Journal of Ecology and the Natural Environment Vol. 3(13), pp. 410-414, 12 November, 2011
Available online at http://www.academicjournals.org/JENE
ISSN 2006- 9847©2010 Academic Journals

Full Length Research Paper

Community structure and population status of *Drosera burmanii* Vahl. with new distributional record in Tripura, India

Koushik Majumdar[1]*, B. K. Datta[1] and Uma Shankar[2]

[1]Plant Taxonomy and Biodiversity Laboratory, Department of Botany, Tripura University, Suryamaninagar 799130, Tripura, India.
[2]Ecosystem Research Laboratory, Centre for Advanced Studies in Botany, School of Life Science, North-eastern Hill University, Shillong 793022, Meghalaya, India.

Accepted 25 November, 2010

Quantitative data of community structure and the current status of ecologically and economically important *Drosera burmanii* Vahl. Populations were gathered at Tripura, India, from two different stands, Suryamaninagar (Site i) and Ishanchandranagar (Site ii). The area of occupancy of *Drosera* in both sites was measured. A total of 31 species (26 genera of 18 families) were recorded to be associated with *Drosera*. Species richness index, dominance index, diversity index and evenness index from both sites were analyzed. The relative importance value (RIV) was calculated for all the species found in the study sites and was highest for *Drosera*. Individuals of *Drosera* were also categorized into mature, juvenile and seedlings based on the presence and absence of reproductive organ. This is the first report of the species from the Tripura region. Local ethno-medicinal use of the Tripuri tribe is also documented.

Key words: *Drosera burmanii*, community structure, regeneration status, species conservation.

INTRODUCTION

Of the 4 genera that compose the family Droseraceae, only the genus *Drosera* occurs in Tripura (This is the first distributional report of Drosera from Tripura). *Drosera* is a cosmopolitan genus of insectivorous plants and consists of approximately 170 species. *Drosera burmanii* Vahl. is an annual insectivorous plant distributed widely in China, Japan, Malaya, West Africa and Australia, with their rosette-like leaves covered with sticky glandular hairs and trichomes which trap insects (Nordbakken et al., 2004). In the Himalaya mountains it was reported from the base up to 4000ft (1219m), and in Deccan it raised up to 8000ft (2438m). The species was also reported from Ceylon and Burma by Hooker (1872 to 1897). Prain (1963) reported the species from all provinces in India except Central Bengal. The species has also been reported from the Khasi and Garo hills of Meghalaya in Northeast India (Kanjilal et al., 1934 to 1940). Many species of *Drosera* are threatened due to their restricted habitat and indiscriminate usage in herbal industries and have been categorized as vulnerable according to the International Union for Conservation of Nature (IUCN) (Ravikumar and Ved. 2000; Reddy et al. 2001). In India, *D. indica* L., *D. burmanii* and *D. peltata* J.E.Sm. ex Wild have been reported from many different locations. These species are used as vital components in an Ayurvedic preparation called 'Swarnabhasma' (Golden ash). Macerated *D. indica* is used to remove corns and this species has been categorized under the vulnerable medicinal plants list (Ravikumar and Ved, 2000; Reddy et al. 2001).

Recently, *D. burmanii* Vahl. was reported from a number of districts of Andhra Pradesh and several protocols had been developed for *ex-situ* conservation and establishment as *in vitro* cultures for rapid multiplication Jayaram and Prasad, 2005. Although the species is in the vulnerable category, it can be considered as a potentially endangered species as government environmental regulation agencies have not adopted any stringent conservation measures. There is

*Corresponding author. E-mail: majumdark80@gmail.com.

Figure 1. a) Habitat of *Drosera burmanii* Vahl.; b) Flower bud and capsule; c) active leaf with insect; and d) flower.

now an urgent need to adopt regional conservation measures (Jayaram and Prasad, 2006, 2007). *D. burmanii* Vahl. was not reported from any part of Tripura. We found two sites with small populations (Figure 1). Since information on the population level of a species is the most important prerequisite for its conservation, in the present paper we report its community structure with particular emphasis on its regeneration and conservation status.

STUDY SITE

The present study was carried out during April' 2008 in

Table 1. Summery of the study.

