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Taxonomic Diversity of Lianas in Tropical Forests of Northern Eastern Ghats of Andhra Pradesh, India

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Abstract

Lianas are important in forest ecosystem and strongly influence the forest dynamics and diversity. Lianas are common in the tropical moist deciduous and rain forests, which are competing with other forest trees. Little information is known on the habitat specialization in tropical lianas diversity and the root causes for variation among forests in liana species composition. A total of 170 liana species (≥ 1.5 cm girth at breast height) representing 109 genera and 43 families were reported in 5×5 m quadrate samples along with their climbing modes in the tropical forests of northern Eastern Ghats of Andhra Pradesh, India. A total of 210 grids were sampled in study area and reported that *Convolvulaceae* was the dominant family with 23 species followed by *Papilionaceae*, 22 species and *Asclepiadaceae*, 19 species and *Ipomoea* was the largest genera. Woody lianas were dominated by 128 species and these are classified into six climbing modes consisting in stem climbers (53.5%) that were the most predominant followed by stragglers-unarmed (14.7%), stragglers armed and tendril climbers (13.5% each), root climbers (2.9%) and hook climbers (1.8%). The most dominant liana species in the northern Eastern Ghats were *Acacia sinuata* and *Bauhinia vahlii*. The results of this investigation suggests that better management and protection is an important for *in situ* conservation of liana diversity and involving local people is emphasized.

Keywords: climbing modes, conservation, diversity, Eastern Ghats, lianas

Introduction

Lianas are long-stemmed woody vines, which are fixed in the soil at ground level and depend on the physical support of other plants to reach the forest canopy (Araujo and Alves, 2010; Schnitzer and Bongers, 2002). These are prominent features of most tropical forests, where their leaves can constitute a large amount of the total area of the entire forest community (Putz and Mooney, 1991). Lianas make use of much greater ecological consequence than their size suggests and represent less than 5.0% of tropical forest biomass but up to 40% of leaf productivity (Hegarty and Caballe, 1991; Heidjen and Phillips, 2008). They struggle strongly with trees, very much reducing tree growth, tree reproduction and greatly increasing tree mortality (Wright *et al*., 2005; Schnitzer and Carson, 2010; Ingwell *et al*., 2010) and altering the course of regeneration in forests (Schnitzer *et al*., 2000). The density of lianas was greater than ever before and significantly increased their diversity during the last two decades of the twentieth century (Phillips *et al*., 2002).

The ecological importance of lianas is well documented, since they are of fundamental importance in the functioning of ecosystems as competing with trees either directly or indirectly. They act as key ecological components of whole forest in transpiration, carbon sequestration and forest regeneration (Schnitzer and Bongers, 2002). Lianas play a significant ecological role in different patterns of pollination, dispersal and phenological systems, provide several resources, and play vital roles in the protection of biological diversity (Reddy and Parthasarathy, 2006). The wealth and species diversity of lianas also depend upon a number of abiotic factors, including total occurrence of rainfall with seasonal variations, soil fertility and disturbances (Schnitzer, 2005). The main causes of the disturbance of lianas are the tree fallings not only important for sustaining the liana species but also maintain diversity that leads to increased development of lianas (Yuan *et al*., 2009; Reddy and Parthasarathy, 2003). The development of highest frequency of lianas is mainly because of declining the rainfall but several factors that are known to favour them are the increase anthropogenic impacts (Londre and Schnitzer, 2006). Lianas act as an indicator species response to increase CO_2 concentrations and benefit from other anthropogenic

disturbances (Zotz, 2006). A few studies on lianas have been carried out in the Eastern Ghats forests, India (Muthumperumal and Parthasarathy, 2009; Reddy and Parthasarathy, 2003; Parthasarathy *et al*., 2004). However, most of the studies were not exclusively on lianas as they involve general botanical surveys with reference to herbaceous, shrub and tree flora. Thus, main objective of present study was to inventory the lianas diversity and ecological findings in the northern Eastern Ghats forests of Andhra Pradesh, India.

