International Journal of Minor Fruits, Medicinal and Aromatic Plants. Vol. 4 (1) : 44-49, June, 2018

Short communication

Blood fruit [*Haematocarpus validus* (Miers) Bakh. f. ex Forman] – A potential nutraceutical and therapeutic fruit plant

Kalkame Ch. Momin[1], Achume N. Sangma[2], C. P. Suresh[2], Y. S. Singh[2] and S. R. Rao[3]

[1]*Department of Floriculture (O&MAP), Central Agricultural University, College of Horticulture and Forestry, Pasighat, Arunachal Pradesh 791 102, India*

[2]*Department of Horticulture, North Eastern Hill University, Tura Campus, Meghalaya 794 002, India*

[3]*Department of Bioinformatics, North Eastern Hill University, Shillong Campus, Meghalaya 794 002, India*

Email: kalkame.momin@gmail.com

Received : 21.03.18 ; Revised : 23.04.18 Accepted : 30.04.18

INTRODUCTION

The increasing population coupled with poverty, natural and man-made crisis poses a challenge to the socio-economic and accessibility to food. However, it is well known that wild edible plants are vital, inexpensive, rich source of vitamins, anti-oxidants, fibre, minerals and other nutrients. A rich diversity of one or the other wild edible plants is found throughout the country that is being consumed by the locals. Since time immemorial, traditional knowledge and indigenous evidences suggest that a variety of wild edible plant species have played a prominent role in providing health and nutritional security to man and animals (Hunde *et al*. 2011). Inspite of their potential, there are large numbers of wild edible plants that have still not been properly addressed for their nutritional issues and are still greatly neglected in daily diets.

Amongst the various species of wild plants, one of the promising and potential sources as fruit, medicine, nutrition and natural colourant is *Haematocarpus validus*, popularly known as '**Blood Fruit**'. Etymologically, the word *Haematocarpus* is derived from two words, *viz*., *haem* meaning iron containing compound and *carpus* meaning fruit. It was first described by John Miers (Singh and Bedi, 2016). Fruits are dark red in colour with full of copious blood red juice when ripe and densely fibrous and hence the name '*blood fruit*'. *H. validus* is a dicotyledonous plant species included in the genus *Haematocarpus* and belongs to the family Menispermaceae. The family Menispermaceae is mainly restricted to tropics and subtropics; however, few species are also found growing in the temperate regions. The plants in the Menispermaceae family are known to be rich in different alkaloids and are famous for their traditional medicinal usages.

Two species of the genus *Haematocarpus, viz., H. subpeltatus* Merr., and *H. validus* (Miers) Bakh.f.ex Forman has been reported from South Asia extending to Philippines, Borneo and Sulawesi (Mabberley, 2008) and one species, *H. Validus* from India (Kanjilal *et al*., 1934).

The importance and ethno-medicinal values of this fruit is well recognized and are utilized by few old members of the village people for its iron-rich fruit. But a little research has been done on identification, proper utilization and the information available is scanty.

Synonym:

Baterium validum, *Fibraurea haematocarpus*, *H. comptus* Miers., *H. thomsonii* Miers. (Singh and Bedi, 2016)

Vernacular name:

Blood fruit (English), Khoon phal (Hindi), Roktogula/Lalgula (Bengali), Rosco (Chakma), Thoyphal (Tripura), Te.pattang (Garo), Theichhung-sen (Mizo), Ranguichi (Marma) Raktaphal (Tamil/Telugu/Malayalam), Sohsnam (Khasi & Pnar).

Distribution and habitat

Blood fruit is native to South East Asia and is mainly distributed in India, Bangladesh, Indonesia, Singapore, Thailand and Sri Lanka. In India, the fruit is found growing wild in Andaman & Nicobar Islands, Arunachal Pradesh, Mizoram, Tripura, Assam and Meghalaya. The plant is generally found growing wild but not cultivated.

