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DIVERSITY AND REGENERATION STATUS OF MEDICINAL PLANTS IN MEDICINAL PLANTS CONSERVATION AREA (MPCA) AT SHIRGUNJI OF UTTARA KANNADA DISTRICT, CENTRAL WESTERN GHATS

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Abstract

Depletion of biodiversity at an alarming rate with burgeoning anthropogenic activities has necessitated inventorying, monitoring, conservation and management of medicinal plants in their natural habitats. This paper highlights the diversity and regeneration status of medicinal plants Medicinal Plants Conservation Areas (MPCAs) at Shirgunji in Uttara Kannada coast of Karnataka. A total of 122 medicinal plants were recorded during the field sampling. Shirgunji MPCA had high disturbances due its proximity to villages. Species such as *Knema attenuata, Nothopegia sp*, etc., occur in higher proportion. Important medicinal plants in the area and views of local stakeholders are discussed.

Introduction

The tropical forests of Uttara Kannada district are repository of diverse medicinal plants and constitute a vital component of the traditional knowledge of various tribes and local communities. Studies earlier have focussed on the status, diverse applications and community uses of the forest medicinal plants (Rao *et al.*, 2014; Kirthikar and Basu, 2003; Bhandari *et al.,* 1995; Harsha *et al.,* 2002; Hegde *et al.*, 2007; Somashekhara *et al.,* 2010). Species and community ecology of these plants are complex necessitating taxonomic, ecological and ethno-botanical knowledge for understanding medicinal properties and uses apart of updated knowledge in pharmacognosy and pharmacological applications.

Demand for a wide variety of wild species has been increasing with growth in demand, numbers and commercial trade (Schippmann *et al.,* 2002).

Hence, vegetation and floristic studies have gained increasing importance and relevance in recent years.

Depletion of biodiversity at an alarming rate with burgeoning anthropogenic activities has necessitated inventorying, monitoring, conservation and management of medicinal plants in their natural habitats. This paper highlights the diversity and regeneration status of medicinal plants Medicinal Plants Conservation Areas (MPCAs) at Shirgunji in Uttara Kannada coast of Karnataka. The vegetation in the study area mainly comprises

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of tropical wet evergreen to semi-evergreen forest in the coastal and hilly areas as the rainfall is high. Moist deciduous forests mixed with savannas is found in more disturbed areas.

Method

Vegetation inventorying was carried out using belt transects of 180m length with alternate quadrats (5) and inter-distance of 20 m. Each quadrat was 20 x 20 m, in which all trees (≥ 30 cm GBH) were studied. Members of the shrub layer (GBH ≤ 30 cm and height more than 1 m) were enumerated in two shrub quadrats (5 x 5m) placed diagonally inside the quadrat. Inside each shrub quadrat two herb plots (height ≤ 1 m) were laid diagonally (1 x 1m). Total of 5 transects and 25 quadrats were laid in Shirgunji area (**Table 1**).

Data analysis

The data from the transects were pooled locality wise into three classes – herbs (<1m height), shrubs (≥ 1m and < 30 cm GBH) and trees (≥ 30cm GBH) and analysed. Forest structure was analysed through computation of basal area/ha, individuals/ha, girth class distribution/ha and Important value index (IVI). For medicinal plants status and regeneration, present status of medicinal individuals/ha in tree, shrub and herb layer were analysed.

Results and Discussion

General floristic composition

Analysis of data (compiled through transects based quadrats and opportunistic surveys) revealed the presence of 154 species of 68 families and 126 genera. Habit wise analyses indicate that 21 were climbers, 24 herbs, 29 shrubs, and 80 tree species. Rubiaceae (11 sp) was the most represented family in terms of number of species followed by Lauraceae (7 sp) and Anacardiaceae (6 sp). Other family represented with five species include Ebenaceae, Apocynaceae, Euphorbiaceae and Myrtaceae .

Floristic diversity and Structure

Shirgunji MPCA forest though primarily composed of evergreen to semi-evergreen forest species has been subjected to exploitation of minor forest produce resulting in degradation, evident from domination of shrub vegetation at Shirgunji-31-T1 transect. However, due to control of fire, the region is rich in evergreen species at Shirgunji-mabgi-T2 (36 sp) followed by Shirgunji-T5 (33 sp). The increase in number of species is due to

Table 1: Forest composition and basal area in Shirgunji

Locality	Forest type	Total individuals	Total species	Average Height (m)	Basal area (sq.m/ha)
Shirgunji-31-T1	Semi-evergreen-minor forest	124	22	12.7	27.7
Shirgunji-mabgi-T2	Semi-evergreen	145	36	13.2	48.5
Shirgunji-mastikallu-T3	Semi-evergreen	143	26	13.5	53.1
Shirgunji-mastikallu-T4	Semi-evergreen	139	31	13.4	43.6
Shirgunji-T5	Evergreen	118	33	11.6	34.3

deciduous species regeneration in degraded forest patches. Lowest number of species is seen in minor forest Shirgunji-31-T1 (22 sp).

