
Distribution patterns and occurrence of the associating tree strata with *Ringal (hill bamboo)* in peak growing season (rainy) in Rudraprayag Garhwal Himalaya.

Subodh Kumar*, J.P. Mehta and Jagdish Chandra Rastogi

Department of Botany, Ecology Laboratory HNB Garhwal University
Srinagar Garhwal 246174 Uttarakhand, India

ABSTRACT: the present study deals with the occurrence and distribution patterns of the trees strata which associating with *Ringal (hill bamboo)*. A/F ratio was used to assess the distribution pattern of the species. The conducted investigation shows that the distribution patterns of the tree strata of all the study sites in peak growing season (rainy) at different surfaces. Distribution pattern indicated that most of the plants species were distributed randomly followed by contagiously. Distribution pattern of woody and herbaceous vegetation generally showed interesting pattern. Regular distribution of plants species was rare. Across the sites and seasons the distribution patterns regularly ranges Badhani (6.66%) to Kot (20.00%), randomly ranges Bhanaj and Kakda-kund (20.00%) to Kakda-kund (80.00%) and contagiously ranges Badhani (40.00%) to Bhanaj and Kakda-kund (80.00%), respectively.

Keywords: *Ringal (hill bamboo)*, Distribution pattern, regular, random and contagious.

INTRODUCTION

The structure of vegetation of an area largely influenced by the quantity and quality of floristic elements in it. The total number of species in any vegetational aspect reflects the adaptational strength of any vegetational unit (Community) in which transformation, accumulation and flow of energy are involved (Odum, 1963). The functioning of this system is closely related to the component of the community. In case the diversity of species in a community show that the adaptational potential is greater to changing condition of an environment. The fluctuations indicate influences by population of each species to the incoming heat, moisture and light as modified by vegetation itself.

Garhwal Himalaya has been a centre of floristic as well as ecological studies in last eighty years. Duthei, (1906) revised and supplemented the catalogue of the plants of Kumaun and Grahwal regions based on the collection made by Strachey and Winter bottom during the years 1846-1849. One of the works on arborescent vegetation of West Himalaya was published as 'A Forest Flora for Kumaun' by Osmaston, (1927). After establishment of northern circle of Botanical Survey of India at Dehradun in 1956, there has been a spurt of botanical exploration in North-West and West Himalaya and several plants collectors at this regional center collected plants from remote localities of Grahwal. Ghildiyal, (1957) collected plants from Valley of Flower and Gupta, (1957) enumerated the plants from Bhilangana Valley, and enumerated 738 species of flowering plants and ferns.

The present study was made to define occurrence and distribution patterns of the trees strata which associating with *Ringal (hill bamboo)*.in some sites of Rudraprayag, Grahwal Himalaya, which may be helpful to the explorers, scholars, and naturalist for various aspects or purposes.

Material and methods

Study area:The present investigation conducted in five sites viz., Badhani, Bhanaj, Kakda-kund, Khaliyan and Kot in Rudraprayag District, Garhwal Himalaya. Badhani, Khaliyan and Kot situated in Lastear gad valley in Jakholi, Bhanaj in Kyunja gad valley and Kakda-kund in left bank of river Mandakini, respectively. Badhani leis between 30°30'19.77"N-78°56'18.65"E (2,541-2,719m amsl) N-W aspect and 40-46° slope, Bhanaj 30°24'56.33"N-79°09'12.18"E (2,129-2,408m amsl) with N-E aspect and 41-44° slope, Kakda-kund 30°30'11.63"N-79°05'17.24"E (968-1,027m amsl) with W-S aspect and 29-32° slope, Khaliyan 30°28'03.93"N-78°55'50.31"E (1,829-2,045m amsl) with E-S aspect and 37-41° slope and Kot between 30°30'00.78"N-78°55'34.20"E (2,094-2,205m amsl) with E-S aspect and 35-43° slope, respectively. Mandakini is the main watershed of the district covers the area 1, 68,049 hectare including 5 sub- watersheds and 40 micro-watersheds (www.uttara.com).

Occurrence

Comparative list of occurrence of tree vegetation growing in different surfaces in peak growing season in all the sites are given in Table-1.0 (a).

Distribution pattern

The abundance to frequency ratio was used to represent the distribution pattern (Whitford, 1949) of any species in the community. The ratio 0.025 indicates regular, between 0.025 to 0.05 indicates random and 0.05 indicates contagious distribution of species (Curtis and Cottom, 1956). If we divide the abundance by frequency, this provides a measure of the relative randomness of the species of the interest.

$$R = \frac{A}{F}$$

RESULTS

In the present field survey of the Mandakni, Kakdagad and Lastar valley with existing five sites viz; Badhani, Bhanaj, Kakda, Khaliyan and Kot of district RudraprayagGrahwalHimalaya, a total number of 29 tree species are found as associating with *Ringal(hill bamboo)*.

