FINAL REPORT

Enclosure I

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ECOLOGICAL STATUS, BIOMECHANICAL ADAPTATION AND FOREST SIGNIFICANCE OF CLIMBING PLANTS IN MELGHAT AREA, DIST. AMRAVATI (M.S.)

1. Introduction-

Climbing plants (vines) are one of the interesting, but also a much neglected group of plants. Vines climb by using other plant for support. These character ristics allow vines stem to be narrow, flexible and capable of phenomenal rates of growth in height.

Vines have long attracted naturalist and story – tellers, yet beside the contribution of Darwin (1867), this group remains understudied. Recent studies have documented the contribution of vines both positive and negative, with many aspects of forest ecology. As far as growth form is concern, climbing plants are woody (Liana) and herbaceous vines. The greatest abundance and diversity of climbing plants found in tropical rainforests (Richards, 1996). Climbers show distinct diversity depending upon their climbing strategies, morphological potential and ecological behavior. Darwin (1867) first time classified climbers on the bases of their divers climbing mechanisms as Twiners (*Ipomoea*); Leaf climbers (*Clematis*); Tendril climbers (*Passiflora*); Root climbers (*Vitis*); Hook climbers (*Calamus*). As far as the taxonomic composition is concern according to Putz (1984) about 97 and Gentry (1991) 131 seed plant families have climbing species in the new world.

The greatest abundance and diversity of climbing plants found in tropical rainforests (Richards, 1996). According to Acevedo-Rodrigues (2005) vines occupy about 25% of the woody flora of Malaysia and up to 44% of the woody biomass in some

areas of Amazon basin. The distributions of vines are more prevalent in areas of secondary forest succession (Balee and Campbell, 1989). Apart from rainforests, the moist and dry tropical forests also represent significant distribution of climbing plants. The temperate zone forests have very few lianas (Gentry, 1985); however the south temperate forests of Chile have comparatively significant liana as well as herbaceous vine composition (Dawson, 1980).

Climbing plants are neglected, but an important part of tropical forests. The presence of woody climbers has been considered as the most important physiognomic feature of tropical forests (Croat, 1978). The woody climbers have been estimated to account for 32-36% of the litter composition of the forests (Putz, 1984). In forest ecosystem liana compete with trees for light, water and nutrition. Ogawa *et al*. (1965) suggest that the competition with lianas is an important cause of tree death.

Climbers show distinct diversity depending upon their climbing strategies, morphological potential and ecological behavior. Darwin (1867) first time classified climbers on the bases of their divers climbing mechanisms as

1. Twiners (*Ipomoea*)
2. Leaf climbers (*Clematis*)
3. Tendril climbers (*Passiflora*)
4. Root climbers (*Vitis*)
5. Hook climbers (*Calamus*)

Recently, Gentry (1985) recognized four fundamental climbing strategies on the basis of their ecology as well as morphology.

i) **Lianas:** These are woody, relatively thick stemmed climbers. These plants begin life as terrestrial seedlings and are capable to grow in mature forests.

ii) **Vines:** These are thin stemmed climbers that begin life as terrestrial seedling and generally grow in disturbed habitats or at the forest edge.

iii) **Woody hemi-epiphytes:** These are stranglers, typically begin life as epiphytic seedlings with roots which later reaching the grounds.

iv) **Herbaceous epiphytes:** These include all the herbaceous species that climb in association with to tree trunks and branches.

According to Schenck (1893) the stem and wood anatomy of climbing plants differs from that of self supporting plants. In climbers successive cambial activities causes proliferation of parenchyma with dispersed xylem. Xylem plates in greater proportion of parenchyma resulted into fibrous wood as compared to shrubs and trees. Although vines and self supporting plants differ physiologically, anatomically and phenologically, the primary differences are biomechanical. Because of lacking capacity to remain upright, climbing plants are forced to encounter suitable support and ascent efficiency. The majority of vine seedlings produce searcher shoots that grow up bend over but fails to encounter a support (Darwin 1867 and Putz, 1984). Vines can increase their power of encountering a suitable support by actively searching, waiting and being able to ascend a wide range of support sizes. These properties of vines influence by stem biochemistry.

