

Biodiversity of Simhachalam hill ranges from Visakhapatnam, Andhra Pradesh, India

Eastern Ghats, one of the nine floristic zones in India is comprised of several broken hill ranges extending from Phulbani in the north-east to Nilgiris in the south (Prasad 2020). Fortunately, in Andhra Pradesh, the north coastal districts- Srikakulam, Vizianagaram, Visakhapatnam, Anakapalli, Alluri Sitharama Raju, West Godavari, and East Godavari are few of the biodiversity rich areas of Eastern Ghats (Pullaiah & Rao 2002).

Among the many hill ranges in Visakhapatnam lies a pristine, highly diverse range of forests - the Simhachalam Hills which is a comparatively less documented, species-rich hotspot. It is a Reserved Forest with dry evergreen and dry deciduous vegetation laden with seasonal streams and ponds. The soil nature, rainfall and climatic conditions here together influenced by the sea level, supports abundant growth of flora and fauna. The hills also contain medicinal herbs used to cure cattle and human diseases. It generally receives more rainfall than the rest of the city. Due to good forest cover and comparatively less disturbances, the abundance of wildlife is more here.

Few studies on these hill ranges are narrowed on the floral diversity through surveys and published books on its floral, tree diversity since 2001 (Pullaiah & Rao 2002; Pullaiah & Murthy 2001; Pullaiah et al. 2018). Few notable studies on avifaunal diversity in these hill ranges include Araku valley and Maredumalli ranges by Kumar et al. (2010), Papikonda National Park by Ray et al. (2020) for their rich avian diversity

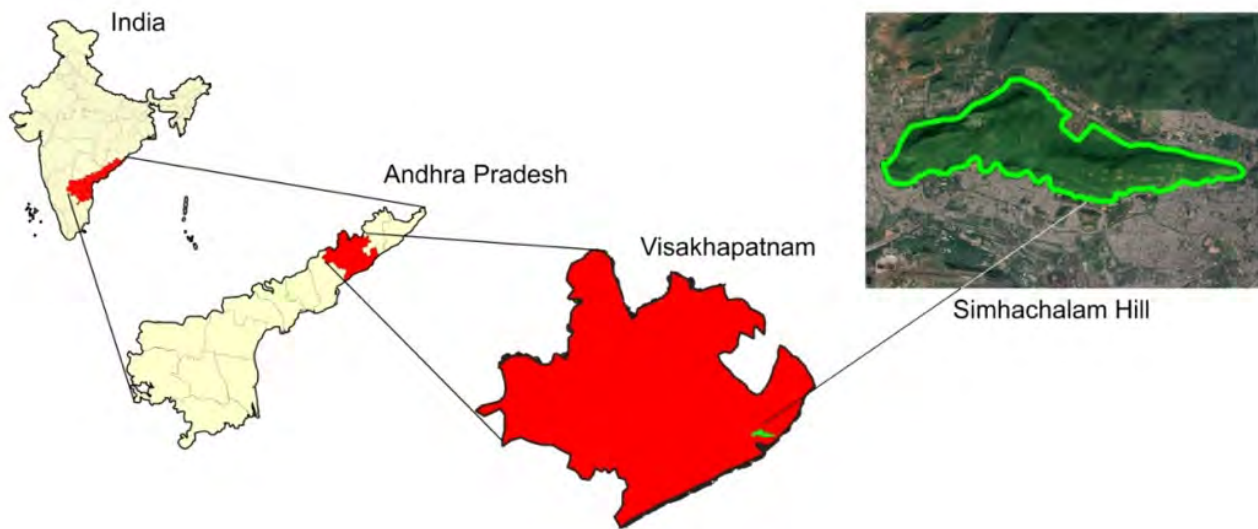
especially in the winter months. Similarly, Gnaneswar et al. (2016) reported few species of herpetofauna from this region along with other biodiversity hotspots in the state.

In this paper, we present our preliminary observations, results and furnish a checklist of flora and fauna including birds, butterflies, mammals, reptiles & amphibians sighted here.

Study Area

The observations are from Simhachalam Hills located in Visakhapatnam District, Andhra Pradesh. The hill ranges are dotted with dry evergreen and dry deciduous forest with elevation varying 100–800 m. The hill which is 800 m (2,600 ft) above sea level is situated at a distance of 14 km north of Visakhapatnam. The hill range is a part of the Eastern Ghats and is named Kailasa. The assessment surveys were carried out in the entire expanse of the hills. It included the main temple shrine and its surroundings, throughout the road that leads to the main shrine, foothills of the hills towards the Bus Rapid Trans System (BRTS) road, foothills towards Mudsarlova lake. Three major trek paths were followed – Venkojipalem to shrine (14 km), Madhavdhara to Shrine (3 km), Staircase from Simhachalam junction to shrine (2 km). Herpetofaunal surveys were conducted during the night along all the above-mentioned paths.

The observations on the various flora and fauna were made from January 2014 till March, 2020. All the taxa were identified up to species level



Map showing location of Simhachalam Hill in Visakhapatnam District, Andhra Pradesh (Courtesy: Google Earth; Note: The above map is indicative and is not to scale).

with the help of floras and literature (Gamble & Fischer 1915–1935; Subbarao & Kumari 2008). All the plant species were arranged according to alphabetical order of their scientific names. Nomenclature as far as possible has been made up-to date (www.plantlist.org; www.plantsoftheworldonline.org).

Surveys of birds were carried out with two to three visits per month all-round the year. The bird-watching group included not the same members every time essentially. Bird records were done following line transect method. Identification of the birds were based on Grimmet et al. (2016). Scientific names, common names and taxonomic classification of birds are after Praveen et al. (2016).

Butterflies were observed during their peak movement- 0800–1100 h and 1500–1800 h. Their classification and nomenclature was done based on Kunte (2000). Mammals were recorded through direct sightings or by recording indirect evidences such as footprints, paw marks, droppings and road kills. Their classification and nomenclature was done

following Menon (2014). Herpetofaunal surveys were conducted mostly at night for usually 2–3 hours. Nocturnal species of birds and mammals were also recorded during these surveys. Scientific names, common names and taxonomic classification of reptiles were done based on Whitaker & Captain (2004). Observation time for all species varied with seasonal changes and accessibility.

Results and Discussion

The biodiversity of Simhachalam Hill ranges is represented by both flora and fauna in this paper. Flora counting to 211 plant species belonging to 51 families were documented (Table 1). A total of 234 species of fauna consisting of amphibians (7), reptiles (40), mammals (18), birds (87), and butterflies (82) were recorded during the survey (Table 2–6).