Table-1.1 shows that the all 29 tree species *Acer acuminatum*, *Acsculusindica*, *Albizialebeck*, *Alnusnepalalansis*, *Bauhinia variegata*, *Benthamidiacapitata*, *Bombaxceiba*, *Buxuswallichiana*, *Carpinusviminea*, *Cinnamomumtamala*, *Daphniphyllumhimalayense*, *Engelhardtiacolebrookeana*, *Juglansregia*, *Ilexdipyrena*, *Lyoniaovalifolia*, *Myricaesculanta*, *Neolitseapallens*, *Perseaduthiei*, *Perseaodoratissima*, *Prunuscerasoides*, *Pyruspashia*, *Quercusleucotrichphora*, *Q.semicarpifolia*, *Rhododendron arboretum*, *Sapium insigne*, *Swidaoblona*, *Symplocospaniculata*, *Taxillusvestitus*, *Toonaciliata* found in

all sites viz., Badhani (Site 1), Bhanaj (Site 2), Kakda-Kund (Site 3), Khaliyan (Site 4) and Kot (Site 5) in peak growing season (rainy) at lower, middle and upper surface.

Table 1.0 explains the distribution pattern of the different tree species in the peak season growing (rainy) at lower, middle and upper surface for tree vegetation and seasonal (winter, summer and rainy) for shrubs and herbaceous vegetation of all sites.

Site 1 (Badhani), in peak growing season (rainy) at lower surface the trees were distributed 40.00% contagiously, 60.00% random, whereas, 6.66% regularly, 46.46% randomly and 46.46% contagiously in middle surface and 46.66% random and 53.33% contagiously in upper surface.

Site 2 (Bhanaj), in peak growing season (rainy) at lower surface the trees were distributed 80.00% contagiously, 20.00% random, whereas, 73.33% contagiously and 26.66% random in middle surface and 53.33% random 46.66% contagiously in upper surface.

Site 3 (Kakda-kund), in peak growing season (rainy) at lower surface the trees were distributed 13.33% regular, 20.00% random and 66.66% contagiously, whereas, 80.00% contagiously and 20.00% random in middle surface and 26.66% random 73.33% contagiously in upper surface.

Site 4 (Khaliyan), in peak growing season (rainy) at lower surface the trees were distributed 66.66% contagiously, 33.33% random, whereas, 46.66% contagiously and 53.33% random in middle surface and 46.66% random 53.33% contagiously in upper surface.

Site 5 (Kot), in peak growing season (rainy) at lower surface the trees were distributed 60.00% contagiously, 40.00% random, whereas, 46.66% contagiously, 33.33% random and regular 20.00% in middle surface and 46.66% random 53.33% contagiously in upper surface.

Table-1.0-Distribution pattern of different tree vegetation in Peak growing season (rainy) in surfaces of different study sites.

Sites/surface		Distribution pattern (%)		
		Regular	Random	Contagious
Badhani (Site 1)	Lower	---	60.000	40.000
	Middle	6.666	46.666	46.666
	Upper	---	46.666	53.333
Bhanaj (Site 2)	Lower	---	20.000	80.000
	Middle	---	26.666	73.333
	Upper	---	53.333	46.666
Kakda- kund (Site 3)	Lower	13.333	20.000	66.666
	Middle	---	20.000	80.000
	Upper	---	26.666	73.333
Khaliyan (Site 4)	Lower	---	33.333	66.666
	Middle	---	53.333	46.666
	Upper	---	46.666	53.333
Kot (Site 5)	Lower	---	40.000	60.000
	Middle	20.000	33.333	46.666
	Upper	---	46.666	53.333

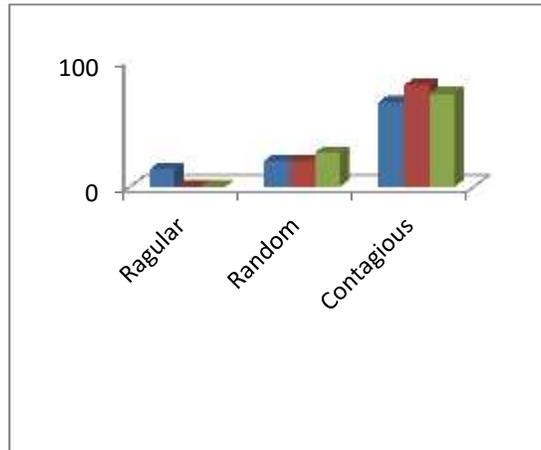
Table-1.1 -Occurrence of tree species in different surfaces and study sites in a peak growing season