With the reduced role of xylem for support, vines have evolved large and wide vessels inside their narrow stems. This characteristic enable vines for rapid transport of large amount of water throughout the plant (Ewers *et al.,* 1991). It is also observed that vessel diameter in vines are often greater than vessel diameter in closely related species of trees. Beside that of vessels, the scandent dicotyledons have true tracheids. Which are usually vasicentric. According to Carlquist (1991) these tracheids serve as a subsidiary conductive system when vessels get blocked. Presence of wide and thin rays in vines may play significant role during twisting and avoid vessels damage (Putz and Holbrook, 1991). Presence of sclerenchyma cylinder or patches in between phloem and periderm would be interesting to know. Whether it is present to protect xylem and phloem from crusting or for something else is yet to be cleared (Putz and Mooney, 1991).

In forest ecosystem climbers have a clear and significant role. Due to the light favoring properties of plants, woody climbers proliferate in canopy gaps and on the top of the trees in the forests. This property of climbers not only fills up the forest gaps but also develop competition among trees for growth (Tabanez and Viana, 2000). Recent findings suggest that woody climbers contribute a major proportion to the transpiration of tropical forests, particularly during the dry season (Meinzer *et al*., 1999). Liana might also play a prominent role in forest - wide carbon sequestration. Heavy growth of liana following disturbance may inhibit tree regeneration, which reduces the amount of carbon that was

sequestered in plant biomass (Chave *et al.,* 2001). Lianas have a strong impact on the trees that they climb through severe constriction. Subsequently the constriction should alter the water and sap moment in the tree and ultimately may lead to the death of the host tree. As lianas causes some negative impacts on forest ecosystem many foresters and forest ecologists recommended the active management of lianas via periodic and pre-harvest Liana cutting.

Most vines exhibit remarkable changes in development from juvenile to adult stages called heteroblastic development (Goebel, 1900). The vines growth habit allows plants to begin life in shade of vegetation, and then ascend towards direct light. Thus to tolerate the challenge during development vines shows variations.

Beside that of indigenous uses, climbing plants have extraordinary range of significance. All parts of climbers; flowers, fruits, seeds, stem, leaves and tubers have important applications. According to the earlier study (Perry, 1980 and Oliever-Bever, 1986) more than 1000 climbing species from 52 families have great economic importance.

The main mountainous region is the Gavilgarh hills of Satpura ranges identified as Melghat (Map) and included in Dharni and Chikhaldara tahsils. Melghat means a meeting place of Ghats consisting of succession of hills and valleys, showing much variation in aspects, gradient and altitude. The Gavilgarh ridge serves as a natural barrier between the forested mountainous part on the north and the cultivated plains on the south.

According to Dhore (1986) the flora of Amravati District comprises about 1084 species of the flowering plants along with 50 climbing species. Re-exploration of flora particularly from Melghat area by Bhogaonkar and Devarkar (1999) reported 67 additional species to the earlier reports of Angiosperms. According to forest department documentation, there are about 70 climbing species in Amravati area including 57 in Melghat. Thus there is not any proper exploration of climbing species in study area.

Thus to enumerate the potentiality of climbing species in Melghat floristic composition and to highlight their adaptive features along with positive as well as negative role in the forest community, present investigation is undertaken.

2. Material and Method

Amravati district is situated in the centre of the northern border of Maharashtra State. The district is distinctly divided into to two widely different tracts i.e. the plain of fertile black soil and a stretch of mountainous tract extending along the whole northern boundary of the district. The large Melghat tract is a hilly terrain of Satpura ranges which is entirely different from the rest of district from climatologically and floristic point of view. The present investigation, Ecological status, biomechanical adaptation and forest significance of climbing plants in Melghat area, Dist. amravati (m.s.) is carried out as under.

2.1: Collection of geographical, forest and climatic data

The data about the geographical information along with maps of Amravati district was collected from district collector office. The information and maps about the Melghat forested area, type of forests, forest fragments and other related aspects was obtained from the office of Chief Conservator of Forest, Melghat as well as territory. All the collected data was verified, compiled and put forward for the further applications.

