic, inflammation, gynaecological	anti- 35

Seeds	Palmitic acid		Induced in type 2 diabetes mellitus, cardiovascular diseases and cancer. induces human dendritic cell secretion of IL-1 $\beta$ .	41,42
	Oleic		Beneficial effect on cancer, autoimmune and inflammatory diseases.	43
	Linoleic		Improved lipid profile in Human health	44

## 2. Conclusion

This literature review suggests that *Abroma augusta* is a valuable source of pharmacologically important chemicals like alkaloid, choline, betaine, beta sitosterol, stigmasterol, L- rhamnase, L- arabinose, D- xylose, D- mannose, D- glucose, D- galactose, D- galacturonic acid and D- glucuronic acid. Phytochemical activity of *Abroma augusta* has diverse reports on the research against wound healing, anti -inflammation, gynecological, diabetes etc. Various Homeopathy doctors suggest that *Abroma augusta* is too much successful for gynecological disorders mainly menopause, anti-fertility and leucorrhoea. Also, this medicine has been used in tribal woman for a long time for gynecological purposes. But till now there are no significant data of clinical trial and no gynecological work regarding phytomedicine of *Abroma augusta* at present scenario in the field of molecular biology. In India diabetes is a burning problem in each family. For diabetic patient, this can be treated by *Abroma* extract. Because few research claimed that mixed leaf methanolic extract of *Abroma augusta*, *Curcuma longa*, and *Coccinia indicia* are also effective against diabetic rats. In case of anti-fungal activity of *Abroma augusta* it showed a prominent antifungal activity against *Candida albicans*, which causes skin infection to human.

In this review we are trying to draw a clear attention of all phytochemists that medicinal plants would be the future active principle of our medicinal world over its chemically synthesized medicine that has a broad side effect in daily life. From ancient period Indian traditional medicines has a new scope for medical science because plant medicines have fewer side effects. At present scenario, anti-fertility, menstrual problem and menopause problem are the burning issues for polluted environment. In that case phytomedicine of *Abroma augusta* would be a potent weapon for coming life. But in this review, we find out that there is too much lack of innovative research of active principle of *Abroma augusta*.

## Compliance with ethical standards

### Acknowledgments

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### Disclosure of conflict of interest

The authors have declared that there are no conflicts of interest.

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