Dipanjan Ghosh
Centre of Advanced Study
Department of Botany
Calcutta University
35, Ballygunge Circular Road
Calcutta 700019, India.

Project Lifescape – 11
Hunter Plants

Hunter plants are among the curiosities of nature, being very different from normal plants in their mode of nutrition. They, however, never prey upon humans or large animals as often depicted in fiction or fables. They are specialised in trapping insects and are popularly known as insectivorous plants. Way back in 1875, Charles Darwin drew the attention of the scientific community to the world of insect eating plants in one of his essays.

Insectivorous plants can broadly be divided into active and passive types based on their method of trapping their prey. The active ones can close their leaf traps the moment insects land on them in the same way we close our fingers on the palm to trap an ant that bites there. The passive plants have a 'pitfall' mechanism, having some kind of jar or pitcher-like structure into which the insect slips and falls, to eventually be digested. The mouth of such a jar is furnished with a lid that functions as the door of the death well. The lid may be active in some species but not active in others. In the former, the pitcher remains passive and the lid mobile like the door of a rat-trap. The insectivorous plants often have several attractions such as brilliant colours, sweet secretions and other curios to lure their innocent victims.

Keywords
Insectivorous plants, biodiversity, pitcher plants, conservation, sundew, ethnomedicine.

Why do these plants hunt despite having normal roots and green photosynthetic leaves? These plants are usually associated with rain-washed, nutrient-poor soils, or wet and acidic areas that are ill-drained. Such wetlands are acidic due to anaerobic conditions, which cause partial decomposition of organic matter releasing acidic compounds into the surroundings. As a result, most microorganisms necessary for complete decomposition of organic matter cannot survive in such poorly oxygenated conditions. Normal plants find it difficult to survive in such nutrient poor habitats. The hunter plants are successful in such places because they supplement their photosynthetic food production by trapping insects and digesting their nitrogen rich bodies.

Glossary

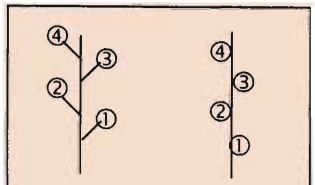
Rosettes: rose-like cluster.
Radical: springing direct from the main stem close to root.
Cauline: originated from stem.
Spathulate: shaped like a spatula head.
Peltate: shaped like an umbrella.

Insectivorous plants of India belong mainly to three families: Droseraceae, Nepenthaceae and Lentibulariaceae.

1. **Family: *Droseraceae:*** This includes 4 genera of which 2, namely *Drosera* and *Aldrovanda*, occur in India.

1.1 *Drosera* or Sundew (Hindi: *Mukhajali*; Bengali: *Suryasisir*; Punjabi: *Chitra*) consists of small, delicate herbs (*Figure* 1) inhabiting wet infertile soils or marshy places. *D. peltata* Sm. ex Wild. var. *lunata* Clarke grows throughout the plains as well as on the hills up to an elevation of 3000 m. *D. burmanni* Vahl. is mostly restricted to eastern and central India. *D. indica* Linn. generally grows along the open habitats of the western coast during the rainy season.

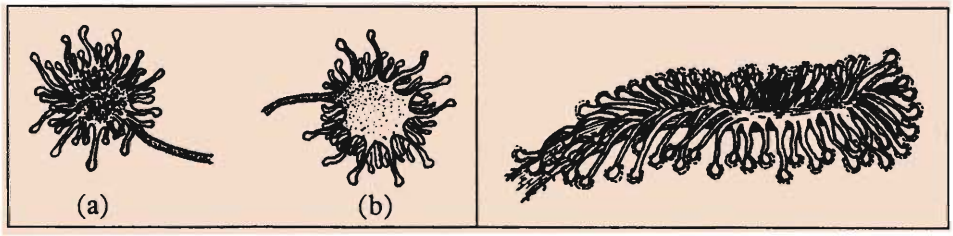
Morphology: *Drosera* spp. have basal *rosettes* or *radical* leaves; sometimes both radical and *cauline* leaves or only cauline leaves may be present. Leaves are narrow and long in *D. indica*, spathulate in *D. burmanni* and peltate in *D. peltata*. The upper surfaces of the leaves in *Drosera* spp. are covered with long, glad–tipped hairs called tentacles (*Figures* 2 and 3). The *Droseras* produced pinkish to purple coloured flowers in small *spikes* or *racemes*.