H. validus is an evergreen perennial creeping woody climber capable of growing under extreme conditions, from very dry environments to highly acidic soils. It grows up to 1000 m and more in height (Rahim *et al*., 2015) with dark green glabrous profusely branched stems. It creeps and grows on other big trees like banyan tree, jackfruit, *Baccaurea species* or other long supporting tree. A recent study by Singh and Bedi (2016) in Meghalaya stated that the forest type of species occurrence was characterized by the presence of subtropical moist evergreen trees, and a huge number of herbaceous undergrowth on a hilly landscape. The vegetation composition at this site was found to be dominated by native tree species such as *Castanopsis indica* (Roxb.) A.DC. (Fagaceae), *Engelhartia roxburghiana* Wall. (Juglandaceae), *Litsea salicifolia* Roxb. ex Nees (Lauraceae), *Mallotus philippensis* (Lam.) Muell–Arg. (Euphorbiaceae), *Ostodes paniculata* Blume (Euphorbiaceae), *Schima wallichii* Korth.(Theaceae), and *Terminalia chebula* Retz. (Combretaceae).

Botanical Description

Haematocarpus species are large woody climbers which spread on tall trees. Leaves are simple, alternate, non-peltate, elliptic, 3 veined, petiolate. Bark is light grayish brown, rough, branches stout, wood consisting of consecutive layers of thin radiating plates. Inflorescence is cauliflorous, axillary, extra-axillary, terminal panicle or raceme. *Haematocarpus* species are dioecious where the male and the female flowers are borne separately. . Male flowers, sepals 12-15, in 3 series, usually inner series larger, imbricate, petals 6, 3 of the inner series auriculate at the base, stamens 6, free, enlarged connective projecting inwards. Female flowers sepals and petals similar as in male flowers, staminodes 6, minute, carpels 6, style reflexed. Fruits are drupes, narrow near the base, stalked, style scar near the base, smooth endocarp. Seeds are curved, non- endospermic, radicle short, cotyledons thick and long. Seeds may be dispersed by barochory *i.e*., gravitational dispersal, zoochory *i.e*., dispersal by birds or animals, anthropochory *i.e*., dispersal by humans.

Table 1: Morphological characteristics of Blood fruit collected from Garo Hills, Meghalaya

Characters	Value
Leaf length	9.34-13.00 cm
Leaf width	3.89-5.78 cm
Fruit weight	12.85-30.85 g
Fruit girth	25.34-35.93 mm
Rind weight	6.21-16.34 g
Rind thickness	3.98-5.31 mm
Seed weight	1.47 -6.41 g
Seed length	3.20-5.20 cm
Seed girth	14.0-19.69 mm
Pulp weight	3.21-8.79 g
Pulp peel ratio	0.32-0.95%
Pulp seed weight	4.96-15.08 g

(Source: Sangma, 2016)

Table 2: The nutritional composition of fruit (per 100 gm)

Parameters	Unit	Contents
Moisture	gm	90.12
Protein	gm	0.6
Carbohydrate	gm	6.99
Fat	gm	1.44
Crude fibre	gm	1.22
Ash	gm	1.23
Energy	Kcal	50
Vitamin C	mg	13.15
Carotenoids	µg	1170
β- carotene	µg	9.0
Iron	mg	0.57
Copper	µg	129.57
Zinc	µg	0.14
Manganese	µg	152.04
Calcium	mg	9.16
Magnesium	mg	6.86
Sodium mg	0.42	
Potassium	mg	255.70
Phosphorus	mg	39.50

(Source: Khatun *et al*., 2014)

The flowering time varies depending on the place. Under Andaman conditions, the species has been observed to flower more than once in a year. Peak season of harvesting is from April to August (Bohra *et al*., 2016). In Bangladesh, the vines produce

Table 3: Anti-nutritional factors (mg/100g) in *H. validus* fruits

Fruit fraction	Anti-nutritional factors (mg/100g)			
	Nitrate	Phytate	Oxalate	Saponin
Pulp	16.25	422.68	34.95	85.56
Pericarp	25.00	506.83	39.82	85.28
Seed	19.58	415.83	33.82	100.06

(Source: Singh *et al*., 2014)

flower in mid November-January and the fruiting season is May to August (Khatun *et al*., 2014). Under Garo hills condition of Meghalaya, the vine comes into flowering from October to December and fruits are available in the local markets from last week of March till June (Sangma, 2016).

