

Medicinal Potential of Weed *Echinochloa colona* (L.) Link: A Review

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ABSTRACT

Echinochloa colona (L.) Link is distributed throughout the world is a persistent weed species. It is a valuable fodder and traditionally used in spleen and hemorrhage problems. Recently found that it has wound healing, antioxidant and antimicrobial property. The objectives of this review to present existing information to pin point key findings which would helpful to explore medicinal importance of this weed.

Keywords: *Echinochloa colona*, poaceae, weed, medicinal potential.

INTRODUCTION

Echinochloa colona is a weed¹. Weeds are the plants growing where it is not desired. They cause considerable damage in various ways. Apart from this, they may have numeral beneficial properties in one way or the other and have immense potential as food resource, medicinal, aromatic, phyto-remediation, industrial, soil and water conservation resources etc.². From the date back to human civilization, some of the medicinal grasses tribally, were well accommodated with the human life; as a result man depends on the members of this group for their food, shelter, cloth and for medicine to treat their ailments and also as fodder for cattle³. The plant in present study is *Echinochloa colona* is an annual or perennial grass, which is distributed throughout the warm regions of the world except Greenland and Antarctica. It is common in areas of heavy rainfall and variable temperature. It is the largest family of monocots having 620 genera and 10,000 species throughout the world⁴. *Echinochloa colona* is a terrestrial, tufted and erect grass commonly known as 'Jungle rice' in India⁵. *Echinochloa* is a cosmopolitan genus belonging to subfamily Panicoideae of the family Poaceae comprised of 20 to 25 species⁶. In India four species of *Echinochloa* is recorded i.e. *Echinochloa colona*, *Echinochloa crus-galli*, *Echinochloa frumentacea* and *Echinochloa stagnina*⁷. *Echinochloa colona* was first described in 1833, as a type of wild grass originating from tropical Asia. It was firstly classified as a species of *Panicum*. The basionym of *Echinochloa colona* is *Panicum colonum* Linnaeus (1759). In 1833 Link included the *Panicum colonum* in the genus *Echinochloa* and named it *Echinochloa colona*, thus using the specific epithet as an adjective with the feminine ending -a^{8,9}. Some taxonomists treat the two taxa as one species, in which case the domesticated forms may also be referred to as *Echinochloa colona*¹⁰. It is mostly found in India, Pakistan and throughout tropics and subtropics. *Echinochloa colona* is an annual and rarely perennial erect grass reaches up to 1 meter in height⁴. It grows in

summer¹¹. It grows with the rice plants as it requires damp and moisture containing soil and is ethnobotanically important as this is used as excellent fodder for animals. Literature about its nutritive value is scarce and includes studies with wild ruminant species^{12, 13}. In Zambia, the digestibility of jungle rice has been measured. Stem were found to be more digestible than the leaves, probably due to the high silicium content of the latter. Jungle rice could meet crude protein, potassium, magnesium and iron requirements of adult animals but could not meet phosphorus and zinc requirements¹⁴.

Plant profile¹⁵

Kingdom: Plantae
Phylum: Spermatophyta
Subphylum: Angiospermae
Class: Monocotyledonae
Order: Cyperales
Family: Poaceae
Genus: *Echinochloa*
Species: *Echinochloa colona*
*Synonyms*¹⁶
Echinochloa colonum(L.) Link,
E. crus-galli subsp.*colona* (L.) Honda,
Echinochloa verticillata Berth.,
Panicum colonum L.,
Panicum cumingianum Steud.,
Panicum zonale Guss.,
Milium colonum (L.) Moench,
Oplismenus colonus (L.) Kunth.

Common names¹⁷

English: Jungle rice, shama millet, small barnyard grass, Samak rice, Samo rice
Hindi: Jangali Chawal, Jangali jhangora, mordhan, sava ka chawal
Telugu: Othagaddi
Kannada: Kaddu
Gujarati: Samo, Moriyoo
Marathi: Bhagar, Vari cha Tandul.



Fig1: *Echinochloa colona* in field

Distribution

Echinochloa colona was originated from India but it is now widespread in the tropics and subtropics^{18, 19}. Jungle rice is found in the Central Valley, San Francisco Bay region, western South Coast ranges, southern Sierra Nevada foothills, southwestern region. It is mainly found in India, Pakistan and South Africa⁴.