Materials and methods

The Eastern Ghats are a long chain of broken hills and elevated plateaus and one of the nine floristic regions in India, running along the east coast of India in the states of Odisha, Andhra Pradesh, Tamil Nadu and Karnataka and lies between Mahanadhi and Vaigai rivers. The present study was carried out in northern Eastern Ghats of Andhra Pradesh, which lies between latitudes of 16º 15' and 19º 12' N and eastern longitudes of 80º 50' and 84º 47' E runs through five districts, namely Srikakulam, Vizianagaram, Visakhapatnam, East Godavari and West Godavari. The highest elevation measures about 1615 m above the msl in this region. Geological formation of the region consists chiefly in Charnokites and Kondalites and varied metamorphic rocks. Soils of northern Eastern Ghats is loamy, black, lateritic and alluvial. Lateritic soils are the common type along the deciduous forests of the area. The climate of the district is characterized by uncomfortably hot during summer and pleasantly cold during winter. There are three distinct seasons in a year; winter (November to February), summer (March to June) and rainy season (July to October). The maximum temperature ranges from 28°–46.2° C and minimum temperature ranges between 12.9°–27° C. The maximum rainfall is 1300 mm per annum in south-west monsoon period. At all the plots, a similar pattern of temperature and rainfall prevails throughout the year. The relative humidity varied between 70–88%. The forests in northern Eastern Ghats are broadly classified into Tropical Semi-evergreen, Tropical Moist Deciduous, Tropical Dry Deciduous, Tropical Thorny-Scrub vegetation and Tropical Dry Evergreen forest types (Champion and Seth, 1968).

The field work was carried out in a total 210 grids in the forests of northern Eastern Ghats of Andhra Pradesh for enumeration of lianas. The entire stretch of northern Eastern Ghats of Andhra Pradesh was divided into 6.25 × 6.25 km grids and within each grid a 0.5 ha transect (5m × 1km) was laid. Depending on the shape of the forest stand, these transects were divided into 5 x 200m sub transects. All lianas – 1.5 cm gbh (5 gbh, girth at breast height) were enumerated in the whole transects, and those of herbaceous vines of < 1.5 cm gbh only in the beginning and end of the transects. The collected specimens were identified with the help of floras (Gamble and Fischer, 1915-1935; Rao and Kumari, 2002 – 2008). The voucher specimens were deposited in the Botany Department Herbarium (BDH), Department of Botany, Andhra University, Visakhapatnam.

Results and discussion

The study area contained a total of 170 liana species representing 109 genera and 43 families, recorded from northern Eastern Ghats of forests in the total of 210 grids (Tab. 1). Muthumperumal and Parthasarathy (2009) enumerated 175 angiosperm climbing plants in 150 grids of southern Eastern Ghats; 60 liana species found in Maruthamalai hills of southern Western Ghats (Sarvalingam and Rajendran, 2012); 93 climbing plant species reported in land Atlantic forest, northern Brazil (Araujo and Alves, 2010); the total number of climbers that are found in Puerto Rico and the Virgin Islands amounts to 386 (Acevedo-Rodriguez, 2005). The present study identified a genus and species ratio of 1:1.55. Out of 170 species, only one species was Gymnosperm i.e. *Gnetum ula* and 169 species consist of 108 genera and 42 families were angiosperms. Among the angiosperms, there were 154 species representing 36 families of dicotyledons and 15 species belonging to 6 monocotyledon families.