The study on the morphological characteristics of this plant was conducted by Sangma (2016) in Garo Hills region of Meghalaya. Studies revealed that the plants have climbing growth habit, tall and fruit shapes were recorded to be ovoid . Fruit colour varied and according to RHS colour chart, N34A, N30A, 53D, 33A, 45A, N34B, 53A, 45B, 46-A, 42A, 46B colour. Inflorescence was small to intermediate and inflorescence position was found to be pseudo-raceme axillaries.

Phyto-chemical composition

Analysis and identification of phyto-chemicals is important for recognizing the potential of indigenous wild edible fruits as reliable supplementary food nutrition. The fruit taste is acidic but of a pleasant flavor when fully ripe. The fruit contains 90.12% moisture, highly acidic pH (2.77), TSS (12.40%), titratable acidity (5.08%), total sugars (27.232%), reducing sugar (6.90%), non-reducing sugar (26.67%) and phenol of 0.51% (Sangma, 2016; Rahim *et al*., 2015). Fruits are also rich in total polyphenol (400 GAE mg/100g), flavonoid (542 RE mg/100g), tannin (275.56 TAE mg/100g) and anthocyanin (203.77 C3GE mg/100g) as reported by Singh *et al*. (2014).

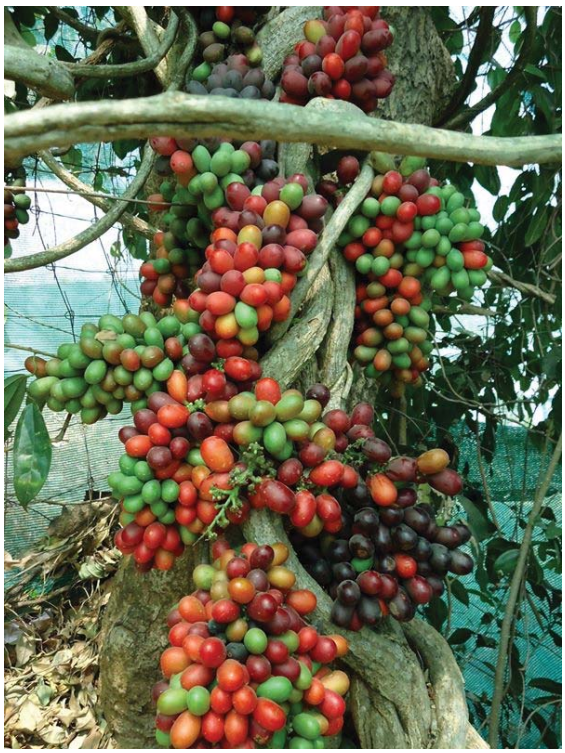
Nutritional composition

Wild edible fruits which have been identified to have rich nutritional value as the cultivated ones play an important role in food and nutrient supplement of the rural poor and tribal communities.. Many of these edible fruits are abundantly available in the forest and wild areas, and huge quantities of wild fruits are usually not collected and wasted because their therapeutic properties and potential as subsidiary food sources are practically unknown to the village and rural communities (Nazarudeen, 2010). The nutritional and therapeutic value of this fruit is extremely important to consume in greater quantity for a balance diet. Regular consumption of such nutraceutical fruit could provide several health benefits and may reduces the risk of several diseases like diabetes, cancer, coronary heart disease, neurodegenerative ailment and aging as well. With alarming increase in human population and depletion of natural resources, it has been felt necessary to explore the potential of this crop for food and other industrial uses to meet challenges of hidden hunger.

Fruits of *H. validus* are found to be rich in iron (0.57 mg/100 g) and seeds contain 0.11 mg/100g which is comparatively higher than the commercial fruit crops such as mango (0.2 mg/100g), apple (0.1 mg/100g), guava and cherries (0.3 mg/100g) (Singh, 2013). Consumption of blood fruit can help in overcoming iron deficiency problems and also anaemia related disorders. Vitamin C content (13.15 mg) is also higher than the commercially available fruits, *viz*., jackfruit (11.08 mg), litchi (7 mg), papaya (7.48 mg) and mango (10.88 mg) (Islam *et al*., 2012). Besides fruits are also a rich source of micro-nutrients like Ca, , Mg, K and P and natural antioxidants due to the high content of carotenoids, β- carotene and minerals.