2.2: Planning and exploration of study area

The present study is the result of extensive and intensive exploration of almost all the possible habitats of Melghat forest of Amravati district. The study was carried out by frequent excursions and continuous notifications along with colleagues, friends, students, and family members to different areas of Melghat during the stipulated period.

In the first phase of investigation the literature related to the floristic of Melghat area was collected and verified with respect to composition of vining species. The taxonomical data of each climbing species regarding to its growth form, community characteristics and biomechanical peculiarities for a significant and economical importance were examined from the available literature.

As far as the distribution of climbers in the investigated area is concerned 17 species are strictly adapted to Melghat undulating habitat. The dominantly found lianas in the Melghat area are *Bauhinia vahlii, Butea superba, Cayratia auriculata, Milletia*

auriculata, Cissus repanda, Ventilago denticulate, Cryptolepis buccnani, Clematis triloba and *Cilastrus paniculata.* Besides liana the other vines which are linked up with Melghat are *Dioscorea species, Cucumis callosus, Vigna radiata, Pruraria tuberosa, Thunbergia alata, Ipomoea eriocarpa* and *Ipomoea quamoclit*.

During the study period the whole forest was explored regarding to ecological status of climbing plants. On an average a week in a month was spent in the undulating forest area of Melghat during the study period. Most of the area of Melghat except some parts of Koktu and Jarida range was covered with the co-operation of forest authorities, NGOs, colleagues and friends.

2.3: Collection, preservation and identification of floristic material

During every visit to any locality the species compositions of climbers was sampled randomly by walking along the network of paths within forest fragments, forest edges, river and stream banks, fencings of agricultural area and other possible habitats. The sample specimens were collected as a herbarium and the detailed notes regarding to habit, habitats, relative abundance, host availability, climbing mechanism, community characteristics and overall ecological status of climbing species were notified (Venu, 1998).

The plant specimens were carefully described in the laboratory. All the morphological characters were recorded and plants were identified with the help of authentic floras as well as related expertise.

2.4: Ecological analysis of climbing species

In the second phase of investigation the ecological aspects regarding to each identified climbing species along with its community were thoroughly examined by continuous observations, measurements and close report (Sidama *et al*., 2010). The examination include, the habitat where the vine tend to grow, the juvenile characters of the seedlings, seedling growth, length of leader shoots and the way of approach towards the host were keenly measured.

The distributional pattern of vines along with their community was also quantified through common ecological procedure. The origin of climbing organs, their way of ascends over host, response of host towards vine approach, and overall vine-host interaction were assessed through close observations. The reproductive display of different vines, their rewards provided towards the visitors for fulfilling the reproductive desirability, reproductive success and the dispersal mechanisms carried out to extend their colonization were also worked out. The ornamental vine ecology was studied with respect to host provisions, growth pattern, canopy impacts as well as economical significance..

2.5: Photographic data

Photographic data of each species regarding to their seedling, habit over host, climbing organs, biomechanics, floral display, fruits propagatory methods and their forest significance were shoot out with the help of Nikon Coolpix Li20 digital camera. The selected photographs were cleared and adjusted through Adobe Photoshop and Coral Draw software. The photographs were mounted according to their status and investigation.

2.6: Anatomical study

In the present investigation about 20 climbing species belonging to 10 families were examined with respect to their stem anatomy. For the anatomical study, the fresh young stem samples were collected from the fields and fixed in 5% formalin solution. The cross sections obtained in laboratory using freehand technique. The slide preparations were independently stained with heamatoxine and safranin (Blazencic, 1979, Souza *et al.,* 2005). A light microscope (Olympus) was used to view the slides and adjusted to finest resolution. The micro photographs of selected slides were obtained using Coslab (Scopeimage 9.0) digital PC - microscope camera focused through the eye piece. The photographs of same anatomy were examined with respect to their peculiarities and put forward for further examination. The terminology of Metcalfe and Chalk (1950) was used for anatomical designations.

The anatomical cross sections were examined with respect to their tissue arrangement, cambium origin and activity and adaptive secondary growth. The findings compared with the related literature and used to make some conclusions.

