

Study on the ethnobotany and nutritional status of three edible *Ficus* species in hill district of Bangladesh

M. J. M. Khatun¹, M. Mahfuzur Rahman, M.A. Rahim², Md. Jakariya³ and M. H. Mirdah⁴

Plant Ecology and Environment Laboratory, Department of Botany, Jahangirnagar University, Saver, Dhaka, Bangladesh

² Department of Horticulture, Bangladesh Agricultural University, Mymensingh, Bangladesh

³ Dept. of Environmental Science and Management, North South University, Dhaka, Bangladesh.

⁴ Department of Agricultural Extension, Khamarbari, Dhaka, Bangladesh.

¹ Email: jannatmahbuba75@gmail.com

ABSTRACT

The natural habitats of the Khagrachari of Bangladesh are incredibly full of natural biological resources, on which the tribal ethnic people, primarily, depend for their all sorts of livelihood. Along with different food items, they traditionally use different ethnic fruits. Wild edible Fig plants (*Ficus* sp.) make a significant contribution to diets and medicines of ethnic people. Among those *Ficus carica* L., *Ficus semicordata* Buch.-Ham. Ex smith and *Ficus auriculata* Lour. belonging to the family Moraceae have been traditionally used by ethnic people in Khagrachari hill district as the popular food and medicine plants. Present investigation has been aimed to study the ethnobotany and nutritional status of these three important edible figs. The results showed the highest protein and fat contents in *Ficus auriculata*, while the lowest in *Ficus semicordata* and *Ficus carica*, respectively. Starch contents were the highest in *Ficus carica* and the lowest in *Ficus auriculata*. β -Carotene and mineral contents were the highest in *Ficus auriculata* but vitamin C contents were the highest in *Ficus semicordata* and the lowest in *Ficus carica*. Fig fruit extracts have been recommended for developing herbal formulation that could reduce the diarrhea and dysentery and prevent cancer development.

Key words: Bangladesh, edible *Ficus* sp., ethnobotany, hill district, nutritional status

INTRODUCTION

Bodo-Dumur (*Ficus auriculata* Lour.), *Angir-Dumur* (*Ficus carica* L) and *Sadimadi-Dumur* (*Ficus semicordata* Buch.-Ham. Ex smith) are three popular wild edible fruits of Khagrachari district in Bangladesh. *Ficus*- the fig genus consists of over 800 species within 40 genera of the Moraceae family (Gaire *et al.*, 2009). In this sub-continent fig grows naturally. A good number of *Ficus* species have been reported as food and for medicinal properties in Ayurvedic and Traditional Chinese Medicine (TCM). There are many *Ficus* species, which grow everywhere in Bangladesh and Khagrachari is the most suitable place for fig plants. Thirty six species of *Ficus* are reported so far from Nepal but a detail investigation of their indigenous uses has never undertaken till now (Kunwar and Bussmann, 2006). Besides their usage as food item; these wild fruits plants are also explored for their medicinal properties. Most of these species are utilized against various

diseases by the local communities through their indigenous knowledge. *Ficus* sp. has got various traditional medicinal uses such as in treating wounds, diarrhea and dysentery, mumps, cholera, vomiting etc. (Ripu *et al.*, 2009). Nutrient analysis of wild edible fruits plays a crucial role in assessing their nutritional significance (Pandey *et al.*, 2006). The considerable use of wild edible fruit species by the local people in hill districts of Bangladesh in their diet motivated us to carry out the present work on nutrients analysis of *Ficus* species. In spite of their importance as a food source, there are no published reports on the nutritional composition of wild edible figs. The present study was therefore initiated to evaluate the ethnobotany and nutritive value of *Ficus carica*, *Ficus semicordata* and *Ficus auriculata*.

MATERIALS AND METHODS

Wild fruits of edible figs, *Ficus carica*, *Ficus semicordata* and *Ficus auriculata* used as experimental material, were collected from

Shotokheda, Ramgorh of Khagrachari district and Pablakhali of Rangamati district through an initial ethnobotanical survey (January, 2011-september, 2014). The collected fruit materials were placed in polythene bag to prevent loss of moisture during transportation to the laboratory. Efforts were made to collect these plants in flowering and fruiting conditions for the correct botanical identification. Detailed ethnobotanical information was recorded while collecting voucher specimens. Botanical identification and authentication were made through consulting the Encyclopedia Flora of Bangladesh and expert taxonomist in Bangladesh National Herbarium (DACB), Dhaka and cross checking was also done through matching with the specimens preserved in DACB. Chemical and nutritional analyses were done at Postharvest Technologies Division and Soil Science Division, Bangladesh Agriculture Research Institute (BARI), Gazipur, Dhaka.

