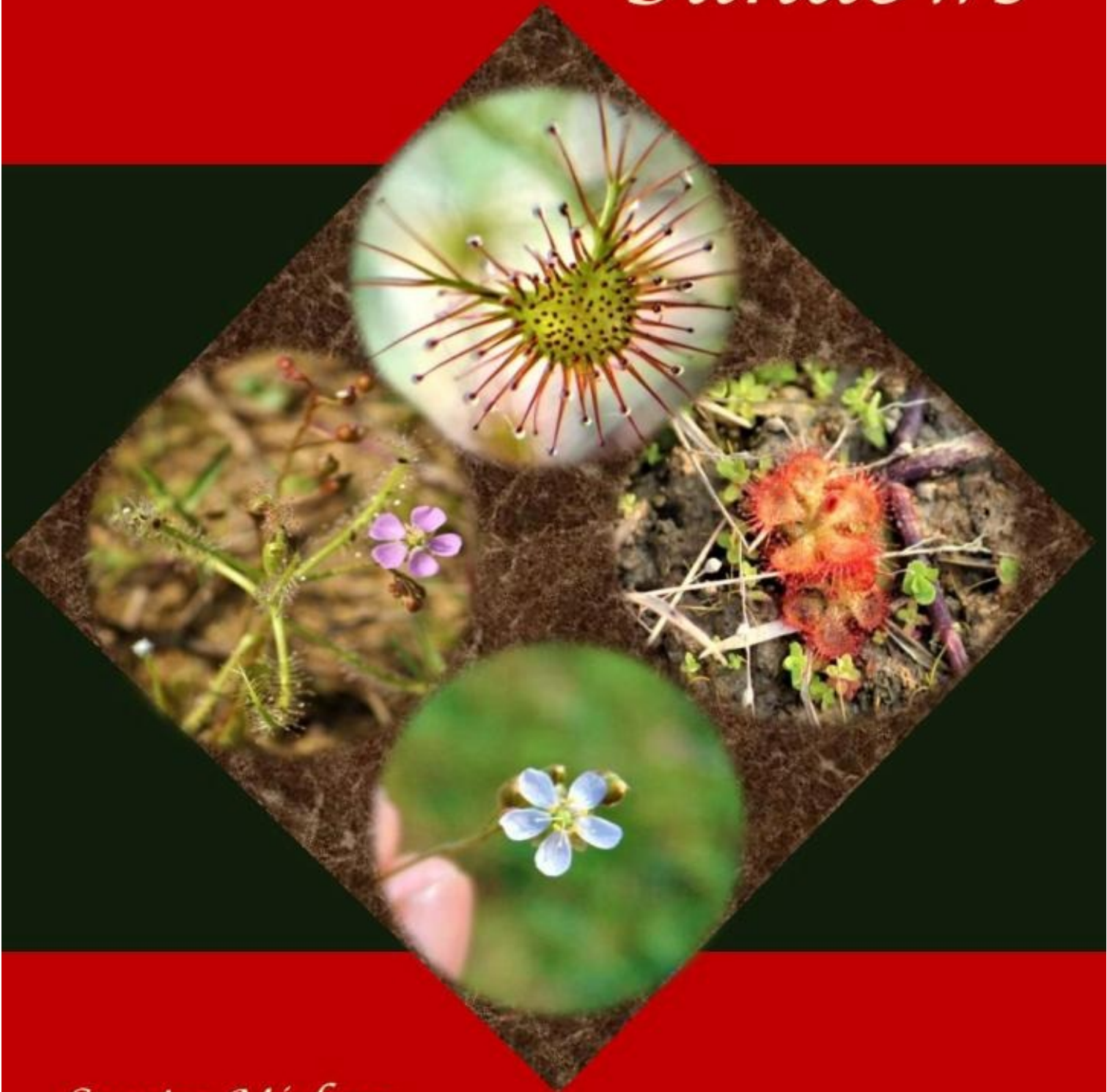


Sundews



Sweta Mishra
Sanjeet Kumar

SUNDEWS

Sweta Mishra

Sanjeet Kumar

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Photographs:

Front page: *Drosera indica*, *Drosera peltata*, *Drosera burmannii*
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Drosera peltata

Drosera burmannii

Drosera indica

CHAPTER 1

INTRODUCTION



Drosera burmannii

The fundamental requirements of all green plants include air, water, carbon dioxide and some minerals such as nitrogen, phosphorus, potassium etc. which are the building blocks for making DNA (Deoxyribonucleic acid) and proteins that the plant usually gain from the soil and these mineral nutrients provide a significant growth to the plant. Photosynthesis is the basic necessity for all green plants as their energy source. But there are many places in the world where the soil is poor and plants cannot obtain enough nutrients through the root to sustain their growth. This particular environmental stress has given rise to evolution of a unique plant different from a normal plant lifestyle. Thus, the plant grow in the place with insufficiency of mineral-nutrients adopt the carnivory nature, and instead of donate their energy to grow large root systems and to compete with other plants for an extremely limited supply of nutrients, they modified their leaves which are adequate and enough skilful to trapping and killing small animals or insects to accomplish their essential supplements for their growth development. These talented extra ordinary plants which have developed the meat-eating habit are known as “Carnivorous Plants” or “Insectivorous Plants” which totally change the concept of food chain; also create mystery in the world of science. Charles Darwin was the first who actually demonstrate that carnivorous plants get nourished from its captured prey.

What is a carnivorous plant?

Carnivorous plant are the photosynthetic angiospermic plant which supplement their daily diet with animal protein or organic matter or diet made up of insects for a plant to be classified as carnivorous, require some necessary criteria that are:

- 1) Attraction of prey (lures, odours and directional guides) entices insects to the plant.
- 2) A method by which the plant captures kills its prey
- 3) Digestion of prey
- 4) Assimilation of various metabolites
- 5) Use of these metabolites for the benefit of the plant.

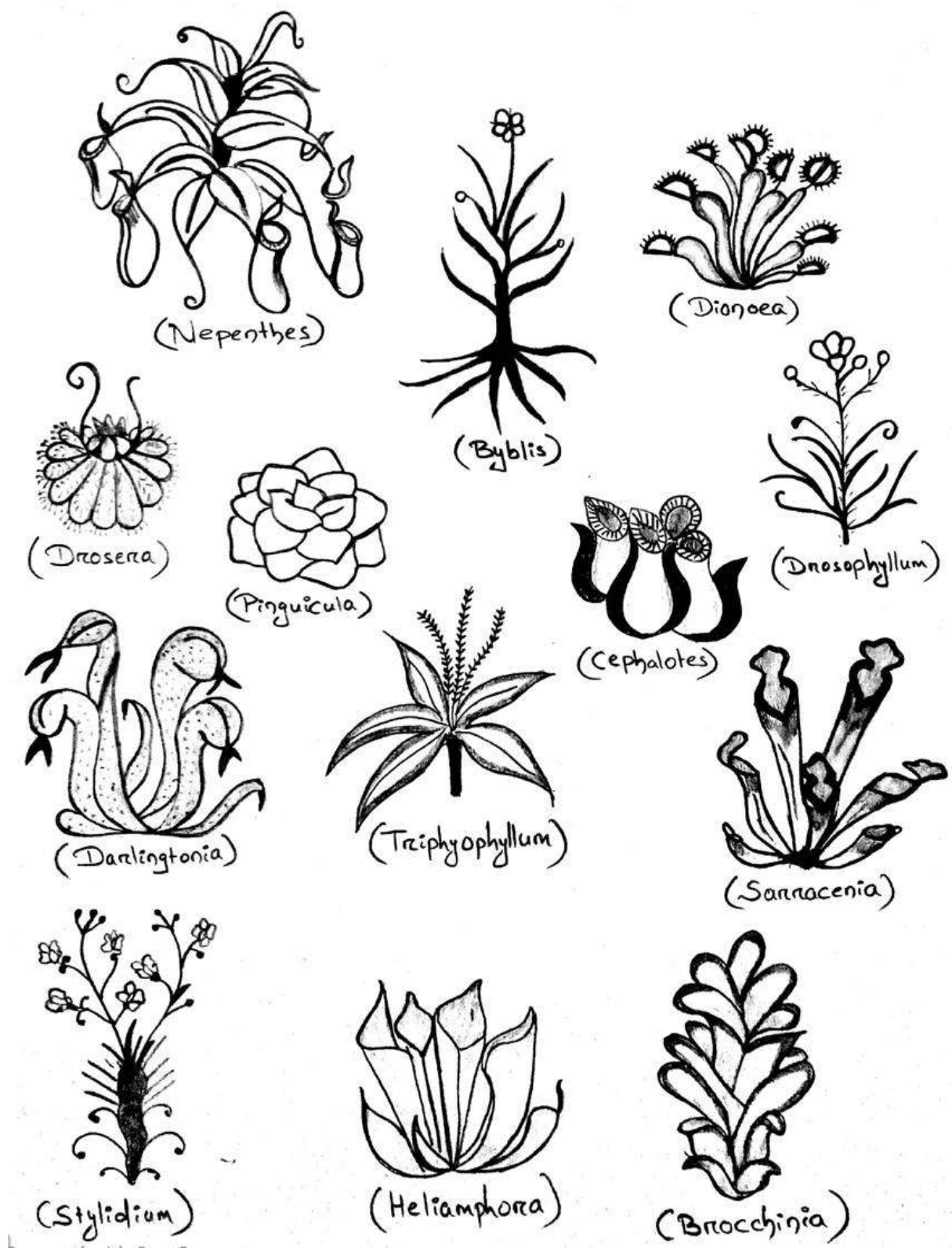


Figure 1: Illustration of some carnivorous plants

Distributions

There are over 800 species of carnivorous plant reported till date, representing 12 taxonomic families of angiosperm (Illustration1). The geographical distribution of carnivorous plant extending the entire globe except Antarctica (Table 1). Over 250 species of bladderworts or *Utricularia* (family Lantibulariaceae) are found throughout the world and shows highest diversity of carnivorous plant. About 200 species of the genus *Drosera*/ sundew (family Droseraceae) available worldwide and are known as the 2nd largest genus of insectivorous plants. These two genera are ubiquitous, means found everywhere in the world. There are about 140 species of *Nepenthes* (family Nepenthaceae) are distributed throughout the world. *Pinguicula* (family Lantibularicea) contain over 100 species. Lantibulariaceae family also contain one more genera i.e. *Genlisea* with about 30 species mostly found in South Africa and South America. Family Sarraceniaceae contain nearly 30 species belonging to genera *Sarracenia*, *Darlingtonia* and *Heliamphora*. The remaining genera of carnivorous plants like *Drosophyllum* (family Dioncophyllaceae) *Philocoxia* (family Lentibulariaceae), *Catopsis* (family Bromeliaceae), *Aldrovanda* and *Dionaea* (family Droseraceae) contain only one species each (Table 2).



Figure 2: *Utricularia aurea* in Eastern Ghats, India

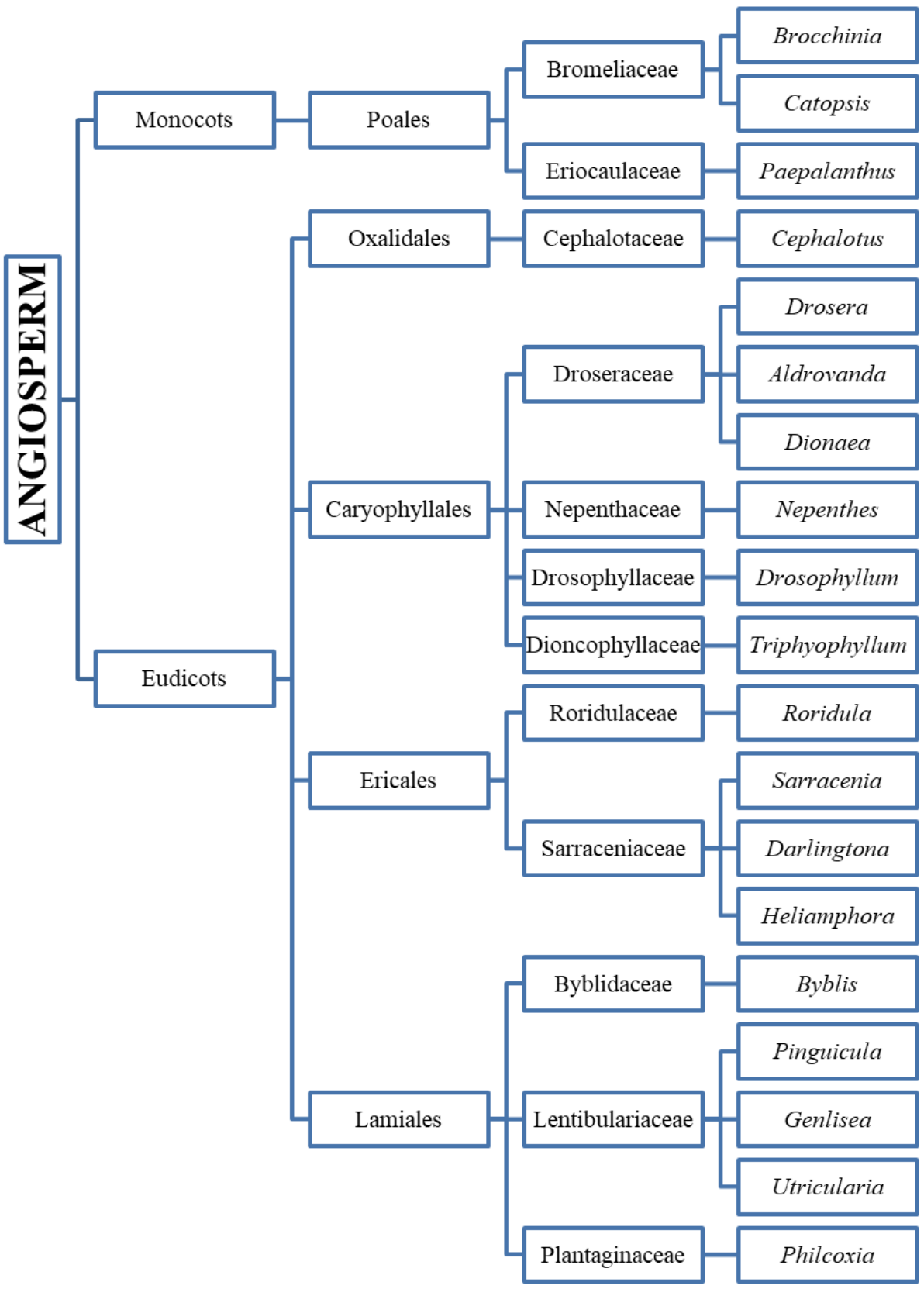


Illustration 1: Classification of Carnivorous plants

Table 1: Geographical distribution of Carnivorous plants

Family	Genus	Geographical distribution
Bromeliaceae	<i>Brocchinia</i>	Guyana highlands
	<i>Catopsis</i>	Neotropics
Eriocaulaceae	<i>Paepalanthus</i>	Brazil
Droseraceae	<i>Dionaea</i>	North Carolina, Northern South Carolina, U.S.A,
	<i>Aldrovanda</i>	Europe, Australia, Japan, India, Africa
	<i>Drosera</i>	Cosmopolitan
Nepenthaceae	<i>Nepenthes</i>	Southeast Asia, India, Australia, Madagascar
Drosophyllaceae	<i>Drosophyllum</i>	South Portugal, South West Spain, Morocco
Dioncophyllaceae	<i>Triphyophyllum</i>	Tropical Western Africa
Sarraceniaceae	<i>Sarracenia</i>	Eastern North America, Labrador states of America, Canada
	<i>Heliamphora</i>	British Guiana, Venezuela, North South America
	<i>Darlingtonia</i>	North California, South Oregon, U.S.A, Western Canada
Roridulaceae	<i>Roridula</i>	Cape of South Africa
Cephalotaceae	<i>Cephalotus</i>	Southwest Western Australia
Byblidaceae	<i>Bybis</i>	Australia
Lentibulariaceae	<i>Pinguicula</i>	North hemisphere & South America
	<i>Genlisea</i>	West Africa & East South America
	<i>Utricularia</i>	Cosmopolitan
Plantaginaceae	<i>Philcoxia</i>	Brazil

Ecology

Carnivorous plants have particular adaptation that allows them to survive in nutrient poor soil. Tropical/subtropical regions with warm, humid and wet climate are the most appropriate condition for the desired growth carnivorous plants.