S. No.	Name of species	Lower surface					Middle surface					Upper surface				
		sites					sites					sites				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1.	<i>Acer acuminatum</i> Wall. ex D.Don	-	+	-	+	+	-	+	-	+	+	-	+	-	+	+
2.	<i>Acsculusindica</i>	+	-	-	+	+	+	-	-	+	+	+	-	-	+	+
3.	<i>Albizialebeck (L.) Benth</i>	+	-	-	+	-	+	-	-	+	-	+	-	-	+	-
4.	<i>Alnusnepalalansis</i>	+	-	+	+	-	+	-	+	+	-	+	-	+	+	-
5.	<i>Bauhinia variegata</i> L.	-	+	+	-	+	-	+	+	-	+	-	+	+	-	+
6.	<i>Benthamidiacapitata</i>	+	+	-	-	+	+	+	-	-	+	+	+	-	-	+
7.	<i>Bombaxceiba</i> L.	-	-	+	+	-	-	-	+	+	-	-	-	+	+	-
8.	<i>Buxuswallichiana</i> Baillon	-	-	+	-	+	-	-	+	-	+	-	-	+	-	+
9.	<i>Carpinusviminea</i> Lindl	-	+	+	+	-	-	+	+	+	-	-	+	+	+	-
10.	<i>Cinnamomumtamala</i> (Buch.-Ham) Nees&Ebermaeir	-	+	-	-	+	-	+	-	-	+	-	+	-	-	+
11.	<i>Daphniphyllumhimalayense</i> (Benth.) Muell. Arg.	-	+	+	-	+	-	+	+	-	+	-	+	+	-	+
12.	<i>EngelhardtiaColebrookeana</i> (lindley ex Wallich.)	+	-	-	-	+	+	-	-	-	+	+	-	-	-	+
13.	<i>Juglansregia</i> (Hook.)	+	+	-	-	-	+	+	-	-	-	+	+	-	-	-
14.	<i>Ilex dipyrena</i> Wall.	-	+	+	+	-	-	+	+	+	-	-	+	+	+	-
15.	<i>Lyoniaovalifolia</i> (Wallich)Drude.	+	+	+	-	+	+	+	+	-	+	+	+	+	-	+
16.	<i>Myricaesculanta</i> Buch-Ham ex D.Dun.	+	-	-	+	+	+	-	-	+	+	+	-	-	+	+

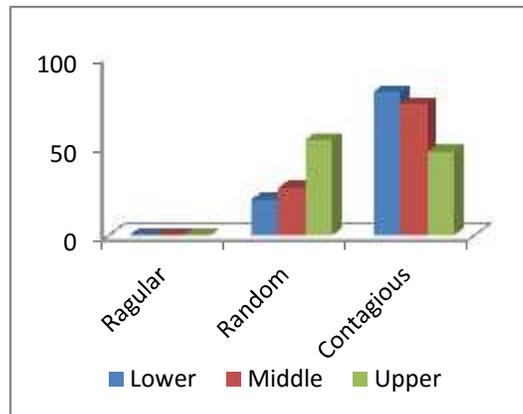
17.	<i>Neolitseapallens</i> (D.Don) Memiyama& Hara ex Hara	+	-	-	+	-	+	-	-	+	-	+	-	-	+	-
18.	<i>Perseaduthiei</i> (King ex Hook. F.) Kostermans	-	-	+	-	+	-	-	+	-	+	-	-	+	-	+
19.	<i>Perseaodoratissima</i> (Nees) Kostermans	-	-	+	+	-	-	-	+	+	-	-	-	+	+	-
20.	<i>Prunuscerasoides</i> D.Don	-	+	+	-	-	-	+	+	-	-	-	+	+	-	-
21.	<i>Pyruspashia</i> (Buch-Ham ex d.Dun).	+	-	+	+	-	+	-	+	+	-	+	-	+	+	-
22.	<i>Quercusleucotrichphora</i> (A.Camus).	+	+	+	-	+	+	+	+	-	+	+	+	+	-	+
23.	<i>Q.semicarpifolia</i> (Smith)..	+	-	-	+	+	+	-	-	+	+	+	-	-	+	+
24.	<i>Rhododendron arboretum</i> (Smith)	+	-	-	-	+	+	-	-	-	+	+	-	-	-	+
25.	<i>Sapium insigne</i>	+	+	-	+	+	+	+	-	+	+	+	+	-	+	+
26.	<i>Swidaoblonga</i> (Wall.) Sojak	-	+	-	-	-	-	+	-	-	-	-	+	-	-	-
27.	<i>Symplocospaniculata</i> (Thunb)Miq.	+	+	-	+	-	+	+	-	+	-	+	+	-	+	-
28.	<i>Taxillusvestitus</i> (Wall.) Danser	-	-	+	+	-	-	-	+	+	-	-	-	+	+	-
29.	<i>Toonaciliata</i> Roem.	-	+	+	-	-	-	+	+	-	-	-	+	+	-	-

Name of the sites: 1- Badhani, 2- Bhanaj, 3- Kakda-kund, 4- Khaliyan and 5- Kot.

