

Phytosociological Studies on Natural Populations of *Terminalia chebula* Retz. in District Hamirpur, Himachal Pradesh

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Article History

Article ID: IJEP0349
Received in 30th October, 2019
Received in revised form 18th November, 2019
Accepted in final form 26th November, 2019

Abstract

The present phytosociological study was conducted on five natural populations of *Terminalia chebula* Retz. Distributed in Hamirpur district of with the objective to study vegetation structure and distribution pattern of different tree and shrub species in these populations. In each natural population five quadrats of 20 x 20 m (400 m²) size were randomly laid to examine tree species and for the analysis of shrubs, a sub-square of 5x 5 m (25 m²) size was chosen in each quadrat. *Terminalia chebula* Retz. was found dominant among tree species in all populations, while among shrubs *Murraya koengii* was dominant species. Species richness in trees ranged from 1.13 to 2.69 and in shrubs it ranged from 0.28 to 0.54.

Keywords: Dominant, frequency, harar, populations, quadrats, richness

1. Introduction

Himachal Pradesh has been regarded as a veritable emporium of plant resources, rich in medicinal and aromatic plants. *Terminalia chebula*, among medicinal plants is one of the important plants used in various medicines. It is commonly called Harar, Black Myrobalan, Chebulic Myrobalan and is also known as the “King of Medicine” and is native to India and South East Asia (Dymock et al., 1976). Harar have been traditionally used in Indian system of medicine Ayurveda. It is routinely used as household remedy throughout sub-continent for treating stomach colic of sucking infants and as a laxative for the old. Harar is also useful in apthae, bite trouble, blood pressure, carious teeth, cough, dysentery, diarrhea, piles, vaginal discharge, ulcers, vomiting, worms and has been held in high esteem in Hindu medicines. Myrobalans are also employed in the preparation of ink and in dyeing as amordant for the basic aniline dyes. *T. chebula* exhibits antibacterial, antifungal, antiviral and anti mutagenic and anti carcinogenic activity. Fruit pulp of *Terminalia chebula* is used in many of the standard preparations such as ‘triphala’ and ‘chayvanprash’ which is use as food supplement. Harar is found in mixed dry deciduous forests, and is often found in tropical and subtropical areas, mostly hilly tracks. It is spread over the greater part of India, except in the arid zone

(Troup, 1921). Phytosociological studies provide information on the abundance, distribution, and rate of change in species composition. Both the vegetation structure and diversity play a strong functional role in controlling processes in ecosystems such as the production of biomass, water and nutrient cycling (Gower et al., 1992). The actual populations of *Terminalia Chebula* in Himachal Pradesh are limited to a few areas, primarily in the Lower or Shivalik Chir pine forest type or subtype 9/C1a in Himachal Pradesh where *Pinus roxburghii* and *Terminalia chebula* are found. A comprehensive literature search failed to discover any useful information on the phytosociology of Harar. Keeping in view the socio-economic importance of the species, this research was carried out with the aim of researching the pattern of distribution and ecological status of natural populations *Terminalia chebula* Retz. in Hamirpur district of Himachal Pradesh.

2. Materials and Methods

2.1. Study sites

The present study was confined to five *Terminalia chebula* Retz. natural populations, distributed in Hamirpur district of Himachal Pradesh. The physical description of the natural populations is provided in Table 1. The research site climate was sub-tropical, with cold winters. The temperature rose to



Table 1: Physical description of sites (populations)

Population	Altitude (m)	Latitude (N)	Longitude (E)
Naraina	478	31o36.396'	076o28.038'
Kothi	370	31o33.700'	076o30.786'
Pahlu	400	31o36.231'	076o31.549'
Makkar	400	31o35.178'	076o31.337'
Uled	764	31o34.414'	076o33.310'

a high of 40°C in the summer and a low of 7 °C in the winter and mostly rainfall in the monsoon.

2.2. Method of data collection

In each natural population, five quadrats of 20×20 m² (400 m²) size were randomly laid to examine tree species. Size of quadrat was determined by the species area curve method. A sub-square of 5×5 m (25 m²) size for shrubs was chosen in each quadrat. The number of trees in each sample plot was computed by counting trees. Basal area of trees and shrubs present in the quadrates was measured with wooden and digital calipers, respectively. The density of

plant was determined by counting plants of various species. Vegetation data for density, frequency, and abundance were quantitatively analyzed. Relative Ecological variation in the size, relative density and relative basal area of *Terminalia chebula* were determined by using formula given by Phillips (1959), while the importance value index (IVI) was calculated by using the formulae of Curtis (1959) and Mishra (1989). The species richness was calculated using 'Margalef's index of richness' (Dmg) (Magurran, 1988).

3. Results and Discussion

The tree and shrub species that were in five natural populations of *Terminalia chebula* Retz. are presented in Tables 2 to 6. There were 11, 9, 11, 6 and 5 tree species in Naraina, Kothi, Pahlu, Makar and Uled respectively in natural populations of *Terminalia chebula*. In Naraina, *Terminalia chebula* was dominant species with IVI value of 124.48 and *Pinus roxburghii* was co-dominant tree species having IVI of 38.95. *Murraya koenigii* was dominant shrub species with IVI of 133.00 followed by *Lantana camara* with IVI of 111.35 (Table 2).