Table 2: Carnivorous plants diversity

Genus	Local name	Distribution		
		World	India	Odisha
<i>Aldrovanda</i>	Waterwheel plant	1	1	
<i>Brochinia</i>	-	2		
<i>Byblis</i>	Rainbow plant	9		
<i>Catopsis</i>	-	1		
<i>Cephalotus</i>	Albany pitcher plant	1		
<i>Darlingtonia</i>	Cobra lily	1		
<i>Dionaea</i>	Venus fly trap	1		
<i>Drosera</i>	Sundew	200	3	3
<i>Drosophyllum</i>	Dewy pine	1		
<i>Genlisea</i>	Corkscrew plant	30		
<i>Heliamphora</i>	Sun pitcher	20		
<i>Nepenthes</i>	Tropical pitcher plant	140	1	
<i>Paepalanthus</i>	-	1		
<i>Philcoxia</i>	-	1		
<i>Pinguicula</i>	Butterworts	100	1	
<i>Roridula</i>	-	2		
<i>Sarracenia</i>	Trumpet pitcher	8		
<i>Triphyophyllum</i>	-	1		
<i>Utricularia</i>	Bladderworts	277	41	16

Morphology

Morphologically the meat eating plants are of different size and shape. Carnivorous plants include herb, shrub, climber with aquatic, terrestrial and epiphytic in habitat from which some are annual or perennial (Figure 1).

The species of the genus *Utricularia* (family Lentibulariaceae) found in both aquatic and terrestrial habitat. These are herbaceous in habit without root but they bear rhizoids and stolon. These are named as bladderworts due to the presence of bladder like trapping organs. They bear terminal flower with long upward shoots. *Pinguicula* from this genus having underdeveloped root systems and some are epiphytic in nature. These species are also known as butterworts. *Genlisea* of this family are like bladderworts with lack of roots. These species bear specific photosynthetic foliage leaves.

Drosera, *Dionaea* and *Aldrovanda* of the family Droseraceae are the herbaceous plant. These genera have different trapping mechanism along with bisexual flower. *Dionaea* is terrestrial in habit but *Aldrovanda* are aquatic and rootless.

Nepenthes (family Nepenthaceae), the famous insectivorous plant, are usually a climbing shrub. Commonly known as Pitcher plant, the modified leaves are the trapping organ with a pool of digestive enzymes. These species consist of a shallow root system.

The family Sarraceniaceae bear 3 genus names *Sarracenia*, *Darlingtonia* and *Heliamphora*. These are herbaceous and perennial herbs. The *Sarracenia* species have pitcher like structure as trapping organ contains amylase protease like enzymes. In *Darlingtonia* the root systems are modified as leaves. They are mainly found in temperate region and also named as Cobra Lily due to their Cobra like tubular leaves ranging from yellow to purplish green in colour. *Heliamphora* of the family also have tubular shaped modified leaves which act as trapping organ. They are about 4-5 m in height consist of both herbs and shrubs.

Trapping Mechanisms

The modified leaves of carnivorous plant plays the role of trap and these traps come in a variety of colours, shapes and sizes among different species and the prey of the plant also varies with the trap (Table 3). The trapping mechanisms of carnivorous plants are categorized as active or passive trap which is subdivided into five types according to their functions (Illustration 2).

Passive Trapping Mechanism

In passive trapping mechanism, plant species move their trapping parts. There are 3 types of passive trap: flypaper trap, pitfall trap, lobsterpot trap.

Adhesive

The modified leaves or the trap covered with fine hairs or tentacles with sticky mucilage containing tentacles as well as leaf folding enclose the prey-typically found in *Drosera* and *Pinguicula*. But in *Pinguicula* there is no movement of tentacles. The margins of the leaves rolled up to form a shallow basin for trapping the prey. The genera *Drosophyllum*, *Byblis*, *Triphyophyllum* and the two species of *Roridula* also show this type of trap but there is no movement of either tentacles or leaves.

Pitfall trap

It is the simplest trapping system found in carnivorous plant. The leaves folded in to slippery pools, filled with plant secretion/ digestive enzymes called Pitcher. This type of trapping action is found in *Cephalotus*, *Darlingtonia*, *Heliamphora*, *Nepenthes* and in *Sarracenia*. In pitcher plants the pitchers are very colourful and attractive with ultraviolet absorption patterns. Some monocot carnivorous plant also show pitfall trap like in *Brocchinia*, *Catopsis* and *Paepalanthus* like genus.

Lobster-pot Trap

Some carnivorous species bear a unique submerged spiral lobster-pot trap. Once inside the trap the prey cannot get out due to presence of inward-pointing hairs. Protozoans are mostly the target of attack for the plants with lobster-pot trap. This type of trap is mainly found in the genus *Genlisea*.

Active Trapping Mechanism

In this trapping mechanism, during trapping the trap cannot move and this trapping action show one of the rapid movements of prey. These are two kinds of active trap: snap trap and suction trap / bladder trap.

Snap trap

Venus fly trap family employs the snap trap or steel trap which includes the genus like *Dionaea* and *aldrovanda* from Droseraceae family. In this trap, the modified leaves are hinged with trigger hairs. When these trigger hairs are stimulated the two lobes of the hinged leaves moves rapidly towards each other and entrap the prey. This is one of the rapid trapping actions.

Suction trap

This is the fastest trapping system in all found in carnivorous plant. The leaves are modified in to a pouch like or tiny sac like structure known as bladder generates an internal vacuum. The one end of the bladder possesses an opening with trigger hairs which show a thigmotropic moving. When the prey triggered that hairs the door opens up and sucks in the prey. There is a pressure difference between the inside and outside environment of the bladder. Some aquatic and semiaquatic species have developed this type of trapping mechanism namely *Utricularia* and *Polypompholyx*.

Table 3: Prey diversity of Carnivorous plants

Genus	Prey
<i>Drosera</i>	Lepidoptera, Isopteran, Diptera, Orthoptera, Hymenoptera, Coleoptera etc.
<i>Utricularia</i>	Mosquito larvae, Tadpole, Protozoa, Rotifer, Water fleas, Nematodes, Small fish etc.
<i>Nepenthes</i>	Rats, insects larvae, flying insects, ants etc.
<i>Pinguicula</i>	Arthropods, Nematocera and other winged insects etc.
<i>Dionaea</i>	Spiders, Ants, Beetles, Insects, Flies etc.
<i>Genlisea</i>	Bacteria, Algae, Nematodes, Rotifers, Protozoans, Annelides, Tardigrades, Crustaceans, Mites etc.
<i>Aldrovanda</i>	Cladocera, Copepods, Ostracoda, Ephemeroptera, Nematocera, Hydrachnidia etc.

<i>Heliamphora</i>	Insects, Ants etc.
<i>Sarracenia</i>	Flies, Ants, Beetles, Wasps, Bugs, Moths etc.
<i>Darlingtonia</i>	Insects & Bugs etc.

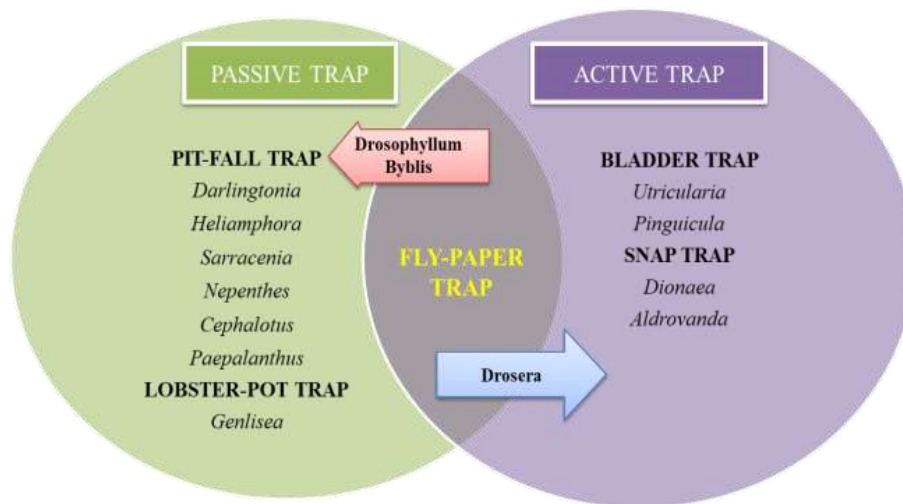


Illustration 2: Trap diversity

Uses of carnivorous plants

Carnivorous plants have been used in diverse ways. Carnivorous plants have many medicinal properties and also have many pharmacological activities like anti-fungal, anti-bacterial, anti-inflammation, anti-viral etc. Some species of these insectivorous plants also act as environmental indicators.

Utricularia, the omnipresent carnivorous plants have the potential to act against malaria and inflammation. These are also the pioneer species, which indicates the past disturbance in a habitat. Some species of this genus also used as a good medicine against wound. These species are the indicator of pH as it grows in the acidic soil and indicates the water pollution which is not suitable for any crops. Also the presence of these species indicates the general health and recovery of many wet micro habitat type. Some species of this genus are also edible.

The other ubiquitous carnivorous plant, *Drosera*, which is used against many respiratory diseases like asthma, whooping cough etc. these herbs are also used against many stomach diseases, toothache, inflammation and eye diseases.

Pinguicula is the insectivorous plants belonging to family Lentibulariaceae having diverse medicinal properties. The leaves of these plants applied to cattle sores. The leaves extract with the linseed oil are used for treating wounds. These leaves have some edible uses like the extract of leaves have been used to curdle milk and make a milk-type desert.

Nepenthes, with the pitcher shaped leaves filled with pool of digestive enzymes used in making many traditional medicines. These digestive enzymes are used to cure bed-wetter by pouring the fluid of the unopened pitcher on the head of the individual, used for drinking purpose by the individual.

CHAPTER 2

SUNDEWS



Drosera burmannii

Caryophyllales is the order consists of four carnivorous families: 1) Droseraceae (*Drosera*, *Aldrovanda*, *Dionea*), 2) Nepenthaceae (*Nepenthes*), 3) Dioncophyllaceae (*Triphyophyllum*), 4) Drosophyllaceae (*Drosophyllum*). Droseraceae is the family with highest number of species. From which *Drosera* contain about 200 species and *Aldrovanda* and *Dionea* consist of only one species (Illustration 3). *Aldrovanda* and *Dionaea* are two monotypic genera display snap-trap mechanism. *Drosera* is the second largest member in the world of carnivorous plants with fly-paper trap. The word *Drosera* is derived from Greek word Droseros- means dewy and Drosos- means dew and the presence of dew like mucilage at the head of the tentacles of *Drosera* sparkle in the sun, so also known as “Sundew”.

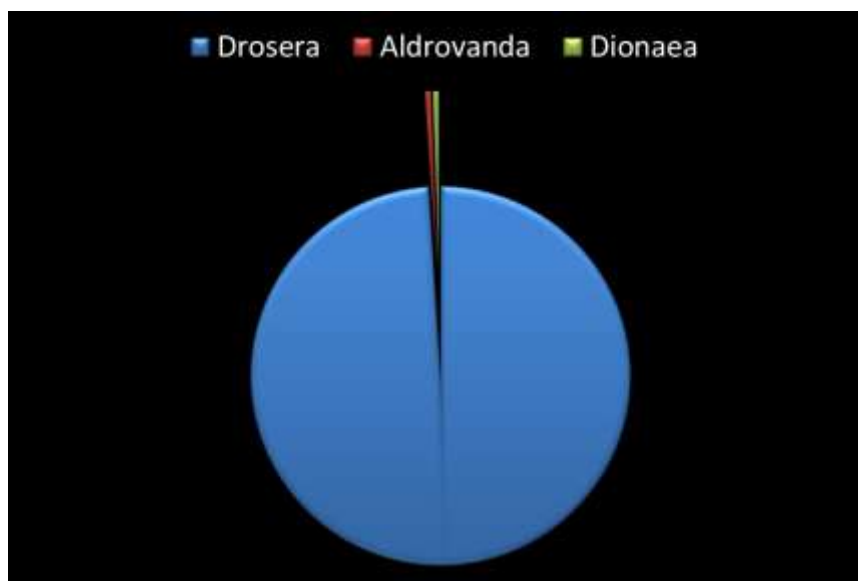


Illustration 3: Diversity in family Droseraceae

Evolution

Dr. A.W. Rath, a physician and botanist, in 1779 discovered the movement of the tentacles or the hair on *Drosera*. After that Darwin established the carnivory nature of *Drosera*. The family Droseraceae have been evolved from 85.6 million year ago. In this family divergent related to Lentibulariaceae family. In *Drosera* we found the fly-paper trap but in some species of *Drosera* have combine functional properties of adhesive trap and snap trap. The evolution of *Drosera* may not be initially from Australia, but it shows the greatest concentration there. This genus gave rise to specialized tuberous, woolly and pygmy sundews (*D. binata*, *D. glanduligera*) along with gave rise to generalized small rosette sundews like *D. burmannii*, *D. aldelae*, *D. indica*, *D. hamiltonii* etc.

CHAPTER 3
SUNDEWS OF THE WORLD



Drosera burmannii

About 200 species of *Drosera* found almost every continent of the earth. Sundews are found in Canada, Alaska and Siberia like regions (Table 4). They are naturally found with bogs and swamps in much of Europe and North America. Tropical places like Brazil, Queens land, Southern most region of New Zealand and South America is the place where *Drosera* have been found.