Flora

Understanding the floral diversity of a habitat plays a major role in understanding the larger patterns of distribution of its biodiversity. A total of 211 species of plant species under 51 families and 170 genera were identified from



A



B



C



D



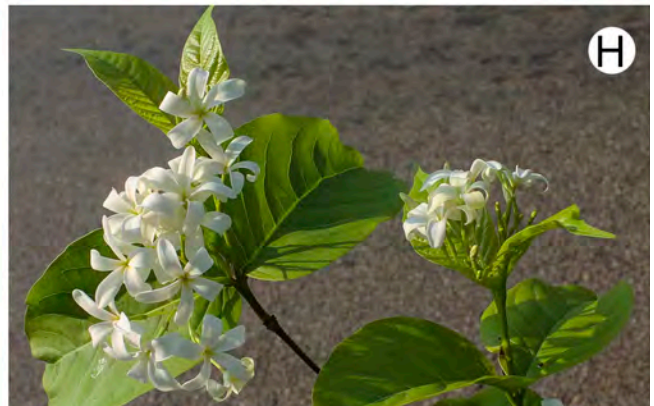
E



F



G



H

A—*Acacia auriculiformis* Benth. | B—*Carissa spinarum* L. | C—*Chloroxylon swietenia* DC. | D—*Dodonaea viscosa* (L.) Jacq. | E—*Gmelina asiatica* L. | F—*Gymnosporia emarginata* (Willd.) Thwaites | G—*Heteropogon contortus* (L.) P. Beauv. ex Roem. &Schult. | H—*Holarrhena pubescens* Wall. ex G. Don. © J Prakasa Rao.



A—*Hugonia mystax* Cav. | B—*Olax scandens* Roxb. | C—*Senna auriculata* (L.) Roxb. | D—*Polyalthia cerasoides* (Roxb.) Bedd. | E—*Terenna asiatica* (L.) Kuntze ex K.Schum. | F—*Trema orientalis* (L.) Blume | G—*Wrightia tinctoria* R. Br. | H—*Ziziphus oenopolia* (L.) Mill. © J Prakasa Rao.

Table 1. Floral diversity of Simhachalam Hills.

	Botanical Name	Habit	Family
1	<i>Abrus precatorius</i> L.	Cl	Fabaceae
2	<i>Abutilon hirsutum</i> (Vell.) K.Schum.	H	Malvaceae
3	<i>Abutilon indicum</i> (L.) Sweet	H	Malvaceae
4	<i>Acacia auriculiformis</i> Benth.	T	Fabaceae
5	<i>Acacia caesia</i> (L.) Willd.	Cl	Fabaceae
6	<i>Acacia chundra</i> (Rottler) Willd.	T	Fabaceae
7	<i>Acacia leucophloea</i> (Roxb.) Willd.	T	Fabaceae
8	<i>Acacia torta</i> (Roxb.) Craib	Cl	Fabaceae
9	<i>Acalypha indica</i> L.	H	Euphrobiaceae
10	<i>Achyranthes aspera</i> L.	H	Amaranthaceae
11	<i>Aegle marmelos</i> (L.) Corrêa	T	Rutaceae
12	<i>Aerva lanata</i> (L.) Juss.	H	Amaranthaceae
13	<i>Alangium salviifolium</i> (L.f.) Wangerin	T	Cornaceae
14	<i>Albizia saman</i> (Jacq.) Merr.	T	Fabaceae
15	<i>Allophylus cobbe</i> (L.) Raeusch.	Sh	Sapindaceae
16	<i>Alstonia scholaris</i> (L.) R. Br.	T	Apocynaceae
17	<i>Alstonia venenata</i> R.Br.	T	Apocynaceae
18	<i>Alternanthera paronychioides</i> A.St.-Hil.	H	Amaranthaceae
19	<i>Anacardium occidentale</i> L.	T	Anacardiaceae
20	<i>Andrographis paniculata</i> (Burm.f.) Nees	H	Acanthaceae
21	<i>Anisomeles indica</i> (L.) Kuntze	H	Lamiaceae
22	<i>Annona reticulata</i> L.	T	Annonaceae
23	<i>Anogeissus acuminata</i> (Roxb. ex DC.) Wall. ex Guillem. & Perr.	T	Combretaceae
24	<i>Argyreia nervosa</i> (Burm. f.) Bojer	Cl	Convolvulaceae
25	<i>Aristida adscensionis</i> L.	H	Poaceae
26	<i>Aristolochia indica</i> L.	Cl	Aristolochiaceae
27	<i>Arundinella pumila</i> (Hochst.) Steud.	H	Poaceae
28	<i>Asparagus racemosus</i> Willd.	Cl	Asparagaceae
29	<i>Azadirachta indica</i> A.Juss.	T	Meliaceae
30	<i>Barleria prionitis</i> L.	Sh	Acanthaceae
31	<i>Bauhinia racemosa</i> Lam.	T	Fabaceae
32	<i>Bergia ammannioides</i> Roxb. ex Roth	H	Elatinaceae
33	<i>Blepharis integrifolia</i> (L.f.) E.Mey. & Drège ex Schinz	H	Acanthaceae
34	<i>Blepharis maderaspatensis</i> (L.) B.Heyne ex Roth	H	Acanthaceae
35	<i>Blumea axillaris</i> (Lam.) DC.	H	Asteraceae
36	<i>Breynia vitis-idaea</i> (Burm.f.) C.E.C.Fisch.	Sh	Phyllanthaceae
37	<i>Bridelia retusa</i> (L.) A.Juss.	T	Phyllanthaceae
38	<i>Bridelia stipularis</i> (L.) Blume	Cl	Phyllanthaceae
39	<i>Cajanus scarabaeoides</i> (L.) Thouars	Cl	Fabaceae
40	<i>Calotropis gigantea</i> (L.) Dryand.	Sh	Apocynaceae
41	<i>Canthium coromandelicum</i> (Burm.f.) Alston	Sh	Rubiaceae
42	<i>Capparis zeylanica</i> L.	Cl	Capparaceae
43	<i>Carissa spinarum</i> L.	Sh	Apocynaceae

