



PHYTOCHEMICALS OF ELAEOCARPUS WITH THEIR THERAPEUTIC VALUE: A REVIEW

**AMIT DADHICH*, ANIRUDHA RISHI , GARGI SHARMA
AND SUBHASH CHANDRA**

** Department of Biotechnology and Food Sciences, Jayoti Vidyapeeth Women's
University, Jaipur-Ajmer Express Way NH # 8, Jaipur, Rajasthan (India) 303007*

ABSTRACT

Elaeocarpus is a genus of evergreen broad-leaved trees and shrubs widely distributed in warm regions belonging to family Elaeocarpaceae. This review consists of all publications relevant to pharmaceutical and pharmacological activity of Elaeocarpus genus that were identified by the authors. Various different methods used in this study prevent any kind of statistical pooling in results. Studies indicate that various Elaeocarpus species contain chemical constituents such as alkaloids, flavonoids, glycosides, tannins, triterpenes, fatty acids, ellagic acid derivatives and cytotoxic compounds. Studies also indicate different therapeutic activity of Elaeocarpus such as antiasthmatic, anxiolytic, antidepressant, antidiabetic and various other activities. All research work on Elaeocarpus reveals the immense medicinal value of this genus but still various Elaeocarpus species should be studied more extensively to confirm these results and reveal other potential medicinal values.

KEYWORDS: Elaeocarpus, alkaloids, antidepressant, pharmaceutical.



AMIT DADHICH

Department of Biotechnology and Food Sciences, Jayoti Vidyapeeth Women's
University, Jaipur-Ajmer Express Way NH # 8, Jaipur, Rajasthan (India) 303007

INTRODUCTION

Elaeocarpus is a genus belonging to family Elaeocarpaceae contain tropical and subtropical evergreen trees and shrubs. It is widely distributed from Madagascar in the west through India, Southeast Asia, Malaysia, Southern China, and Japan, through Australia

to New Zealand, Fiji, and Hawaii in the east with its approximately 350 species. The islands of Borneo and New Guinea have the greatest concentration of species¹. Some common species with their Occurrence are as follows:

Sr. No.	Species of Elaeocarpus	Occurrence
1.	<i>Elaeocarpus aberrans</i>	New Guinea
2.	<i>Elaeocarpus acuminatus</i>	India. Endangered.
3.	<i>Elaeocarpus amoenus</i>	Sri Lanka
4.	<i>Elaeocarpus angustifolius</i>	Queensland, Australia.
5.	<i>Elaeocarpus apiculatus</i>	China, Indonesia, Malaysia, Philippines
6.	<i>Elaeocarpus blascoi</i>	India. Endangered.
7.	<i>Elaeocarpus coorangooloo</i>	Queensland (Australia)
8.	<i>Elaeocarpus coriaceus</i>	Sri Lanka
9.	<i>Elaeocarpus crassus</i>	New Guinea
10.	<i>Elaeocarpus dentatus</i>	New Guinea
11.	<i>Elaeocarpus eumundii</i>	Australia
12.	<i>Elaeocarpus ganitrus</i> (rudraksh tree)	India, South-East Asia, Indonesia, New Guinea, Australia, Guam, and Hawaii
13.	<i>Elaeocarpus gaussonii</i>	Southern India. Endangered.
14.	<i>Elaeocarpus grandiflorus</i>	India, Indo-China, Malasia
15.	<i>Elaeocarpus hartleyi</i>	New Guinea
16.	<i>Elaeocarpus hedyosmus</i>	Sri Lanka
17.	<i>Elaeocarpus hookerianus</i>	Pokaka. New Zealand.
18.	<i>Elaeocarpus holopetalus</i>	New South Wales, Victoria (Australia)
19.	<i>Elaeocarpus williamsianus</i>	NSW, Australia
20.	<i>Elaeocarpus variabilis</i>	Southern India
21.	<i>Elaeocarpus timikensis</i>	New guinea
22.	<i>Elaeocarpus taprobanicus</i>	Sri lanka
23.	<i>Elaeocarpus sylvestris</i>	Japan, Taiwan, China, Indochina
24.	<i>Elaeocarpus stipularis</i>	Indochina, malasia
25.	<i>Elaeocarpus sikkimensis</i>	India, Bhutan
26.	<i>Elaeocarpus serratus</i>	South asia
27.	<i>Elaeocarpus robustus</i>	India, Bangladesh
28.	<i>Elaeocarpus obovatus</i>	Australia
29.	<i>Elaeocarpus neobritannicus</i>	New Guinea
30.	<i>Elaeocarpus photiniaefolius</i>	Ogasawara island
31.	<i>Elaeocarpus montanus</i>	Sri lanka
32.	<i>Elaeocarpus miegei</i>	New Guinea
33.	<i>Elaeocarpus lanceifolius</i>	South Asia
34.	<i>Elaeocarpus kirtonii</i>	Australia

Phytochemical investigation of Elaeocarpus species.