Table 4: *Drosera* species found throughout the world

Species	Distribution
<i>Drosera aberrans</i> (Lowrie & Carlquist) Lowrie & Conran	Australia
<i>Drosera acaulis</i> L.f.	South Africa
<i>Drosera adelae</i> F.Muell.	Australia
<i>Drosera admirabilis</i> Debbert	South Africa
<i>Drosera affinis</i> Welw. ex Oliv	African Tropics
<i>Drosera afra</i> Debbert	South Africa
<i>Drosera alba</i> E.Phillips	South Africa
<i>Drosera aliciae</i> Raym.-Hamet	South Africa
<i>Drosera allantostigma</i> (N.G.Marchant & Lowrie) Lowrie & Conran	Australia
<i>Drosera amazonica</i> Rivadavia, A.Fleischm. & Vicent	Brazil
<i>Drosera andersoniana</i> Fitzg. ex Ewart & Jean White	Australia
<i>Drosera anglica</i> Huds.	North America, Europe & Asia
<i>Drosera arcturi</i> Hook.	Australia & New Zealand
<i>Drosera arenicola</i> Steyerm.	Venezuela
<i>Drosera atrostyla</i> Debbert	Cape Province
<i>Drosera auriculata</i> Backh. ex Planch.	Australia
<i>Drosera badgerupii</i> Cheek	Australia
<i>Drosera banksii</i> R.Br. ex DC.	Australia & New Zealand
<i>Drosera barbiger</i> Planch.	Australia
<i>Drosera barbiger</i> subsp. <i>silvicola</i>	Australia

(Lowrie & Carlquist) Schlauer	
<i>Drosera beleziana</i> E.G.Camus	Australia
<i>Drosera bequaertii</i> Taton	Angola & the Democratic Republic of the Congo
<i>Drosera bicolor</i> Lowrie & Carlquist	Australia
<i>Drosera biflora</i> Willd. ex Schult	Venezuela
<i>Drosera binata</i> Labill.	Australia & New Zealand
<i>Drosera brevicornis</i> Lowrie	Australia
<i>Drosera brevifolia</i> Pursh	North America , Central America & South America
<i>Drosera broomensis</i> Lowrie	Australia
<i>Drosera browniana</i> Lowrie & N.G.Marchant	Australia
<i>Drosera bulbigena</i> Morrison	Australia
<i>Drosera bulbosa</i> Hook.	Australia
<i>Drosera bulbosa</i> subsp. major (Diels) N.G.Marchant & Lowrie	Australia
<i>Drosera burkeana</i> Planch	African Tropics
<i>Drosera burmanni</i> Vahl	Australia & Southeast Asia
<i>Drosera caduca</i> Lowrie	Australia
<i>Drosera callistos</i> N.G.Marchant & Lowrie	Australia
<i>Drosera camporupestris</i> Rivadavia	Brazil
<i>Drosera capensis</i> L.	South Africa
<i>Drosera capillaris</i> Poir.	North America , Central America & South America
<i>Drosera cayennensis</i> Sagot ex Diels	Brazil, French Guiana & Venezuela
<i>Drosera cendeensis</i> Tamayo & Croizat	Venezuela
<i>Drosera chrysochila</i> Schlauer	Australia
<i>Drosera chrysolepis</i> Taub.	Brazil & Peru
<i>Drosera cistiflora</i> L.	South Africa
<i>Drosera citrina</i> Lowrie & Carlquist	North America , Central America & South

	America
<i>Drosera citrina</i> var. <i>nivea</i> (Lowrie & Carlquist) Schlauer	Australia
<i>Drosera closterostigma</i> N.G.Marchant & Lowrie	North America , Central America & South America
<i>Drosera coccipetala</i> Debbert	Cape Prov.
<i>Drosera collinsiae</i> N.E.Br.	South Africa
<i>Drosera communis</i> A.St.-Hil.	Brazil, Colombia, Paraguay & Venezuela
<i>Drosera corinthiaca</i> R.A.Gibson & E.Green	Australia
<i>Drosera cuneifolia</i> L.f.	South Africa
<i>Drosera darwinensis</i> Lowrie	Australia
<i>Drosera derbyensis</i> Lowrie	Australia
<i>Drosera dichrosepala</i> Turcz.	Australia
<i>Drosera dichrosepala</i> subsp. <i>enodes</i> (N.G.Marchant & Lowrie) Schlauer	West Australia
<i>Drosera dielsiana</i> Exell & J.R.Laundon	Southern Africa
<i>Drosera dilatatopetiolaris</i> Kondo	Australia
<i>Drosera echinoblastus</i> N.G.Marchant & Lowrie	Australia
<i>Drosera elongata</i> Exell & J.R.Laundon	Angola
<i>Drosera enneabba</i> N.G.Marchant & Lowrie	Australia
<i>Drosera ericgreenii</i> A.Fleischm., R.P.Gibson & Rivadavia	South Africa
<i>Drosera ericksoniae</i> N.G.Marchant & Lowrie	Australia
<i>Drosera erythrorhiza</i> Lindl.	Australia
<i>Drosera erythrorhiza</i> subsp. <i>collina</i> N.G.Marchant & Lowrie	West Australia
<i>Drosera erythrorhiza</i> subsp. <i>magna</i> N.G.Marchant & Lowrie	West Australia

<i>Drosera erythrorhiza</i> subsp. <i>squamosa</i> (Benth.) N.G.Marchant & Lowrie	West Australia
<i>Drosera esterhuyseniae</i> (T.M.Salter) Debbert	South Africa
<i>Drosera falconeri</i> Kondo & P.Tsang	Australia
<i>Drosera filiformis</i> Raf.	North America
<i>Drosera filiformis</i> var. <i>tracyi</i> (Macfarl.) Diels	North America
<i>Drosera fimbriata</i> DeBuhr	Australia
<i>Drosera fontinalis</i> Rivadavia	Australia
<i>Drosera gibsonii</i> P.Mann	West Australia
<i>Drosera gigantea</i> Lindl.	Australia
<i>Drosera gigantea</i> subsp. <i>geniculata</i> N.G.Marchant & Lowrie	Australia
<i>Drosera glabripes</i> (Harv. ex Planch.) Stein	South Africa
<i>Drosera glanduligera</i> Lehm.	Australia
<i>Drosera graminifolia</i> A.St.-Hil.	Brazil
<i>Drosera graniticola</i> N.G.Marchant	Australia
<i>Drosera graomogolensis</i> T.R.S.Silva	Brazil
<i>Drosera grieviei</i> Lowrie & N.G.Marchant	Australia
<i>Drosera hamiltonii</i> C.R.P.Andrews	Australia
<i>Drosera hartmeyerorum</i> Schlauer	Australia
<i>Drosera halodes</i> N.G.Marchant & Lowrie	Australia
<i>Drosera heterophylla</i> Lindl.	Australia
<i>Drosera hilaris</i> Cham. & Schltldl	South Africa
<i>Drosera hirticalyx</i> Duno de Stefano & Culham	Venezuela
<i>Drosera hookeri</i> R.P.Gibson, B.J.Conn & Conran	Australia
<i>Drosera huegelii</i> Endl.	Australia

<i>Drosera humbertii</i> Exell & J.R.Laundon	Madagascar
<i>Drosera humilis</i> Planch.	Australia
<i>Drosera hybrida</i> Macfarl.	NE. U.S.A
<i>Drosera hyperostigma</i> N.G.Marchant & Lowrie	Australia
<i>Drosera indica</i> L.	Tropical Africa, Asia & Australia
<i>Drosera insolita</i> Taton	Australia
<i>Drosera intermedia</i> Hayne	Temperate Europe, North America & South America
<i>Drosera intricata</i> Planch.	Australia
<i>Drosera kaieteurensis</i> Brumm.-Ding.	Guyana, Trinidad & Tobago, Venezuela
<i>Drosera kansaiensis</i> Debbert	Australia
<i>Drosera katangensis</i> Taton	Democratic Republic of the Congo
<i>Drosera kanneallyi</i> Lowrie	Australia
<i>Drosera lanata</i> K.Kondo	Australia
<i>Drosera lasiantha</i> Lowrie & Carlquist	Australia
<i>Drosera leucoblata</i> Benth.	Australia
<i>Drosera leucostigma</i> (N.G.Marchant & Lowrie) lowrie & Conran	Australia
<i>Drosera linearis</i> Goldie	North America
<i>Drosera liniflora</i> Debbert	Australia
<i>Drosera longiscapa</i> Debbert	South America
<i>Drosera lowriei</i> N.G.Marchant	Australia
<i>Drosera macrantha</i> Endl.	Australia
<i>Drosera macrantha</i> subsp. <i>planchonii</i> (Hook.f. ex Planch.) N.G.Marchant	Australia
<i>Drosera macrophylla</i> Lindl.	Australia
<i>Drosera madagascariensis</i> DC.	Africa
<i>Drosera mannii</i> Cheek	Australia
<i>Drosera marchantii</i> DeBuhr	Australia
<i>Drosera menziesii</i> R.Br. ex DC.	Australia
<i>Drosera menziesii</i> subsp. <i>penicillaris</i>	Australia

(Benth) N.G.Marchant & Lowrie	
<i>Drosera menziesii</i> subsp. <i>thysanosepala</i> (Diels) N.G.Marchant	Australia
<i>Drosera meristocaulis</i> Maguire & Wurdack	Venezuela
<i>Drosera microphylla</i> Endl.	Australia
<i>Drosera modesta</i> Diels	Australia
<i>Drosera montana</i> A.St.-Hil.	Argentina, Brazil, Paraguay & Venezuela
<i>Drosera moorei</i> (Diels) Lowrie	Australia
<i>Drosera myriantha</i> Planch.	Australia
<i>Drosera natalensis</i> Diels	Madagascar, Mozambique & South Africa
<i>Drosera neesii</i> Lehm.	Australia
<i>Drosera neocaledonica</i> Raym.-Hamey	New Caledonia
<i>Drosera nidiformis</i> Debbert	South Africa
<i>Drosera nitidula</i> Planch.	Australia
<i>Drosera nitidula</i> subsp. <i>omissa</i> (Diels) N.G.Marchant & Lowrie	Australia
<i>Drosera oblanceolata</i> Y.Z.Ruan	China
<i>Drosera obovata</i> Mert. & W.D.J.Koch	Temperate Northern Hemisphere
<i>Drosera occidentalis</i> Morrison	Australia
<i>Drosera orbiculata</i> N.G.Marchant & Lowrie	Australia
<i>Drosera ordensis</i> Lowrie	Australia
<i>Drosera oreopodion</i> N.G.Marchant & Lowrie	Australia
<i>Drosera paleacea</i> DC.	Australia
<i>Drosera paleacea</i> subsp. <i>leioblastus</i> (N.G.Marchant & Lowrie) Schlauer	Australia
<i>Drosera paleacea</i> subsp. <i>roseana</i> (N.G.Marchant & Lowrie) Schlauer	Australia
<i>Drosera paleacea</i> subsp. <i>stelliflora</i> (N.G.Marchant & Lowrie) Schlauer	Australia

<i>Drosera paleacea</i> subsp. <i>trichocaulis</i> (Diels) N.G.Marchant & Lowrie	Australia
<i>Drosera plilda</i> Lindl.	Australia
<i>Drosera paradoxa</i> Lowrie	Australia
<i>Drosera parvula</i> Planch.	Australia
<i>Drosera parvula</i> subsp. <i>sargentii</i> (N.G.Marchant & Lowrie) Schluer	Australia
<i>Drosera patens</i> Lowrie & Conran	Australia
<i>Drosera pauciflora</i> Banks ex Dc.	South Africa
<i>Drosera pedicellaris</i> Lowrie	Australia
<i>Drosera peltata</i> Thunb.	Australia, New Zealand & Southeast Asia
<i>Drosera peltata</i> var. <i>nipponica</i> (Masam.) Ohwi ex E.H.Walker	Australia, New Zealand & Southeast Asia
<i>Drosera peruensis</i> T.R.S.Silva & M.D.Correa	Peru
<i>Drosera petiolaris</i> R.Br. ex DC.	Australia & New Zealand
<i>Drosera pilosa</i> Exell & J.R.Laundon	Cameroon, Guinea, Kenya & Tanzania
<i>Drosera platypoda</i> Turcz.	Australia
<i>Drosera platystigma</i> Lehm.	Australia
<i>Drosera porrecta</i> Lehm.	Australia
<i>Drosera prolifera</i> C.T.White	Australia
<i>Drosera prostrata</i> (N.G.Marchant & Lowrie) Lowrie	Australia
<i>Drosera prostratoscaposa</i> Lowrie & Carlquist	Australia
<i>Drosera pulchella</i> Lehm.	Australia
<i>Drosera purpurascens</i> Schlotth.	Australia
<i>Drosera pycnoblata</i> Diels	Australia
<i>Drosera pygmaea</i> DC.	Australia & New Zealand
<i>Drosera quartzicola</i> Rivadavia & Gonella	Brazil
<i>Drosera radicans</i> N.G.Marchant	Australia
<i>Drosera ramellosa</i> Lehm.	Australia

<i>Drosera ramentacea</i> Burch ex DC.	South Africa
<i>Drosera rechingeri</i> Strid	Australia
<i>Drosera regia</i> Stephens	South Africa
<i>Drosera roraimae</i> (Klotzsch ex Diels) Maguire & J.R.Laundon	Brazil, Guyana & Venezuela
<i>Drosera rotundifolia</i> L.	North America, Europe & Asia
<i>Drosera rubrifolia</i> Debbert	South Africa
<i>Drosera rubripetala</i> Debbert	South Africa
<i>Drosera rupicola</i> (N.G.Marchant) Lowrie	Australia
<i>Drosera salina</i> N.G.Marchant & Lowrie	Australia
<i>Drosera schizandra</i> Diels	Australia
<i>Drosera schmutzii</i> Lowrie & Conran	Australia
<i>Drosera schwackei</i> (Diels) Rivadavia	Brazil
<i>Drosera scorpioides</i> Planch.	Australia
<i>Drosera sessilifolia</i> A.St.-Hil.	Brazil, Guyana & Venezuela
<i>Drosera sidjamesii</i> Lowrie & ConRan	Australia
<i>Drosera slackii</i> Cheek	South Africa
<i>Drosera solaris</i> A.Fleischm., Wistuba & S.Mcpherson	Guyana
<i>Drosera spatulata</i> Labill.	Australia, New Zealand Southeast Asia
<i>Drosera spilos</i> N.G.Marchant & Lowrie	Australia
<i>Drosera stenopetala</i> Hook.f.	New Zealand
<i>Drosera stolonifera</i> Endl.	Australia
<i>Drosera stolonifera</i> subsp. <i>monticola</i> Lowrie & N.G.Marchant	Australia
<i>Drosera stricticaulis</i> (Diels) O.H.Sarg.	Australia
<i>Drosera stricticaulis</i> subsp. <i>eremaea</i> (N.G.Marchant & Lowrie) Schlauer	Australia
<i>Drosera subhirtella</i> Planch.	Australia
<i>Drosera subtilis</i> N.G.Marchant	Australia
<i>Drosera tokaiensis</i> (Komiya & Shibata)	Japan

T.Nakam. & K.Ueda	
<i>Drosera trinervia</i> Spreng.	South Africa
<i>Drosera tubaestylis</i> N.G.Marchant & Lowrie	Australia
<i>Drosera ultramafica</i> A.Fleischm., A.S.Rob. & S.Mc.pherson	Malaysia
<i>Drosera uniflora</i> Willd.	Argentina, Chile, Falkland & Islands
<i>Drosera variegata</i> Debbert	Australia
<i>Drosera venusta</i> Debbert	South Africa
<i>Drosera villosa</i> A.St.-Hil.	Brazil
<i>Drosera viridis</i> Rivadavia	Brazil
<i>Drosera walyunga</i> N.G.Marchant & Lowrie	Australia
<i>Drosera whittakeri</i> Planch.	Australia
<i>Drosera yutajensis</i> Duno de Stefano & Culham	Venezuela
<i>Drosera zigzagia</i> Lowrie	Australia
<i>Drosera zonaria</i> Planch.	Australia

Australia is the hub of this Flycatcher plant with roughly about 75% or about 125 of all known species like *D. aberrans*, *D. allantostigma*, *D. burmanni*, *D. gigantea*, *D. falconeri* etc. Followed to this South Africa about 26 species are found (*D. acaculis*, *D. afra*, *D. alba*, *D. alicine*, *D. capensis*, *D. cistiflora*), in Brazil some 14 species are found (*D. mazonica*, *D. camporupestus*, *D. graminifolia*, *D. communis*), in Venezuela 12 species of *Drosera* are found (*D. arenicola*, *D. biflora*, *D. cendeensis*) and New Zealand contain about 9 species of sundew (*D. arcturi*, *D. banksii*, *D. binata*) are also the core of Sundews. A few species of *Drosera* are also reported from North America, South America, Asia etc. like continents (Illustration 4).