Important Value Index (IVI) and Endemism

Most of the forests though having high number of evergreen species also have mix of deciduous species, coming under higher IVI. *Knema attenuata* was found in higher numbers in four transects followed by *Holigarna ferruginea* (one transect). *Lophopetalum wightianum* (Banate) a huge emergent tree having medicinal properties constitute next higher IVI in Shirgunji-Mabgi-T2 and Shirgunji-Mastikallu-T3 indicating existence of richer forests in the past. Occurrence of deciduous species in higher numbers in most of these transects highlights of logging, fire, and other extraction pressures. *Vitex altissima* (Bharanige), *Terminalia paniculata* (Kindal), *Lagerstroemia microcarpa* (Nandi), *Stereospermum colais* (Patali) were present in good numbers in most of transects. Although many of these are medicinally important plants, but their occurrence inside the evergreen to semi-evergreen along with *Aporosa lindleyana* and *Olea dioica* indicates disturbances. As forests get degraded from evergreen to secondary deciduous forest, gives way to generalist and wide-spread medicinal plants than sensitive ones. Due to high extraction pressure, sensitive medicinal plants such as *Saraca asoca* (Ashoka), *Salacia sp* (Ekanayaka), *Coscinium fenestratum, Embelia ribes* (Vayuvilanga) etc., have become scanty due to absence of suitable microhabitats. Most of the sampled transect are semi-evergreen with only one evergreen transect. Western Ghats tree endemism was higher in most transect (>60%) except in Shirgunji-Mastikallu-T3 (34.3%) due to the presence of *Knema attenuata, Hopea ponga, Holigarna* sp. etc.

Diversity of medicinal plants

A total of 122 medicinal plants were recorded during the field sampling. These include 61 medicinal trees, 21 shrubs, 20 climbers, and 20 herbs. Habitat wise evergreen to semi-evergreen forest had 50 medicinal species; evergreen–moist deciduous complex had 25 sp., while 16 species in moist deciduous-scrub savannah areas. Remaining was found in other habitats such as grasslands, streamside, marshes, etc., or in combination of different habitats (Annexure 1). Shirgunji MPCA had high disturbances due its proximity to villages, evident from canopy openings with domination of weeds and common medicinal plants.

Transect wise medicinal plant composition

Transect-wise 92 medicinal species were noted with highest for Shirgunji-T5 (24 sp). Highest medicinal individuals were at Shirgunji-Mastikallu-T4 (112), while lowest was in minor forest Shirgunji-31-T1 (15 sp).

Most other transects had medicinal plants > 60% with known medicinal properties, and being used in folk medicine. Highest medicinal plants were in Shirgunji-Mastikallu-T3 (84.6%). Thick canopy shaded region with higher moisture content is habitat for rare medicinal species while common species occurs predominantly in open areas.

Girth classes

Girth class structure of Shirgunji tree community, especially of climax species and medicinal trees, shows a regular inverted "J" curve with highest number of stems found in lower girth class (30-59 cm range) representing growing stock (**Fig. 1**). The paucity of trees in higher girth classes (>200 cm class) reflects disturbances. Reduced population of mature medicinal trees will also affect the regeneration

Annexure 1: Checklist of plants with their habit, distribution, medicinal uses, habitats and traded medicinal plants of Shirgunji MPCA. (Note for Habitat: Evg-Evergreen to semi-evergreen; MD-Moist deciduous; SS-Scrub, Savanna; RS-Roadside, Waste lands, Walls; STM-streamside; MSW-Marsh, Wet areas; PI-Plantations; GR-Grasslands)

Sl. No.	Family	Genera	Habit	Distri-bution	Medi-cinal Use	Habitat	Traded
1	Fabaceae	*Abrus precatorius*	Climber		M	EVG, MD, SS	T
2	Fabaceae	*Abrus pulchellus*	Climber		M	EVG	
3	Fabaceae	*Acacia concinna*	Shrub		M	EVG, MD	T
4	Lauraceae	Actinodaphne hookeri	Tree	Endemic	M	EVG	
5	Acanthaceae	*Justicia adhatoda* (=*Adhatoda zeylanica*)	Herb		M	MD, SS	T
6	Orchidaceae	*Aerides maculosa*	Herb	Endemic		EVG, MD, SS	
7	Simaroubaceae	*Ailanthus excelsa*	Tree		M	RS, PI	
8	Alangiaceae	*Alangium salviifolium*	Tree		M	EVG, MD	
9	Araceae	*Amorphophallus bulbifer*	Herb		M	EVG, RS, MD	
10	Menispermaceae	*Anamirta cocculus*	Climber		M	EVG	
11	Ancistrocladaceae	*Ancistrocladus heyneanus*	Climber	Western Ghats Sri Lanka	M	EVG	
12	Euphorbiaceae	*Aporosa cardiosperma*	Tree		M	EVG, MD	
13	Myrsinaceae	*Ardisia solanacea*	Shrub		M	EVG, STM	
14	Aristolochiaceae	*Aristolochia indica*	Climber		M	MD	
15	Annonaceae	*Artabotrys zeylanica*	Shrub	Western Ghats Sri Lanka	M	EVG, MD	
16	Moraceae	*Artocarpus hirsutus*	Tree	Western Ghats Sri Lanka	M	EVG	T
17	Liliaceae	*Asparagus racemosus*	Climber		M	EVG	T
18	Rutaceae	*Atalantia racemosa*	Shrub		M	EVG, MD	
19	Lauraceae	*Beilschmiedia wightii*	Tree	Endemic	M	EVG	
20	Euphorbiaceae	*Blachia denudata*	Tree	Endemic		EVG, STM	
21	Bombacaceae	*Bombax insigne*	Tree		M	MD, SS	T
22	Acanthaceae	*Bremekampia neilgherryensis*	Herb	Endemic		MD, SS	
23	Anacardiaceae	*Buchanania lanzan*	Tree		M	MD, SS	T
24	Arecaceae	*Calamus thwaitesii*	Shrub	Endemic	M	EVG	
25	Arecaceae	*Calamus pseudotenuis*	Slender-climbing cane			EVG	

