Pharmacological Studies of Annatto (*Bixa orellana* L.)

Urvashi Chandel¹, Tahira Begum² and Mohsina Syedy¹*

¹Dept. of Life Science, Career Point University, Kota, Rajasthan, India  
²Dept. of Botany, Govt College, Ajmer (Rajasthan) 305001  
*Corresponding Author E-mail: ali.mohsina.07@gmail.com

ABSTRACT

*Bixa orellana* L. is a shrub having natural coloring pigments. It is used in the formation of food color additives and also lipsticks. So, it is also known as ‘Lipstick tree’. Traditionally it is used in the treatment of snake bite, diabetes and obesity, tonsils, baldness etc. Now a day its various other medicinal uses has been explored. It can use in the treatment of tumor, cancer, aphrodisiac, jaundice, gonorrhea, hepatitis, anti-dysenteric, and antipyretic. Considered good for the digestive system and for treatment of liver disease. This review is an attempt to explore the various traditional uses, pharmacological studies as well as tissue culture studies of *Bixa orellana* L.

**Keyword:** Lipstick tree, Diabetes, Obesity, Tonsils, Baldness.

INTRODUCTION

*Bixa orellana* is a plant having natural coloring agent so, it is a plant having commercial value. *Bixa orellana* is a small tree and it belongs to *Bixaceae* family. It is commonly known as annatto. It is grown to obtain the food coloring agent named carotenoid from mature seeds [1,2]. Mature seeds were collected in the month of February. Flowering occurs in October-december. Bixa is propagated through seeds and cutting. It shows 20% viability of seeds only and it requires a specific soil rich in Mn [3,4]. Conventional propagation via cuttings has limitations because of the intense leaching of a gummy substance and phenolics from the cut ends, which obscure rooting. Hence, in *vitro* propagation of *B. orellana* could be the answer to get more planting material. Traditionally, it has been used as an ingredient in weight- loss products and also in the treatment of snakebite. It is also used in the formation of herbal lipstick.

Annatto possesses various pharmacological activities also like anti-diarrheal, anti-inflammatory, anti-oxidant, hypoglycemic, anti- bacterial.

Taxonomical classification

Kingdom- Plantae  
Order- Malvales  
Family- Bixaceae  
Genus- Bixa  
Species- orellana

English name- Lipstick tree, Annatto  
Hindi name- Latkan  
Gujrati- Sinduri, Marathi- Sendri, Kannada- Rangarnali, Assamese- Jolandhar

Distribution

*Bixa orellana* is native to tropical America and west indies. In tropical Africa it is cultivated on a commercial scale and it has become neutralized to hotter parts of India.
Botanical Description
It is a fruiting shrub. Height of plant approximately upto 6-20 feet. Leaves of this plant is pointed and 5-15 cm long and 4-11 cm wide in size. Flowers occur in vertical upright clusters, showy, white or pink in color with five petals. Fruits is two valved, ovoid, red in color and spiny, and approx. 2.5 – 5 cm long.

Traditional Uses
It is used in the treatment of Snakebite, Diabetes, Weight loss products. It is also used in the formation of lipsticks and food coloring agents.

Cultivation
Soil should be prepared in the same manner as for cotton. Seeds, previously softened by soaking in water, are planted in holes or furrows 2.5-3.5 m apart in shaded nurseries. Seeds germinate in 8-10 days. As the young plants develop, they should be protected by artificial shade or intercrops, with increased light as they get older. When 15-25 inches high, they are ready for outplanting, spaced for final distribution at 4.5-6 m apart. Plantings fare well if in 60 cm cubed plots filled with well aged farm manure. Water well at planting. Can be intercropped with cassava, corn, and malanga. After 3 months, plantation should be weeded and superfluous plants removed. Except for periodical weeding, the plantation needs little attention. ANAI recommends growing medicinal or culinary herbs, like lemongrass, between the shrubs (DAD, WO2). Collection of seed may begin as early as 18 months, a full crop expected 3-4 years after sowing. Trees remain productive for 10-15 years. Capsules are gathered, usually by hand, when they are reddish and beginning to break open. It is wise to prune branches rather vigorously when harvesting the capsules; pruned plants yield better. Capsules are dried in the shade for about 10 days then exposed to the sun until all have opened. Clusters and seeds are then placed in a bag and beaten with a stick to loosen the seed. Thus, seeds are easily removed from the capsule, and little dye is lost. Seeds are then sifted to separate seed from trash. Seed is again sun-dried 4-6 hours before bagging. For home extraction of dye/spice, pouring hot water over the pulp and seeds to macerate and separate them by pounding with a wooden pestle. Remove seeds, letting the pulp settle, pouring off excess water; dry pulp gradually in the shade. In India, the plant produces throughout the year, with two main crops in March and September. In Hawaii, harvests are in May, September, and the best yields are obtained in January, with about 44 kg/ha for round pod variety, and 939 kg/ha for pointed-pod variety. A tree should yield 4.5-5 kg dried seed per year. An average yield of 500-2000 kg/ha per year is satisfactory, but up to 4500 kg/ha have been reported in five-year old fields; 100 kg of seed yield about 5-6 kg of material which contains 12-30% bixin.