3. Observations

Amravati District is one of the hilly and floristically rich districts of Maharashtra state. The district has two distinct regions with characteristics topography and climate, that is the expanse of plains and mountainous region. The mountainous region includes the Gawilgarh hills of Satpura ranges which passes through Dharni and Chikhaldara tahsils of Amravati District. The succession of hills and valleys shows much variation in gradients and altitude. The area possesses Melghat Tiger project.

The undulating tropical dry deciduous forest, low line hills and the plains of the Melghat area shows potential floristic diversity. The present investigation explored all the possible habitats of the district from ecological point of view except some unreachable parts of Melghat. The study worked out about 72 climbing species belonging from 24 families of flowering plants. Out of the total, 67 species belongs to dicotyledons and the remaining 5 species belongs to monocotyledons. 59 species examined in their wild state, whereas 13 species studied under cultivation may be as a crop or ornamental vine (Table No. 1).

Table No. 1: *Statistics of enumerated Climbing Species*

Investigation Type	No. of Species Enumerated	Families	Wild	Cultivated	Dicot	Monocot
					Species	Species
Ecology	72	26	59	13	67	05
Stem Anatomy	20	10				

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triloba and *Cilastrus paniculata.* Besides liana the other vines which are linked up with Melghat are *Dioscorea species, Cucumis callosus, Vigna radiata, Pruraria tuberosa, Thunbergia alata, Ipomoea eriocarpa* and *Ipomoea quamoclit*.. The abundantly found vining species in the plains are *Cocculus hirsutus, Tinospora cordifolia, Capparis zeylanica, Cissus vitiginea, Cardiosperum helicacabum, Abrus precatorius, Clitoria ternatea, Rhynchosia minima, Coccinia grandis, Mukia maderaspatena, Trichosanthus cucumerina, Dregea volubilis, Pergularia daemia, Telosma pallida, Hemidesmus indicus, Ipomoea hederifolia, Ipomoea obscura, and Cuscuta reflexa.* It was remarkably noted that the conditions of the plain area is mostly suitable for herbaceous vines (Table No. 2).

Taxonomical composition of vines in the studied area also shows great diversity. The potentially rich families are Convolvulaceae (11 species), Cucurbitaceae (10 species), Papilionaceae (7 species), Asclepiadaceae (6 species), Vitaceae (3 species) followed by Bignoniaceae, Acanthaceae, Oliaceae, Dioscoriaceae and Araceae having 4-6 species (Table No. 6). The area supports the growth of about 50 woody and 54 herbaceous climbing species.

The rich floristic of the district also shows diversity with respect to biomechanics of the climbers. About 50 climbers from the investigated area are twiners. The major families consisting twining species are Convolvulaceae, Papilionaceae and Dioscoriaceae. About 16 species especially from Cucurbitaceae, Vitaceae and Bignoniaceae exhibit tendrillar climbing mechanism. Beside these, 3 species are armed stragglers, 2 species are unarmed stragglers, 2 species are root climbers and remaining 2 species are hook climbers (Table No. 5).

Table No.2: *Biomechanical classification and percentage of enumerated Climbing Species*

Stem twiners	Stragglers-armed	Stragglers-unarmed	Tendril climbers	Root climbers	Hook climbers	Total
48	03	02	15	02	02	72
66.66%	4.16%	2.77%	20.83	2.77%	2.77%	100%

Table No. 3: *Details of climbing plants enumerated from Amravati District with respect to distribution, climbing modes and ecological status.*

(**WV**: Woody vines; **HV**: Herbaceous vines; **ST**: Stem twiners; **Str-A**: Stragglers-armed; **Str-UR**: Stragglers-unarmed; **TC**: Tendril climbers; **RC**: Root climbers; and **HC**: Hook climbers)

