

FARMERS' OPINION TOWARDS CONSERVATION AND GENETIC EROSION OF CITRUS SPECIES AT JAINTAPUR UPAZILA OF SYLHET DISTRICT IN BANGLADESH

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Abstract

A study was undertaken to know the extent and causes of genetic erosion of citrus species at Jaintapur upazila of Sylhet district during July to November 2013. A total number of 15 citrus species were recorded from the studied homestead areas. Sorbati lebu (*Citrus limmetta*) and Deshi lebu (*Citrus limon*) were identified as endangered while Kolombo lebu and Pati lebu (*Citrus limon*) as critically endangered species. Kot lebu, Sulang lebu and Tuna lebu were identified as extinct from the study area. On the other hand, Zara lebu (*Citrus medica*), Ada jamir (*Citrus assamensis*), Kata jamir (*Citrus jambhiri*), Kurun jamir (*Citrus aurantium*), Elachi lebu (*Citrus limon*), Kagzi lebu (*Citrus aurantifolia*) and Komola lebu (*Citrus sinensis*) were found in safe condition as they were grown commonly in most homesteads of the study area. Diseases and insect pest infestation were the most serious problems responsible for the genetic erosion of citrus species followed by lack of credit facilities, and quality seed and seedling. In the study area farmers' perceived most importance for homestead citrus species conservation was related to fruit and food (83%) followed by subsistence family income (49%) and soil erosion control (32%).

Keywords: Genetic erosion, conservation, citrus

Introduction

In native plant populations, genetic erosion results from habitat loss and fragmentation, but it also can result from a narrow genetic base in the original collections or by practices that reduce genetic diversity. One can minimize the risk of genetic erosion by being familiar with the biology of the affected species. The loss of biological diversity has been measured generally by recurrence of species terminations. However, not only does genetic diversity underlie species diversity, being concomitantly lost with species extinctions, but also genetic diversity has been recognized in its own right as one of three levels of biological diversity recommended for conservation by the World Conservation Union (IUCN) (McNeely *et al.* 1990). Species currently are being lost at a rate that far exceeds the origin of new species. Unlike the previous mass extinctions, this is primarily the result of human activities (Frankham *et al.* 2004). In numerous occasions, the genetic resource may be seriously debased without a prompt loss in enumeration number. Genetic erosion is loss of genetic diversity within a species. It can speak to the loss of whole populaces genetically separated from others, the loss or change in recurrence of particular alleles (that is, different forms of a gene) within populations or over the species as a whole, or the loss of allele combinations. The main decently pitched utilization of the expression "genetic erosion" was in reference to the loss of the primitive races and varieties of cultivated plants as they were step by step supplanted in farming with more current and more profitable crop varieties. Inside the theme of genetic erosion in natural plants communities, one could address keeping up genetic diversity inside the populaces, re-introducing proper levels of genetic diversity in ventures planting or seeding of native plant species, or checking plant populaces to recognize diminishes in genetic diversity. Genetic diversity is lost in much the same way as species get to be terminated. Habitat loss and habitat fragmentation can lessen the extent of plant populaces. More modest populaces have a tendency to lose genetic variety by genetic drift significantly more rapidly than bigger populaces. Some loss of genetic diversity is natural. Genetic diversity is a dynamic entity, changing over time. Natural selection removes some genetic diversity (at least at the population, if not the species, level). Loss of genetic diversity can occur in restoration or reintroduction programs in which the

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propagule source includes only a small number of parent plants or a small amount of genetic diversity (Rogers, 2004).

In Bangladesh, Sylhet district is famous for citrus cultivation. The atmospheric and soil condition of Jaintapur upazila of Sylhet district are congenial for the growth and development of citrus fruits. Citrus fruits were variable size, shape, colour, scent and use etc. were found in Jaintapur upazila in Sylhet district but some of the species are being lost due to several reasons. Some of the reasons behind the loss are the natural extinction, disease infection and insect pest infestation, less care, increase in family members which led to split of the family as well as land and thus housing requirements enhanced destruction of homestead garden and fruit trees and as well as the citrus was the victim of the process. It is revealed from the literatures that a vast reservoir of citrus diversity was available in the north-eastern region of India in both wild and cultivated forms but the erosion of the genetic resources was one of the main causes of concern. Presence of two wild types of sweet orange (*Citrus sinensis*), namely Soh bitara and Soh nairiang in Meghalaya provided a strong evidence that most of the citrus species originated in this region and claimed to be the epi centre of citrus biodiversity (Singh et al. 2006). The present study area is very close to the aforesaid region but systematic study and in depth of investigation about present status of citrus is lacking or sporadic which needs proper attention. To know the present conservation status as well as to find the causes and extent of reduction of citrus biodiversity at Jaintapur upazila of Sylhet district, the present investigation was undertaken.

