



## THREATS AND CONSERVATION SIGNIFICANCE OF CLIMBERS AT ARID LAND, KACHCHH, GUJARAT

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### ABSTRACT

Kachchh district falls under the Arid Bio-geographic Zone of the country having distinct floristic and faunal composition due to its distinct climatic condition. Now in recent decades, the changing climatic conditions and several anthropogenic activities have led to the unknowingly loss of several plant species. Climbers are one among the unique floristic compositions of the dryland habitat of Kachchh which are distributed in all types of habitats. With the loss of many of the host species in their natural habitat, climbers are facing threats to their survival at present. Therefore, the study has been carried out to assess various threats on climbers, to mitigate and conserve the native climbers' species of this landscape. Threats on climber's species were made using the rapid threat assessment (RTA) technique.

The survey observed different types of threats on climbers, including; habitat loss, intensive resource use, harvesting for food and medicine, infra-structure development, invasion, etc. Among the climber species of the district; *Corallocarpus epigaeus*, *Ipomoea muricata*, *Tinospora cordifolia* as the highest risk, while *Bougainvillea spectabilis*, *Merremia aegyptia*, *Ipomoea pes-caprae* has the lowest risk.

The study concluded that climbers are an ecologically important flora distributed in all habitats of the district and the intensity of threats was found to vary from species to species and also among the habitats of its distribution. Therefore, suitable conservation measures need to be adopted preferably for the species and habitats which are comparatively facing more threats.

**KEYWORDS :** Climbers, Arid region, Threats, Conservation, Kachchh

### INTRODUCTION

Kachchh district falls under the Arid Bio-geographic Zone of the country having distinct floristic and faunal composition due to its distinct climatic condition. The district has a reservoir of unique gene pools of various plant species adopted to flourish in extreme climatic conditions. Climbers are one among the unique floristic compositions of the dryland habitat of Kachchh which are distributed in all types of habitats. Now in recent decades, the changing climatic conditions, desertification and several anthropogenic activities have led to the unknowingly loss of several plant species. In addition, the spread of *Prosopis juliflora*, an invasive alien plant species many of the natural habitats of native floral species are under threat. With the loss of many of the host species in their natural habitat, climbers are facing threats to survival at present.

The advancement of humans as a species has resulted in several complicated consequences that span across the globe, affecting numerous other species co-habiting the planet (Wyka *et al.*, 2019). As a result, in many cases over time, entire ecosystems are found to be under varying degrees and types of human-induced stresses. Further, consequences due to ongoing climate change are affecting the local environment and ecology of different types of vegetation in many areas, mostly in areas having extreme climates such as arid land.

The climbers are largely used by local communities especially those surviving in areas near the settlement (Putz, 1984; Muthumperumal and Parthasarathy, 2010). Although climbers are a large group of plants that have been known to have prominent ecological and medicinal value (Schnitzer and Bongers, 2002; Mahmood, 2019; Kumar & Satapathy, 2019), they are largely unexplored, unlike major tree species in the area. They are a group of plants that depend on other plant species (either for physical support or a host or both) and include vines (Valladares *et al.*, 2011) climbers, scandent, and creepers. They actively search for support by employing a

variety of searching movements, also known as directional tropic growth (Gianoli, 2015). In a natural environment, due to anthropogenic stresses, climbers are, quite frequently, unable to find their ideal hosts conveniently and/or in close proximity – since the host population and distribution are adversely affected by human-induced stresses (Wyka *et al.*, 2019).

Kachchh, with its arid geological fabric and erratic rainfall, supports a very peculiar and limited set of biodiversity, as opposed to other better-watered biomes. This unique biodiversity becomes extremely vulnerable to species loss, and consequently, to percentage-loss of biodiversity, due to the arid landscape. The region has seen several major environmental changes in the recent past (such as climate change, desertification, land degradation, salinity ingressions and increased anthropogenic stresses) highlighting the need to constantly monitor climbers, especially ones that are of high ecological and medicinal value in the study area. Therefore, biodiversity in this area demands high conservation priority (Patel *et al.*, 2014). Not only do the climbers provide ecological support to the fauna in the region, but also to the people and cattle inhabiting Kachchh – by being a potent and abundant source of traditional medicine, food, and fuel (Vijaykumar *et al.*, 2022). However, as mentioned previously, only limited studies have identified and studied the status of climbers and their ecological significance.

Kachchh's floristic biodiversity faces threats, both natural and anthropogenic. The natural threats include; desertification, land degradation, salinity ingressions, climate change and invasion of alien species, while anthropogenic threats include; loss of habitat by industrialization, mining, intensive agriculture, overgrazing, exploitation of forestry resources, etc. These threats lead to the direct loss of native climber species as well as indirectly through the loss of host species of climbers. Thus, the study aims to assess various threats of climbers in various ecosystems of this district and its conservation significance. Therefore, the study has been carried out to assess various threats on climbers, to mitigate

and conserve the native climbers' species of this landscape.

