

ECO-TAXONOMICAL DIVERSITY AND FOREST SIGNIFICANCE OF VITACEAN CLIMBING PLANTS OF AMRAVATI DISTRICT, MAHARASHTRA, INDIA.

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Abstract

Vitaceae is the one of the popular families of flowering plants in India because of *Vitis venifera*, a grape vine. Besides, the other species of this family also have good potential and thus needs much focus. The present investigation tends to highlight some shadowed angles of Vitacean members which are the dominant part of forest community in Amravati region. Eco-taxonomical variations and forest significance of Vitaceae members has been worked out through continuous observational study. Each climber was analyzed with respect to their habit, habitat and distribution, seedling growth, climbing mechanism, way of host approach, association and the overall role in the forest community. The investigation summarized that all the naturalized species are well adapted to their community habitats and plays significant role. Some forest management activities will be harmful to their existence.

Key words: Vitaceae, tendrils, leader shoots, forest community.

Introduction

Vitaceae, the grape family of flowering plants, comprising 15 genera and 900 species of woody plants, most of them are tendril bearing climbers. The largest genus is *Cissus* comprising about 350 species. *Vitis* is the second largest genera with about by 60 species including *Vitis venifera* having great economic importance and frequently cultivated for edible fruits. The family is worldwide in destination and quite isolated from its relation in the classification system because of its specific characteristics (Soejima and Wen, 2005). The fossil records of this family indicate that the family was already present in India and Eurasia (Manchester *et al.*, 2013). Phylogenetic analysis of Vitaceae on molecular level revealed that the family is monophyletic in origin and suggested that the pentamerous flowers, leaf opposed

inflorescence are the ancestral characters (Hui *et al.*, 2011).

Climbing plants can be defined as; the plants that are rooted in the soil and whose stems are incapable of maintaining themselves erect, so that they need external support (Darwin 1867). Climbing plants are found in numerous ecosystems, but are more abundant in low elevation tropical forests than in any other habitat. According to Gentry (1983 a) climbing plants in temperate forests represent on average 7% of the local flora, while in tropical forests this number reaches 20%. These plants constitute a significant portion of the biomass of the forest, because of the large crowns than that of the trees that supports them. Some of the most conspicuous morphological traits found in many species of climbers that are useful in distinguishing different taxonomic groups at the level of family, genes or species (Putz and Chai, 1987).

Climbers have long and flexible stems that depend on external support to ascend erect and to reach desirable position in their habitat. For this reason their stem anatomy represents distinct alternation of vascular and parenchymatous tissues, isolated patches of pericycle that gives them considerable flexibility to withstand these types of pressure. Many lianas represent intraxillary phloem to mitigate the friction against the host trees (Dobbius and Fisher, 1986). In the forest ecosystem climbers play both positive as well as negative roles such as competition in the community for light approach, biomass production, host fragmentation, forests gap filling, and many more. Since historical time this group attracted taxonomist as well as the philosophers but still needs more exploration and study.

Amravati district is situated in the centre of the northern border of Maharashtra State. The district is distinctly divided into 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. There is also a low altitudinal trap of hills rising in the vicinity of Amravati and extending eastwards to some distance. 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 review of literature related that the flora of the district reveals that, the Melghat area as well as the plains attracted the attention of several workers since the time of British Empire. But R.I. Patel, a Forest officer initiate the significant study and published the 'Forest Flora of

Melghat' (1968). Later on M.A. Dhore (1886) explored the flora of overall district and published the flora of Amravati district. The flora described about 1084 species including 75 species of climbing plants from 34 families. The families having diverse climbing species include Papilionaceae, Cucurbitaceae, Vitaceae, Asclepiadaceae and Convolvulaceae. The floristic richness and its ethnobotanical significance of the district are thoroughly explored by most of the workers. But ecological aspects related to overall biodiversity is still waiting. In the investigated area the family Vitaceae confined 4 genera and 7 species which are diversified with respect to habit, habitat and distribution. The present investigation focused on the shadowed but significant characteristics of the family.

Review of Literature

From the literature cited it was observed that the floristic Survey of Melghat region of Amravati District satisfactorily investigated by Patel (1968) and published the flora of Melghat. The flora described about 600 species including 175 cultivated species in the area. Beside this the extensive work on the floristic of district has been carried out by Dhore (1986) in flora of Amravati District. The flora described about 1084 species from 126 families of the flowering plants including about 75 species belonging to 34 families which exhibit variable climbing habits. Recently Bhogaonkar and Devarkar re-explored Melghat area and added about 67 new species including some climbers. All these works were purely taxonomical and not focused over any ecological aspects.

The potentiality of climbing plants initially investigated by Darwin (1867) in the book, "On the movements and habits of climbing plants". He not only classified this group according to climbing mechanisms but also worked out their approaches to do so. Later on Schenck (1893), Putz and Mooney (2009), Schnitzer (1995), Carlquist (1988) focused over the pattern of distribution, adaptation in a community, behavior with respect to host, anatomical peculiarities and the forest significance of the climbing plants.

