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Relative density and frequency of wild fruits in Kalpa area of Kinnaur District of Himachal Pradesh

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Abstract

The present investigations were carried out in the wild fruit species in Kalpa area of Kinnaur district of Himachal Pradesh during 2001 to 2003. These wild fruits were studied with respect to their relative density, frequency and pomological description. The superior wild fruit tree of each species in all the transacts were pomologically described. The selected walnut, wild apricot, crab apple, Rubus and grapes trees/vines showed considerable variation in fruit weight and fruit size. The wild apricot and crab apple also showed significant variation in physico-chemical characters. However, in prunes variation was recorded for characters like flower diameter, petal breadth, stamen number and length, pistil length, fruit size, fruit weight and yield. In behmi, no variation was recorded for characters like fruit length, stamen length and pistil length. In wild peach considerable variation was recorded in trunk girth, length and breadth, flower diameter and fruit length. Significant variation recorded for trunk girth, cane length, bunch weight, fruit yield and biochemical characters in grapes. In all the species no variation was recorded for characters like bearing habit. In Rubus variation for full bloom was recorded. However, no significant variation was observed for petal length, stamen number, and yield in wild strawberry but significant variation was recorded in time of fruit ripening. The relative density values in transects I to XI ranged between 2.90 to 63.53 for different fruits under study. Similarly the relative frequency varied from 8.33 for crab apple in transact VII to 58.33 for wild apricot in transect XI.

Introduction

The edible fruit bearing wild plants are growing uncared and unattended. However, these fruits are eaten by village people and thus make a valuable contribution towards the nutrition of the rural masses. A large number of wild fruits are found in Kinnaur district of Himachal Pradesh The major wild fruits reported from Kinnaur are wild apricot, walnut, grapes, crab apple, bitter almond, behmi etc. The wild fruits are increasingly being threatened now because of the continuing degradation of their habitats and due to rapid replacement of locally adapted indigenous plant resources by the modern high yielding varieties.

The vulnerability of a plant species to the genetic erosion can be estimated by studying its population structure. The significance of relative density and relative frequency of a particular species lies in the fact that it constitutes a synthetic approach for evaluating plant response to the local environment. The relative density and frequency express the quantitative information on the composition and pattern of distribution of species. Since such studies have not been carried out earlier, hence the present investigations were planned to study the relative density and frequency of Kalpa area of district Kinnaur in Himachal Pradesh.

Material and Methods

The present studies carried out in Kalpa area of district Kinnaur in Himachal Pradesh. The altitude of different areas ranges between 1910-3100 m above mean sea level having dry temperate climate. The details of techniques and methods followed during the course of these studies are given below:

Field sampling design

A stratified random cluster sampling approach was adopted. The complete survey of Kalpa area (both left as well as right banks of the Satluj river) was carried out to select eleven different sites for laying of permanent transects.

The area will be divided into grids of 20x20 sq.km. In one grid, transact of 240 to 360 m will be laid and there will be 11 such transacts in one grid. Quadrates will be demarcated at every 40 m i.e. 20x20m for trees and 5x5 m for shrubs. There will be

6 to 9 quadrates in one transects and total number of quadrates will be 66 to 99 in one grid (20x20 km) and total number of transects will be 11 in one grid.

In total, eleven transacts of size 20x360 m were marked in longitudinal direction at different sites. The quadrates in a transect were spaced at a distance of 20m each from one another as depicted below in Fig.1.

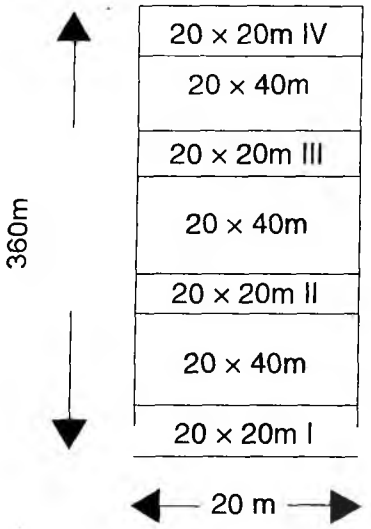


Fig 1. Depicting location of quadrates in a transect [not to scale]

In order to express the dominance and ecological success of any species with a single value, index has been developed. This index utilizes different characteristics viz. relative frequency and relative density (Mishra, 1968). To calculate the value of each wild species in each quadrates, the following observations were recorded in the field itself.

