HOMESTEAD FRUIT SPECIES DIVERSITY IN THE HAOR AREA OF BANGLADESH

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ABSTRACT

Diversity of fruit species, species richness and relative prevalence of species were investigated in the Haor area of Bangladesh. A total of 27 fruit species belonging to 19 families were identified. Among 27 fruit species, coconut, mango and jujube were found in the 100% homestead surveyed. The relative prevalence of the most common species such as banana, betel nut, coconut, mango, papaya and guava were very high while pineapple, litchi was found very low. Coconut and mango were found highly diversed (0.990) fruit species followed by guava (0.986) and papaya (0.987). It is necessary to take special attention towards the fruit production system and fruit diversity in the study areas.

Key words: Homestead, species diversity, haor area, Bangladesh

INTRODUCTION

The well-being of the growing world population depends on the availability of biodiversity. Tropical fruits can provide an important source of income and nutrition. Fruits in the daily diet have been strongly associated with reduced risk for some forms of cancer, heart disease, stroke, and other chronic diseases (Goldberg, 2003, Hyson, 2002, Prior and Cao, 2000; Southon, 2000).

Bangladesh is an agro- based country and almost attained self-sufficiency in cereal food. Fruit production is very limited and the consumption of fruit, we depend on foreign supplies. It offers a highly congenial environment for the growth of varieties of fruits like banana, papaya, pineapple, litchi, jackfruit etc, which are more nutritious compared to the imported foreign fruits like orange, grape, apple etc. Our fruit production is not sufficient to meet up our domestic demand. During last five decades population of Bangladesh increased from 75 million to 152.81 million (BBS, 2011), simultaneously food grain production increased from 10 million to about 32 million tons (BBS, 2011). But fruit production did not increase at the same rate. Day^{-1} person^{-1}, the minimum dietary requirement of fruit is 85 g, whereas our availability is only 30-35 g. In view of the fact, the consumption and availability of fruits is very negligible. As a result, imbalanced nutrition and nutrition deficiency diseases such as xerophthalmia, rickets, scurvy, iron-deficiency anemia are being increased at an alarming rate.

There are 25.53 million homesteads in Bangladesh (BBS, 2011). Homestead fulfill basic needs of the people such as fruit, food, shelter, cash etc and high species

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diversity of the homestead help to reduce the environmental deterioration commonly associated with monoculture production system.

A large area of every homestead remain as fallows because of poor plant population whereas plantation of diversified fruit trees in planned way considering the harvesting period, a farmer can easily get year round fruit supply from his homestead garden and can get more production of fruit from their garden. Therefore, fruit diversity in homestead is necessary (Sellathurai, 1997). But no study was so far carried out solely on the status of homestead fruit diversity in the Haor area of Bangladesh. It is necessary to develop suitable plans and fruit production system for fruit diversification in Haor homestead. Therfore, it is very important to have a clear understanding of the present position of Haor homestead fruit diversity and the factors related to fruit diversity in homestead of the farmers. Fruit diversity and its relationship with farmer's helpful for planning and implementing effective fruit diversification program to increase balanced food intake of the farm family. Therefore, a survey was carried out to identify the fruit species being grown and the magnitude of diversity of fruits in the homesteads of Haor of Bangladesh.

MATERIALS AND METHODS

The study was carried out in the Haor area during April to September, 2011. It is located in Ajmiriganj upazila of Hobigonj district in Bangladesh under the AEZ-21 (Brammer, 1971). The soil pH of this area ranges from 6.6-8.3 and the organic matter content ranges from 0.6% to 2.3%. The geographical positions of the survey area between 24°30' to 24°38' North latitude and between 91°10' to 91°22' East longitude. The lowest and the highest temperatures are generally recorded 13.6°C and 33.2°C respectively. In Bangladesh there are six seasons However there are visible distinctly. May to October is rainy, November to February is winter and March to April is summer season.