Vitaceae is one of the dominant and diversified families of climbing plants distributed throughout the tropical forests including India. The phylogenetic analysis of the grape family recently carried out by Hui *et al.* (2011). According to this study the family exhibit interesting geographical distribution patterns some genera are strictly regional, some are endemic and some are worldwide. Acevedo - Rodrigues (2005) described throughout families of climbing plants and assessed their resemblances. According to this study Vitaceae is one of the primitive families of angiosperms and may evolve into Asclepiadaceae.

Tendrils are the vegetative organs specialized for climbing and represent very complex biomechanics during ascend. Darwin (1867), Darwin (1980), Slatter (1979) and Hibbler (1983) thoroughly examined the origin, growth, behavior, coiling, anatomy and physiology of tendril in different families of Angiosperms. According to these studies tendrils are variously derived vegetative organs, begins relatively thin and straight structures, with the host approach tendrils circumnutates similar to twining shoots. Carlquist (1988) worked out the

anatomical peculiarities of Vitaceae and pointed out some significant peculiarities which help plant to develop flexile stems. Carlquist and Hockman (1885) investigated the wood anatomy and ecological aspects of Californian liana and revealed that, the Vitacean species shows largest vessels as compared to other liana. These characteristics should be considered as an adaptation to a xeric environment.

Lambordi (1997) focused on the nomenclature system given to the Vitaceae members i.e. *Ampelocissus* and *Cissus*. His work evidenced the validity to the published names in American literature. Wilson *et al.* (2006) investigated the morphological and anatomical development in family Vitaceae. Their work reveals that some species of Vitaceae shows important vegetative and reproductive differences among the species. In India, Chittibabu and Parthasarthy (2001), Reddi and Parthasarthy (2003), Rawal and Pangtey (1991), Parthasarthy *et al.* (2008) and Methumperumal and Parthasarthy (2010) prepared the preliminary list, patterns of diversity and phenology of climbing plants from different ecological zones. Ratnaparkhi (2007) investigated the community ecological studies in Melghat forest with emphasis on Ecotourism Thus in India and study area no such work related to listing, distribution, behavior and adaptations of any sort of climbing plant has been carried out so far...

Material and Methods

The present investigation pertains to Eco-taxonomical diversity of Vitacean climbing plant of Amravati District (M.S). The study was based on extensive and intensive field trips made during different

seasons of 2011-2013. During the course of field study the authors have explored the entire district including Melghat and different habitats of Vitacean climbers were selected for the study. Regular field trips were made twice in a month to different selected habitats for the collection of climbing species and important field notes. The study focused on the seedling growth, searching shoots, climbing mode, flowering, fruiting and overall forest significance of each Vitacean species. During this course wet stem samples were collected to analyze the anatomical peculiarities of each species. The specimens were pressed, dried and preserved and properly identified with the help of available literature and expertise. The field data and literature of all the investigated species were finalized and compiled for further procedure.

Results and Discussion

During the study period the authors have reported a total of 6 Vitacean climbing species belonging to different habitats. Out of the 6 species 5 was naturalized in the study area and remaining one was rarely cultivated in houses. The investigated species are *Ampelocissus latifolia* (fig.1), *Cissus repanda* (fig.7), *Cissus vitiginea* (fig.9), *Cayratia auriculata* (fig.3), *Cayratia trifolia* (fig.5) and *Vitis venifera* (fig.11).

As far as distribution pattern of investigated species are concern, *Cayratia auriculata* and *Cissus repanda* are strictly confined along with hilly tracts of Melghat area. Whereas, *Ampelocissus latifolia* and *Cayratia trifolia* distributed along the plains. *Cissus vitiginea* found to be adapted to both hilly forests as well as plain area. *Vitis venifera* rarely cultivated in one or two houses of Amravati urban

area. The host community preferred by *Cayratia auriculata* was shrubs and trees especially along banks of streams and hill slopes. *Cissus repanda* usually grows in association of large diameter trees particularly along thick and high altitudinal forested area. In the plains *Cayratia trifolia* dominantly distributed in different habitats such as suburban, garden, roadside, agricultural as well as Pohara - Malkhed forest ranges. The host preference of this species was also diverse such as old, barren walls, riverian rocks, roadside trees and ornamental garden plants. *Cissus vitiginea* usually distributed along hill slopes of Melghat and in thickets, on bushes and trees particular along stream banks in plains. *Ampelocissus latifolia* observed in association with the thick community of *Acacia* and *Ziziphus* along Pohara – Malkhed forest borders and low line hills of Warud Tahsil. The diverse distribution pattern of Vitacean climbers also observed by Genry (1983 a) while investigating neotropical diversity of climbing taxa .

