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# Floristic Diversity of Climbing Plants of Ballari District: Its Utility and Conservation

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**ABSTRACT**
This study embarked on a thorough investigation of climber species in Ballari district, yielding a rich repository of 40 species consisting of 16 families, with Cucurbitaceae 9 species, followed by Apocyanaceae 8 species and Convolvulaceae 7 species, emerged as the dominant 3 families,. Herbaceous climbers were 29 species followed by woody climbers with 11 species, with twining 24 species being the prevalent climbing mechanism, followed by tendrils 13 species and straggling unarmed 1 species. Notably, these climbers exhibited a wide range of uses, including medicinal, ornamental, economic, and other applications.

**Keywords:** Repository, **Climbers**, Emerged, Twining, Tendrilar, Straggling.

## INTRODUCTION

Climbing plants, or climbers, are a fascinating group of species that have evolved remarkable adaptations to ascend and thrive in a wide range of environments. From the delicate tendrils of grapevines to the sturdy stems of ivy, climbers have developed unique strategies to overcome gravity and reach for the sky. With their ability to scale vertical surfaces and exploit resources not available to non-climbing plants, climbers play a significant role in shaping ecosystems and supporting biodiversity. Climbers are broadly divided into herbaceous (vines) and woody climbers (Lianas), which are further divided into five major types: twiners, tendril climbers, root climbers, hook climbers, and scrambles, based on their climbing strategies.

Globally, Apocynaceae and Leguminaceae stand out as the most prominent families among climbers, with over 2000 species each, while Convolvulaceae ranks third, with over 1000 species (Hu & Li, 2015). These three families account for approximately 25% of all climbing plants worldwide. Consistent with previous studies (Cai & al., 2009; Ghollasimood & al., 2012; Anbarashan& Parthasarathy, 2013), stem twiners are the most frequent climbing plants in tropical forests.

Climbers can be found in various habitats, from tropical rainforests to temperate forests, and even in urban landscapes. They have evolved to occupy a wide range of ecological niches, from sun-loving vines to shade-tolerant epiphytes. With over 1,000 species across 70 plant families, climbers exhibit an astonishing diversity of forms, functions, and adaptations. Despite their importance, climbers remain a relatively understudied group, with many aspects of their ecology, evolution, and diversity awaiting further investigation.

While some climbers are celebrated for their ornamental value, medicinal properties, or economic importance, others are considered invasive species, posing threats to native ecosystems. This study aims to contribute to our understanding of climbers by exploring their diversity, distribution, and uses. By examining the characteristics, adaptations, and ecological significance of climbers, this research seeks to shed light on the complex relationships between these plants and their environment, through a comprehensive analysis of climber species, their habitats, and their roles in ecosystems.

## MATERIALS AND METHODS

Plant samples were collected from diverse geographical locations in Ballari district, Karnataka. It is situated in the eastern part of Karnataka with geographical coordinates, $15^0 30'$ to $15^0$ 50'north latitude and $75^0$ 40' to $77^0$ 11' east longitude. The district has semi-arid to arid climate and hot summers with 600mm rainfall. Ballari's vegetation consists of dry deciduous forests, scrublands, and grasslands.

Current survey has been carried out from January 2023-June 2024. The collected plants are identified with the aid of flora. The plant names were updated using the plant list (www.worldfloraonline.org). The plants collected were subjected to chemical treatment for killing, fixing and made herbarium accordingly, indicating the conservation status as per IUCN red list of threatened species.