The study area is significant because natural vegetations were rich compared to the other areas of Bangladesh. According to the size of homestead area, samples of 300 homesteads were selected for each category under five unions. They were grouped into five farm categories like marginal (up to 10 decimals), small (11-30 decimals), medium (31-50 decimals), large (51-100 decimals) and very large (more than 100 decimals). The collected data were verified through survey the villages and discussion with fruit grower. Informations was collected from primary and secondary sources and complied by survey as well as non-survey methods. The survey sources include interviews through a pre-tested interview schedule; key informant and farmer's group discussion while non-surveys include the information through field survey, direct observations and secondary sources. The interview schedule was pre-tested with 10 homesteads and then final shape was given to the interview schedule. Data for fruit diversity of the homestead were collected using questionnaire. Information was recorded through interviews of family members like head of the family, housewife and others. Data were collected mainly on name and numbers of fruit species, demographical characteristics of the homesteads, socio-economic information. In this study only fruit species was identified and calculated. Relative Prevalence (RP) of species was calculated by using the following formula: RP = Population of the species per homestead × % Homestead with the species. These relative prevalence values were used to rank the species in different regions (Millat-e-Mustafa, 1997). The mean dominance rank was determined by pooling the entire set of data of all the three regions the most commonly used formula of Simpson (1949) index (D) was used to calculate species diversity (D) as follows:

$$D = 1 - E_p \, i^2$$

Where,

P is the proportional abundance of the i species,

$P = N_i/N$

N = Plant population of ith species and

$N = N_1 + N_2 + N_3 + \ldots\ldots\ldots N$

Where N is the number of species

Fruit diversity was described under the headlines of species richness, relative prevalence of species and species diversity. The collected data were compiled, tabulated, coded and analyzed in accord with the objectives of the study. Qualitative data were quantified by means of scoring techniques. The statistical measures such as number and distribution were used for describing the variables of the study. Microsoft Excel programs were used to process all collected information. To estimate the descriptive statistics of the data SPSS software, 2006 was used.

RESULTS AND DISCUSSION

Species richness

A wide range of fruit species were found in the study area. Twenty seven fruit species were identified in the homesteads surveyed which are commonly use for human consumption. The list of the identified fruit species was presented in the Table 1. The total number of fruit species per homestead in five different unions is shown in Table 3. The higher number of fruit species was found in larger farms and less number of fruit species was found in smaller farms.

Table 1. Species richness of fruits in the study area

English Name	Local Name	Scientific Name	Family
Banana	Kola	*Musa sp*	Musaceae
Betel nut	Supari	*Areca catechu*	Palmaceae
Black berry	Jam	*Syzygium cumini*	Myrtaceae
Burmese grape	Lotkon	*Baccaurea ramiflora*	Phyllanthaceae
Carrabolla	Kamranga	*Averrhoa carambola*	Agerrhoaceae
Coconut	Narikel	*Cocos nucifera*	Palmae
Custard apple	Ata	*Anona squamosa*	Annonaceae
Date	Khejur	*Phoenix sylvestris*	Palmaceae
Elephant apple	Chalta	*Dillenia indica*	Dilleniaceae
Gooseberry	Arboroi	*Phyllanthus acidus*	Euforbiaceae
Guava	Peara	*Psidium guajava*	Myrtaceae
Hog plum	Amra	*Spondias dulcis*	Anacardiaceae
Indian apple	Bel	*Aegle marmelos*	Rutaceae
Indian Goose Berry	Amloki	*Phyllanthus embelica*	Euforbiaceae
Indian jujube	Kul	*Zizyphus mauritiana*	Rhamnaceae
Jackfruit	Khathal	*Artocarpus heterophyllus*	Moraceae
Lemon	Lebu	*Citrus limon*	Rutaceae
Litchi	Lichu	*Litchi chinensis*	Sapindaceae
Mango	Aam	*Mangifera indica*	Anacardiaceae
Olive	Jalpai	*Elaeocarpus floribundus*	Elaeocarpaceae
Orange	Komla	*Citrus chrysocarpa*	Rutaceae
Palmyra palm	Tal	*Borassus flabellifer*	Palmaceae
Papaya	Papaya	*Carica papaya*	Caricaceae
Pomegranate	Dalim	*Punica granutum*	*Punicaceae*
Tamarind	Tetul	*Tamarrinbus indica*	Fadaceae
Velvet apple	Gab	*Piospyros discolor*	Ebenaceae
Wax jumbo	Jamrul	*Syzygium samarangense*	Myrtaceae

From this survey it was observed that species richness and fruit diversity of homestead is increasing day by day but the increasing rate is very low. The distribution of the plant species was influenced by macro and micro environmental factors of the homestead and the needs and choices of the family members. Species richness varied from one location to another and from one farm category to another.The observed 27 fruit species were belonged to different family and 19 families were identified with these 27 species presented in Table 2. Among these families, Myrtaceae, Rutaceae and Palmaceae are dominant.