Sl. No.	Family	Genera	Habit	Distri-bution	Medi-cinal Use	Habitat	Traded
26	Clusiaceae	*Calophyllum apetalum*	Tree	Endemic	M	EVG, STM	T
27	Combretaceae	*Calycopteris floribunda*	Climber		M	EVG, MD, SS	
28	Rubiaceae	*Canthium rheedii*	Shrub	Endemic		EVG, SS	
29	Rubiaceae	*Canthium parviflorum*	Shrub	Endemic		EVG, MD	
30	Capparaceae	*Capparis rheedii*	Shrub	Endemic	M	EVG, SS	
31	Rhizophoraceae	*Carallia brachiata*	Tree			EVG, STM	
32	Lecythidaceae	*Careya arborea*	Tree		M	MD, SS	T
33	Apocynaceae	*Carissa carandas*	Shrub		M	SS	
34	Arecaceae	*Caryota urens*	Tree		M	EVG	
35	Flacourtiaceae	*Casearia bourdillonii*	Tree	Endemic		EVG	
36	Caesalpiniaceae	*Cassia tora*	Herb		M	RS, PI	T
37	Celastraceae	*Celastrus paniculatus*	Climber		M	EVG, MD	T
38	Apiaceae	*Centella asiatica*	Herb		M	PI, MSW	T
39	Oleaceae	*Chionanthus mala-elengi*	Tree	Endemic	M	EVG	
40	Lauraceae	*Cinnamomum malabatrum*	Tree	Endemic	M	EVG	T
41	Combretaceae	*Combretum latifolium*	Climber		M	EVG, MD	
42	Connaraceae	*Connarus wightii*	Shrub	Endemic	M	EVG, MD, RS	
43	Orchidaceae	*Cottonia peduncularis*	Herb			MD, SS	
44	Hypoxidaceae	*Curculigo orchioides*	Herb		M	MD, SS	T
45	Poaceae	*Cynodon dactylon*	Herb		M	SS, PI, MSW, GR	T
46	Fabaceae	*Dalbergia rubiginosa*	Shrub			EVG	
47	Fabaceae	*Derris* sp.	Climber			EVG, MD	
48	Dichapetalaceae	*Dichapetalum gelonioides*	Shrub			EVG	
49	Dilleniaceae	*Dillenia pentagyna*	Tree		M	EVG, MD, SS	
50	Dioscoriaceae	*Dioscorea bulbifera*	Herb		M	EVG, MD, SS	
51	Ebenaceae	*Diospyros oocarpa*	Tree	Endemic	M	EVG	
52	Ebenaceae	*Diospyros candolleana*	Tree	Endemic	M	EVG	
53	Ebenaceae	*Diospyros nigra*	Tree	Western Ghats Sri Lanka		EVG	
54	Ebenaceae	*Diospyros saldanhae*	Tree	Endemic		EVG	
55	Ebenaceae	*Diospyros buxifolia*	Tree			EVG	
56	Menispermaceae	*Diploclisia glaucescens*	Climber		M	EVG	
57	Agavaceae	*Dracaena terniflora*	Shrub		M	EVG, MD	
58	Meliaceae	*Dysoxylum binectariferum*	Tree		M	EVG	
59	Asteraceae	*Eclipta prostrata*	Herb		M	RS	

Sl. No.	Family	Genera	Habit	Distri-bution	Medi-cinal Use	Habitat	Traded
60	Elaeocarpaceae	*Elaeocarpus serratus*	Tree		M	EVG	
61	Asteraceae	*Elephantopus scaber*	Herb		M	EVG, MD, SS	
62	Asteraceae	*Emilia sonchifolia*	Herb		M	RS, MD, SS	
63	Acanthaceae	*Eranthemum roseum*	Herb	Endemic	M	EVG, MD	
64	Apocynaceae	*Ervatamia heyneana*	Tree	Endemic	M	EVG	
65	Convolvulaceae	*Erycibe paniculata*	Climber		M	EVG	
66	Asteraceae	*Eupatorium odoratum*	Shrub		M	RS, MD, SS	
67	Convolvulaceae	*Evolvulus alsinoides*	Herb		M	SS, GR	T
68	Convolvulaceae	*Evolvulus nummularius*	Herb		M	SS, GR	
69	Moraceae	*Ficus callosa*	Tree		M	EVG	
70	Moraceae	*Ficus nervosa*	Tree			EVG	
71	Flacourtiaceae	*Flacourtia montana*	Tree		M	EVG	
72	Clusiaceae	*Garcinia morella*	Tree		M	EVG	T
73	Clusiaceae	*Garcinia indica*	Tree	Endemic	M	EVG, MD	T
74	Clusiaceae	*Garcinia gummi-gutta*	Tree	Endemic	M	EVG	
75	Clusiaceae	*Garcinia talbotii*	Tree	Endemic		EVG	
76	Rutaceae	*Glycosmis pentaphylla*	Shrub		M	EVG, MD	
77	Gnetaceae	*Gnetum ula*	Climber		M	EVG, MD	
78	Tiliaceae	*Grewia microcos*	Shrub		M	EVG, MD	
79	Tiliaceae	*Grewia tiliifolia*	Tree		M	MD, SS	
80	Sterculiaceae	*Helicteres isora*	Shrub		M	MD, SS	
81	Apocynaceae	*Holarrhena Pubescens*	Shrub		M	MD, SS	
82	Anacardiaceae	*Holigarna ferruginea*	Tree	Endemic	M	EVG	
83	Anacardiaceae	*Holigarna arnottiana*	Tree	Endemic	M	EVG	
84	Flacourtiaceae	*Homalium zeylanicum*	Tree	Endemic		EVG	
85	Dipterocarpaceae	*Hopea ponga*	Tree	Endemic		EVG	
86	Flacourtiaceae	*Hydnocarpus pentandra*	Tree	Endemic	M	EVG	
87	Apocynaceae	*Ichnocarpus frutescens*	Climber		M	MD, SS	
88	Rubiaceae	*Ixora coccinea*	Shrub	Endemic	M	EVG, MD, SS	
89	Rubiaceae	*Ixora brachiata*	Tree	Endemic	M	EVG	
90	Rubiaceae	*Ixora polyantha*	Shrub	Endemic	M	EVG, MD	
91	Rubiaceae	*Ixora arborea*	Tree	Endemic	M	EVG, MD	
92	Myristicaceae	*Knema attenuata*	Tree	Endemic	M	EVG	T