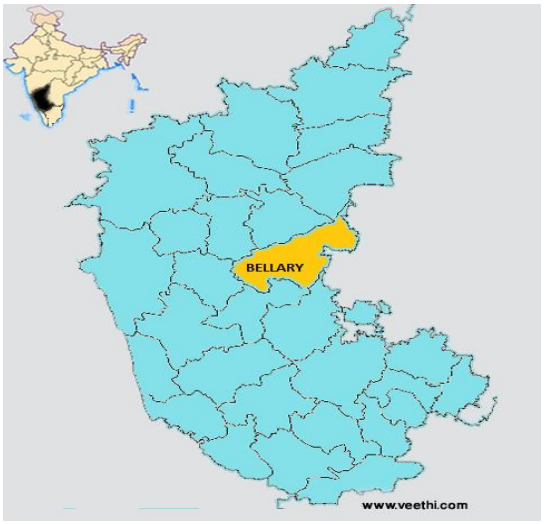


**Figure.1: Map representing Ballari district.**


**Figure.2: Enlarged map view of Ballari district.**

## RESULTS AND DISCUSSION

This study presents a comprehensive documentation of 40 species of climbing plants, representing 16 families, collected from various areas in Ballari, Karnataka, India. The most dominant families are Cucurbitaceae 9 species (22.5%) followed by Apocynaceae 8 species(20%) and Convolvulaceae 7 species(17.5%) in Figure 3. Fabaceae, Menispermaceae, and Aristolochiaceae also contribute significantly, with 3, 2, and 1 species, respectively. Additionally, Asparagaceae, Balanitaceae, Basellaceae, Sapindaceae, Vitaceae, Cobretaceae, Acanthaceae, Rhamnaceae, and Passifloraceae are represented by one species.

The *Ipomeae* emerges as the most diversified genus, with 6 species, followed by *Cucumis* 4 species and *Momordica* 2 species.

The current research categorizes the enumerated with three climbing modes: twining 24 species (62.5%), tendrilar 13 species (30%), and stragglers-unarmed one species (2.5%) in Figure 4.Consistent with previous studies (Cai & al., 2009; Ghollasimood & al., 2012; Anbarashan& Parthasarathy, 2013), stem twiners are the most frequent climbing plants in tropical forests.