The most specious families investigated in the present study include Convolvulaceae (23 species), Papilionaceae (22 species), Asclepiadaceae (19 species), Cucurbitaceae (9 species), Dioscoreaceae, Menispermacae and Vitaceae (8 species each) etc., while in southern Eastern Ghats Asclepidaceae, Convolvulaceae, Papilionaceae, Apocynaceae, Vitaceae and Menispermaceae formed the most dominant familes (Muthumperumal and Parthasarathy, 2009). Papilionaceae, Cucurbitaceae, Convolvulaceae and Asclepiadaceae formed the common liana families in Maruthamalia hills of Western Ghats (Sarvalingam and Rajendran, 2012). Families such as Smilacaceae, Menispermaceae, Passifloraceae, Cucurbitaceae and Convolvulaceae are entirely dominated by species with a climbing habit (Araujo and Alves, 2010). According to Gentry (1991) New World families, with the highest diversity of climbing plants, are Apocynaceae (esp. Asclepiadoideae), Convolvulaceae and Papilionaceae. The dominant genera in the present study were *Ipomoea* (9 species), *Dioscorea* (8 species), *Argyreia* and *Merremia* (5 species each). Muthumperumal and Parthasarathy (2009) recorded that *Jasminum*, *Acacia*, *Argyreia* and *Capparis* were the most abundant genera in southern Eastren Ghats, while in Maruthamalia hills of Western Ghats *Ipomoea* and *Rhynchosia* were the dominant genera (Sarvalingam and Rajendran, 2012).

The most dominant liana species in the study are *Acacia sinuata* (Mimosaceae), *Bauhinia vahlii* (Caesalpiniaceae), *Calycapteris floribunda* (Combretaceae), *Combretum albidum* (Combretaceae), *Dioscorea pentalhylla* (Dioscoreaceae), *Tinospora cordifolia* (Menispermaceae) *Schefflera stellata* (Araliaceae) and *Ziziphus oenoplia* (Rhamnacea). The rare species were *Anodendron paniculatum* (Apocynaceae), *Aristolochia tagala* (Aristolochiaceae), *Clematis smilacifolia* (Ranunculaceae), *Entada pursaetha* (Mimosaceae), *Gnetum ula* (Gnetaceae), *Leptadenia reticulata* (Aslepiadaceae), *Uncaria sessilifructus* (Rubiaceae) and *Vanilla wightiana* (Orchidaceae).

The enumerated lianas classified into woody vines (128 species) and herbaceous vines (42). The mechanisms of the climbers to get attached to their host plants play a major role

in their distribution (Nabe-Nielsen, 2001). In this study, six major mechanisms of climbing systems were recognized: stem twiners (53.5%) followed by stragglers-unarmed (14.7%), stragglers-armed (13.5%), tendril climbers (13.5%), root climbers (2.9%) and hook climbers (1.8%). Several authors have reported that stem twiners were most common in the different tropical forests (Ghollasimood *et al*., 2012; Parthasarathy *et al*., 2004; Kuzee and Bongers, 2005). Burnham (2004) suggested that the basic information about lianas regarding the location of the species is hard to compile because vouchering, reporting and sampling have been standardized for comparable tree communities.

