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Floristic and Ecological studies of Mayureshwar and Rehekuri wildlife sanctuaries

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Abstract
The present investigation was carried out on floristic composition and ecological studies of Mayureshwar and Rehekuri wildlife sanctuaries, Maharashtra. The vegetation is semi-arid and dry deciduous southern tropical thorny scrub type. In Mayureshwar wildlife sanctuary total 268 plants species belonging to 191 genera and 57 families were recorded. However, in Rehekuri wildlife sanctuary 280 plants species belonging to 59 families with 202 plants genera were recorded. In both the sanctuaries Fabaceae and Poaceae were dominant families. Abundance, density, relative density, relative abundance, frequency, relative frequency, species richness and IVI were studied.

Keywords: floristic, ecology, wildlife sanctuary

1. Introduction
India is having richest biodiversity in the world. The Flora of India is consists of 47513 plant species of all groups and 18117 flowering plant species (Arisdason and Lakshminarasimhan, 2016) [3]. National parks and wildlife sanctuaries are plays important role in conservation of Flora and Fauna. National parks and wildlife sanctuaries are areas which are strictly reserved for the conservation of the wildlife and biodiversity.

Mayureshwar wildlife sanctuary for Chinkara (*Gazella gazella bennetti*) is located between 18° 21′ 00″ N to 18° 22′ 00″ N latitude and 74° 20′ 00″ E to 74° 23′ 00″ E longitudes in the Baramati Tehsil of Pune District, Maharashtra (MS), India at 610 m altitude with an area 5.14 sq. Kms (Ben *et al.*, 2013). This sanctuary is having dry deciduous southern tropical thorny forest. The climate is semi-arid and total annual rainfall 350 mm to 400 mm. December to January are average minimum and maximum temperature are 28°C and 35°C and April to May to 44°C (Anonymous, 2015) [2].

Rehekuri wildlife sanctuary for Blackbuck (*Antilope cervicapra*) located between 18° 35′ 36″ N to 18° 36′ 25″ N latitude and 74° 57′ 42″ E to 74° 58′ 59″ E longitudes in the Karjat Tehsil of Ahmednagar District, Maharashtra (MS), India at 610 m altitude and an area 217.30 hectares.. This sanctuary is having dry deciduous southern tropical thorny forest. The climate is arid and semi-arid. The total annual rainfall is 500 - 600 mm. The mean minimum temperature is 28°C but it may be dropped down to 16°C during winter. The maximum temperature reached up to 43°C (Anonymous, 2015) [2].

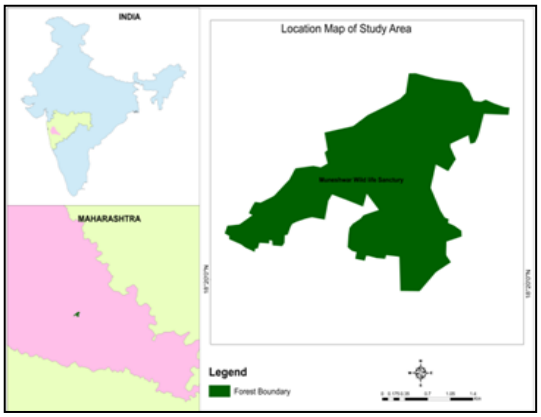

Fig 1: Location map - Mayureshwar wildlife sanctuary

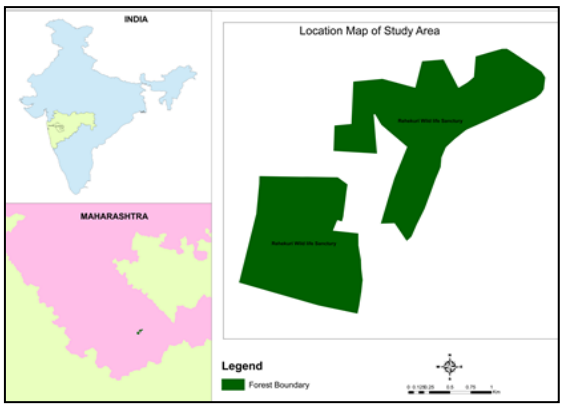

Fig 2: Location map - Rehekuri wildlife sanctuary

2. Material and methods
2.1. Floristic study
2.1.1 Collection of plant materials: The field work was carried out from January, 2015 to December, 2016. Collection of different plant specimens was undertaken from study area.

2.1.2 Herbarium preparation and photo images: Plants specimen herbariums were prepared by using standard method (Santapau, 1955, Diane and Leonard, 1998) [11]. Photo images of all species were taken in different stages by using digital camera (Sony Cyber-Shot DSC-W830).

2.1.3 Plant Identification: The microscopic characters were studied with the help of compound microscope (EcoBlue) (Jayalakshmi *et al*., 2016) [18]. The identification of the collected specimens was done by using relevant floras *viz*., Hooker, 1872-1897 [17], Cooke, 1958 Repr ed. [8], Sharma *et al*., 1996 [39], Pradhan and Singh, 1999 [32], Naik, 1998 [30], Yadav and Sardesai, 2002 [47], Bhagat *et al*., 2008[3] etc. Author citation and nomenclature of each plant species was verified with International Plant Name Index (IPNI, 2015), Catalogue of life (2016) and The Plant list (2013).

2.1.4 Documentation: The arrangements of the families were principally based on Bentham & Hooker (1862-83) system of classification and then families were arranged systematically according to APG-IV, 2016 [7a].