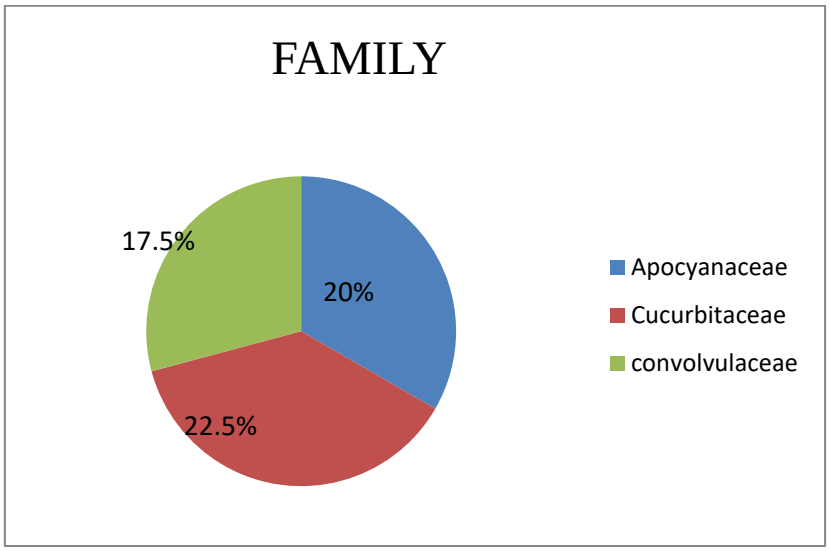


**Figure.3: Top 3 families of the climber**

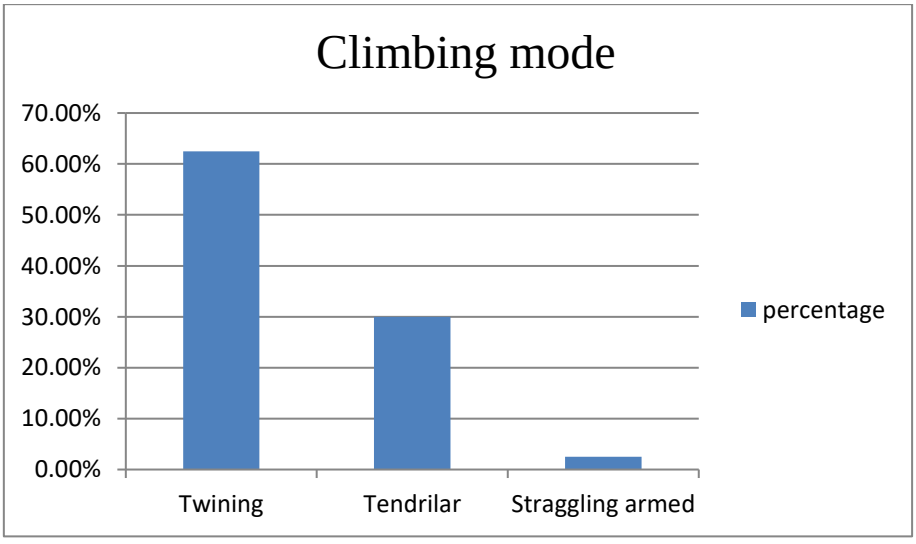


**Figure.4: Climbing mode distribution of the climbers**

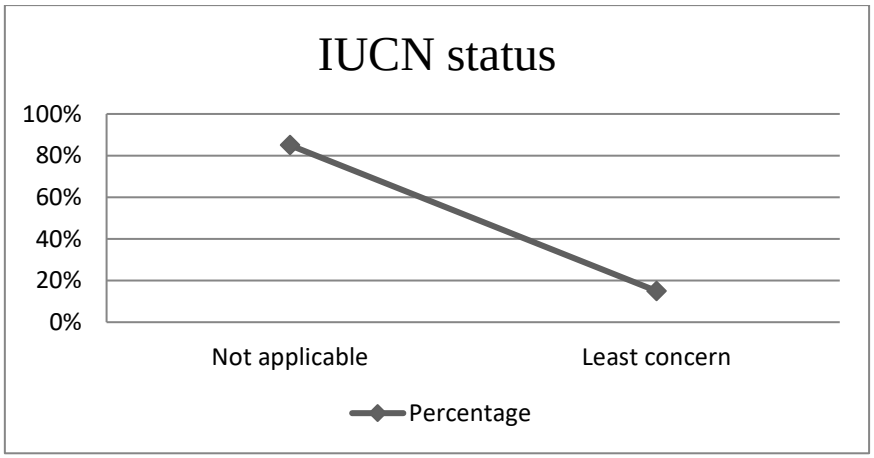


**Figure.5: IUCN status of the climbers**

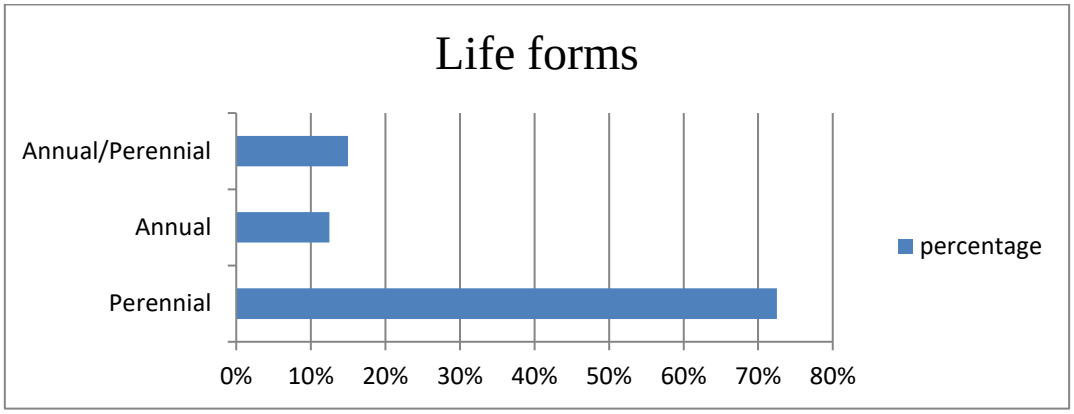


**Figure.6: The life forms of the climbers**

An evaluation of the 40 documented climber species revealed that 6 species fell under the Least Concern category (15%), while 34 species were Not Applicable to the Red List category (85%), according to IUCN Red List criteria in Figure 5.In terms of life forms, the majority of climbers were perennials 30 species (75%), followed by annuals 4 species (10%), and a combination of both annuals and perennials 6 species (15%) which is presented in Figure 6.