Preparation of samples

Freshly collected sample was washed with deionized water to eliminate visible dirt and excess water was quickly removed with blotting paper. Then the samples were cut into small pieces, homogenized and accurate amount was weighed as required for different analysis. Three test samples from each fruit were selected for measurement of various parameters.

Reagents

All chemical and reagents used in the analysis of the nutrient profile were of analytical

grade and were purchased from Merck (Darmstadt, Germany, BDH, UK). β -carotene, ascorbic acid and minerals standards, 2,4 di-nitrophenyl hydrazine were purchased from Sigma Chemical Co. (St. Louis, MO, USA).

Methods of nutrient analysis

a. Estimation of weight, p^H , Titratable Acidity, Moisture, TSS and Total sugar

Weight of figs was estimated by digital weight balance. The pH was determined with digital pH meter (Ibrahim, 2002) and Titratable acidity was estimated with the visual acid-base method (Ranganna, 1986). Moisture content was determined by digital moisture analyzer. Total Soluble Solid (TSS) was determined with hand refractometer (Gofur *et al.*, 1998). Total sugar was determined by Lane and Eynon method (Ranganna, 1986).

b. Estimation of Protein

Protein content in the food item was determined by indirect method estimating total nitrogen. It was calculated by multiplying the total nitrogen using the respective factor as estimated by Micro-Kjeldahl method (AOAC, 1998b).

c. Estimation of Fat

Powdered sample was subjected to extraction with mixture of chloroform and methanol (Raghuramulu *et al.*, 2003). Total fatty acid content was estimated by calculation and by multiplication of total fat content by a factor.

Table 1. Pictures of three edible ethnic figs



Fig 1: *Ficus carica* L



Fig 2: *Ficus semicordata* Buch.-Ham. Ex smith

d. Estimation of Starch

Starch was hydrolysed into simple sugars by dilute acids and the quantity of simple sugars was measured colorimetrically (Ranganna, 1986).

e. Analysis of Vitamin C

Ascorbic acid was estimated by spectrophotometer method (AOAC, 1998e). The fresh fruit sample was homogenized in a mortar with pestle using metaphosphoric acid, filtered, treated with 85% sulfuric acid solution and 2,4-dinitrophenylhydrazine and incubated at 60°C for 60 minutes in water bath. It was read at 520nm in spectrophotometer (UV-1601, UV-Visible, Shimadzu, Tokyo, Japan).

f. Analysis of β - Carotene

Reverse phase HPLC (Shimadzu PC based Binary Gradient HPLC Prominence System with PDA Detector, SPD- M20A; Solvent delivery System, LC-20AT; LC Solution Multi workstation Software was used to determine the β -Carotene (Roriguez-Amaya, 2004).

g. Analysis of mineral profile

Mineral content was analyzed by Atomic Absorption Spectrophotometer method (Petersen, 2002).

RESULTS AND DISCUSSION

Taxo-Ethnobotanical Information of three *Ficus* spp.

Scientific name : *Ficus carica* L

Synonym : *Ficus carica* var. *caprificus* Risso

Common/Local name : Common fig; *Deshi dumur*

Vernacular name : *Angir-dumur*, *Anjir* (Bangla), *Sudreshi* (Marma), *Soficgula* (Chakma), Common fig, European fig (English).

Family : Moraceae (Mulberry family)

Distribution

The fig is believed to be indigenous to Western Asia and to have been distributed by man throughout the Mediterranean area. It is found everywhere in Bangladesh.

Botanical description

Ficus carica, commonly called common fig, is a deciduous shrub or small tree. It is noted for its spreading habit, attractive foliage and edible fruit. Old trees with smooth silver-gray bark (sometime gnarled with age) are ornamentally attractive. Large, palmate, hairy, 3-5 lobed leaves are rough dark green above and smooth light green beneath. Non-showy greenish flowers form in spring inside hollow receptacles near the branch growing tips. The most fig cultivars are parthenocarpic (fruits develop without cross pollination). The fruit (edible fig) develops within each receptacle.

Consumption practice

Fruits are eaten raw or as vegetable. The latex is widely applied on warts, skin ulcers and sores, and taken as a purgative and vermifuge, the fruits are much used as poultices on tumors and other abnormal growths. The leaf decoction is taken as a remedy for diabetes and calcifications in the kidneys and liver. Fresh and dried figs have long been appreciated for their laxative action.

Scientific name : *Ficus semicordata* Buch.-Ham. Ex smith

Synonym : *Ficus cunea* Buch.-Ham. ex Roxb.

