

ARUNDO DONAX: AN OVERVIEW OF ITS BIOACTIVE COMPOUND, AND THEIR POTENTIAL THERAPEUTIC EFFECTS

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ABSTRACT

Arundo donax L. is a large perennial grass that belongs to the family of Poaceae. It is the worst and most invasive plant in the global. It's found in low-moisture of soil, it's always found near the bank of rivers. These are uses such as bioactive and potential therapeutic value and socio-economic importance. This plant is used to treat many diseases Antifungal, Antibacterial, Anti-proliferative, Antioxidant, Anti-parasitic, Anti-anthelmintic, cancerous, anti-feedant, Smooth muscles, Blood pressure effect, and much more. The recent review gives information on the bioactive and therapeutic potential of these plants. We have studied many literature review surveys through various sources like Science Direct, Pubmed, Google Scholar, and many more. Giant cane, spinach reed *Arundo donax*. The plant is reported to be the major class of sources are Flavonoids, Alkaloids, Tannins, Terpenoids, and Phenolic compounds. The phytochemicals of the plant are reported to use various diseases like Antimicrobial, Antispasmodic, Antialgae, Leprosy, and Haemostatic, and also can be used in treating Menstrual problems in cattle. Therefore further studies are possible on the *Arundo donax*.

KEYWORDS: *Arundo donax*, Bufotenine, Donaxiridine, Arundine, Ardine.

INTRODUCTION

Arundo donax L. is a large, perennial grass and woody stalks. It is a rhizomatous plant they are associated with the Poaceae family and one of the most reed species of the genus *Arundo*. They are a general presence in the globe. The plant has more species and invasive growth in the world because it replaces *Arundo donax* (native flora) they are worsens the bionomical state of the soil.^[1] It is very long and cane-like everlasting grass with major distribution this root of the plant can grow evenly underground and the whole leaves of the plant are about 5 cm broad and 30.5-61cm long and arranged prominently in two opposing order on the culms. Its leaf is like a corn leaf, the margin of this plant is very sharp to feel can cut the hand. The flowering of this plant in late summer, 0.3 -0.6m long light brown or purplish but changes in whitish color in mature, they are feathery soft, and silky long colored hair.^[2] The plant has various qualities that are beneficial for the health and can be used for their medicinal properties and therefore historically been used beneficial properties people from different states or cultures around the world have relied on it traditionally to treat a variety of illnesses or health issues. Accordance to the World Health Organization (WHO) about 80% of the whole world's residents trust that domestic plants show medicinal properties & can treat illnesses.^[3,4] This conventional system has given an

Arundo donax in Ayurvedic writing that is susruta samite, charka samite, and Madhava chiktisaya cure of renal diseases like the mutrakrcchra in scientific term as Dysurias.^[5] A wide number of populations related to the various religions says that the use of plants used for the curing the fever, Bone Fracture, Urinary disorder, organ dysfunction in cattle's, Menstrual disorder.^[6] From an ancient time there have been many formulations of these plants; which are used in the treatment of vasopressors, antispasmodic, uterine stimulator, and hypotensive. The native people of the Himachal Pradesh district (Kinnaur) used the decoction of *Arundo donax* roots for cancer treatment.^[7] The phytochemicals of the rhizomes which are obtained through the decoctions are used in the menstrual stimulator, diuretics, Emollient, and Galactagogue for increasing the lactations.^[8] In the northern eastern area of India especially in Manipur the boiled leaves and stems of the plant are given Chronic Hemorrhoid activity.^[9] According to Chinese folk herbal medicine the rhizomes of the *Arundo donax* are used for knee osteoporosis, swollen gum, and vomiting.^[10] In Italy Albanian Tribes groups used the internal membrane of the stem of *Arundo Donax* to stop the bleeding.^[11,12] The native people of Pakistan use the rhizomes of the plant for cancer treatment.^[13,14] The plant had economic benefits, the various groups of people used the powerful stem & leaves used to build the rape and baskets.⁶ and

also the stem is used for making the Finishing net and musical instruments.^[6,15] The biological potency of plants shows noticeable various pharmacological activities Anti-microbial, Antipyretic, Anti-tumorous, and Anti-

oxidant.^[16,17] The phytochemical Latin obtained from the root of *Arundo donax* claimed to give the Anti-Tumorous Activity.^[17]



Fig. 1: *Arundo donax*.

