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Research Article

NUTRITIONAL AND PHYTOCHEMICAL PROFILE OF BOMBAX CEIBA L. FLOWERS – A WILD EDIBLE

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ABSTRACT

Since generations wild plant species are exploited by human for medicine and food. Ethnobotanical studies are mainly concentrated around documentation of these species. An ehnobiological project conducted by Ministry of Environment and Forestes, New Delhi, resulted in reporting 3900 wild plant species uswd as edibles. However, negligible information is available regarding their nutritional potential. Present study was undertaken to evaluate the nutritional and medicinal potential of *Bombax ceiba* L.flowers which were found to be used by tribal and rural people of Vidarbha region of Maharashtra, India. Primary nutrients like protein, carbohydrates, fat, lipids, vit.C vit.A antioxidents and minerals were quantitatively estimated, while bioactive molecule profile was studied qualitatively. Flowers secrete abundant nectar; nectar chemistry was also studied.

INTRODUCTION

Since generations wild plant species are exploited by humanbeings for medicine as well as food world-over. Due to modern agricultural practices life-styles; even tribles and rural folk are avoiding the use of wild edibles. However, at least some of them still continue the use of wild edibles, while some of the species are still favored as delicacies. 'A Status Report' of All India co-ordinated Research Project on Ehnobiology conducted by Ministry of Environment and Forests, New Delhi, has recorded about 3900 wild plant species used as edibles (Anonymous 1994), which is near about 17-18% of Angiospermic flora (species of lower plants are comparatively very less, almost negligible) of the country. Survey of wild edibles of Vidarbha carried out during 2004-2009 resuted in recording 125 angiospermic plant species, out of which flowers of 24 species were foud edible. *Bombax ceiba* L. is one of them.

B. ceiba L. is a large deciduous tree of Bombacaceae, characterized by woody thorns on trunks and branches and large crimson-red flowers that are bird pollinated. The tree is distributed throughout India in dry and moist, mixed deciduous forests as well as in mixed evergreen forests. They are also grown along road sides as avenue trees. During survey the species was found to be used by tribles and rural people of Gadchiroli and Yavatmal Distt. of Vidarbha region of Maharashtra state, India. Young plants (1-2 year old) bear tuberous roots. These are eaten either raw or cooked after removing outer skin. They are starchy and taste like sweet potato. Flowers are fleshy, juicy, testing sweet. Flowers are eaten after removing stamens, either raw or cooked into vegetable. The species is found to be widely used throughout (Jain 1991). The Munda and Oraon tribes of north-eastern India consume the flowers, calyx and roots of young plants. The immature calyx known as "semargulla" is consumed as a vegetable in Utter Pradesh, in addition to fleshy flowers (Jain 1996). Pulp of young fruits is eaten by Bhoxa tribe of Bijnor and Garhwal Distt. (Maheshwari and Singh 1988). Dried and powdered flowers are made into bread with or without corn flour. The gum oozing out from young bark is edible (Anonymous 1988). Ovaries of young flowrs are used in preparation of 'Biryani' – a traditional Indian spicy rice made from 'Basmati' rice in Kerala (Gopakumar and Yasodabai 2012). The flowers are used medicinally also. Flowers and fruits used in snke-bite (Chopra *et.al* 1996). They are astringent and cooling. Paste of flowers applied on cutaneous troubles (Asolkar *et.al* 1992, Khare 2007). They are good for skin troubles, splenomegaly and haemorrhoids (Warrier *et.al* 1994). In addition they are noted to be useful in dysenrty, diarroea, all sorts of stomach problems, gynaecological problems, to promote conception, to induce permanent sterility and for urinary problems (Katewa *et. al* 2001 and Parmar 2001).

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Because of wide use of flowers, they were selected for nutritional and phytochemical studies.

MATERIAL AND METHODS

Fresh flowers were collected, washed, excess removed with blotting paper and stamens removed. Fresh flowers were preserved at 4 0c.for fresh tissue analysis, while powder was made of shade dried flowers and stored in zip-locked bags in fridge. Nutritional analysis was done following Thimmaiah (1999) and, Sadashivam and Manikkam (2005). Flowers produce abundant nectar. Flowers were bagged for 24 hoursand floral nector was collected. Sugars were studied by one diamentional chromatography. For better results chromatograms loaded with nectar were kept at low temp. in refrigerator for 24-48 hours. Ethyl acetate : acetic acid ; water (9:2:2) as solvent system and 1% resorsinol in absolute alcohol and 0.2 N HCl (1:1) as developer were used. For amino acid study nectar was preserved in iso-propenol. Sugars crystallize at bottom and solution contains only amino acids.They were studied by two diamentional chromatography (Lederer and Lederer 1957 and Harborne 1973). To study mineral profile, dry powder was made into ash. Different minerals were tested qualitatively (Johanson 1940, Evans 1997) as well as quantitatively using spectrophotometer (for iron and phosphorus following Gupta and Varshney (1997) and flame photometer (for sodium potassium and calcium). Since flowers are used medicinally; the tissue was tested for 16 types of bioactive molecules (Chabra 1984, Evans 1997, Harborne 1973, Peach and Tracy 1979, Kokate *et.al* 1998 and Kulkarni and Apte 2000). Responses to these testes were denoted as + (weak), ++ (moderate), +++ (strong); which is indicative of concentration of the compound in the tissue.