Table 2: Density, abundance, basal area, frequency and IVI of trees and shrubs in Naraina

Trees						
S.No.	Species	Density (individual ha ⁻¹)	Abundance (AB)	Basal area (cm ² ha ⁻¹) trees or shrubs	Frequency (%)	IVI
1.	<i>Acacia catechu</i>	3	1.50	634.68	40.00	21.53
2.	<i>Cassia fistula</i>	3	3.00	309.12	20.00	14.37
3.	<i>Emblica officinalis</i>	3	1.50	389.04	40.00	19.90
4.	<i>Grewia optiva</i>	1	1.00	240.41	20.00	9.04
5.	<i>Leucaena leucocephala</i>	3	1.50	249.83	40.00	18.98
6.	<i>Mallotus philippensis</i>	1	1.00	70.85	20.00	7.91
7.	<i>Mangifera indica</i>	2	1.00	1677.58	40.00	26.02
8.	<i>Melia azedarach</i>	1	1.00	122.66	20.00	8.25
9.	<i>Pinus roxburghii</i>	3	1.50	3256.06	40.00	38.95
10.	<i>Syzygium cumini</i>	1	1.00	471.20	20.00	10.57
11.	<i>Terminalia chebula</i>	20	4.00	7632.81	100.00	124.48
	Total	41	18	15054.24	400.00	300
Shrubs						
1.	<i>Lantana camara</i>	12	4	23.17	60.00	111.35
2.	<i>Murraya koenigii</i>	24	8	19.21	60.00	133.00
3.	<i>Rubus ellipticus</i>	5	2.5	9.59	40.00	55.65
	Total	41	14.5	51.97	160.00	300

In Kothi with IVI value of 112.31, *Terminalia chebula* was dominant tree species and *Pinus roxburghii* as co-dominant tree species with IVI value of 78.64. Among shrubs *Murraya koenigii* was having maximum IVI value (139.66) and *Lantana camara* was co-dominant having IVI of 115.36 (Table 3).

In Pahlu, *Terminalia chebula* was dominant tree species with

IVI value of 128.40 and *Pinus roxburghii* was co-dominant tree species having IVI of 36.62. *Murraya koenigii* was dominant shrub species with IVI of 188.81 followed by *Lantana camara* with IVI of 111.19 (Table 4).

In Makar, *Terminalia chebula* dominated among trees species with IVI value of 119.72 followed by *Acacia catechu* as co-



Table 3: Density, abundance, basal area, frequency and IVI of trees and shrubs in Kothi

Trees						
Sl. No.	Species	Density (individual ha ⁻¹)	Abundance (AB)	Basal area (cm ² ha ⁻¹) trees or shrubs	Frequency (%)	IVI
1.	<i>Acacia catechu</i>	4	2	581.91	40.00	18.73
2.	<i>Delbergia sissoo</i>	4	2	1138.65	40.00	20.59
3.	<i>Emblica officinalis</i>	7	2.33	1150.54	60.00	30.84
4.	<i>Grewia optiva</i>	1	1	188.60	20.00	7.21
5.	<i>Mallotus philippensis</i>	3	1.5	468.63	40.00	16.54
6.	<i>Mangifera Indica</i>	1	1	379.94	20.00	7.84
7.	<i>Pinus roxburghii</i>	15	3.75	9711.07	80.00	78.64
8.	<i>Terminalia bellirica</i>	1	1	213.72	20.00	7.29
9.	<i>Terminalia chebula</i>	19	3.8	16211.69	100.00	112.31
	Total	55	18.38	30044.75	420.00	300
Shrubs						
1.	<i>Lantana camara</i>	23	5.75	15.13	80.00	115.36
2.	<i>Murraya koenigii</i>	27	5.40	18.34	100.00	139.66
3.	<i>Rubus ellipticus</i>	2	2.00	15.13	20.00	44.98
	Total	52	13.15	48.60	200.00	300

Table 4: Density, abundance, basal area, frequency and IVI of trees and shrubs in Pahlu

Trees						
S.No.	Species	Density (individual ha ⁻¹)	Abundance (AB)	Basal area (cm ² ha ⁻¹) trees or shrubs	Frequency (%)	IVI
1.	<i>Acacia catechu</i>	3	3.00	344.03	20.00	12.86
2.	<i>Cassia fistula</i>	7	3.50	561.67	40.00	27.71
3.	<i>Emblica officinalis</i>	5	2.50	1640.79	40.00	25.61
4.	<i>Grewia optiva</i>	1	1.00	379.94	20.00	8.40
5.	<i>Leucaena leucocephala</i>	1	1.00	254.34	20.00	8.11
6.	<i>Mallotus philippensis</i>	6	3.00	5491.66	40.00	36.62
7.	<i>Mangifera indica</i>	3	1.50	2202.91	40.00	22.34
8.	<i>Melia azedarach</i>	1	1.00	1163.57	20.00	10.18
9.	<i>Pinus roxburghii</i>	1	1.00	1133.54	20.00	10.11
10.	<i>Syzygium cumini</i>	15	3.00	29961.37	100.00	128.40
11.	<i>Terminalia chebula</i>	1	1.00	934.35	20.00	9.66
	Total	44	21.50	44068.17	380.00	300
Shrubs						
1.	<i>Lantana camara</i>	7	2.33	11.41	60.00	111.19
2.	<i>Murraya koenigii</i>	20	4.00	12.48	100.00	188.81
	Total	27	6.33	23.89	160.00	300