	Botanical Name	Habit	Family
44	<i>Cassia fistula</i> L.	T	Fabaceae
45	<i>Cassytha filiformis</i> L.	Cl	Lauraceae
46	<i>Catharanthus roseus</i> (L.) G.Don	H	Apocynaceae
47	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.	Sh	Rubiaceae
48	<i>Celastrus paniculatus</i> Willd.	Cl	Celastraceae
49	<i>Chloris barbata</i> Sw.	H	Poaceae
50	<i>Chloroxylon swietenia</i> DC.	T	Rutaceae
51	<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Sh	Asteraceae
52	<i>Cipadessa baccifera</i> (Roth) Miq.	Sh	Meliaceae
53	<i>Cissampelos pareira</i> L.	Cl	Menispermaceae
54	<i>Coccinia grandis</i> (L.) Voigt	Cl	Cucurbitaceae
55	<i>Cocculus hirsutus</i> (L.) W.Theob.	Cl	Menispermaceae
56	<i>Coldenia procumbens</i> L.	H	Boraginaceae
57	<i>Combretum albidum</i> G.Don	Cl	Combretaceae
58	<i>Combretum ovalifolium</i> Roxb.	Cl	Combretaceae
59	<i>Commelina diffusa</i> Burm.f.	H	Commelinaceae
60	<i>Crotalaria hebecarpa</i> (DC.) Rudd	H	Fabaceae
61	<i>Crotalaria medicaginea</i> Lam.	H	Fabaceae
62	<i>Croton bonplandianus</i> Baill.	H	Euphrobiaceae
63	<i>Curculigo orchioides</i> Gaertn.	H	Hypoxidaceae
64	<i>Cyanthillium cinereum</i> (L.) H.Rob.	H	Asteraceae
65	<i>Dactyloctenium aegyptium</i> (L.) Willd.	H	Poaceae
66	<i>Dalbergia lanceolaria</i> subsp. <i>paniculata</i> (Roxb.) Thoth.	T	Fabaceae
67	<i>Dalbergia latifolia</i> Roxb.	T	Fabaceae
68	<i>Dalbergia sissoo</i> DC.	T	Fabaceae
69	<i>Datura stramonium</i> L.	H	Solanaceae
70	<i>Delonix regia</i> (Hook.) Raf.	T	Fabaceae
71	<i>Derris scandens</i> (Roxb.) Benth.	Cl	Fabaceae
72	<i>Desmodium gangeticum</i> (L.) DC.	H	Fabaceae
73	<i>Desmodium triflorum</i> (L.) DC.	H	Fabaceae
74	<i>Dichrostachys cinerea</i> (L.) Wight & Arn.	Sh	Fabaceae
75	<i>Dioscorea oppositifolia</i> L.	Cl	Dioscoreaceae
76	<i>Diospyros chloroxylon</i> Roxb.	T	Ebenaceae
77	<i>Diospyros melanoxyton</i> Roxb.	T	Ebenaceae
78	<i>Diospyros sylvatica</i> Roxb.	T	Ebenaceae
79	<i>Diospyros vera</i> (Lour.) A.Chev.	T	Ebenaceae
80	<i>Diplocyclos palmatus</i> (L.) C.Jeffrey	Cl	Cucurbitaceae
81	<i>Dipteracanthus prostratus</i> (Poir.) Nees	H	Acanthaceae
82	<i>Dodonaea viscosa</i> (L.) Jacq.	Sh	Sapindaceae
83	<i>Dolichos trilobus</i> L.	Cl	Fabaceae
84	<i>Echinochloa colona</i> (L.) Link	H	Poaceae
85	<i>Ehretia microphylla</i> Lam.	Sh	Boraginaceae
86	<i>Erioglossum rubiginosum</i> (Roxb.) Blume	T	Sapindaceae
87	<i>Eugenia roxburghii</i> DC.	Sh	Myrtaceae
88	<i>Euphorbia heterophylla</i> L.	H	Euphrobiaceae

	Botanical Name	Habit	Family
89	<i>Euphorbia hirta</i> L.	H	Euphorbiaceae
90	<i>Evolvulus alsinoides</i> (L.) L.	H	Convolvulaceae
91	<i>Evolvulus nummularius</i> (L.) L.	H	Convolvulaceae
92	<i>Ficus benghalensis</i> L.	T	Moraceae
93	<i>Ficus religiosa</i> L.	T	Moraceae
94	<i>Flacourtia indica</i> (Burm.f.) Merr.	Sh	Salicaceae
95	<i>Flueggea virosa</i> (Roxb. ex Willd.) Royle	Sh	Phyllanthaceae
96	<i>Gardenia gummifera</i> L.f.	Sh	Rubiaceae
97	<i>Garuga pinnata</i> Roxb.	T	Burseraceae
98	<i>Glycosmis mauritiana</i> (Lam.) Tanaka	Sh	Rutaceae
99	<i>Gmelina asiatica</i> L.	Sh	Lamiaceae
100	<i>Grewia hirsuta</i> Vahl	Sh	Malvaceae
101	<i>Grewia tiliifolia</i> Vahl	T	Malvaceae
102	<i>Gymnema sylvestre</i> (Retz.) R.Br. ex Sm.	Cl	Apocynaceae
103	<i>Gymnosporia emarginata</i> (Willd.) Thwaites	Sh	Celastraceae
104	<i>Gymnosporia montana</i> (Roth) Benth.	Sh	Celastraceae
105	<i>Helicteres isora</i> L.	Sh	Malvaceae
106	<i>Hemidesmus indicus</i> (L.) R. Br. ex Schult.	Cl	Apocynaceae
107	<i>Heteropogon contortus</i> (L.) P. Beauv. ex Roem. & Schult.	H	Poaceae
108	<i>Hibiscus micranthus</i> L.f.	H	Malvaceae
109	<i>Hibiscus vitifolius</i> L.	H	Malvaceae
110	<i>Holarrhena pubescens</i> Wall. ex G.Don	T	Apocynaceae
111	<i>Hugonia mystax</i> Cav.	Cl	Linaceae
112	<i>Hybanthus enneaspermus</i> (L.) F.Muell.	H	Violaceae
113	<i>Hyptis suaveolens</i> (L.) Poit.	H	Lamiaceae
114	<i>Ichnocarpus frutescens</i> (L.) W.T.Aiton	Cl	Apocynaceae
115	<i>Indigofera trita</i> L.f.	H	Fabaceae
116	<i>Ipomoea marginata</i> (Desr.) Verdc.	Cl	Convolvulaceae
117	<i>Ipomoea obscura</i> (L.) Ker Gawl.	Cl	Convolvulaceae
118	<i>Ipomoea pes-caprae</i> (L.) R. Br.	Cl	Convolvulaceae
119	<i>Ixora pavetta</i> Andr.	T	Rubiaceae
120	<i>Jasminum auriculatum</i> Vahl	Cl	Oleaceae
121	<i>Jatropha gossypifolia</i> L.	Sh	Euphorbiaceae
122	<i>Justicia glauca</i> Rottler	H	Acanthaceae
123	<i>Justicia procumbens</i> L.	H	Acanthaceae
124	<i>Kigelia africana</i> (Lam.) Benth.	T	Bignoniaceae
125	<i>Lannea coromandelica</i> (Houtt.) Merr.	T	Anacardiaceae
126	<i>Lantana camara</i> L.	Sh	Verbenaceae
127	<i>Lepisanthes tetraphylla</i> Radlk.	T	Sapindaceae
128	<i>Leucaena leucocephala</i> (Lam.) de Wit	T	Fabaceae
129	<i>Litsea deccanensis</i> Gamble	T	Lauraceae
130	<i>Mallotus philippensis</i> (Lam.) Müll.Arg.	T	Euphorbiaceae
131	<i>Malvastrum coromandelianum</i> (L.) Garcke	H	Malvaceae
132	<i>Manilkara hexandra</i> (Roxb.) Dubard	T	Sapotaceae
133	<i>Manilkara zapota</i> (L.) P.Royen	T	Sapotaceae

