Original Research Article

TAXONOMIC COMPENDIUM OF PLANT COMMUNITY ON SHANKARACHARYA RESERVE FOREST

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Abstract

The present investigation was carried out to study the taxonomic compendium of plant community on Shankaracharya reserve forest. The hillock over looks famous Dal lake and presents a beautiful look of Srinagar city on the eastern side of Jammu and Kashmir. During the survey, different quadrants were laid and plant samples were collected for identification. The taxonomic compendium of the plant community identified in Shankaracharya Reserve forest includes 72 genera (69 Angiosperms and 3 Gymnosperms) and 84 species (78 Angiosperms and 6 Gymnosperms) out of which 54 were herbs and grasses, 12 were shrubs and 18 were trees. Monocots and dicots contributed nearly 91.2% of the total angiosperm population indicating that the forest grove is rich in pioneer and mid successional species composition. The study area hosts a remarkable floristic richness with majority of taxa belonging to family Fabaceae followed by Rosaceae, Poaceae and Pinaceae.

Key words: taxonomic, compendium community, Shankaracharya

Introduction

The knowledge of patterns of variation in forest structure over time and space have always served as the basis of formulating forest management strategies that seek to sustain a broad array of forest goods and services [1]. The concept of sacred groves is prevalent in most parts of the world and [2] have presented a detailed overview of their distribution around the globe mainly in Asia, Africa, Australia, Europe and America. A report by [3] has described sacred groves in Ghana, Senegal and Sumatra. In India, sacred groves occur in Western Ghats, Madhya Pradesh, Maharashtra, Meghalaya, Karnataka, etc. These groves are found in variety of habitats ranging from scrub forests of Thar Desert to rain forests in Western Ghats and temperate forests of Himachal Pradesh and Jammu and Kashmir in the North to deciduous forests of Kerala in the South. Estimates suggest that there might be between 1,00,000 to 1,50,000 sacred groves around the country [4]. Further, all forms of vegetation in the sacred groves are supposed to be under the protection of the reigning deity of that grove, and the removal of even a small twig is taboo [5]. Shankaracharya reserve forest hillock also known as suliman teng or takht-i- suliman in Kashmir is one of such groves famous for religious tourism all over the country. This traditional conserveation sacred grove has lost their identity due to biodiversity loss in earlier time, needs to replenish

by new conservation approaches. This will enable fair share of the wider values of conservation to the local communities and positive inherited attitudes towards conservation goals. Nature worship has been a key force of shaping the human attitudes towards conservation and sustainable utilization of natural resources. Such traditional practices have been invariably operating in different parts of India and Shankaracharya is one of the living examples of least studied plantation forest which can now be regarded as the remnant primary forest left untouched by the local inhabitants for conservation of biodiversity.

The vegetation of Kashmir forests has been occasionally explored in the past by few botanists. The prominent among them are [6 and 7]. The early twentieth century saw the work of [8 and 9] and who published their work in the form of manuals and floras. Their work was followed by that of [10 and 11]. [12] from Botanical Survey of India, surveyed many places in the valley with a view to document flora of this region. In all these studies, the vegetation characteristic of Shankaracharya hillock which is largely characterized by a typical topographic physiognomy, is poorly cited. This hillock has a long history of degradation due to exploitative deforestation for timber and other non-timber forest products. However, following its massive re-vegetation programme in 1940 and 1970 with many species including exotic tropical pines viz., *Pinus helpensis*, *Pinus roxburghii* and *Pinus canarensis*, the hillock has been designated as a reserve forest. Despite a recorded history of more than seventy years since reforestation of this hillock was taken up, only one or two comprehensive attempts have been made to conduct a systematic study of the vegetation composition and its structure. The present study was therefore, undertaken to study the floristic and successional status of this unique man made reserved forest grove which now comprises many plant species of both tropical and temperate origin. The information generated from this study helped to classify this reserved forest hillock on the basis of floristic composition.