Depending upon the two distinct climatic belts of the district the growth form of the investigated taxa shows remarkable variations. Out of 6, the *Cayratia auriculata* and *Cissus repanda* was extensive woody climber, *Cissus vitiginea* was moderate climber with woody base, where as the *Cayratia trifolia* and *Ampelocissus latifolia* shows perennial, herbaceous, climbing habit. The seedlings of *Cayratia auriculata* *Cissus vitiginea* and *Ampelocissus latifolia* usually grow in the thickets or along hedges and bushes and approaches large support in the next stages of development whereas, of *Cissus repanda* and *Cayratia trifolia* strictly grows in association with

permanent host. This observations regarding to Vitacean climbers resembles with Panamanian lianas investigated by Gentry (1983).

Taxonomically Vitaceae differ in leaves, tendrils, branching orientation, community association and economical significance. Similar observations made by Darwin (1880) and Rawal and Pangtey (1991). Leaves of *Cayratia* species are palmately compound, whereas shallowly 3-5 lobed in *Cissus* and *Ampelocissus*. Tendrils are simple in *Cissus vitiginia* (Fig.10) and branched in other species of Vitaceae. Branched tendrils in *Cissus repanda* (Fig.8) and *Cayratia trifolia* (Fig.6) are stout, reduced with terminal flattened, adhesive discs. Whereas branched tendrils of *Cayratia auriculata* (Fig.4) and *Ampelocissus latifolia* (Fig 2) are slender, long, becomes woody with the host approach. The origin of tendrils in *Ampelocissus* is also adaptive, during vegetative growth tendril remains auxiliary, while during reproductive growth tendril arise from inflorescence axis which not only support growing stem but also fruiting branch. In most of the species tendrils are 10-15 cm. in length with curved apex which is suitable to approach and grasp the host of variable diameter.

In the forest community *Cissus repanda* and *Cayratia trifolia* ascend superficially over the host surfaces, without lodging any extra burden. Both these species should ascend not only over tree barks but also over rough rocks and buildings. On the other hand *Cayratia trifolia*, *Cissus vitiginea* and *Ampelocissus latifolia* require thick canopy of host to ascend because of much branched nature. These species should cover entire

community and reduces their photosynthetic area. In the thick community these species shows vigorous growth with long internodal distances. The seedling after approaching the host always tried to ascend at the top. On the other hand the *C. repanda* and *C. trifolia* grows gradually in association with the host. Similar to that of other tropical lianas the mature plants becomes leafless at the bottom and represent clustered leaves at the top of host. Such a growth pattern is considered as heteroblastic development (Givnish, 1987). All species normally reproduced through seeds. Sometimes vegetative propagation by nodal rooting observed in *Cayratia auriculata*.

Beside that of toxo-ecological peculiarities climbers plays significant role in forest ecosystem. (Parren and Bongers, 2005). Similar to this view it was observed that the vitacean members plays significant role in both Melghat as well as Pohara – Malkhed regions. *Cissus repanda* and *Cayratia trifolia* usually shows association with trees. Vigorously growing liana had tendency to grow at the top in the forest community. Similarly the host trees also compete with liana by fast growth and increase in photosynthetic area. Extra burden by liana sometimes causes host fragmentation. On the other hand liana association protect host from lodging over hill slopes. Seedlings growth in open areas fills up the forest gaps and maintains the greenery. The hanging networks of branches provide the so called ladder for arboreal fauna in the forest ecosystem. The terminal panicles or cymes and the red-black berries of Vitacean climbers provide great rewards to both insects and avian fauna.



Fig. 1 Ampelocissus latifolia habit



Fig. 2 Tendril attachment



Fig. 3 Cayratia auriculata habit



Fig. 4 Tendril attachment



Fig. 5 Cayratia trifolia habit



Fig. 6 Tendril attachment



Fig. 7 *Cissus repanda* habit



Seedling



Fig. 8 Tendril attachment



Fig. 9 *Cissus vitiginia* habit



Fig. 10 Tendril attachment



Fig. 11 *Vitis venifera* habit



Fig. 12 Tendril attachment

Conclusion

The conclusion drawn on the basis of extensive field study and observations is that, the investigated area had great diversity of Vitacean flora with respect to their distributional pattern, seedling development, growth form, tendril orientation and its approach towards host, community interaction and forest significance. The climbers grows them in association with host, sometimes the woody stem may acts as host for herbaceous twines, ascend within their limitations and always try to cover host canopy. The utilized berries by birds or some other agents causes climbers dispersal and provide opportunity to germinate over the forest gaps. This interaction within community is just seems like natural wound hilling property.

Occasionally such a significant group of forest ecosystem becomes the victim of forest management, under which liana cutting preferred for the welfare of the trees. It's a truly nonsense activity and happened because of lack of knowledge and supervision.

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