Tab.1. List of liana species in northern Eastern Ghats of Andhra Pradesh

No.	Plant species	Family	Category	Climbing mode
1	*Abrus precatorius* L.	*Papilionaceae*	WV	ST
2	*Acacia caesia* (L.) Willd.	*Mimosaceae*	WV	Str-A
3	*Acacia pennata* (L.) Willd.	*Mimosaceae*	WV	Str-A
4	*Acacia sinuata* (Lour.) Merr.	*Mimosaceae*	WV	Str-A
5	*Acacia torta* (Roxb.) Craib.	*Mimosaceae*	WV	Str-A
6	*Aganosma dichotoma* (Roth) K. Schum.	*Apocynaceae*	WV	ST
7	*Ampelocissus latifolia* (Roxb) Planch.	*Vitaceae*	WV	TC
8	*Ampelocissus tomentosa* (Roth) Planch.	*Vitaceae*	WV	TC
9	*Anamitra cocculus* (L.) Wt. & Arn.	*Menispermaceae*	WV	ST
10	*Anodendron paniculatum* (Roxb.) DC.	*Apocynaceae*	WV	ST
11	*Argyreia arakuensis* Bal.	*Convolvulaceae*	WV	ST
12	*Argyreia daltoni* Cl.	*Convolvulaceae*	WV	ST
13	*Argyreia involucrata* Cl.	*Convolvulaceae*	WV	ST
14	*Argyreia nervosa* (Burm.f.) Boj.	*Convolvulaceae*	WV	ST
15	*Argyreia roxburghii* Choisy	*Convolvulaceae*	WV	ST
16	*Aristalochia indica* L.	*Aristolochiaceae*	HV	ST
17	*Aristolochia tagala* Cham.	*Aristolochiaceae*	WV	ST
18	*Asparagus racemosus* Willd.	*Liliaceae*	HV	Str-A
19	*Atylosia albicans* (Wt. & Arn.) Benth.	*Papilionaceae*	WV	ST
20	*Atylosia scaraboides* (L.)Benth.	*Papilionaceae*	WV	ST
21	*Atylosia volubilis* (Blanco) Gamble	*Papilionaceae*	WV	ST
22	*Bauhinia vahlii* Wt. & Arn.	*Caesalpiniaceae*	WV	Str-UA
23	*Bridelia stipularis* (L.) Bl.	*Euphorbiaceae*	WV	Str-UA
24	*Butea superba* Roxb.	*Papilionaceae*	WV	Str-UA
25	*Caesalpinia decapetala* (Roth) Alston	*Caesalpiniaceae*	WV	Str-A
26	*Caesalpinia digyna* Rottl.	*Caesalpiniaceae*	WV	Str-A
27	*Calycopteris floribunda* Lam.	*Combretaceae*	WV	ST
28	*Canavalia gladiata* (Jacq.) DC.	*Papilionaceae*	WV	ST
29	*Canavalia virosa* (Roxb.) Wt. & Arn.	*Papilionaceae*	WV	ST
30	*Capparis divaricata* Lam.	*Capparaceae*	WV	Str-A
31	*Capparis zeylanica* L.	*Capparaceae*	WV	Str-A
32	*Cardiospermum helicacabum* L.	*Sapindaceae*	HV	TC
33	*Carissa carandas* L.	*Apocynaceae*	WV	Str-A
34	*Carissa inermis* Vahl.	*Apocynaceae*	WV	Str-A
35	*Cassytha filiformis* L.	*Lauraceae*	HV	ST
36	*Cayratia auriculata* (Roxb.) Gamble	*Vitaceae*	WV	TC
37	*Cayratia pedata* (Lam.) Gangep.	*Vitaceae*	WV	TC
38	*Cayratia trifolia* (L.) Domin.	*Vitaceae*	WV	TC
39	*Celastrus paniculatus* Willd.	*Celastraceae*	WV	Str-UA
40	*Ceropegia bulbosa* Roxb.	*Asclepiadaceae*	HV	ST
41	*Cissampelos pareira* L.	*Menispermaceae*	HV	ST
42	*Cissus quadrangularis* L.	*Vitaceae*	WV	TC