Presence of anti-nutritional factors

Advances have been made in the nutritional values and health benefits of wild edible fruits, however, there is a dearth of knowledge about its anti-nutritional contents. Available of information on the anti-nutritional contents of these fruits will aid their maximum utilization as food products. These fruits are also known to contain anti-nutritional factors that can interfere with the metabolic activities of the body which in most cases predispose negatively on growth and bioavailability of nutrients. Anti-nutritional factors are the determining factors for the exploitation of plants



a. Bearing plants of *Haematocarpus validus*

b. Ripe fruits

c. Flowers

d. Cross section view of blood fruit

as food materials. They are also known as secondary metabolites and are generated naturally in feed stuffs through normal metabolism of the plant species. Some of the common examples are saponins, tannins, flavonoids, alkaloids, trypsin (protease) inhibitors, oxalates, phytates, haemagluttinins (lectins), cyanogenic glycosides, cardiac glycosides, coumarins, gossypol, *etc*. (Rout and Basak, 2015). The presence of anti-nutritional compounds have also been reported in fruits like *Ficus racemosa L., Elaeagnus conferta Roxb. Flacourtia indica (Burm. f.) Merr,etc.* which is within the safe permissible limit (Rathod and Valvi, 2011).

Blood fruit was also found to contain nitrate, phytate, oxalate and saponin (Table 3; Singh *et al*., 2014),. The analysis of three different parts of blood fruit showed that the pulp, an edible portion had low nitrate and oxalate content and in a safe health limit for consumption. The seeds comparatively had high amount of saponin which indicates its potential for use in industries.

Uses

Even though *H. validus* is a lesser known fruit, yet it has a lot of potential uses. Fruits are slightly acidic, sweet in taste when fully ripe and are eaten raw. The fruits have high anthocyanin content which gives true blood red colour which can be used as a natural colouring agent and natural additive dye for food products (Singh *et al*., 2014). Fruit extracts can also be used in colouring soft drinks and desserts. This will be helpful in avoiding health risk associated with artificial colouring. The Chakma and Marma tribes of Chittagong in Bangladesh use the tender shoots extract as curative measure for jaundice. Fruits and seeds are also used as curative measure for anaemia and root mash is used to get relief from itching (Rahim *et al*., 2015). The iron rich blood fruit is highly valued by the Garo tribe in Meghalaya to treat anaemic or blood related disorders. Ripe fruits are sliced and soaked in a glass of water overnight and taken as medicine the next morning. They also use this fruit for preparing wines (Sangma, 2016). In Tripura, the fruits are being used as a dye in colouring the handicrafts and also in preparation of squash. Processed products like pickles and chutneys are also prepared from green fruits. Ripe fruits can also dried and stored and used for future consumption (Bohra *et al*., 2016).

Future prospects

With the growing concern and commitment to hill area development and poverty alleviation by the government, there has been an increasing interest in low untapped and underutilized wild bio-resources that contributes to the household food and livelihood security. The value and importance of the wild edible plants and *H. validus* in particular, is less attention being given at various level. Many neglected and underutilized species play a role in balancing a cultural diversity associated with food habits, health practices, religious rituals and social exchanges. Focusing attention on neglected and underutilized species is an effective way to help a diverse and healthy diet and to combat micronutrient and deficiencies, the so-called 'hidden hunger' and other dietary deficiency particularly among the rural poor and the more vulnerable social groups in developing countries. An emphasis needs to be given to identify more areas to explore the potential pockets for cultivation which can bring in more economic benefits to the local communities if harnessed properly.

Research on the utilization aspect will help to identify new uses and improve production and also promote welfare of the local community. Information and research concerning the crop improvement, propagation, utilization, agro-techniques, nutritional and conservation aspects, especially on this particular fruit species is extremely scarce and needs to be worked upon. Efforts need to be directed towards better maintenance of their resource base, both through *ex situ* and *in situ* conservation methods, to ensure their development and sustainable use by present and future generations. For making the blood fruit more popular, it is important to morphologically screen populations from different geographical regions of the country. This endeavour can assist in identifying plants with edible and larger fruits, exhibiting wider adaptability, having tolerance to disease and insect pests which can later be used for the breeding purpose. It is also important to improve the acceptability and marketability of this fruit by making people aware of their nutritional qualities.

