

## Regeneration Problem of Wild Edible Fruits and Impact on Himalayan langur (*Presbytis Entellus*)

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### Abstract

This paper concept was to observe the knowledge about some wild edible fruit species which are consumed by Himalayan langur (*Presbytis entellus*) and its regeneration in the Nainital district of Kumaun Himalaya. The wild edible fruit species are not only as a source of supplemental food, had nutritionally balanced diet, medicines, fodder for cattle and fuel, but also for income generating potential of rural people in this region.. The diet of the Himalayan langur (*Presbytis entellus*) was studied for duration of one year. Wild edible fruits were harvested from their natural habitats by local people and sold into the local market for livelihood generation. The regeneration of maximum wild edible tree species is affected and the fruits become insufficient for the langurs diet. Due to this reason, the troupes of Himalayan langurs move towards villages of forest margins and destroy agricultural crops. A total 15 wild edible fruit species were recorded, out of which *Quercus spp.*, *Aesculus indica*, *Careya arborea*, *Myrica esculenta*, *Rubus ellipticus* etc. were consumed by Himalayan langurs are under threats to regenerate.



### Article History

Received: 16 March 2020  
Accepted: 7 August 2020

### Keywords

Himalayan Langurs;  
Human-Wildlife Conflict;  
Livelihood.

### Introduction


Uttarakhand state is highly enriched with its vegetation including wild edible fruits due to its varied eco-geographical and eco-climatic conditions (Saklani *et al.*, 2011). Central Himalaya is an important source of wild edible fruit species. These wild edible fruits species grow abundantly across an altitudinal gradient of Himalaya and the majority

of them bear fruits during summer (Maikhuri *et al.*, 2009). Wild edible plants refer to species that are harvested or collected from their wild natural habitats and used as food for human consumption (Lulekal *et al.*, 2011; Heywood, 2011; Seal, 2012). The wild edible fruits are closely linked with socio-economic condition of rural people of Himalayan region for their day to day requirements. Many wild edible fruits

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Doi: <http://dx.doi.org/10.12944/CWE.15.2.15>

have attained high market value in recent years. They maintain the diversity in the food system which has sustained the hilly rural people for generations from calamities such as crop failure etc. Efforts have been made for cultivation of commercial wild edible fruit crops a lot, but no efforts have been made for its domestication, conservation and utilization of these under-exploited, nutritionally and medicinally rich wild fruits. About 80% of the wild edible are drawn from forest area and sold in the market by rural community for income generation. Due to intense biotic pressure, the indigenous communities residing in the vicinity of forest collect the seed/fruits for the income, due to which the seedling availability is low and the regeneration of most of the wild edible fruit species is poor in their natural habitats. (Sundriyal and Sundriyal, 2001; Jeeva *et al.*, 2011). . Intense biotic pressure like grazing, fire, lopping, encroachment, illicit felling, collection of seeds and fruits etc are the most important reasons of the failure of natural regeneration. Natural regeneration of some of the wild edible fruit plants is however, affective in forest areas where condition is conducive. Increased overexploitation of wild edibles may cause threat to regeneration of certain species. On account of their nutritional and pharmaceutical potential, the wild edible fruit plants in the Himalayan region, have emerged as potential resources for addressing issues of rural development and biodiversity conservation.

Human-wildlife conflict is one of the Central issues in particular for cases that required a balance between the demands of forest resources between human and wildlife. Direct damage by wildlife is commonly referred to as the main driver of conflict and there is an urgent need to device method to reducing such damage. In the hilly areas of Uttarakhand, the Himalayan langur (*Presbytis entellus*) damage several crops and fruit varieties and there are several reports of human conflicts with langurs and Rhesus monkeys (*Macaca mulatta*). Over 675 species of wild edible fruits species belonging to 384 genera and 149 families are known from Indian Himalayas. In the present study we tried to concentrate our attention on the Himalayan langur regarding the various wild edible fruits that serves as a staple food for them in different locations in the Himalayan forests. We hypothesize that if there is sufficient food for langur

in the forest areas probability of their visit and stay in the human habitats can be reduced if not stopped all together. The main objective of the study was to prepare a list of the some wild edible fruit plants that are eaten by the langur, common fruits that are consumed by both human and langur and assess the regeneration and density of these wild edible fruit plants species in their natural habitats.

#### **Material and Methods**

This study was conducted in Nainital district of Kumaun Himalaya between 28°44' to 30°49'N latitude and 78°45' to 81°01' E longitudes. Geologically, the rocks comprises of thinly bedded grey calcareous slates and marls interbedded with dolomites and carbonaceous shales at the top (upper krol). The soil is derived predominantly from limestone of krol series (Valdiya, 1980) . The annual rainfall received varies from 2175.6mm to 3739.2mm in Nainital. The mean maximum monthly temperature varies from 17.5°C to 29°C and 13.1°C to 26.2°C and mean minimum monthly temperature ranges from 3.1°C to 15°C and 3.9°C to 17°C. (Verma & Tewari, 2020) The climate is governed by the monsoon rhythms. .

For the present study 3 sites were selected in Nainital district of Kumaun Central Himalaya between 1000-2000m above sea level. Details on wild edible fruits were recorded by interviewing the local people and visiting local forest areas near village margins for inventory knowledge generation on wild edible fruits consumed by Himalayan langur. We also observed at weekly intervals, the fruits/seeds consumed by troupes of langurs over one year. Troupes were estimated as a group of 10-12 langurs. Several Participatory Rural Appraisal meeting were organized at village level involving 10-15 villagers, self-help group and some social workers. The information was gathered after long sessions of discussions on preferred species of fruits/seeds consumed by langurs, regeneration of the species and livelihood related information. An each study site, a permanent plot of 10X10m for trees, 5X5m for sapling and 1X1m for seedling were marked and the density and basal area was estimated (Curtis & Mc Intosh, 1950).