Habitat of *Echinochloa colona* is that it grows and matures very rapidly in the edaphic conditions which are favorable in a wide range of ecological niche¹¹. It is usually grown in sunny or partial-shade areas associated with moist or soggy loam, silt, and clayey soils and chiefly occurs on damp, fertile, and heavy-textured soils which receive seasonal floods. It is naturally found in wetlands: in ponds and swampy places, in seasonally flooded grasslands, riverbanks, edges of saline waterholes, in disturbed areas, waste places and cultivated or irrigated fields and ditches and can grow on a wide range of soils but does better in loams, silts and clay soils that are well drained^{20, 21}. *Echinochloa colona* grows most commonly at low altitudes but it can be found at up to 2000 m and in those areas where annual rainfall is ranging from 400 mm to about 1200 mm^{20, 19, 22}. *Echinochloa colona* cannot grow in very low temperature and it gets killed at 9°C²⁸.

Description

Echinochloa colona is a C4 plant. It is polymorphic and a hexaploid with $2n = 6$ to $2n = 54$ ²⁷. It is an annual (rarely perennial) grass, 30-100 cm high. Its color is green to purple, tufted and shortly stoloniferous. Its culms are glabrous, cylindrical, erect and decumbent. They are red purple at their base and can root at the lower nodes^{18, 20, 28, 29}. Special identifying features are simple, awnless spikelets, purple leaf band not present on young plants, no ligule. Leaves blade are linear 10-40cm long and 3-10 cm wide, glabrous or sparsely pubescent above. The ligules are absent and sheath is glabrous. Root of this plant is fibrous and stems spreading to erect, bent at the nodes and glabrous³⁰. Flowering starts from July to September and

seeds ripen in August to October. Seedlings are often flat and spreading with pointed tip rolled leaves with no hair. Its morphological features resemble with rice and cause problems during its eradication at very early vegetative stages from rice fields¹¹.

Reproductive characteristics

Seed head: Panicle 5-20 cm long with 8-10 branches, each 1-4 cm long.

Spikelets: 2.3 - 2.8 mm long, 1 - 1.5 mm wide, sessile.

Glumes: First, $\frac{1}{2}$ as long as the spikelets and second, equaling the spikelets.

Lemma: Similar to second glume.

Palea: Equaling the spikelet, shiny³⁰.

Uses

Echinochloa colona is a valuable fodder enjoyed greatly by all classes of livestock, notably dairy animals and water buffalo^{18, 29, 22}. The whole plant is used as fodder by grazing animals and it cures ingestion³¹.

The seeds of this plant are ground into flour from which porridge or bread can be prepared²⁶. Seeds are roasted and mixed with roasted seeds of wheat and bhang and eaten by the native peoples. Stems are used in weaving mats³. It is often used in times of food shortage as a famine food, evidently in Chad (central) and Sudan (Kordofan, Darfur)²⁶. The young plants and shoots are edible and can be eaten in times of scarcity^{18, 32}.

This plant is used in spleen and haemorrhage problems. It is also used in nausea and constipation³³. The tuber of the plant is said to possess antiemetic values and act as a sedative in dyspeptic disorders particularly in vomiting during pregnancy²⁶.

Local uses in India

In India seeds of the *Echinochloa colona* grass are used to prepare a food dish called *Khichadi* and is consumed during festival fasting days. In Rajasthan the seeds are boiled in water and used as a substitute for rice. The seeds are also ground into flour, sometimes being mixed with maize or blackgram, and made into bread or porridge^{34, 35}. It contains digestible fibers, high nutritional content and excellent nourishment, because of that jungle rice become exceedingly popular amongst the Indian majority³¹.

Phytoconstituents

Echinochloa colona contains alkaloids, steroids, carbohydrates, glycosides, tannins, phenols and flavonoids. Using thin Layer Chromatography, UV, IR, ¹HNMR and MS three compounds were isolated β -sitosterol, 2, 3, 4-trihydroxy- 6-methyl benzoic acid and ethyl 3, 4, 5 trihydroxy benzoate³¹. It contains a flavone moiety tricinin³⁶.