Materials and Methods

The study was conducted in six unions i.e., Nijpat, Jaintapur, Fatehpur, Darbast, Chiknagul and Charikata at Jaintapur upazila of Sylhet district, Bangladesh during July to November 2013. The study area was located between 24°59' and 25°11' North latitudes and in between 92°03' and 92°14' East longitudes. The climate of Jaintapur is humid subtropical with a predominantly hot and humid summer and a relatively cool winter. It is generally marked with the monsoon climatic zone, with annual average highest temperature is 23°C in August to October and average lowest temperature is 7 °C in January. Nearly 80% of the annual average rainfall is 3334 mm between May and September (Wikipedia, 2013). The primary data were collected by (i) direct observation; (ii) interviewing farmers and (iii) record kept by farmers. Data were collected through farm visits in the study area and personal interviewing with a purposive sample of 60 households from a total of 27719 which is about 0.002% (BBS, 2010). The head of the households were interviewed with the use of an informal and semi-structured questionnaire. The data collected from household interviews were crosschecked with key informants and people from various levels of society. At the stage of data analysis, qualitative and quantitative analyses were carried out using Microsoft Excel and SPSS software, 2006.

Results and Discussion

Conservation level of different citrus species

In the study area 80% farmers opined that Zara lebu was the highest in safe position followed by Ada Jamir, Kagzi, Elachi and Kata Jamir (78.33%, 73.33%, 71.67% and 70%, respectively). Forty five percent farmers gave opinion that Satkara was the highest in threaten position followed by Komola, Deshi lebu, Kurun Jamir, Pati lebu and Batabi lebu (38.33%, 30%, 23.33%, 13.33% and 13.33%, respectively). Deshi lebu was the highest in endangered position (21.67%) followed by Sorbati lebu, Pati lebu, Kolombo lebu, Kurun Jamir and Satkara (20%, 18.33%, 11.67%, 11.67% and 10%, respectively). Kolombo lebu was the highest in critically endangered position (31.67%) followed by Pati lebu, Sorbati lebu, Sulang lebu and Katachara lebu (23.33%, 15%, 13.33% and 11.67%, respectively) according to farmers opinion defined by IUCN Red List Categories IUCN, 1994. In respect of extinction 53.33 percent farmers said that Kot lebu were the highest in extinct position followed by Sulang lebu, Kolombo lebu, Tuna lebu, Sorbati lebu and Katachara lebu (40%, 28.33%, 26.67%, 15% and 15%, respectively) (Table 1). NRCC (2013), Nagpur, India identified 8 wild citrus species *C. indica*, *C. latipes* (SohShyrkhoit/khasipameda), *C. assamensis* (Ada Jamir), *C. macroptera* (Satkara), *C. rugulosa* (Attanni-Chawnni), *C. megaloxycarpa* (Sour Pummeelo-Sulanglebu), *C. limettioides* (Sweet lime/mistilebu/mithalebu) and *C. limmetta* (Sorbati lebu) as endangered.

Table 1. Conservational level of different citrus species at Jaintapur upazila of Sylhet district

Name of the species	Farmers' opinion (%)					
	Safe	Threaten	Endangered	Critically endangered	Extinct	No response
Zara lebu	80	3.33				
Kata Jamir	70	8.33	5			
Ada Jamir	78.33	5				
Batabi lebu	66.67	13.33	3.33			
Kurun Jamir	28.33	23.33	11.67	1.67		
Komola	38.33	38.33	6.67			
Kagzi lebu	73.33	8.33	1.67			
Satkara	25	45	10	3.33		
Sorbati lebu	0	6.67	20	15	15	
Kolombo Lebu	0	0	11.67	31.67	28.33	16.67
Pati Lebu	10	13.33	18.33	23.33		
Elachi Lebu	71.67	11.67				
Deshi Lebu	25	30	21.67	6.67		
Katachara Lebu				11.67	15	
Kot Lebu					53.33	
Sulang Lebu				13.33	40	
Tuna Lebu					26.67	

Citrus species found in study area

Fifteen citrus species were recorded in the study area which was enlisted in Table 2.