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2.2 Ecological analysis

At study sites, 10 quadrats of 20 m X 20 m size were randomly placed for trees and shrubs. Herb species were studied by placing 10 quadrats of 1m X 1m size randomly in study area (Rathod, 2014) [34].

2.2.1 Quantitative analysis: The quantitative analysis of herbs, shrubs and trees species for density, abundance and frequency, relative values and Importance Value Index (IVI), Species richness, etc. were done (Curtis and McIntosh, 1950, Mueller- Dombois and Ellenberg, 1974, Greig-Smith, 1983, Singh and Gaur, 2008, Buba, 2015, Magurran, 1988, Nkoa *et al*., 2015, Sinha *et al*., 2015, Zhigila *et al*., 2015, Singh *et al*., 2016) [9, 28, 15, 42, 7, 26, 31, 43]. Raunkiaer's frequency classes A>B>C=D<E (Raunkiaer, 1934) [35].

3. Results

3.1 Floristic study

3.1.1 Collection and Identification of plant materials: During field studies 268 plants species, belonging to 57 families with 191 genera were recorded in Mayureshwar wildlife sanctuary and 280 plants species belonging to 59 families with 202 genera were recorded in Rehekuri wildlife sanctuary respectively. Pteridophyte, *Actiniopteris dichotoma* Mett. Was recorded in both the sanctuaries however, *Ophioglossum costatum* R. Br. was recorded only in Mayureshwar wildlife sanctuary. Gymnosperm, *Platycladus orientalis* (L.) Franco is found in planted form in both the sanctuaries.

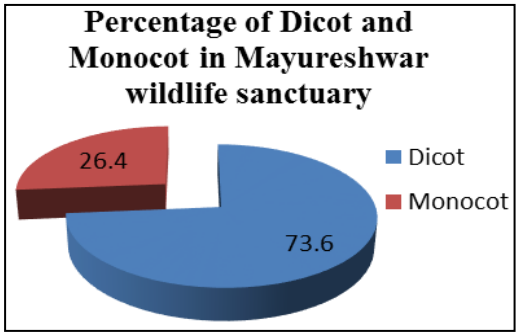

Fig 3: Percentage of Dicotyledons and Monocotyledons in Mayureshwar wildlife sanctuary

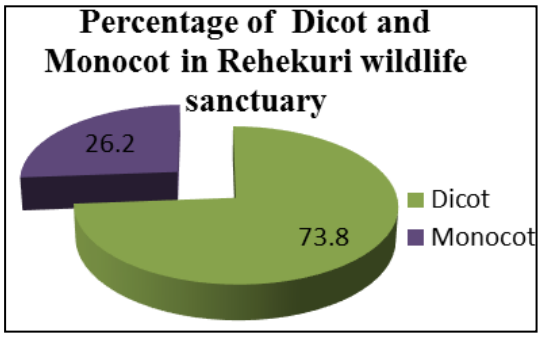

Fig 4: Percentage Dicotyledons and Monocotyledons in Rehekuri wildlife sanctuary

In Mayureshwar wildlife sanctuary 73.6 percent dicotyledons and 26.4 percent monocotyledons were recorded (fig.1). However, it was Dicotyledons and monocotyledons in were observed 73.8% and 26.2% in Rehekuri wildlife sanctuary respectively (fig.2).

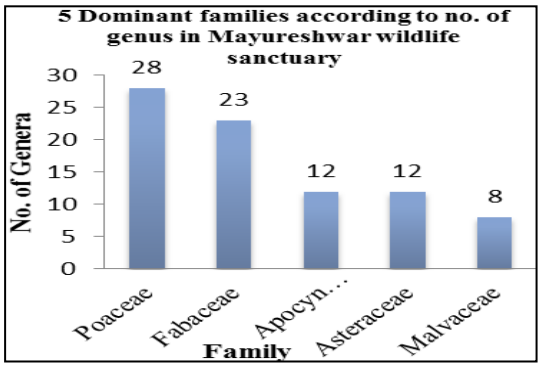

Fig 5: Dominant families according to no. of genera in Mayureshwar wildlife sanctuary

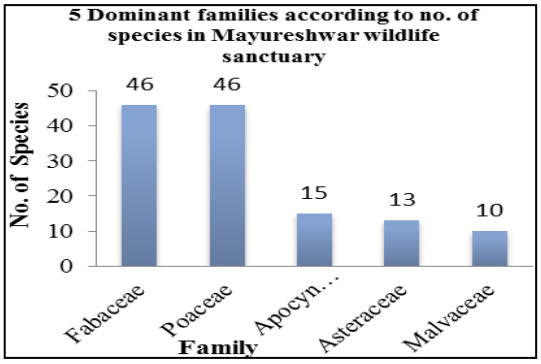

Fig 6: Dominant families according to no. of species in Mayureshwar wildlife sanctuary

Dicotyledons were showed dominant vegetation in Mayureshwar and Rehekuri wildlife sanctuary.

During the work Poaceae was dominant family followed by Fabaceae, Apocynaceae, Asteraceae and Malvaceae according to number of genera (Fig. 3). However Poaceae and Fabaceae were dominant families followed by Apocynaceae, Asteraceae and Malvaceae according to species number (Fig. 4). In Mayureshwar wildlife sanctuary, Poaceae and Fabaceae families were observed with same species numbers. Poaceae and Fabaceae family were dominant according to no. of genera and no. of species.