CLASSIFICATION, MORPHOLOGY AND GEOGRAPHICAL SOURCE

Table 1: Taxonomical Classification.^[18]

Kingdom	Plantae
Phylum	Spermatophyta
Subphylum	Angiospermae
Class	Monocotyledon
Order	Poales
Family	Poaceae
Subfamily	Arundi Noideae Kunth
Genus	Arundo
Species	Arundo donax
Scientific Name	Arundo donax L
Taxonomical Position	Monocotyledons
Synonyms	Donax arundinaces

Table 2: International Common Name of *Arundo Donax*.^[18]

English	Wild cane; Giant cane; Bamboo reed; Spanish reed
Spanish	Canacomun; Cariza; Cana de Castilla
French	Grandroseau; Canne de Provence
Arabic	Qala; Ghab
Chinese	Luzhu
Portuguese	Canapalusture; Canno de Reino

Table 3: Vernacular Name.^[19]

Hindi	Barnal, baru Doka Nal naldura
Kannada	Baaladakaddi, bileelaalakaddi, hulagiluhullu
Malayalam	Oodappullu
Marathi	Nal
Nepali	Thulonarka
Sanskrit	Nala, Dhamana, Potagala
Tamil	Koraikkuccu, Caravanam, korukachi
Telugu	Adavikikkasgadi, Adavikikasa-Gaddi, Kaki Veduru

DISTRIBUTION

Arundo donax broadly found the tropical and subtropical worldwide, it grows in equal-temperature areas and under the civilized state. This is widely distributed and

domesticated in all controlled environments in the world including Mexico, South Africa, The USA, the Pacific Island, Southern Africa, Caribbean. (20) (Fig. 2)

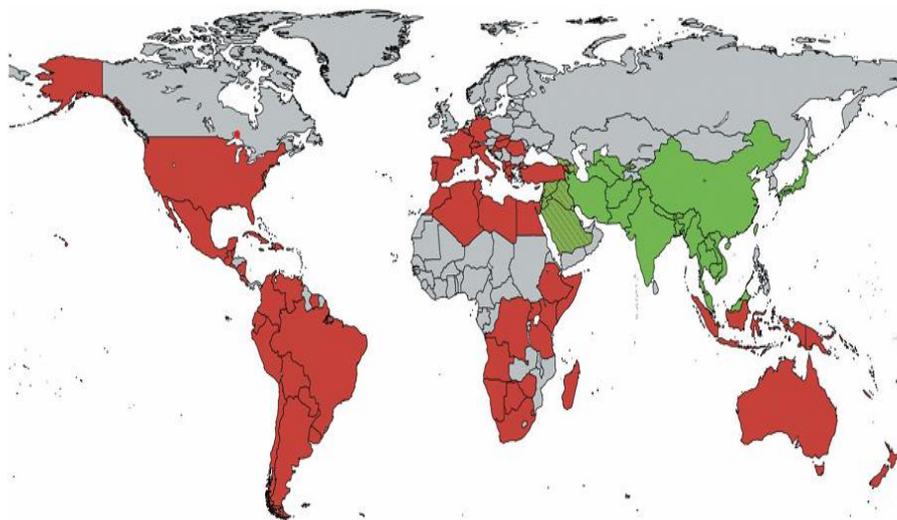


Fig. 2. Spreading of the *A. donax* between Natural (green) and Introduce Red Area.

The original domestic area of the *Arundo donax* in the origin the Middle East or East Asia^[21] from ancient times *Arundo donax* has been noticeable domestically in Asia (Middle East & East Asia). In this area, the plant has the largest morphology of the different areas. *Arundo donax* is likely domestic in some countries of Asia such as India, Afghanistan, Bangladesh, Nepal, Bhutan,

Malaysia, Japan, Vietnam, Pakistan, Cambodia, Thailand, and China.^[22]

INTRODUCE RANGE

Recently *Arundo donax* has been incorporated in different hot countries worldwide. It is a remarkably unwanted species in most of the country. *Arundo donax* is an unwanted species in different countries.^[22]

Table 4: Introduce Range.