Micro Propagation
In-vitro micro propagation has become a promising technique for the bulk production of commercial and medicinal value plants and by this technique germplasm of endangered plants can be stored. For the mass multiplication of Bixa orellana number of attempts has been done some of them are reported here-

Marie-Claire D'Souza and Madhuri Sharon established the in vitro propagation protocol for Bixa orellana. plants were regenerated from shoot apex and nodal explants on B5 medium supplemented with 4.9 µM 2-isopentenyl adenine. The multiplication factor of shoot apex explants was higher (nine shoots per explant) than that of the nodal explants (five shoots per explant). Regenerated shoots from shoot apex explants rooted best on MS medium supplemented with 0.05 µM α-naphthalene acetic acid (NAA), whereas shoots regenerated from nodal explants needed 2.7 µM NAA for rooting. Eighty per cent survival of in vivo transferred plants occurred on the best potting substrate, coco peat. Since the multiplication factor was nine per explant, this protocol can be use for commercial micropropogation [5].

R. Parimalan-et. al. Tried to establish a protocol which help to reduce the time period for in vitro regeneration in annatto (Bixa orellana L.), a highly efficient two-stage plant regeneration protocol had been developed that can be used commercially.
Different types of explants: nodal shoot tips, shoot tips and single nodes from in vitro grown seedlings were inoculated onto the Murashige and Skoog (MS) medium supplemented with different concentrations and combinations of plant growth regulators. Highest number of shoot buds was obtained when nodal shoot tip explants were inoculated onto MS medium supplemented with 31.1 \( \mu M \) \( N^6 \)-benzyladenine (BA) and 14.7 \( \mu M \) phenylacetic acid (PAA). PAA in combination with BA exhibited a synergistic effect on shoot multiplication and elongation. Then they are sub cultured for rooting and the rooted plantlets were hardened and their field survival rate after 6 weeks time was 73% [6].

P. S. Sha Valli Khan et al. developed the protocol for plantlet regeneration from seed callus of *Bixa orellana* L. Seeds demonstrated a high percentage of callus induction and a high yield of white friable callus on Murashige and Skoog (MS) medium containing 5.0 \( \mu M \) 1-naphthaleneacetic acid (NAA) and 2.5\( \mu M \) \( N^6 \)-benzyladenine (BA) within 6 wk of culture in the dark. Callus induction frequency was greater under 24h dark as compared to 16h light/8h dark photoperiod or 24h light photoperiod. Increased myo-inositol (MI: 200mg\( l^{-1} \)) and addition of ascorbic acid (AA: 200 mg\( l^{-1} \)) to the culture medium positively improved callus induction frequency and growth. About 85% of these plants were established in pots containing pure garden soil and organic manure after 3 wk of hardening. Regenerated plants were morphologically uniform with normal leaf, shape and growth patterns. These plants are currently being screened for the presence of agronomically useful genetic variants [7].

**Medicinal Uses**

Seeds and latex used for tumors, cancer. Seeds gargled with vinegar and rice water for cancer of the mouth. Leaf infusion used in Costa Rica to prevent baldness. Leaf infusion gargled for tonsilitis. Bolivians press leaves on aching body parts. Seeds are reportedly aphrodisiac, astringent, cordial, expectorant (laxative and vermifuge), and febrifugal. Astringent febrifugal fruit pulp is used for dysentery and kidney disease. The reddish paste is applied as an unguent to burns. Considered a cosmetic, dye, food, hair dressing, medicine, ornamental tree, and vitamin source. In India, where the useful ornamental weed tree has established itself, as it has pantropically, leaves are used for jaundice and snakebite, the root bark for fevers, including malaria. Fruits are considered astringent and laxative. The plant is also recommended for gonorrhea. The hot water extracts potently inhibit lens aldose reductase, perhaps due to isoscetellarein.

The foliage of Bixa is used to treat skin problems and hepatitis; also used as aphrodisiac, antidysenteric, and antipyretic. Considered good for the digestive system and for treatment of liver disease. Very effective as a gargle for tonsilitis. Chinatecas poultice leaves on cuts to avoid scars. But all these uses have no scientific confirmation. Research is going on to explore these uses of Bixa.

**Pharmacological Activities**

Some activities of Bixa have scientific evidences these are-

1) **Anti-microbial activity**-

O.N. Irobi et.al. descibed anti microbial activity of Annatto extract. For this purpose, an organic extract of Annatto (Bixa orellana) leaves obtained in 95% ethanol was examined for in vitro antifungal and antibacterial activity using the agar diffusion and tube dilution methods. The extract (5 mg/ml) produced antimicrobial action in agar diffusion assays against standard strains of Gram-positive bacteria including Bacillus subtilis, Staphylococcus aureus, and Streptococcus faecalis while exerting only slight action against Escherichia coli, Serratia marcescens, Candida utilis, and Aspergillus niger. The zones of inhibition obtained against the susceptible bacteria were 15-17 mm while those obtained in assays with Chloramphenicol and phenol positive controls were 12-18 mm and 10-28 mm, respectively. The minimum inhibitory concentration (MIC) of the extract was 4-16 mg/ml while its bactericidal action (MBC) was exerted at higher doses (16-64 mg/ml) [8].
2) Analgesic and Hypoglycemic activity-

P. Jusal et al. evaluated the Analgesic and Hypoglycemic activity of *Bixa orellana*. Methanol extract showed significant hypoglycemic activities when administered 15 min. After glucose load using a modified oral glucose tolerance test with Swiss Webster mice as a test animal. An infusion of B. Orellana was found to lower blood glucose level when administered 45 min. Before glucose load [9].

CONCLUSION

*Bixa orellana* L. is an unique plant having commercial potential because of the red color pigment which can be use as food additive and lipstick formation. Bixa has reached to the threatened level. So, it requires *ex-situ* and *in-situ* conservation and also it needs to be evaluated in pharmacological manner and clinical trials to understand its effect on various diseases.

REFERENCES