Section	Sample sites	
	Site(i)	Site(ii)
Section 1: Characteristic features of habitats and soil Nutrient status		
Area of occupancy (m^2)	75	185
Latitude	23°45'49.58"N	23°45'46.76"N
Longitude	91°15'48.58"E	91°15'27.17"E
Altitude (m)	16	17
pH	5.56	6.16
Water holding capacity (kg/kg)	0.39	0.38
N (kg/ha)	304.2	327.1
P (kg/ha)	2.5	4.3
Section 2: Plant community parameters of the study site		
Species richness	17.00 ± 1.53	16.67 ± 0.66
Dominance index	0.50 ± 0.11	0.33 ± 0.05
Diversity index	2.31 ± 0.35	2.74 ± 0.08
Evenness index	0.57 ± 0.09	0.68 ± 0.03
Section 3: Regeneration structure of *Drosera burmanii* Vahl.		
No. of mature plants	107.5±49.19	70.4±22.09
No. of juvenile plants	78±16.46	82.8±11.55
No. of seedlings	59.5±14.90	97.6±23.29
Total	245±95.62	250.8±35.77

two different sites of West Tripura district, Suryamaninagar site (i), is a marshy lake margin and Ishan Chandranagar site (ii), a rain fed agriculture land where rice is grown annually (June to September). The study sites were chosen based on the presence of *Drosera* on the surface area of 75 m^2 and 185 m^2 respectively. Both the sites are separated by a distance of 2.5 km. Detailed site characteristics are presented in (Table 1: section 1). The climate of the study area is monsoonal. The average annual rainfall is 2109.3 mm, about 65% received during the south-west monsoon season (June to September). The cold weather conditions started at the end of November with regular diminution of temperature. The annual mean daily maximum temperature is 25.5˚C and mean daily minimum 10.4˚C.

MATERIALS AND METHODS

The localities where *D. burmanii* was observed were marked with global positioning system (GPS) and the surface area of the populations recorded. Habitat characteristics such as pH and soil nutrient status were analyzed as the method outlined by Tandon (1993) for both the sites over a number of visits. It is always interesting to record parameters such as temperature, but the only relevant parameter here is pH. The community structure, population density of *Drosera* and the associated species were determined through 6 - 1m x 1m quadrat randomly placed on the surface area three in each of two different sites at average of 0.02% sampling intensity. All the individual plant were counted and collected specimens had been processed to put up on the herbarium sheets as per method proposed by Jain and Rao (1997).

The individuals of *Drosera* occurring in each of the quadrats were examined and scored in three categories, that is a) Mature, b) Juvenile and c) Seedling. The flower and capsule bearing *Drosera* were considered as matured. Plants lacking reproductive parts were considered as juvenile. Seedling plants were categorized by size into three classes having, on average, a rosette diameter of 2.28, 1.47 and 0.64 cm respectively. Associated species were identified with the help of existing literature (Deb, 1981 and 1983; Hooker, 1872 to 1897; Sharma et al. 1993 to 2000) and herbarium available at Botanical Survey of India, Shillong. RIV was calculated for 31 species from the field data collected using the method of Misra (1968). To study community structure the Shannon-Winner Index of diversity was used. Species richness was determined as the number of species present in each of the study sites (Whittaker, 1972, 1975). Along with diversity index, Pielou index of evenness and Simpson dominance index were calculated (Magurran 1988).

RESULTS

A total of 31 species representing 26 genera and 18 families were recorded from both sites, 19 unique to site (i), 20 unique to site (ii), with 8 species were common in both sites (Table 2). The family Cyperaceae constituted 19.35% of the total species present due to its marshy habitat. *Chrysopogon aciculatus* and *Eriocaulon cinereum* were the dominant associates of *Drosera* in site (i)

Table 2. Relative importance value (RIV) of *Drosera burmanii* Vahl. and its associated plant.

S/N	Name of the species	Site(i)	Site(ii)
1	*Acacia auriculaeformis* A. Cunn. ex Benth. (seedling)	2.95	-
2	*Alysicarpus vaginalis* (L.) DC.	3.85	1.47
3	*Ammania baccifera* L.	5.3	17.68
4	*Centella asiatica* (L.) Urban	-	1.94
5	*Chrysopogon aciculatus* Trin.	40.08	15.78
6	*Cyperus diffusus* Vahl.	4.44	-
7	*Cyperus pumilus* L.	3.03	3.73
8	*Dichanthium caricosum* (L.) A. Camus.	-	22.17
9	***Drosera burmanii* Vahl.**	**67.85**	**50.47**
10	*Eriocaulon cinereum* R. Br.	17.76	16.7
11	*Eupatorium odoratum* L.	2.69	-
12	*Fimbristylis aestivalis* (Retz.)Vahl.	-	14.2
13	*Fimbristylis diphylla* (Retz.)Vahl.	12.72	-
14	*Fimbristylis miliacea* (L.) Vahl.	-	4.32
15	*Fuirena ciliaris* (L.) Roxb.	-	1.7
16	*Glochidion assamicum* Hook. (seedling)	9.36	15.6
17	*Hedyotis corymbosa* (L.) Lamk.	-	2.21
18	*Hollarrhena antidysenterica* Flem. (seedling)	2.18	-
19	*Hydrocotyle sibthorpioides* Lamk.	-	3.59
20	*Jasminum subtriplinerve* Bl. (seedling)	3.58	-
21	*Limnophila chinensis* (Osb.) Merr.	-	3.83
22	*Lindernia antipoda* (L.) Alston in Trin.	5.29	-
23	*Lindernia ciliata* (Colsm.) Pennell in Journ.	-	4.64
24	*Melastoma malabathricum* L. (seedling)	5.78	-
25	*Microcos paniculata* L. (seedling)	6.41	-
26	*Nelsonea canescens* (Lamk.) Spreng.	3.38	2.1
27	*Panicum brevifolium* L.	-	2.71
28	*Panicum psilopodium* Trin.	1.54	-
29	*Rotala indica* (Wild.) Koehne in Bot.	-	3.54
30	*Urticularia gibba* L. Sp.	-	13.3
31	*Vitex peduncularis* Wall. (seedling)	2.16	-

