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Melochia corchorifolia L. (Chocolate Weed) an Underutilized Bio-resource: A Review

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ABSTRACT

Melochia corchorifolia L. commonly known as 'Chocolate weed' is an annual herbaceous troublesome weed found in cultivated land across the world. 'Eradication by Utilization' could be employed as an effective means of managing *Melochia corchorifolia*. Plant extracts of *Melochia corchorifolia* can be utilized for the control of the storage pest, *Callosobruchus maculatus.* Active fraction of the plant extract along with neem oil and karanj oil could be used to prepare botanical pesticides. Several phytochemicals having pharmacological properties have been identified from the plant extracts of *Melochia corchorifolia*. Being a good source of minerals and nutrients, the fresh leaves are used as food and folk medicine in various parts of the world.

Key words: Bio-utilization, Chocolate weed, Eradication through utilization.

Weeds are one of the major biological constraints that limits crop productivity. They are omnipresent and reduces the yield and quality of crops substantially. In India, yield loss due to weeds was estimated to be 37 per cent (Yaduraju, 2006). Weeds causes immense menace both ecologically and economically by interfering with agriculture, forests, natural ecosystems and human health.

In agriculture, weeds compete with crops for available resources and increases the cost of production. Weeds are estimated to cause crop loss which is worth about 11b$ (Jayan, 2018). The ubiquitous nature of weed plants is accredited to their more adaptability to diverse ecological habitats. Short life cycle, seed propagation and adaptation to wide range of soils favoured rapid infestation in cultivated areas (Pullaiah, 2014).

Environmental variations have been identified as the major factor leading to variations in weed species composition in a plant community. Intensification of agriculture also leads to changes in the composition and diversity of weed communities and minor weeds gain the status of problematic ones in comparatively short periods of time. One such potential plant chocolate weed (*Melochia corchorifolia*), a weedy tropical plant, usually seen in waste lands.

Distribution of *Melochia*

Chocolate weed had its origin in old world tropics and is prevalent in sunny or slightly shaded regions, humid areas in fields and waste places (Eastin, 1983). Although it is adapted to xerophytic conditions, *Melochia* thrives well in mesophytic and hydrophytic habitats. *Melochia corchorifolia* belongs to the family Malvaceae, order Malvales and class Magnoliopsida. *Melochia* is a herb, annual or perennial in habit. The leaves are simple, spirally arranged with serrated margins. The petioles are generally 5 cm long with linear stipules of 5mm. It usually grows up to a height of 1.3-2.0 m and stem is covered with stellate hairs.

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De Datta and Llagas (1984) revealed that annual weeds including Melochia declined the yield of upland rice by 67 per cent. Melochia was the most frequent broad-leaved weed in carrot, potato and wheat (Yakubu *et al.,* 2006). Frequent incidence of Melochia was reported by Martin *et al*. (2017) in paddy.

In Kerala, *Melochia corchorifolia* is a common weed in banana, sesame and rice. Earlier it was seen only in upland areas, but now it is a common weed both in uplands and lowlands during the *Kharif* season. A state wide survey revealed that *Melochia corchorifolia* which was present only in localized patches a decade ago, has spread to large areas and become a problem weed in rice and sesame (NIWSP, 2011). *Melochia* was the predominant weed in the sesame growing tracts of Onattukara (Sreepriya and Girija, 2018).

Onattukara region of Kerala comprises Karunagapally, Karthikapally and Mavelikara taluks of Kollam and Alappuzha districts. The farmers of Onattukara are facing a major threat from chocolate weed. *Melochia corchorifolia* usually seen as a major weed in rice fields of Onattukara tract is now a serious menace in the sesame crop during the summer season (Rathish, 2010). It has been spreading fast because

of its prolific seed production capacity and chance of mixing with sesame seeds due to mimicry.

Being a broad-leaved weed, the scope of using herbicide is limited for the control of chocolate weed in sesame. Due to the lack of proper management options, the farmers are reluctant to grow sesame and keep the field idle during third crop season (summer) resulting in reduction in the production and productivity of sesame in Kerala.

Eradication by utilization

Eradication by utilization is the economic exploitation of invasive species as a means of harnessing their economic potential for meeting the basic human needs and at the same time prevent its spread and eradicating them (Tessema, 2012).

It is an attractive strategy, determined by both socioeconomic and ecological conditions and involves mechanisms which create immediate incentives to people through eradication of invasive species (Finnoff *et al*., 2009).