43	*Cissus repanda* Vahl.	*Vitaceae*	WV	TC
44	*Cissus vitiginea* L.	*Vitaceae*	WV	TC
45	*Clematis gouriana* DC	*Rananculaceae*	WV	Str-UA
46	*Clematis roylei* Rehder	*Rananculaceae*	WV	Str-UA
47	*Clematis smilacifolia* Wall.	*Rananculaceae*	WV	Str-UA
48	*Clitoria ternatea* L.	*Papilionaceae*	WV	ST
49	*Coccinia grandis* (L.) Voigt	*Cucurbitaceae*	WV	TC
50	*Cocculus hirsutus* (L.) Diels	*Menispermaceae*	WV	ST
51	*Combretum albidum* G. Don	*Combretaceae*	WV	ST
52	*Combretum roxburghii* Spreng.	*Combretaceae*	WV	ST
53	*Cryptolepis buchanani* Roem. & Schult.	*Asclepiadaceae*	WV	ST
54	*Cryptolepis elegans* Don	*Asclepiadaceae*	WV	ST
55	*Cynanchum callialatum* Wt.	*Asclepiadaceae*	WV	ST
56	*Dalbergia volubilis* Roxb.	*Papilionaceae*	WV	Str-UA
57	*Derris scandens* (Roxb.) Benth.	*Papilionaceae*	WV	ST
58	*Dioscorea anguina* Roxb.	*Dioscoreaceae*	HV	ST
59	*Dioscorea bulbifera* L.	*Dioscoreaceae*	HV	ST
60	*Dioscorea glabra* auct.	*Dioscoreaceae*	HV	ST
61	*Dioscorea hamaltonii* Hook.f.	*Dioscoreaceae*	HV	ST
62	*Dioscorea hispida* Dennst.	*Dioscoreaceae*	HV	ST
63	*Dioscorea oppositifolia* L.	*Dioscoreaceae*	HV	ST
64	*Dioscorea pentaphylla* L.	*Dioscoreaceae*	HV	ST
65	*Dioscorea tomentosa* Spreng.	*Dioscoreaceae*	HV	ST
66	*Diplocyclos palmatus* (L.) Jeffrey	*Cucurbitaceae*	WV	TC
67	*Dolichos trilobus* L.	*Papilionaceae*	HV	ST
68	*Embelia ribes* Burm.f.	*Myrsinaceae*	WV	Str-UA
69	*Entada pursaetha* DC.	*Mimosaceae*	WV	Str-UA
70	*Flagellaria indica* L.	*Flagellariaceae*	WV	TC
71	*Galactia longiflora* Benth.	*Papilionaceae*	HV	ST
72	*Gloriosa superb* L.	*Liliaceae*	HV	RC
73	*Gnetum ula* Brongh	*Gnetaceae*	WV	Str-UA
74	*Gouania leptostachya* DC.	*Rhamnaceae*	WV	TC
75	*Grewia rhamnifolia* Roth.	*Tiliaceae*	WV	Str-UA
77	*Gymnopetalum cochinchinensis* (Lour) Kurz.	*Cucurbitaceae*	WV	ST
78	*Hemidesmus indicus var. indicus* (L.) R. Br.	*Asclepiadaceae*	HV	TC
79	*Hemidesmus indicus var. pubescens* (Wt. & Arn. Hook.f.	*Asclepiadaceae*	HV	ST
80	*Hewittia scandens* (Milne) Mabb.	*Convolvulaceae*	WV	ST
81	*Hiptage benghalensis* (L.) Kurz.	*Malphigiaceae*	WV	Str-A
82	*Holostemma ada-kodien* Schult.	*Asclepiadaceae*	WV	Str-UA
83	*Hoya pendula* Wt. & Arn.	*Asclepiadaceae*	WV	ST
84	*Hugonia mystax* L.	*Linaceae*	WV	Str-UA
85	*Hypserpa nitida* Miers	*Menispermaceae*	WV	HC
86	*Ichnocarpus frutescens* (L.) Ait.	*Apocynaceae*	HV	ST
87	*Ipomoea eriocarpa* R.Br.	*Convolvulaceae*	WV	ST
88	*Ipomoea hederifolia* L.	*Convolvulaceae*	HV	ST
89	*Ipomoea nil* (L.) Roth	*Convolvulaceae*	HV	ST
90	*Ipomoea obscura* (L.) Ker-Gawl.)	*Convolvulaceae*	HV	ST
91	*Ipomoea pes- tigridis* L.	*Convolvulaceae*	HV	ST
92	*Ipomoea sepiaria* Roxb.	*Convolvulaceae*	WV	ST
93	*Ipomoea staphylina* Roem. & Schult.	*Convolvulaceae*	WV	ST
94	*Ipomoea turbinata* Lag.	*Convolvulaceae*	WV	ST
95	*Ipomoea wightii* (Wall.) Choisy	*Convolvulaceae*	WV	ST