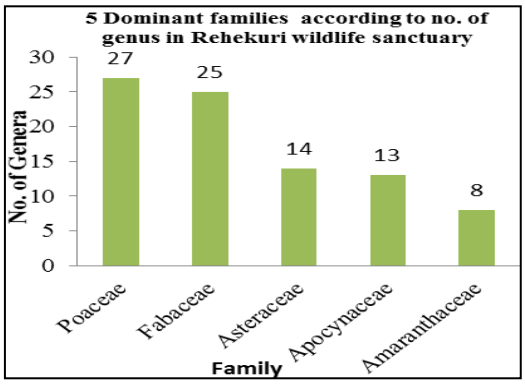

Fig 7: Dominant families according to no. of genera in Rehekuri wildlife sanctuary

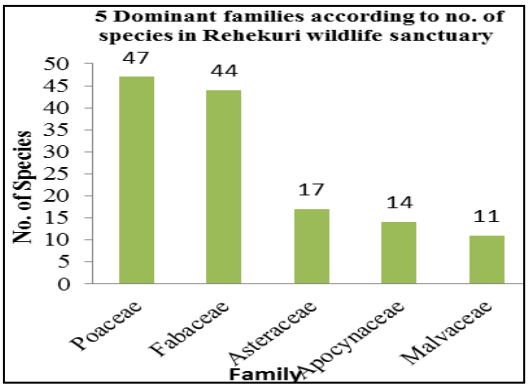

Fig 8: Dominant families according to no. of species in Rehekuri wildlife sanctuary

In Rehekuri wildlife sanctuary five dominant families were reported according to no. of genera such as Poaceae (27) genera followed by Fabaceae (25), Asteraceae (14), Apocynaceae (13) and Amaranthaceae (08) (Fig. 5). Five dominant families according to no. of species such as Poaceae (47) followed by Fabaceae (44), Asteraceae (17), Apocynaceae (13) and Malvaceae (11) were reported in Rehekuri wildlife sanctuary (Fig.6). Poaceae (Monocotyledons) and Fabaceae (Dicotyledons) family were dominant in Rehekuri wildlife sanctuary.

3.2 Ecological analysis

3.2.1 Quantitative analysis

3.2.1.1 Quadrat study for herbaceous community in Mayureshwar wildlife sanctuary: Quadrats were placed in 10 different locations. The data reported from surveys related the floristic diversity showed the species having maximum abundance, relative density, density, relative abundance and IVI were observed in *Cyanotis fasciculata Cenchrus ciliaris*, *Brachiaria eruciformis*, *Parthenium hysterophorus*, etc. respectively and the species having minimum abundance and relative abundance were observed in *Evolvulus alsinoides*, *Malachra capitata*, *Physalis minima*, *Alysicarpus monilifer* etc. respectively (Table 1).

The species having least relative density, frequency, density and relative frequency were obsereved by *Malachra capitata*, *Citrullus colocynthis*, *Launaea procumbens*, *Rhynchosia minima*, etc. respectively and the species having least IVI were *Malachra capitata*, *Vigna trilobata* and *Rhynchosia minima* (Table 1).

3.2.1.2 Quadrat study for trees and shrubs community in Mayureshwar wildlife sanctuary: The data reported from surveys related the floristic diversity showed the species having highest abundance, relative dominance; relative frequency and frequency were observed in *Leucaena leucocephala*, *Acacia torta*, *Albizia lebbeck*, *Prosopis juliflora*, *ziziphus mauritiana*, *Azadirecta indica* etc. respectively. The species having highest relative density, density and IVI were observed in *Acacia torta*, *Azadirachta indica*, *Dalbergia sissoo*, *Acacia leucophloea*, *Ziziphus mauritiana* respectively (Table 2).

The species having least relative density, relative frequency, density, frequency and IVI were observed in *Dolichandrone falcata*, *Syzygium cumini*, *Moringa oleifera*, *Ficus benghalensis*, *Hardwickia binata*, etc. respectively. The species having minimum abundance and relative abundance were observed in *Balanites aegyptiaca*, *Acacia leucophloea*, *Vitex negundo* etc. respectively (Table 2).

Table 1: Quadrat survey of Mayureshwar wildlife sanctuary (herb community)

Species name	Density	Abundance	Frequency (%)	Relative density (%)	Relative abundance (%)	Relative frequency (%)	IVI
Evolvulus alsinoides	0.7	1.0	70	1.27	0.74	3.16	5.9
Glossocardia bosvallia	0.8	1.6	50	1.45	1.18	2.26	4.9
Leucas longifolia	0.6	1.2	50	1.09	0.89	2.26	4.24
Phyllanthus amarus	0.9	3.0	30	1.63	2.22	1.35	5.22
Echinops echinatus	0.6	1.2	50	1.09	0.89	2.26	4.24
Amaranthus blitum	0.5	2.5	20	0.90	1.85	0.90	3.7
Cleome viscosa	1.6	2.66	60	2.90	1.97	2.71	7.7
Malachra capitata	0.1	1.0	10	0.18	0.74	0.45	1.4
Sida acuta	1.0	2.0	50	1.81	1.48	2.26	5.6
Boerhavia diffusa	1.8	2.57	70	3.27	1.90	3.16	8.4
Brachiaria reptans	1.7	2.83	60	3.09	2.10	2.71	7.9
Cenchrus ciliaris	1.4	7.0	20	2.54	5.19	0.90	8.6
Cyanotis fasciculata	4.5	15	30	8.18	11.1	1.35	20.6
Commelina forskaolii	1.2	6.0	20	2.18	4.45	0.90	7.54
Ruellia tuberosa	0.5	1.25	40	0.90	0.92	1.80	3.64

