



Drosera Sp: A Critical Review on Phytochemical and Ethnomedicinal Aspect

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Abstract

Day by day medicinal plant research and their phytometabolites drawing interest in medical sciences due to loyal medicinal and pharmacological values. *Drosera* is a very well-known insectivorous plant and it consists of near about 170 species throughout the world. Phytochemical profiling of this species has revealed the presence of highly valuable phytochemicals like Quercetin, Hyperoside, Isoquercitrin and Naphthoquinones etc. We utilized logical writing and scientific literature from electronic search engine such as Springer link, science direct, Pub Med, Scopus and BioMed central as well as relevant books, websites, scientific publications and dissertation as a source of information. According to recent research information, these compounds are strongly associated with anti-cancerous, anti-microbial and also anti-inflammatory activities. This review intends to investigate the published report regarding phytochemicals, ethnomedicinal and pharmacological viewpoints and put forth the therapeutic potential of *Drosera*. Future research can be directed to extensive investigation about phytochemistry, clinical trials and pharmacokinetics acquiring safety data so as to add new dimensions to therapeutic utilization of *Drosera*.

Keywords

Drosera, Phytometabolites, Medicinal values.

INTRODUCTION

Drosera or Sundew plant is a very well-known insectivorous plant and as well as medicinal plant, consists of approximately 170 species in all over the world. In India *Drosera indica* L. family-Droseraceae, *Drosera burmannii* Vahl and *Drosera peltata* J.E.

Sm.ex. Wild have been reported at different locations. It has been reported that these species have highly therapeutic properties like recovery of memory loss, overall body weakness, improvement of defective eyesight, and help in fertilization in human and also curing of early aging etc ^[1]. Charles

Darwin discovered the carnivorous nature of other *Drosera* species, wrote: "At this present moment I care more about *Drosera* than the origin of all the species in the world". Basic research says that *Droseraceae* is a small family of mostly herbaceous plants with potential medicinal values. Glandular hair of this plant plays major role to catch the insects and make digestion the tissues of insects with proper enzymes. ^[2, 3]. Among the genus – *Drosera magnifica* is the largest carnivorous plant in the world ^[4]. Various researches proved that carnivores a plant have some basic mechanism which helps to catch the insects properly. The insect trapping mechanisms are as follows:-

1. Pitfall traps (pitcher plants) trap prey in a rolled leaf that contains a pool of digestive enzymes or bacteria.
2. Flypaper traps use sticky mucilage.
3. Snap traps utilize rapid leaf movements.

4. Bladder traps suck in prey with a bladder that generates an internal vacuum.

5. Lobster-pots, also known as eel traps, force prey to move towards a digestive organ with inward-pointing hairs ^[5].

Naturally *Drosera* has various potential medicinal components like naphthoquinones and plumbagin, ramentaceone etc. Another study revealed that naphthoquinones and ramentaceone has potential anti-cancer activity, to destroy the breast cancer cell in proper way. As per another research plumbagin derivatives also used for healing, hyperglycemia, malaria, hypolipidemia etc (6, 7). LC-NMR, NMR and LC-MS and LC-DAD quantification study on *Drosera peltata* reported presence of flavonoids and ellagic acid. Ellagic acid also plays an important role in oxidative stress through reducing mechanism ^[8, 9]. So as per research it can be say that *Drosera* has various valuable chemical components which can be uses in human welfare.