Materials and methods

Study site

The present investigations were carried out on Shankaracharya hillock (fig-1) which stands declared as a reserve forest under Section 11 of the Forest Act of 1987 and a Game Sanctuary under Section 5 of the Game Prevention Act of 1998 [13]. The hillock is maintained by the Forest Department, Government of Jammu and Kashmir for religious,

aesthetic and recreational purposes. The study site is located between 34°04′ 35.56″ to 34°05′ 25.08″ N latitude and 74°50′ 03.16″ to 74°51′ 08.63″ E longitude (Table 1). Spread over an area of 141.93 ha, this forest grove lies in South-Eastern side of Srinagar and presents a marvelous view of world famous Dal Lake and other adjoining environs. The altitude of the study site varies from 1575 to 1967 m asl (Table 1) with entire hillock serving as a catchment area to Dal Lake.

Table 1: Geographical attributes and Lithology of Shankaracharya Reserve Forest

Altitude	Aspect	Longitude	Latitude	Lithology	Slope
1575-1705 m asl	North West	34° 04′ 35.36″ N	74°50′03.132″E	Deep loam	Steep
	North East	34°05′25.38″ N	74°50′03.145″E	Fine loam	Steep
	South East	34°05′ 25.396″ N	74°50′03.148″E	Silty loam	Very steep
1705-1835 m asl	North West	34 °04′ 35.44″ N	74°50′03.160″E	Deep loam	Steep
	North East	34°05′25.46″ N	74°50′03.155″E	Fine loam	Very steep
	South East	34° 05′ 25.490″N	74°50′03.158″E	Silty loam	Steep
1835-1967 m asl	North West	34°04′35.508″ N	74°50′03.16″E	Deep loam	Very steep
	North East	34°04′35.563″N	74°50′03.16″	Fine loam	Very steep
	South East	34°05′25.083″	74°51′ 08.63″E	Silty loam	Very steep

Plant sample collection and Identification

Three altitudes and three aspects were selected from Shankaracharya hillock for the study. Each grove was visited during 2012-13 and analysed the floristic composition. In order to study the floristic diversity, quadrant methods were adopted.

Taxonomic reservoirs were used for pant identification in this study [14]. Specimens of some of the species particularly difficult to identify at the species level were got identified by expert taxonomists in Division of Environmental Science, SKUAST of Kashmir, Shalimar, Srinagar and Department of Botany, University of Kashmir. For this purpose herbarium specimen sample with some distinguishing characteristics of general appearance of vegetative or reproductive material were prepared and these served as a crude basis for their classification.

Results and discussion

The vegetation survey conducted indicated that the selected reserve forest on Shankaracharya hill is rich in plant composition, supporting many plant species, of diverse taxonomic and ecological significance. Floristic composition and successional status of Shankaracharya sacred groves are small patches of man-modified conserved landscapes or lingering samples of natural vegetation with the highest levels of biological diversity. Besides centre of high species richness [15], these areas act as a gene pool and provide refuge to a large number of endemic, endangered and threatened species [16] and render many ecological services such as regulation of perennial water, maintaining local micro-environment and sustenance of biogeochemical cycles [17]. Among the 13,720 sacred groves in India, Shankaracharya is a reserve forest being maintained for aesthetic and recreational purposes [17]. The grove is very rich in species richness as depicted by plant community organizational analysis; of the study area, which revealed presence of 84 plant species belonging to 72 genera and 40 families. The data presented in Table 2 reveals that this reserve forest hosts 40 families (38 Angiosperms and 2 Gymnosperms), 72 genera (69 Angiosperms and 3 Gymnosperms) and 84 species (78 Angiosperms and 6 Gymnosperms) out of which 56 were herbs, 12 were shrubs, and 18 were trees. Monocots and dicotyledons contributed nearly 91.2% of the total angiosperms recovered in the area. Fabaceae was the dominant family with (ten) 10 species followed by Rosaceae (8) Poaceae (7), Pinaceae (5), Asteraceae (5) Malvaceae (4) Lamiaceae (3), Convolvulaceae (3), Salicaceae (3), Cannabaceae (2), Caryophyllaceae (2), Polygonaceae (2), Apiaceae (2) and Plantaginaceae