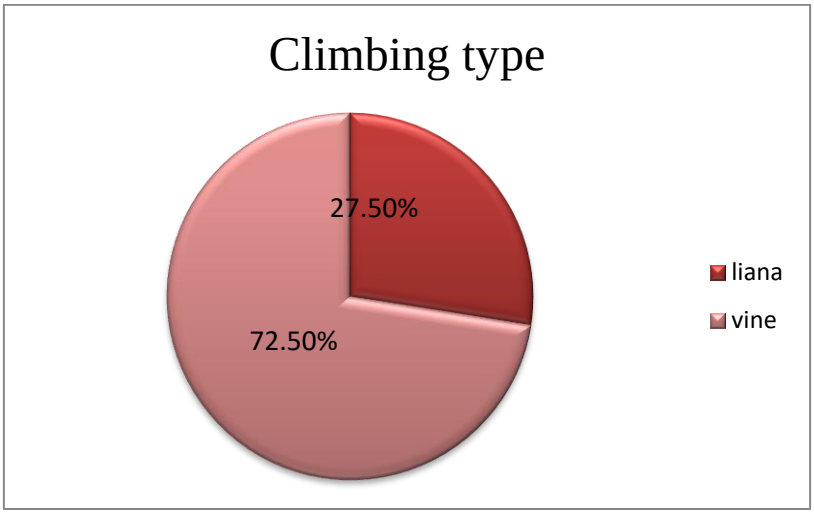


**Figure.7: The climbing type of the climbers**

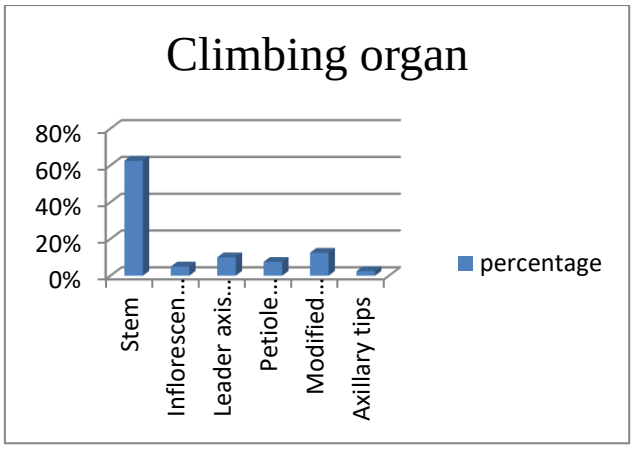


**Figure.8: The climbing organ of climbers**

Among the 40 species collected, the climbers are of two main types: woody lianas 11 species (27.5%) and herbaceous climbers 29 species (72.5%) in Figure 7, along with the 6 climbing mechanisms that is stem 25 species (62.5%), inflorescence axis 2 species (5%), leader axis and branches 4 species (10%), petiole tendril 3 species (7.5%), modified auxillary buds 5 species (12.5%) and axillary tips 1 species (2.5%) in Figurr 8.