dominant species with IVI of 67.90. *Murraya koenigii* was dominant shrub species with IVI of 152.56 followed by *Lantana camara* with IVI of 111.68 (Table 5).

In Uled also *Terminalia chebula* dominated with IVI value of 128.64 followed by *Acacia catechu* with IVI of 97.39. *Murraya koenigii* was dominant shrub species with IVI of 162.97

Table 5: Density, abundance, basal area, frequency and IVI of trees and shrubs in Makar

Trees						
S.No.	Species	Density (individual ha ⁻¹)	Abundance (AB)	Basal area (cm ² ha ⁻¹) trees or shrubs	Frequency (%)	IVI
1.	<i>Acacia catechu</i>	10	2.50	5178.72	133.33	67.90
2.	<i>Emblica officinalis</i>	4	2.00	888.85	66.67	24.69
3.	<i>Grewia optiva</i>	2	2.00	469.63	33.33	12.45
4.	<i>Mangifera Indica</i>	3	1.50	1143.36	66.67	23.40
5.	<i>Pinus roxburghii</i>	7	2.33	4390.09	100.00	51.83
6.	<i>Terminalia chebula</i>	17	3.40	12452.10	100.00	119.72
	Total	43	13.73	24522.75	500.00	300
Shrubs						
1.	<i>Lantana camara</i>	14	3.50	9.54	133.33	111.68
2.	<i>Murraya koenigii</i>	24	4.80	11.19	166.67	152.56
3.	Rubusellipticus	3	3.00	4.69	33.33	35.77
	Total	41	11.30	25.42	333.33	300

followed by *Lantana camara* with IVI of 137.03 (Table 6).

The values of tree species richness ranged in between 1.13

to 2.69 and shrub species richness range was 0.28 to 0.54 in natural populations. Tree species richness was highest in

Table 6: Density, abundance, basal area, frequency and IVI of trees and shrubs in Uled

Trees						
S.No.	Species	Density (individual ha ⁻¹)	Abundance (AB)	Basal area (cm ² ha ⁻¹) trees or shrubs	Frequency (%)	IVI
1.	<i>Acacia catechu</i>	10	2.50	10779.57	80.00	97.39
2.	<i>Leucaena leucocephala</i>	1	1.00	907.46	20.00	13.40
3.	<i>Santalum album</i>	5	1.67	1113.22	60.00	40.20
4.	<i>Syzygium cumini</i>	2	2.00	2007.45	20.00	20.36
5.	<i>Terminalia chebula</i>	16	3.20	12545.24	100.00	128.64
	Total	34	10.37	27352.94	280.00	300
Shrubs						
1.	<i>Lantana camara</i>	14	3.50	13.95	80.00	137.03
2.	<i>Murraya koenigii</i>	21	4.20	12.58	100.00	162.97
	Total	35	7.7	26.53	180.00	300

Naraina (2.69) and lowest in Uled (1.13) and shrub species richness was highest in two populations viz., Naraina and

Makar (0.54) and lowest in Uled (0.28) (Table 7).

This pattern of differences in basal area and IVI basal area

Table 7: Species richness of trees and shrubs of different Harar populations

Population	Plant category	Species Richness	Population	Plant category	Species Richness
Naraina	Trees	2.69	Pahlu	Shrubs	0.30
	Shrubs	0.54	Makar	Trees	1.33
Kothi	Trees	2.00	Uled	Shrubs	0.54
	Shrubs	0.51		Trees	1.13
Pahlu	Trees	2.64		Shrubs	0.28



different populations may be due to differences in habitat. Plants growing together have a shared relationship with nature and among themselves (Mishra et al., 1997). These interactions between different plants and their environment result in different types of vegetation occurring in different areas Sharma and Kant (2014); Kumar and Bhatt (2006); Tripathi et al. (2010), Similar results were obtained by Sharma and Thakur (2015), while studying ecological variation among natural populations of *Terminalia chebula* Retz. in Himachal Pradesh. The observed values for the diversity indices were within the limits stated by Sharma and Thakur (2016), Pandey (2001) and Kumar et al. (2010)

4. Conclusion

Terminalia chebula Retz. was found as dominant tree species in its natural growing population while *Murraya koenigii* was found as dominant tree species. Keeping in view the huge demand of Harar fruits in national and international market there is need of its domestication for socio-economic upliftment of farming community. The species of trees and shrubs co-existing with natural population of Harar indicate that the areas where these associated species are growing naturally have good scope for raising commercial plantations of Harar.

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