Sr. No	Name of Species	Family	Distribution	Habit	Climbing mode	Status
1	*Clematis triloba* Heyne	Ranunculaceae	High altitude of Melghat (Amzari , Ghatang, Raipur)	WV	Str-UR	common
2	*Cissampelos pareira* L.	Menispermaceae	Along river banks in Melghat (Jununa-Shahanoor).	HV	TC	Rare
3	*Cocculus hirsutus* L.	Menispermaceae	On hedges and crop Fields	` WV	ST	Very common
4	*Tinospora cordifolia* Miers	Menispermaceae	On hedges and small trees	WV	ST	Very common
5	*Capparis zeylanica* L.	Capparidaceae	On hedges and small trees	WV	Str-AR	common
6	*Celastrus paniculata* Willd	Celastraceae	High altitude of Melghat (Amzari, Ghatang, Pastalai)	WV	Str-UR	Rare
7	*Ventilago denticulata* Willd	Rhamnaceae	Whole area along river and stream banks	WV	Str-AR	common
8	*Ziziphus oenoplia* Mill	Rhamnaceae	On hedges and small trees	WV	Str-AR	common
9	*Ziziphus rugosa* Lamk	Rhamnaceae	Chikhaldra and Pohara plateaus (Chikhaldara, Makhala)	WV	Str-AR	Rare
10	*Ampelocissus latifolia* Rox*b*	Vitaceae	Secondary hills of Melghat	WV	TC	Common but restricted
11	*Cayratia auriculata* Roxb	Vitaceae	Secondary hills of Melghat (Amzari,Dhargarh,Ghatang)	WV	TC	Common but restricted
12	*Cissus repanda* Vahl	Vitaceae	Throughout Melghat (Semadoh, Koha, Makhala)	WV	TC	Frequent
13	*Cardiosperum helicacabum* L	Sapindaceae	Melghat foot hills along field fencings,	HV	TC	common
14	*Abrus precatorius* L.	Papilionaceae	Melghat foot hills along field fencings, stream banks and open grazing lands	WV	ST	common
15	*Butea superba* Roxb	Papilionaceae	Along river and stream banks of secondary hills of Melghat (Dhakna, Harisal, Semadoh)	WV	ST	Rare

16	*Milletia auriculata* Bak.	Papilionaceae	Along river and stream banks of secondary hills of Melghat (Ghatang,Raipur,Belkund)	WV	ST	common
17	*Mucuna prurita* Hook	Papilionaceae	In all habitats of Melghat foothills	WV	ST	Very common
18	*Pueraria tuberosa* Roxb	Papilionaceae	In valleys of higher elevations of Melghat (Amzari,Makhala)	HV	ST	Common but restricted
19	*Rhynchosia minima* L.Dc.	Papilionaceae	On plateaus of Melghat	HV	ST	Very common
20	*Vigna radiata* L.	Papilionaceae	Rare along hill slopes of higher altitude of Melghat (Amzari)	HV	ST	Rare
21	*Bauhinia vahlii* Wt.&Arn.	Caesalpiniaceae	Higher elevations of Melghat (Belkund, Ghatang, Raipur,Makhala)	WV	TC	common
22	*Acacia torta* Roxb.	Mimosaceae	Along banks of Rivers and streams Melghat foot hills (Dhargad)	WV	Str-AR	common
23	*Combretum ovalifolium* Roxb	Combretaceae	Along river-sides and foot hills of Melghat	WV	ST	Very common
24	*Quisqualis indica* L.	Combretaceae	Commonly grown as a ornamental plant	WV	ST	common
25	*Citrulus colocynthis* Schdr.	Cucurbitaceae	Rarely along foot hills of Melghat (Mallur,)	HV	TC	Rare
26 `	*Corallocarpus epigaeus* Arn.	Cucurbitaceae	Rarely on fencings and hedges (Chaurakund)	HV	TC	Rare
27	*Ctenolepis garcini* L.	Cucurbitaceae	Rarely along foot hills of Melghat (Salburdi)	HV	TC	Rare
28	*Cucumis callosus* Rottl.	Cucurbitaceae	Common in fields, wastelands and grasses in forest (Chikhaldara, Jamli,Raipur)	HV	TC	common
29	*Cucurbita maxima* Duch.	Cucurbitaceae	Cultiveted in field and courtyards for edible fruits (Amravati, Mangia, Rajura)	HV	TC	common
30	*Diplocyclos palmatus* L.	Cucurbitaceae	Common on fencing, bushes and hedges	HV	TC	Very common
31	*Luffa cylindrica* L.	Cucurbitaceae	On road side trees, fields fencings and hedges of plains (Dharni)	HV	TC	Rare
32	*Momordica charantia* L.	Cucurbitaceae	Commonly cultivate as	HV	TC	common