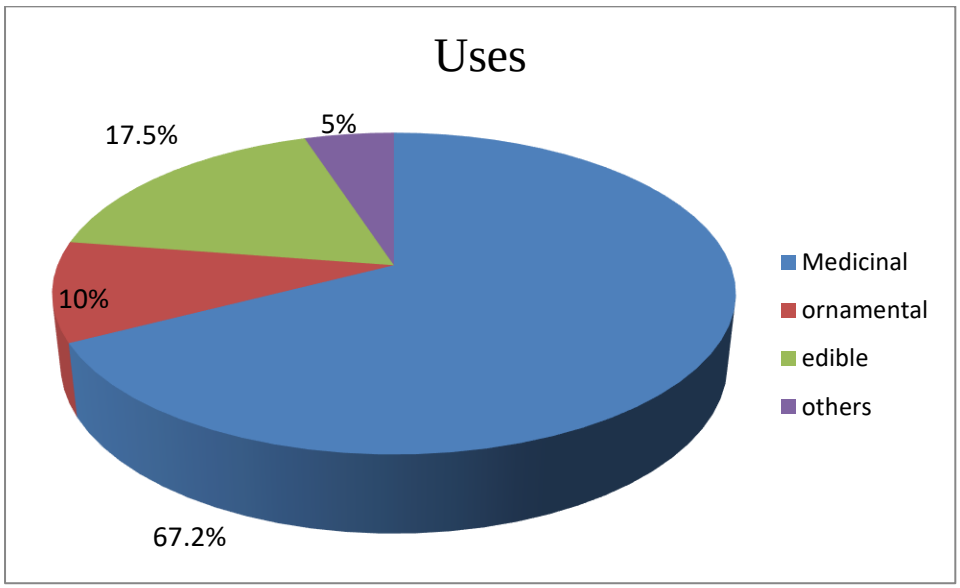


**Figure.8: uses of the climbing plants.**

In the Figure 8, different uses of the climbing plants are representing 27 species with medicinal uses (67.2%), 4 species ornamental (10%), 7 species edible (17.5%) and 2 species of other uses (2.5%).
Notably, the fruits of *Coccinia grandis*, leaves of *Basella alba*, and roots/tubers of *Hemidesmus indicus* are highly sought after for their medicinal properties and human consumption. Historically, the seeds of *Abrus precatorius* were used by jewelers as weight measures. Globally, local communities utilize climbers for various purposes (Bongers & al., 2005).
In the tropical forests of India's Southern Eastern Ghats, 82 species have been found to possess economic value, including 62 species with medicinal properties, six with edible fruits, two with both edible and medicinal properties, and 12 used for fuel, fodder, cover crops, rope making, and furniture

(Muthumperunal & Paethasarathy, 2013).

The most commonly used medicinal plants include Abrus precatorius, *Cocculus hirsutus*, *Cuccuta reflexa*, *Pergularia daemia*, and *Tinospora cordiflolia*, which are used to treat various ailments such as dysentery, skin diseases, fever, cough, cold, abdominal pain, and gastrointestinal disorders. Tubers and fruits are harvested from forest areas and sold directly or through commission agents.

The fruits of *Coccinia grandis*, *Momordica chanrantia*, *Passiflora foetida*, and other species are collected from forests or cultivated areas and sold in markets. Certain climbers like *Abrus precatorius*, *Asparagus racemosus*, *Aristolichia indica*, *Clitoriaternata*, and *Tinospora cordiflolia* have high commercial potential due to their high industrial demand."

Forest ecosystems are facing unprecedented threats, including degradation and over-exploitation of plant resources (Bonati, 1991). Climbing plants, an important component of these ecosystems, are particularly vulnerable to these impacts. This review highlights the devastating effects of forest degradation and indiscriminate collection on the phytochemical properties and survival of climbing plants.

The destructive collection of wild populations before seed set not only reduces the availability of climbers in their native habitat but also leads to the categorization of several species as threatened. Climber plants are more threatened than species from which leaves are harvested, especially when reproductive organs used for medicinal purposes become rare and threatened (Chaudhari, 2007).

Woody climbers, such as *Tinospora* and *Cissus*, require a vigorous host plant for survival, and removing the host plant negatively impacts their survival (Richardson & al., 2000). Conservation efforts should focus on preserving these species before they become rare in the region. Interestingly, climbers can also act as transformer species, altering the microenvironment where they become dominant, especially when invasive.

This review emphasizes the need for sustainable collection practices and conservation efforts to protect climbing plants from the threats of forest degradation and over-exploitation. By preserving these species, we can maintain the integrity of forest ecosystems and ensure the long-term survival of these valuable plant resources.