Sl. No.	Family	Genera	Habit	Distri-bution	Medi-cinal Use	Habitat	Traded
93	Cyperaceae	*Kyllinga melanosperma*	Herb		M	MSW	
94	Lythraceae	*Lagerstroemia microcarpa*	Tree		M	MD, SS	T
95	Anacardiaceae	*Lannea coromandelica*	Tree		M	MD, SS	
96	Leeaceae	*Leea indica*	Tree		M	EVG, MD	
97	Sapindaceae	*Lepisanthes tetraphylla*	Tree		M	EVG	
98	Lauraceae	*Litsea laevigata*	Tree	Endemic		EVG	
99	Lauraceae	*Litsea floribunda*	Tree	Endemic		EVG	
100	Celastraceae	*Lophopetalum wightianum*	Tree		M	EVG	
101	Rutaceae	*Luvunga sarmentosa*	Shrub		M	EVG, MD	
102	Euphorbiaceae	*Macaranga peltata*	Tree		M	EVG, MD	
103	Sapotaceae	*Madhuca neriifolia*	Tree			STM, EVG, MD	
104	Euphorbiaceae	*Mallotus philippensis*	Tree		M	EVG	
105	Clusiaceae	*Mammea longifolia*	Tree		M	EVG	
106	Anacardiaceae	*Mangifera indica*	Tree		M	EVG	
107	Celastraceae	*Maytenus rothiana*	Shrub		M	EVG, SS	
108	Melastomaceae	*Melastoma malabathricum*	Shrub			EVG	
109	Melastomataceae	*Memecylon talbotianum*	Tree	Endemic	M	EVG	
110	Melastomataceae	*Memecylon edule*	Tree	Endemic	M	MD, SS	
111	Sapotaceae	*Mimusops elengi*	Tree	Endemic	M	EVG, MD	
112	Caesalpiniaceae	*Moullava spicata*	Climber		M	EVG, MD	
113	Rutaceae	*Murraya paniculata*	Tree		M	EVG, MD	
114	Myristicaceae	*Myristica malabarica*	Tree	Endemic	M	EVG	T
115	Meliaceae	*Naregamia alata*	Herb		M	EVG, MD, MSW	T
116	Lauraceae	*Neolitsea scrobiculata*	Tree	Endemic	M	EVG	
117	Icacinaceae	*Nothapodytes nimmoniana*	Tree		M	EVG, MD	T
118	Anacardiaceae	*Nothopegia castaneifolia*	Tree		M	EVG	
119	Ochnaceae	*Ochna obtusata*	*Shrub*	*Western Ghats* Sri Lanka	M	MD, SS	
120	Oleaceae	*Olea dioica*	Tree		M	EVG, MD	
121	Lauraceae	*Persea macrantha*	Tree	Western Ghats Sri Lanka	M	EVG	
122	Orchidaceae	*Pholidota imbricata*	Herb			MD, SS	
123	Euphorbiaceae	*Phyllanthus urinaria*	Herb		M	SS, GR	

Sl. No.	Family	Genera	Habit	Distri-bution	Medi-cinal Use	Habitat	Traded
124	Piperaceae	*Piper nigrum*	Climber	Endemic	M	EVG	
125	Annonaceae	*Polyalthia fragrans*	Tree	Endemic		EVG	
126	Araceae	*Pothos scandens*	Climber		M	EVG	
127	Rubiaceae	*Psychotria flavida*	Shrub	Endemic	M	EVG	
128	Rubiaceae	*Psychotria dalzellii*	Shrub	Endemic		EVG	
129	Rubiaceae	*Psychotria truncata*	Shrub	Endemic		EVG	
130	Sterculiaceae	*Pterospermum diversifolium*	Tree		M	EVG	
131	Sterculiaceae	*Pterospermum reticulatum*	Tree	Endemic		EVG	
132	Apocynaceae	*Rauvolfia serpentina*	Herb		M	MD, SS	T
133	Rubiaceae	*Rubia cordifolia*	Herb		M	EVG, MD	
134	Annonaceae	*Sageraea laurifolia*	Tree	Endemic	M	EVG	
135	Celastraceae	*Salacia gambleana*	Climber	Endemic	M	EVG	T
136	Sapindaceae	*Schleichera oleosa*	Tree		M	EVG	
137	Malvaceae	*Sida acuta*	Herb		M	SS, RS	
138	Smilacaceae	*Smilax zeylanica*	Climber		M	EVG	T
139	Bignoniaceae	*Stereospermum colais*	Tree		M	MD	T
140	Olacaceae	*Strombosia ceylanica*	Tree			EVG	
141	Myrtaceae	*Syzygium gardneri*	Tree		M	EVG	
142	Myrtaceae	*Syzygium hemesphericum*	Tree	Western Ghats Sri Lanka	M	EVG	
143	Myrtaceae	*Syzygium cumini*	Tree		M	EVG, MD, SS	
144	Myrtaceae	*Syzygium caryophyllatum*	Tree		M	STM, MD	
145	Myrtaceae	*Syzygium macrocephala*	Tree			EVG	
146	Combretaceae	*Terminalia bellirica*	Tree		M	MD, SS	T
147	Combretaceae	*Terminalia paniculata*	Tree		M	MD, SS	
148	Vitaceae	*Tetrastigma gamblei*	Shrub	Endemic	M	EVG	
149	Meliaceae	*Toona hexandra*	Tree		M	EVG, MD	
150	Rubiaceae	*Tricalysia sphaerocarpa*	Tree	Endemic		EVG	
151	Annonaceae	*Uvaria narum*	Climber	Western Ghats Sri Lanka	M	EVG	
152	Rhamnaceae	*Ventilago maderaspatana*	Climber		M	EVG	
153	Verbenaceae	*Vitex altissima*	Tree			EVG, MD	
154	Fabaceae	*Zornia gibbosa*	Herb		M	GR, SS	