**MATERIALS AND METHODS**

**Study Area**

Kachchh district spans 45,674 sq. km, covering 23.27% of the total geographical area of Gujarat state of India. 51% per cent of this area is occupied by highly saline, unproductive Rann of Kachchh. Kachchh district extends from latitudes 22° 04' - 11" to 24° 41' - 25" N and longitudes 68° - 09' - 46" to 71° - 54' - 47" E and includes the Kachchh peninsula. The total area of the district is 45,674 km<sup>2</sup> which is 23.27 % of the total geographical area of Gujarat state, and is the largest district of India. The district shares the longest coastline of the Gujarat state which is about 406 km. About 51 percent area of Kachchh is occupied by high saline unproductive deserts (Greater Rann of Kachchh-GRK and Little Rann of Kachchh-LRK) and 34.73% of the area is under agriculture. The coverage of forest area is 15.67%. The district has 17.31% of their cultivable land as unutilized land, and 21.07% of land as wasteland. Pastureland forms 3.58% of the geographical area. The climate of the district is characterized by long hot summers, cold winters, and very scattered rain in monsoon which represents overall aridity. Several major types of ecosystems and distinct transitional ecotones are evident in the district. Grassland, savannah, thorn forest and scrublands are the major productive terrestrial ecosystems.



Figure 1. Study area and its location

(Our study area covers 22,381 sq. km. of the 45,674 sq. km. (Mainland Kachchh) and excludes GRK and LRK since no vegetation is found in those regions.)

**Methodology**

The survey and sampling of various threats and conservation significance of climber species, the whole study area was divided into 55 grids (5 km X 5 km) for inventory of climbers and their hosts and supports. The grids were randomly selected on the major ecosystem/habitat types, such as; tropical thorn forest, agriculture, coastal ecosystem, wetland and grassland. To study the threats to climber species, ecological assessments were made through a floristic survey using systematic sampling and threats were estimated using the Rapid Threat Assessment (RTA) technique as adopted by Pandey *et al.* (2018). The threats on each climber species encountered during the survey were noted using various major threat criteria such as; plant parts used, lifespan,

habitat type, distribution, use type, Host Plant Support and Invasive *Prosopis juliflora*. Based on the above criteria, threat scores were calculated using the status of host plant/support type, population, degree of grazing, degree of deforestation, degree of encroachment by *Prosopis juliflora*, degree of soil erosion, degree of pollution and user type. With the threat score, threat categories of recorded climber species were estimated.

**RESULTS AND DISCUSSION**

A total of 75 climber species belonging to 15 families and 54 genera were recorded from the study area during the threat assessment study in various ecosystem/habitat surveys. Among the various habitats, the majority of the species were recorded from the cultivation (34 species) and forest areas (32 species) and the least number of species was recorded from the wetlands (8 species).

Threats based on the criteria, Use of plant parts, the study found that whole plant and root of 37.3% of climber species were used for various purposes, followed by flowers, fruit and seeds of 35% of climbers, and thus, due to use of various plant parts more than 70% species were under threats (table 1). The study also revealed that perennial species are more prone to threats and only 7% of the species of recorded climbers are perennials hence, the least number of species are under threat based on the threat criteria of life span. Further, the study revealed that climber species present in unproductive land and in grassland and fellow land were more prone to threat as these lands are prone to overgrazing. A total of 33% of climber species were recorded or restricted in only one type of habitat/ecosystem, hence these species are comparatively more prone to threats to their survival.

The climber species which are mostly used for medicinal and food are facing more threats due to their use value, and the study recorded that about 80% of climbers are used for ethno-medicine and food purposes by the local community and also harvested by various agencies for business. It was also found that more than 75% of the species were only used by the local communities for their ethno-medicinal purposes and hence, these species were least prone to threats for survival. About 50% of the climber species population is very low or low and they were scarce or thinly distributed in the district, hence these species were facing more threats. The population of livestock in the district is high and therefore, the majority of the grassland, fellow land and forests are overgrazed. Thus, climbers distributed in these areas were facing threats to their survival.

Further, *Prosopis juliflora*, an alien invasive species of the district, resulted loss of many native species and their populations which were the natural host species for the climbers. Due to the loss of host species, native climber species were facing threats in the district. It was also found that many of the native species were recorded over the *P. juliflora* which showed that those climber species are acclimatized to grow on invasive species.