	Botanical Name	Habit	Family
134	<i>Melochia corchorifolia</i> L.	H	Malvaceae
135	<i>Merremia emarginata</i> (Burm. f.) Hallier f.	H	Convolvulaceae
136	<i>Merremia hederacea</i> (Burm. f.) Hallier f.	Cl	Convolvulaceae
137	<i>Merremia tridentata</i> (L.) Hallier f.	Cl	Convolvulaceae
138	<i>Microstachys chamaelea</i> (L.) Müll.Arg.	H	Euphrobiaceae
139	<i>Millingtonia hortensis</i> L.f.	T	Bignoniaceae
140	<i>Mimosa pudica</i> L.	H	Fabaceae
141	<i>Mimusops elengi</i> L.	T	Sapotaceae
142	<i>Mollugo pentaphylla</i> L.	H	Molluginaceae
143	<i>Morinda coreia</i> Buch.-Ham.	T	Rubiaceae
144	<i>Mukia maderaspatana</i> (L.) M.Roem.	Cl	Cucurbitaceae
145	<i>Muntingia calabura</i> L.	T	Muntingiaceae
146	<i>Murraya koenigii</i> (L.) Spreng.	T	Rutaceae
147	<i>Naringi crenulata</i> (Roxb.) Nicolson	T	Rutaceae
148	<i>Ochna obtusata</i> DC.	Sh	Ochnaceae
149	<i>Ocimum tenuiflorum</i> L.	H	Lamiaceae
150	<i>Olax scandens</i> Roxb.	Cl	Olacaceae
151	<i>Oldenlandia corymbosa</i> L.	H	Rubiaceae
152	<i>Oldenlandia diffusa</i> (Willd.) Roxb.	H	Rubiaceae
153	<i>Operculina turpethum</i> (L.) Silva Manso	Cl	Convolvulaceae
154	<i>Opilia amentacea</i> Roxb.	Cl	Opiliaceae
155	<i>Oxystelma esculentum</i> (L. f.) Sm.	Cl	Apocynaceae
156	<i>Parthenium hysterophorus</i> L.	H	Asteraceae
157	<i>Pavonia zeylanica</i> (L.) Cav.	H	Malvaceae
158	<i>Peltophorum pterocarpum</i> (DC.) K.Heyne	T	Fabaceae
159	<i>Perotis indica</i> (L.) Kuntze	H	Poaceae
160	<i>Phyla nodiflora</i> (L.) Greene	H	Verbenaceae
161	<i>Phyllanthus amarus</i> Schumach. & Thonn.	H	Phyllanthaceae
162	<i>Phyllanthus maderaspatensis</i> L.	H	Phyllanthaceae
163	<i>Phyllanthus virgatus</i> G.Forst.	H	Phyllanthaceae
164	<i>Physalis minima</i> L.	H	Solanaceae
165	<i>Polyalthia cerasoides</i> (Roxb.) Bedd.	T	Annonaceae
166	<i>Pongamia pinnata</i> (L.) Pierre	T	Fabaceae
167	<i>Premna mollissima</i> Roth	T	Lamiaceae
168	<i>Pseudarthria viscida</i> (L.) Wight & Arn.	H	Fabaceae
169	<i>Psydrax dicoccos</i> Gaertn.	T	Rubiaceae
170	<i>Pterolobium hexapetalum</i> (Roth) Santapau & Wagh	Cl	Fabaceae
171	<i>Pterospermum xylocarpum</i> (Gaertn.) Oken	T	Malvaceae
172	<i>Reissantia indica</i> (Willd.) N.Hallé	Cl	Celastraceae
173	<i>Rhynchosia cana</i> (Willd.) DC.	Sh	Fabaceae
174	<i>Rhynchosia minima</i> (L.) DC.	Cl	Fabaceae
175	<i>Ricinus communis</i> L.	T	Euphrobiaceae
176	<i>Sansevieria roxburghiana</i> Schult. & Schult.f.	H	Asparagaceae
177	<i>Sapindus emarginatus</i> Vahl	T	Sapindaceae
178	<i>Scutia myrtina</i> (Burm.f.) Kurz	Sh	Rhamnaceae

	Botanical Name	Habit	Family
179	<i>Senna auriculata</i> (L.) Roxb.	Sh	Fabaceae
180	<i>Senna occidentalis</i> (L.) Link	H	Fabaceae
181	<i>Senna siamea</i> (Lam.) H.S.Irwin & Barneby	T	Fabaceae
182	<i>Sida acuta</i> Burm.f.	H	Malvaceae
183	<i>Sida cordata</i> (Burm.f.) Borss.Waalk.	H	Malvaceae
184	<i>Sida cordifolia</i> L.	H	Malvaceae
185	<i>Solanum americanum</i> Mill.	H	Solanaceae
186	<i>Spermacoce hispida</i> L.	H	Rubiaceae
187	<i>Spermacoce pusilla</i> Wall.	H	Rubiaceae
188	<i>Sterculia foetida</i> L.	T	Malvaceae
189	<i>Streblus asper</i> Lour.	T	Moraceae
190	<i>Strychnos nux-vomica</i> L.	T	Loganiaceae
191	<i>Symphorema involucreatum</i> Roxb.	Cl	Lamiaceae
192	<i>Syzygium cumini</i> (L.) Skeels	T	Myrtaceae
193	<i>Tabebuia rosea</i> (Bertol.) Bertero ex A.DC.	T	Bignoniaceae
194	<i>Tarenna asiatica</i> (L.) Kuntze ex K.Schum.	Sh	Rubiaceae
195	<i>Tephrosia purpurea</i> (L.) Pers.	H	Fabaceae
196	<i>Tephrosia villosa</i> (L.) Pers.	H	Fabaceae
197	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	T	Combretaceae
198	<i>Terminalia catappa</i> L.	T	Combretaceae
199	<i>Thespesia populnea</i> (L.) Sol. ex Corrêa	T	Malvaceae
200	<i>Tinospora cordifolia</i> (Willd.) Miers	Cl	Menispermaceae
201	<i>Toddalia asiatica</i> (L.) Lam.	Sh	Rutaceae
202	<i>Tragia involucreta</i> L.	Cl	Euphrobiaceae
203	<i>Trema orientalis</i> (L.) Blume	T	Cannabaceae
204	<i>Tridax procumbens</i> (L.) L.	H	Asteraceae
205	<i>Triumfetta pentandra</i> A.Rich.	H	Malvaceae
206	<i>Tylophora indica</i> (Burm. f.) Merr.	Cl	Apocynaceae
207	<i>Waltheria indica</i> L.	H	Malvaceae
208	<i>Wrightia tinctoria</i> R.Br.	T	Apocynaceae
209	<i>Ziziphus jujuba</i> Mill.	T	Rhamnaceae
210	<i>Ziziphus oenopolia</i> (L.) Mill.	Sh	Rhamnaceae
211	<i>Ziziphus xylopyrus</i> (Retz.) Willd.	T	Rhamnaceae

