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Utilization of Weed Plants in Textile Processing: An Effective Management Tool

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ABSTRACT

Various invasive weed plants can create adverse effects on crop productivity, ecology, human and animal health if not controlled. Utilizing extracts of different parts of such plants for textile applications will not only offer a sustainable resource to the textile industry but also protect the environment from ill effects of these species. Knowledge regarding possible uses of weed plants is inevitable in utilizing these plants for textiles processing such as dyeing, finishing or fiber extraction. Hence a brief account of uses of some weed plants has been presented in this paper.

Keywords Environment conservation, Textile processing, Weed plants.

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INTRODUCTION

Processing is important from the perspective of ensuring quality product to the consumers by adding value to textiles which is needed for surviving in the era of global trade. Textile processing is one of the indispensable components of the textile industry. It constitutes various processes that are responsible for converting the raw material into the end product possessing all desirable attributes. Wet processing of textiles comprises dyeing, printing and finishing that use large volume of water and wide variety of chemicals resulting into harmful effluent generation and its release into environment. Gone are the days when people were unaware of the health hazards caused by synthetic agents used for textile processing like dyeing and finishing. However exploiting limited number of natural resources can be a grave matter of concern in forthcoming days. Nonetheless efforts are on its way to explore new sources which are available abundantly or otherwise considered as waste in the ecosystem.

Having agriculture as a major occupation, Indian farmers have always faced the problem of weed plants in their fields, roadside, empty land and wild areas. Weeds are defined as a plant out of place or an unwanted plant or a plant with a negative effect or plant that competes with man for the soil (Kasera *et al.* 1998). Weeds have been identified as the second reason after the habitat destruction for the extinction of native species at world level (Genovesi and Shine

2004). There are various characteristics that make plants a weed like they grow faster and compete with crop plants for light, moisture and nutrients. They can grow in adverse conditions and are harmful to crops, cattle and human-beings. Crop yield losses range from 10 to 80 % due to weeds. In India, weeds are one of the major biological constraints that limit crop productivity (Rao and Nagamani 2013). Weeds have been used for long time as sources of food, fiber, dye, medicines, animal fodder, a remover of water pollutants, green manure, materials for slope management, mulches, ornamental plants, handicraft, broomstick, feeding honey bee, roof thatching and allelopathic plant (Kim and Shin 2012). Some weed species like Japanese mugwort (*Artemesia princes* Pampan.), safflower (*Carthamus tinctouris* L.), American false daisy (*Eclipta prostrata* (L.) annual fleabane (*Erigeron annuus* (L.) Pers.) were used to obtain dye in Korea (Lee *et al*. 2007).

Invasive species such as *Chromolaena odorata, Lantana camara, Parthenium hysterophorous* and *Ageratum conyzoides* have made severe ecological losses in India (Tripathi *et al*. 1981, Annapurna and Singh 2003, Raghubanshi *et al.* 2005, Negi and Hajra, 2007, Reddym 2008). However researches are being conducted to explore effective methods to prevent and control the spread of weeds. In developing agrarian country like India where farmers remain in debt due to crop failures, utilizing weeds for commercial purposes can prove a reliable way to generate overcome poverty. It will also help in preventing the weed flora to become an obstacle on the way of obtaining higher crop productivity.

Making people aware about the possible uses of various weedy plants can promote use of the unused, unwanted plants for gaining profits out of them. Such management by utilization will ensure protecting the biodiversity along with economic and social security from harmful plants. Hence in this paper an attempt has been made to compile information about the uses of weeds in textile applications based on various reports.

Application of weed plants in textiles

Eupatorium adenophorum **:** This is one of highly invasive weed causing losses to biodiversity almost all over India. Various efforts have been put to prevent spread of this weed. Exploiting the plant in dye extraction may also help in reducing the extent of spread. NGOs like *Devbhoomi* and *Avani* in Uttarakhand are utilizing the plant for dyeing textiles and providing employment to the local people. In a study by Bansal and Sood (2001) colors obtained from this plant were greenish raw umber, light greenish raw umber, light umber sienna and olive green. In another study by Sood *et al.* (2006) wool was dyed with eupatorium leaves in combinations with apricot leaf extracts using different proportions at 1:1, 1:2, 1:3, 1:4, 2:3, 2:1, 3:1, 3:2 and 4:1. Different shades like greenish brown, brown and green were obtained using alum as mordant. Fastness to various agents like sunlight, washing, perspiration and crocking were found to be good to excellent. (Fig. 1).

Fig. 1. *Eupatorium adenophorum.*

Fig. 2. *Parthenium histerophorus*

Partheniumhisterophorus: According to Holm *et al.* (1997) this noxious invasive species is one of the worst weeds at present time. This is responsible for severe human and animal health issues such as dermatitis, asthma and bronchitis and agricultural losses apart from great problem for biodiversity. It spreads widely in wasteland, road sides, railway sides, water courses, cultivated fields and overgrazed pastures (Javaid and Adrees 2009). It was used for dye extraction to obtain a range of colors on silk yarn (Suneeta and Mahale 2002). In another study by Mathur and Srivastava (2003) parthenium was used for dyeing wool and silk fabrics using synthetic mordants like alum, chrome, copper sulfate, ferrous sulfate, and stannous chloride. It was concluded that parthenium leaves can be successfully used for dyeing of protein fabrics to obtain a wide range of soft, lustrous, dark and light colors without posing any harmful effect. (Fig. 2).