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|---|---|---|---|
|  |  |  |  |
| **A** | **B** | **C** | **D** |
|  |  |  |  |
| **E** | **F** | **G** | **H** |

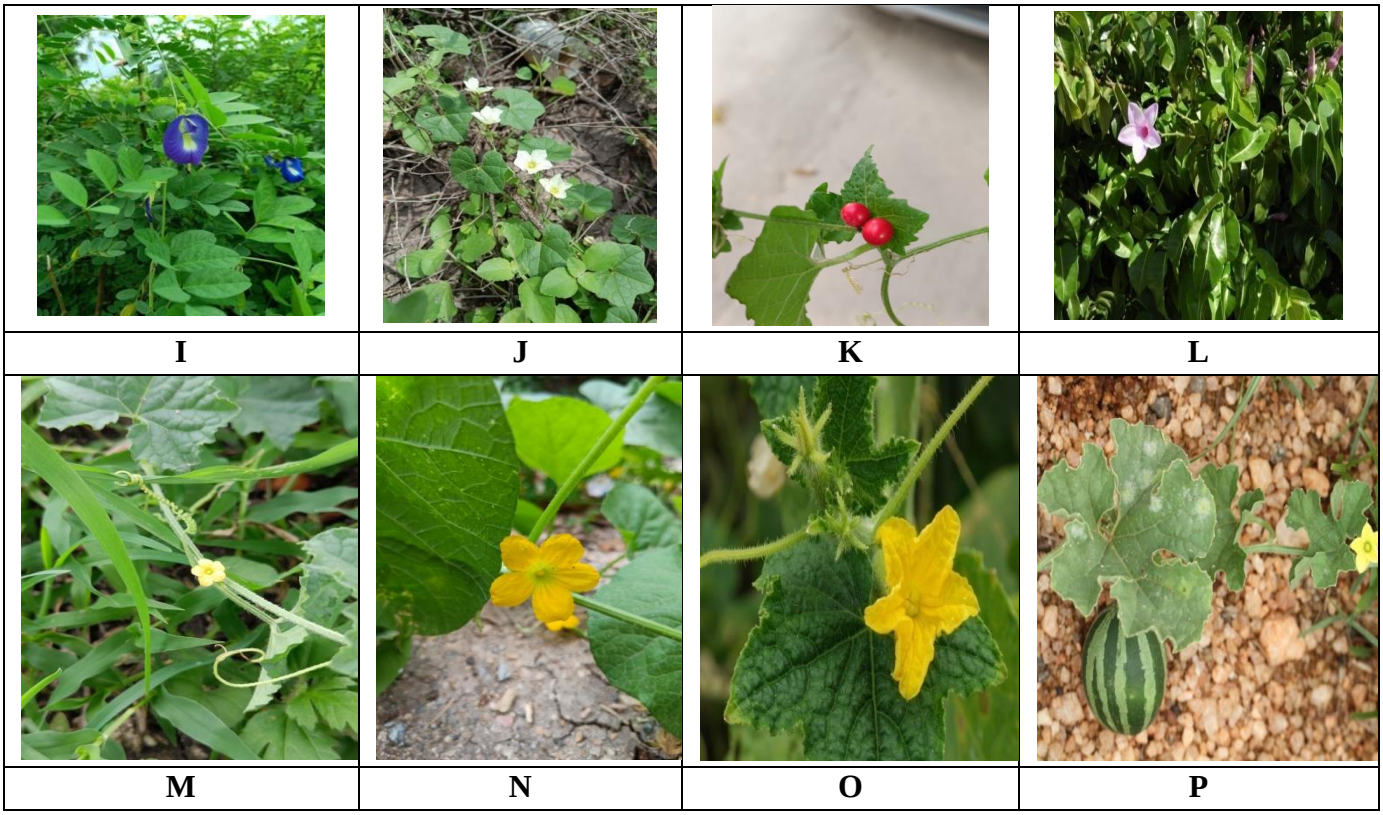


Figure.5: A-*Momordica charantia*, B-*Allamanda blanchetti*, C-*Passiflora foetida*, D-*Trachelospermum jasminoides*, E-*Pergulariadaemia*, F-*Rhynchosia minima*, G-*Tinospora cordifolia*, H-*Thunbergia erecta*, I-*Clitoriaternatea*, J-*Coccinia grandis*, K-*Cucumis maderaspatanus*, L-*Cryptostegia grandiflora*, M-*Cucumis prophetarum*, N- *Cucurbita maxima*, O-*Cucumis melo*.