T—Tree | H—Herb | Sh—Shrub | Cl—Climber

Table 2. Amphibian diversity of Simhachalam hills.

	Order	Family	Common Name	Scientific Name
1	Anura	Bufonidae	Common Indian Toad	<i>Duttaphrynus melanostictus</i>
2		Dicroglossidae	Indian Bull Frog	<i>Hoplobatrachus tigerinus</i>
3			Indian Skittering Frog	<i>Euphlyctis cyanophlyctis</i>
4			Burrowing Frog	<i>Sphaerotheca</i> sp.
5			Wart Frog	<i>Fejervarya</i> sp.
6		Microhylidae	Ornate Narrow-Mouthed Frog	<i>Microhyla ornata</i>
7		Rhacophoridae	Indian Tree Frog	<i>Polypedates maculatus</i>

the study area (Table 1). Among the 51 families, Fabaceae is the dominant one with 35 (16.59%) species followed by Malvaceae with 18 (8.53%) species, Apocynaceae with 12 (5.69%) species, Rubiaceae with 11 (5.21%) species. Genus *Acacia* occupies first with five species followed by *Diospyros* 4, *Ipomoea*, *Merremia*, *Phyllanthus*, *Senna*, *Sida*, and *Ziziphus* are with three species, 20 genera with two species and remaining 141 genera with only single species were reported. Andhra Pradesh Red List of medicinal plants like *Aegle marmelos*, *Celastrus paniculatus*, *Gymnema sylvestre*, *Pseudarthria viscida* and other important medicinal plants natural populations of *Santalum album* and *Litsea deccanensis* were reported. Cultivation and plantations of *Anacardium occidentale* (Cashew nut), *Ananas comosus* (Pineapple) *Artocarpus heterophyllus* (Jack fruit), *Magnolia champaca* (Sampenga Chettu), *Cananga odorata* (Pachha Sampenga) also observed.

Fauna

Amphibians

Seven species of amphibians belonging to four families are found in Simhachalam Hills (Table 2). The monsoon plays a huge role in the survival of amphibian populations. The rain water gets collected in several depressions on the ground, creating puddles across the hills. These puddles act as breeding grounds and hotspots for egg laying. The altitude vegetation of Simhachalam also favors the amphibian diversity. *Duttaphrynus melanostictus*, *Polypedates maculatus* and *Fejervarya* species are the commonly spotted frogs in Simhachalam Hills.

Reptiles

A total of 40 species of reptiles belonging to two orders and 14 families among which Colubridae family represented highest of 10 species followed by Gekkonidae (7), Elapidae (3), Agamidae (3), Scinidae (3). The list of reptiles found in the study area is given in Table 3. These hill ranges are representatives of a very active, vital habitat type amidst the city chaos. With increased sightings in urban and suburban areas, the human-reptile conflict is in the rise in major cities nowadays. Playing an important role in the food chain as both 'prey' & 'predator', reptiles (especially snakes) are equally affected because of encroachment and deforestation as any other animal on earth. The diverse reptile richness of these hills also makes them a focal point for students and researchers for their study and research activities. Species such as *Trimeresurus gramineus*, *Bungarus caeruleus* and *Indotyphlops braminus* hold the unique status of being first described in Visakhapatnam (Bauer 1998; McDiarmid et al. 1999).

Mammals

Eighteen mammals were observed from this study area. They include Wild Boar, Spotted Deer, Mouse Deer, Jungle Cat, Indian Pangolin, Indian Crested Porcupine and more (Table 4). The basic factors that decide the presence of mammals such as food availability (seasonal patterns), ambient temperature, rainfall, spatial distribution of the interlinking habitat types can be observed in this area. The Rusty-spotted Cat, the smallest wild cat in the world which is Near Threatened as per the IUCN Red List was recorded here during the study period in the form of a road kill.



A—Bamboo Pit Viper | B—Bronzeback Tree Snake | C—Green Vine Snake | D—Sandboa | E—Elliot's Shieldtail | F—Leopard Gecko | G—Golden Gecko | H—Indian Chameleon. © A—G- Vivek Rathod, H- Ch Avinash.

Table 3. Reptilian diversity of Simhachalam hills.