Various phytochemical investigations were performed for showing the presence or isolation of different phytochemicals from Elaeocarpus sps. All these investigations are summarized in table 1, 2 and 3:

Table 1
Investigation of alkaloids in different species of *Elaeocarpus*.

Sr.No.	Name of alkaloids	Species of <i>Elaeocarpus</i> with description
1	Elaeocarpine	These three aromatic indolizidine alkaloids have been isolated from <i>Elaeocarpus polydactylus</i> and from leaves of <i>Elaeocarpus sphaericus</i> ^{2,3,4} .
2	Isoelaecarpine	
3	Elaeocarpidine	
4	Epiisoelaecarpiline	These isomeric alkaloids of molecular formula, C ₁₆ H ₂₁ NO ₂ , have been isolated from the leaves of <i>Elaeocarpus sphaericus</i> (Gaertn.) K. Schum. ⁴ .
5	Epialloelaecarpiline	
6	Alloelaecarpiline	
7	Pseudoepiisoelaecarpiline	
8	Rudrakine	This non aromatic indozolidine alkaloid isolated from <i>Elaeocarpus sphaericus</i> ⁵ .
9	Elaeokanine A, B, C, D, E	These different series of indolizidine alkaloids are present in <i>Elaeocarpus kaniensis</i> ⁶ .
10	Elaeokanidine A	These Five new indolizilidine alkaloids grandisines C, D, E, F, and G were isolated from the leaves of <i>Elaeocarpus grandis</i> ⁷ .
11	Grandisines C, D, E, F & G	
12	Isoelaecarpiline	
13	Elaeocarpidine	This alkaloid has been isolated from <i>Elaeocarpus densiflorus</i> ³ .
14	15, 16 dihydroelaecarpine	These two non aromatic indolizidine alkaloid have been isolated from <i>Elaeocarpus dolichostylis</i> ² .
15	15, 16 dihydroelaecarpine	
16	Elaeocarpine	This one new indolizidine alkaloid were isolated from the leaves of <i>Elaeocarpus fuscoides</i> ⁸ .
17	Isoelaecarpicine	These three known alkaloids were isolated from the leaves of <i>Elaeocarpus fuscoides</i> ⁸ .
18	Isoelaecarpine	
19	Elaeocarpine	

Table 2
Investigation of flavonoids in different species of *Elaeocarpus*.

Sr.No.	Name of flavonoids	Species of <i>Elaeocarpus</i> with description
1	Myricitrin	These four flavonoids conjugated with glycosides have been yielded from leaves of <i>Elaeocarpus serratus</i> ⁹ .
2	Mearnsetin 3-O-β-D-glucopyranoside	
3	Mearnsitrin	
4	Tamarixetin 3-O-α-L-rhamnopyranoside	
5	4'-Methylmyricetin	These have been isolated from the leaves of <i>Elaeocarpus lanceofolius</i> ⁹ .
6	Myricetin and its 3-O-rhamnoside	A new flavnoid that has been isolated from <i>Elaeocarpus sphaericus</i> ⁹ .
7	Quercetin	

Table 3
Investigation of other phytochemicals in different species of *Elaeocarpus*