Desmodium dichotomum	1.9	4.75	40	3.45	3.52	1.80	8.8
Heteropogon triticeus	1.6	2.7	60	2.90	1.98	2.71	7.6
Zornia gibbosa	1.8	2.57	70	3.3	1.90	3.16	8.3
Physalis minima	0.4	1.0	40	0.7	0.74	1.80	3.2
Solanum americanum	0.3	1.0	30	0.54	0.74	1.35	2.6
Polygala erioptera	1.2	2.4	50	2.2	1.75	2.26	6.2
Cyanotis axillaris	0.4	1.33	30	0.72	0.99	1.35	3.07
Pulicaria wightiana	0.8	1.6	50	1.45	1.18	2.26	4.90
Citrullus colocynthis	0.2	2.0	10	0.36	1.48	0.45	2.30
Apluda mutica	1.9	2.71	70	3.45	2.01	3.16	8.63
Aristida redacta	1.9	3.8	50	3.45	2.82	2.26	8.53
Brachiaria eruciformis	2.6	6.5	40	4.72	4.82	1.80	11.3
Cyperus iria	1.3	6.5	20	2.36	4.82	0.90	8.09
Dactyloctenium aegyptium	1.2	2.0	60	2.18	1.48	2.71	6.38
Digitaria ciliaris	1.0	2.0	50	1.81	1.48	2.26	5.56
Portulaca oleracea	0.9	1.8	50	1.63	1.33	2.26	5.23
Tridax procumbens	1.6	2.66	60	2.90	1.98	2.71	7.60
Gomphorena serrata	0.5	1.25	40	0.90	0.92	1.80	3.64
Indigofera cordifolia	0.7	1.4	50	1.27	1.03	2.26	4.57
Fagonia indica	0.6	2.0	30	1.09	1.48	1.35	3.93
Datura innoxia	0.3	1.5	20	0.54	1.11	0.90	2.56
Parthenium hysterophorus	2.8	4.7	60	5.09	3.46	2.71	11.2
Chrysopogon polyphyllus	1.6	2.3	70	2.90	1.69	3.16	7.77
Vigna trilobata	0.2	1.0	20	0.36	0.74	0.90	2.01
Launaea procumbens	0.2	2.0	10	0.36	1.48	0.45	2.30
Commelina erecta	0.3	3.0	10	0.54	2.22	0.45	3.22
Digitaria abludens	1.2	1.71	70	2.18	1.27	3.16	6.62
Tricholepis radicans	0.3	1.5	20	0.54	1.11	0.90	2.56
Polygala arvensis	0.8	1.6	50	1.45	1.18	2.26	4.90
Triumfetta rhomboidea	0.5	1.25	40	0.90	0.92	1.80	3.64
Rhynchosia minima	0.2	1.0	20	0.36	0.74	0.90	2.01
Alysicarpus monilifer	0.5	1.0	50	0.9	0.74	2.26	3.91
Chloris virgata	1.7	1.9	90	3.09	1.40	4.07	8.56
Stylosanthes fruticosa	1.8	3.6	50	3.27	2.67	2.26	8.20
Tragus mongolorum	0.4	2.0	20	0.72	1.48	0.90	3.11
Euphorbia hirta	1.5	1.87	80	2.72	1.39	3.61	7.73
Total number species	51						
Total no. of individuals	543						
Species Richness	7.94						

Table 2: Quadrat survey of Mayureshwar wildlife sanctuary (Tree and shrub community)

Species name	Density	Abundance	Frequency (%)	Relative density (%)	Relative abundance (%)	Relative frequency (%)	IVI
Balanites aegyptiaca	1.0	0.2	20	4.34	0.65	1.47	6.47
Limonia acidissima	0.4	0.75	30	1.73	2.46	2.20	6.41
Albizia lebbeck	0.2	1.0	20	0.86	3.28	1.47	5.62
Ailanthus excelsa	0.2	1.0	20	0.86	3.28	1.47	5.62
Acacia catechu	0.7	0.71	50	3.04	2.34	3.67	9.06
Dolichandrone falcata	0.1	1.0	10	0.43	3.28	0.73	4.45
Flueggea leucopyrus	0.6	0.7	40	2.60	2.19	2.94	7.74
Lantana camara	1.3	0.5	60	5.65	1.51	4.41	11.5
Jatropha gossypiifolia	0.8	0.62	50	3.47	2.05	3.67	9.20
Calotropis procera	0.4	0.75	30	1.73	2.46	2.20	6.41
Syzygium cumini	0.1	1.0	10	0.43	3.28	0.73	4.45
Moringa oleifera	0.1	1.0	10	0.43	3.28	0.73	4.45
Ficus benghalensis	0.1	1.0	10	0.43	3.28	0.73	4.45
Annona squamosa	0.8	0.37	30	3.47	1.23	2.20	6.9
Aegle marmelos	0.1	1.0	10	0.43	3.28	0.73	4.45
Capparis decidua	0.5	1.0	50	2.17	3.28	3.67	9.13
Acacia auriculiformis	0.1	1.0	10	0.43	3.28	0.73	4.4
Senna siamea	0.1	1.0	10	0.43	3.28	0.73	4.47
Senna auriculata	0.5	0.6	30	2.17	1.97	2.20	6.35
Tamarindus indica	0.2	1.0	20	0.86	3.28	1.47	5.62