| Sl. no | Name of species | Family | IUCN status | Habitat | Climbing mode | Climber type | Climbing organ | Life form | Uses |
|---|---|---|---|---|---|---|---|---|---|
| 1 | *Abrus precatorius* L. | Fabaceae | NA | Terrestrial | Tw | L | St | P | Medicinal |
| 2 | *Allamanda blanchetti* A.DC. | Apocynaceae | NA | Roadside, yards | Tw | V | St | P | Ornamental |
| 3 | *Antigonum leptocus* Hook&ARN. | Polygonaceae | NA | Forest edges | Td | V | In | P | Medicinal |
| 4 | *Aristolochia acuminata* Lam. | Aristolochiaceae | NA | waste lands | Tw | L | In | P | Medicinal |
| 5 | *Asparagus racemosus* Willd. | Asparagaceae | NA | Fallow lands | Tw | V | La | P | Medicinal |
| 6 | *Balanites aegyptiaca* (L.) Delile | Balanitaceae | NA | Valleys, open areas | Tw | L | La | P | Medicinal |
| 7 | *Basella alba* L. | Basellaceae | NA | Farms/Fields | Tw | V | St | P | Medicinal |
| 8 | *Cardiospermum helicacabum* L. | Sapindaceae | LC | Grasslands | Td | V | Pt | A/P | Medicinal |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9 | *Cissus quadrangularis* L. | Vitaceae | NA | Scrub jungles | Td | V | At | P | Medicinal |
| 10 | *Clitoria ternatea* L. | Fabaceae | NA | Grasslands | Tw | V | St | P | Medicinal |
| 11 | *Cocculus hirsutus* (L.)W.Theob. | Menispermaceae | NA | Open areas | Tw | V | St | P | Folk medicine |
| 12 | *Coccinia grandis* (L.)Voigt | Cucurbitaceae | NA | waste lands | Td | V | Ab | P | Medicinal |
| 13 | *Combretum indicum* (L.) DeFilipps | Combretaceae | NA | Rain forests, hedges | Tw | L | St | P | Medicinal |
| 14 | *Cryptolepis dubia* (Burm.f) M.R.Almeida | Apocynaceae | NA | deciduous forests | Tw | L | St | P | Medicinal |
| 15 | *Cryptostegia grandiflora* Roxb.exR.Rr | Apocynaceae | NA | Gardens, Lake side | Tw | L | St | P | Medicinal |
| 16 | *Cucumis prophetarum* L. | Cucurbitaceae | NA | Wastelands | Td | V | St | P | Medicinal |
| 17 | *Cucumis maderaspatanus* L. | Cucurbitaceae | NA | Grasslands | Td | V | St | A | Edible |
| 18 | *Cucumis melo* L. | Cucurbitaceae | NA | Forest areas | Td | V | Ab | A | Medicinal |
| 19 | *Cucumis sativus* L. | Cucurbitaceae | NA | savanna, shrubland | Td | V | Ab | A | Edible & Medicinal |
| 20 | *Cucurbita maxima* Duchesne | Cucurbitaceae | LC | Savanna | Td | V | Pt | A | Medicinal |
| 21 | *Evolvus alsinoides* (L.)L. | Convolvulaceae | NA | Yards, roadsides | | L | La | A/P | Ornamental |
| 22 | *Hemidesmus indicus* (L.) R.Br.exSchult. | Apocynaceae | NA | scrub jungles, slope | Tw | V | St | P | Medicinal |
| 23 | *Ipomoea aquatica* Forssk. | Convolvulaceae | LC | Canals, damp areas | Tw | V | St | A/P | Medicinal |
| 24 | *Ipomoea cairica* (L.)Sweet | Convolvulaceae | LC | wastelands, gardens | Tw | V | St | P | Edible& Medicinal |
| 25 | *Ipomoea obscura* (L.) Ker Gewl. | Convolvulaceae | NA | Open forests, Hedges | Tw | V | St | A/P | Medicinal |
| 26 | *Ipomoea pes-caprae* (L.)R.Br | Convolvulaceae | NA | Open areas, shores | Tw | V | St | P | Medicinal |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 27 | *Ipomoea tricolor* Cav. | Convolvulaceae | NA | Scrub, waste places | Tw | V | St | P | Weed control |
| 28 | *Ipomoea triloba* L. | Convolvulaceae | NA | woodland, roadside | Tw | V | Pt | A | Edible& Medicinal |
| 29 | *Melothria pendula* L. | Cucurbitaceae | NA | sandy moist soil | Tw | V | St | P | Edible& Medicinal |
| 30 | *Momordica charantia* L. | Cucurbitaceae | NA | roadside, dumpsites | Td | V | Ab | A/P | Edible&medicinal |
| 31 | *Momordica cymbalaria* Fenzl ex Naudin | Cucurbitaceae | NA | Gardens, farms | Td | V | St | P | Edible& Medicinal |
| 32 | *Passiflora foetida* L. | Passifloraceae | NA | Roadsides | Td | V | Ab | P | Medicinal |
| 33 | *Pentalinon luteum* (L.) B.F.Hansen&Wunderlin | Apocynaceae | NA | scrublands, shores | Tw | V | St | P | Ornamental |
| 34 | *Pergularia daemia* (Forssk.)Chiov. | Apocynaceae | LC | Roadsides | Tw | V | St | P | Medicinal |
| 35 | *Rhynchosia minima* (L.) DC. | Fabaceae | LC | plain areas | Tw | V | St | A/P | Medicinal |
| 36 | *Thunbergia erecta* (Benth.) T.Anderson | Acanthaceae | NA | wet biome | | L | La | P | Medicinal |
| 37 | *Tinospora cordifolia* (Willd.) Miers ex Hook.f. & Thomson | Menispermaceae | NA | gardens, scrublands | Tw | L | St | P | Medicinal |
| 38 | *Trachelospermum jasminoides* (Lindl.) Lem. | Apocynaceae | NA | shrublands, trails | Tw | L | St | P | Medicinal/ Ornamental |
| 39 | *Vincetoxicum indicum* (Burm.f.) Mabb. | Apocynaceae | NA | coast regions | Td | V | St | P | Folk medicine |
| 40 | *Ventilago maderaspatana*Gaertn. | Rhamnaceae | NA | Foothills | Str-UA | L | St | P | Medicinal |