Table 2. Families with number of species observed in the study area

Family name	Species number	Family name	Species number
Myrtaceae	3	Elaeocarpaceae	1
Palmaceae	3	Fadaceae	1
Rutaceae	3	Moraceae	1
Anacardiaceae	2	Musaceae	1
Euforbiaceae	2	Palmae	1
Agerrhoaceae	1	Phyllanthaceae	1
Annonaceae	1	Punicaceae	1
Caricaceae	1	Rhamnaceae	1
Dilleniaceae	1	Sapindaceae	1
Ebenaceae	1		

The number of fruit producing species was higher than other species in each home garden. The farmers concentrate on fruit species because of their subsistence and cash need. Mango, coconut, banana, guava, betel nut, papaya, lemon, black berry were cultivated in the most of the homesteads. Among them, mango, coconut, banana, guava, betel nut and lemon were the dominant species in homesteads at all locations and had the most diverse utility among all other fruit species. It was found that fifty-seven different varieties were grown within 150 homesteads of Haor of Bangladesh. It was varied depending upon the family choice.

Relative prevalence of species

The relative prevalence of fruit species found in 300 homesteads of this study area are presented in Table 3. The relative prevalence of most common species are betel nut, banana, mango, coconut, guava, jackfruit, lemon and black berry were very high while that of less common species like burmese grape, goose berry, Indian goose berry, plamyra palm and orange were found very low. Mango was the most prevalent among the horticultural species followed by guava, jackfruit, coconut and jujube (Alam *et al.* 1990). It was reported that coconut was the most prevalent where among the fruit species followed by jackfruit, date palm, banana and mango in Bangladesh (Chowdhury and Satter, 1992). Mannan (2000) also observed mango as the most prevalent among the fruit species followed by jackfruit, guava, jujube and coconut in Bangladesh. Ecological factor is one of the determinants of species grown in the farms. Besides the ecological reasons, the socio-economic conditions of the homesteads were a major determinant of the species-mix prevailing in a home garden. There were minor differences in relative prevalence of less common species but significant differences of most common species among the farm categories. Especially farmers were giving the preference to grow for particular fruit species in their homesteads. The decision of which trees to grow depended on a combination of price and yield, the location of the farm in terms of ecological zone and consumption center.

Table 3. Relative prevalence of different fruit species in the study area

Name of species	Unions					Total
	Ajmirigonj	Kakailcheo	Bodolpur	Jolshukha	Sibpasha	
Betel nut	75.60	54.54	206.01	174.69	64.53	115.074
Banana	31.86	58.05	109.89	51.30	120.69	74.358
Mango	61.83	62.91	48.06	86.94	58.05	63.558
Coconut	65.88	86.67	51.84	66.42	38.88	61.938
Papaya	7.29	22.14	62.64	28.35	30.78	30.240
Guava	14.04	37.8	34.02	23.49	17.82	25.434
Jackfruit	13.50	35.64	26.73	8.91	4.86	17.928
Lemon	12.69	9.99	22.14	12.96	18.36	15.228
Black berry	16.20	9.45	21.06	13.23	11.61	14.310
Indian jujube	3.78	9.18	17.01	7.29	2.43	7.938
Elephant apple	0.81	1.08	7.83	7.83	2.16	3.942
Olive	1.62	3.24	10.53	3.24	0.81	3.888
Indian apple	2.43	1.62	11.34	2.43	1.35	3.834
Litchi	3.51	5.94	4.05	2.7	0.27	3.294
Hog plum	1.62	2.97	5.67	2.7	2.7	3.132
Custard apple	1.35	4.86	2.97	3.51	1.89	2.916
Pomegranate	2.16	0.54	3.51	1.35	2.16	1.944
Wax jumbo	1.62	1.35	4.59	1.89	0.27	1.944
Tamarind	0.00	0.00	2.97	0.00	1.35	0.864
Carrabolla	1.08	0.81	0.27	0.81	0.00	0.594
Date	0.00	0.27	1.89	0.27	0.00	0.486
Velvet apple	0.00	0.00	1.89	0.27	0.00	0.432
Orange	0.81	0.54	0.00	0.27	0.00	0.324
Palmyra palm	0.00	0.27	0.27	0.81	0.00	0.270
Indian Goose Berry	0.54	0.00	0.00	0.00	0.27	0.162
Burmese grape	0.00	0.27	0.00	0.00	0.27	0.108
Gooseberry	0.27	0.00	0.00	0.00	0.27	0.108