Capparis divaricata	0.3	1.0	30	1.30	3.28	2.20	6.79
Acacia leucophloea	1.5	0.2	30	6.52	0.65	2.20	9.38
Pongamia pinnata	0.1	1.0	10	0.43	3.28	0.73	4.45
Dalbergia sissoo	1.7	0.3	50	7.39	0.96	3.67	12.0
Gliricidia sepium	1.3	0.46	60	5.65	1.51	4.41	11.6
Acacia nilotica	0.5	0.4	20	2.17	1.31	1.47	4.95
Hardwickia binata	0.2	0.5	10	0.86	1.64	0.73	3.24
Azadirecta indica	1.8	0.38	70	7.82	1.27	5.14	14.25
Leucaena leucocephala	0.9	1.0	90	3.91	3.28	6.61	13.8
ziziphus mauritiana	1.2	0.75	90	5.21	2.46	6.61	14.3
Acacia torta	1.3	0.69	90	5.65	2.27	6.61	14.5
Santalum album	0.7	0.71	50	3.04	2.34	3.67	9.06
Cryptostegia grandiflora	0.4	0.5	20	1.73	1.64	1.47	4.85
Ficus virens	0.1	1.0	10	0.43	3.28	0.73	4.45
Prosopis juliflora	0.4	1.0	40	1.73	3.28	2.94	7.96
Calotropis procera	0.4	0.75	30	1.73	2.46	2.20	6.41
Cynanchum viminale	0.2	0.5	10	0.86	1.64	0.73	3.24
Eucalyptus globulus	0.8	0.87	70	3.47	2.87	5.14	11.5
Vitex nigundo	0.4	0.25	10	1.73	0.82	0.73	3.29
Delonix regia	0.3	1.0	30	1.30	3.28	2.3	6.79
Dregea volubilis	0.2	1.0	20	0.86	3.28	1.47	5.62
Total no. of species (S)	41						
Total no.of individuals (N)	230						
Species Richness	7.35						

3.2.1.3 Quadrat study for herbaceous community in Rehekuri wildlife sanctuary: Quadrats were put in 10 different locations at Rehekuri wildlife sanctuary. The data presented from surveys showed the species maximum abundance and relative abundance were observed in *Neanotis lancifolia* followed by *Aristida redacta* and *Neanotis montholonii* etc. respectively (Table 3). The species having highest relative frequency and frequency were observed in *Digitaria ciliaris* followed by *Pulicaria wightiana*, *Striga densiflora*, *Aristida redacta* etc. respectively (Table 3). The species having highest relative density and density were observed in *Aristida redacta* followed by *Heteropogon triticeus*, *Brachiaria reptans* etc. respectively (Table 3).

The species having minimum abundance and relative abundance were observed in *Echinops echinatus* followed by *Sida acuta, Malachra capitata* and *Desmodium dichotomum*, *Trianthema portulacastrum* etc. respectively (Table 3). The species having least relative density, relative frequency, density, frequency and IVI were observed in *Malachra capitata* followed by *Sida acuta, Zornia gibbosa*, *Indigofera cordifolia* etc. respectively (Table 3).

The species having highest IVI was observed in *Aristida redacta* followed by *Heteropogon triticeus, Striga densiflora*, *Brachiaria reptans, Chloris virgata* etc.

3.2.1.4 Quadrat study for trees and shrubs community in Rehekuri wildlife sanctuary: The data reported from floristic diversity showed the species having highest abundance and relative abundance were observed in *Leucaena leucocephala* followed by *Dalbergia sissoo*, *Eucalyptus globulus*, *Vitex negundo* etc. respectively (Table 4). The species having highest relative density, relative frequency, density, frequency and IVI were presented by *Dalbergia sissoo* followed by *Gliricidia sepium*, *Acacia torta*, *Eucalyptus globulus*, *Acacia leucophloea* etc. respectively (Table 4).

The species having minimum abundance, relative density, relative dominance, density and IVI were observed in *Limonia acidissima* followed by *Cascabela thevetia*, *Albizia lebbeck*, *Ailanthus excelsa*, *Millingtonia hortensis* etc. respectively (Table 4). The species having least relative frequency and frequency were observed in *Cissus woodrowii* followed by *Limonia acidissima Cascabela thevetia, Ailanthus excelsa* and *Millingtonia hortensis* (Table 4).

Table 3: Quadrat survey of Rehekuri wildlife sanctuary (Herbaceous community)

Species name	Density	Abundance	Frequency (%)	Relative density (%)	Relative abundance (%)	Relative frequency (%)	IVI
Evolvulus alsinoides	1.0	1.42	70	3.10	2.10	3.78	8.99
Phyllanthus amarus	0.8	1.33	60	2.48	1.96	3.24	7.69
Echinops echinatus	0.3	1.0	30	0.93	1.47	1.62	4.02
Sida acuta	0.2	1.0	20	0.62	1.47	1.08	3.17
Corynandra viscosa	1.4	2.33	60	4.34	3.44	3.24	11.0
Boerhavia diffusa	0.7	1.4	50	2.17	2.06	2.70	6.94
Trianthema portulacastrum	0.9	1.28	70	2.79	1.89	3.78	8.47
Malachra capitata	0.1	1.0	10	0.31	1.47	0.54	2.3
Cenchrus ciliaris	1.0	1.42	70	3.10	2.10	3.78	8.9
Brachiaria reptans	1.5	3.0	50	4.65	4.42	2.70	11.7