**Table – 1: Tabular column showing species, family, IUCN status, habitat, climbing mode, climber type, climbing organ, life form and uses.**

Note*

IUCN status- NA = Not applicable, LC = Least concern; Climbing mode- Tw = twining, Td = tendrilar,

Str-UA = Straggling unarmed;Climbing type- L = Liana (Woody climber), V = Vine (Herbaceous climber); Climbing organ-Ar = Arial adventitious root, At = Axillary tips, In = Inflorescence axis, La = Leader axis and branches, Ab = Modified auxillary bud, Pt = petiolule tendril, St = Stem; Life forms-A = Annual, P = Perennial, A/P = Annual or perennial.

## CONCLUSION

The climbing plants provide invaluable resources to the local communities that depend on them, thereby supporting various aspects of local livelihoods. The optimal utilization of these species are both economically and culturally significant. The research on climbers in Ballari district reveals a diverse range of species, with 40 species distributed across 16 families, exhibiting various life forms, and providing valuable resources to local communities. According to IUCN criteria 6 species were threatened, under the Least Concern category.The dominant families are Cucurbitaceae, Apocynaceae and Convolvulaceae, with vines being the most common climber type. The research also highlighted the importance of conservation efforts to protect these valuable species and their habitats, ensuring sustainable resource development and species survival in the long run. The documented climber species possess a wealth of values, including edible materials, ornamental significance, medicinal properties, economic importance, and various other uses like fodder, fuel, cover crops, furniture, and insecticide.

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