Africa	Swaziland, Algeria, South Africa, Morocco and Tunisia
America	Haiti, Mexico, USA, Brazil, Dominican Republic
Europe	Romania, Spain, France, Grassy, Portugal and Italy
Oceania	New Zealand, Australia, French Polynesia, Fiji, Micronesia, New Caledonia

PHYTOCHEMICAL SCREENING

The major Phytoconstituents that are present in the *Arundo donax* are Triterpenoids, Alkaloids, Phenols, Lignin, and Sterols. There are some alkaloids which are isolated from the Rhizomes of the *Arundo donax*

- Bufotenine
- Dehydrobufotenine
- Bufotenidine
- N-Dimethyl tryptamine

- 5-methoxy-n-methyl tryptamine
- Gramine
- Donaxine
- Donaxirine
- Donaxiridine
- Arundine
- Ardine

Table 5: Phytoconstituents isolated from the *Arundo donax*.^[23]

Category	Source parts	Phytoconstituents
Alkaloids	Leaves	Donaxarine, gramine, donaxine, phenyl- β -naphthylamine, deoxyvasicinone, arundine, ardine, donaxarine, donaxanine, donaxaridine, donine
	Rhizome	Arundaline, arundalcohol, N-acetyltryptamine, trans-N-(p-coumaroyl) serotonin, trans-N-feruloylserotonin, tuberosine B
	Rhizome	Donasine
	Rhizome	N,N-dimethyl-tryptamine, 5-methoxy-N-methyltryptamine, bufotenine, dehydro-bufotenine, and bufotenidine
	Roots and	Arundaphine

	rhizome	
	Epigeal and roots	Arundinine
	Roots	Arundamine, arundaline, arundanine, arundacine, arundarine, arundavine, arundafine, N-methyltetrahydro- β -carboline
	Leaves	Donaxine
	Flowers	Gramine, N,N-dimethyltryptamine, bufotenine, 5-methoxy-N-methyl-tryptamine, eleagnine
Sterols and triterpenes	Leaves	Campesterol, stigmasterol, stigmasterol, β -sitosterol, β -amyirin acetate, dihydrobrassicasterol, stigmasta-3,5-dien-7-one, stigmast-4-en-3-one, stigmasta-3,6-dione, Friedelin, α -amyrenone; β -amyrenone, cycloartenone
	Rhizome	Squalene
Phenolics	Rhizome	Xanthone, Xanthene
		Guaiacol, o-Cresol, m-Cresol, methyl-guaiacol, 4-methylguaiacol, 4-methylcatechol, 4-ethylguaiacol, 4-vinylguaiacol, 4-ethylcatechol, eugenol, 4-methylsyringol, E-isoeugenol, 4-ethylsyringol, Z-isoeugenol, 4-vinylsyringol, E-propenylsyringol, Z-syringylpropanol
Lignins	Stem and leaves	Guaiacyl, syringyl propane, p-hydroxyphenylpropane
Carotenoids		β -caroten, xanthophyll

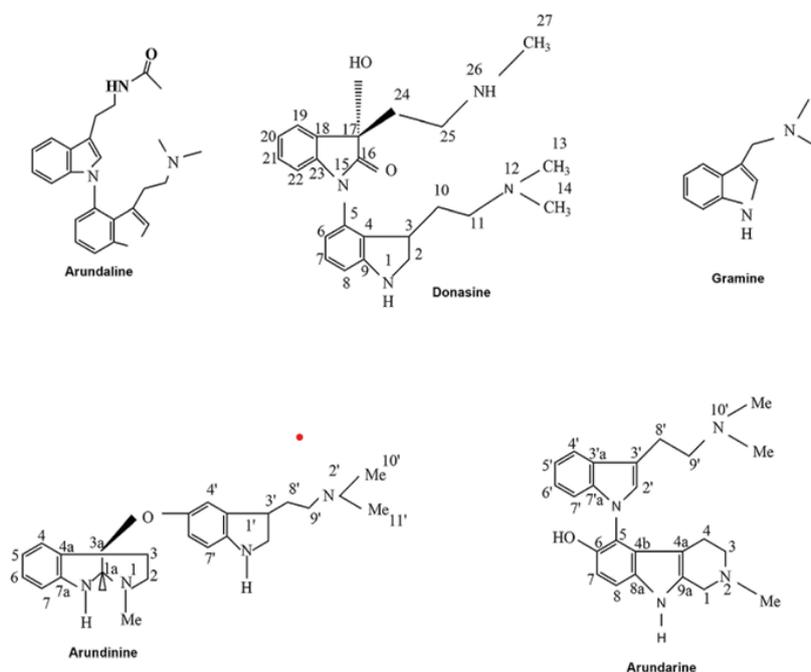


Fig. 3: Structure of alkaloids isolated from *A. donax*.^[23]