New technologies like molecular genetics and GIS, will certainly play their part in the process of developing conservation and use strategies. Improving the availability of information on underutilized crop species is one of the most important areas that demand our immediate attention. Besides these, there is a scope for studying the response of pruning, training and other cultural practices. Standardization the post-harvest techniques including packaging and value addition could also be taken up. Suitable procedures for isolation of anthocyanins and its utilization as a natural colourant for preparing products also need to be standardized (Bohra *et al.,* 2016). Since traditional knowledge in this wild edible fruit is being eroded through acculturation and the loss of plant biodiversity along with indigenous people and their cultural background, hence promoting research on this wild fruit is crucial in order to safeguard this information for the future generations and their conservation.

REFERENCES :

Bohra P., Waman A.A. and Roy S.D. 2016. Khoon Phal [*Haematocapus validus*(Miers) Bakh ex. F. Forman] CRP-AB/Underutilized Species/T.B.-01, ICAR-CIARI, Port Blair.

Hunde D., Njoka J., Zemede A., Nyangito M. 2011. Wild edible fruits of importance for human nutrition in semiarid parts of east shewa zone, Ethiopia: associated indigenous knowledge and implications to food security. *Pakistan Journal of Nutrition,* **10**:40–50.

Islam, S. N., N. I. Khan and M. Akhtaruzzaman. 2012. Food Composition Tables and Database For Bangladesh with Special Reference to Selected Ethnic Foods. Institute of Nutrition and Food Science, University of Dhaka, Dhaka-1000, Bangladesh. p. 9

Kanjilal U.N., Kanjilal P. C and Das A. 1934. Flora of Assam, Vol 1. Prabasi Press, Calcutta, pp 57–58

Khatun M. J. M., Mahfuzur Rahma M., Rahim M.A. and Mirdah M.H. 2014. Study on the taxonomy and nutritional status of Lalgula (*Haematocarpus validus*): A Promising endemic ethnic fruit of Bangladesh. *International Journal of Sustainable Agricultural Technology* **10**(2):1-4.

Mabberley D. J. 2008. Mabberley's plant-book: a portable dictionary of plants, their classiûcations, and uses. Cambridge University Press, Cambridge, p 1040 3.

Nazarudeen A. 2010. Nutritional composition of some lesser-known fruits used by ethnic communities and local folks of Kerala. *Indian J. Tradit. Knowl*., **9**(2): 398-402.

Rahim M.A., Khatun M.J.M., Mahfuzur Rahman M., Anwar M.M and Mirdah M.H. 2015. Study on the morphology and nutritional status of Roktogota (*Haematocarpus validus*)- an important medicinal fruit plant of hilly areas of Bangladesh. *International Journal of Minor Fruits, Medicinal and Aromatic Plants,* **1**(1):11-19.

Rathod V. S. and Valvi S. R. 2011. Anti-nutritional factors of some wild edible fruits from Kolhapur district. *Recent Research in Science and Technology,* **3**(5):68-72

Rout P. and Basak U.C. 2015. Screening of antinutritional factors of nine underutilized wild edible fruits of Odisha. *Annals of Biological Sciences,* **3**(4): 21-27

Sangma A. N. 2016. Morphological and biochemical characterization of Blood fruit (*Haematocarpus validus*) in Garo Hills region of Meghalaya. M.Sc. Thesis submitted to North Eastern Hill University, Tura Campus. Meghalaya.

Singh B. and Bedi Y.S. 2016. Rediscovery, taxonomic history and extended enumeration of *Haematocarpus validus* Bakh.f.ex. Forman (Menispermaceae) to Indo-Myanmar biodiversity hot-spot. *National Academic Science Letter,* ISSN 0250-541X, DOI 10.1007/s40009-016-0483-8

Singh D.R, Singh S. and Shajeeda Banu V. 2014. Estimation of phytochemicals and determination of beta carotene in *Haematocarpus validus*, an underutilized fruit of Andaman and Nicobar Islands. *European Journal of Environmental Ecology,* **1**(1):12-15.

Singh, D. R. 2013. Antioxidant rich fruits. *The Ecology of India,* Port Blair. p.4.