Common/Local name : Dumur, Lata dumur,

Vernacular name : *Sadimadi* (Marma), *Kurali* (Chakma), *Thaijang* (Tripura), *Aninsep*, Garo), *Thydu* (Khumi), *Jonua*, *Sodoi* (Mogh), *Ududui Ui-Duth* (Murang), *Chorki Gula* (Tanchangya), Fig (English).

Family : Moraceae (Mulberry family)

Distribution

Forests of Chittagong, Chittagong Hill Tracts and Cox's Bazar.

Botanical Description

A small to medium-sized evergreen tree with long spreading branches down to the ground, bark grey, smooth. Leaves are very variable in size, usually elliptic or oblong-lanceolate, acuminate, entire or serrate, scab rid on both surfaces, waxy glands in the axils of the basal lateral veins. Receptacles in pairs or small clusters on long leafless scaly shoots from the

larger branches or main stem near the base, shortly pedunculate, globose or pyriform. Fruit an achene, broadly ovoid, whitish, apically slightly concave on one side, with small tubercles, reddish-brown when ripen.

Consumption practice

Fruits are eaten raw or as vegetable. The leaves are used for carbuncle, dysentery, hematuria, piles; dried leaves and stems for boils, rheumatism, sore throat. Women and children eat this fruit to improve appetite. Latex is used for skin disease; stem or fruit peel for backache, cancer, hernia, piles, swellings, and tuberculosis of the testicles. Root is used for bladder inflammation.

Scientific name : *Ficus auriculata* Lour.

Synonym : *F. oxburghii* Wall. ex Miq. *F. macrophylla* Roxb. *F. regia* Miq.

Common/Local name : Jaggu Dumur, Demur, Doomoor

Vernacular name : *Kani-bot*, *Baradumur*, *Sapai* (Bangla), *Bora Jagna gach* (Chakma), *Jaggu Dumur* (Marma), *Thebol* (Tripura), *soh-la-kechiath* (Khasia), Elephant ear fig tree, Gaint Indian fig, Eve's apron (English).

Family : Moraceae (Mulberry family)

Distribution

It is native to Asia especially in China, Nepal, India, Bhutan, Pakistan, Myanmar, Thailand, Vietnam, Malaysia, etc. This *Ficus* species have a wide range of distribution in Bangladesh.

Forests of Chittagong, Chittagong Hill Tracts, Cox's Bazar and Sylhet.

Botanical description

Low spreading with elongated and wide crown, dioecious tree, bark grayish brown with rough texture. Leaves broadly ovate, alternate, base cordate, margin shallowly or coarsely toothed; stipules triangular. Peduncles on short, thick, leafless branches from the trunk and major branches. Male flowers sessile, female flowers pedicellate or sessile. Fruits specialized on leafless branchlets at base of trunk and main branches, reddish brown, pear shaped, depressed globose shaped, with 8 – 12 conspicuous longitudinal ridges, white, shortly pubescent when young, glabrescent when mature. Peduncle is thick.

Consumption practice

This fruits are eaten raw or to make vegetable. Leaves of *Ficus auriculata* are crushed and the paste is applied on the wounds. They are also used in diarrhoea and dysentery. Stem bark juice is effective for diarrhoea, cuts and wounds. Roasted figs are taken for diarrhea and dysentery. Root latex is used in mumps, cholera, diarrhea and vomiting. Mixture of root powder of *F. auriculata* and bark of *Oroxylum indicum* is taken in jaundice (Kunwar and Bussmann, 2006).

Nutrient composition of three *Ficus spp*

The composition of fruits may vary from one continent to another, one country to another in the same continent and in the same country, and also may vary from region to region. This variation may be due to change of climatic condition, nature of soil and sometimes rainfall. The results of the investigation on chemical and nutritional parameters of three wild edible fig species are given in the Table 2 and Table 3 respectively.

Table 2: Proximate chemical composition of three edible fig.

Parameter	<i>Ficus carica</i>	<i>Ficus semicordata</i>	<i>Ficus auriculata</i>	LSD at 5%
Moisture (%)	92.83	89.01	87.91	2.11
pH	4.56	3.70	5.39	0.31
TSS (%)	2.68	2.33	4.42	0.13
Titrateable Acidity (%)	0.16	1.02	0.47	0.011
Total Sugar (%)	16.43	10.11	4.15	2.45
Protein (%)	1.75	1.24	3.50	0.45
Fat (%)	0.22	0.79	1.71	0.021
Starch (%)	17.18	15.11	13.13	1.13

Table 3: Micronutrient composition (Vitamin and Minerals)