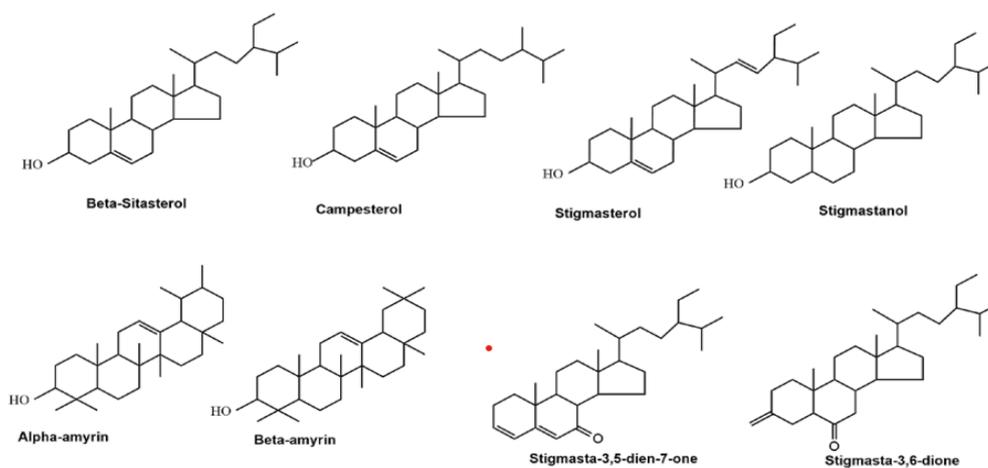


Fig. 4: Structure of Phytosterols isolated from *A. donax*.^[23]

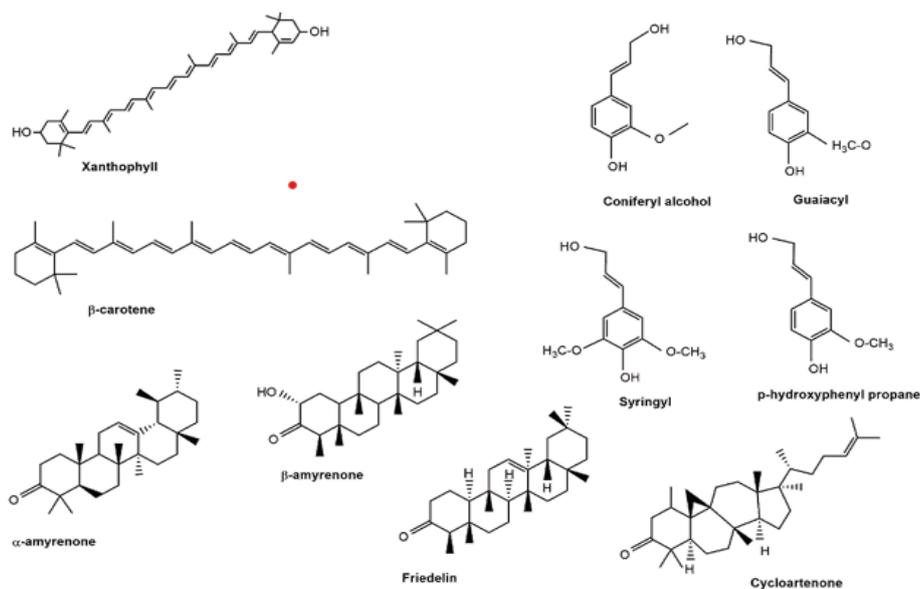


Fig. 5: Chemical structure of terpenoids, lignin, and carotenoids isolated from *A. donax*.^[23]