(2). Families with representation of only one species included Moraceae, Juglandaceae, Sapindaceae, Chenopodiaceae, Cupressaceae, Rhamnaceae, Berberidaceae, Oleaceae, Thymelaeaceae, Scrophulariaceae, Zygophyllaceae, Iridaceae, Caprifoliaceae, Ophioglossaceae, Violaceae, Urticaceae, Labiatae, Boraginaceae, Campanulaceae, Apocynaceae, Cupuliferae, Amaranthaceae and Hypericaceae. The survey of Shankaracharya forest hillock conducted by [18] reveals the presence of 49 families with dominance of dicotyledenous (85%). Out of the 86 plant species recorded in the study area, 18 were trees, 12 were shrubs and 56 were herbs (Table 2) (Plate-1, 2, 3). This species representation pattern of herbs > shrubs > trees has also been reported by [19 and 20] in undisturbed patches of Branwar temperate coniferous forests of Kashmir and temperate broadleaved Rhododendron forest of Western Arunachal Pradesh respectively.The tree plantations thus established on Shankaracharya hillock (long devoid of native plant cover) have acted as successional catalysts, facilitating re-colonisation of many woody and non woody native flora. The planting of trees encouraged the invasion of local species and thereby resulting in enhanced richness of shrubs and herbaceous species as reported by [21 and 22]. Dar and Christensen [23] reported that reforestation by diverse type of plant communities along the environmental gradient facilitated improvement in local habitat.The re-vegetation effort thus profoundly determine the patterns of community structure and its distribution.

The recorded flora reveals a biological spectrum dominated by therophytic vegetation (65%) and thrives through the unfavourable season by overwintering [24]. The second dominant category of flora was that of phanerophytes (34.5%) which includes shrub and tree species whose perennating buds are borne on aerial shoot reaching a height of at least 25 cm or more above the ground surface. These results show that the flora at Shankaracharya Forest Reserve is predominantly thero-phanerophytic to climate. Hilal [25] have reported almost similar pattern of biological spectrum for Kandi forest range in Kashmir respectively. Asri [26] stated that while higher number of therophytes indicates the shortage of moisture, the less number of phanerophytes specifies that the selected forest is the best representative site for open physiognomy where the latter lifeform spectrum decreases with increasing altitude. The phanerophytes viz., *Cupressus torulosa, Cedrus deodara* and *Pinus wallichiana* form a dominant community with prominent association of *Tribulus terretris, Cannabis sativus*, *Linaria dalmatica*, *Taraxacum officinale*, *Medicago sativa*, *Cuscuta europaea*, *Artemisia obsinthum*, *Iris nepalensis*, *Lonicera quinquelocularis*, *Rumex acetos*, *Rumex orientalis*, *Lespedeza cuneata*, *Ophioglossum vulgatum*, *Cichorium intybus*, *Viola odorata*, *Panicum*

crusgalli, *Foeniculum vulgare*, *Cynodon dactylon*, *Pegasus hermala*, *Chenopodium album*, *Cuminum cyminum*, *Utrica dioca*, *Salvia moorcraftian*, *Trifolium repens*, *Nepeta cataria*, *Organum vulgare, Rosa webbiana*, *Rosa moschata*, *Zizyphus vulgaris*, *Rubus fructicosus*, *Indigofera gerardiana*, *Berberis lycium*, *Jasminium humile* and *Daphne oleoides* through out the altitudinal range.

Conclusion

Analysing the success of ecological restoration is not as straightforward and simple as it appears. The overall results of this study can be concluded as having ‘ 40 families among which 38 are of angiosperms and the remaining 2 of gymnosperms represented by 54 grasses and herbs, 12 shrubs and 18 tree species. The spread of shrubs, grasses and herbs has greatly expanded due to improvement in site conditions over a period of induced secondary succession. Thus the reforestation of Shankaracharya forest has influenced the microclimate of the area as depicted by invasion of new species of shrubs and herbs on the hillock from the adjoining areas.