Bio-utilization of Melochia

Storage pest control

Approximately 50 per cent of cowpea grains are lost during storage within 3 to 4 months due to *Callosobruchus maculatus* infestation (Caswell, 1981). Dubey *et al*. (2008) revealed that in a tropical country like India, losses in chickpea due to infestation of storage pest can be 100 per cent. Insect damage in stored grains alone may account to l0-50 per cent (FAO, 2012).

Raja *et al.* (2001) evaluated the potential of *Melochia corchorifolia* plant extract in protecting pulses from the attack of *Callosobruchus maculatus* during post harvest storage and found that storage of grains in gunny bags treated with aqueous extract of leaves of *Melochia corchorifolia* recorded the lowest number of eggs laid, lowest adult emergence and least mean weight loss of cowpea seeds. The study pointed out the potential of utilizing the aqueous extracts of *Melochia corchorifolia* against storage pests.

Botanical pesticide

Plant products are mostly target specific and exhibit anti-insect property in many ways. Manickam *et al*. (2012) studied the bio efficacy of extracts of *Melochia corchorifolia* leaves on the feeding behaviour of four lepidopteran pests *viz., Helicoverpa armigera, Spodoptera litura, Earias vitella* and *Leucinoiodes orbonalis.* The results clearly indicated the significant antifeedant activity of ethyl acetate extract of *Melochia corchorifolia* leaves. They also studied the effect of different fractions of ethyl acetate extract of *Melochia corchorifolia* with different Rf values on the antifeedant activity against *Helicoverpa armigera, Spodoptera litura, Earias vitella and Leucinoiodes orbonalis*. The results revealed that fraction eluted using 40:60 hexane and ethyl acetate (2:3 ratio) with a Rf value of 0.43 showed maximum antifeedant activity against the four lepidopteran pests. The antifeedant activity of *Melochia corchorifolia* was due to the presence of steroids and alkaloids. Different formulations were prepared with the active fraction mixed with neem oil and karanj oil. The results revealed that the active fraction of the plant extract (12.25 mg) along with neem oil (4.45 ml) and karanj oil (4.45 ml) recorded maximum antifeedant activity and could be considered to prepare botanical pesticides.

Nutrient source

Hassan *et al*. (2005) revealed that *Melochia corchorifolia* is a good source of minerals. Among the minerals, calcium content was found to be high. On dry weight basis, 100 g of *Melochia corchorifolia* contain 750.37 mg Ca. Proximate analysis of dried powdered leaves of *Melochia corchorifolia* revealed that *Melochia corchorifolia* leaves were rich in crude protein, dietary fibre and minerals like K, Na, Ca, Mg, P, Cu, Fe and Mn. Because of high protein content it can be used as protein supplement also (Umar *et al*., 2007).

Fresh leaves of *Melochia corchorifolia* are consumed as a portherb and cooked leaves as slimy side-dish in West Africa and Malai respectively. Similar use of Melochia leaves have also been reported from Indo-China and India (Grubben, 2004). Santhal tribes of Jharkhand used the leaves of Melochia for culinary purpose.

Medicine

Melochia is used as an effective folk medicine in many parts of the world. Leaves are used for the treatment of abdominal sores and swellings in Malaysia and the sap is applied as an antidote in wounds caused by *Antiaris toxicaria* poisoned arrows (Mamatha *et al*., 2018). Studies revealed that the leaves and roots were used for curing small pox (Herbal Medicine Research Centre, 2002). Leaf and stem boiled in oil was used to prevent negative consequences from water snake bites (Sharma and Rawal, 2013). Fruit powder could be used for ear problems, dysentery, abdominal swellings and snake bites (Ajaib *et al*., 2010). Tribal communities of Uttar Pradesh use the leaf decoction to treat dysentery (Shukla *et al*., 2013).

Pharmacological properties

The major phytoconstituents identified from the methanol extract of *Melochia corchorifolia* are given in Table 1.

Table 1: The major phytoconstituents identified from the methanol extract of *Melochia corchorifolia*

Group	Compound	Reference
Triterpenes	Friedelin, Friedelinol, β-Amyrin	Umar *et al.* (2007)
Flavonoids	Vitexin, Robunin	Bhakuni *et al.* (1991)
Alkaloids	Franganine, Melochironine	Bhakuni *et al.* (1991)
Flavanol glycosides	Hibifolin, Triflin, Melocorin	Umar *et al.* (2007)
Aliphatic compounds	Ethyl stearate, Teratriacontanol	Bhakuni *et al.* (1991), Bhakuni *et al.* (1987)

Antioxidant activity

Palaksha *et al*. (2013) investigated the free radical scavenging activity of *Melochia corchorifolia* plant extract and revealed that the highest DPPH (2-diphenyl-1-picryl-hydrazyl-hydrate) inhibition per cent, hydroxyl radical inhibition per cent and hydrogen peroxide inhibition per cent was observed at 100 µg/ml concentration of phenolic content. Free radical scavenging activity of *Melochia corchorifolia* was attributed to the presence of flavonoids and tannins. The ability of methanol extract of *Melochia corchorifolia* in scavenging free radicals was assessed by Harini *et al*. (2015) using DPPH, $ABTS^+$ (cation) and OH^- (anion) and showed that inhibition of free radicals was dose dependent. The maximum free radical scavenging activity was observed at 60 µg/mL concentration.