Sr.No.	Name of phytochemicals	Species of <i>Elaeocarpus</i> with description
Cytotoxic compounds		
1	Cucurbitacins	These cytotoxic compounds against a panel of human tumor cells were isolated from <i>Elaeocarpus mastersii</i> using KB (human oral epidermoid carcinoma) cells as a monitor ¹⁰ .
2	Cucurbitacin D	
3	Cucurbitacin F	
Ellagic acid derivatives		
4	40-O-methylellagic acid 3-(200,300-di-O-acetyl)-a-1-rhamnoside	These two ellagic acid derivatives were isolated from <i>Elaeocarpus mastersii</i>). ¹⁰ .
5	4,40-O-dimethylellagic acid 3-(200,300-di-O-acetyl)-a-1-rhamnoside	
6	4-O-methylellagic acid 3'- α -rhamnoside	The bark of <i>Elaeocarpus parvifolius</i> led to the isolation of these three new ellagic acid derivatives ¹¹ .
7	4-O-methylellagic acid 3'-(3"-O-acetyl)- α -rhamnoside	
8	4-O-methylellagic acid 3'-(4"-O-acetyl)- α -rhamnoside	
9	4-O-methylellagic acid 3'-(2",3"-di-O-acetyl)- α -rhamnoside	One known ellagic acid derivative isolated from the bark of <i>Elaeocarpus parvifolius</i> ¹¹ .
Glycosides		
10	6'-O-galloylsambunigrin	It has been isolated from the foliage of the Australian tropical rainforest tree species <i>Elaeocarpus sericopetalus</i> ¹² .
Tannins		
11	Gallic acid	Two tannins have been isolated from leaf of <i>Elaeocarpus sphaericus</i> ⁹ .
12	Ellagic acid	
Fatty acids		
13	Palmitic acid	These fatty acids have been isolated from the seed of <i>Elaeocarpus sphaericus</i> namely ¹³ .
14	Isopalmitic acid	
15	Linoleic acid	
16	Palmitic acid	The fruit-coat fats of <i>Elaeocarpus dentatus</i> and the seed fats of <i>Elaeocarpus dentatus</i> contain these all fatty acids ¹⁴ .
17	linoleic acid	
18	oleic acid	
19	hexadecenoic acid	
20	linolenic acid	
21	Tannin, geraniin and 3, 4, 5-trimethoxy geraniin	These have been isolated from <i>Elaeocarpus grandiflorus</i> leaves ¹⁵ .

Pharmacological investigation of *Elaeocarpus* species **Antiasthmatic**

The petroleum ether, benzene, chloroform, acetone and ethanol extracts of *Elaeocarpus sphaericus* fruits were found to have mast-cell stabilizing activity, substantiating the efficacy of *Elaeocarpus sphaericus* in bronchial asthma¹⁶. In another study the petroleum ether, benzene, chloroform, acetone and ethanol extracts protected guinea-pigs against bronchospasm induced by histamine and acetylcholine aerosols¹⁶.

Antianxiety

Elaeocarpus ganitrus contain natural antianxiety agents. It was evaluated for antianxiety activity in mice using elevated plus maze model. The petroleum ether, chloroform, ethanol and water extractives were prepared from dried fruit of *E. ganitrus* and evaluated. The chloroform and ethanol extractives were shown effective against anxiety at all doses, but a dose of 200 mg/kg of ethanol extractive was at par with that of diazepam as evident from statistical equivalence between the results of this dose and that manifested by diazepam. Chloroform extractives also effective at all doses but most

effective at a dose of 400 mg/kg¹⁷. Fruit extract (methanolic) of *Elaeocarpus sphaericus* showed anxiolytic effect in Swiss albino mice¹⁸.

Antidepressant

Petroleum ether, ethanol extracts of *Elaeocarpus sphaericus*'s fruit decreased swim stress immobility in mice indicating some degree of antidepressant activity¹⁶.

Antidiabetic

Antidiabetic potential is also shown by chitosan based aqueous extract of *Elaeocarpus ganitrus* by producing hypoglycemic effect in normal rats. At doses of 100 mg/kg body weight given orally produced clinically significant hypoglycaemia. The % blood glucose reduction of the chitosan based aqueous extract at a dose of 200mg/kg is comparable with that of standard anti diabetic drug glimeperide 20mg/kg¹⁹. In another study Water extract of leaves, fruit and twigs of *Elaeocarpus grandiflorus* has been traditionally used to treat diabetic patients. *Elaeocarpus grandiflorus* water extract possesses a hypoglycemic effect²⁰. Aqueous extract of *Elaeocarpus ganitrus* showed potential antidiabetic effects²¹.

Antihypertension

Aqueous extract of *Elaeocarpus ganitrus* Roxb. Seeds powder produced antihypertensive effect in renal artery occluded hypertensive male wistar rats²².

Anti-inflammatory

The petroleum ether, benzene, chloroform, acetone, and ethanol, extracts of *Elaeocarpus sphaericus* fruits at a dose of 200 mg/kg was studied in rat paw edema using different inflammogens. The petroleum ether, ethanol, extracts are effective against carrageenan, bradykinin and PGE. The chloroform extract showed effect against histamine. Ethanol (EE) extract also inhibit histamine. Chloroform extract, was mainly effective in 5-HT induced inflammation²⁷. In another study petroleum ether, benzene, chloroform, acetone and ethanol extracts showed significant anti-

inflammatory action against both acute and sub-acute models¹⁶.

Antimicrobial

The petroleum ether, benzene, chloroform, acetone, and ethanol extracts of dried *Elaeocarpus sphaericus* fruits was investigated against 28 gram-positive and gram-negative bacteria using the disc diffusion and plate dilution methods. The acetone fraction showed marked antimicrobial activity against ten organisms. Benzene extracts was active against *Salmonella typhimurium* and *Morganella morganii*, and ethanol extracts against *Plesiomonas shigelloides*, *Shigella flexnerii* and *Sh. Sonnei*²³. Leaves extract (ethanolic) of *Elaeocarpus serratus* showed antibacterial activity against *Plesiomonas*, *Salmonella typhi* and *Proteus spp.*²⁴.