96	*Jacquemontia paniculata* (Brum.f.) Hallier.f.	*Convolvulaceae*	HV	ST
97	*Jasminum angustifolium* Vahl	*Oleaceae*	WV	ST
98	*Jasminum arborescens* Roxb.	*Oleaceae*	WV	ST
99	*Jasminum roxburghianum* Wall.	*Oleaceae*	WV	ST
100	*Leptadenia reticulata* (Retz.) Wt. & Arn.	*Asclepiadaceae*	WV	ST
101	*Mallotus repandus* Muell.-Arg.	*Euphorbiaceae*	WV	Str-A
102	*Merremia hederacea* (Burm.f.) Hallier f.	*Convolvulaceae*	HV	ST
103	*Merremia tridentate* (L.) Hallier f.	*Convolvulaceae*	HV	ST
104	*Merremia tridentata s.sp tridentata* (Desr.) Oostr.	*Convolvulaceae*	HV	ST
105	*Merremia umbellata* (L.)Hallier f.	*Convolvulaceae*	HV	ST
106	*Merremia vitifolia* (Burm.f.) Hallier f.	*Convolvulaceae*	WV	ST
107	*Millettia auriculata* Brandis	*Papilionaceae*	WV	Str-UA
108	*Millettia racemosa* (Wt. & Arn. Benth.	*Papilionaceae*	WV	Str-UA
109	*Mimosa intsia* L.	*Mimosaceae*	WV	Str-A
110	*Momordica charantia* L.	*Cucurbitaceae*	WV	TC
111	*Momordica dioica* Willd.	*Cucurbitaceae*	WV	TC
112	*Morinda umbellata* L.	*Rubiaceae*	WV	Str-UA
113	*Mucuna gigantea* DC.	*Papilionaceae*	WV	ST
114	*Mucuna monosperma* Wt.	*Papilionaceae*	WV	ST
115	*Mucuna nigricans* (Lour.) Steud.	*Papilionaceae*	WV	ST
116	*Mucuna pruriens* (L.) DC.	*Papilionaceae*	WV	ST
117	*Mukia maderaspatana* (L.) Roem.	*Cucurbitaceae*	WV	TC
118	*Naravalia zeylanica* (L.) DC.	*Rananculaceae*	WV	TC
119	*Olax scandens* Roxb.	*Olacaceae*	WV	Str-UA
120	*Operculina turpethum* (L.) Silva Manso	*Convolvulaceae*	WV	ST
121	*Oplia amentacea* Roxb.	*Opiliaceae*	WV	ST
122	*Paracalyx scariosus* (Roxb.) Ali	*Papilionaceae*	WV	ST
123	*Passiflora foetida* L.	*Passifloraceae*	HV	TC
124	*Pergularia daemia* (Forssk.) Chiov.	*Asclepiadaceae*	HV	ST
125	*Pisonia aculeata* L.	*Nyctaginaceae*	WV	Str-A
126	*Plecospermum spinosum* Trecul	*Moraceae*	WV	Str-A
127	*Pterolobium hexapetalum* (Roth) Sant. & Wagh	*Caesalpiniaceae*	WV	Str-A
128	*Pueraria tuberosa* DC.	*Papilionaceae*	WV	Str-UA
129	*Reissantia indica* (Willd.) Halle	*Celastraceae*	WV	Str-UA
130	*Rhaphidophora decursiva* (Roxb.) Schott.	*Convolvulaceae*	WV	ST
131	*Rivea hypocrateriformis* (Desr.) Choisy	*Araceae*	WV	RC
132	*Rubia cordifolia* L.	*Rubiaceae*	HV	ST
133	*Rubus ellipticus* Sm.	*Rosaceae*	WV	Str-A
134	*Rubus niveus* Thunb	*Rosaceae*	WV	Str-A
135	*Salacia chinensis* L.	*Celastraceae*	WV	Str-UA
136	*Sarcostemma acidum* (Roxb.) Voigt	*Asclepiadaceae*	WV	Str-UA
137	*Schefflera roxburghii* Gamble	*Araliaceae*	WV	Str-UA
138	*Schefflera stellata* (Gaertn.) Harms	*Araliaceae*	WV	Str-UA
139	*Schefflera venulosa* (Wt. & Arn.) Harms	*Araliaceae*	WV	Str-UA
140	*Scindapus officinalis* (Roxb.) Schott.	*Araceae*	WV	RC
141	*Scutia maritime* (Burm.f.) Kurz.	*Rhamnaceae*	WV	Str-A
142	*Secamone emetic* (Retz.) R.Br.	*Asclepiadaceae*	WV	ST
143	*Smilax zeylanica* L.	*Smilacaceae*	HV	TC
144	*Solanum trilobatum* L.	*Solanaceae*	WV	Str-A
145	*Solena amplexicaulis* (Lam.) Gandhi	*Cucurbitaceae*	WV	TC
146	*Stemona tuberosa* Lour.	*Stemonaceae*	HV	RC
147	*Stephania japonica* (Thunb.) Miers.	*Menispermaceae*	HV	ST
148	*Symphorema involucratum* Roxb.	*Verbenaceae*	WV	ST
149	*Teramnus labialis* (L.f.) Spreng.	*Papilionaceae*	WV	ST
150	*Teramnus mollis* Benth.	*Papilionaceae*	WV	ST
151	*Thunbergis fragrans* Roxb.	*Acanthaceae*	HV	ST