			vegetable			
33	*Momordica dioica* Roxb.	Cucurbitaceae	Common throughout on field fencing, bushes and hedges (Khongda)	HV	TC	common
34	*Trichosanthes cucumerina* L.	Cucurbitaceae	on road side trees, fields fencings and hedges	HV	TC	Rare
35	*Vernonia elignifolia* DC.	Asteraceae	Frequentlt cultivated on fencing and porches	WV	Str-AR	common
36	*Jasminum auriculatum* Vahl	Oleaceae	Cultivated as ornamental plant	WV	ST	Common
37	*Jasminum fluminense* Vell.	Oleaceae	Cultivated as ornamental plant	WV	ST	Common
38	*Jasminum officinale* L.	Oleaceae	Cultivated as ornamental plant	WV	ST	Common
39	*Jasminum sambac* Ait	Oleaceae	Cultivated as ornamental plant	WV	ST	Common
40	*Allamanda cathartica* L.	Apocynaceae	Frequentlt cultivated on fencing and porches (Amravati, Paratwada, Dhamangaon)	WV	ST	common
41	*Beaumontia grandiflora* Wall	Apocynaceae	Rarely cultivated as ornamental plant (Chikhaldara)	WV	ST	Rare
42	*Cryptolepis buchanani* Roem	Asclepiadaceae (Periplocaceae)	Common throughout on trees and bushes of river and stream bank (Amzari)	WV	ST	Very common
43	*Cryptostegia grandiflora*R.Br.	Asclepiadaceae (Periplocaceae)	Common on urban wasteland,roadsides and walls (Amravati, Chandur Ralway,Paratwada)	WV	ST	Common in urban areas
44	*Dregea volubilis* L.f.	Asclepiadaceae	Along foot hills of Melghat	WV	ST	common
45	*Hemidesmus indicus* L.	Asclepiadaceae (Periplocaceae)	Along foot hills of Melghat	HV	ST	common
46	*Pergularia daemia* Foesk.	Asclepiadaceae	Along foot hills of Melghat	HV	ST	Very common
47	*Telosma pallida* Roxb.	Asclepiadaceae	Along foot hills of Melghat	HV	ST	Rare
48	*Argyreia sericea* Dalz.	Convolvulaceae	Common on trees and bushes (Khongda)	WV	ST	Common but restricted
49	*Ipomoea eriocarpa* R. Br.	Convolvulaceae	Rarely found on grasses and herbs (Bihali, Jamli)	HV	ST	Rare
50	*Ipomoea hederifolia* L.	Convolvulaceae	Along foot hills of Melghat	HV	ST	Very common

51	*Ipomoea muricata* L.	Convolvulaceae	Common near valleys (Bihali,Mangia)	HV	ST	Common but restricted
52	*Ipomoea obscura* L.	Convolvulaceae	Along foot hills of Melghat	HV	ST	common
53	*Ipomoea pes-tigridis* L.	Convolvulaceae	Along foot hills of Melghat	HV	ST	Common
54	*Ipomoea quamoclit* L.	Convolvulaceae	commonly grown as an ornamental plant (Chaurakund)	HV	ST	common
55	*Ipomoea sepiaria* Koen.	Convolvulaceae	Along foot hills of Melghat Chaurakund,)	HV	ST	common
56	*Ipomoea sinensis* C. B. Desv.	Convolvulaceae	Along foot hills of Melghat (Tembrusonda)	HV	ST	Common but restricted
57	*Jacquemontia coerulea* Choisy	Convolvulaceae	Rarely grown as an ornamental plant	WV	ST	Rare
58	*Rivea hypocrateriformis* Choisy	Convolvulaceae	Along foot hills of Melghat	WV	ST	Common
59	*Cuscuta reflexa* Roxb.	Cuscutaceae	Along foot hills of Melghat	HV	ST	Common
60	*Bignonia unguis-cati* L.	Bignoniaceae	Thickly distributed on the upper plateau of Chikhaldara	WV	HC	Common but restricted
61	*Bignonia venusta* Ker.	Bignoniaceae	Cultivated as ornamental plant	WV	TC	Rare
62	*Thunbergia alata* L.	Acanthaceae	Distributed over forest ground vegetation, rarely cultivated as ornamental plant(Chikhaldara, Amzari)	HV	ST	Common But resstricted
63	*Thunbergia fragrans* Roxb.	Acanthaceae	Cultivated as ornamental plant	HV	ST	Rare
64	*Clerodendrum splendens* Don	Verbinaceae	Cultivated as ornamental plant (Chikgaldara)	WV	ST	Common
65	*Bougainvillia spectabilis* Willd.	Nyctaginaceae	Cultivated as ornamental plant (Chikgaldara)	WV	Str-AR	Common
66	*Aristolochia elegans* Mast.	Aristolochiacea e	Rarely cultivated as an ornamental plant (Mangia)	HV	ST	Rare
67	*Tragia hildebrandtii* Muell.	Euphorbiaceae	Along foot hills of Melghat	HV	Str-UR	Common
68	*Dioscoria belophyla* Haines.	Dioscoriaceae	On hedges and small trees along stream and river banks of Melghat, (Semadoh,)	HV	ST	Common
69	*Dioscoria bulbifera* L.	Dioscoriaceae	On hedges and small trees along stream and river banks of Melghat,(Dhargadh, Kolkaaj,)	HV	ST	Common
70	*Dioscoria hispida* Dennst.	Dioscoriaceae	On hedges and small trees	HV	ST	Rare