To assess the regeneration status of individual species following categories were created.

Good regeneration = seedling > sapling>adult  
 Modrate regeneration = seedling ≥ sapling≥adult  
 Poor regeneration= Adult> sapling > seedling

For estimation of fruit/seed yield was made by counting the number of branches, twigs, number of branches per twigs and number of fruit per branch from 5 tree/ site. (Singh *et al.*, 2019)

**Result & Discussion**

Observation by the local forest area survey showed that the some important forest tree species bearing

fruits are *Quercus spp.* *Aesculus indica*, *Careya arborea*, *Myrica esculenta*, *Rubus ellipticus* are consumed by Himalayan langurs are under threats as regeneration of these species is low. Number of seedling and sapling of these species was very short in their natural habitats due to high anthropogenic pressure. On the basis of field studies wild edible fruit species consumed by Himalayan langur, we identified the following major wild edible fruit bearing tree/shrub species that provide food to langur through different seasons.(Table 1)

**Table 1: List of selected Tree/Shrub species of wild fruits consumed by Himalayan Langur in Nainital District of Kumaun Central Himalaya**

S. N.	Species	Local name	Fruiting season	Regeneration
1.	<i>Aesculus indica</i> (Tree)	Pangar	June- July	moderate
2.	<i>Quercus leuchotrichophora</i> (Tree)	Banj	October to January	Poor
3.	<i>Quercus floribunda</i> (Tree)	Tilonj	August to October	Poor
4.	<i>Quercus semecarpifolia</i> (Tree)	Kharsu	July to August	Poor
5.	<i>Bauhinia purpurea</i> (Tree)	Kwiral	January to March	moderate
6.	<i>Careya arborea</i> (Tree)	Kumbhi	June to July	Good
7.	<i>Indigofera pulchella</i> (Shrub)	Sakin	May	Good
8.	<i>Cornus macrophylla</i> (Deciduous tree)	Khadang	August to October	Good
9.	<i>Ficus numeralis</i> (Tree)	Dudhila	August to September	moderate
10.	<i>Prunus cerasoides</i> (Tree)	Padam	March	moderate
11.	<i>Myrica esculenta</i> (Tree)	Kaphal	June	moderate
12.	<i>Rubus esculenta</i> (Shrub)	Hisalu	June	Good
13.	<i>Cordia dichotoma</i> (Deciduous tree)	Lashora	October	Moderate
14.	<i>Debregeasia salicifolia</i> (Sub-deciduous shrub)	Tushiari	August	Good
15.	<i>Ehretia laevis</i> (Deciduous Tree)	Chamror	April –August	Good

Among these wild edible fruits *Myrica esculenta*, *Morus alba*, *Prunus armeniaca*, and *Rubus ellipticus*, were the most preferred species, which are also human edible and collected by vendors from the forest and sold into the market for income in fruiting season. These species are multipurpose income generating species of rural people of Kumaun Central Himalaya. These species are facing the severe problem of their natural regeneration which is poor..

The diet of the Himalayan langur (*Presbytis entellus*) was studied for 1 year divided into 4 seasons in the Nainital district of Kumaun Central Himalayas between 1000-2000m above sea level. Although

they eat leaves of several species in the non- fruit bearing seasons, they are basically frugivores. The size of troupes of langur and its moving range are large. Troupes had two or more than two adult males each, though about 20% of the troupes have only one male each. Newton, 1992; reported that, the troupe consumed items from 90% of trees and woody climbers available, in which only 24.4% fruits were consumed and 60-65% rest part of the trees were used for diet. Observation showed that the fruits consumed by Himalayan langur was 70-80% which was more than these reported values. Also found that the langurs changed their monthly diet according to the availability of fruits and seeds. Diet of *Pentellus* is approximately 50% fruits including ripe pulpy fruits.

This is only possible in the period of maximum fruit/seed availability (Sugiyama, 1976).

Due to the fact that certain wild edible fruits are harvested from their natural habitats for livelihood generation by humans, the regeneration of the species is effected and the fruits become insufficient for the langurs. This is one of the major causes why langurs move towards villages in forest margins and destroy crops. The newly germinated seedlings of some *Quercus* species are also eaten by grazing domestic animals, aggravating regeneration problem. The lesser number of seedling and sapling in these sites, may be due to severe biotic pressure. Regular human/ animal intervention like overgrazing, lumbering and encroachment of forest areas are among the key regulatory factors controlling the distribution of species (Mueller and Dombois; 1974). Research needs to be focused on the basic biology of these wild edible fruit plants and to be understood of their systematic, reproductive biology, ecology and biogeography. Investigations are needed into productivity, harvestability and regeneration status of wild edible fruit species. By the systematic planning and plantation in the forest areas the food can be

provided to the Himalayan langurs through the year and visit to human habitation can be reduced. In large scale afforestation/reforestation program of some important species like *Quercus spp.*, *Myrica esculenta*, *Rubus ellipticus*, *Aesculus indica*, *Careya arborea*, *Prunus ceresoides*, *Indigofera pulchella*, etc. in natural forest areas will play an important role in reducing the langur damage to fruits/crops in human habitation.

#### Acknowledgement

I am thankful to Department of Science & Technology (DST), New Delhi, for providing Financial Support. I am also thankful to Dr. Ashish Tewari, Department of Forestry, Kumaun University, Nainital, for their valuable suggestion and support to complete my work.

#### Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

#### Conflict of Interest

The authors do not have any conflict of interest.

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