Chromoleana odorata: It is a species of Asteraceae Family and known in English as Siam weed, is a perennial shrub, native to Central and South America (Mgobozi *et al*. 2008). Reported as one of the world's most invasive, it is considered to be a serious weed in central and western Africa, India, Australia, Pacific Islands and Southeast Asia (McFadyen 2003). It is recognized for its anti-pyretic, antimicrobial and anti-inflammatory properties. Aqueous extract of the plant was used for the synthesis of silver nano particles which were applied on the viscose non woven fabric. The treated fabric exhibited good antimicrobial properties and strong antifungal activity (Resmi and Amsamani 2015), (Fig. 3)

Fig. 3. *Chromoleana odorata.*

Lantana camara : It was introduced in India as an ornamental plant. It soon spread into fields and forest and today has become one of India's most invasive species (Fig. 4). Phenolic, flavonoids, tannin and saponin were peresnt in its leaf extract (Naz and Bano 2013). Its ethanolic extracts along with Copper Oxide nano-particles were coated on gauze materials for imparting antibacterial activity against *E. coli* and *S. aureus* (Neeraja *et al*. 2015). Lantana flowers were also used for production of dye to be applied on cotton fabric. The washing, light and rubbing fastness with mordants were found to be quite good. The study also revealed that heavy metals such as antimony, arsenic, cadmium and lead were not present in the dye extract which indicates it is safe for skin. It was concluded that the dye has good scope in the commercial dyeing of cotton (Saravanan *et al.* 2014).

Ricinus communis: A member of family Euphorbiaceae, *Ricinus communis* L. Fig. 5 grows prolifically and produces toxic seeds that are adaptable to different environments. It is reported as being invasive weed in many countries particularly in the tropics. Phytochemical analysis of ricinus shows presence of phyto-constituents such as tannins and flavonoids (Kensa and Yasmin 2011). Aerial parts of the plant have been utilized for producing dye material. In a study waste fruit coat and leaves were tried to assess

Fig. 4. *Lantana camara.*

Fig. 5. *Ricinus communis.*

their dyeability on cotton and silk fabric. Green dye was extracted from leaf of plant, which gave cream, yellow, light brown muddy brown, black brown and dull black color on cotton and silk fabric with mordant; fruit coat also produced various shades using synthetic mordants. Washing and light fastness property was also found to be good (Deshpande and Chaturvedi 2012). In a similar study by Ramadevi and Kalaiarasi (2015) dye was extracted from its leaves in microwave. The dye extraction conditions of microwave assisted extraction were compared with the conventional method of dyeing. Fabric dyed using microwave assisted extraction exhibited excellent fastness compared to conventional dye extraction method except washing fastness. It was also used for the finishing of denim fabric by Sumithra and Vasugi (2012). The treated fabric showed antibacterial activity against microbes i.e. *Escherichia coli* and *Staphylococcus aureus.* The durability of the herbal finishing was increased by micro encapsulation and nano encapsulation methods.

Eichhornia crassipes (Mart.) Solms: Also known as water hyacinth which invades water bodies badly and becomes problematic to other aquatic plants and animals. It can not be eradicated completely. Its population can be minimized by utilizing it for beneficial purposes as reported by Ghosh in Science reporter.Shergill *et al.* (2015) tested the roots of

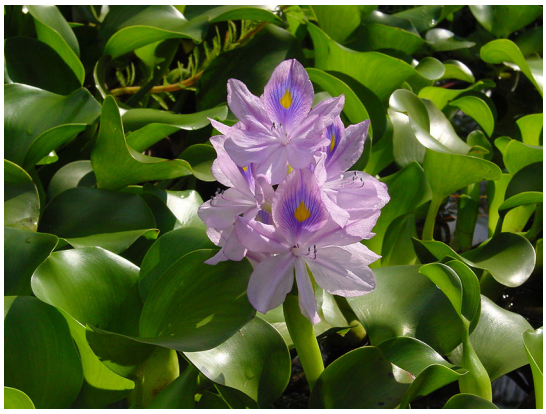

Fig. 6. *Eichhornia crassipes* (Mart.) Solms.

Eichhorniacrassipes (Mart.) Solms for its coloring properties on different textile substrates viz. wool, nylon, silk, cotton and polyester (Fig. 6). The 80% methanol extract as well as the crude extract exhibited good coloring property on wool, nylon and silk. They attributed good color yield to the presence of alkaloids, flavonoids, tannins, terpenoids, quinones, phenols and other phytochemicals in the 80% methanol extract and methanol fraction on substrates. The colored substrates showed better fastness properties especially on wool substrate, however all substrates showed good color depth.

Eclipta prostrata: It is a common weed of lowland rice in India. It is usually found on poorly drained, wet areas; along streams and ditches in marshes and on the dikes of rice paddies (Fig. 7). This plant was

Fig. 7. *Eclipta prostrata.*

Fig. 8. *Datura stramonium.*

used to develop dye for silk for producing green shades (Devi *et al.* 2002).

Datura stramonium: *D. stramonium* is very widely distributed in temperate and tropical areas (Fig. 8). It was reported as a weed in more than 40 crops in almost 100 countries according to Holm *et al.* (1997). In India, it is distributed in the Himalayn region.

In a study by Bhuyan and Gogoi (2013) dyeing of eri silk yarns with datura dye produced various soft and subtle natural shades. Silk yarn sample mordanted with coper sulfate showed good fastness to sunlight, perspiration, pressing, washing and crocking. Daturametel (leaves with fruits) extract treated cotton denim fabric exhibited good antibacterial activity (Sumithra and Raaja 2013).

CONCLUSION

For livelihood security of local people there is a need to promote income generating activities and offer employment at the community level itself. Management of weed plants, which are otherwise a waste, for production of dyes can prove an effective means to enhance the income of local people. This will also offer opportunity for creating small scale dyeing units for colouring the locally available fibers and grasses used in handicraft sector. Commercial cultivation of weed plants is only possible after assessing the merits and demerits associated with its utilization for different purposes. Hence a need exists to explore the weed flora for their dyeing potential which can prove a step towards sustainable community development.

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