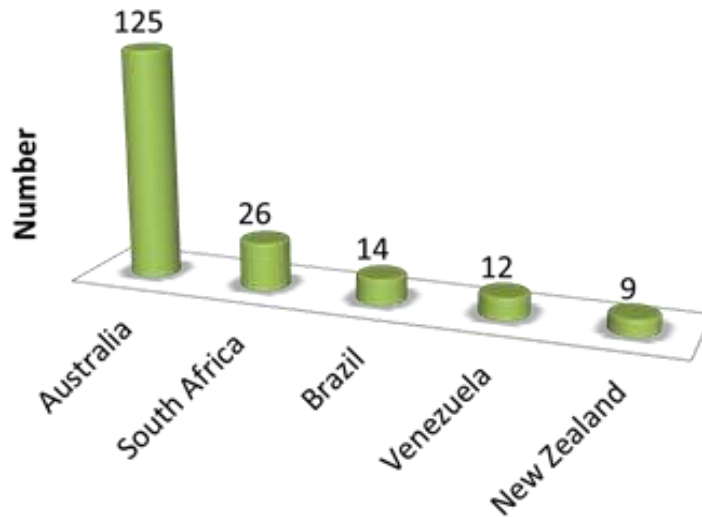


Illustration 4: Distrubution of *Drosera* species throughout the world



Illustration 5: Associate genus of *Drosera*

Habitat

Sundews are adapted to diverse climatic condition. They adapted to temperate, tropical even highly shaded environment and also found in tropical rain forests. Some species also grow in Mediterranean- like climates with very low temperature. They require wet habitats with high sunlight. These species are able to survive in both hot and cool condition. Low nutrient soil or

acidic soil with bogs is the appropriate environment for their growth. Sundews usually grow in association with Sphagnum moss, fern, marshes etc. overlying rocks, pools, streams, open humid soil is the best place for sundews. These species are found in grassland habitat in association with many wetland flora like *Utricularia*, *Eriocaulon*, *Rotala* etc (Illustration 5).

Types of Sundews

Drosera species can be grouped in to five types depending upon their habitat and on their growth form (Illustration 6).

1. Temperate Sundews
2. Pygmy Sundews
3. Tropical Sundews
4. Tuberous Sundews
5. Petiolaris Complex

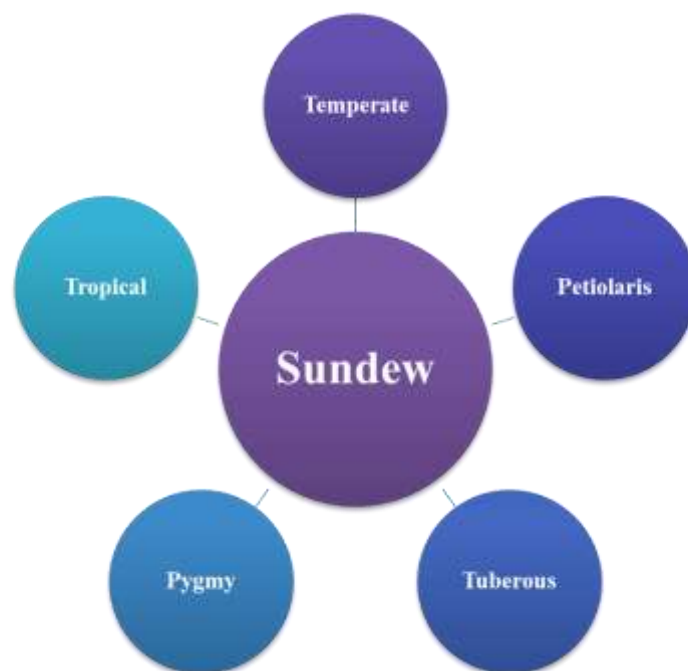


Illustration 6: Types of Sundew

1. Temperate Sundews

Sundews tolerant to the cold temperate climate and can grow in this climate called temperate sundews. Some of these species have wide natural ranges and their origination of the plant

and the seed decide their length of dormancy and cold tolerance. During winter, some species produce winter buds called hibernaculum. This winter bud is formed at the rosette of leaves and usually after information, the old leaves die back.

Four species from this genus are found in the Northern hemispheres that are *D. linearis*, *D. rotundifolia*, *D. anglica*, *D. intermedia*. Some species can grow in warm temperate region *D. capillaris*, *D. brevifolia*, *D. filiformis*, *D. tracyi*.

2. Pygmy Sundews

Pygmy sundews, originated from South-western & Western Australia. Majority of this species grow in hot dry summers and cool, moist winter with 38-56 cm rain. Winter temperature range from 4-21°C & the summer temperature is about 21-38°C. These are tiny rosette *Drosera*. This includes the smallest *Drosera* species among all. Some 40 species of *Drosera* are included in this group. Warm temperate to subtropical and Mediterranean like climate is the proper climate to grow these sundews. The traps in these species are circular to spoon-shaped and the tentacles have very quick movement. These species show asexual method of reproduction by producing gemmae. Wet and sandy soil with the early winter climate is the most active growing season for gemmae.

For example: *D. pygmaea*, *D pulchella*, *D. callistos*, *D. mannii*, *D. scorpiodes* etc.

3. Tropical Sundews

Sundews from the tropical areas of the world are included in this group. Some species of this group can grow in wet and dry season in temperate climate. These species have quite diverse habit that from rosette to prostrate or erect plants and produce rounded to linear shaped leaf.

For example: *D. adaelae*, *D. burmannii*, *D. indica*, *D. pilosa*, *D. prolifera*, *D. burkeana*, *D. spathulata*, *D. madagascariensis*.

4. Tuberous Sundew

These are the tuber producing sundews and of two types: erect tuberous sundews- produce stem that are usually self-supporting; climbing tuberous sundews- produce wiry, flexible stems. These species are indigenous to Australia (Table 5). The tuber colour and size varies from species to species and of white, red, pink in colour with about 4 cm in diameter. Tuberous *Drosera* experience a 6 month growing seasons. They usually grow in 2-26°C

temperature and in 38-56 cm rain during winter season and in summer season they require 21-38°C temperature.

Table 5: Types of tuberous Sundew

Erect tuberous sundews	Climbing tuberous sundews
<i>Drosera peltata</i>	<i>Drosera macrantha</i>
<i>Drosera gigantean</i>	<i>Drosera modesta</i>
<i>Drosera andersoniana</i>	<i>Drosera subhirtella</i>
<i>Drosera huegelli</i>	
<i>Drosera marchantii</i>	
<i>Drosera microphylla</i>	

5. Petiolaris Complex

The group consist of 14 members of *Drosera* species usually grow in Northern tropical Australia region with very high rainfall. The temperature required during summer is about 30°C and during winter temperature is below 18°C. These are also known as Woolly Sundews. These sundews grow in sandy areas, water logged region or swampy region. Most of these sundews have a unique petioles and leaf blades densely packed with long fine tentacles.

For example: *D. petiolaris*, *D. falconeri*, *D. lanata*, *D. paradoxa*, *D. banksii*, *D. ordensis* etc.

Morphology

Sundews are the tiny herbaceous plant having distinguished root, stem and leaves. They generate an erect bushy like structure up to few mm in height. The leaves get modified in to trapping organ and are of diverse shaped and sized.

Leaves

The leaves of *Drosera* consist of leaf blades with distinct petiole or one which is continuous with the shape of the blade. The shape of the blade varies from species to species which is categorized in to two types i.e. broad and thread like blade. In broad blade type the shape of the leaves varies from circular to spatulate to linear and in thread like blade the leaves structures are simple or divided into long and thin segments (Figure 2). The leaves have flat

lamina and are covered with numerous stalked gland or tentacles. On some species the outer edged tentacles don't produce the mucilage are called retentive gland. In both erect and climbing sundews the leaves form a beautiful rosette like structure which is a unique character of leaves in all sundews.

Tentacles

Tentacles are the intermediate structure between leaves and trichome. These tentacles are hair like filaments which produce mucilage which is of glue like consistency and of dew drop structure. These tentacles are extremely sensitive and power of movement and curving, help these plants to trap their prey (Figure 3).

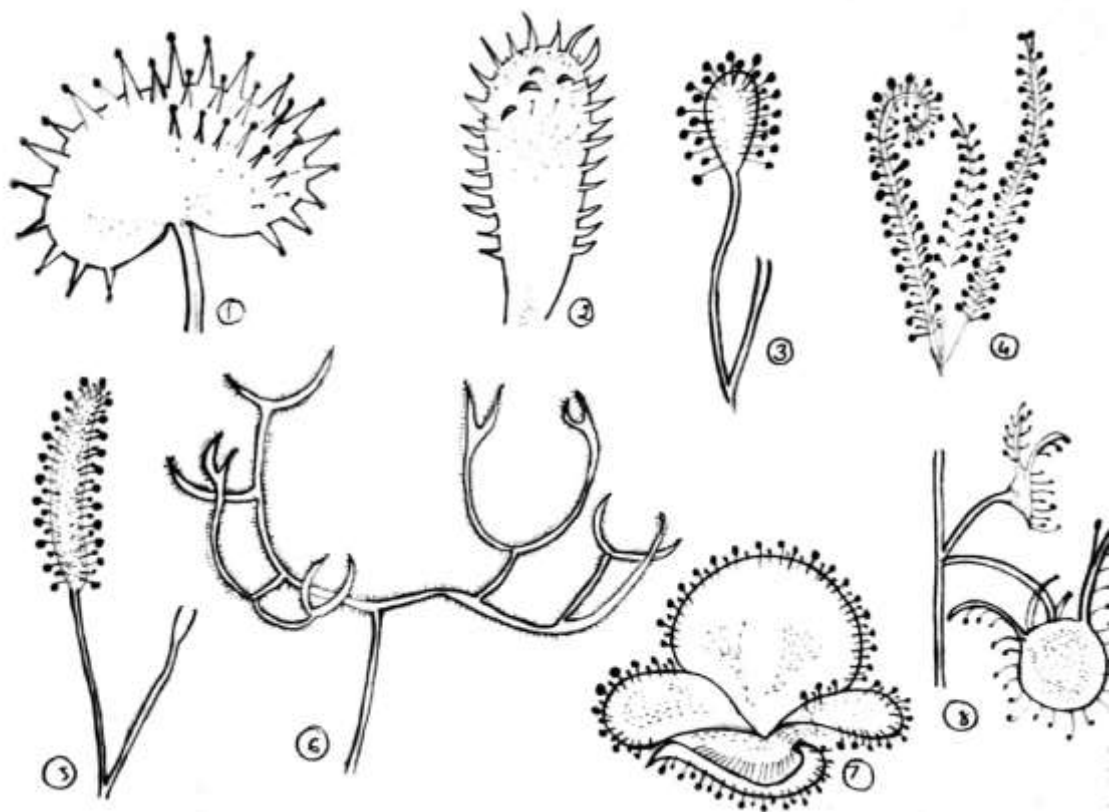


Figure 3: Leaf diversity found in Sundews



Figure 4: Types of tentacles in Sundews

Flowers

The flowers of sundews are borne singly or in cluster by along stem. They adopt terminal flower with long stem to avoid the trapping of pollinators. The flowers of sundews are of diverse shaped. All flowers of the sundews are five petaled, circular and flat faced flowers, usually open in bright light in response to sun and close later in the day. The inflorescence also move in response to the sun's position termed as heliotropic. The petal colour is ranges from white to pink or in some tuberous sundews colour varies from orange, red, yellow, violet.

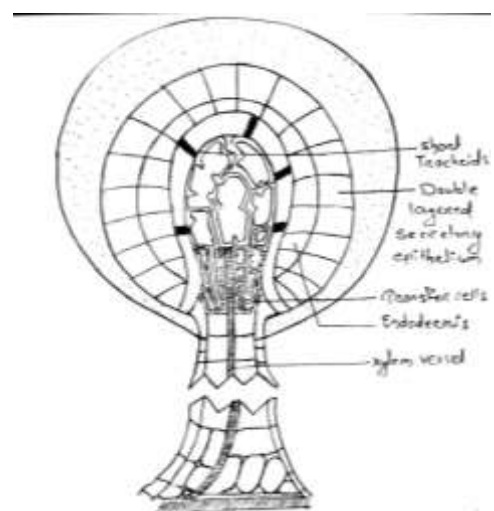


Figure 5: Anatomy of tentacles

Roots

Sundews do not uptake nutrients from soil so the root systems are in underdeveloped condition but in some species that grow in dry regions roots penetrates deep in to soil, where they retreat to survive in the dry season. They extend their root up to 15cm beneath the soil surface. Root system in this genus is either fibrous or fleshy.

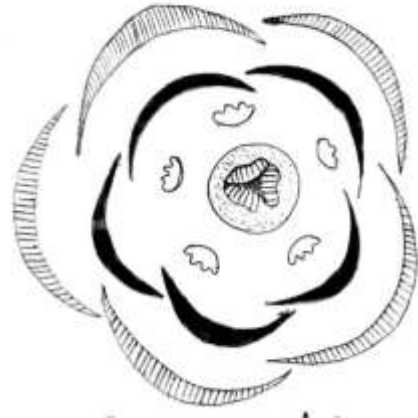


Figure 6: Floral Diagram

Anatomy

Flower

Flowers are actinomorphic, hermaphrodite, hypogynous, tetra or pentamerous.

Corolla

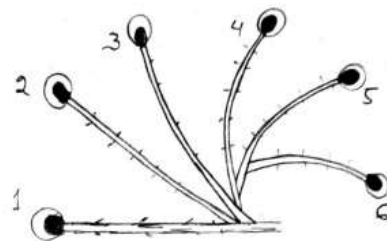
Petals 5 which are distinct convolute imbricate, membranous or soft.

Calyx

Sepal 4-5, basally connate, persistent and imbricate.

Tentacles

Tentacles have two latered secretoty epithet followd to this endodermis, transfer cells and xylem vessels (Figure 4-5).



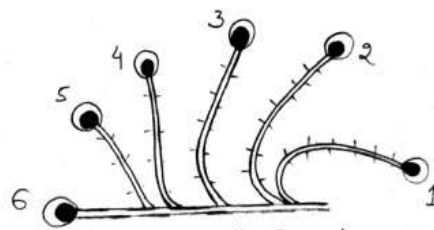
Bending of Tentacles

Androecium

Stamen 5-20 in one or more pentamerous whorls, free distint or rarely the filament basically connate: anthers bithecous, dehiscing longitudinally extrose, pollen in tetrads.

Gynoecium

Carpels 3-5, syncarpous, superior, sometimes nearly half inferior, parietal placentation,



Unbending of Tentacles

Figure 7: Trapping action

unilocular, styles 3-5, mostly free, distinct, often forked or branched, stigma as many as stylartips. Capitat; ovules numerous, anatropus.

Fruit

Loculicidal capsule

Seed

Numerous, embryo straight, endosperm, crystalline-granular

Pollination

Entomophilous, Anemophily

Floral formula: $\oplus, \wp, K_{4+5}, C_5, A_{5-20} G_{(3-5)}$ (Figure 6)

Trapping in Sundews

This small green meat eating plants shows an extraordinary and startling type of trapping. The leaves are modified in to trapping organ covered with delicate hairs called tentacles which contain tiny drop of liquid or mucilage on its head. These tentacles are glisten in the sunlight and develop red colouration. The red glorious tentacles and the dew like glisten mucilage attract the prey by creating a mirage of flowers sweet nectar. After that the prey get trapped and the plant uptake its delight nutrients.

Many species have the capacity to unfold their both tentacles and leaf. Varieties of sundews have thin, filiform leaves or fork or branched leaves are not able to move their leaves and the trapping totally depend upon the movement of tentacles. These sundews with their circular or star shaped leaves able to unfold themselves around their meal (Figure 7).

The trapping mechanism in sundews is closely related to its sister genus *Dionaea*. This trapping action can be related to the action potential in the brain. This is like a bio electrochemical signals that look like nerve impulses exist in all plant.

When insect attracted by these insectivorous plants, it comes in contact with the sticky glands or the tentacles. The insect get trapped in the mucilage containing tentacles. As the insect attempts to release from the trapping, it moves its legs and wings and by this the mucilage is drawn out in to thin threads. This stimulation creates impulses in the plant. Within these thin mucilage threads the prey get fully covered and get suffocated. In case of large insects, they usually die of exhaustion and starvation. The impulses trigger the secretion of additional fluids in the tentacles. Along with this the tentacles commence bending towards the prey. If

the insect struggle towards the edge of the leaf, the retentive glands along the edges begin to curl inwards, blocking the panicking insect's escape. In some species the leaf itself act as trapping organ and folded around its prey (Figure 8).