	Order	Sub-order	Family	Common Name	Scientific Name	
1	Sauria	Sauria	Agamidae	Common Garden Lizard	<i>Calotes vericolor</i>	
2				Peninsular Rock Agama	<i>Pssamophilus dorsalis</i>	
3				Fan-throated Lizard	<i>Sitana ponticeriana</i>	
4			Chameleionidae	Indian Chameleon	<i>Chamaeleo zeylanicus</i>	
5			Gekkonidae	Clouded Indian Gecko	<i>Cyrtodactylus nebulosus</i>	
6				Termite Hill Gecko	<i>Hemidactylus triedrus</i>	
7				Dutta’s Mahendragiri Gecko	<i>Hemidactylus sushildattai</i>	
8				Asian House Gecko	<i>Hemidactylus cf. Frenatus</i>	
9				Yellow-bellied House Gecko	<i>Hemidactylus flaviviridus</i>	
10				Spotted House Gecko	<i>Hemidactylus parvimaculatus</i>	
11				Indian Golden Gecko	<i>Calodactylodes aureus</i>	
12			Eublepharidae	East Indian Leopard Gecko	<i>Eublepharis hardweickii</i>	
13			Scinidae	Bronzed Grass Skink	<i>Eutrophis cf. macularia</i>	
14				Many-keeled Grass Skink	<i>Eutropis carinata</i>	
15				Common Snake Skink	<i>Lygosoma punctata</i>	
16			Varanidae	Indian Monitor Lizard	<i>Varanus bengalensis</i>	
17	Squamata	Serpentes	Colubridae	Green Vine Snake	<i>Ahaetulla nasuta</i>	
18				Common Cat Snake	<i>Boiga trigonata</i>	
19				Yellow-green Cat Snake	<i>Boiga flaviviridis</i>	
20				Barred Wolf Snake	<i>Lycodon striatus</i>	
21				Common Wolf Snake	<i>Lycodon aulicus</i>	
22				Bronze-back Tree Snake	<i>Dendrelaphis tristis</i>	
23				Common Kukri	<i>Oligodon arnensis</i>	
24				Russell’s Kukri	<i>Oligodon taeniolatus</i>	
25				Indian Rat Snake	<i>Ptyas mucosa</i>	
26				Dumeril’s Black-headed Snake	<i>Sibynophis subpunctatus</i>	
27				Elapidae	Indian Spectacled Cobra	<i>Naja naja</i>
28					Slender Coral Snake	<i>Calliophis melanurus</i>
29			Common Krait		<i>Bungarus caeruleus</i>	
30			Natricidae	Checkered Keelback	<i>Fowlea piscator</i>	
31				Striped Keelback	<i>Amphisema stolatum</i>	
32			Typhlopidae	Brahminy Blind Snake	<i>Indotyphlops braminus</i>	
33				Beaked Worm Snake	<i>Grypodythlops acutus</i>	
34			Uropeltidae	Elliot’s Shieldtail	<i>Uropeltis cf. elliotii</i>	
35			Boidae	Common Sand Boa	<i>Eryx conicus</i>	
36			Pythonidae	Indian Rock Python	<i>Python molurus</i>	
37			Viperidae	Russell’s Viper	<i>Daboia russelli</i>	
38				Bamboo Pit Viper	<i>Trimeresurus gramineus</i>	
39			Testudines	Geoemydidae	Indian Black Turtle	<i>Melanochelys trijuga</i>
40				Testudinidae	Indian Star Tortoise	<i>Geochelone elegans</i>

Table 4. Mammalian diversity of Simhachalam Hills.

	Order	Family	Common Name	Scientific Name
1	Artiodactyla	Suidae	Wild Boar	<i>Sus scrofa</i>
2		Cervidae	Spotted Deer	<i>Axis axis</i>
3			Sambar	<i>Rusa unicolor</i>
4			Barking Deer/ Indian Muntjac	<i>Muntiacus muntjak</i>
5		Tragulidae	Mouse Deer / Indian Chevrotain	<i>Moschiola indica</i>
6	Carnivora	Felidae	Leopard*	<i>Panthera pardus</i>
7			Rusty-spotted Cat	<i>Prionailurus rubiginosus</i>
8			Jungle Cat	<i>Felis chaus</i>
9	Lagomorpha	Leporidae	Black-naped Hare/ Indian Hare	<i>Lepus nigricollis</i>
10	Pholidota	Manidae	Indian Pangolin	<i>Manis crassicaudata</i>
11	Scandentia	Tupauidae	Madras Treeshrew	<i>Anathana ellioti</i>
12	Rodentia	Hystricidae	Indian-crested Porcupine	<i>Hystrix indica</i>
13		Sciuridae	Three-striped Palm Squirrel	<i>Funambulus palmarum</i>
14		Muridae	House Rat	<i>Rattus rattus</i>
15			Indian Gerbil	<i>Tatera indica</i>
16	Chiroptera	Pteropodidae	Indian Flying Fox	<i>Pteropus giganteus</i>
17		Rhinopomatidae	Lesser Mouse Tailed Bat	<i>Megaderma spasma</i>
18		Vespertilionidae	Indian Pipistrelle	<i>Pipistrellus pipistrellus</i>

*Recorded in 2015 (Secondary sources). Not seen or recorded by the authors.

Birds

Birds from 37 families representing 12 orders were recorded here during the study period. A total of 87 species of avifauna was recorded (Table 5). Out of them, Passeriformes represented the highest order having 45 (51.7%) species, followed by Accipitriformes with 11 species (12.6%), Columbiformes and Coraciiformes with five species (5.7%), Cuculiformes with four species (4.6%), Galliformes, Psittaciformes and Strigiformes with three species (3.4%), Bucerotiformes, Caprimulgiformes, Charadriiformes, and Piciformes with two species (2.3%) each.

Ali (1933, 1934) had recorded birds from the Eastern Ghats section but focused more on the Araku and Lambasingi valley. With notable diversity in birds of prey, the Simhachalam Hills are home to more than 50 resident bird species.

Species such as Orange-breasted Green Pigeon, Crested Goshawk, Bonelli's Eagle, Indian Grey Hornbill, Black-naped Oriole, Asian Brown Flycatcher, Brown-breasted Flycatcher, Verditer Flycatcher, and Tickell's Blue Flycatcher are notable ones with some of them being winter and local migrants.

Butterflies

Eighty-two species of butterflies belonging to five families were recorded in the study area (Table 6). Nymphalidae represented the highest family having 27 species followed by Pieridae with 22 species, Lycaenidae with 18 species and Papilionidae and Herperiidae with each 10 and five species, respectively.

Threats

Recent developments in the hills have resulted in serious disturbances to the wildlife here.



A—Shikra | B—Black-winged Kite | C—Crested Serpent-Eagle | D—Brahminy Kite | E—Orange-headed Thrush | F—Blue-tailed Bee-Eater | G—Rose-ringed Parakeet | H—Alexandrine Parakeet. © A—C & E—H- Vivek Rathod, D- Ch Avinash.

Table 5. Avian diversity of Simhachalam Hills.