			(Makhla, Aamzari)			
71	*Asparagus racemosus* Willd.	Liliaceae	Common in Melghat (Pili)	WV	ST	Common
72	*Gloriosa superba* L.	Liliaceae	Rarely in bushes and thickets (Manbhang)	HV	TC	Rare

The flexile-erect postures of climbing species prominently supported by distinct anatomical peculiarities provide great taxonomical significance. During the present investigation about 50 species belonging from 18 families were examined with respect to their stem anatomy. Most of the species have an arrangement of vascular tissue in the stem that is noticeably different from related plants. Among the dicotyledonous climbers the anatomy follows the typical sequence of tissue arrangement. However, the vessels in the stems of most of the species are wider than the related non-climber species. In lianas, stem anatomy shows anomalous structures particularly in Bignoniaceae and Convolvulaceae members. Secondary vascular tissue with typical internal or included phloem is an intensive and adaptive vine character especially for twining mechanism. Isolated patches of sclerenchyma along pericycle in most of the members provide flexible strength to ascending stems.

Maximization of photosynthetic area for harvesting insolation in forest community observed in several lianas. *Bauhinia vahlii*, *Butea superba, Canavalia gladiate*, *Combretum ovalifolium, Antigonon leptopus*, *Cayratia auriculata*, and most of the Convolvulaceae, Cucurbitaceae members effectively impart their photosynthetic display and dominantly stand at the prior position in the forest community. Most of the investigated vines have greater volume of leaf-biomass per stem diameter compared with tree species.

Heteroblastic development is one of the adaptive characters among vining species. Some ornamentals in the studied area such as members of Vitaceae (*Cissus,*), Liliaceae (*Gloriosa*), Passifloraceae (*Passiflora,* Plate No 36), Convolvulaceae (*Argyrea,*), Bignoniaceae (*Bignonia*) shows potential heteroblasty along with juvenile form, internodal distances, leaf morphology and shoot apex structure. These modifications allow them not only to tolerate the situation but also to make dominant in the community.

Climbers normally associated with a well balanced community because of lack of self support among themselves. In various habitats of the Melhgat area climbing species shows great diversity as far as their associating hosts and the tropic community is concerned. The herbaceous vines are normally associated with all the possible growth forms of the community. In the absence of host the vines may trail over the surface or adapt the situation by changing their habit. In the forest community liana develop competition with their tree partners which not only survive them but also perceive some significant characters among tree species. Liana network over host particularly over hill slopes, along river banks and escapes always resist the adverse environmental conditions.