The speeds of these delicate tentacles depend upon variable tentacles like species of plant, age of the leaf, temperature and also on the size and strength of the prey. The strength of the prey will determine the intensity of its struggle and the struggle is directly proportional to stimulation of tentacles and the impulses. As these tentacles are very sensitive they also respond to chemicals or nitrogenous substances. They also digest these chemicals without moving their tentacles. About twenty minutes a number of tentacles may pin an insect to the center of the leaf while to curl around the prey the leaf take twenty four hours.

The additional fluids secreted from the tentacles are the digestive enzymes like protease, amylase, chitinase etc. which help them to digest their prey. These enzymes completely cover the prey and liquefy the softer part of their prey. After that the entire prey is digested by the plant. After digestion and absorption the tentacles returned back to their vertical position, leaf blades opens up dew drops reappear and the leaf is ready for another meal.

According to the size and stimuli, the tentacles of sundews are of three types. Those are marginal, interzonal and distal. These three types of tentacles have different activities during stimulation. Marginal tentacles are the tentacles present at the margin of the leaf blade and are the longest tentacles. The central tentacles are known as discal tentacles are the shortest and the tentacles located between the marginal and discal tentacles are called interzonal tentacles which is shorter than marginal tentacles but longer than discal tentacles. The marginal tentacles have the capability to develop impulses after trapping and it is the first one which shows the bending towards the prey. The interzonal tentacles respond the stimulation rapidly comes from the marginal tentacles. The discal tentacles also produce stimulation after



Figure 8: Trapping action

trapping but this stimulation is not enough to develop impulses in the plant. For this reason the discal tentacles don't bend itself first and send the stimulation to the nearby discal, interzonal and marginal tentacles and these tentacles bend directly towards the prey after receiving indirect stimulation (Figure 9) (Illustration 7).

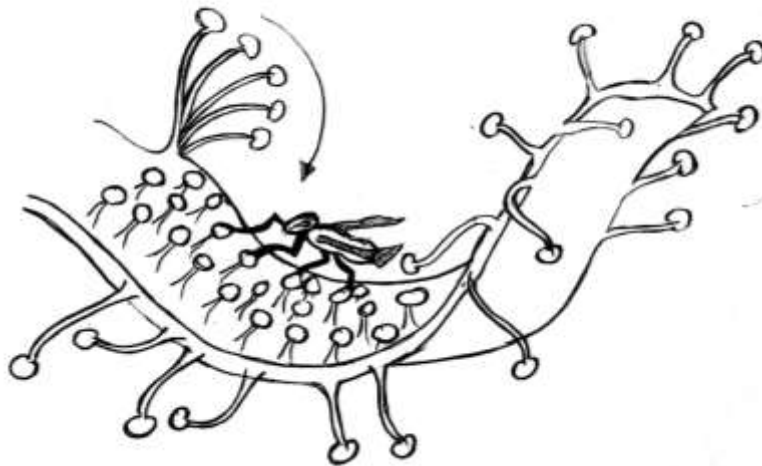


Figure 9: Trapping action using whole leaf

Uses of Sundews

Medicinal uses of *Drosera*

All parts of *Drosera* have their own medicinal properties. Roots, flowers and fruits of the plant have been used against diabetes, bronchial asthma, nervous disorder, arthritis etc. Presences of terpenoid in the plant make them effective against cough. *Drosera burmannii*, *Drosera indica* and *Drosera peltata* used as vital components in an Ayurvedic preparation called Swarnabhasma (Golden ash). This golden ash has been used against loss of memory, defective eye sight, infertility, body weakness, incidence of early aging, asthma, rheumatoid arthritis, diabetes mellitus, nervous disorder etc. Sundews are also effective against whooping cough, tuberculosis, microbial infection, hyperglycaemia, hypolipidaemia, tuberculosis, leprosy, malaria, cancer, fertility problems etc. Quercetin is one of the flavonoids, present in sundews, is active against cancer and Many flavonoids also seem to have antiviral, antibacterial, antifungal and antiallergenic properties *Drosera* produces various secondary metabolites. The most abundant, among these compounds, are the naphthoquinones. These

secondary metabolites are active against toothache and stomach ulcer like diseases (Illustration 8).

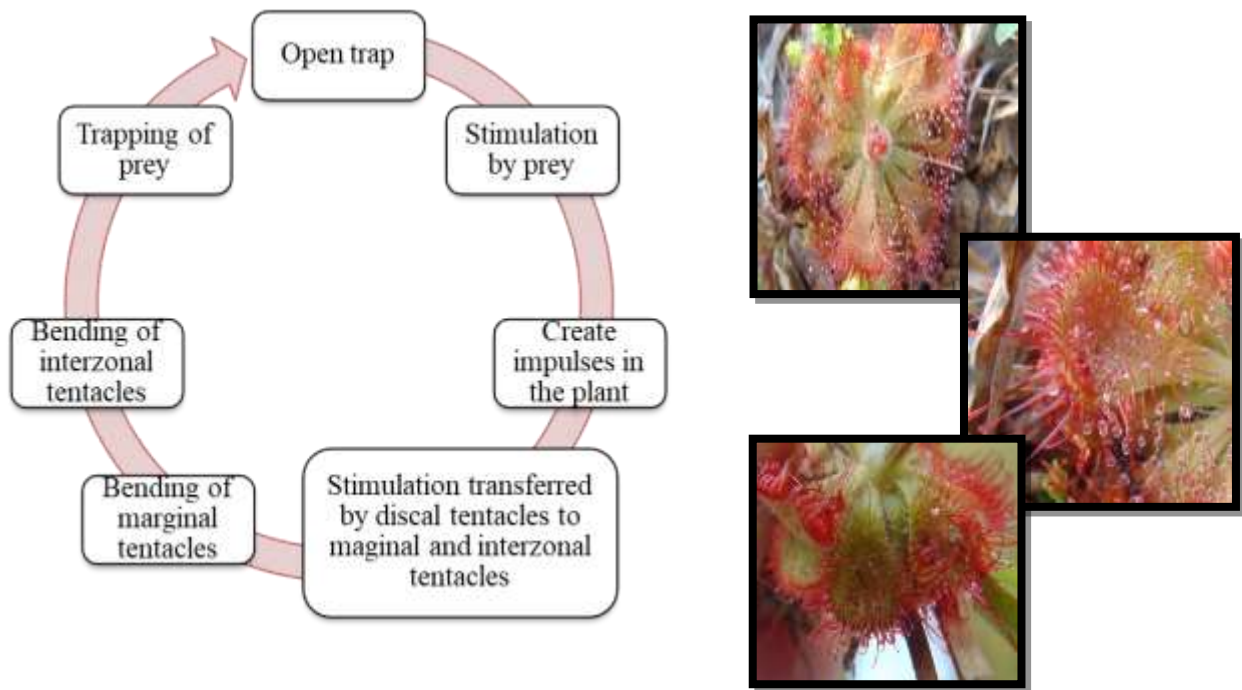


Illustration 7: Trapping Mechanism

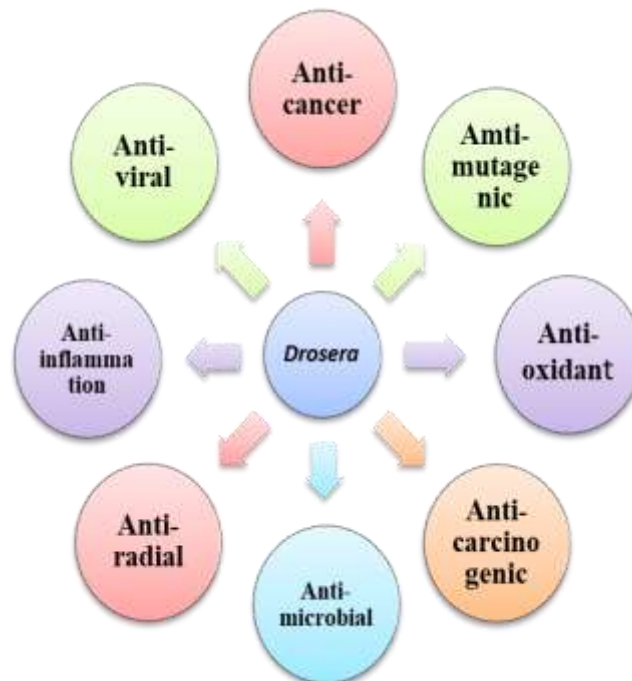


Illustration 8: Medicinal uses of *Drosera*

Economic importance of *Drosera*

Sundews are one of the most beautiful ornamental plants. For example *Drosera capensis*, *Drosera aliciae*, *Drosera spatulata*. The leaves of *Drosera* yield a violet colour dye. A yellowish brown crystalline pigment from *Drosera peltata* is used for dyeing silk. Due to the rich content of organic acids and enzymes in these plant species, they are capable of curdling milk.

Description

Drosera aberrans

Drosera aberrans are tuberous sundew native to South Australia and Victoria. These plants form a rosette like structure bear oval leaves with wide petiole. These are perennial herbs show white fragrant flowers from July to September. These species grow in woodland forest habitats along with damp soils, sand, laterite gravel, lime stone clay, heathland, open forest and have summer dormancy. These species keep their soil slightly damp during its dormancy.

Drosera acaulis

Drosera acaulis are the herbaceous plant generally found in South Africa. These species have very thin underdeveloped root system. Leaves are 8 petiolate, exstipulate, the leaf lamina is narrowly spatulate about 7-8 mm long and 2-3 mm wide. These species bear solitary red or purple flower with obovate petals about 6mm long. Calyx is about 3mm long and styles forked from the base.

Drosera adelaie

These tropical perennial sundews have erect lanceolate leaves up to 10-25 cm long form a basal rosette structure. These plants require less humidity and cooler temperature with more sunlight like Australian rain forest also grow in wet rocks. *D. adelaie* is native to Queensland, Australia. With a long stalk these plants bear numerous bright red, reddish orange or cream coloured flowers from June to November. Older plants may die away and be replaced by many new plants generated from the roots.

Drosera admirabilis

Drosera admirabilis (Floating Sundews) are the perennial herbaceous plant native Australia. The leaves in this plant also form a rosette structure. These leaves widen towards the end and have rounded tips. A single pink or light-violet terminal flower appears on a few centimetre tall stalk which bend horizontally as each flower opens. There are ten yellow anther appear in the center of the rosette plant which is surrounded by six light-violet stigmas .

Drosera affinis

Drosera affinis is a subtropical sundew native to South Africa. These species are mainly grown in moist soils associated with sphagnum. The leaves are slender and can reach up to 4 inches. In this species, during trapping the whole leaf will curl around its meal within a few hours. This plant produces a slender flower with a stalk. These plants show self-pollination.

Drosera afra

Drosera afra is a small herbaceous plant bear apple green leaves native to South Africa. These leaves form a beautiful rosette structure. These species bear a pink colour flower on few inch long stalk. They are mainly grown in winter season. These plants do not develop well nerves on the under surface of the leaves which differentiate it from the other species.

Drosera alba

Drosera alba is the herbaceous sundew native to South Africa. The rounded leaves of this plant form rosette shaped at the base and the thread like leaves form an erect structure above the base. *Drosera alba* owes its name from its white flower. Vegetation period of these species is from October to March. After that the air parts disappear naturally, and then the plant grows back from its fleshy roots in autumn.

Drosera aliciae

Drosera aliciae (Alice Sundew) comes from the Cape Province of South Africa. Evergreen growth habit. These species bear pale green and wedge shaped leaves (5cm long) forming a compact rosette. This plants show the curling of leaves during its trapping of its food. These plants produce a bright pink flower with a long stalk. This species often produce offshoots from its root. These are easily propagated from abundant seed or leaf and root cutting. Some consider it to be a member of *D. Spathulata* complex.

Drosera allantostigma

Drosera allantostigma is a pygmy sundew, herbaceous in nature, native to Australia. These plants are very thin and small. These plants are fibrous rooted. The leaves with numerous tentacles form a rosette. They become so densely packed that the old leaf stipules are pushed away from the rosette center. This plant can reach up to 0.08m height. The appropriate growth of this plant is seen in loam, silica sand or peaty soils. They bear white colour flower and the flowering period is between November to December. These flowers rarely produce seeds and these seeds are extremely difficult to germinate.

Drosera amazonica

Drosera amazonica is a perennial herbaceous plant native Brazil. This species is endemic to the Northern Amazon basin in Amazonas and Roraima states of Brazil, from where the amazonica name is derived from. Stems are short and unbranched, covered by dried leaves. The leaves are rosulate, glabrous, the tentacles are found in young leaves only. Flowers are solitary, short pedunculate, sepals are covered by white or red hairs.

Drosera andersoniana

Drosera andersoniana (Sturdy Sundew) is an erect tuberos sundew, native to Western Australia. The circular and peltate leaves form a tight rosette at the base. The stem of this plant grows up to 10 inches. White to pinkish flower is appeared in the plant during the month of August to September. The whole plant can achieve a rich red colour in good sunlight.

Drosera anglica

Drosera anglica (English Sundew) is a temperate sundew native to North America, Europe and Asia. This plant is generally grows in bog habitats. They are mainly found in association with Sphagnum mosses. It is a perennial herb forms an upright stem less rosette of generally linear spatulate leaves. White flowers appear in this plant with five sepal, petal and stamen. Literature revealed that *D. anglica* is a fertile hybrid between *D. rotundifolia* and *D. linearis*.

Drosera arcturi

Drosera arcturi is a herbaceous sundew native to Australia and New Zealand mainly found in alpine and sub-alpine region where its mountain habitat is covered with snow during winter. This species generally grows in this high altitude that is above 1500m in association with bogs, *Utricularia* species and *Sphagnum* moss. The leaves are pale green in colour. Young leaves begin at the center of the plant and is folded along their center. After maturity they get unfolded. This species bear a solitary white flower with a short stalk and appear during November – February. Fruiting period is between January to March.

Drosera auriculata

Drosera auriculata is an herbaceous sundew native to Australia. In this sundew both basal rosette and elongated stem are produced. The rosette forming leaves are circular to reniform 2-6 mm in diameter and grow on petiole of 3-10mm. the stem leaves are alternate or in cluster form. 8-10 flowers are

appear in the few centimetre height stalk. The sepals are glabrous with black dots. Flowering period is between spring to summer.

Drosera badgerupii

Drosera badgerupii is tiny pygmy herbaceous sundew native to Australia. This species is a hybrid of *Drosera patens* and *Drosera micra*. The leaves of this plant form a bright red rosette structure with long petioles. They bear a white colour flower with a small stalk. These are winter growing plants also able to grow in warm weather. This can be propagated by its buds.

Drosera banksii

Drosera banksii (Banks' Sundew) is an annual sundew native to Australia and New Zealand. The reniform, cup-shaped, peltate leaves on thin petioles form a rosette pattern around the stem. These plants produce no drought resisting tuber and die away during the dry season. They produce beautiful white coloured flower.

Drosera barbigera

Drosera barbigera is a pygmy sundew native to Western Australia. Usually found in Lateritic soils. The leaves with long petiole form a rosette shape around the stem. They bear fibrous roots height up to 0.04-0.1m. A solitary flower appears in this plant which is orange with black combination on a short stalk. This flower differentiates this sundew species from other species. Flowering period is between August to October.

Drosera beleziana

Drosera beleziana is the natural hybrid between *Drosera rotundifolia* and *Drosera intermedia*. These are temperate sundews native to Australia. These species hold large, up right, spoon shaped leaves. This hybrid is sterile and must be propagated by division or leaf cutting.

Drosera bequaertii

Drosera bequaertii is a perennial sundew native to Angola & the Democratic Republic of the Congo. The obovate leaves are alternately erect and dense at the top of the stem and rarefied on the lower part of the stem. Usually grow with bogs. They appear 2-8 bright pink coloured flower having 5 petal, 5 sepal and 5 stamens. Ovary subglubose and glabrous, upto 2-3 mm long. These species bear ovoid, black shining numerous seeds.