a) Raceme – inflorescence with stalked flowers, which are borne acropetally on an elongated rachis.
b) Spike – same as raceme but the flowers are without stalks.

Insect trapping mechanism: The tentacles on the leaves secrete a sticky fluid that shines in the sun like dew-drops. Therefore the *Drosera* spp. are commonly known as 'sundews'. When an insect lured by these glistening drops alights on the leaf surface it gets stuck in this fluid. Soon the tentacles, which are protein sensitive, bend down and hold the insect firmly making its escape almost impossible. The glands on the leaf surface secrete protein-digesting enzymes. The tentacles remain in a closed

Figure 2 (a, b) (left).
Figure 3 (right).



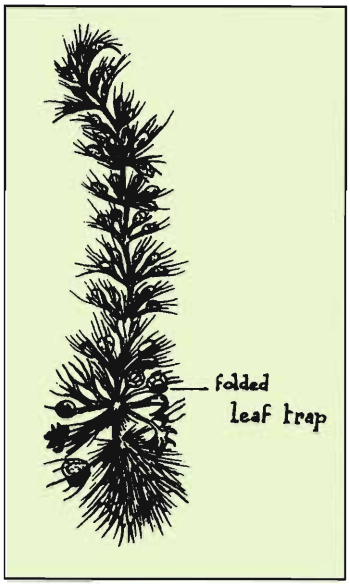


Figure 4.

position until digestion is complete. The digested substances are then absorbed by the leaves.

Economic importance: *Drosera* spp. are important medicinally. Due to the rich content of organic acids and enzymes, these plants are capable of curdling milk. In ethno-medicine the bruised leaves, with or without common salt, are applied on blisters. The leaf extract of *D. indica* is applied over corns. *D. pelata* is reported to be used by Ayurvedic practitioners in the preparation of 'gold-bhasma' considered an anti-syphilitic and tonic. A yellowish brown crystalline pigment from *D. peltata* is used for dyeing silk.

1.2 ***Aldrovanda*** (Bengali and Hindi: *Malacca jhangi*) is a free-floating, rootless aquatic plant (*Figure* 4). It is also found in central Europe and Australia. *A. vesiculosa* Linn., the only species found in India, occurs in the salt marshes of Sunderbans, south of Calcutta. It also grows in fresh water bodies like ponds, tanks and lakes.

Morphology: The plant is rootless; its stem is slender and wiry, bearing leaves in *whorls*[1]. The *petiole*[2] is slightly winged. The leaf blade is two lobed having a notch at the tip. The middle vein of the leaf can act like a hinge along which the lamina (leaf blade) can fold. Tiny sensitive teeth like structures are present along the leaf margins, which are slightly curved inwards (*Figure* 5).

[1] Whorls: ring of leaves around a stem.
[2] Petiole: the stalk of a leaf.

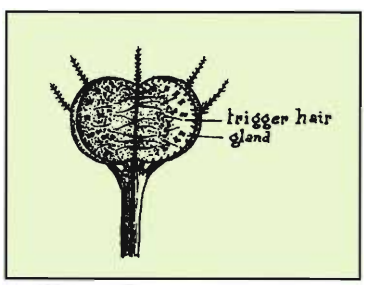


Figure 5.

Insect trapping mechanism: On the midrib are found some sensitive trigger hairs[3]. The two halves of the leaf blade of *Aldrovanda* close along the midrib the moment an insect comes into contact with the leaf, trapping the victim inside; this happens within fraction of a second. The leaf surface is studded with glands, which secrete digestive enzymes (*Figure* 6). The leaf remains closed until digestion and absorption processes are complete.