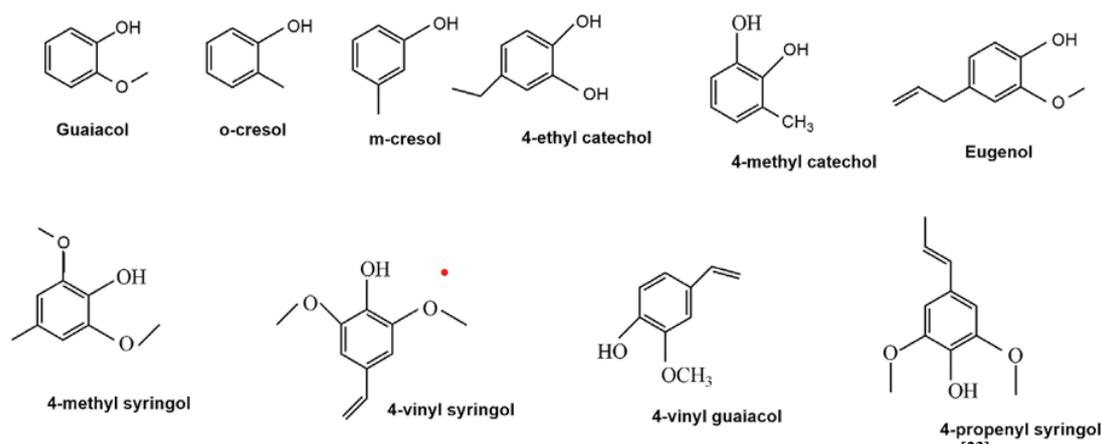


Fig. 6: Structure of Phenolics, Pyrolyzed, Lignin, isolated from *A. donax*.^[23]

Table 6: *Arundo donax* Ethnomedicinal.^[23]

Disease classification	Part Utilized	Disease	Manner of taken drugs / Uses
Blood Disease	Stem	Hemostatic	
	Rhizomes & Roots	Dropsy	
Dermatological Disorders	Leaves & shoot	Leprosy	
	Tender Shoot	Skin Problem	New stem applied on affected areas
	Leaf & stem		
	Tuber	Eczema	Externally applrhizome mixture taking 20 gm is used on the injured area
	Rhizomes & Leaf	Condyloma	
		Erysipelas	
	Aerial Plant	Astringent	
Respiratory	Stem	Asthma	Soft stem extract is given orally with honey.
	Roots	Whooping cough	A little glass of red sap is given orally thrice a day.
Digestive Disorder	Whole plant	Diarrhea & dysentery	
	Root		The aqueous fluid of new rhizomes with sufficient salt is provided to the cattle to prevent dysentery.
	Stem	Duodenal wall &	New green buds combination of honey

		Typhoid fever	provide to children
	Leaves	Hemorrhoids	Boiled leaf direct gives an anal route
Reproductive Disorder	Rhizomes	Menstrual Disorder in Cattles	Phytochemicals obtained from the root of the Arundo donax stimulate the period release in chattels.
	Root	Menolipsis in Human	An aqueous fluid of new rhizomes with 8-tall pepper mixture is provided to the female in the morning on the blank stomach to treat moniliasis. After the end of the menstrual cycle drug is given for 3 days.
	Rhizome	Menses Disorder	Infusion of the root is utilized to stimulate Period discharge.
	Stem		Menstrual Cycle
	Tuber	Abortifacient	For abortifacient, root decoction and jaggery are given orally.
	Rhizomes	Antigalactagogue (diminishes the secretion of milk)	
	Root stalk		Root stalk with the combination of black pepper.
	Leave		
	Stems	Galactagogue (stimulate milk secretion)	
Excretory Problem	Root	Diaphoresis	
	Stem		
Skeletal	Root & stem	Bone Dislocation	Dust of honey, bandage
	Stalk		A powder of stem is applied for fracture-dislocation therapy.
	Stem	Limb pain	
Inflammatory	Leaves & Shoots	Fever	
	Roots & Leaves	Headache	
	Root	Headache	
	Leaves	Otitis	Vapors
Cancer	Root & Leaves		
	Root & Stalk		Crush with honey
	Rhizomes		Infusion of root in wine with honey