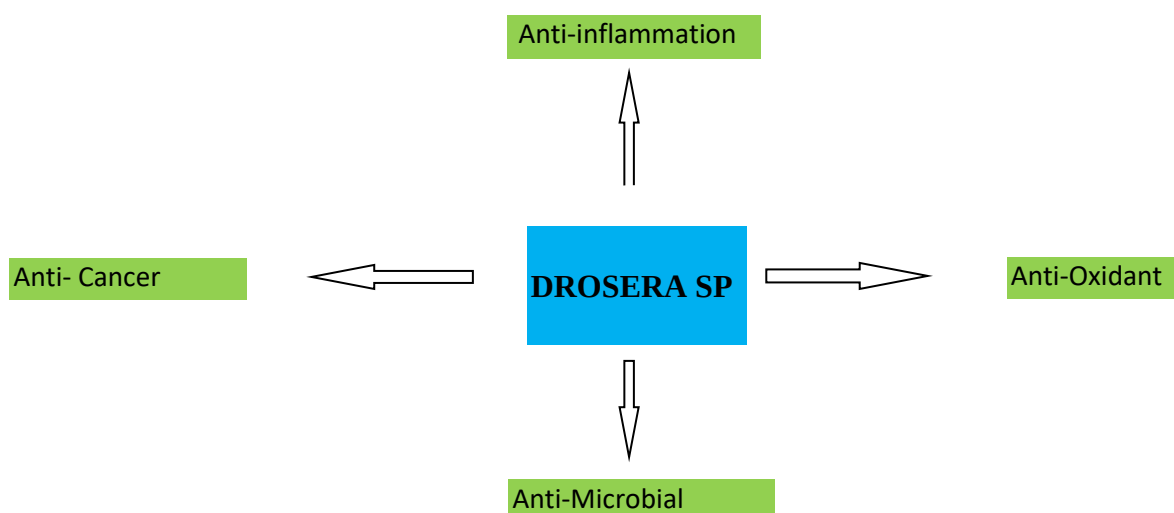


Fig-1: Schematic diagram of role of *Drosera* in human health

Morphological and Geographical description of *Drosera* species:

Sundews are basically perennial herbaceous plants, basically 1 and 100 cm (0.39 and 39.37 in) in height, depending on the species. In the case of *Drosera erythroyne* heights is up to 3 m (9.8 ft) because it is a climbing species (10). The name *Drosera* is derived from the Greek word meaning 'dewdrops'. These plants usually show remarkable tolerance to high-stress habitats and have acquired adequate reproductive property on the evolutionary trend for

their future survival (11). According to different habits *Drosera* species can be divided in to five natural things like temperate sundews, pygmy sundews, subtropical sundews, tuberous sundews and the petiolaris complex (12). Geographical distribution shows that *Drosera* species has been spared in some parts of the Northeastern region, Deccan peninsular region, Southern India and along regions in West Bengal (13, 14). Geographical research proposed that three species of *Drosera* was found in India i.e., *D. burmanii* Vahl., *D. indica* L. and

D. peltata and among them two are in Meghalaya i.e., *D. burmanii* and *D. peltata*. Evolution also noticed in *Drosera* species according to temperature like *D. burmanii* and *D. peltata* habited in deserts

whereas some other species of *Drosera* favor to grow in shaded environments like *D. adelae*, *D. prolifera*, *D. schizandra* (7, 15).



Fig-2: Photograph of *Drosera sp* was captured from Bolpur in West Bengal.

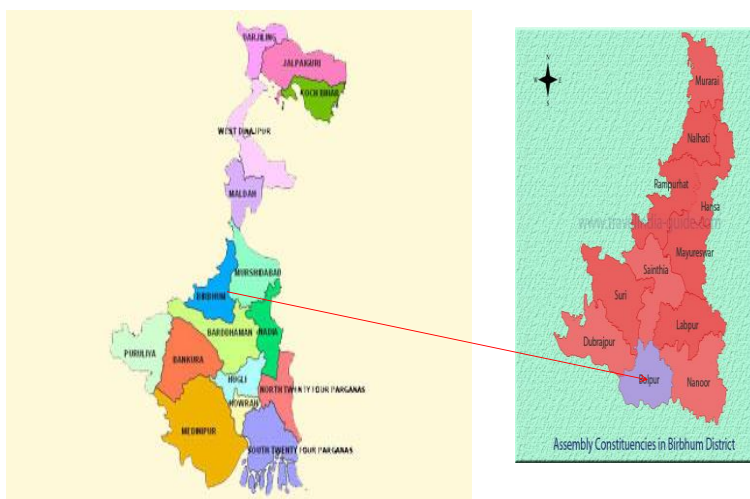


Fig-3: Collection area of *Drosera sp* in India and west Bengal

Major Phytochemicals and their medicinal properties:

Based on the phytochemical research of different *Drosera* species, it has remarkable pharmacological and medicinal properties like:

A) Antioxidant activity:

Another research revealed that *Drosera madagascariensis* flavonoids extracts like quercetin (IC₅₀ 0.8 µg/ml), hyperoside (IC₅₀ 0.15 µg/ml) and isoquercitrin (IC₅₀ 0.7 µg/ml) contributed in antioxidant activity [16]. Another research confined that free iron typically leads to the formation of excess free radicals and additional iron deposition in the liver contributes to the oxidative pathologic

processes of liver disease. In this case recent study proved that methanol extract of *Drosera burmannii* contributed to its iron chelation activity to reduce the free iron activity. Various phyto-constituents, like phenols, flavonoids, carbohydrates, tannins, alkaloids and ascorbic acid are reported in *Drosera burmannii* and as well as purpurin, catechin, tannic acid, reserpine, methyl gallate and rutin were found in *Drosera burmannii* after HPLC detection. These chemicals are excellent for iron chelatinization [17]. In-vitro study revealed that ethanolic extract was rich in flavonoid than aqueous extract, which played import role in cancer cell line by inhibiting the antioxidant activity of the cancer cell [18]. Further study on mice,

also shown that ethanolic and aqueous extracts of *Drosera burmannii* successfully inhibit the tumor cell (in cancer cell line) through reducing some potential anti-oxidant blood parameters like catalase (CAT), superoxide dismutase (SOD), glutathione (GSH), malondialdehyde (MDA), peroxidase (P), gradually reduced the levels of all parameters [19]

B) Anti-Inflammation Activity:

Regarding anti-inflammation research of *Drosera* shown that *Drosera rotundifolia* and *Drosera madagascariensis* has anti-inflammation activity. In this research HPLC experiment showed that presence of myricetin-3-O-galactoside, quercetin, ellagic acid. These chemicals possess anti-inflammatory mechanism via their ability to inhibit reactive oxygen or nitrogen compound [20]. Another study shown that quercetin extracts from *Drosera peltata* playing import role in anti-inflammation activity M3 receptors in guinea-pig ileum [21]. Immunological science says that T cell playing an import role in inflammation and regulating inflammatory genes. A novel study on *Drosera* proved that three species of *Drosera* i.e. *Drosera rotundifolia*, *Drosera tokaiensis* and *Drosera spatulata* extracts induced T cell activated related inflammatory genes in HMC-1 must cell [22].

C) Anticancer Activity:

On the other hand some research revealed that *Drosera* has potential activity in cancer cell. Like- in previous study shown that *Drosera burmannii* Vahl has potent antioxidant activity which reduced the cancer cell activity [17]. Another in vitro study examined that phytoconstituent of *Drosera peltata* exhibited excellent antioxidant activity against free radicals and showed excellent anti-cancer activity between two cells like Dalton's Ascitic Lymphoma (DAL) and Ehrlich Ascitic Carcinoma (EAC) [18]. Plumbagin one of the most important plants derivatives, which can use in many medical purposes like cancer cell line. Plumbagin also present in two

plant species e.g. *Drosera* and *Plumbago*. Another research their said that plumbagin induces the apoptosis in Her2-overexpressing breast cancers through the mitochondrial-mediated pathway [23]. Another plumbagin mediated research proposed that plumbagin induces apoptosis through inactivation of NF-kB. Bcl-2 mediated pathway [24].