Parameter	<i>Ficus carica</i>	<i>Ficus semicordata</i>	<i>Ficus auriculata</i>	LSD at 5%
Vitamin C (mg)	5.37	7.77	5.48	1.01
β-Carotene (μg)	257.1	600.9	898.0	22.13
Ca (mg)	80.0	12.1	15.6	3.45
Mg (mg)	35.0	11.71	68.0	6.78
K (mg)	240	112	329	34.97
Na (mg)	11	31	29	2.56
P (mg)	77	33	31	7.81
S (mg)	0.03	0.03	0.02	.001
B (mg)	0.01	0.06	0.03	.002
Fe (μg)	3322	2340	5432	231

Proximate composition of Macronutrient

The proximate composition of three wild edible figs is presented in Table 2. The moisture content of figs ranged from 87.91 to 92.83% of fresh weight. The pH values varied from 3.70 to 5.39. The lowest pH (3.70) and the highest amount of titratable acidity (1.02) were found in *Ficus semicordata*. On the other hand, the highest pH (5.39) was observed in *Ficus auriculata* Lour. and the lowest amount of titratable acidity was found in *Ficus carica* (0.16%). Ceggara (1964) found that the pH range of ripe fruits was 4.5 to 5.35. The Total Soluble Solids (TSS) varied from 2.33% to 4.42%. The highest amount (4.42%) of TSS was found in *Ficus auriculata* and the lowest (2.33%) in *Ficus semicordata*. Generally higher TSS indicates more sugar in the pulp. The riper the fruits contained more amount of sugar in fruits. Highest fat and protein content of fruits were 1.71 % and protein 3.5% respectively and the findings of this result are similar to the results found by Potter (1976). The range of protein content of figs was 1.24 to 3.50% dry weight. The highest Protein content was 3.5% in *Ficus auriculata* and lowest in *Ficus semicordata*. *Ficus carica* L as an excellent source of starch and total sugar (17.18%, 16.43%, respectively in dry weight basis) while the lowest quantity of starch and total sugar were found in *Ficus auriculata* (13.13%, 4.15%, respectively, on dry weight). The fat contents ranged from 0.22 to 1.71% on dry weight basis. Due to generally low level of fat in the fruits, their consumption in large amounts is a good dietary habit and may be recommended to individuals suffering from overweight or obesity. The highest contents of fat (1.71%) were found in *Ficus auriculata* and the lowest fat contents were found in *Ficus carica* (0.22%). *Ficus auriculata* was found to be rich in protein and fat content (3.50%, 1.71%, respectively) which is comparatively higher than the fruit which we use in our daily life like, Mango (0.61%, 0.63%), Jackfruit (1.53%, 0.14%), Papaya (0.61%, 0.14%) (Islam *et al.*, 2012).

Vitamins and Minerals analysis

The results of the vitamins and minerals estimation of the three edible figs are presented in Table 3. In this study, it was observed that *Ficus semicordata* contained the highest amount (7.77mg/100g) of vitamin C and the lowest amount (5.37 mg/100g) was present in *Ficus carica*. According to the Nutrition Expert Committee (ICMR, India, 1981), the daily requirement of vitamin C for an adult is 40 mg; however, the fig contains 7.77 mg/100g of vitamin C. The U.S. recommended dietary allowance (RDA) for β-carotene or other provitamin A carotenoids. The IOM (2001) states that consuming 3-6 mg of β-Carotene daily (equivalent to 833 IU to 1,667 IU vitamin A) will maintain blood levels and lower risk of chronic diseases. In the present study, the highest amount (898 μg/100g) of β-carotene was found in *Ficus auriculata* Lour. and the lowest amount (257.1/100g μg) was found in *Ficus carica*. It indicates that these wild fruits could prevent the night blindness in the children due to rich source of provitamin A.

The species analyzed in this study contained remarkably the highest amount of calcium (Ca) (80 mg/100g) in *Ficus carica* and lowest (12.1 mg/100g) in *Ficus semicordata*. *Ficus auriculata* Lour. contain highest amount of magnesium (Mg), potassium (K) and iron (Fe) (68.0 mg/100g, 329 mg/100g and 5432 μg respectively). Sodium (Na), sulphur (S) and boron (B) were highest (31 mg/100g, 0.03 mg/100g, 0.06 mg/100g) in *Ficus semicordata* and lowest amount of Na and B (11mg/100g and 0.01mg/100g respectively) in *Ficus carica*. But *Ficus carica* contain highest amount (77mg mg/100g) of phosphorus (P) and lowest amount of P (31 mg/100g) in *Ficus auriculata* Lour. It is indicated that these minor fruits contain a relatively higher amount of minerals than the exotic fruits (USDA-NNDSR, 2011). When compared to the ripe Mango (calcium 16.9mg/100g, magnesium 6.7mg/100 g, potassium 98.5 1.0 mg/100 g, phosphorous 7.7mg/100 g edible) and the national fruit of Bangladesh – ripe Jack fruit (calcium-12.6 mg/100g, magnesium 26.8mg/100 g, potassium 305.0 mg/100 g and phosphorous 10.9 mg/100 g edible) (FAO-NFPCSP, 2010), it was seen that most of the wild fig species contain higher amount of minerals and vitamins.