152	*Tiliocora acuminata* (Lam.) Miers.	*Menispermaceae*	WV	ST
153	*Tinospora cordifolia* (Willd.) Hook.f. & Thoms.	*Menispermaceae*	WV	ST
154	*Tinospora sinensis* (Lour.) Merr.	*Menispermaceae*	WV	ST
155	*Toddalia asiatica* (L.) Lam.	*Rutaceae*	WV	HC
156	*Toxocarpus kleinii* Wt. & Arn.	*Asclepiadaceae*	WV	ST
157	*Tragia involucrata* L.	*Euphorbiaceae*	WV	ST
158	*Tragia plukenetii* R.Sm.	*Euphorbiaceae*	HV	ST
159	*Trichosanthes cucumerina* L.	*Cucurbitaceae*	WV	TC
160	*Trichosanthes tricuspidata* Lour.	*Cucurbitaceae*	WV	TC
161	*Tylophora fasciculata* Wt.	*Asclepiadaceae*	HV	ST
162	*Tylophora indica* (Burm.f.) Merr.	*Asclepiadaceae*	HV	ST
163	*Tylophora macrantha* Hook.f.	*Asclepiadaceae*	HV	ST
164	*Tylophora rotundifolia* (Roxb.) Wt. & Arn.	*Asclepiadaceae*	HV	ST
165	*Uncaria sessilifructus* Roxb.	*Rubiaceae*	WV	HC
166	*Vanilla wightiana* Lindl.	*Orchidaceae*	HV	RC
167	*Ventilago denticulata* Willd.	*Rhamnaceae*	WV	ST
168	*Wattakaka volubilis* (L.f.) Stapf	*Asclepiadaceae*	WV	ST
169	*Ziziphus oenoplia* (L.) Mill.	*Rhamnaceae*	WV	Str-A
170	*Ziziphus rugosa* Lam.	*Rhamnaceae*	WV	Str-A

WV- Woody vines; HV-Herbaceous vines; ST-Stem twiners; STr-A-Straggler armed; STr-UA- Straggler unarmed; TC- Tendril climber; RC-Root climbers; HC-Hook climbers .

Conclusion

Lianas play a key role in the ecology and dynamics of forests and may be helpful in conservation of forest resources. The present study has shown that the tropical forests of northern Eastern Ghats harbor has a high floristic diversity of lianas, which contribute to the overall biodiversity of the forests. These forests are deteriorating under constant anthropogenic activities. The present data of floristic diversity of lianas would be useful in species conservation and management. The importance of climbers can be useful to biologists in the establishment of a standardized methodology and to provide these data on the structural threats to tropical forests for a global audience.

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