



Ecology and Distribution Pattern of Insectivorous Plant in Sanjay Dubri Tiger Reserve Sidhi, Madhya Pradesh, India

**Vivek Kumar Yadav ^{a*}, Diwakar Singh ^b, A. P. Singh ^c
and Hemangad Shukla ^d**

^a Kamlia Memorial College Sidhi, M.P., India.

^b SGS Govt. PG College Sidhi, M.P., India.

^c Govt. Model Science College Rewa, M.P., India.

^d A.P.S. University Rewa, M.P., India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Some angiosperm flowering plants of the plant kingdom obtain essential nutrients for themselves by feeding on small arthropods similar to animals; they are called insectivorous or carnivorous plants. These are often found in such places where the soil is acidic, moist land/swamp and lacking nutrients. The presence of several species of insectivorous plants such as *Drosera burmannii*, *Aldrovanda vesiculosa*, *Nipenthes rajah*, *Utricularia aurea* and *Pinguicula vulgaris* has been reported in different sites in India. *Drosera burmannii*, *Drosera indica* and *Utricularia aurea* have also been reported in Sanjay Dubri Tiger Reserve Sidhi, Madhya Pradesh. The availability of

*Corresponding author: E-mail: vivekkumar2689@gmail.com;

insectivorous plants will prove helpful in the study of soil diversity, geographical structure, climatic environmental conditions. The presence of the specific plants species to create the special characteristics of the area as well as raise the question in mind to observed the association of specific types of insect species and some associated plant species linkage that are available here.

Keywords: Angiosperm; environmental conditions; insectivorous plant; nutrients.

1. INTRODUCTION

Insectivorous plants eat insects to keep themselves healthy and fit. They consume insects in the form of nutrient supplements. They are found in all the continents except the continent of Antarctica. These are often found growing in swamp or moist acidic and low nutrient soil. There are many such natural places in the four enclaves of Sanjay Dubri which create suitable conditions for their growth.

Insectivorous plants are mixotrophic, which grow in areas rich in nitrogen, phosphorus, and potassium in the soil, for which they feed on insects, thus increasing, the process of photosynthesis and the plant continues its life by staying healthy. There is lack of oxygen in the area where insectivorous plants grow. Complete oxidation of organic matter does not take place.

Due to the excess of acidic substances in the environment, acidity increases in soil, for this reason which microorganisms cannot survive, these plants live well and by eating insects, they play an important role in keeping the environment healthy. The term carnivorous syndrome is in vogue in the plant world, which means the development of internal structure, glandular structure, gene expression and developmental characteristics of insectivorous plants. Out of 2,500,000 floral species, about 810 floral species are insectivores, mainly belongs to *Nipenthes* and *Lamiales* orders (Adamec et al. 2021). Carnivorous syndrome develops 11 times more in insectivorous plants. These plants belong to 13 families of the world as an example *Triantha occidentalis*, (*Tofieladiaceae*) Fleischmann et al. [1]; Lin et al. [2], latest reported insectivorous plants are observed.

Insectivorous plants are classified as polyphytic group based on their specific characteristics and ability to capture and consume insects. *Drosera burmannii*, *Drosera indica* insectivorous plants have been observed in Sidhi district. Such glands are found in the leaves of *Drosera* species, which releasing sticky substances to attract insects. *Aldrovenda* is a rootless insectivorous plant

which is found in Sunder Forest (West Bengal) in India.

The taxonomic classification of *Drosera burmannii* insectivorous plant is described. This plant belongs to the Family of *Droseraceae*, Order- *Caryophyllales* Class- *Dicotyledoneae*, and Division- *Angiospermeae*.

During the field survey and investigation work we have found specific closed association with *Eriocaulon aquaticum* herb. This herb also seen in tidal muddy area of rivers, ponds and springs in July to December month with *Drosera burmannii*.

The Taxonomic classification of *Eriocaulon aquaticum*, Family- *Eriocaulaceae*, and Order- *Eriocaulales*, division- *Angiospermeae* and kindom- *Plantae*.