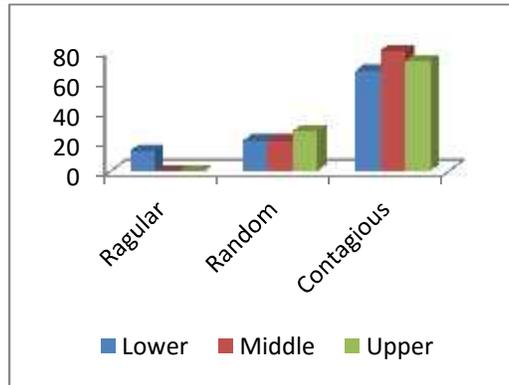
Fig.1.Distribution pattern of different treevegetation in Peak growing season (rainy) in surfaces of different study sites.



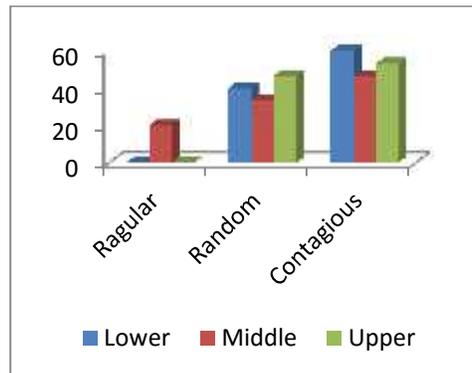
Badhani



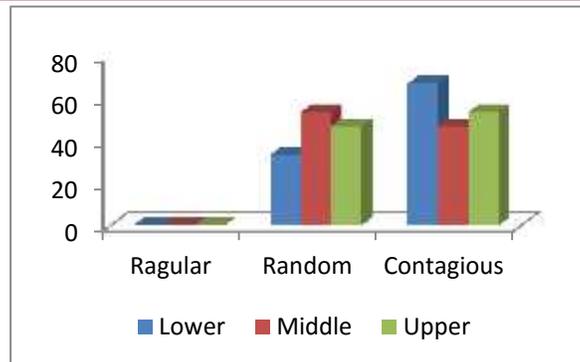
Bhanaj



Kakda-Kund



Khaliyan



Kot

Discussion:

The conducted investigation shows that the distribution patterns of the tree strata of all the study sites in peak growing season (rainy) at lower surface Kakda-kund (13.33%) show only regular distribution. randomly ranges Bhanaj and kakda-kund (20.00%) to Badhani (60.00%). Contagiously ranges Badhani (40.00%) to Bhanaj (80.00%). At middle surface, it regularly ranges Badhani (6.66%) to Kot (20.00%), randomly ranges Kakda-kund (20.00%) to Khaliyan (53.33%) and contagiously ranges Badhani, Khaliyan and Kot (46.66%) to Kakda-kund (80.00%). At upper surface, no any regular distribution found. Randomly ranges Kakda-kund (26.66%) to Bhanaj (53.33%) and contagiously ranges Bhanaj (46.66%) to Kakda-kund (73.33%). Across the sites and seasons the distribution patterns regularly ranges Badhani (6.66%) to Kot (20.00%), randomly ranges Bhanaj and Kakda-kund (20.00%) to Kakda-kund (80.00%) and contagiously ranges Badhani (40.00%) to Bhanaj and Kakda-kund (80.00%), respectively.

Distribution pattern indicated that most of the plants species were distributed randomly followed by contagiously. Distribution pattern of woody and herbaceous vegetation generally showed interesting pattern. Regular distribution of plants species was rare. The contagious pattern of distribution is general characteristic pattern of nature (Odum, 1971). Even in the present investigation, all study sites show this pattern for tree, shrubs, herbs, climbers and *ringal* (Hill-bamboo). Most of the tree, shrub, herb, climber and *ringal* species contagiously distributed, very fewer was distributed randomly and regularly at different sites. Regular distribution as observed in the present case has not been reported in grasses. This indicates the uniform microclimatic niches for vegetation. Similar findings have been reported for Central Himalayan forests by different workers likes Saxena and Singh, 1982, Singhal et al., (1986), and Bhandari and Tiwari, 1997. Contagious distribution in natural vegetation has been reported by Greig-Smith (1957), Kershaw, (1973) and Singh and Yadava, (1974). The present investigation show dissimilarity with the result of Raturi, (2002) recorded the high regular and random distribution pattern and less contagious distribution pattern from Rdudraprayag District, Garhwal Himalaya.

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Corresponding to:

Subodhkumar

Department of Botany, Post Box-22,

H. N. B. Garhwal University,

Srinagar (Garhwal), 246174, India

Phone No-9756463815

Email- subodhkandari96@gmail.com

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