It also contains:

Protein content: 3-18% DM

High fiber content: 25-45% DM

Dry matter – 26%

Ash – 14.5 % DM

Lignin – 5.4 % DM

Micronutrients: Calcium - 4.5 g/kg, Phosphorus - 2.2 g/kg,

Potassium – 27.4 g/kg, Sodium – 2.2g/kg, Magnesium –

2.8 g/kg, Manganese – 203 mg/kg, Zinc – 39 mg/kg,

Copper – 8 mg/kg^{37, 38, 39, 40}.

Pharmacological studies

In India it is mostly found in the states shown in the table below^{23, 24, 25, 26}:

State	Distribution	Origin	Invasive	References
Arunachal Pradesh	Present	Introduced	Invasive	Chandra, 2012
Assam	Present	Introduced	Invasive	Chandra, 2012
Himachal Pradesh	Present	Introduced	Invasive	Chandra, 2012
Jammu & Kashmir	Present	Introduced	Invasive	Chandra, 2012
Manipur	Present	Introduced	Invasive	Chandra, 2012
Meghalaya	Present	Introduced	Invasive	Chandra, 2012
Mizoram	Present	Introduced	Invasive	Chandra, 2012
Nagaland	Present	Introduced	Invasive	Chandra, 2012
Sikkim	Present	Introduced	Invasive	Chandra, 2012
Tripura	Present	Introduced	Invasive	Chandra, 2012
Uttar Pradesh	Present	Introduced	Invasive	Chandra, 2012
Uttarakhand	Present	Introduced	Invasive	Chandra, 2012
West Bengal	Present	Introduced	Invasive	Chandra, 2012
Delhi	Present	Introduced	Invasive	Lansdown, 2013
Goa	Present	Introduced	Invasive	Lansdown, 2013
Gujarat	Present	Introduced	Invasive	Lansdown, 2013
Andhra Pradesh	Present	Introduced	Invasive	Lansdown, 2013
Karnataka	Present	Introduced	Invasive	Lansdown, 2013
Kerala	Present	Introduced	Invasive	Lansdown, 2013
Madhya Pradesh	Present	Introduced	Invasive	Lansdown, 2013
Rajasthan	Present	Introduced	Invasive	Lansdown, 2013
Tamil Nadu	Present	Introduced	Invasive	Lansdown, 2013

Wound healing activity

The wound healing activity of *Echinochloa colona* was studied using *in vivo* guinea pig punch wound model and *in vitro* wound assay and chick chorioallantoic membrane model. Among the various fractions, chloroform fraction (1%) was able to decrease wound area by 14.8 mm² as compared to vehicle control (ointment base) 30.6 mm² and standard (Povidone- Iodine ointment) 8.5 mm² measured on 10th day. There was 85.87 % and 83.37 % increase in hydroxyproline content and tensile strength with chloroform fraction treatment. The percentage wound contraction was found to be in different fractions were chloroform 40.67, ethyl acetate 26.47 and ethanol 30.61 at 200 µg/ml concentration respectively in wound assay. Whereas there were 14, 1 and 1 new blood vessels formation at 40 mg/disk with chloroform, ethyl acetate and ethanol fraction treatment compared to control (Saline), which indicated better angiogenic activity of chloroform fraction comparing other two⁴¹.

Antioxidant activity

The antioxidant activity using five different approaches, *i.e.* 2,2'-azinobis(3-ethylbenzothiazoline)-6-sulphonic acid (ABTS) method; ferric reducing antioxidant power (FRAP) assay, metal chelating assay, total phenolic contents (TPC) and flavonoid contents was also reported. The results showed that the methanolic extracts possessed significant antioxidant activity. In metal chelating assay inhibition was observed as 8.91% bound value. FRAP and ABTS assay was calculated to be 20.12mM and 0.910 mM. The results also indicated that methanolic extract of *Echinochloa colona* had total phenolic and flavonoid contents, *i.e.* 734.25 and 7774.54 mg/ml⁴.

Borkar *et al.*, 2015 studied antioxidant activities of different extracts. Chloroform, ethyl acetate and ethanol fractions were obtained from ethanol extract of

Echinochloa colona and screened by *in vitro* antioxidant methods, using reducing power assay, 2, 2- diphenyl-1-picrylhydrazyl assay and nitric oxide radical assay against standard ascorbic acid at 25, 50, 75 and 100 mg/ml. The reducing power of all the fractions was found to be increased with increasing concentration. All these fractions shown antioxidant potential but chloroform fraction has shown good antioxidant activity comparing other two⁵.