RESULTS AND DISCUSSION

Fresh flowers were found to contain primary nutrients in following proportions per 100 gm. fresh tissue – moisture 85.7 %, total carbohydrates 1.48 gm., reducing sugars 1.314 gm., non- reducing sugars 0.107 gm., protein 0.7 gm., crude fat 0.75 gm., total lipids 1.5 gm. and crude fiber 2.58 gm.

Dry flowers are also used in various food preparations. Hence, primary nutrients per 100 gm. dry tissue were also estimated. The values obtained are – total carbohydrates 10.36 gm., starch 0.432 gm., reducing sugar 9.19 gm., protein 5.1 gm., crude fat 0.53 gm.

Results of primary nutrient profile clearly show that *B. ceiba* flowers can be advocated as good nutritional supplement.

Vitamin content was estimated for fresh tissue only. However, vit. C and A do not degrade with shade drying . Values per 100 gm. fresh wt. are – Ascorbic acid (vit. C) 7.82 mg. and beta-carotene 800 mg. Value of vit. A and retinol were further calculated following Gopalan *et.al* (2004). Values come to be vit. A 133333 IU and retinol 400 mg. Considering the daily requirement of vit.A which is 2500IU and the fact that only 50% of beta carotene is absorbed by human body; vit. A content of flowers is ideal. According to WHO 1995 report India comes under vit. A deficiency region (F. Ahmed and Darton Hill 2005). Promotion of such wild edibles can help in combating these deficiencies in natural way. Also people consuming diets rich in carotenoids from natural foods, are healthier and have low mortality from a number of chronic illness (Diplock *et.al* 1998).

Lycopene content was found to be 0.19 mg., anthocyanin 3.89 mg. and phenol 13.708 mg. per 100gm. fresh tissue. These pigments play very important role in human health. Presence of anthocyanin can provide potential health benefits against cancer, aging and neurological diseases (Stoner 2007, HOU Dx 2003). Dietary lycopene increases serum level and lowers oxidative damage to lipids, lipoproteins, proteins and DNA (Agrawal and Rao, 1998). Mohanty *et. al* (2001) has shown that 8 mg. lycopene per day is effective against infertility in males. Anthocyanins also play protective role against various xidative stresses (Youdim *et.al* 2000). Phenols act as aromatizer, flavoring and antioxidant agents. The flowers thus can serve as good antioxidant.

Flowers are ornithophilous; some bird species, squirrels and monkeys eat flowers, because they secrete abundant nectar. Basal part of calyx is lined by dense growth of secretary , filiform, clavate hairs interspersed with long unicellular non-secretary trichomes. Nectar was found to contain fructose, glucose and sucrose; the fructose being dominant sugar. Nectar is rich in amino acids. Total 11 types of amino acids were detected of which seven are non- essential – DL-alanine, Alanyl glycine, Arginine-monohydrochloride, Glutamic acid, Lanthionine, Serine and Proline; while, four are essential amino acids – Cysteine, iso-Leucine, Leucine and Thrionine. Glutamic acid, cysteine and glycine are components of glutathione. It is a precursorof the neurotransmitter, gama-amino butyric acid in brain (Srilakshmi 2002). However, these sugars and amino acids are available only when flowers are eaten raw; when they are made into vegetable, they first washed; which will wash-out the nectar.

Mineral content in terms of ash yield was found to be 5.47 gm. per 100 gm. dry tissue. Of this water soluble fraction is 40%, acid soluble 60% and sulphated ash yield is 32%. Qualitative analysis showed presence of sulpher (+), Magnesium (++), chloride (+++) and Manganese (+); while Nickel, Copper and Aluminium were absent. Quantitative estimation showed Calcium 0.273gm., Potassium 0.18 gm.,Sodium 1.039 gm., Phosphorus 0.04 gm. and Iron 0.04 gm. per 100 gm. dry wt. Dietary role of minerals is well known. Magnesium and Manganese are either structural part or activate large number of enzyme systems. Sodium, potassium and chloride keep water and acid base balance. Calcium, phosphorus and iron are essential elements required in daily amount of 0.4 gm., 0.6 gm., 1 gm. 1-3 mg. respectively (Gopalan *et.al* 2004). *B. ceiba* flowers thus prove to be a good source of minerals.

B. ceiba flowers are used medicinally also. They were found to contain Flavanones (+++), Leucoanthocyanins (++), Catechol (++), Hydroquinone (++) and Pseudo-tannins (++); while iridoids, alkaloids, anthraquinones, cardenolides, steroids, saponins, fatty acids, emodins, polyoses, polyurenoids and anthracene glycosides were absent. Flavanones are a group of flavonoid compounds, known for their anti-inflammatory and anti- allergic effects, protect gastric mucosa and inhibit tumor formation. Catechol acts as stimulant, while fluroglucinol derivatives of hydroquinone have taenicidal properties (Evans 1997).

The nutritional and phytochemical studies clearly reveal the potential of *Bombax ceiba* L. flowers. Scientific advocation and commercialization of these flowers will support the rural economy.

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