1. Total number of each species present in each quadrate (trees and vines)

2. In each transects one plus tree was selected.

3. Girth (cm) and height (m) in each quadrates on individual wild fruits (tree and vines)

4. Calculation for relative density and relative frequency of each quadrate for all the individual of each wild species was done following Phillips (1959) as:

$$\text{Relative density} = \frac{\text{Number of individual of the species}}{\text{Number of individual of all the species}} \times 100$$

$$\text{Relative frequency} = \frac{\text{Number of occurrence of the species}}{\text{Number of occurrence of all the species}} \times 100$$

Results and Discussion

Study sites

The study area was Kalpa Tehsil of Kinnaur district. The area on left and right bank of river has diverse wild fruits. Eleven permanent transects were laid in the entire area on both the banks of the Satluj river. The exact location of the transect and details regarding average altitudes are presented in Table 1. Out of eleven transect four were in the left bank of Satluj river and seven on the right bank.

Table 1. Altitude of the villages in the marked transects

Transects No.	Villages per area	Altitude (m.amsl)
I	Kalpa	2860-3100
II	Pangi	2629-2809
III	Roghi	2694-2954
IV	Purbani	2369-2529
V	Telangi	2263-2383
VI	Tengling	1957-2018
VII	Dhako	1985-2185
VIII	Barang	2070-2210
IX	Kothi	2362-2543
X	Rali	1910-2030
XI	Khawangi	1955-2190

Floristic composition

During the present studies carried out in eleven sites (transects) a total of 11 wild fruit species were recorded (Table 2). The species of maximum occurrence was wild apricot which was found in all the transects. This was followed by walnut, grapes which were found growing in eight transects. Crab apple, behmi and prunes were found growing in five transects. The species which occurred in four transects were *Rubus* and wild peach, while kainth was found in three transects. The species which were found in two transects were wild strawberry and bitter almond.

Relative density

In the present study (Table 3), it was observed that the relative density values in transects I to XI ranged between 12.41 (walnut) to 26.11 (wild strawberry), 10.39 (grapes) to 45.50 (wild apricot), 6.97 (prunes) to 44.24 (wild apricot), 22.04 (prunes and wild peach) to 44.62 (grapes), 2.90 (walnut) to 54.54 (crab apple), 15.38 (wild peach) to 36.80 (wild apricot), 11.76 (crab apple and prunes) to 26.88 (wild apricot), 100.00 (crab apple) to 47.95 (wild apricot), 10.72 (grapes) to 22.74 (wild apricot), 9.72 (crab apple and wild peach) to 63.53 (wild apricot), 35.58 (grapes) and 54.37 (wild apricot).

Relative frequency

The observations on relative frequency of different fruits are presented in Table 3. The relative frequency of different fruit in transect I varied from 8.88 (crab apple) to 28.88 (Rubus species).

In transect II, maximum relative frequency (19.23) was recorded for walnut and wild apricot and minimum 11.53 for other species. In transect III wild apricot showed the higher relative frequency (22.22) whereas prunes showed the lower relative frequency (10.81).

The relative frequency of different fruits in transect IV varied from 7.40 (grapes) to 22.20 (wild apricot). The relative frequency in transect V ranged between 4.76 to 23.80. In transect VI maximum frequency was 21.62 for wild apricot. In transect VII maximum relative frequency was observed (22.22) in wild apricot and minimum (8.33) in crab apple and bitter almond.

The relative frequency in different fruits in transect VIII varied from 8.82 (wild peach) to 20.58 (wild apricot). In transect IX (Table 3) the maximum frequency was recorded for wild apricot (22.85) followed by prunes and grapes (14.28). In transect X relative frequency values are maximum for wild apricot (21.42) and minimum for crab apple (10.71). On transect XI (Table 3), the maximum relative frequency was found for wild apricot (58.33) and minimum relative frequency was found for grapes (41.66).

Area of the study starts from village Rali to village Pangi along the left bank as well as right bank of the Satluj river. The elevation of the areas studied ranged from 190 m above mean sea level at Rali to 3100 m above mean sea level at Kalpa. In the entire study area eleven wild fruit species were found growing. The highest number of wild fruits encountered in the transect (T_5 and T_8) located in Telangi and Barang area and one with least number of species is located in Khawangi area (T_{11}).

The floristic composition revealed that both the occurrence of a species in different transects as well as of different species in single transect depicted variation in the transects under study. Thus revealing different associations at different altitudinal ranged in entire area (Table 2). The main reason behind such varied associations/ floristic composition is that all the species in a natural community are not isolated.

To evaluate the ecological success of a species, Curtis (1959) suggested study of its relative density and relative frequency. The area under present study was dominated by wild apricot as it has recorded maximum relative density (63.53) and frequency (58.33). Pande *et al.* (2001) also studied the relative density and relative frequency of forest species in Kedarnath forest division. The increase or decrease in the relative density and frequency values can be attributed to the change in number of species, the association between different species due to less number of species contributing at different times to the total values, more intensified competition between different species and due to vigorous alterations such as abiotic interferences (Precsenyi, 1981).