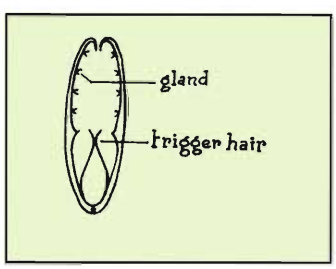
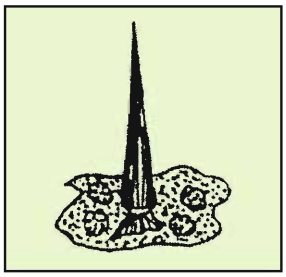


Figure 6.

2. Family Nepenthaceae: It consists of a single genus *Nepenthes* having about 70 species distributed throughout the tropical Old World, particularly in Borneo, New Guinea, Madagascar,

Seychelles, India, Sri Lanka and Australia. The members of the family are commonly known as 'pitcher plants' because their leaves bear jar-like structures.



[3] Trigger hair: a pointed sensitive hair present on a leaf surface.

2.1 *Nepenthes* **(Pitcher plant)** is greatly varied in its habit ranging from prostrate to *scandent* or rarely erect herbs, undershrubs or shrubs. The plants are mostly associated with the natural vegetation of very humid climates. *N. distillatoria* grows in wet, open habitats.

Nepenthes khasiana Hook., (Hindi: *Ghatparni;* Bengali: *Kalaspatri;* Khasi: *Tiew-rakot*) is the only species of pitcher plant found in India. It is confined to the high rainfall hills and plateaus of north-eastern region, at altitudes ranging from 100 – 1500 m, particularly in Garo, Khasi and Jaintia hills of Meghalaya.

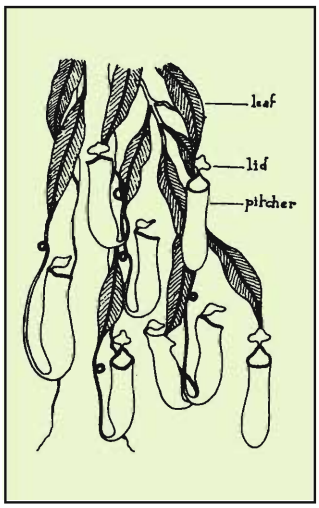


Figure 7.

Morphology: *N. khasiana* is a short, stout, prostrate to climbing under shrub with sub-cylindrical pitchers (*Figure* 7). These pitchers are modified leaf blades. The basal part of the long petiole is flattened into a leaf blade like structure 'phyllode'. The distal part of the petiole is a narrow wiry spring like structure called tendril, that coils around supporting plants. The pitchers, coloured bright red, green, yellow or a mosaic of all these, dangle in the air. They vary greatly in size, ranging from 5 to 30 cm in length (*Figure* 8). The mouth of the pitcher is furnished with a colourful half open lid.

Figure 8.

Insect trapping mechanism: *Nepenthes* conforms to the pitfall type of trap. The brightly coloured pitchers with their mysterious contents are a fatal attraction for the insects. A honey like substance is also secreted from glands at the entrance of the pitcher, as well as at the lower surface of the lid, to attract insects. The inside of the pitcher is very slippery. Once the insect enters into the pitcher, it is unable to climb out because of the slipperiness. The inner wall, towards its lower half, bears numerous glands, which secrete a proteolytic enzyme. This enzyme digests the body of the trapped insects. The digested substances are absorbed into the plant. Sometimes the pitcher

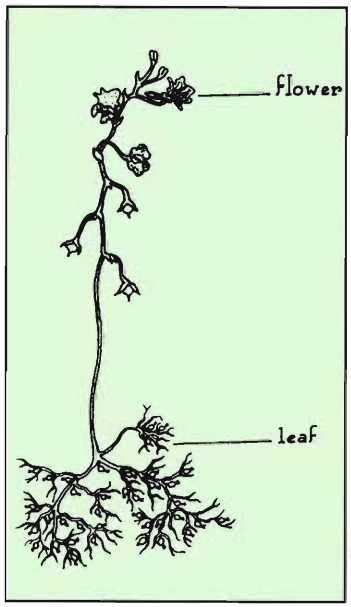


Figure 9.

contains a liquid, mainly rainwater and dew mixed with enzymes and some acids.