Antimicrobial activity

The most significant results were obtained from the methanolic and petroleum ether extracts of *Echinochloa colona*, *i.e.* 24 ± 2.64 mm and 23 ± 2.64 mm against *S. aureus*, respectively⁴.

CONCLUSION

The study of medicinally important weeds has not been realized as fully as other traditional communities. The literature study reveals so many traditional uses of this weed in the treatment of various diseases. Therefore this weed needs to exploit more which could help the usage of this plant in the clinical application.

REFERENCES

1. Holm LG, Plucknett DL, Pancho JV, Herberger, JP. The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Malabar, Florida, 1991; 609.
2. Priya HR, Veena, Pavithra AH, Divya Jyothi. Prospects and Problems of Utilisation of Weed Biomass: A Review. Research & Reviews: Journal of Agriculture and Allied Sciences. 2014; 3(2):1-11.
3. Kumari K, Saggoo MI. Traditional and Ethnomedicinal uses of some grasses (Poaceae) of Kinnaur, Himachal

- Pradesh, India. *Annals of Plant Sciences*. 2015; 4(10):1195-1198.
4. Ajaib M, Khan KM. Antimicrobial and antioxidant activities of *Echinochloa colona* (Linn.) Link and *Sporobolus coromandelianus* (Retz.) Kunth. *Journal of the Chemical Society of Pakistan*. 2013; 35(3):961-966.
 5. Borkar VS, Senthil Kumaran K, Senthil Kumar KL, Gangurde HH, Chordia MA. Antioxidant effect and characterization of bioactive constituents isolated from *Echinochloa colona* (Poaceae). *World Journal of Pharmaceutical Research*. 2015; 4: 1652-1661.
 6. Serag MS, Khedr AHA, Abogadallah GM and Shaaban HE. Performance and chemical composition of three *Echinochloa* grasses over short term experiment. *Scientific Journal for Damietta Faculty of Science*. 2014; 3(1):43-52.
 7. Anonymous. *The world book of Encyclopedia*. United State of America, RR Donnelley, Willard, Ohio, 2012, 124.
 8. Michael PW. Taxonomy and distribution of *Echinochloa* species with special reference to their occurrence as weeds of rice. In *Proceeding of the Conference on Weed Control in Rice*. 1983; 31:291-306.
 9. Michael PW. *Echinochloa colona* versus. *Taxon*. 2009; 58(4):1366-1368.
 10. Hilu KW. Evidence from RAPD markers in the evolution of *Echinochloa* millets (Poaceae). *Plant Systematics and Evolution*. 1994; 189(3):247-257.
 11. Peerzada AM, Bajwa AA, Ali HH, Chauhan BS. Biology, impact, and management of *Echinochloa colona* (L.) Link. *Crop Protection*. 2016; 83:56-66.
 12. Anigbogu NM. Weed meal from a rice plot for broiler chicks. *International Rice Research Notes*. 1999; 24(2):40.
 13. Ahmed MM, El-Hag FM. Degradation characteristics of some Sudanese forages and tree pods using in sacco and gas production techniques. *Small Ruminant Research*. 2004; 54(1):147-156.
 14. Rees WA. The ecology of the Kafue lechwe: the food supply. *Journal of Applied Ecology*. 1978; 177-91.
 15. Wagner WL, Herbst DR, Sohmer SH. *Manual of the Flowering Plants of Hawai'i*, University of Hawai'i and Bishop Museum Press. 1999; 1&2.
 16. USDA. GRIN - Germplasm Resources Information Network. National Germplasm Resources Laboratory, Beltsville, Maryland. 2011.
 17. Bana M, Gupta RK. Formulation, nutritional and phytochemical analysis of ready to mix infant Food using Gorgon Nut, Samak Rice and Banana powder. *Journal of Pharmacognosy and Phytochemistry*. 2015; 4(4):76.
 18. Quattrocchi U. *CRC World dictionary of grasses: common names, scientific names, eponyms, synonyms, and etymology*. CRC Press, Taylor and Francis Group, Boca Raton, USA. 2006.