Commelina forskaolii	0.8	2.66	30	2.48	3.93	1.62	8.04
Desmodium dichotomum	0.3	1.0	30	0.93	1.47	1.62	4.02
Neanotis lancifolia	1.0	3.33	30	3.10	4.91	1.62	9.64
Heteropogon triticeus	1.8	2.57	70	5.59	3.79	3.78	13.2
Solanum americanum	0.3	1.0	30	0.93	1.47	1.62	4.02
Andropogon pumilus	1.0	2.5	40	3.10	3.68	2.16	8.95
Polygala erioptera	0.4	1.33	30	1.24	1.96	1.62	4.83
Zornia gibbosa	0.2	1.0	20	0.62	1.47	1.08	3.17
Aristida redacta	2.5	3.12	80	7.76	4.61	4.32	16.7
Apluda mutica	1.5	2.5	60	4.65	3.68	3.24	11.6
Digitaria ciliaris	0.9	1.0	90	2.79	1.47	4.86	9.13
Tridax procumbens	0.7	1.4	50	2.17	2.06	2.70	6.94
Dactyloctenium aegyptium	0.9	2.25	40	2.79	3.32	2.16	8.27
Gomphorena serrata	0.4	1.0	40	1.24	1.47	2.16	4.88
Fagonia indica	0.5	1.66	30	1.55	2.45	1.62	5.63
Pulicaria wightiana	0.9	1.0	90	2.79	1.47	4.86	9.13
Indigofera cordifolia	0.2	1.0	20	0.62	1.47	1.08	3.17
Datura innoxia	0.2	1.0	20	0.62	1.47	1.08	3.17
Rungia repens	0.8	2.66	30	2.48	3.93	1.62	8.04
Striga densiflora	1.5	1.66	90	4.65	2.45	4.86	11.9
Chrysopogon polyphyllus	1.2	1.71	70	3.72	2.53	3.78	10.0
Stylosanthes viscosa	0.8	1.6	50	2.48	2.36	2.70	7.54
Digitaria abludens	1.0	1.42	70	3.10	2.10	3.78	8.99
Tricholepis radicans	0.4	1.33	30	1.24	1.96	1.62	4.83
Polygala arvensis	0.5	1.7	30	1.55	2.45	1.62	5.63
Tragus mongolorum	0.2	1.0	20	0.62	1.47	1.08	3.17
Euphorbia hirta	0.7	1.75	40	2.17	2.58	2.16	6.91
Neanotis montholonii	0.9	3.0	30	2.79	4.42	1.62	8.84
Commelina erecta	0.3	1.5	20	0.93	2.21	1.08	4.22
Chloris virgata	1.5	1.87	80	4.65	2.76	4.32	11.7
Total number of species (S)	40						
Total number individuals (N)	322						
Species Richness	7.54						

Table 4: Quadrat survey of Rhekuri wildlife sanctuary (Tree and shrub community)

Spacies name	Density	Abundance	Frequency (%)	Relative density (%)	Relative abundance (%)	Relative frequency (%)	IVI
Acacia catechu	1.4	2.8	50	5.03	3.66	3.93	12.6
Cissus woodrowii	0.2	2.0	10	0.71	2.61	0.78	4.12
Limonia acidissima	0.1	1.0	10	0.35	1.30	0.7	2.45
Cascabella thevetia	0.1	1.0	10	0.35	1.30	0.78	2.45
Albizia lebbeck	0.2	1.0	20	0.72	1.30	1.57	3.60
Balanites aegyptiaca	1.3	2.6	50	4.67	3.4	3.93	12.0
Ailanthus excelsa	0.1	1.0	10	0.36	1.30	0.78	2.4
Dichrostachys cinerea	1.2	4.0	30	4.31	5.23	2.36	11.9
Millingtonia hortensis	0.1	1.0	10	0.35	1.30	0.78	2.45
Nerium oleander	0.2	1.0	20	0.72	1.30	1.57	3.60
Jatropha gossypiifolia	0.5	2.5	20	1.80	3.26	1.57	6.64
Lantana camara	1.4	2.8	50	5.03	3.7	3.93	12.6
Ficus benghalensis	0.1	1.0	10	0.35	1.31	0.78	2.45
Moringa oleifera	0.1	1.0	10	0.35	1.31	0.78	2.45
Syzygium cumini	0.1	1.0	10	0.35	1.31	0.78	2.45
Annona squamosa	0.8	2.66	30	2.87	3.48	2.36	8.72
Aegle marmelos	0.1	1.0	10	0.35	1.30	0.78	2.45
Capparis zelylanica	0.3	1.5	20	1.07	1.96	1.57	4.61
Senna siamea	0.1	1.0	10	0.35	1.31	0.78	2.45
Tamarindus indica	0.2	1.0	20	0.71	1.30	1.57	3.60
Senna auriculata	0.5	1.0	50	1.79	1.31	3.93	7.04
Capparis divaricata	0.5	1.66	30	1.79	2.18	2.36	6.34
Acacia leucophloea	1.5	2.5	60	5.39	3.27	4.72	13.3
Pongamia pinnata	0.1	1.0	10	0.35	1.30	0.78	2.4