	Order	Family	Common Name	Scientific Name
1	Galliformes	Phasianidae	Grey Francolin	<i>Francolinus pondicerianus</i>
2			Indian Peafowl	<i>Pavo cristatus</i>
3			Painted Spurfowl	<i>Galloperdix lunulata</i>
4	Columbiformes	Columbidae	Laughing Dove	<i>Streptopelia senegalensis</i>
5			Orange-breasted Green-Pigeon	<i>Treron bicinctus</i>
6			Rock Dove	<i>Columbia livia</i>
7			Spotted Dove	<i>Streptopelia chinensis</i>
8			Yellow-footed Green-Pigeon	<i>Treron phoenicopterus</i>
9	Caprimulgiformes	Caprimulgidae	Grey Nightjar	<i>Caprimulgus indicus</i>
10			Indian Nightjar	<i>Caprimulgus asiaticus</i>
11	Cuculiformes	Cuculidae	Asian Koel	<i>Eudynamys scolopaceus</i>
12			Common Hawk-Cuckoo	<i>Hierococcyx varius</i>
13			Greater Coucal	<i>Centropus sinensis</i>
14			Sirkeer Malkoha	<i>Taccocua leschenaultii</i>
15	Charadriiformes	Charadriidae	Red-wattled Lapwing	<i>Vanellus indicus</i>
16			Yellow-wattled Lapwing	<i>Vanellus malabaricus</i>
17	Accipitriformes	Accipitridae	Black Eagle	<i>Ictinaetus malaiensis</i>
18			Black Kite	<i>Milvus migrans</i>
19			Black-winged Kite	<i>Elanus caeruleus</i>
20			Bonelli's Eagle	<i>Aquila fasciata</i>
21			Booted Eagle	<i>Hieraetus pennatus</i>
22			Brahminy Kite	<i>Haliastur indus</i>
23			Crested Goshawk	<i>Accipiter trivirgatus</i>
24			Crested Serpent-Eagle	<i>Spilornis cheela</i>
25			Shikra	<i>Accipiter badius</i>
26			White-eyed Buzzard	<i>Butastur teesa</i>
27	White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>		
28	Strigiformes	Strigidae	Common Barn Owl	<i>Tyto alba</i>
29			Indian Eagle-Owl	<i>Bubo bengalensis</i>
30			Spotted Owlet	<i>Athene brama</i>
31	Bucerotiformes	Bucerotidae	Indian Grey Hornbill	<i>Ocyrceros birostris</i>
32		Upupidae	Eurasian Hoopoe	<i>Upupa epops</i>
33	Piciformes	Picidae	Lesser Goldenbacked Wood-pecker	<i>Dinopium benghalense</i>
34		Ramphastidae	Coppersmith Barbet	<i>Psilopogon haemacephalus</i>
35	Coraciiformes	Meropidae	Blue Tailed Bee-eater	<i>Merops philippinus</i>
36			Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>
37			Green Bee-eater	<i>Merops orientalis</i>
38		Coraciidae	Indian Roller	<i>Coracias benghalensis</i>
39		Alcedinidae	White-throated Kingfisher	<i>Halcyon smyrnensis</i>
40	Psittaciformes	Psittaculidae	Alexandrine Parakeet	<i>Psittacula eupatria</i>
41			Plum-headed Parakeet	<i>Psittacula cyanocephala</i>
42			Rose-ringed Parakeet	<i>Psittacula krameri</i>

	Order	Family	Common Name	Scientific Name
43	Passeriformes	Campephigidae	Large Cuckooshrike	<i>Coracina javensis</i>
44			Orange Minivet	<i>Pericrocotus flammeus</i>
45		Oriolidae	Black-naped Oriole	<i>Oriolus chinensis</i>
46			Black-hooded Oriole	<i>Oriolus xanthornus</i>
47			Indian Golden Oriole	<i>Oriolus kundoo</i>
48		Vangidae	Common Woodshrike	<i>Tephrodornis pondicerianus</i>
49		Aegithinidae	Common Iora	<i>Aegithina tiphia</i>
50		Dicruridae	Black Drongo	<i>Dicrurus macrocercus</i>
51		Laniidae	Brown Shrike	<i>Lanius cristatus</i>
52			Long-tailed Shrike	<i>Lanius schach</i>
53		Corvidae	House Crow	<i>Corvus splendens</i>
54			Large-billed Crow	<i>Corvus macrorhynchos</i>
55			Rufous Treepie	<i>Dendrocitta vagabunda</i>
56		Monarchidae	Asian Paradise Flycatcher	<i>Terpsiphone paradisi</i>
57		Dicaeidae	Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchos</i>
58		Nectariniidae	Purple-rumped Sunbird	<i>Leptocoma zeylonica</i>
59			Purple Sunbird	<i>Cinnyris asiaticus</i>
60		Irenidae	Jerdon's Leafbird	<i>Chloropsis jerdoni</i>
61		Passeridae	House Sparrow	<i>Passer domesticus</i>
62		Alaudidae	Ashy-crowned Sparrow-Lark	<i>Eremopterix griseus</i>
63		Cisticolidae	Ashy Prinia	<i>Prinia socialis</i>
64			Common Tailorbird	<i>Orthotomus sutorius</i>
65			Plain Prinia	<i>Prinia inornata</i>
66		Acrocephalidae	Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>
67			Booted Warbler	<i>Iduna caligata</i>
68		Hirundinidae	Barn Swallow	<i>Hirundo rustica</i>
69		Pycnonotidae	Red-vented Bulbul	<i>Pycnonotus cafer</i>
70			Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>
71			White-browed Bulbul	<i>Pycnonotus luteolus</i>
72		Phylloscopidae	Common Chiffchaff	<i>Phylloscopus collybita</i>
73			Greenish Leaf Warbler	<i>Phylloscopus trochiloides</i>
74			Hume's Leaf Warbler	<i>Abrornis humei</i>
75		Leiothrichidae	Yellow-billed Babbler	<i>Turdoides affinis</i>
76		Sturninidae	Asian Pied Starling	<i>Gracupica contra</i>
77			Brahminy Starling	<i>Sturnia pagodarum</i>
78			Common Myna	<i>Acridotheres tristis</i>
79			Rosy Starling	<i>Pastor roseus</i>
80	Muscicapidae	Asian Brown Flycatcher	<i>Muscica padaurica</i>	
81		Brown-breasted Flycatcher	<i>Muscicapa muttui</i>	
82		Indian Robin	<i>Saxicoloides fulicatus</i>	
83		Oriental Magpie-Robin	<i>Copsychus saularis</i>	
84		Taiga Flycatcher	<i>Ficedula albicilla</i>	
85		Tickell's Blue Flycatcher	<i>Cyornis tickelliae</i>	
86		Verditer Flycatcher	<i>Eumyias thalassinus</i>	
87	Turdidae	Orange-headed Thrush	<i>Geokichla citrina</i>	



A—Chestnut Bob | B—Black Rajah | C—Common Jezebel | D—Common Four Ring | E—Common Crow | F—Indian Hare | G—Three Striped Palm Squirrel | H—Lesser Mouse Tailed Bat. © Vivek Rathod.

Table 6. Butterfly diversity of Simhachalam Hills.