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Table 2: Floristic list and plant life form spectra along an altitudinal gradient in Shankaracharya Reserve Forest

S. No.	Family	Species	Common name/Local name	Life form	Altitude (m)		
					1575-1705	1705-1835	1835-1967
1.	Rosaceae	*Pyrus cumminis*	Pear/Tang	T	+	+	-
		Prunus cerasifera	Plum/Gurdhoal	T	+	-	-
		Prunus armenica	Apricort/Cheer	T	+	-	-
		Crataegus oxycantha	Hawthorn/Ring	S	+	-	-
		Rosa webbiana	Wild rose/Arwal	S	+	-	+
		Rubus fructicosus	Black berry/Daen Chanch	S	+	+	-
		Rubus pungens	Rubus oldhamii/Rang ratch	S	-	+	-
		Rosa moschata	Rose hip	S	+	-	+
2.	Salicaeceae	*Populus alba*	Silver poplar (Dodhi fras)	T	+	-	-
		Populus nigra	Black poplar (Bati fras)	T	+	-	-
		Salix fragilis	Brittle willow	T	+	-	-
3.	Moraceae	*Morus alba*	White mulberry/Toot	T	+	+	-
4.	Juglandaceae	*Juglans regia*	Walnut/Doon	T	+	-	-
5.	Cannabaceae	*Celtis australis*	Nettle tree/Brimji	T	+	-	+
		Cannabis sativa	Hemp/Bhang	H	+	+	+
6.	Sapindaceae	*Aesculus indica*	Indian horse chestnut/Handoon	T	+	+	-

Contd…

S. No.	Family	Species	Common name/Local name	Life form	Altitude (m)		
					1575-1705	1705-1835	1835-1967
7.	Fabaceae	*Robinia pseudoacacia*	Black locust/Kikar	T	+	+	-
		Quercus ilex	Holm oak	T	-	+	+
		Indigo gerardiana	Himalayan indigo/Neel	S	+	+	-
		Lespedeza cuneata	Chinese bush clover	H	+	-	+
		Medicago sativa	Lucerne/Poshi gassi	H	+	+	-
		Trifolium repens	White Clover/Batak nur	H	+	-	-
		Trifolium fragiferum	Clover/Batak laut	H	+	+	+
		Melilotus alba	Sweet clover	H	-	+	-
		Trigonella emodi	Himalayan Fenugreek	H	-	-	+
		Cytisus scoparius	Common broom	S	+	+	-
8.	Pinaceae	*Pinus helpensis*	Aleppo Pine	T	-	+	-
		Cedrus deodara	Himalayan cedar/Deodar	T	-	+	+
		Pinus roxburghii	Chir pine/Chir	T	-	+	-
		Pinus canariensis	Canary Island Pine	T	-	+	-
		Pinus wallichiana	Blue pine/Kail	T	-	-	+
9.	Cupressaceae	*Cupressus torulosa*	Bhutan cypress/Sarvikul	T	+	+	-

Contd…

S. No.	Family	Species	Common name/Local name	Life form	Altitude (m)		
					1575-1705	1705-1835	1835-1967
10.	Rhamnaceae	*Zizyphus vulgaris*	Zizyphus/Bre	S	-	-	+
11.	Berberidaceae	*Berberis lycium*	Indian barberry/Kawdach	S	+	+	-
12.	Oleaceae	*Jasminum humile*	Yellow Jasmine	S	+	+	+
13.	Polypodiaceae	*Adiantum capillus-veneris*	Adiantum/Gew theer	H	-	-	+
14.	Thymelaeaceae	*Daphne oleoides*	Dafne spatolata	S	-	+	+
15.	Zygophyllaceae	*Tribulus terretris*	Puncture Vine/Mister kund	H	+	+	+
16.	Caryophyllaceae	*Dianthus angulatus*	Himalayan Pinks	H	+	+	-
		Phytolacca acinosa	Indian Poke	H	-	-	+
17.	Convolvulaceae	*Cuscuta europaea*	Devil's hair/Wozul kukli poot	H	+	+	-
		Cuscuta cuspidata	Golden thread/Kokil pot	H	-	+	-
		Convolvulus arvensis	Bindweed/Soi posh	H	-	+	-
18.	Iridaceae	*Iris nepalensis*	Graceful himalayan iris/Mazar mond	H	+	+	+
19.	Caprifoliaceae	*Lonicera quinquelocularis*	Translucent Honey suckle/Pakhur	H	+	+	+
20.	Polygonaceae	*Rumex acetosa*	Sheep's sorrel/Choki chen	H	+	+	+