Acacia torta	1.8	2.25	80	6.47	2.94	6.29	15.7
Gliricidia sepium	1.9	2.71	70	6.83	3.55	5.51	15.8
Acacia nilotica sp *indica*	0.5	1.66	30	1.79	2.18	2.36	6.34
Leucaena leucocephala	1.8	4.5	40	6.47	5.9	3.14	15.5
Azadirecta indica	1.6	2.66	60	5.75	3.5	4.72	13.9
Capparis decidua	0.7	1.16	60	2.51	1.5	4.72	8.76
Dalbergia sissoo	2.9	3.22	90	10.4	4.2	7.08	21.7
Cryptostegia grandiflora	0.6	2.0	30	2.15	2.61	2.36	7.13
Santalum album	0.3	1.0	30	1.07	1.30	2.36	4.74
Prosopis juliflora	0.4	2.0	20	1.43	2.61	1.57	5.62
Delonix regia	0.1	1.0	10	0.35	1.30	0.78	2.45
ziziphus mauritiana	0.9	2.25	40	3.23	2.94	3.14	9.32
Calotropis procera	0.3	1.0	30	1.07	1.30	2.36	4.74
Mimosa hemata	0.4	2.0	20	1.43	2.61	1.57	5.62
Eucalyptus globulus	1.8	3.0	60	6.47	3.92	4.72	15.1
Dregea volubilis	0.2	1.0	20	0.7	1.30	1.57	3.60
Ficus virens	0.1	1.0	10	0.4	1.30	0.78	2.45
Vitex nigundo	0.3	3.0	10	1.08	3.92	0.78	5.78
Total number of species (S)	42						
Total number individuals (N)	264						
Species Richness	7.35						

3.2.2. Raunkiaer's frequency class in Mayureshwar and Rehekuri wildlife sanctuary

In herbs frequency class 'C' was dominant with 19 species followed by 'A' with 13 species, 'B' with 11 species, 'D' with 7 species, and 'E' with 1 species in Mayureshwar wildlife sanctuary (Fig.7). In trees and shrubs, the frequency class 'A' was dominant with 19 species followed by 'B' with 10 species, 'C' with 7 species, 'E' with 3 species, and 'D' with 2 species in Mayureshwar wildlife sanctuary (Fig. 8).

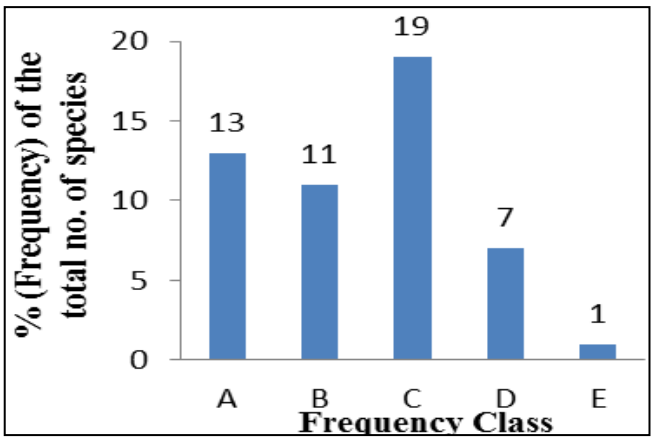

Fig 9: Percentage of frequency class in Mayureshwar wildlife sanctuary (Herb)

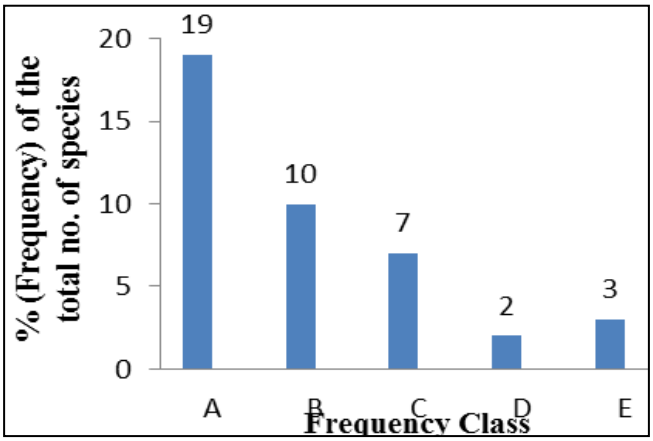

Fig 10: Percentage of frequency class in Mayureshwar wildlife sanctuary (Tree & Shrub)

In herbaceous frequency class 'B' was observed with 15 species followed by 'D' with 8 species, 'C' with 7 species, 'A' with 7 species, and 'E' with 3 species. The herbs quadrats survey 'B' frequency class was dominant in Rehekuri wildlife sanctuary (Fig. 9). Maximum and minimum numbers of species observed in frequency class 'B' and frequency class 'E' respectively. In Rehekuri wildlife sanctuary herbs frequency class A<B>C<D>E and trees and shrubs A>B>C>D>E.

In trees and shrubs, the frequency class 'A' represented by total 22 species followed by 'B' with 9 species, 'C' with 8 species, 'D' with 2 species, and 'E' with 1 species. The 'A' Frequency class was dominant in Rehekuri wildlife sanctuary (Fig. 10).