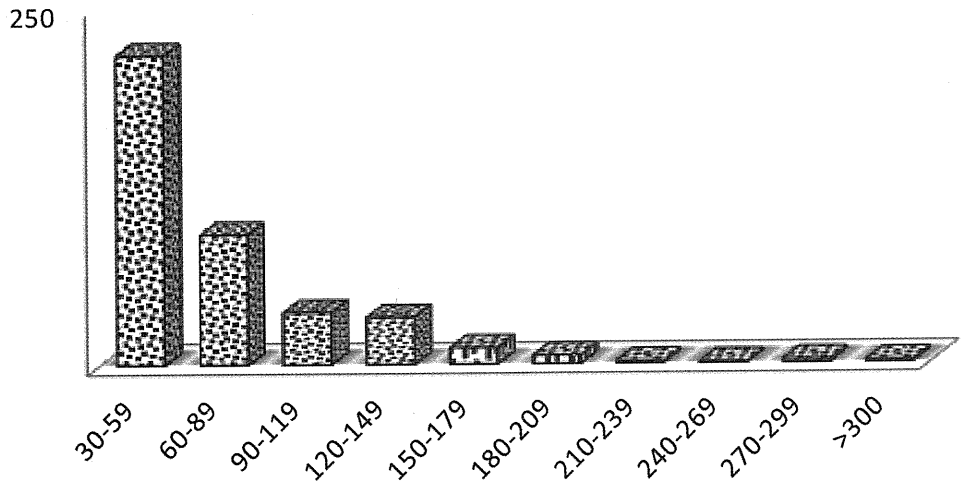

Fig. 1: Girth class individuals/ha., for important medicinal and climax tree species in Shirgunji MPCA area

due to unavailability of seeds. Hence for effective conservation of species of medicinal importance, trees and shrubs of all age classes are important in a community. Details of the regeneration in seedling and sapling stages and in their higher girth classes are listed in **Table 3.** Regeneration of medicinal shrubs and climbers is given in **Figure 2.**

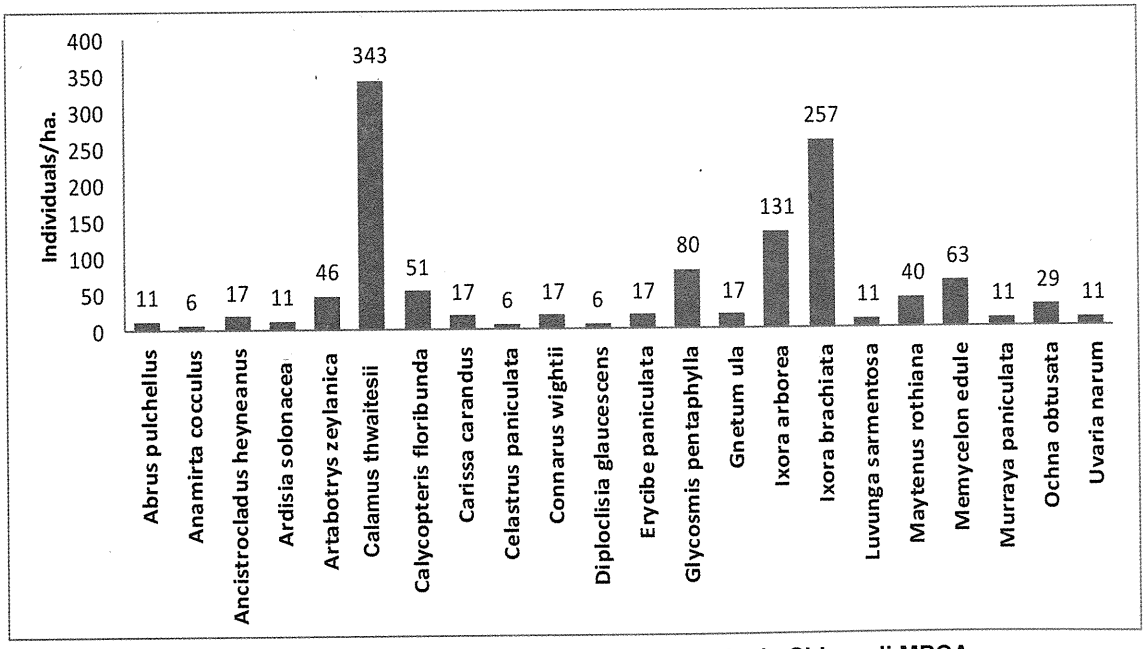

Fig. 2: Estimated climber and shrub population per ha in Shirgunji MPCA

Table 3: Important medicinal and climax trees individuals/ha in seedling, sapling and tree class)