Drosera bicolor

Drosera bicolor is a tuberous sundew native to Australia. It is an erect species of bronze-green to rust colour. The leaves produce a basal rosette. The basal rosette is well developed before the stem will emerge. The flowers of this species have red dot on the white petals, so this species is named bicolor and this is a peculiar character for this species. The flowering period is between September to October.

Drosera biflora

Drosera biflora is the herbaceous sundew native to Venezuela. The spatulate leaves form the rosette shape of the plant. Every plant has 1-2 Inflorescences, 2-3 cm long. This plant appears white colour flower, entire margin and ovate sepals. Stamens 2.5-3 mm long, ovary is with 3 styles, bipartite near base. Seeds foveolate, ovate, almost circular, covered with granulate wax.

Drosera binata

Drosera binata is an upright plant 40 cm high with stalked leaves native to Australia & New Zealand. Also found in Victoria, Tasmania and Queensland. Usually grow in swampy and coastal areas. This species is known as T-form sundews. The leaves of this plant are y-shaped. The leaves can reach lengths up to 20 inch. Flowers are white. It goes dormant in winter when exposed to low temperature up to 15 degree Celsius.

Drosera brevicornis

Drosera brevicornis is a small sundew native to Western Australia. High humidity and moist environment is the appropriate condition for the growth of this species. This sundew is perennial sundews appear pink colour flowers during the month of March & April. The greyish green basal rosettes bear red coloured traps. The anthers of the flower have a horn like projection. So that this species is named as brevicornis means short horned.

Drosera brevifolia

Drosera brevifolia (Dwarf Sundew) is a tiny sundew native to North America, Central America & South America. The leaves are wedged shaped gradually taper to a short petiole. Leaves colour ranges between red to reddish purple. The leaf blade length is 0.2-0.7 inch. These plants form very dense colonies and about one-half inch in diameter. Flowers are large and up to 8 white to pink colour flowers are borne on a glandular pubescent scape during spring season.

Drosera broomensis

Drosera broomensis is a woolly sundew native to Australia. They are also found on the Northern shores of Taylor's lagoon, east of Broome and Kimberley. The plant bears green hairy peduncles with orange-red circular trap leaves at its head and these leaves form a small, leafy rosette. These are perennial herb. These plants are mostly growing in sandy soil. These plants appear beautiful white coloured flower during the month of February and March.

Drosera browniana

Drosera browniana is a perennial tuberous sundew native to Western Australia. The tubers are red in colour. Older tubers may be covered by dark papery sheaths from previous year's tubers. The leaves form rosette about 3-5 cm in diameter. Usually these plants grow in loam soils in wet zones near granite outcrops. This plant appears pink or white colour flowers during August to September.

Drosera bulbigena

Drosera bulbigena (Midget Sundew) is a tuberous erect growing sundew endemic to Western Australia. These plants usually grow on swamps and inter-wet depression. The stem is glabrous along its entire length with 1-2 bracts on the lower part of the stem. These plants produce white flowers during August to October. The tubers are red in colour up to 1.5-2 mm in diameter and enclosed in papery sheaths from previous season's tubers.

Drosera bulbosa

Drosera bulbosa (Red-leaved Sundew) is a tuberous species endemic to Western Australia. The leaves are pale green in colour and the colour will change to golden-yellow towards the end of the growing season. The leaves are torn up, and in particular the glandular hairs are usually laying down, exhausted, without mucus. The tubers are red in colour. A white solitary flower appear in the plant with a small stalk during April to June.

Drosera burkeana

Drosera burkeana is a dwarf sundew grows as a rosette native to South Africa. These plants generally grow in marshes, bogs, swamps and veils areas. The leaves are radical, small with a sub rotund lamina up to ½ inch long, shorter than the petiole (2-20mm long) form the basal rosette structure. The inflorescences are 5-20 cm high with 3-10 flowers having white or rosy petals. These plants are stem less perennial herb.

Drosera caduca

Drosera caduca is a petiolaris complex group of sundew native to Western Australia. The plant requires lots of light, high humidity and white sandy soils for their growth. These are the perennial sundews. The leaves are arranged in a rosette form emerging from the root stock. White flowers are appeared in this sundew during the month of December to July.

Drosera callistos

Drosera callistos is a pygmy sundew endemic to Western Australia. The leaves are modified in to gemmae which detach root and form new plants. These plants are mostly grown during winters. The flowers of this species are usually big and appear in a combination with white, pink, yellow, orange and red. These species grow mainly as small stem less rosette possessing minute trapping leaves of 1-2 mm diameter with prominent marginal tentacles.

Drosera camporupensis

Drosera camporupensis occur over mountain tops in central Brazil. Wet summer, dry winters, high vapour pressure deficit, high total radiation, shallow soils in a matrix of decomposed quartzite rocks with fissures is the best environment for such species. These are perennial herbs.

Drosera capensis

Drosera capensis (Wide-leafed Sundew) is a cape sundew native to South Africa. The leaves are erect and the leaf blades are linear and about as long as the petiole. The leaves are green in colour covered with bright red tentacles. Numerous pink flowers are borne on each scape. These are of three types: *Drosera capensis* "Narrow"- the leaves and the petioles are rather narrow, about a quarter inch in diameter. *Drosera capensis* "Alba"- the flowers are white and the tentacles are pale pink coloured. *Drosera capensis* "Red"- the entire herb is reddish maroon in colour with deep pink flowers.

Drosera capillaris

Drosera capillaris is a pink sundews endemic to North America , Central America & South America. The leaves are egg-shaped and the rosettes are usually 1- 2 inches. The leaf blades are longer than broad which differentiate it from other similar species. These species are annual or short-lived perennial. This sundew produces 1-12 flowers with rose pink to white coloured petals.

Drosera cayennensis

Drosera cayennensis is an herbaceous sundew native to Brazil, French Guiana & Venezuela. Spathulate leaves organize in to rosette form. Blades are widely obovate. 1-2 light pink or pink colour flower appear in the stalk of few centimetre long. The sepals are narrowly ovate, free from base also contain little hairs. Stamen 4-5, ovary is with 3 styles, bipartite near base, seeds foveolate and covered with granular wax.

Drosera cendeensis

Drosera cendeensis is an erect subtropical sundew endemic to Venezuela. These are the rare sundews grow in open riparian location or in *Sphagnum* peat wetlands amongst montane forest region. The smaller basal spatulate leaves form a rosette. The leaves are green in colour and bear scarlet tentacles. Pink coloured flowers with obovate petals are produced in the 25 cm long stalk.

Drosera cistiflora

Drosera cistiflora is a perennial elongated sundew endemic to South Africa. These are the winter growing sundews. The leaves are spear-shape which taper from top to bottom are scattered alternately along the un-branched stem and organized in to a rosette structure at the base. Large elongated reddish knob shaped tentacles are present on the upper leaf margin and tip. It produces one of the largest flower in this genus having white, yellow, mauve, pink or purple to dark red coloured petals during August to September.

Drosera citrina

Drosera citrina is a pigmy herbaceous sundew native to North America, Central America & South America. These are the perennial sundews. The leaves form the rosette structure. These sundews produce fibrous root. This plant appears flower with white and yellow combination during the month of October.

Drosera closterostigma

Drosera closterostigma is a pigmy sundew native to North America, Central America & South America. Leaves are organised in to rosette structure and are of bright red colour. These sundews are very tiny in size about 2-3inches in diameter. It produces large flower white colour with red coloured center.

Drosera coccipetala

Drosera coccipetala is native to Cape Province produce pink coloured flower with a long stalk. A packed rosette is formed by the leaves full of tentacles. Usually grow on sandy soil.

Drosera collinsiae

Drosera collinsiae is a subtropical sundew endemic to South Africa. The leaves are spoon shaped and attached to a long and thin petiole. These sundews don't form a stem. The leaves are bright green in colour. This sundew produces beautiful pink coloured flowers and is self-pollinating herb.

Drosera communis

Drosera communis is a rosette sundew endemic to Brazil, Colombia, Paraguay & Venezuela. The leaves are spoon shaped. This sundew required more sunlight for proper growth. Flowers of these sundews are dark pink in colour.

Drosera corinthiaca

Drosera corinthiaca is the hybrid between *Drosera aliciae* and *Drosera glabripes* native to Australia. These are perennial sundews with an erect stem grow mostly on moist peaty sandy soil. Leaves are spatulate and the blades are obovate on a straight sided petiole. Inflorescence ascending, flowers are dark pink in colour with 5 petals and 5 sepals.

Drosera cuneifolia

Drosera cuneifolia is a subtropical sundew endemic to South Africa. These are the rosette forming perennial sundews. The green coloured leaves are produced in a wide petiole. The leaf blades are also wider and with rounded corners. Pink to reddish purple flowers are appear in these types of sundews. They are self-pollinated.

Drosera darwinensis

Drosera darwinensis is a perennial sundew native to Australia. The spoon shaped leaves are arranged in a rosette with a long petiole. Pink or white petaled flowers are appeared in this sundew from December to April.

Drosera derbyensis

Drosera derbyensis is a beautiful perennial sundew native to Australia. This species are usually grown in sandy soil. The rosette forming leaves are erect to semi erect in shape with long narrowly oblanceolate petioles. It produces white coloured flower from March – June. .

Drosera dichrosepala

Drosera dichrosepala is a pygmy sundew endemic to Australia. This sundew bears spoon shaped leaves form rosettes about half inch in diameter. This sundew produces white coloured flower worth 5 petals and 5 sepals.

Drosera dielsiana

Drosera dielsiana is a subtropical sundew native to Sourthern Africa. Diels is the scientist who wrote first monograph on this sundew, so the species is named as “Dielsiana”. It produces rounded leaves with a wide petiole. White flowers are appeared in this sundew.

Drosera dilatatopetiolearis

Drosera dilatatopetiolearis is a woolly sundew endemic to Australia. These are mostly found in damp areas. These are clamp producing sundews. It produces medium broad green petioles with small circular red traps. White coloured flowers are appeared in these sundews.

Drosera echinoblastus

Drosera echinoblastus are the sundews native to Australia. The spatulated leaves of this sundews form a compact rosette structure around the stem. An orange colour flower is appeared in this sundew with a long stalk. This sundew produces beautiful vibrant red colour leaf blades with tentacles.

Drosera elongata

Drosera elongata is a branched sundew having an enormously long stem endemic to Angola. These sundews are mostly found in boggy soils. The small leaves with petioles are scattered around the long stem. This sundew produces a pink coloured flower.

Drosera enneabba

Drosera enneabba is a pygmy sundew native to Australia. This rosette sundew produces pinkish white flower with a few centimetre long stalk.

Drosera ericgreenii

Drosera ericgreenii is a perennial herb native to South Africa. These are much shorter sundew with short stem. Leaves are broadly obovate to narrowly oblong. Usually grow in sandy soil with clay.

Drosera ericksoniae

Drosera ericksoniae is a pygmy sundew native to Australia. This sundew is named after Rica Erickson. Golden rosettes are formed in this sundew. It appears circular pink coloured flower that occasionally produce seed.

Drosera erythrorhiza

Drosera erythrorhiza (Red ink Sundew) is [perennial tuberous sundew endemic to Australia. These sundews produce 5-12 oval to obovate leaves. This broadly oval leaves are organised in to a rosette. Numerous flowers are produce in these sundews. There are three subspecies of this sundew species: *Drosera erythrorhiza* subsp. magna, *Drosera erythrorhiza* subsp., *Drosera erythrorhiza* subsp. squamosal.

Drosera esterhuyseniae

Drosera esterhuyseniae (Alice Sundew) is a sundew native to South Africa. The wedge shaped leaves form a compact rosettes. This plant produce pink coloured flower with about 30cm long stalk. This plants are realtively easy to cultivate and grow.

Drosera falconeri

Drosera falconeri is a tropical sundew native to Australia. This sundew has short, broad petiole with immense, oblong traps over an inch wide. The leaves are flat against the soil and covered with non-glandular white hairs. The whole plant is deep maroon in colour. About 12 white or pink flowers are produced in one inflorescence. Mostly found in the coastal areas of the Northern Territory.

Drosera filiformis

Drosera filiformis (Thread-leaved Sundew) is a temperate sundew native to North America. The leaves are thread like, which gives this plant its common name. In winter, the leaves died and the plant form a resting bud, which will grow in to a new plant in appropriate condition. These plants also form large clumps.

Drosera fimbriata

Drosera fimbriata (Manypeakes Sundew) is an erect sundew endemic to Australia. The stem is non-branched and bears 2-3 whorls of non-carnivorous leaves on the base and 2-5 whorls of carnivorous leaves above that. This is a tuber producing sundew of orange colour. It produces white coloured flowers.

Drosera gibsonii

Drosera gibsonii is a pygmy sundew endemic to Western Australia. These are fibrous rooted sundews. 6-12 leaves are found in these sundews and lamina narrow elliptical. Inflorescence singular, racemose and covered with minute short stalked glands, pink to mauve coloured flower with yellow anthers and pollen.

Drosera gigantean

Drosera gigantean, the king of tuberous sundew, native to Australia. The tubers are usually red in colour and about 1 ½ inches in diameter. These sundews produce a stem with lateral branches. Small and shield like leaves are arranged over the branches. White colour flowers are appeared in these sundews and the foliage is golden green to bronze in colour.

Drosera glabripes

Drosera glabripes is a perennial sundew native to South Africa. Sprawling stems with the rosette of green leaves. Leaves are closely imbricate and spoon shaped. Blades shortly obovoid and stipules long lacerate. Petals 6-12, reddish purple in colour and broadly obovate and cuneate.

Drosera glanduligera

Drosera glanduligera (Pimpernel Sundew) is a rosette annual sundew native to Southern region of Australia. This species usually grow and germinate during rainy season. Flowers are orange to red in colour appeared during early March to late April and produce large number of seeds.

Drosera graminifolia

Drosera graminifolia is a perennial rosette herb native to Brazil. Stems are up to 6-15 cm long. Leaves are linear with regular circinate venation. Inflorescence a scorpioid cyme, often bifurcate, bearing 9-23 flowers. Flowers having 5 petals and are light pink in colour. Fruit a dry capsule and seeds oblong fusiform.

Drosera graniticola

Drosera graniticola is a tuberous sundew native to Australia. These are perennial herbs. White flowers are produced by these sundews during the month of August to September. This species was first described and named by N.G. Marchant in 1982.

Drosera graomogolensis

Drosera graomogolensis is endemic to Minas Gerais in Brazil. It has long and thick leaves. Under strong light the leaves turned to bright pink colour. Mature plants form clusters in them. It is cultivated as an ornamental plant. These sundews produce 1-2 flowering stalks with 10-15 pinkish-violet flowers.

Drosera grieviei

Drosera grieviei is native to Australian region. The stem of this sundew is erect. The leaves are scattered around the stem bearing red coloured tentacles. This plant produces beautiful white coloured flowers.

Drosera hamiltonii

Drosera hamiltonii (Rosy Sundew) is a rosette sundew endemic to Australia. The leaves are brown in colour form a flat rosette. These leaves are shaped like rounded paddles and sparsely covered in red tentacles. It produces purplish flowers and these flowers don't bear seeds.

Drosera hartmeyerorum

Drosera hartmeyerorum is an annual sundew native to Australia. This sundew produces yellow round trichomes at the leaf base. These sundews are mostly found in temperate region and grow in warm wet, sandy, peaty areas with high humid condition.

Drosera heterophylla

Drosera heterophylla (Swamp rainbow) is a tuberous sundew native to Australia. The stem is erect. Small leaves are arranged around the stem. White flowers are appeared in these sundews having 5-6 petals, which is a key character for this species, found during the month from June to September.

Drosera hilaris

Drosera hilaris is a perennial sundew endemic to South Africa. These species are usually found in mountain slope areas. Leaves are oblanceolate. Purple colour flowers are produced on an erect stem during September to November.

Drosera hookeri

Drosera hookeri (Grassland Sundew) is a tuberous sundew native to Australia. Mostly found in winter-wet, summer dry grasslands. These are perennial sundews. The semi-orbicular leaves form a rosette structure around the branched aerial stem. It produces white colour flowers.