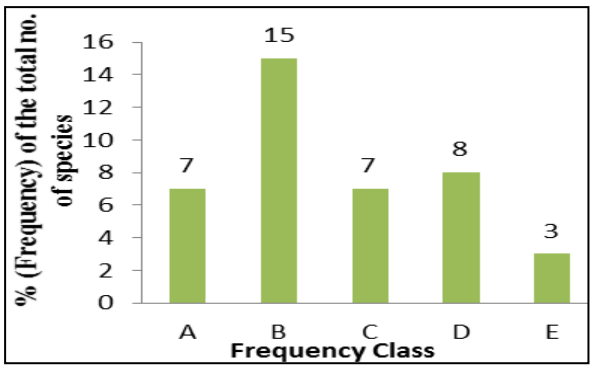

Fig 11: Percentage of frequency class in Rehekuri wildlife sanctuary (Herb)

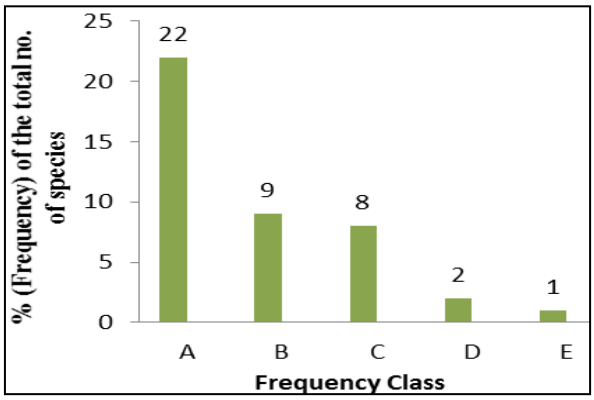

Fig 12: Percentage of frequency class in Rehekuri wildlife sanctuary (Tree & Shrub)

4. Discussion

Ben, (2008) [5] studied Angiosperm flora of Mayureshwar wildlife sanctuary and reported 185 plant species belonging to 55 families. In the present findings, recorded plant species number was higher i.e. 268 belonging to 57 families. Hande *et al*., (2014) [16] recorded 94 plant species with 36 families and 76 genera in Katepurna wildlife sanctuary of Akola Wildlife Division, Maharashtra. Out of 94 species 79 were dicotyledons plants with 33 families and 63 genera. However, 15 species were belonging 3 families with 13 genera of monocot. Dicotyledons plants were dominant which corroborates with present finding.

Bhagat *et al*., (2008) [6], studied the floristic composition of Baramati tahsil, Dist. Pune and recorded 938 species. In the present study, five species *viz.*, *Hardwickia binata* Roxb, *Indigofera spicata* Forssk., *Corchorus depressus* (L.) Stocks, *Mollugo nudicaulis* Lam. and *Chlorophytum tuberosum* (Roxb.) Baker were not recorded in the flora of Baramati. Hence our reports showed new addition of these species to the flora of Baramati tehsil from Mayureshwar wildlife sanctuary. Rathod (2014) [34] reported. Fabaceae, Poaceae, Asteraceae Acanthaceae, Euphorbiaceae and Malvaceae were dominant families in Patnadevi forest. Fabaceae, Poaceae and Asteraceae reported dominant families according to species number from Sangamner Tehsil of Ahmednagar District, Waman (2014) [46].

Khyade *et al*., (2009) [22] reported the dominant family was Amaranthaceae with 4 species, while Papilionaceae with 3 species and Ascplepidaceae with 2 species from the hilly areas in Akole Taluka of Ahmednagar District. Aher, (2015) [1] investigated dominant families according to species number from Parner Tahsil of Ahmednagar District, Maharashtra (India) *viz*., Fabaceae, Solanaceae, Poaceae, etc. Kulkarni *et al*., (2015) [24] studied the flora of Lohgad and Visapur forts, a small ecological area in Western Ghats. Moraceae was reported as largest family which followed by Mimosaceae and Euphorbiaceae which was not supporting with present investigation.

Rathod, (2012) [33] recorded highest density in Patnadevi forest for *Hardwickia binata*, *Tamarindus indica* etc. However, maximum total density recorded for herbs *viz.*, *Cuscuta chinensis*, *Goniogyna hirta* and *Asparagus racemosus.* The recorded highest density for tree species and herbs species are not support with present work. Rathod, (2014) [34] studied that species having maximum density *Hardwickia binata* followed by *Tamarindus indica* and *Acacia catechu* in Patnadevi forest which were not similar with present investigation.

Kanade *et al*., (2008) [20] studied species having highest frequency *viz.*, *Mememecylon umbellatum*, *Syzygium cumini*, *Oleadioica*, *Catunaregam spinosa* and *Terminalia elliptica* in Chandoli National Park Western Ghats Maharashtra. The recorded highest frequency for tree plant species are not corroborating with present work. Behera, (2006) investigated highest IVI for *Heteropogon contortus* followed by *Desmodium triflorum*, *Spermacoce hispida*, *Andrographis paniculata* etc. in Eastern Ghats of India which was not supporting with present investigation.

Surpam *et al*., (2016) [44] investigated trees species composition and diversity indices in Seminary Hills, Nagpur. Maximum IVI was observed in *Tectona grandis* while minimum IVI was observed in *Lagerstroemia parviflora*. The recorded Maximum IVI for tree plant species are not corroborating with present work. Gokhale *et al*., (2015) [14] proposed that as class E higher then species population will be homogenous. While high classes B, C, D will be represent heterogeneous species population. Therefore, results demonstrated the heterogeneous species population in Mayureshwar and Rehekuri wildlife sanctuary. Ben, (2008) [5] investigated frequency class in Mayureshwar wildlife sanctuary and recorded homogenous population of species, the findings which are not matching with the present finding.

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