Species	Girth classes (in cm)												Tot. Trees/ ha.
	Seed-lings	Sap-lings	30-59	60-89	90-119	120-149	150-179	180-209	210-239	240-269	270-299	>300	
Actinodaphne hookeri	500	57	1	1	0	0	0	0	0	0	0	0	2
Ailanthus excelsa	0	0	0	1	0	0	0	0	0	0	0	0	1
Alangium salvifolium	0	6	0	0	0	0	0	0	0	0	0	0	0
Aporosa lindleyana	286	149	7	6	1	1	0	0	0	0	0	0	15
Artocarpus hirsutus	0	0	0	1	0	1	0	0	0	0	0	0	2
Calophyllum apetalum	286	40	0	0	0	0	0	0	1	0	0	0	1
Carallia brachiata	71	0	0	1	1	0	0	0	0	0	0	0	2
Careya arborea	0	0	0	0	0	0	1	0	0	0	0	0	1
Cinnamomum malabatrum	429	23	1	1	1	0	0	0	0	0	0	0	3
Dillenia pentagyna	71	0	1	0	1	1	0	0	0	0	0	0	3
Diospyros candolleana	357	303	11	3	0	0	0	0	0	0	0	0	14
Dysoxylum binectariferum	71	6	1	1	0	1	0	0	0	0	0	0	3
Elaeocarpus serratus	929	109	3	0	3	1	0	0	0	0	0	0	7
Ervatamia heyneana	143	17	1	0	0	0	0	0	0	0	0	0	1
Flacourtia montana	1071	114	9	1	0	1	0	0	0	0	0	0	11
Garcinia cambogia	714	34	0	0	0	1	0	0	0	0	0	0	1
Garcinia indica	286	11	2	4	0	0	0	0	0	0	0	0	6
Garcinia Morella	0	17	0	0	0	0	0	0	0	0	0	0	0
Grewia tiliifolia	0	0	0	0	1	0	0	0	0	0	0	0	1
Holigarna arnottiana	1429	46	4	8	4	3	0	0	0	0	0	0	19
Holigarna grahamii	214	0	0	0	0	0	0	0	0	0	0	0	0
Homalium zeylanicum	0	0	0	1	0	0	0	0	0	0	0	0	1
Hydnocarpus pentandra	0	17	0	0	0	0	0	0	0	0	0	0	0
Ixora brachiata	929	257	11	1	0	0	0	0	0	0	0	0	12
Knema attenuata	6143	817	89	24	6	0	0	0	0	0	0	0	119

Species	Girth classes (in cm)												Tot. Trees/ ha.
	Seed-lings	Sap-lings	30-59	60-89	90-119	120-149	150-179	180-209	210-239	240-269	270-299	>300	
Lagerstroemia microcarpa	0	0	1	0	0	1	0	1	0	0	0	0	3
Litsea laevigata	0	11	1	1	0	0	0	0	0	0	0	0	2
Lophopetalum wightianum	0	11	0	0	1	1	0	0	0	0	1	1	4
Macaranga peltata	0	11	6	4	0	0	0	0	0	0	0	0	10
Madhuca neriifolia	286	6	10	7	0	1	0	0	0	0	0	0	18
Mallotus philippensis	0	97	2	0	0	0	0	0	0	0	0	0	2
Mangifera indica	0	17	3	1	1	3	0	0	0	0	0	0	8
Mimusops elengi	0	0	1	1	0	0	0	0	0	0	0	0	2
Myristica malabarica	214	91	4	3	2	1	0	0	0	0	0	0	10
Neolitsea scrobiculata	429	183	6	0	0	0	0	0	0	0	0	0	6
Nothopegia castaneifolia	2500	74	6	0	0	0	0	0	0	0	0	0	6
Lannea coromandelica	0	0	0	0	1	1	1	0	0	0	0	0	3
Olea dioica	1357	389	26	6	6	2	1	0	1	0	0	0	42
Persea macrantha	71	0	0	1	1	0	1	0	0	0	0	0	3
Polyalthia fragrans	714	97	1	0	0	0	0	0	0	0	0	0	1
Pterospermum diversifolium	1000	11	1	1	0	1	0	0	0	0	0	0	3
Sageraea laurifolia	286	74	1	0	0	0	0	0	0	0	0	0	1
Schleichera oleosa	71	11	1	1	0	1	0	0	0	0	0	0	3
Stereospermum colais	0	11	0	0	0	0	1	1	0	0	1	0	3
Strombosia ceylanica	71	0	0	0	0	0	0	0	0	0	1	0	1
Syzygium caryophyllatum	71	0	1	3	0	1	0	0	0	0	0	0	5
Syzygium cumini	0	6	0	1	1	0	0	1	0	0	0	0	3
Syzygium gardneri	0	6	0	0	1	1	0	0	0	0	0	0	2
Syzygium hemisphericum	0	0	1	0	0	1	0	0	0	0	0	0	2
Terminalia bellirica	0	0	0	0	0	0	0	0	0	0	0	1	1
Terminalia paniculata	0	6	0	2	2	5	2	1	0	0	0	0	12
Toona hexandra	0	0	0	1	0	0	0	0	0	0	0	0	1
Vitex altissima	0	11	4	4	4	4	5	2	0	1	0	0	24