 19. Holm LG, Plucknett DL, Pancho JV, Herberger JP. *The World's Worst Weeds. Distribution and Biology*. Honolulu, Hawaii, USA: University Press of Hawaii. 1977.
 20. FAO. *Grassland Index. A searchable catalogue of grass and forage legumes*. FAO 2011.
 21. Lazarides M. *The Tropical Grasses of Southeast Asia*. Vaduz, Germany: Strauss and Cramer. 1980; 225.
 22. Manidool C. *Echinochloa colona* (L.) Link. Record from Proseabase. Marnette, L.'t and Jones, R.M. (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. 1992.
 23. Kapoor P, Ramakrishnan PS. Weed-crop behaviour in pure and mixed stands of maize and *Echinochloa colona* Link. *Proceedings: Plant Sciences*. 1975; 82(5):175-194.
 24. Tadulingam C, Venkatanarayana G. *A handbook of some south Indian weeds*. Government Press, Madras, India. 1985; 356.
 25. Sekar KC. Invasive alien plants of Indian Himalayan region—diversity and implication. *American Journal of Plant Sciences*. 2012; 3(02):177-184.
 26. Lansdown RV. *Echinochloa colona*. The IUCN Red List of Threatened Species. 2013; e.T164380A1047208.
 27. Yabuno T. Cytotaxonomic studies on the two cultivated species and the wild relatives in the genus *Echinochloa*. *Cytologia*. 1962; 27(3):296-305.
 28. Ecocrop. Ecocrop database. FAO. 2011.
 29. Catindig JLA, Lubigan RT, Johnson D. *Echinochloa colona*. Factsheets about rice weeds: the dirty dozen. International Rice Research Institute. 2011.
 30. Southern Weed Science Society. *Weeds of the United States and Canada. CD-ROM*. Southern Weed Science Society. Champaign, Illinois. 1998.
 31. Borkar VS, Kumaran KS, Kumar KL, Gangurde HH, Chordiya MA. Ethno medicinal properties of *Echinochloa colona* and *Hydrolea zeylanica*: A review. *World Journal of Pharmaceutical Research*. 2016; 5:354-360.
 32. Galinato MI. Upland rice weeds of South and Southeast Asia. *Int. Rice Res. Inst.*; 1999; 76-77.
 33. Devi KY, Devi MH, Singh PK. Survey of medicinal plants in Bishnupur District, Manipur, North Eastern India. *International Journal of Applied Research*. 2017; 3(4):462-471.
 34. Gammie GA. A note on plants used for food during famines and seasons of scarcity in the Bombay Presidency. *Botanical Survey Records*. 1902; 2:171-196.
 35. Abdelmuti OM. Biochemical and nutritional evaluation of famine foods of the Sudan. Faculty Agriculture. Khartoum, Sudan, Univ. Khartoum, Dr. Diss. Biochem. Nutr., Sudan. 1991.
 36. Hegab MM, Abdelgawad H, Abdelhamed MS, Hammouda O, Pandey R, Kumar V, Zinta G. Effects of tricin isolated from jungle rice (*Echinochloa colona* L.) on amylase activity and oxidative stress in wild oat (*Avena fatua* L.). *Allelopathy Journal*. 2013; 31(2):345.
 37. Bartha R. *Fodder plants in the Sahel zone of Africa*. München, Weltforum Verlag. 1970.

38. Holm J. Feeding tables. Composition and nutritive value of feedstuffs in Northern Thailand. Feeding tables. Composition and nutritive value of feedstuffs in Northern Thailand. 1971; 23.
39. CIRAD. Laboratory data 1963-1991. CIRAD, 1991.
40. Zaharaby AKM, Mia MM, Reza A, Khan MJ, Ali ML. Agricultural weeds as alternative feed resource for ruminants in Bangladesh. *Indian Journal of Animal Sciences*. 2001; 71(4):398-401.
41. Borkar VS, Senthil Kumaran K, Senthil Kumar KL. Evaluation of Wound Healing Potency of *Echinochloa colona* using In Vivo and In Vitro Methods. *International Journal Pharmaceutical Sciences Research*. 2015; 6(8):1140-1145.