Drosera huegelii

Drosera huegelii (Bold Sundew) is a tuberous sundew native to Australia. Bell shaped leaves are produced around the stem. White to cream coloured flowers are appeared in this sundew from June to September.

Drosera humilis

Drosera humilis is a tuberous sundew endemic to Australia. The leaves arranged in whorls around the stem. This is a perennial sundew. White coloured flowers are produced in these sundews from June to September.

Drosera hybrida

Drosera hybrida is a rare hybrid between *Drosera filiformis* and *Drosera intermedia* native to NE. U.S.A. the thin and erect leaves form the rosette structure. It grows usually during summer season. This is a perennial sundew.

Drosera hyperostigma

Drosera hyperostigma is a rosette sundew native to Australia. These are perennial herbs. Found in laterite and silica sand soil. These are fibrous rooted. Flowers are orange in colour appear during October to November.

Drosera intermedia

Drosera intermedia, a temperate sundew endemic to Temperate Europe, North America & South America. Primarily grow around lakes in pure peat covered in a few inches of water. Spoon shaped leaves are found around the stem on a narrow petiole. The flowers are white in colour.

Drosera intricata

Drosera intricata is a tuberous sundew native to Australia. This is a perennial climbing species. Stem is glabrous and the leaves are formed around this stem. This plant produce yellow coloured flower from September to October.

Drosera kaieteurensis

Drosera kaieteurensis is a perennial sundew native to Guyana, Trinidad, Tobago & Venezuela. The leaves are oval in shape and the tentacles are crowded on the upper surface. 2-9 flowers are appeared in few centimetre long inflorescence, produce white or pink coloured flower.

Drosera katangensis

Drosera katangensis is a perennial sundew native to Democratic Republic of the Congo. Primarily grow on swampy areas. Now it is a critically endangered species.

Drosera lanata

Drosera lanata is a woolly sundew native to Australia. The rosette forming leaves have long and thin petioles. Both the petioles and the center of the rosettes are densely covered with dense, silvery, woolly hairs.

Drosera lasiantha

Drosera lasiantha is a pygmy sundew native to Australian region. On maturation the lower portion will turn brown, but the upper portion will remain green. It is a tropical perennial herb. They produce gemmae during autumn. Flowers are pink in colour.

Drosera leucoblata

Drosera leucoblata is a pygmy sundew native to Australia. The circular leaves are arranged to form a rosette structure. Large bright orange flowers are appeared in this sundew. Reproduction is by the formation of gemmae.

Drosera linearis

Drosera linearis (Slender leaf Sundew) usually grow in alkaline region endemic to North America. It produces leaner leaves on long upright petioles.

Drosera longiscapa

Drosera longiscapa is a perennial sundew native to South America. Stems covered with dead leaves from previous season's growth. Leaves are alternate and upright when young then held about 35° from the main axis. Flowers are dark pink in colour.

Drosera lowriei

Drosera lowriei is a rosette tuberous sundew endemic to Australia. The leaves are reddish and spoon shaped and is reduced in size towards the center of the rosette. It is a perennial herb. It usually grows in loam soils.

Drosera macrantha

Drosera macrantha is a climbing tuberous sundew native to Australia. Produces cup shaped leaves. White or pink coloured flowers are appeared in these sundews with a long inflorescence.

Drosera macrophylla

Drosera macrophylla is a tuberous sundew endemic to Australia. The leaves are large and tear drop shaped. These leaves are arranged in to rosette structure. The flowers are appeared before the rosette is fully developed.

Drosera madagascariensis

Drosera madagascariensis is a sundew native to African region. This sundew has an upright stem and the upper part of the stem has young leaves while the lower part bears the old leaves. Pink coloured flowers are appeared in 20-40 cm long inflorescence.

Drosera mannii

Drosera mannii is a pygmy sundew native to Australia. The leaves are produces in with broad petioles. Pink or white glowers are appeared in these sundews.

Drosera marchantii

Drosera marchantii is an erect tuberous sundew endemic to Australia. They bear peltate leaves on a circular stem. This is a perennial herb. This plant produces white or pink coloured flowers emerges from June to October.

Drosera menziesii

Drosera menziesii (Pink rainbow) is an erect tuberous sundew native to Australia. Circular leaves are produce along the undulating stem. Pink coloured flowers are bloomed from July to November.

Drosera meristocaulis

Drosera meristocaulis is a perennial sundew native to Venezuela. These spatulated leaves are produced in a stem covered with dead leaves. Flowers with pink petals are produced in winter season.

Drosera microphylla

Drosera microphylla (Golden rainbow) is an erect tuberous sundew native to Australia. It is a perennial herb primarily grows in sandy or laterite soil. The leaves are circular and peltate shaped. It produces red coloured flowered with golden sepals.

Drosera modesta

Drosera modesta (Modest rainbow) is a climbing tuberous sundew endemic to Australia. This is a perennial herb. It produces shield shaped leaves with extra-long tentacles. White coloured flowers are appeared in this type of sundew.

Drosera Montana

Drosera montana is a subtropical sundew endemic to Argentina, Brazil, Paraguay & Venezuela. The leaves are wedge-shaped with blunt ends.

Drosera moorei

Drosera moorei is a tuberous sundew native to Western Australia. It produces glabrous stem and circular peltate leaves. Two to ten yellow flowers emerges in the in the inflorescence from September to October.

Drosera myriantha

Drosera myriantha (Star rainbow) is a tuberous sundew native to Western Australia. Usually found in sandy soil. White or pink coloured flowers bloom from October to December.

Drosera natalensis

Drosera natalensis is a subtropical sundew native to Madagascar, Mozambique & South Africa. In bright light condition this species can turn to orange-red. The leaves with the tentacles curl around the prey for trapping. Small pink coloured flowers are produced in this sundew.

Drosera neesii

Drosera neesii (Jewel rainbow) is a tuberous sundew endemic to Australia. Small cup shaped leaves are produced along the stem. These species are mainly found in swampy areas. Pink coloured flowers are appeared from August to December.

Drosera neocaledonica

Drosera neocaledonica is endemic to New Caledonia. The green petioles have many silver hairs. White colour flowers are produced in this sundew.

Drosera nidiformis

Drosera nidiformis is a tropical sundew native to South Africa. This sundew produces obovate leaves on petioles. Pink coloured flowers are produced on a long stalk.

Drosera nitidula

Drosera nitidula is a pygmy sundew native to Australia. Round leaves are produced on a thin petiole. These leaves are arranged in to rosette structure. The flowers are white in colour with red colour in center bloom from early spring to mid-summer.

Drosera oblanceolata

Drosera oblanceolata is a subtropical sundew native to China. White hairs are appeared in the petiole of this sundew. They are self-fertile. Pinkish peach coloured are produced in these sundews.

Drosera obovata

Drosera obovata is a natural hybrid between *Drosera rotundifolia* and *Drosera anglica* found in Temperate Northern Hemisphere. These sundews are infertile in nature. It produces white coloured flower with slender flower stalk.

Drosera occidentalis

Drosera occidentalis is a pygmy sundew native to Australia. This is a very tiny sundew. White coloured flowers are appeared in this sundew produces one or two seeds.

Drosera orbiculata

Drosera orbiculata is a tuberous sundew endemic to Australia. Circular leaves are produced on long red petiole. This is a perennial herb. It mainly grows in sandy clay soil.

Drosera ordensis

Drosera ordensis is a woolly sundew native to Australia. Erect leaves are produced on long and wide petioles. The petioles are covered with white hairs. Pink or white flowers are produced in these sundews.

Drosera oreopodion

Drosera oreopodion is a pigmy sundew native to Australia. These are very tiny jewel like sundews. This sundew produces white coloured small flowers.

Drosera paleacea

Drosera paleacea is a pigmy sundew native to Western Australia. It produces white coloured flower.

Drosera pallida

Drosera pallida (Pale rainbow) is a climbing tuberous sundew native to Western Australia. It produces white coloured flower from July to November.

Drosera paradoxa

Drosera paradoxa is a woolly sundew endemic to Australia. It is a perennial herb. The leaves are sub-orbicular and hairy. It produces few centimetre long inflorescences with white or pink coloured flowers during July to September.

Drosera parvula

Drosera parvula is a tiny sundew endemic to Australia. White tiny flowers are appeared in these types of sundews.

Drosera patens

Drosera patens is a pigmy sundew native to Australia. These are tiny red sundews. This sundew produces white coloured flower on a long stalk.

Drosera pauciflora

Drosera pauciflora is a winter growing sundew native to South Africa. Leaves are broad and wedge shaped. It produces the fastest moving tentacles of this genus. Stems are wiry. Pink coloured are produced by these sundews.

Drosera pedicellari

Drosera pedicellaris is a pygmy sundew endemic to Australia. It produces hairy petioles with semi erect leaves. This sundew produces up to twenty flowers on a single inflorescence and is white in colour.

Drosera peruensis

Drosera peruensis (Peruvian Sundew) is a sundew native to Peru. The upper side of the leaves have hairy shaggy texture with glandular hair while the undersides of the leaves have thread like trichomes and are of golden colour. It produces white or red coloured flowers.

Drosera petiolaris

Drosera petiolaris is a woolly sundew endemic to Australia & New Zealand. It produces long narrow petioles with erect leaves. Dark pink coloured flowers are bloomed on this sundew.

Drosera pilosa

Drosera pilosa is a sundew native to Cameroon, Guinea, Kenya & Tanzania. These are tiny rosette species with a very hairy surface. Leaves are oval or obovate. These are perennial herbs. Red or reddish purple flowers emerge from these sundews.

Drosera platypoda

Drosera platypoda (Fan leaved Sundew) is a tuberous sundew native to Australia. Cauline leaves are arranged alternately along the stem. White coloured flowers are emerged from this sundew in the month of October.

Drosera platystigma

Drosera platystigma (Black eyed Sundew) is a pigmy sundew native to Australia. The flowers are with orange and black combination. The flowers are almost as big as the plant.

Drosera porrecta

Drosera porrecta is a tuberous plant endemic to Australia. These species are commonly found in sandy soil. White flowers are bloomed from July to September.

Drosera prolifera

Drosera prolifera is a sundew native to Queensland, Australia. These sundew bear kidney shaped leaf with a long and thin petiole. Small red flowers are appeared in these sundew and these flowers sometimes produce seeds.

Drosera prostrata

Drosera prostrata is a tuberous sundew native to Australia. These are perennial herbs. Leaves are arranged along the prostrate stem of this sundew. It produces white coloured flower during May to June.

Drosera pulchella

Drosera pulchella is a pygmy sundew endemic to Australia. These are very tiny sundews. The leaves of these sundews surround a central bud. This sundew produces beautiful orange coloured flower.

Drosera purpurascens

Drosera purpurascens is a tuberous sundew endemic to Australia. It produces semi erect lateral stems. White coloured flowers are appeared during the month of July to October.

Drosera pycnoblata

Drosera pycnoblata is a tiny sundew native to Australia. It produces tiny circular leaves with shallow fibrous root system. White coloured flowers are appeared in this sundew.

Drosera pygmaea

Drosera pygmaea is pygmy sundew endemic to Australia & New Zealand. It produces small, bright red to green rosettes and tiny white flowers with four petals.

Drosera quartzicola

Drosera quartzicola is a perennial sundew endemic to Brazil. It is typically found growing in silica sands surrounded by white quartz gravel, which is the origin of the specific epithet quartzicola. Flower emerges from January to February.

Drosera radicans

Drosera radicans is a tuberous sundew endemic to Western Australia. It produces small leaves. White colour flower emerges from this sundew from August to September.

Drosera ramellosa

Drosera ramellosa is a climbing tuberous sundew endemic to Australia. These are perennial herb. These are small golden green plants. Stems are folded and fan shaped leaves are arranged along the stem.

Drosera ramentacea

Drosera ramentacea is a rare sundew native to South Africa. It produces thin and needle leaves with a tall stem. The root system is thick in this sundew.

Drosera rechingeri

Drosera rechingeri is a perennial sundew endemic to Australia. It produces fibrous root. Yellow flowers appear in these sundew during September to October.

Drosera regia

Drosera regia is the King Sundew native to South Africa. The tentacles bearing leaves folded around their prey. These species are found during October to April. Pink flowers are appeared from January to February.

Drosera roraimae

Drosera roraimae is a sub-tropical sundew endemic to Brazil, Guyana & Venezuela. It produces spoon shaped leaves arranged along a tall stem. White beautiful flowers produced in these sundews.

Drosera rotundifolia

Drosera rotundifolia is a sundew native to North America, Europe and Asia. The ovals to rounded leaves are produced with long and thin petioles form a rosette structure. The flowers are white produced in 5-25 centimetre long inflorescences.

Drosera rubrifolia

Drosera rubrifolia is a reddish sundew endemic to South Africa. These are primarily grow in humid condition in peat and sandy soil and required bright light.

Drosera rupicola

Drosera rupicola is a tuberous perennial sundew endemic to Western Australia. It produces erect lateral stem. Mainly grow in loamy soils. It produces white colour flowers from July to October.

Drosera salina

Drosera salina is a perennial tuberous sundew native to Australia. The small leaves are arranged along the stem. It produces white flowers from July to September.

Drosera schizandra

Drosera schizandra is a notched sundew endemic to Australia. It produces round to oval leaves and develops a notch at the tip. It produces pink colour flowers.

Drosera schmutzii

Drosera schmutzii is a tuberous sundew endemic to Australia. It produces red leaves and grows in sandy soils. It flowers from June to September.

Drosera scorpioides

Drosera scorpioides (Shaggy Sundew) is a pygmy sundew native to Australia. It produces white or pink flowers emerge from August and October.

Drosera sessilifolia

Drosera sessilifolia is a sundew native to Brazil, Guyana & Venezuela. It produces wedge shaped leaves. On maturation this sundew turned in to yellow to red. Pink coloured flowers are produced in these sundews.

Drosera sidjamesii

Drosera sidjamesii is a natural hybrid between *Drosera nitidula* and *Drosera pulchella* native to Australia. It is a perennial herb.

Drosera slackii

Drosera slackii is a subtropical sundew endemic to South Africa. It produces pink coloured flowers.

Drosera solaris

Drosera solaris is a sundew native to Guyana. It is a perennial herb. Produces erect stem. Ascendant leaves form the rosette structure. White to pinkish white flowers appeared in these sundew. It mainly grows in swampy areas.

Drosera spatulata

Drosera spatulata is a perennial sundew endemic to Australia, New Zealand Southeast Asia. It produces spoon shaped leaves. This sundew produces tall erect scapes with 5-6 white or pink flowers.

Drosera stenopetala

Drosera stenopetala is a perennial sundew native to New Zealand. It produces white flowers with five petals.

Drosera stolonifera

Drosera stolonifera (Leafy Sundew) is a tuberous perennial sundew endemic to Australia. These species usually grow in swampy and water logged soil. It produces white flowers from September to October.

Drosera stricticaulis

Drosera stricticaulis (Erect Sundew) is a tuberous sundew endemic to Western Australia. The cup shaped leaves are arranged along the glandular stem. it produces pink flowers from July to October.

Drosera subhirtella

Drosera subhirtella (Shunny rainbow) is a tuberous sundew endemic to Australia. These are perennial herbs. It primarily grows in sandy and loamy soils. Flowers are yellow and emerge from August to October.

Drosera subtilis

Drosera subtilis is an erect annual species native to Australia. Erect leaves are arranged along the reddish stem. The inflorescence bears 50 or more individual flowers. Flowers are white in colour with four petals bloom from February to March.

Drosera tokaiensis

Drosera tokaiensis is a natural hybrid between *Drosera rotundifolia* and *Drosera spatulata* endemic to Japan. It produces pink flowers with five petals.

Drosera trinervia

Drosera trinervia is a sundew native to South Africa. It produces round shaped leaves arranged in rosette form. Beautiful white flowers emerge from these sundews.