Contd…

S. No.	Family	Species	Common name/Local name	Life form	Altitude (m)		
					1575-1705	1705-1835	1835-1967
21.	Ophioglossaceae	*Rumex orientalis*	Spinach dock/Jungli abuj	H	+	-	+
22.	Asteraceae	*Ophioglossum vulgatum*	Adder's Tongue/Chonchur	H	+	+	+
		Cichorium intybus	Chicory/Handi posh	H	+	+	-
		Taraxacum officinale	Dandelion/Hand	H	+	+	+
		Artemisia absinthium	Worm wood/Tethwan	H	+	+	+
		Tragopogon pratensis	Meadow Salsify	H	-	+	+
23.	Violaceae	*Cardus nutans*	Musk thistle	H	-	+	+
24.	Apiaceae	*Viola odorata*	Wood violet/Bunafshah	H	+	+	+
		Foeniculum vulgare	Common fennel/Baidanii	H	+	+	-
		Cuminum cyminum	Cumin/Zur	H	+	+	-
25.	Poaceae	*Cynodon dactylon*	Dūrvā grass/Dramun	H	+	+	+
		Echinochloa crusgalli	Cockspur/Hama	H	+	+	-
		Stipa sibirica	Stipa sibirica	H	+	-	-
		Eragrostis nigra	love grass	H	-	-	+
		Hordeum murinum	False barley/Pingi	H	-	-	+

Contd…

S. No.	Family	Species	Common name/Local name	Life form	Altitude (m)		
					1575-1705	1705-1835	1835-1967
		Sorghum halepense	Aleppo grass	H	-	+	+
		Poa angustifolia	Meadow-grass	H	-	+	+
26.	Chenopodiaceae	*Chenopodium album*	Lamb's quarters/Lachij	H	+	+	-
27.	Urticeae	*Utrica dioca*	Nettle/Soi	H	+	+	-
28.	Labiatae	*Salvia moorcroftiana*	Kashmir Salvia/Sholer	H	+	+	+
29	Lamiaceae	*Thymus serphyllum*	Breckland thyme	H	+	+	+
		Origanum vulgare	Oregano	H	+	-	-
		Nepeta cataria	Cat mint/Gandi soi	H	+	+	-
30.	Boraginaceae	*Lycopsis arvensis*	Small bugloss/Handi gaasi	H	-	+	-
31.	Campanulaceae	*Campanula colorata*	Bell flower/Chari hakh	H	-	+	-
32.	Malvaceae	*Malva sylvestris*	Blue Mallow	H	-	+	-
		Malva album	Purple Mallow	H	-	+	+
		Malva rotundifolia	Dwarf mallow/Sochal	H	-	-	+
		Peganum harmala	Syrian Rue/Isband	H	+	-	-

Contd…

S. No.	Family	Species	Common name/Local name	Life form	Altitude (m)		
					1575-1705	1705-1835	1835-1967
33.	Apocynaceae	*Vinca major*	Bigleaf periwinkle	H	-	+	+
34	Scrophulariaceae	*Linaria dalmatica*	Balkan toadflax	H	+	+	-
35.	Plantaginaceae	*Kickxia subsessilis*	Branched Cancerwort	H	-	+	+
		Plantago lanceolata	Ribwort Plantain/Veuth gulla	H	-	-	+
36.	Oxalidaceae	*Oxalis corniculata*	Creeping wood sorrel (Khati buti)	H	-	-	+
		Oxalis spp		H	-	-	+
37.	Hypericaceae	*Hypericum perforatum*	Amber	H	-	-	+
38.	Hamamelidaceae	*Parrotiopsis jacquemontiana*	Parrotia/Hatab	S	+	-	-
39.	Cupuliferae	*Quercus ilex*	Holm oak	T	-	+	+
40.	Amaranthaceae	*Amaranthus* spp	Pigweed	H	-	+	-