whereas for site (ii) it was *Dicanthium caricosum* and *Ammania baccifera*. Seedlings of *Acacia auriculaeformis, Hollarrhena antidysenterica, Vitex peduncularis, Jasminum subtriplinerve, Glochidion assamicum* and *Melastoma malabathricum* were found only in site (i) while the seedlings of *G. assamicum* were found in site (ii). Community structure parameters are given in (Table 1: Section 2). A comparison of species richness and dominance shows higher values for site (i) representing 17.00 ± 1.53 and 0.50 ± 0.11 respectively, due to the availability of water, low soil pH and nutrition than site (ii). For the diversity index and evenness index calculated values were higher (2.74 ± 0.08 and 0.68 ± 0.03 respectively) in site (ii), because the soil nutrition (nitrogen, phosphorus and potassium, NPK) is much more than site (i), hence other associate plants can also grow well (Table 1, Section 1). Comprehensive differences in RIV of *Drosera* and its associating plants are given in (Table 2). The RIV of *Drosera* was highest for both sites.

DISCUSSION

The species richness and dominance index were found higher in site (i) due to the availability of water, low soil pH and nutrition than the site (ii) of *Drosera* habitat. Whereas, the diversity index and evenness index was elevated in case of site (ii), because the soil nutrition was much more than site (i), hence other associate plants can also grow well (Table 1, Section 1). Species richness did not differ significantly in both sites (F = 5.987, df = 1 and P = 0.998) or (F = 7.708, df = 1 and P = 0.903). However, the number of observed *Drosera* populations between site (i) (F = 3.708, df = 2 and P = 0.028) and site (ii) (F = 1.201, df = 2 and P = 0.305) varied significantly.

Furthermore, result of the t-test also varied in the number of observed mature *Drosera* (*t* = 2.979*, df* = 28 and *P* = 0.002), juvenile (*t* = 0.480*, df* = 28 and *P* = 0.317*)* and seedlings *Drosera* (*t* = 1.073*, df* = 28 and *P* = 0.146*.* Highest value of RIV in both sites reflects the dominance of *Drosera* in the different site characteristics. Different microhabitat preferences have been demonstrated for different *Drosera* species (Thum 1986).

In the present study, the diameter of the mature *Drosera* rosette had ranged from 1.3 to 2.8 cm, while for juvenile plants rosette diameter was 1.1 to 2.1 cm and for seedlings 0.3 to 1.1 cm. The total *Drosera* populations were procured at various stage of growth at different time interval and mature, juvenile and seedling contributed 43.88, 31.84 and 24.29% for site (i) and 28.07, 33.01 and 38.92% for site (ii) respectively, the seedlings develop into maturity and in the next season the seed gets germinated within the suitable habitat. Higher numbers of seedlings at site (ii) reflects the high regeneration of *Drosera* at the site (Table 1, Section 3). The very shallow rooting systems of seedlings, restricted to peat layers where the fluctuations in soil moisture, temperature and disturbances are greatest, may explain higher mortality of seedlings than of mature plants both in dry and wet periods (Ridder and Dhondt, 1987; Nordbakken et al. 2004). Site (ii) is more exposed than site (i) and this may account for the higher production of seedling. Plants exposed to full sunlight where the reflection of the sunlight from the dew-like glicosaminoglican droplets secreted by the glandular trichomes is greatest, are visually more attractive to insects, an important source of nutrients for the *Drosera* plants (Saridakis et al 2004).