D) Antimicrobial Activity:

Oral infection or carries mainly caused by the bacteria mainly *Streptococcus*. Bacterial infection based research proved that oral pathological infections inhibited by extract of *Drosera peltata*. In this study plumbagin obtained from *Drosera peltata* by TLC method inhibit the growth of oral bacteriological infections gradually and shown higher MIC rate on *Streptococcus mutans*, *Streptococcus sobrinus*, *Streptococcus rattus*, *Streptococcus cricetus* [25]. Another study on *Drosera rotundifolia* reported the best antimicrobial effects against gram negative and gram positive pathogenic bacteria [26]. Antimicrobial activities were observed on three different extracts (hexanic, ethyl acetate, methanol) obtained from different Brazilian *Drosera* species like *Drosera communis*, *Drosera montana* var. *montana*, *Drosera brevifolia*, *Drosera villosa* var. *graomogolensis*, *Drosera villosa* var. *villosa*. This experiment was done against different gram positive and negative bacteria like *Staphylococcus aureus*, *Enterococcus faecium*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Salmonella Choleraesuis*, *Klebsiella pneumonia* and *Candida albicans*. Phytochemical analysis of *D. communis*, *D. montana* var. *montana* and *D. brevifolia* reported 5-hydroxy-2-methyl-1, 4-naphthoquinone (plumbagin) higher antimicrobial activity [27]. Another in vitro study quantified those secondary metabolites of *Drosera gigantea* have potential antimicrobial activity which inhibited the growth of *Pseudomonas synargis* [28].

Sl.No-	Name of the Drosera Species	Name of the constituents	Medicinal Properties	References
1	<i>Drosera madagascariensis</i>	Quercetin, Hyperoside and Isoquercitrin	Anti-Oxidant activity	M.F.Melzig et al., 2011
2	<i>Drosera burmannii</i>	Reserpine, methyl gallate and rutin	Anti-Oxidant activity	Nikhil BabanGhate et al., 2015
3	<i>Drosera rotundifolia</i>	Myricetin-3-Ogalactoside, quercetin, ellagic acid	Anti-Inflammation	D.H., Karall, E. et al., 2005
4	<i>Drosera madagascariensis</i>	Myricetin-3-Ogalactoside, quercetin, ellagic acid	Anti-Inflammation	D.H., Karall, E. et al., 2005
5	<i>Drosera peltata</i>	Naphthoquinones	Anti-Inflammation	Kolodziej H et al., 2002
6	<i>Drosera Sp</i>	Naphthoquinones, Plumbagin	Anti-Cancer	Aamir Ahmad et al., 2008
7	<i>Drosera peltata</i>	Plumbagin	Anti-cancer	Venkateshwarapuram et al., 2015
8	<i>Drosera peltata</i>	Plumbagin	Anti-bacterial	Nicole Didry a et al., 1998
9	<i>Drosera communis, Drosera montana var. montana, Drosera brevifolia, Drosera villosa var. graomogolensis Drosera villosavar</i>	Quercetin, Hyperoside and Isoquercitrin	Anti-bacterial	DalvaTrevisan Ferreira et al., 2004

Table-1- Medicinal properties of Drosera

DISCUSSION

Many researchers reported that *Drosera* has many valuable constituents which may be used in proper way in different medicinal fields. Most of the species are rich in flavonoides, ellagic acids etc, that has potent anti-oxidant activity. Other chemicals like, Naphthoquinones, Plumbagin derived from *Drosera peltata* has potent anti-cancer activity. Most of the researchers, regarding *Drosera*, reported that *Drosera madagascariensis* and *Drosera peltata* are fully affluent with many phytochemicals which are medically important. As per IUCN report, *Drosera* is now endangered species. So we have to take care about it for their conservation and law should be implemented for in vivo and in vitro conservation of the plant. In Europe, *Drosera* has been cultivated and protected by government but in India there are no such law for protection and cultivation of *Drosera* species.

CONCLUSION

In this review we are trying to draw a kind attention that *Drosera* would be a challenging plant in the field of medical science, because of the presence of

different medicinally important pharmacological active compounds in *Drosera* species. Many research papers indicated that all these compounds have a potent power in anti-inflammation, anti-bacterial and also anti-cancer activity. But till date, we observe that there are many research gaps of phytochemicals analysis and their biological activities of *Drosera* species. So this paper may be worthy for upcoming research on *Drosera* species and on the other hand how various important phytochemicals would be useful in pharmacological industries obtained from *Drosera*, to identify the novel drugs and their potent applications on many diseases. Another challenging part is that we have to protect this plant in earth for better life.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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