THERAPEUTIC APPLICATIONS

- **Antifungal Activity:** Shatalov A. A et al; (2001) studied that the Arundo donax shows the Antifungal Activity against the Basidiomycetes.^[24]
- **Antibacterial Activity:** Shirvani A et al; (2014) studied that the aqueous extract of Arundo donax shows Antibacterial Activity against the Methicillin Resistant Staphylococcus Aureus (MRSA) dose of 128 microgra/ml.^[25]
- **Antifeedant Activity:** Neto C.P et al; (1997) studied that the Arundo donax shows the Antifeedant Activity against the boll weevil, Anthonomus grand.^[26] Bandaranayake W.M (2002) & Leporatti M.L et al; (2007) studied that some of the Sterols (like 3-diimine, tricin, tetramethyl-N, N-bis-2-6-dimethylphenyl cyclobutane, triacontanol) show the Antifeedant Activity.^[27,28]
- **Anti-proliferative effect:** Kaur A et al; (2005) studied that the Arundo donax gives Antiproliferative Activity in the combination of the

Cynodon dactylon L. & Spartium junceum L.^[17] Zanetti G.D studied that the Arundo donax and lectin gives the Antiproliferative Activity against the cancer cell lines.^[28] It is thermostable at a temperature of 55°C and the activity is given at the pH of 7.0-9.0.^[29]

- **Anti-algal Activity:** Hong Y et al; (2010) studied the Methanol extract of the Arundo donax specially Skatone (3-methyl-indole), Phytone (6, 10, 14-trimethyl-2-pentadecanone, and 2, 4, 6-trimethyl-benzonitrile,) Phytol gives the anti-algal properties.^[30]
- **Antioxidant Activity:** Piluzza G et al; (2011) studied that the Acetone extract of Arundo donax leaves especially phenol compounds gives Antioxidant Activity.^[31] Kumar A. et al; (2021) studied the current scenario of many need for natural antioxidants for the treatment of disease through phytoconstituents. In the study, it is found that due to various metabolic pathways production of free

radicals leads to damage to the cells and also causes aging and the natural substances are used for the treatments as the leaf of the *Arundo donax* shows antioxidant activity.^[32]

- **Anti-parasitic:** Badar et al; (2011) studied that the extract of *Arundo donax* leaves gives the Anti-parasitic Activity.^[33] Singh B et al; (2018) studied that the aqueous and methanol extract of the *Arundo donax* leaves gives anthelmintic activity against *Haemonchus contortus*.^[34]
- **Anti-cancerous properties:** Nisar M.F et al; (2014) studied that the local people of Bahawalpur, Pakistan used the roots and leaves of the *Arundo donax* for the treatment of cancer.^[35] Ahmed M.J (2016) studied the roots and stem of the *Arundo donax* given with the honey used to treat cancer.^[36]
- **Effect on skeletal and smooth muscle:** Ghosal S et al; (1969) studied that the ethanol extract of *Arundo donax* Rhizomes gives Antispasmodic and Hypotensive Effect against the acetylcholine, serotonin, and histamine-induced spasms at the concentration of 20mg/kg. The alkaloid isolated from the rhizomes of the *Arundo donax* especially bufotenidine gives smooth muscle activity in the guinea pig intestine, tracheal chain of dog, uterus of guinea pig, and uterus of albino rats.^[37]
- **Blood Pressure Effect:** Khuzhaev V. U et al; (1994) studied that the ethanol extract of the *Arundo donax* rhizomes alkaloids especially bufotenine injection at the dose of 0.2-0.5mg/kg leads to maintaining the blood pressure.^[38]

CONCLUSION

It is seen from the various literature that the *Arundo donax* is a very important plant and has various medicinal properties as well as important chemicals like Triterpenoids, Alkaloids, Phenols, Lignin, and Sterols. The plant shows various pharmacological Activities are Antifungal, Antibacterial, Anti-proliferative, Antioxidant, Anti-parasitic, Anti-anthelmintic, cancerous, anti-feedant, Smooth muscles, Blood pressure effect, and much more which are studied.

FUTURE SCOPE

Due to the Anti-proliferative effect, Anti-inflammatory Activity & Antibacterial activity it is possible that the *Arundo donax* shows the Wound Healing Activity. *Arundo donax* has several property apart from these some areas are still untouched on which research can be carried out like wound healing.

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