Insect species belonging principally to *Lepidoptera, Isoptera, Diptera, Orthoptera, Hymenoptera,* and *Coleoptera*, were recorded as being trapped by *D. burmanii* during this field*. D. burmanii* is locally used as an antiseptic on poisonous bites and all form of throat infection by the Tripuri community. It is locally known as ‘Bishkatali’, meaning the drug which absorbs poison. Both the sites are subject to persistent anthropogenic disturbance. At site (i) grazing, soil removal, thatch collection, annual weeding of lake margins, habitat destruction during fishing, are the primary threats to persistence and survival of the species. Extensive use of agrochemicals, tillage, grazing, etc., is a primary threats at site (ii). Soil water logging at both sites inhibits the seed dispersal capacity. The existing population was seen only in small patches due to effect of various environmental factors such as restriction of the habitat to the wet land ecosystem, average rainfall, temperature and delayed monsoons, invasive species etc., which influence nutritional intake and seed production, dispersal.

Both natural and anthropogenic influences have brought the species regionally almost to the brink of extinction (Jayaram and Prasad, 2006). Like other carnivorous plants *Drosera* is likely to be a sensitive indicator of global climate change and other environmental impacts such as enhanced nitrogen deposition (Ellison and Goteli, 2001).

ACKNOWLEDGEMENTS

The present work has been supported by grants from the Department of Biotechnology, Government of India under the Network Project.

REFERENCES

Deb DB (1981, 1983). The Flora of Tripura State, Vol. I & II. Today and Tomorrow’s Printers and Publishers, New Delhi.

Ellison AM, Gotelli NJ (2001). Evolutionary ecology of carnivorous plants, Trends Ecol. Evol., 16: 623-629.

Hooker JD (1872-1897). The Flora of British India. Vol. IV. L. Reeve & Co., London, p. 683.

Jain SK, Rao RR (1997). A Handbook of Field and Herbarium Methods, Today and Tomorrows’ Printers and Publishers, New Delhi.

Jayaram K, Prasad MNV (2005). Rapidly in vitro multiplied *Drosera* as reliable source for plumbagin bioprospection. Curr. Sci., 89(3): 447-448.

Jayaram K, Prasad MNV (2006). *Drosera* indica L. and D. burmanii Vahl., medicinally important insectivorous plants in Andhra Pradesh – regional threats and Conservation. Curr. Sci., 91(7): 943-946.

Jayaram K, Prasad MNV (2007). Rapid in vitro multiplication of *Drosera indica* L.: A vulnerable, medicinally important insectivorous plant. Plant Biotechnol. Rep., 1: 79-84.

Kanjilal UN, Kanjilal PC, Das A, De RN, Bor NL (1934-1940). Flora of Assam. Vol. 1-5, Government Press, Shillong.

Magurran AE (1988). Ecological Diversity and Its Measurement. Princeton: Princeton University Press.

Misra R (1968). Ecology work book. Oxford and IBH company, New Delhi, India, p. 244.

Nordbakken JF, Rydgren K, Okland RH (2004). Demography and population dynamics of *Drosera anglica* and *D. rotundifolia*. J. Ecol., 92: 110-121.

Pain D (1963). Bengal Plants. Rep. ed. Calcutta, 1: 472.

Ravikumar K, Ved DK (2000). 100 Red Listed Medicinal Plants of Conservation Concern in Southern India, Foundation for Revitalisation of Local Health Traditions, Bangalore, pp. 1-467.

Reddy CHS, Reddy KN, Jadhav SN (2001). Threatened (Medicinal) plants of Andhra Predesh. Medicinal Plants Conservation Center, Hyderabad, pp. 1-39.

Ridder F, Dhondt AA (1987). Dynamics of long-leaved sundew *Drosera intermedia* population at two extremes of a hydrological gradient. Holarctic Ecol., 10: 299-307.

Tandon HLS (1993). Methods of analysis of soils, plants and waters. New Delhi, India.

Saridakis DP, Torezan JMD, Andrade G (2004). Microhabitat preferences of six *Drosera* (*Drosera*ceae) from Tibagi River Basin, Parana State, Brasil. Brazilian Arch. Bio. Technol., 47(4): 495-501.

Sharma BD, Balakrishnan NP (1993-2000). In Flora of India (eds. Sharma, B. D. et al.), Botanical Survey of India, Calcutta, Vol. I - VI.

Thum M (1986). Segregation of habitat and prey in two sympatric carnivorous plants species, *Drosera rotundifolia* and *Drosera intermedia*. Oecologia, 70: 601-605.

Whittaker RH (1972). Evolution and measurement of species diversity. Taxon, 21: 213-251.

Whittaker RH (1975). Communities and Ecosystems, Macmillan, New York, 2nd edn.