Economic importance: *Nepenthes* has some ethno-medical uses. In local medicine, the pitchers, along with the debris of trapped insects inside, are rubbed into paste, mixed with water, and given to cholera patients. The liquid inside the pitcher is consumed as a remedy for urinary troubles; it is also used as eye drops for treating redness and itching of eyes.

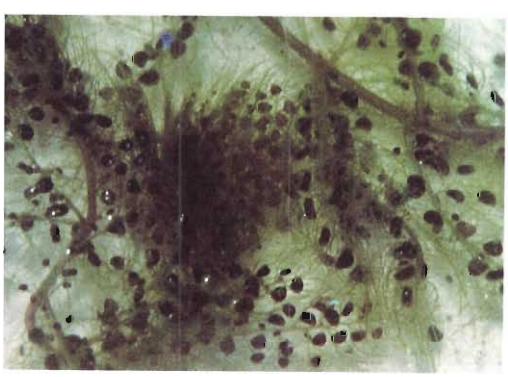
3. Family: ***Lentibulariaceae***: This is family of insectivores having 4 genera, of which *Utricularia* and *Pinguicula,* occur in India.

3.1 ***Utricularia or*** **Bladderworts** (Hindi: *Grhangi*; Bengali: *Jhangi Patajhangi*, Santal: *Arakjhawar*; Mundari: *Itka-Otejugi*) *Utricularia* is a large cosmopolitan genus with 120 species distributed throughout the tropical and temperate regions. About 30 species are known from India. Among them, *Utricularia inflexa* Forsk. var. *stellaris* (L.f.) Taylor (*Figure* 9) and *U. aurea* Lour. syn. *U. flexuosa* Vahl. commonly occur throughout India. *U. bifida* Linn. is common in Chota Nagpur plateau. *U. caerulae* Linn. occurs frequently in the Western Ghats and west coast. *U. brachiata* Oliver is found in Sikkim, Arunachal Pradesh and West Bengal. It has been reported from Garhwal Himalayas as well.

The Bladderworts generally inhabit freshwater wetlands and waterlogged areas. Some species are associated with moist moss covered rock surfaces, and damp soils during rains.

[4] Heterophylly: more than one morphologically distinct leaf type.

Figure 10.



Utricularia spp. are very delicate herbs of varied lengths/heights. Most species exhibit *heterophylly*[4] having two types of leaves. One type is normal being simple; these form rosettes towards the base of the plant. The other leaves are highly dissected. The latter bear tiny bladders or utricles, devices for trapping insects (*Figure* 10). Inflorescence is one to few flowered. Flowers are bisexual. The corolla is characteristic having

petals forming upper and lower flaps or lips. The flowers are brightly coloured- white, yellow, blue and purple are frequent.

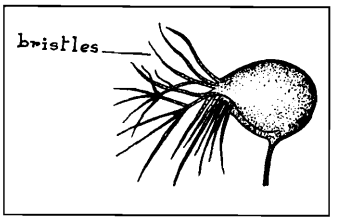


Figure 11.