	Family	Common Name	Scientific Name
1	Papilionidae	Blue Mormon	<i>Papilio polymnestor</i>
2		Common Bluebottle	<i>Graphium sarpedon</i>
3		Common Jay	<i>Graphium doson</i>
4		Common Mime	<i>Papilio clytia</i>
5		Common Mormon	<i>Papilio polytes</i>
6		Common Rose	<i>Pachliopta aristolochiae</i>
7		Crimson Rose	<i>Pachliopta hector</i>
8		Lime	<i>Papilio demoleus</i>
9		Spot Swordtail	<i>Graphium nomius</i>
10		Tailed Jay	<i>Graphium agamemnon</i>
11	Pieridae	Common Albatross	<i>Appias albina</i>
12		Common Crow	<i>Euploea core</i>
13		Common Emigrant	<i>Catopsilia pomona</i>
14		Common Grass Yellow	<i>Eurema hecabe</i>
15		Common Gull	<i>Cepora nerissa</i>
16		Common Jezebel	<i>Delias eucharis</i>
17		Common Wanderer	<i>Pareronia valeria</i>
18		Crimson Red Tip	<i>Colotis danae danae</i>
19		Crimson Tip	<i>Colotis danae</i>
20		Large Salmon Arab	<i>Colotis fausta</i>
21		Little Orange Tip	<i>Colotis etrida</i>
22		Mottled Emigrant	<i>Catopsilia pyranthe</i>
23		Pioneer	<i>Belenois aurota</i>
24		Plain Orange Tip	<i>Colotis aurora</i>
25		Psyche	<i>Leptosia nina</i>
26		Purple Leaf Blue	<i>Amblypodia anita</i>
27		Yellow Orange Tip	<i>Ixias pyrene</i>
28		Small Grass Yellow	<i>Eurema brigitta</i>
29		White Orange Tip	<i>Ixias marianne</i>
30		Small Salmon Arab	<i>Colotis amata</i>
31		Indian Sunbeam	<i>Curetis thetis</i>
32		Common Apefly	<i>Spalgis epius</i>
33	Nymphalidae	Baronet	<i>Euthalia nais</i>
34		Blue Pancy	<i>Junonia orithya</i>
35		Blue Tiger	<i>Tirumala limniace</i>
36		Chocolate Pansy	<i>Junonia iphita</i>
37		Common Baron	<i>Euthalia aconthea</i>
38		Common Bush Brown	<i>Mycalesis perseus</i>
39		Common Castor	<i>Ariadne merione</i>
40		Common Evening Brown	<i>Melanitis leda</i>
41		Common Four Ring	<i>Ypthima huebneri</i>
42		Common Leopard	<i>Phalanta phalantha</i>
43		Common Nawab	<i>Polyura athamas</i>

	Family	Common Name	Scientific Name	
44	Nymphalidae	Common Sailor	<i>Neptis hylas</i>	
45		Danaid Eggfly	<i>Hypolimnas misippus</i>	
46		Glassy Tiger	<i>Parantica aglea</i>	
47		Great Eggfly	<i>Hypolimnas bolina</i>	
48		Grey Pansy	<i>Junonia atlites</i>	
49		Indian Tortoise Shell	<i>Aglais caschmirensis</i>	
50		Joker	<i>Byblia ilithyia</i>	
51		Lemon Pansy	<i>Junonia lemonias</i>	
52		Plain Tiger	<i>Danaus chrysippus</i>	
53		Striped Tiger	<i>Danaus genutia</i>	
54		Tawny Coaster	<i>Acraea terpsicore</i>	
55		Yellow Pansy	<i>Junonia hierta</i>	
56		Black Rajah	<i>Charaxes solon</i>	
57		Peacock Pansy	<i>Junonia almana</i>	
58		Angled Castor	<i>Ariadne merione</i>	
59		Common Lascar	<i>Pantoporia hordonia</i>	
60		Lycaenidae	Common Cerulean	<i>Jamides celeno</i>
61			Common Pierrot	<i>Castalius rosimon</i>
62			Common Silverline	<i>Cigaritis vulcanus</i>
63	Dark Grass Blue		<i>Zizeeria karsandra</i>	
64	Forget-Me-Not		<i>Catochrysops strabo</i>	
65	Gram Blue		<i>Euchrysops cnejus</i>	
66	Indian Cupid		<i>Cupido lacturnus</i>	
67	Indian Oak Blue		<i>Arhopala atrax</i>	
68	Lesser Grass Blue		<i>Zizina otis</i>	
69	Monkeys Puzzle		<i>Rathinda amor</i>	
70	Pale Grass Blue		<i>Pseudozizeeria maha</i>	
71	Pea Blue		<i>Lampides boeticus</i>	
72	Plains Cupid		<i>Chilades pandava</i>	
73	Red Pierrot		<i>Talicauda nyseus</i>	
74	Small Cupid		<i>Chilades parrhasius</i>	
75	Tailless Line Blue		<i>Prosotas dubiosa indica</i>	
76	Zebra Blue		<i>Leptotes plinius</i>	
77	Grass Jewel		<i>Freyeria trochylus</i>	
78	Hesperiidae	Common Banded Awl	<i>Hasora chromus</i>	
79		Grass Demon	<i>Udaspes folus</i>	
80		Indian Palm Bob	<i>Suastus gremius</i>	
81		Indian Skipper	<i>Hesperia sassacus</i>	
82		Small Branded Swift	<i>Pelopidas mathias</i>	

The mud road on the hilltop is being used more frequently than in the past by trekkers and goatherds. Camping activities are on the rise in these hills by explorers during the night. Invasive and unsuitable plants such as *Terminalia mantaly*, *Conocarpus erustus* are being planted which is causing damage to natural eco systems. Also, the road from BRTS lane leading to the Devasthanam (main deity) separates the Simhachalam and Kambalakonda Hills and has become a hotspot for road kills. Improper solid waste management including plastic, construction debris and other wastes poses a major threat to the biodiversity here. The foothills have been surrounded almost from all sides with constructions and housing colonies, which are causing landslides and pressingly impacting the wildlife corridors. Poaching activities have dropped gradually but occasional hunting of small mammals is still being witnessed.

Conclusion

This terrain is noteworthy to conduct habitat and movement pattern studies on wildlife. With a rich faunal diversity, needless to mention the equally and even more diverse floral diversity here, the value of these hills in terms to education and research is noteworthy to mention. These hills are a haven to several species of wildlife which are otherwise not commonly seen elsewhere in Visakhapatnam. With many more reasons, it is thus stated that this beautiful habitat within the district needs to be conserved and not heeded into the expanding concrete jungles.

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