Table 2. Citrus species found in Jaintapur upazila with their local, English and Scientific name

Sl. No.	Common/Local name	English name	Scientific name
1	Zara lebu	Citron	<i>Citrus medica</i>
2	Ada jamir	Zinger lime	<i>Citrus assamensis</i>
3	Kata jamir	Citronelle/ Rough lemon	<i>Citrus jambhiri</i>
4	Batabi lebu	Pummelo/ Shaddock	<i>Citrus grandis</i>
5	Karun jamir	Indian lemon	<i>Citrus aurantium</i>
6	Komola lebu	Orange	<i>Citrus reticulata</i>
7	Malta	Sweet orange	<i>Citrus sinensis</i>
8	Kagzi lebu	Acid lime	<i>Citrus aurantifolia</i>
9	Satkara	Large-winged orange	<i>Citrus macroptera</i>
10	Sorbati lebu	Sweet lime	<i>Citrus limetta</i>
11	Kolombo lebu	lime	<i>Citrus sp</i>
12	Pati lebu	Lemon	<i>Citrus limon</i>
13	Elachi lebu	Lemon	<i>Citrus limon</i>
14	Deshi/ Gotha lebu	Lemon	<i>Citrus limon</i>
15	China lebu	Chinese lemon/Sylhet lime/ Gandharaj lemon	<i>Citrus limonia</i>

Importance of Conservation of citrus Species

The results of importance of citrus conservation are exhibited in Table 3. Farmers' perceived most importance for homestead citrus species conservation was related to fruit and food (83%) followed by subsistence family income (49%) and soil erosion control (32%). Citrus cultivation being practiced by the people of the region from time immemorial. However, they were not concerned about medicinal importance of citrus. Yet most of the respondents evaluated the citrus as being "less important" as a means of source of medicinal plants (41%) followed by soil erosion control (35%). So, it appears that there is still an absence of knowledge in these two categories, and institutional and government and NGOs training and awareness programs are necessary to enhance the knowledge about citrus.

Insect pest infestation in citrus plants

Several types of insect pest caused a huge loss in citrus production and those were identified during visiting and collecting information from farmers. Among them the highest 21.67 % was citrus leaf miner followed by bark and stem borer, leaf roller, lemon butterfly, orange bug and aphid which were 18.33%, 10%, 8.3%, 8.3% and 6.7%,

respectively (Table 4). The citrus leaf miner infestation was the highest followed by leaf roller and bark and stem borer of citrus in Jaintapur upazila (Anon. 2010), which was similar to the present findings.

Table 3. Importance of citrus conservation in the study area

Items	Very important (%)	Less important (%)	Not important (%)
Food and fruit	83	17	0
Firewood	14	27	59
Building materials	0	4	96
Subsistence family income	49	28	23
Soil erosion control	32	35	33
Medicinal plants	25	41	34

Table 4. Insect infestation found in citrus plants at Jaintapur upazila of Sylhet district

Insect	Farmers' opinion	
	Frequency	Percent
Scale insect	3	5.0
Orange bug	5	8.3
Termite	3	5.0
Bark and stem borer	11	18.3
Mealy bug	4	6.7
Leaf roller	6	10.0
Lemon butterfly	5	8.3
Citrus leaf miner	13	21.67
Aphid	4	6.7
No response	6	10.0
Total	60	100.0

Diseases found in citrus plants

Various kinds of diseases cause a huge loss in citrus cultivation and those are identified during visiting and collecting information from farmers. Among them 26.66% die back followed by citrus greening, gummosis, scab and citrus canker (21.66%, 16.7%, 15% and 13.33%, respectively) were important. Die-back, citrus greening, scab, gummosis and citrus canker were important diseases for citrus in Jaintapur upazila (Anon. 2010), which corroborated the present findings.

Table 5. Diseases found in citrus plants at Jaintapur upazila of Sylhet district

Diseases	Farmers' opinion	
	Frequency	Percent
Die back	16	26.66
Citrus greening	13	21.66
Gummosis	10	16.7
Citrus canker	8	13.33
Scab	9	15.0
No responses	5	8.3
Total	60	100.0

Problem faced by the respondents during citrus cultivation

The respondents were asked about the problem faced by them in citrus cultivation. Various kinds of problems were identified. Among those, some are mostly dominant to others. On the basis of the statement of the respondents, nine problems were recorded as the barrier of citrus cultivation. Problem in each item has been presented with rank order according to their importance with farmer's expectation to solve these problems in the Table 6.