T = Tree, S = Shrub, H = Grasses and Herbs, + = Present, - = Absent

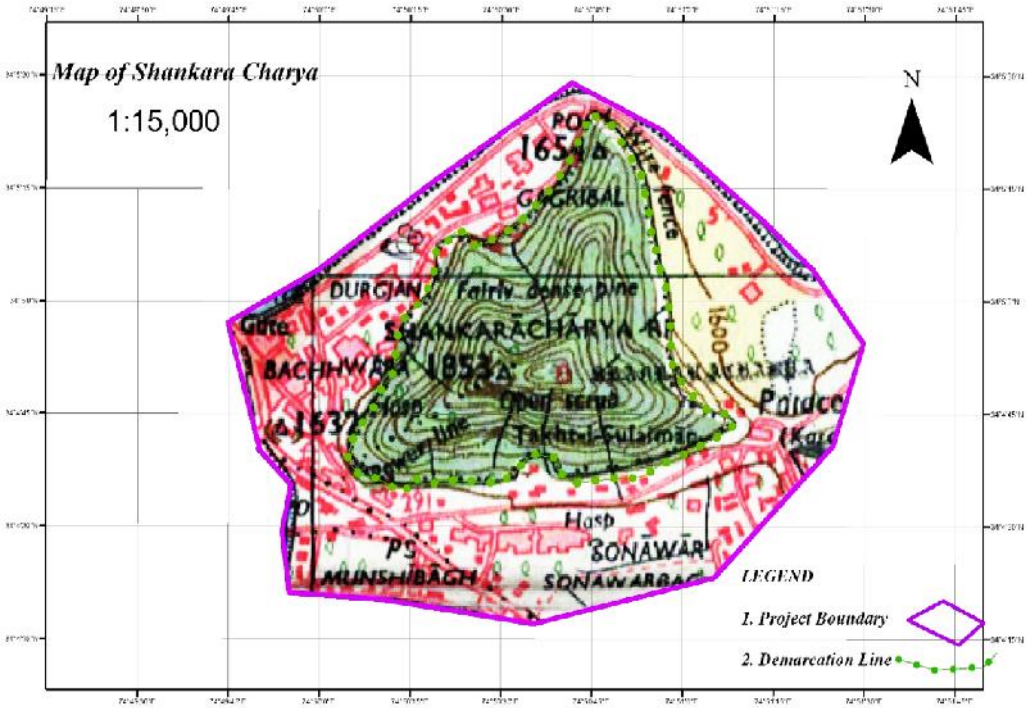
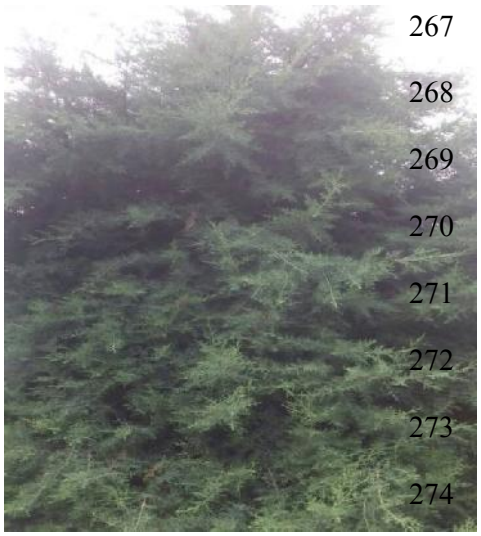


Fig. 1: Map of Shankaracharya Reserve Forest/Sulaiman-Teng

Cedrus deodrara ***Pinus helpensis***

Pinus wallichiana ***Pinus canariensis***



Pinus roxburghii ***Cupresses torulosa***

Plate-1: Coniferous tree species in Shankaracharya Reserve Forest

Rasa webbiana

Daphne oleoides

Rosa moschata

Jasminium humile

Berberis lycium

Parrotiopsis jacquemontiana

Plate-2: Shrub species in Shankarachaya Reserve Forest

Artemisia absinthium

Iris nepalensis

Salvia moorcroftiana

Rumex acetosa

Hypericum perforatum

Rumex orientalis

Trifolium repens

Trifolium fragiferum

Adiantum capillus veneris

Lespedeza cuneata

Plate-3: Grasses and herbs in Shankaracharya Reserve Forest