Species such as *Knema attenuata, Nothopegia castaneifolia*, etc., occur in higher proportion compared to sensitive climax species. The ground layer vegetation was dominated by hardy evergreens like *Ixora brachiata, Olea dioica, Aporosa lindleyana, Holigarna arnottiana* etc., and indicating disturbances. There is a need to improve the regeneration and survival of Uppage (*Garcinia cambogia,* (syn *G. gummigutta*) and Kokum (*Garcinia indica*) and other fast emerging endemic medicinal plants, to cater to the rising market demands. Currently these species occur in seedlings and sapling stages than as trees. *Mallotus phillippensis* also occur as shrubs and can be grown in less shaded areas. Medicinally very important species *Persea macrantha, Cinnamomum malabatrum, Myristica malabarica, Terminalia bellirica* etc., have potential habitats within MPCA and requires appropriate management attention. *Nothapodytes nimmoniana* and *Strychnox nux-vomica* may be grown experimentally, as this region is their natural habitat. Important medicinal plants such as *Salacia, Saraca, Embelia, Coscinium fenestratum* etc., not noticed during the survey, due to over-exploitation, may be planted in appropriate micro-habitats of MPCA.

Some of the medicinal plants which require attention in Shirgunji MPCA are:

- *Garcinia indica* (Kokum; Murgila): has high demand for medicinal, culinary uses and as beverage. The distribution of this medicinal plant is good and occurs in most forest edges and other open areas. However, with increasing anthropogenic pressure this tree is under threat and needs *in situ* conservation measures. Restoration measures such as planting in forest open areas and edges will naturally increase the species survival.
- *Garcinia cambogia:* has high global demand for extraction of HCA.
- *Abrus precatorius* (Gulgunji): Mostly found in semi-evergreen areas. It also occurs in minor forests with high disturbance. Hence this species is suitable for in situ conservation in open forests.
- *Asparagus racemosus* (Shatavari): This important medicinal plant is found distributed in semi-evergreen forest and can be very important addition during planting with other medicinal plants in more shaded fragmented areas.
- *Celastrus paniculatus* (Jotishmati): Highly traded medicinal plant found in small number in these areas can be more intensively planted in open forest areas and edges.
- *Rauvolfia serpetina* (Sarpagandha): A valuable and highly traded and over-exploited medicinal plant found in the open degraded forest areas needs more intensive *in-situ* conservation. Scrubby forest areas are ideal.
- *Alstonia scholaris* (Halemara, Saptaparni): Found distributed more in semi-evergreen forest. This tree is suitable for forest openings and semi-evergreen degraded forest areas.
- Other less seen medicinal plants, mainly evergreens, in high demand for consideration are: *Cinnamomum sulphuratum. C.malabatrum* (Dalchini), *Gmelina arborea* (Shivani), *Myristica malabarica* (Rampatri), *Artocarpus hirsutus* (Hebbalasu), *Calophyllum apetalum* (Bobbi). Shrubs and climbers such as *Salacia chinensis* (Ekanayaka), *Nothopodytes nimmoniana*, *Rubia*