This plant phenotypically seen with white flower in month of July to December. Its plant looks like a pipeworts. These herbs found throughout the muddy places of Sanjay Dubri Tiger Reserve in Sidhi District. *Eriocaulon aquaticum* herb is single hollow pipe with 4-12 cm in heights. The lower section of the herb is connected some narrow lanceolate leaves. *Eriocaulon aquaticum* plant is basically seen in very low nutrients soil.

Drosera burmannii is a true hollow carnivorous plant because it attracts and eats special insects, which leads to their growth and development. Chase et al. [3].

Nepenthes L. and *Drosera* have endogenously special types of enzymes which help in the digestion of insects. Insectivorous plants capture insects both actively and passively Kroll et al. [4]. For this, they catch prey by changing their entire morphology or only the shape of the leaves Fukushima et al. [5]; Dkhar J Pareek [6]; Davila-Lara [7]; Whitewood [8].

Interestingly, prey capture is the result of parallel evolution in some insectivorous plants, such as *Nepenthaceae*, *Cephalotaceae* and *Sarraciniaceae* (Thorogood et al. 2017).

There are 5 types of hunting method found in insectivorous plants in which 3 active types and 2 passive types of method. In active type of trapping method, plants become dynamic by expending plant energy to catch the prey. eg. Snaptrap of *Dionaea muscipula*, flypaper traps of *Drosera* and *Pinguicula*. In passive type hunting trapping no energy is expended. The prey comes to their surface and sticks automatically. (Pietropaolo and Pietropaolo 2001) Ex. Eel-Trap of *genlisea*, Pit fall-trap of *Cephalotus follicularis*, *Darlingtonia californica*, *Sarracenia*, *Heliamphora* and *Nepenthes*.

In order to digest the prey, they secrete several types of hydrolytic enzymes which are controlled by genes Ravee et al [9]. It has now been discovered that the development of carnivorous syndrome is part of a protective mechanism Mithofer [10]; Pavlovic and Saganova [11]; Bemm et al. [12]; Fleischmann et al. [1]; Hedrich and Fukushima [13].

This study is deals with the conservation and sustainable development of insectivorous plants in Sanjay-Dubri Tiger Reserve Sidhi. it is represent the specific geographical, ecological climatic conditions of SDTR Sidhi Madhya Pradesh. This research is focused on the representing the Specific ecological status with first White Tiger "Mohan" (Progenitor of all white tigers currently found in worldwide) of Sanjay Dubri Tiger Reserve Sidhi in world wide.

2. MATERIALS AND METHODS

During the study and survey work between the months of October - November 2022 in SDTR Sidhi, in this study we have found insectivorous plants in all 4 ranges in SDTR forest areas. It is a bit difficult to reach their habitat as they grow in rainfed/ swamp/ moist areas. The plants are collected using conventional procedures. Flora, monographs, reviews, journals, and other sources were reviewed to determine the identity of the insectivorous plant [14]. Mishra [15] examines the relationship between abundance and density as indicators of the numerical characteristics of species within a plant species community. The field data and field observations are noted in a record diary.

Species richness is a quantitative metric that assesses the total number of species present within a given community or geographic area. Various diversity indices are employed in order to

quantify species richness, typically by considering both the total number of species and the total number of individuals present. The species richness is equivalent to the number of species per unit area [16].

The assessment of tree species' regeneration status was conducted by Khan et al. [17] through the examination of population sizes of seedlings, saplings, and adult trees. The classification of the condition as "good regeneration" occurs when the quantity of seedlings surpasses that of saplings, and the quantity of saplings above that of adults.

Recently, Ellison and Adamec [18], gave five essential symptoms of Carnivorous Syndrome - 1. Catching insects in a special way, 2. Killing, 3. Digestion, 4. Absorption or assimilation, 5. Using the nutrients obtained from them for our growth and development [19,20].

3. RESULTS AND DISCUSSION

Drosera burmannii insectivorous plant was found during the survey study in Sanjay Dubri Tiger Reserve area, for which the following parameters were prepared, which is as follows-

3.1 Habitat Status

Drosera burmannii was found in marshy sandy nitrogen free soil in all the forest areas of Sanjay Dubri Tiger Reserve. Availability of insectivorous plants was reported in Dubari forest range of this tiger reserve on the bank of river Banas from where continuous water flow was found in the form of spring from the mountain side towards the river. The association of insectivorous plants *Drosera burmannii* with *Eriocaulon aquaticum* is specifically observed which clearly indicates the availability of insectivorous plants with the soil. The presence of *Drosera burmannii* was found in 4 (all four forest ranges) of Sanjay Dubri Tiger Reserve which expresses a specific type of soil quality.