Drosera tubaestylis

Drosera tubaestylis is a tuberous sundew native to Western Australia. It primarily grows on sandy soils. It produces trumpet shaped style apices. Its flowers are white in colour.

Drosera ultramafica

Drosera ultramafica is a sundew native to Malaysia. These sundews grow on upland habitats.

Drosera uniflora

Drosera uniflora is a tiny sundew native to Argentina, Chile, Falkland and Island. The flowers are white and it produces solitary flowers, so named as uniflora.

Drosera venusta

Drosera venusta is a sundew endemic to South Africa. It produces semi-erect leaves and are red-orange in colour. It produces pink flowers.

Drosera villosa

Drosera villosa is a sundew endemic to Brazil. The leaves are strapped shaped and reddish in colour, full of tiny hairs.

Drosera viridis

Drosera viridis is a perennial sundew endemic to Brazil. These are aquatic sundew and sometimes found submerged with only the leaves above water. It produces spatulated leaves inflorescence bear 2-12 flowers which are dark lilac in colour.

Drosera walyanga

Drosera walyanga is a perennial sundew native to Australia. It produces fibres root and grow on sandy clay with lateritic gravel. White or pink flowers emerge during October to November.

Drosera whittakeri

Drosera whittakeri is a sundew native to South Australia. It produces spathulate leaves of orange yellow or red in colour. White flowers bloom from May to November.

Drosera yutajensis:

Drosera yutajensis is a rare sundew endemic to Venezuela. These sundews are mostly found in high elevation region.

Drosera zigzagia

Drosera zigzagia is a tuberous sundew endemic to Western Australia. The small leaves of this sundew arranged along a zigzag stem. Yellow beautiful flowers emerge from August to September.

Drosera Zonaria:

Drosera zonaria is a tuberous sundew native to Australia. These are perennial herbs. Small rosettes of 20-30 tightly held leaves arranged like overlapping shingles. This sundew form underground stolons and developed in to compact colonies

CHAPTER 4
SUNDEWS OF INDIA



Drosera indica

In India, three species of the genus *Drosera* have been described that is 1) *Drosera burmannii*, 2) *Drosera indica*, 3) *Drosera peltata* and in India also it is the 2nd largest genera of carnivorous plants (Figure 10; Table 6 & 9).



Figure 10: Sundews of India

Table 6: Sundews of India

Species	Distribution	Status
<i>Drosera burmannii</i> Vahl	Throughout India	LC
<i>Drosera indica</i> L.	Throughout India	LC
<i>Drosera peltata</i> Thunb.	Hilly areas of the country	LC

Habitat and distribution of *Drosera* species found in Odisha

Odisha also enjoys all these three species of the genus *Drosera*. These are annual or perennial herb and usually found in nearby rice fields, swampy -marshy areas, overlaying rock with poor nutrient soil and some species are found hilly and mountain area. The Sundews are usually perennial herb but a couple of Sundews are also annual- means they germinate, grow, flower and ultimately produce seed in a single season before dying. These meet eating herbs usually generate hermaphrodite flowers varies from whitish to pinkish in colour with terminal or lateral inflorescence. The flowering period varies from species to species but in Odisha September to February is period when we get to see flowers (Table 7).

Table 7: Habitat and distribution of *Drosera* species found in Odisha

Species	Common name	Local name	Habit	Habitat	Distribution in odisha
<i>Drosera burmannii</i> Vahl	Tropical Sundew	Pokakhia	Annual Herb	Terrestrial (Grass land, Rice fields, wet & swampy areas)	Krishnamali and Khandualmali hills of Karlapat Wildlife Sanctuary, Kalahandi, Gandhamardan hills, Bolangir, Mahendragiri hills, Gajapati, Coastal areas of Chandrabhaga
<i>Drosera indica</i> L.	Indian Sundew	Kankikhai	Annual Herb	Terrestrial (Pool, streams, open humid soil)	Krishnamali and Khandualmali hills of Karlapat Wildlife Sanctuary, Kalahandi, Coastal areas of Chandrabhaga, Gandhamardan hills, Bolangir
<i>Drosera peltata</i> Thunb.	Shield Sundew	Mukhajali	Perennial Herb	Terrestrial/Epiphyte (Stream & hilly areas)	Deomali hills of Koraput above 5000ft

***Drosera peltata* Thunb.**

Drosera peltata (Shield sundew or Pale sundew), is an evergreen annual/perennial erect herb growing to 0.3 m composed of tubers, that usually have dimorphic leaves. This tuberous sundew has the largest distribution, which includes Eastern and Western Australia, New Zealand, India, and most of Southeast Asia including the Philippines.

It is a climbing or scrambling perennial herb, 5-50 cm in height, its basal tuber is generally found 4-6 cm. *Drosera peltata* generally has an evident rosette of leaves at the soil surface and are ephemeral. Upper leaves are dimorphic and the cauline leaves are numerous and alternate 0.25 – 0.4 X 0.15 – 0.25 cm, stems are slender, erect, leafy and glabrous. The aerial stem is simple or slightly branched. Petiole 4-11 mm long. Recemes subterminal, 1-5 cm long, 2-10 flowered; flowers are generally between white or light pink. bracts cuneate to oblanceolate. Pedicel slender, 2-9 mm long. Sepals 5 united near base, petals 5, 4-6 X 2-3, obovate-orbicular, apex round-truncate, white. Stamens 5, 2-4 mm. subglobose ovary 1.5 mm. style 3, c. 0.8 mm long, stigmas 2-3 fid, capsules c. 2 mm across, subglobose, 3-5 valved, enclosed by persistent sepals and petals. Seeds c. 0.4 mm, ellipsoid-ovoid to globose, veined. It cannot grow in shade (Figure 11-12).

Flowering Period: May-October



Figure 11: *Drosera peltata*

Distribution in India: Throughout the country (Maharashtra, Pune, Karnataka, Mysore, Tamil Nadu etc.), hills (Jantia hills. East and West Khasi hills)

Distribution in Odisha: Deomali hills of Koraput above 5000ft

Medicinal Value: Traditionally it is used in India in making Gold Bhasma (Swarnabhasma). The plant is used as blood tonic and carminative. Decoction of leaves has been used as a blistering agent. This can be of value as a poultice since it brings more blood to the area and helps speed the clearance of toxins in arthritis and rheumatism. Antimicrobial activity of extracts of aerial parts of *D. peltata* against bacterial oral diseases has also been reported. It is reported to be used as an anti-syphilitic and tonic.

Other Uses: A crystalline yellow brown pigment from *D. peltata* can also be used as a dye in silk industry.

Conservation Status: Least Concern



Figure 12: Drosera peltata

***Drosera burmannii* Vahl.**

Drosera burmannii (Tropical Sundew), a small, compact, acaulescent annual or biennial herb. These species are ranges between less than 1 cm to about 3cm in and may be golden green, dark green, green with red tentacles or all red. Root in transverse section shows cork, cortex, stele and central pith. Epidermis made up of rectangular cells. Cork 2-3 layered, cells rectangular, 10-21-43 μ . Leaves are obovate, prostrate, densely covered with glandular hairs, greenish pink, 0.5- 1 X 0.3 -0.6. This blunt ended spatulated leaves tend to have an overall maroon coloration with long tentacles. Petiole absent. Short stems with few fibrous root. Stipules 3-7 mm long, this species shows scapiform inflorescence , erect, 5-20 cm long. Flowers few in erect racemes. The scapes or the flower stalks tend to be greater than 10 cm long and bend at the apex. This species is described as having white flowers but at some location it has pink flowers. Pedicle erect, 1-7 mm. sepals 5, united at base, 2-3 mm, elliptic, oblong to broadly lanceolate. Petals 4x2-3 mm across, obovate to oblong- lanceolate. Pinkish to Whitish. Stamens 5. Ovary ovoid, superior, 3 chambered, 2 ovules in each locule, style apically lobed, placentas 5 or 6, styles 5 or 6, filiform, 2-3 mm long, incurved, stigma tooth like. Capsules c. 6 x 4 mm, ovoid, 5-6 valved. Seeds numerous, dark brown to black. It lives for few months during the warm rainy season, seeds prolifically, then dies off when the soil dries out, returning from seeds when the rains return (Figure 13).

Flowering Period: November – February

Distribution in India: Throughout India up to 3000m i.e. Maharastra, Karnataka, Mysore, Tamil Nadu etc.

Distribution in Odisha: Krishnamali and Khandualmali hills of Karlapat Wildlife Sanctuary, Kalahandi, Gandhamardan hills, Bolangir, Mahendragiri hills, Gajapati, Coastal areas of Chandrabhaga

Medicinal Values: *D. burmannii* possesses rubefacient property. They contain medicinally active compound like quinones plumbagin, hydroplumbagin glucoside, flavonoids and rossoliside, carotene, plant acids, resins, tannins and ascorbic acid. Its extracts can be a used as sources of natural antioxidant and anticancer drug. *D. burmannii* from Oriental Asia for an Ayurvedic product named 'Herba Droserae'. It has been reported to be used as antifertility, anticonvulsant and antitumor activities in mice.

Conservation Status: Least Concern



Figure 13: Vegetative parts of Drosera burmannii

***Drosera indica* L.**

These are herbaceous plants native to India, Africa and Australia but absent from the neotropics . These species are mainly found in rain forests and deserts. It is an unbranched annual herb, supported by a fibrous root system, 5-50 cm long. This plant produces a scrambling stem several inches in length. Leaves cauline, narrowly linear, alternate, sparse up to 10 cm, lower leaves recurved, upper leaves erect, young plants stand upright, while older ones form scrambling stems with only the newest growth exhibiting an upright habit, petioles 5-10 mm, glabrous, stipules absent or reduced and hair like. Leaves are opposite, raceme 1-30 flowered, peduncle up to 12 cm long, bracts linear, 6-8 mm long. Flowers are white or pink purple, usually over 1.5 cm across, 3-15 on axillary, terminal. Calyx segments oblong-ovate, sub obtuse, entire, glandular-pubescent. Petals 5 narrow, obtuse 5-10x3-4 mm. pink, orange, reddish violet or white in colour, sepals 5, united near base, 3-5x1-2 mm, lanceolate to narrowly oblong, glandular. Styles 3, capsule broadly oblong. Stamen 5, 3-5 mm long. Ovary obovate or subglobose. 1-2 mm across, placentas 3, stigma simple, 2-3 mm long. Seeds minute, ovoid, reticulate (Figure 14-15).

Flowering Period: September – January



Figure 14: *Drosera indica*

Distribution in India: Throughout India up to 5000m.

Distribution in Odisha: Krishnamali and Khandualmali hills of Karlapat Wildlife Sanctuary, Kalahandi, Coastal areas of Chandrabhaga, Gandhamardan hills, Bolangir

Medicinal values: *Drosera indica* is a vital component in an ayurvedic dug preparation called “Swarnabhasma” (Golden ash) which has been used in several clinical manifestations including loss of memory, defective eyesight, infertility, weakness, incidence of early aging, bronchial asthma, rheumatoid arthritis, diabetes mellitus, nervous disorder. Macerated *Drosera indica* is used to remove corns and this species has been categorized under the vulnerable medicinal plant list. The *in vitro* antioxidant potential against various models has been reported (Table 8).

Conservation Status: Least Concern



Figure 15: Vegetative parts of Drosera indica

Table 8: Medicinal uses of *Drosera* species found in India

Species	Medicinal uses
<i>Drosera burmannii</i> Vahl	Used as antioxidant and anticancer drug, act against cough, asthma
<i>Drosera indica</i> L.	Used against diabetes mellitus, weakness, nervous disorder, asthma
<i>Drosera peltata</i> Thunb.	Having antioxidant activity, helps in clearance of toxins in arthritis and rheumatism, also used as blood tonic and carminative

Table 9: Comparative diagnostic characters between the species of *Drosera* found in India

Characters	<i>Drosera burmannii</i>	<i>Drosera indica</i>	<i>Drosera peltata</i>
Leaf shape	Obovate	Narrowly linear	Diamorphic
Adaxial surface of petiole	Glabrous	Glabrous	Glabrous
Petal size	4x2-3 mm	5-10x3-4 mm	4-6x2-3 mm
Seed shape	Ovoid	Ovoid	Ellipsoid-ovoid to globose
Style number	5/6	3	3
Flowering period	November-February	September-January	May-October
Flower colour	Pinkish white	Pink/ white	White
Stamen number	5	5	5
Ovary shape	Ovoid	Obovate or subglobose	Subglobose



Drosera burmannii in different landscapes, A) Coastal areas; B) Chota Nagpur Plateau; C) Eastern Ghats, D) Semi-urban areas



Drosera indica in different landscapes

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Survey works for collection of Drosera species

Author's Profile

Miss Sweta Mishra

She has completed M.Sc. in Life Sciences and doing M.Phil in Life Sciences. She has published 7 Research papers and 2 Books. Her research interest is on ecological mapping of carnivorous plants of Odisha, evaluation of pharmacological values of carnivorous plant, trapping behaviour of insectivorous plants, plant taxonomy and phytochemistry of medicinal plants. Currently she is actively engaged as Managing Editor of the Journal- Journal of Biodiversity and Conservation (ISSN: 24570761) and contributing in documentation of Biodiversity.



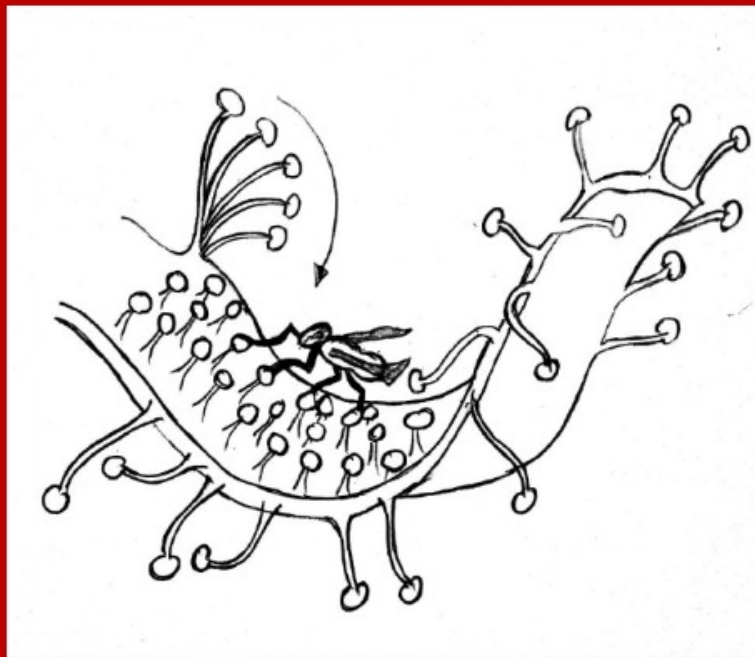
Dr. Sanjeet Kumar, DELF

He is the founder & CEO of Ambika Prasad Research Foundation, Odisha; Zonal head, Sustainable Biodiversity Committee, Odisha Wildlife Hub, Odisha, India. His current work focused on status, taxonomy, diversity, phytochemistry and antimicrobial activity of medicinal plants; population analysis and restoration of rare, endangered and threatened plant species; wetland ecosystems and their biowealth; various management practices in protected areas particularly in Biosphere Reserve and breeding habitat of tiger; establishment of relation between flora and fauna and restoration of medicinal plants found in riverine ecology. He has 10 years of research experiences on medicinal plants and on rare, endangered and threatened taxa. He has published about 120 Research papers and 10 Books.



"I care more for *Drosera* than the origin of species... It is a wonderful plant, or rather a most sagacious animal. I will stick up for *Drosera* to the day of my death"

.....Darwin



AMBIKA PRASAD RESEARCH FOUNDATION

First Floor, Saraswati Tower, Laxmisagar

Bhubaneswar-751006, Odisha, India

Email-Id: president@aprf.org.in

www.aprf.org.in