Death of trees due to infestation of insect pest and diseases is the first ranked problem as perceived by the respondents. The government and non-government organizations should provide training for the farmers to solve these problems. Lack of credit facilities was also a big problem in citrus cultivation which can be solved by providing loan among the farmers. Quality seed and seedling of citrus species was seen as the problem that was ranked third. By providing good quality sapling in proper time these problems can be solved. Similar problems were found by Hassan (2010). He reported that water scarcity, insects and diseases are the most important problems faced by farmers during citrus cultivation at Moulvibazar district.

Table 6. Problem faced by the respondents during citrus cultivation at Jaintapur upazila

Problem faced by the respondents	Rank order	Farmer's expectation
Problems regarding infestation of insect pest and diseases	1	Providing training on insect pest and diseases control by Govt. and non Govt. organization
Lack of credit facilities	2	Providing loan
Quality seed and seedling of citrus species	3	Providing good quality sapling in proper time
Death of trees after being maturity	4	Providing training by Govt. and non Govt. organization
Unavailability of insecticide and pesticide	5	Insecticide and pesticide require to treatment plants should be economical and available
Marketing problem of product	6	Improve marketing communications channel
Difficulties in post-harvest of product	7	Providing training on post harvest operation
Lower price of the product	8	Providing subsidy by the Government
Technical knowledge and formal training	9	Providing training on citrus cultivation

Causes of genetic erosion of citrus species at Jaintapur upazila in Sylhet district

There were several reasons responsible for the genetic erosion of citrus species. Among them diseases and insect pest infestation, less interest in citrus cultivation due to poor market price and several environmental problems, unavailability of space, death after maturity etc. were remarkable according to the opinion of the local people. More than 16.7% farmers said that diseases and insect pest infestation were main reasons behind citrus extinction followed by less interest in citrus cultivation, environmental problem, poor market price, unavailability of space and felling down trees during construction of house which were 15%, 13.3%, 10%, 8.3% and 6.7%, respectively. Besides these, 10% farmers claimed diseases and insect pest infestation, inadequate demand and poor market price were responsible for genetic erosion of citrus species (Table 7). Pole *et al.* (2011) found that the farmers experienced a number of constraints in citrus farming in Kwale district, Kenya which include insect pests and diseases, poor crop husbandry practices, low yields, old and aging trees, high transportation costs due to poor road infrastructure, lack of inputs, lack of knowledge about improve value addition, drought, low prices, theft and poor markets. Among those diseases and poor markets were ranked the highest. The present finding was corroborated to the findings of Pole *et al.* (2011).

Table 7. Causes of genetic erosion of citrus species at Jaintapur upazila of Sylhet district

Causes of genetic erosion	Farmers' perception		
	Frequency	Percent	Ranking
Diseases and insect pest infestation	10	16.7	1
Less interest	9	15.0	2
Environmental problem	8	13.3	3
Poor market price	6	10.0	4
Diseases and insect pest infestation, inadequate demand & poor market price	6	10.0	4
Space not available	5	8.3	5
Felling down trees for construction of house	4	6.7	6
Poor yield & inadequate demand	4	6.7	6
Diseases and insect pest infestation felling down tree during construction of house & death after maturity	4	6.7	6
Bearing no fruit	2	3.3	7
No response	2	3.3	7
Total	60	100.00	

Diseases and insect pest infestation were the most serious problems responsible for the genetic erosion of citrus species followed by lack of credit facilities, quality seed and seedling of citrus species. Some of the respondents were found more interested in growing income generating commercial citrus tree species such as Zara lebu, Ada jamir, Elachi lebu instead of other citrus species prevailing in homesteads. This may happen to be a serious threat to the biodiversity of other citrus species which traditionally conserved in homesteads in near future. Therefore, scientists, researchers and naturalists have to give priority in bio-prospecting and value addition of the other citrus species for better income generation and to conserve biodiversity of the homesteads. This can be done by providing training and/or some incentives to the owners to be more careful about conserving citrus species. Government and non-government agencies should work closely with local people to provide advisory and material support to play significant roles in creating a better future for these citrus species.

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