Antiulcerogenic

The petroleum ether, benzene, chloroform, acetone, and ethanol, extracts of dried *Elaeocarpus sphaericus* fruits, show antiulcerogenic activities in rats¹⁶.

Cytotoxic

Chloroform-soluble extract of the bark of *Elaeocarpus mastersii* was found to exhibit significant cytotoxic activity when evaluated against a panel of human cancer cell line²⁵. The cytotoxic properties showed in the brine shrimp lethality bioassay by the ethanolic extract of *Elaeocarpus serratus*²⁶. Cucurbitacins, cucurbitacin D and cucurbitacin F isolated from *Elaeocarpus mastersii* showed cytotoxic effect against KB (human oral epidermoid carcinoma) cells¹⁰. Leaves extract (ethanolic) of *Elaeocarpus serratus* showed Cytotoxic activity of plant extracts against brine shrimps

Other activities

Ethanolic extract of fruits of *Elaeocarpus ganitrus* exhibit sedative, hypnotic, tranquillizing, anticonvulsive, antiepileptic and antihypertensive properties²⁸. An infusion of bark stem and leaf of *Elaeocarpus floribundus* has been used as mouth wash and fruits have been used as antiseptic²⁹. *Elaeocarpus*

grandiflorus possesses antibacterial activity³⁰. *Elaeocarpus grandis* indolizidine alkaloids grandisine A and isoelaecarpiline compounds bind to opioid receptor and have analgesic effect³¹.

The fruit of *Elaeocarpus oblongus* is used as antiseptic. It is useful in rheumatism, pneumonia, ulcers, piles and leprosy²⁹. The bark of the plant *Elaeocarpus parvifolius* (Elaeocarpaceae), which is found in Indochina, Thailand, Peninsular Malaysia, Singapore and Borneo especially in the treatment of malarial infection³². Bark of *Elaeocarpus petiolatus* is bitter and sour juice of leaves is used to prevent sunstroke and given in fevers²⁹. *Elaeocarpus polydactylus*, *Elaeocarpus dolichostylis*, *Elaeocarpus densiflorus* species have antitumour, analgesic activities and exhibited cardiovascular effect³³. *Elaeocarpus serratus* is used in rheumatism and as antidote for poison. Bark is used in hemorrhages, biliousness and ulcers²⁹. *Elaeocarpus tuberculatus* is used in rheumatism, typhoid and epilepsy²⁹. Ethanol extract of the fruits of *Elaeocarpus ganitrus* shows analgesic activity²⁸. In rats fruit extract of *Elaeocarpus sphaericus* showed significant antiinflammatory action against both acute and sub-acute models, analgesic, barbiturate-hypnosis potentiation and antiulcerogenic activities whereas extract is prepared in petroleum ether (PE), benzene (BE), chloroform (CE), acetone (AE) and ethanol (EE) (50-200 or 200mg/kg, ip, or 200mg/kg, po) and pretreatment time is 30-45min. All the extracts protected guinea-pigs against bronchospasm

induced by histamine and acetylcholine aerosols³⁴. Ethanolic extract of *Elaeocarpus serratus* showed antibacterial activity against some gm(+) and gm(-) bacteria at the concentration of 500µg disc⁻¹ in agar disc diffusion method²⁶. 1,2,3,4,6- penta-O-galloyl-β-D-glucose isolated from *Elaeocarpus sylvestris* var. ellipticus showed antioxidant property³⁵.

CONCLUSION

After studying all publications it is concluded that different species of *Elaeocarpus* are very important in the field of medical science due to the presence of their phytochemicals with their high medicinal values. Mainly these chemicals are alkaloids, flavonoids, tannins, glycosides, and ellagic acid derivatives. Various *Elaeocarpus* species have also been widely studied for their various pharmacological activities like antiasthmatic, antidepressant, antianxiety, antidiabetic, antioxidative, antiviral, antitumor and antihypertensive activities. Although in ancient science *Elaeocarpus* was used as ayurvedic medicine but scientific study revealed many other medicinal use of this genus and make its species the source of multi-purpose medicinal agent proved in experimental animal but clinical trials should be conducted to support its therapeutic use. It is also important to recognize that *Elaeocarpus* species may be effective not only in isolation, but may actually have a potentiating effect when given in combination with other herbs or drugs.

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