The fruit species were ranked according to their relative prevalence in five different unions viz Ajmirigonj, Kakailcheo, Bodolpur, Jolshukha and Sibpasha (Table 4). Among 27 fruit species, guava, elephant apple, hog plum, betel nut and Indian goose berry were found in the around 100% homestead surveyed. Banana was found the most prevalent in all the unions except Ajmirigonj where betel nut was the most prevalent one. The next prevalent species were coconut, mango and date. It was reported by Mannan (2000) that mango was the most prevalent followed by guava, jackfruit and coconut.

Distribution of the species

In general, frequency of a particular species is one of the indications of its biodiversity in that specific area. It was observed that coconut and mango were found in 80% homestead in the study area followed by guava (63.67%), papaya (51.67%), betel nut (46.67%) and black berry (42%) (Table 5). Among the others banana, lemon, pomegranate were found at more than 30% homesteads. Abedin *et al.* (1990) found mango at 95% homesteads of Tangail and above 67% homesteads of Ishurdi, Jessore, and Rangpur. It was reported that mango, jackfruit, coconut and banana were available at more than 65% homesteads of Jessore (Alam *et al.,* 1990).

Table 4. Ranking of fruits in different union according to their relative prevalence in the study area

Name of species	Unions					Total
	Ajmirigonj	Kakailcheo	Bodolpur	Jolshukha	Sibpasha	
Custard apple	17	8	20	13	15	27
Indian jujube	10	24	17	8	24	26
Black berry	5	18	16	9	12	25
Jackfruit	7	12	14	26	27	24
Date	24	20	12	14	20	23
Pomegranate	13	15	10	25	16	22
Papaya	9	17	8	21	25	21
Olive	15	10	25	27	22	20
Burmese grape	23	7	18	15	11	19
Palmyra palm	25	26	21	22	26	18
Velvet apple	27	16	7	12	10	17
Lemon	8	22	23	5	23	16
Litchi	11	5	22	20	17	15
Tamarind	26	27	15	11	7	14
Indian apple	12	14	26	23	5	13
Banana	4	21	27	17	6	12
Mango	3	9	13	16	9	11
Orange	20	13	11	6	4	10
Gooseberry	22	23	3	7	14	9
Wax jumbo	16	6	4	24	13	8
Carrabolla	18	11	6	3	8	7
Coconut	2	4	24	18	21	6
Indian Goose Berry	21	19	5	19	3	5
Betel nut	1	3	9	10	19	4
Hog plum	14	25	19	2	2	3
Elephant apple	19	2	1	4	18	2
Guava	6	1	2	1	1	1