Table 2. Floristic composition of wild species in different transects

Species	Trans I	Trans II	Trans III	Trans IV	Trans V	Trans VI	Trans VII	Trans VIII	Trans IX	Trans X	Trans XI	Total
Juglans regia (walnut)	+	+	+	+	+	+	-	+	-	+	-	8
Malus baccata (crab apple)	+	+	+	+	+	-	+	+	+	+	-	9
Prunus armeniaca (wild apricot)	+	+	+	+	+	+	+	+	+	+	+	11
Prunus amygdalus (bitter almond)	-	-	-	-	+	-	+	-	-	-	-	2
Prunus domestica (prunes)	+	-	+	+	-	-	+	+	+	+	-	7
Prunus mira (behmi)	+	+	+	+	-	-	-	+	-	-	-	5
Prunus persica (wild peach)	-	+	-	-	+	+	-	+	-	+	-	5
Pyrus pashia (kainth)	-	-	-	-	+	-	+	+	-	-	-	3
Fragaria indica (wild strawberry)	+	-	-	-	-	+	-	-	-	-	-	2
Rubus spp. (akhe)	+	+	+	+	+	-	-	-	-	-	-	5
Vitis spp. (grapes)	-	+	-	+	+	+	+	+	+	+	+	9
Total	7	7	6	7	8	5	6	8	4	6	2	66

Table 3. Relative density and relative frequency of wild fruits

Species	Transect I		Transect II		Transect III		Transect IV		Transect V	
	Relative density	Relative frequency	Relative density	Relative frequency	Relative density	Relative frequency	Relative density	Relative frequency	Relative density	Relative frequency
Juglans regia (walnut)	12.41	17.77	12.50	19.23	13.39	16.66	30.47	14.81	2.90	14.28
Malus baccata (crab apple)	18.15	8.88	26.66	11.53	10.53	18.91	-	-	54.54	7.14
Prunus armeniaca (wild apricot)	19.93	20.00	45.50	19.23	44.24	22.22	44.04	22.20	51.94	23.80
Prunus amygdalus (bitter almond)	-	-	-	-	-	-	-	-	20.00	4.76
Prunus domestica (prunes)	23.07	11.11	16.36	11.53	6.97	10.81	22.04	18.51	-	-
Prunus mira (behmi)	20.32	13.33	18.57	15.38	23.89	18.91	23.80	11.11	-	-
Prunus persica (wild peach)	-	-	-	-	-	-	22.04	11.11	20.00	4.76
Pyrus pashia (kainth)	-	-	-	-	-	-	-	-	8.82	14.28
Fragaria indica (wild strawberry)	26.11	13.33	-	-	-	-	-	-	-	-
Rubus spp. (akhe)	25.85	28.88	18.10	11.53	18.22	13.88	37.52	18.51	4.63	11.90
Vitis spp. (grapes)	-	-	10.39	11.53	-	-	44.62	7.40	4.92	9.52

Species	Transect VI		Transect VII		Transect VIII		Transect IX		Transect X		Transect XI	
	Relative density	Relative frequency	Relative density	Relative frequency	Relative density	Relative frequency	Relative density	Relative frequency	Relative density	Relative frequency	Relative density	Relative frequency
Juglans regia (walnut)	20.56	13.51	-	-	29.42	17.64	-	-	26.38	17.85	-	-
Malus baccata (crab apple)	-	-	11.76	8.33	10.00	14.70	11.36	11.42	9.72	10.71	-	-
Prunus armeniaca (wild apricot)	36.80	21.62	26.88	22.22	47.95	20.58	32.74	22.85	63.53	21.42	54.37	58.33
Prunus amygdalus (bitter almond)	-	-	25.00	8.33	-	-	-	-	-	-	-	-
Prunus domestica (prunes)	-	-	11.76	13.88	14.00	8.82	14.53	14.28	16.66	10.71	-	-
Prunus mira (Behmi)	-	-	-	-	19.28	11.76	-	-	-	-	-	-
Prunus persica (wild peach)	15.38	8.10	17.91	11.11	21.26	11.76	-	-	9.72	14.28	-	-
Pyrus pashia (kainth)	-	-	17.45	11.11	27.77	14.70	-	-	-	-	-	-
Fragaria indica (wild strawberry)	28.57	18.90	-	-	-	-	-	-	-	-	-	-
Rubus spp. (akhe)	16.66	10.00	-	-	-	-	-	-	-	-	-	-
Vitis spp. (grapes)	29.66	13.51	25.44	16.66	28.04	14.70	10.72	14.28	10.41	14.28	35.58	41.66

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