Table 1: Threat Criteria, Indicators And Threat Score Observed For The Climbers Of The District.

Sr. No.	Criteria	Category/Indicator	Threat Score	Result (% of species)
1	Use of Plant Parts	Rhizome/root/whole plant	4	37.33%
		Bark, stem	3	13.33%
		Inflorescence, flower, fruit, seed	2	34.66%
		Leaves	1	1.33%
2	Lifespan	Long-lived perennial (> 5 years)	4	6.66%
		Short-lived perennial (3-5 years)	3	29.33%
		Multiyear (1-2 years)	2	50.66%
		Annual (<1 year/seasonal)	1	13.33%
3	Habitat	Gravel, Rocky, Barren	4	1.33%
		Grassland, Pastureland, Wasteland	3	42.66%
		Agriculture/Managed land	2	57.33%

		Forest	1	1.33%
4	Distribution	One habitat	4	33.33%
		Two habitats	3	38.66%
		3 or 4 habitats	2	18.66%
		Multi habitat	1	9.33%
5	Use Type	Medicinal value	4	21.33%
		Edible (fodder or food)	3	57.33%
		Other use (fuel, ornamental)	2	18.66%
		Not used	1	1.33%
6	Host Plant Support	No support/on ground	4	2.66%
		Manmade	3	5.33%
		Prosopis juliflora	2	57.33%
		Native, not species-specific	1	34.66%
7	Population	Scarce	4	10.66%
		Low	3	40%
		Moderate	2	29.33%
		Abundant	1	20.00%
8	Grazing	more than 75% sample	4	0.00%
		50-75% sample	3	18.66%
		25-50% sample	2	76.00%
		less than 25% sample	1	5.33%
9	Cutting	more than 75% of sample	4	0.00%
		50-75% of sample	3	70.66%
		25-50% of sample	2	28.00%
		less than 25% of sample	1	1.33%
10	Invasive species	more than 75% of quadrat	4	0.00%
		50-75% of quadrat	3	26.66%
		25-50% of quadrat	2	60.00%
		less than 25% of quadrat	1	13.33%
11	soil erosion	Extreme	4	0.00%
		High	3	0.00%
		Medium	2	25.33%
		low	1	5.33%
12	Pollution	No	0	66.66%
		Extremely	4	0.00%
		High	3	0.00%
		Medium	2	9.33%
13	User group	low	1	89.33%
		Local self-use + Local barter	4	4.00%
		Local self-use + Local &/or general trade	3	9.33%
		Local self-use + Local barter	2	9.33%
		Local self-use	1	77.33%

In the overall analysis of the threats on recorded climber species of the district based on threats score, a total of 6 species were facing the highest threats which include; *Corallocarpus epigaeus*, *Ipomoea muricata*, *Abrus precatorius*, *Ceropegia bulbosa*, *Mucana prurita* and *Tinospora cordifolia*. Out of the total recorded species, more than 85 percent of species are facing medium to moderate level of threats while three species, namely; *Bougainvillea spectabilis*, *Merremia agyptica* and *Ipomoea pes-carpae* were facing the low levels of threat or have no threats for their survival in the district.

**Conservation Significance**

Climbers play an important ecological role in most of the ecosystems present in arid environments. They were recorded in all-natural as well as in manmade ecosystems of the district. As a vast array of the land in this district is barren and devoid of vegetation, climber provides cover to the open soil and maintains soil moisture, along with other dry land vegetation. Further, the environment and biodiversity of the district face several natural threats like land degradation, desertification, salinity ingression, and climate change, climbers play an important role in the maintenance of vegetation and biodiversity due to their multiple roles such as maintenance of soil moisture, control of soil erosion, growth of understory vegetation and food and shelters for many of the faunal species. In addition, the study revealed that more than 75 per cent of respondents used climber species for ethno-

medicine and food, showing the dependency of the local community on climbers. Therefore, the conservation of climbers in the district is very important for the maintenance of ecology and biodiversity, and in providing valuable natural resources to the local community of this arid district.

**CONCLUSION**

Climbers in Kachchh are a group of plants exposed to extreme arid climate along with being dependent on other species for host/support (this exposes them to an additional layer of stress for anything that affects the host/support, also affects the dependent climbers directly or indirectly. Other major threats as listed with the help of this study are overuse, deforestation, amplified human influence via urbanization, agriculture and overgrazing, and the expanding dominance of the invasive *Prosopis juliflora*.

The study concluded that climbers are an ecologically important flora distributed in all habitats of the district and the intensity of threats was found to vary from species to species and also among the habitats of its distribution. Therefore, suitable conservation measures need to be adopted preferably for the species and habitats that are comparatively facing more threats.

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