Table 5. Distribution of fruit species in the homesteads of five unions

Name of species	Unions					Total
	Ajmirigonj	Kakailcheo	Bodolpur	Jolshukha	Sibpasha	
Coconut	73.33	93.33	85.00	80.00	71.67	80.67
Mango	78.33	90.00	80.00	80.00	68.33	79.33
Guava	35.00	75.00	81.67	81.67	45.00	63.67
Papaya	16.67	61.67	85.00	38.33	56.67	51.67
Betel nut	28.33	38.33	81.67	46.67	38.33	46.67
Black berry	38.33	28.33	53.33	48.33	41.67	42.00
Banana	11.67	38.33	48.33	26.67	55	36.00
Lemon	40.00	18.33	63.33	31.67	26.67	36.00
Jackfruit	18.33	33.33	41.67	25.00	13.33	26.33
Indian jujube	11.67	23.33	50.00	16.67	10.00	22.33
Carrabolla	13.33	8.33	38.33	18.33	21.67	20.00
Olive	10.00	15.00	38.33	13.33	5.00	16.33
Hog plum	3.33	13.33	30.00	13.33	18.33	15.66
Indian apple	13.33	11.67	36.67	8.33	6.67	15.33
Custard apple	11.67	28.33	18.33	6.67	10.00	15.00
Elephant apple	6.67	5.00	28.33	8.33	15.00	12.67
Litchi	13.33	20.00	18.33	10.00	1.67	12.67
Pomegranate	10.00	3.33	15.00	8.33	8.33	9.00
Wax jumbo	1.67	1.67	10.00	5.00	1.67	4.00
Palmyra palm	1.67	1.67	1.67	3.33	8.33	3.33
Date	5.00	1.67	3.33	1.67	3.33	3.00
Tamarind	1.67	1.67	10.00	0.00	0.00	2.67
Velvet apple	1.67	0.00	3.33	1.67	5.00	2.33
Orange	8.33	0.00	0.00	0.00	1.67	2.00
Indian Goose Berry	3.33	0.00	0.00	0.00	1.67	1.00
Burmese grape	1.67	0.00	0.00	0.00	1.67	0.67
Gooseberry	1.67	0.00	0.00	0.00	1.67	0.67

Species diversity

Diversity of fruit species varied from region to region and species to species. To know the plant biodiversity, species diversity was calculated considering the five unions as a whole. It might help to understand the fruit diversity in respect of Ajmiriganj. Species diversity of fruit was varied from 0 to 0.992 in the study area (Table 6). Mango and coconut were found highly diversed fruit species which was 0.992 and 0.990, respectively. The second highest intra species diversity was found in papaya (0.987), banana and guava (0.986) and 22 species of fruits were having a low diversity in this study area.

Table 6. Species diversity of fruit in the homesteads of five unions in the study area

Name of species	Union					Total
	Ajmirigonj	Kakailcheo	Bodolpur	Jolshukha	Sibpasha	
Mango	0.960	0.969	0.958	0.958	0.961	0.992
Coconut	0.951	0.944	0.964	0.969	0.966	0.990
Papaya	0.859	0.964	0.956	0.932	0.948	0.987
Banana	0.835	0.938	0.946	0.878	0.958	0.986
Guava	0.783	0.940	0.961	0.96	0.927	0.986
Black berry	0.846	0.885	0.905	0.945	0.935	0.978
Hog plum	0.611	0.843	0.93	0.84	0.880	0.973
Jackfruit	0.835	0.909	0.905	0.836	0.852	0.971
Lemon	0.572	0.789	0.927	0.883	0.840	0.966
Indian jujube	0.765	0.863	0.906	0.700	0.716	0.962
Betel nut	0.811	0.941	0.868	0.798	0.928	0.960
Custard apple	0.800	0.926	0.876	0.627	0.816	0.960
Olive	0.778	0.889	0.897	0.861	0.444	0.960
Indian apple	0.864	0.833	0.904	0.716	0.720	0.957
Pomegranate	0.813	0.5	0.757	0.720	0.813	0.943
Litchi	0.817	0.798	0.791	0.600	0.000	0.942
Wax jumbo	0.722	0.72	0.685	0.653	0.000	0.903
Carrabolla	0.75	0.667	0.000	0.444	0.000	0.893
Tamarind	0.000	0.000	0.793	0.000	0.800	0.883
Elephant apple	0.667	0.750	0.875	0.250	0.750	0.858
Velvet apple	0.000	0.000	0.694	0.000	0.000	0.750
Palmyra palm	0.000	0.000	0.000	0.444	0.000	0.720
Berry	0.500	0.000	0.000	0.000	0.000	0.667
Orange	0.835	0.500	0.000	0.000	0.000	0.667
Date	0.835	0.000	0.245	0.000	0.000	0.519
Gooseberry	0.000	0.000	0.000	0.000	0.000	0.500
Burmese grape	0.000	0.000	0.000	0.000	0.000	0.000

CONCLUSIONS

This study would be the foundation for the policy makers to understand the species richness, fruit species conservation, and socio-economic importance of homestead as well as to formulate biodiversity conservation planning highlighting homestead of Bangladesh for sustainable production and maintenance of biodiversity.

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