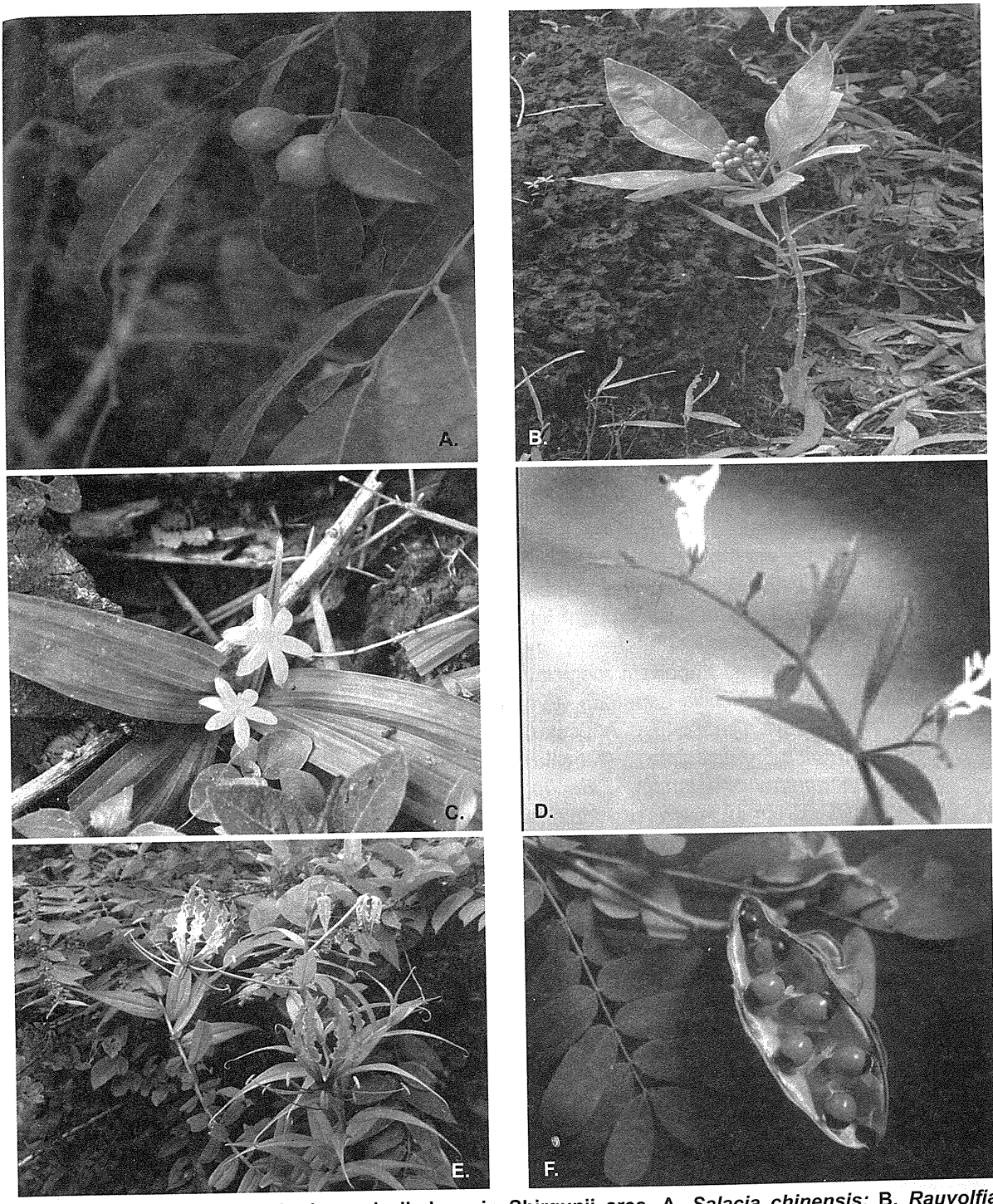

Fig. 3: Medicinal shrubs, herbs and climbers in Shirgunji area. A. *Salacia chinensis;* B. *Rauvolfia serpentina*; C. *Curculigo orchioides*; D. *Andrographis paniculata*; E. *Gloriosa superba* and F. *Abrus precatorius*

cordifolia (Majishta), *Smilax sp.,* (Kaadu-hambu), *Tinospora cordifolia* (Amruthaballi), *Piper* spp (Kaadu-menasu; wild pepper), *Coscinium fenestratum* (Maradarishina, Tree turmeric), *Acacia concinna* (Shikekai), *Gloriosa superba* etc. can be more planted in disturbed forest areas.

- Deciduous species: Many important deciduous tree medicinal plants well distributed here includes *Buchanania lanzan* (Nurkalu), *Careya arborea* (Kaval-mara), *Terminalia bellirica* (Tari), *Phyllanthus emblica* (Nellikai), *Bombax insigne* etc. These also can be used in *insitu* conservation for planting in highly degraded scrub areas.
- Cultivable species: Many medicinal plants have very high demand which cannot be catered to from wild sources only. Hence these can be brought into cultivation with the local farmers and medicinal gardens. Important medicinal plants such as *Justicia adhatoda* (Syn: *Adhatoda zeylanica;*Vasaka; Adusoke), *Andrographis paniculata* (Kiriyata), *Baliospermum montanum*, *Bacopa monnieri* (Brahmi), *Gloriosa superba*, *Piper longum* (Hippali; Long pepper), *Tinospora cordifolia* (Amruthaballi), *Curcuma zerumbet* (Kasthuri), *Cyclea peltata*, etc., are cultivable, have high demand and their shorter life cycle enables early harvest.

Views of local stakeholders of medicinal plants cultivation in Shirgunji

Suggestions during group discussion with local stakeholder regarding cultivation of medicinal plants are:

- Majority is interested and takes active part in cultivation of medicinal plants.
- Requires assurance such as "buy back" scheme for cultivated medicinal plants.
- Protocol of cultivation methods for specific medicinal plants.
- Favor mostly biennial or annual medicinal plants or which yield early.
- Some requires initial support for cultivating long term medicinal plants such as *Cassia fistula*, *Myristica malabarica*, *Phyllanthus emblica*, *Terminalia* spp., etc.
- Requirement of medicinal plant cultivation knowledge and awareness.

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KARNATAKA BIODIVERSITY BOARD

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Karnataka Biodiversity Board was established vide Section 22 of Biological Diversity Act 2002, by Government of Karnataka on 01/08/2003.

Main objectives of the Board are:

1. Implementation of Biological Diversity Act 2002 and Karnataka Biological Diversity Rules 2005.
2. Conservation of Biological Diversity
3. Promotion of in-situ and ex-situ conservation of biological resources, incentives for research, training and public education to increase awareness with respect to biodiversity.
4. Planning schemes and programmes for the sustainable utilization of Biological Diversity.

Activities of the Board:

1. **Constitution of Biodiversity Management Committees (BMCs)**

As per section 41 of Biological Diversity Act 2002, every local body shall constitute a Biodiversity Management Committee with its area for the purpose of promoting conservation, sustainable use and documentation of Biological Diversity.

2. **Awareness and Training Programs:**

The Biodiversity awareness training program to Government employees, University Students, teachers, Non-Government organizations, Panchayats members and general public is being conducted throughout the State.

3. **People's Biodiversity Register (PBRs):**

PBR is a panchayat level register that documents local biodiversity and local community knowledge on biodiversity including its conservation and traditional uses. The PBRs are prepared in various districts at Gram panchayath level. PBRs are prepared both in Kannada and English. The PBR will help in opposing patenting and other legal matters.

Member Secretary
Karnataka Biodiversity Board
Members Secretary