4. Discussion and Conclusion

The foundation of assessing the importance of biodiversity is an inventory of how many species exist and which species exist where. Every country has the responsibility to conserve, restore and sustainably use the biological diversity within its jurisdiction. An environment rich of biological diversity offers the broadcast array of options for sustainable economic ability for sustaining human welfare and for adapting to change. India is a mega diverse country, while following the path of development; it has been sensitive to needs for conservation. Owing to this view in last two decades concept of biological diversity was considered largely in an attempt to focus research on the extent to which human beings are contributing towards biodiversity evaluation as well as conservation. The present study was also a small approach to evaluate the diversity and ecological status amongst a taxonomically significant group of plants.

As far as distribution of climbers is concern 17 species are strictly adapted to undulating tracts of Melghat area. Frequency wise the major lianean species like *Bauhinia vahlii, Cissus repanda, Milletia auriculata, Butea superba, Cayratia, auriculata. Dioscoria* spp., *Celastrus paniculata,* and *Ziziplus rugosa* are usually distributed along the slopes and valleys of higher altitudinal area of Chikhaldara range. *Thunbergia alata* and *Bignonia unguis-cati* get endemically naturalized with thick populations along upper plateau of Chikhaldara. *Ipomoea eriocarpa, Ipomoea quamoclit, Ipomoea simensis* and *Ipomoea pes-tigridis* are rarely confined along foothills of Melghat

area. It was observed that the woody liana mainly restricted to hilly areas of tropical forests. Whereas, the herbaceous vines are confined along foothills means approaching towards plains. Gentry (1988 a) supported this observation while working on changes in plant community diversity and floristic composition on environmental and geographical gradients of tropical forests. It was again observed that teak dominating plains of Melghat does not represent significant climbing association. The climbers are usually distributed along hill slopes, bank of streams and valley relaxes of the investigated area. Schnitzler (1995) supported this observation while working on community ecology of arboreal lianas in gallery forests of the Rhine valley, France. According to Duncan (1975), Carlqusit and Hoekman (1985) and Emmons and Gentry (1983) different tropical forests have different liana densities.

It was noticed that climbing mode is also significant in that the mechanism by which a vine climb; determines where it can climb in terms of community structure and the light environment in which its leaves occur. Owing to this tendril climbers are normally confined over forest edges, field fencings because they required hosts of smaller diameter and height. Whereas stem twiners are confined along forest under story because they can ascend over trees and harvest light at the top. While studding climbers of Puerto Rico and Virgin Islands Rodrigues (2005) observed that climbing plants achieve their objective of climbing on and attracting themselves to host plant by different active and passive mechanisms. Similar observation also made by Fordjour *et al*., (2009) in the Babiri forest reserve of Ghana

Stem anatomy of climbing plant differ from self supporting plants in great extent (Schenck, 1893). Keeping this view in mind about 50 climbing species belonging to 18 different families has been worked out with respect to their stem anatomy. The anatomical peculiarities of enumerated climbing plants relates with cambial activity, vessel dimensions and distribution pattern, axial parenchyma, medullary rays, inter and intraxylary phloem and stem sclerenchyma.

In primitive members like *Clematis*, interfascicular cambium is not develop, the bundles remains separated by the primary rays. Secondary bundles originate from an interfascicular cambium. Cortical and pith cells are lignified to provide extra rigidity. According to Metcalfe and Chalk (1950) scattered - ringed vascular bundles with

mutiseriate rays, pericyclic scelerenchyma makes *Clematis* flexible climber in forest community. In *Cocculus hirsutus* of Menispermaceae vascular bundles separated by broad lignified primary medullary rays. Vessels are large, conspicuous and arranged in tangential groups. Conjunctive parenchyma is present in between the successive layers of xylem and phloem.

Vine presence changes how self-supporting plants compete among themselves. The above conclusions are quite true with respect to investigated area. Such a multi-significant floristic-group sometimes came across in human developmental activities. During the investigated period it was noted that forest developmental as well as management activities causes liana cutting and removal of herbaceous vines.

Although vines needs support structure to access light, they evolved mechanism for fast growth, resistance, and obtaining access to the canopy. Beside that their tree damaging ability, vines compete with their resources and change structural make of the forest community. The present investigation tried to focus different ecological angles related to vines along with their community interaction. In India very little attention provided towards this significant group. Thus there is need of sensual exploration over each and every aspect of this group.

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