3.2 Colour Status

The colour of *Drosera burmannii* insectivorous plant is green in the initial stage and as the plant matures the color of the plant changes to dark red and purple. The color of the leaves of this plant is green, small pointed thorn-like protrusions are found in them, which to trap insects.



Fig. 1A. Bastua range-near umradi river



Fig. 1B. Mohan range- kusmi

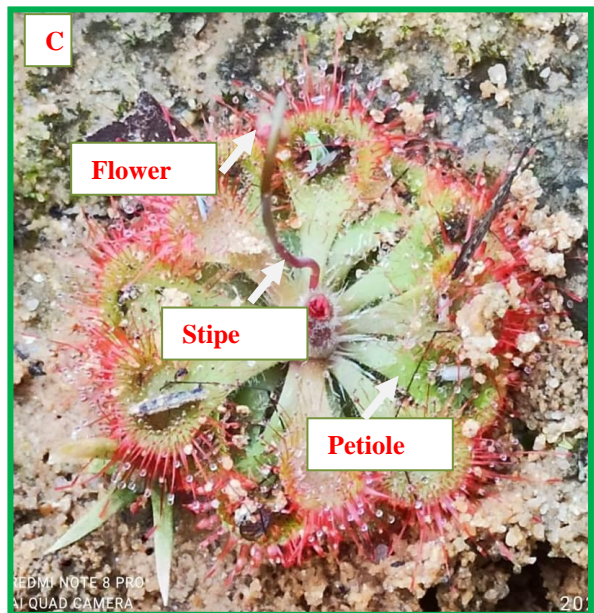


Fig. 1C. Dubri range- near banas river

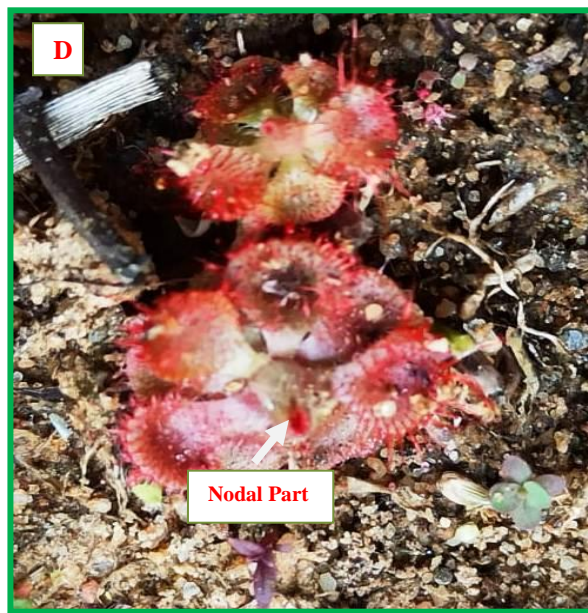


Fig. 1D. Pondi range

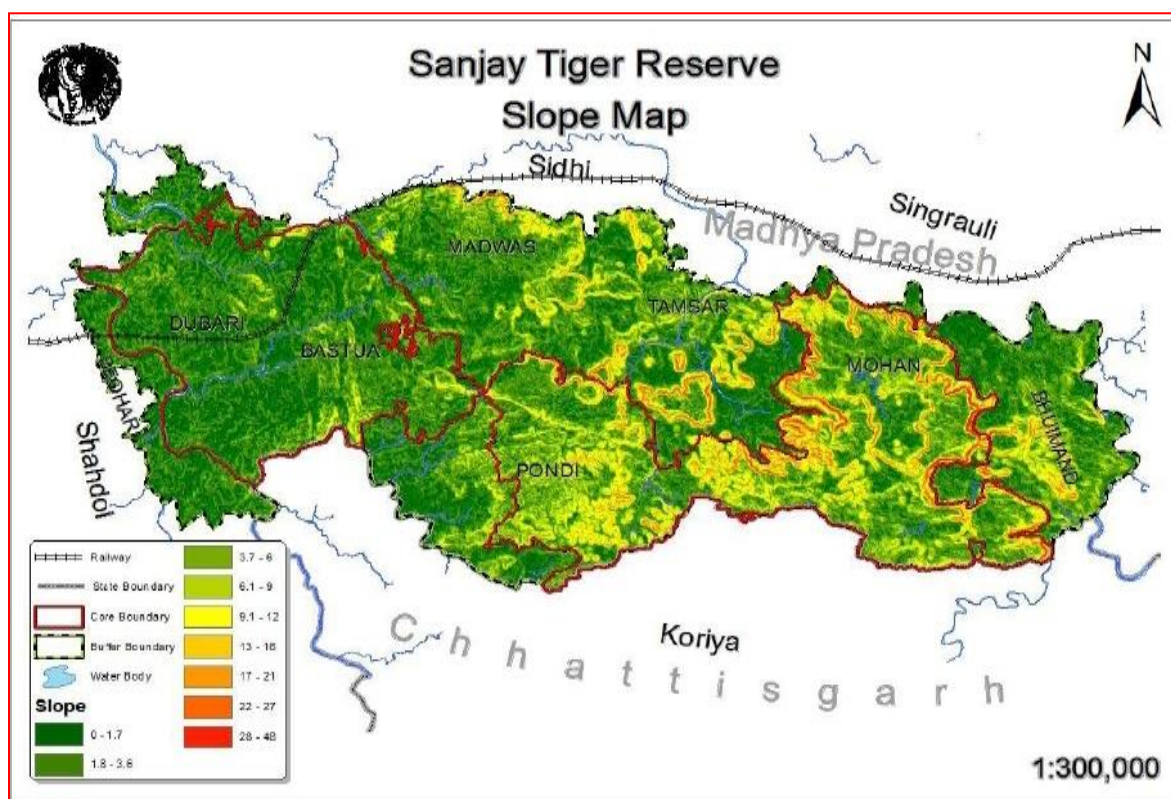
3.3 Growing Season

Drosera burmannii insectivorous plant has grown in month of September to October but maturation period between Nov. to last December. *Drosera burmannii* plant is abundantly seen in December to January month and afterward the plant died due to climatic changes and dry soil with increasing temperature of atmosphere in Sanjay Dubri Tiger Reserve Sidhi (M.P.).

Approximately 4 month of a one year we have naturally seen in reserve and buffer zone of SDTR.

3.4 Occurrence Site of *Drosera burmannii*

Drosera burmannii plant is naturally found in all zone of SDTR such as Dubri, Mohan, Bastua and Pondi in different location, but mainly grow in moist sandy or muddy sandy acidic soil. It has



Map 1. Sanjay-Dubri tiger reserve

[Source of information: The Gazette of India: Extraordinary, Page no. 22 [PART II—SEC. 3(ii)]

been seen nearby area of spring, rivers and ponds.

3.5 Some Specific Angiospermic Plant Association with *Drosera burmannii*

During the field study and investigative work we have observed the specific association of *Drosera burmannii* with *Eriocaulon aquaticum* herb in Sanjay Dubri Tiger Reserve Sidhi. This is an herbaceous pipeworts plant with white headed flowers found in fresh and tide muddy places in rivers, ponds and springs. The presence of *Eriocaulon aquaticum* plant is shows that the nutrient deficient soil and availability of *Drosera burmannii* in nearby area.

4. CONCLUSION

The *Drosera burmannii* insectivorous plant is a special ecological diversity of the Sanjay Dubri Tiger Reserve Sidhi (M.P.). This is a rare endangered insectivorous plant shows that the specific natural microclimatic habitat of the national park as well as forest. In this forest also famous for the Birth place of first white tiger “Mohan” which indicates a specific naturality and

specificity of this Habitat. This research work is based on the conservation and sustainable development of threatened and rare endangered flora of Sanjay-Dubri Tiger Reserve Sidhi to maintain the ecological diversity of availability of some renowned floras.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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