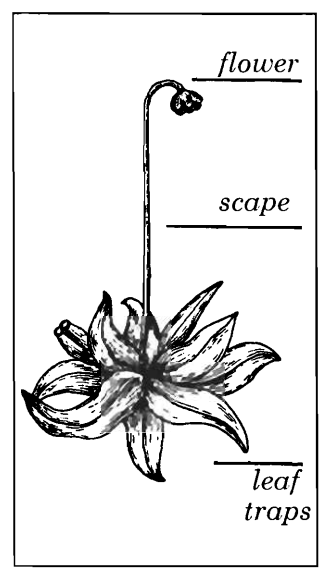
Insect trapping: *Utricularia* traps minute aquatic insects in its bladders. The bladder, towards its mouth, has sensitive bristles or hairs. The mouth is closed by a trap door that opens inwards (*Figure* 11) When an insect happens to contact these hairs the door opens, carrying the insect into the bladder along with a little current of water that rushes into the empty chamber. The door is shut when water fills the bladder, the entire operation taking place in fraction of a second. The enzymes produced by the inner wall of the bladder digest the insect. When the digested matter is absorbed the bladder gets ready for trapping its next prey.

Economic importance: *U. aurea* and *U. reticulata* are ornamental, specially suitable for aquaria and rockeries. *U. stellaris* is useful against cough; *U. caerulae* is useful for dressing of wounds; *U. bifida* is used as a remedy for urinary disease.

[5] Sessile – attached directly on stem without stalk.

3.2 ***Pinguicula*** or **Butterwort** consists of 46 species distributed throughout northern Europe, central Asia and America. In India it is represented by a sole species, *P. alpina* Linn. It grows in the alpine heights of Himalayas, at 3000–4400m, from Kashmir to Sikkim, along stream-sides in cool boggy places.

Figure 12.



Morphology: *Pinguicula* (*Figure* 12) is a small herb with ill developed or rudimentary roots. Leaves of elliptic shape occur in a rosette at the base of the stem; they are ***sessile***[5] and have entire margins. On the leaf surface are stalkless glandular hairs, which secrete an enzyme, and stalked hairs which secrete a sticky butter-like substance; hence the name 'butter-wort'. The plant produces a single white flower, spotted with yellow, on a 20-30 cm long axis or scape. Flowering season is May-June.

Insect trapping mechanism: In *Pinguicula,* an entire leaf works as trap. When an insect lands on the leaf surface, it gets stuck in the sticky exudate. The sensory hairs on the leaf surface, on detecting the presence of the creature, cause the leaf margins to

Student Projects

1. A check list of insectivorous plants in your locality.
2. Role of insectivorous plants in the ecosystem.
3. Ethnomedical uses of insectivorous plants in your locality.
4. Causes behind the decline of insectivorous plants in your locality.
5. Effect of fertilizers on insectivorous plants.
6. Effect of pesticides on insectivorous plants.

roll up thus trapping the victim. The leaf unrolls after the completion of digestion and absorption of the prey.

Conservation

The hunter plants are a threatened lot. Some species are on the verge of extinction the world over. In India, species like *Drosera peltata, Aldrovanda vesiculosa* and *Nepenthes khasiana* have been included in the *Red Data Book* as endangered plants. Their popularity with gardeners and traders of medicinal plants is one of the main causes for their decline. Habitat destruction is also rampant, the wetlands harbouring such plants being the main casualties during the expansion of urban and rural habitation. Pollution caused by effluents containing detergents, fertilizers, pesticides, sewage etc into the wetlands is yet another major cause for their decline, since insectivorous plants do not tolerate high nutrient levels, as they are well adapted to grow in habitats poor in nutrients. Moreover, polluted water bodies are dominated by prolific water weeds which cause elimination of the delicate insectivorous plants.

The insectivorous plants are these days coming into limelight of modern research because of their characteristic enzyme complexes, absent in other plants. Unfortunately, these plants are on the decline when they have the potential to open up new vistas in the field of medicine. An awareness need to be created among the student community and the public on this group of interesting plants. Their important distribution centres need to be catalogued and set aside for conservation.

Suggested Reading

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[6] W A Rodgers and S Gupta, The pitcher plant (*Nepenthes khasiana* Hk. f.) Sanctuary of Jaintia Hills, Meghalaya: Lessons for conservation, *J.Bombay Natl. Hist. Soc.*, Vol. 86, pp 17-21, 1989.