Anticancerous property

The important hallmarks of cancer that enable tumor growth are excessive proliferative signaling, evading growth suppressors and activating invasion and metastasis (Hanahan and Weinberg, 2011). Hu *et al*. (2012) specified the importance of natural phytochemical compounds as an emerging strategy to prevent, delay or cure cancer. Studies conducted by Harini *et al*. (2015) revealed that methanol extract of *Melochia corchorifolia* exhibited significant cytotoxic effects on MCF7 cell line and maximum cell death (66.84%) at 100 µg/mL concentration.

Kumaran *et al*. (2008) extracted taxol, an anticancer drug from an endophytic fungus *Phyllostica melochiae* isolated from the healthy leaves of *Melochia corchorifolia.* The fungal taxol extract showed strong cytotoxic activity in human cancer cells and the results designated that the fungal endophyte is an excellent taxol supply and could serve as a potential species for genetic engineering to enhance the production of taxol to a higher level.

Antibacterial activity

Rao *et al*. (2012) studied the antibacterial activity of methanol, ethanol and ethyl acetate extracts of *Melochia corchorifolia* against six bacterial strains *viz*., *Streptococcus faecalis*, *Bacillus megaterium*, *Staphylococcus aureus*, *Escherichia coli, Pseudomonas aeruginosa* and *Salmonella typhimurium*. Results showed that methanol extracts at concentrations of 100, 200 and 400 µg exhibited considerable antibacterial activity against tested bacterial species (gram +ve and gram -ve).

Hepatoprotective activity

The uncontrolled production of oxygen free radicals derived from oxygen triggers chronic liver diseases (Afonso *et al*., 2007). Praveen *et al*. (2011) pointed out that rise in concentration of serum enzymes (SGOT and SGPT) indicated hepatic damage. Rao *et al.* (2013) revaluated the hepatoprotective and antioxidant capacity of aerial part extracts of *Melochia corchorifolia* and revealed that the extracts produced concentration dependent percentage protection of liver cells by decreasing the serum enzymes. It was also found that among all extracts, methanol extract showed better activity with percentage protection of SGOT (88.98%), SGPT (89.65%), ALP (82.48%) and total bilirubin (80.0%) levels against CCl_4 liver intoxication.

Anthelmintic activity

Tagbota and Townson (2001) opined that in endemic areas parasitic diseases caused ruthless morbidity. The resistance acquired by gastro-intestinal helminthes against anthelmintic drugs posed a serious hurdle in treatment of helminth diseases (Sondhi *et al*., 1994). Studies on the anthelmintic activity of aqueous and ethanol extracts of *Melochia corchorifolia* against *Pheritima posthuma* revealed that the aqueous extract of *Melochia corchorifolia* at higher concentration of 60 mg/ml showed paralysis and death of worms especially in shorter time as compared to reference drug piperazine citrate (Palaksha *et al.,* 2012). Tannins caused death of helminthes by binding to free proteins in the gastrointestinal tracts of host animal or glycoprotein on the cuticle of the parasite (Athnasiadou *et al*., 2001).

CONCLUSION

Weeds contribute major share in agricultural losses. Conventional practices of weed management *viz*., cultural, mechanical and chemical are often found ineffective in managing the weeds and may hamper the soil health and ecological balance.

Melochia corchorifolia a minor weed has become a troublesome weed in many crops including rice, banana and sesame. Usual efforts to control *Melochia corchorifolia* till date have proved unsatisfactory and cause the weed to extend its domain to new areas. The concept of 'Eradication by utilization' forecasts weed from the status of a bain to boon. Bio-utilization could be adopted as an effective means to bring down the population of *Melochia corchorifolia*.

The properties of the plant in storage pest control and as a botanical pesticide are under explored. The plant parts of *Melochia corchorifolia* have been reported to contain various phytochemicals with pharmacological properties like anticancerous, anthelmintic, hepatoprotective, antioxidant and antibacterial. In light of the above properties of *Melochia corchorifolia*, the plant needs to be recognized as one whose virtues, though identified are still under-exploited.

Conflict of interest

All authors declare that they have no conflict of interest.

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