Fig 3: *Ficus auriculata* Lour.

REFERENCES

- AOAC. 1998b. Official Method 925.10: Micro-Kjeldahl Method (16th edition). AOAC. International press, Maryland, USA. 7p.
- AOAC. 1998e. Official Method 984.26: Vitamin C (Total) in Food (16th edition). AOAC. International press, Maryland, USA. 7p.
- Cegara J. R. 1964. Estudios comparative de algunos indices quimicos y fisicos impoortances en variedades de mangos injertados. Fac. De. Agronomia. Univ. Central de Venezuela.
- Food and Agriculture Organization-National Food Policy Capacity Strengthening Programme (FAO-NFPCSP). 2010. Preparation of food composition database with special reference with ethnic and indigenous foods: report of a joint FAO/USAID funded project, Ministry of Food and Disaster Management, Dhaka-1000, Bangladesh.
- Gaire, A.S.B.P.; Sunar, C.B.; Ramakanta Lamichhane, R.; Neupane, S. 2009. Phytochemical Screening and Analysis of Antibacterial and Antioxidant Activity of *Ficus auriculata*, Lour. Stem Bark. Bachelor's thesis, Department of Health and Allied Sciences, PUN, Nepal.
- Gofur M. A., Shafiq M. Z., Helali M. O. H., Ibrahim M. Rahama M. M. N. and Hakim M. A. 1998. Effect of application of plant hormone on the control of fruit drop, yield and quality characteristics of mango (*Mangifera indica* L.). *Bangladesh J.Sci. Ind. Res.*, **XXI** (III):163- 171.
- Ibrahim M. 2002. Application of plant hormone on the control of anthracnose disease, yield and quality characteristics of mango. Ph.D. Thesis, Institute of Biological Sciences, Rajshahi University, Bangladesh., P-181.
- IOM (Institute of Medicine). 2001. Food and Nutrition Board. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. National Academy Press, Washington, DC, Pp: 442-501.
- I.C.M.R. 1981. Nutrition Advisory Committee, Recommended daily allowances of nutrients and balanced diets. Indian Council of Medical Research, New Delhi.
- Islam, S. N., Khan, N. I. and Akhtaruzzaman, M. 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. 60p.
- Kunwar RM and Bussmann RW. 2006. *Ficus* (Fig) species in Nepal: A Review of Diversity and Indigenous Uses. *A Journal of Ecology and Application*, **11**: 85-97.
- Pandey, M., AB Abidi, S. Singh and RP Singh. 2006. *J. Human Eco.*, **19** (2): 155-156.
- Petersen, L. 2002. Analysis of Plant Materials In: Analytical Method Soil, Water, Plant material, Fertilizer. Soil Resources management and Analytical Services. Soil Resource Development Institute, Danida, Camp Sax. 4-7.
- Potter, N.N. 1976. Food science, 2nd Edition, The Avi publishing company, INC-Westport, Connecticut.
- Raghuramulu, N, Nair KM and Kalyanasundaram S. 2003. Fat: Food analysis In: A manual of Laboratory Techniques. National Institute of Nutrition, Hyderabad, India. 57p.
- Ranganna S. 1986. Handbook of Analysis and Quality Control for Fruit and Vegetable products, Tata McGraw-Hill Publishing Company Lt. New Delhi. P-12-123.
- Ripu M, Kunwar Y, Uprety C, Burlakoti C, Chowdhary L and Bussmann RW. 2009. Indigenous Use and Ethnopharmacology of Medicinal Plants in Far- west Nepal. *Ethnobotany Research and Application*, **7**: 5-28.
- Roriguez-Amaya, D.B. and Kimura. 2004. General procedure for carotenoid analysis In : Harvest Plus Handbook for Carotenoid Analysis. *Harvest Plus Technical Monograph Series*, **2**. 56-75.
- United States Department of Agriculture- National Nutrient Database for Standard Reference (USDA-NNDSR), (2011). Accessed 28.11.11. <http://www.nal.usda.gov/fnic/foodcomp/search/>