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CONTRIBUTIONS TO THE DIVERSITY OF CARNIVOROUS GENERA-*DROSERA* AND *UTRICULARIA* IN THE BHOPAL DISTRICT (M.P.), INDIA

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Abstract

Bhopal is blessed with rich herbaceous flora including two carnivorous plant groups, *viz*. sundew and bladderwort. A total of 6 insectivorous species belonging these two genera is being reported from the Bhopal district. This includes 2 species of genus *Drosera* and 4 species of genus *Utricularia* are being reported. The species are -*Drosera indica* L., *Drosera burmannii* Vahl; *Utricularia exoleta, Utricularia wallichiana, Utricularia flexuosa* and *Utricularia stellaria*. One additional species of Drosera - *D. burmannii* Vahl and one additional species of Utricularia – *U. exoleta* are being reported for the first time in present communication.

Key words : insectivorous species, carnivorous plants, herbaceous flora.

Introduction

There are approximately 700 identified species of carnivorous plants placed in 15 genera of nine families of dicotyledonous plants (Albert *et al*., 1992; Ellison & Gotellli, 2001; Fleischmann, 2012; Rice, 2006). In India, a total of five genera of carnivorous plants are reported with 44 species; *viz*. Utricularia (38 species), Drosera (3), Nepenthes (1), Pinguicula (1), and Aldrovanda (1) (Santapau & Henry, 1976; Anonymous, 1988; Singh & Sanjappa, 2011; Zaman *et al*., 2011; Kamble *et al*., 2012). Northeastern India is considered the home of all the above mentioned five insectivorous genera with a total of 21 species.

Materials and Methods

In the present investigation, besides Bhoj wetland (Upper Lake and Lower Lake), 16 more perennial water bodies in and around Bhopal were explored for the presence of aquatic/marshy plant. A total of 18 sites were investigated. The investigation sites are Upper Lake, Lower Lake, Shahpura Lake, Motia Tank, Halali Reservoir, Hataikheda Reservoir, Kerwa Reservoir, Kolar Reservoir, Sarang pani, Laharpura Reservoir, Siddique Hussain Tank, Munshi Hussain Khan Tank, Jawaher Pond(Char Imli),Landiya Talab, Neel Bud Tank, Ayodhaya Nagar (Abandoned Stone Quarry) Pond and Damkheda Village ponds.

Floristic and ecological surveys on the wetlands of water bodies of Bhopal were undertaken during 2010-2013 mainly through random sampling. 18 water bodies in all were surveyed periodically to record the occurrence of aquatic/marshy carnivorous plant. Plants were collected from different water bodies and processed to prepare mounted herbarium sheets /museum specimen following Jain & Rao (1977). Identification was done by using different taxonomical literature (Prain, 1903; Ghosh *et al*., 2004). Binomial and author citation of the entire collected voucher specimens were verified through checking with The Plant List (www.theplantlistorg). The International Plant Name Index (IPNI) and Index Keweinsis (IK). The voucher specimens are deposited at Govt. BHEL College Herbarium.

All the collected specimens were poisoned, processed and labeled by standard herbarium methods (Jain and Rao, 1993). The correct identity of the herbarium specimen was then confirmed by further critical study with the help of relevant floras, monographs and revisions (Gamble and Fischer, 1997; Janarthanam and Henry, 1992; Matthew, 1983; Taylor, 1989). Their identification was later confirmed by matching specimens with previously authenticated specimens available at Botanical Survey of India (BSI).

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Enumeration of the species

Key to species of genus Drosera in Bhopal

Droseraceae

Genus Drosera L.

Leaves with hair like tentacles; Flowers actinomorphic, stipule absent, plants non scapigerous; ——*D. indica*

Leaves forming a flat rosette, sub sessile or petiolate, stipulate, plants scapigerous; ——— *D. burmanii*

Drosera indica L. Hooker 2:424, M. Oommachan 140. Haines 2:359.

Common / Local Names: Flycatcher, Sundew, Dew plant, Indian Sundew (English); Kandulessa (Hindi); Gawatidavbindu (Marathi).

Herbs, annual, 5-50cm long, with fibrous roots. Stem-slender, sub erect, straggling weak stemmed, unbranched, procumbent, glandular- pubescent, yellow-green to maroon in color, little plant; mostly found in bogs. Leaves-cauline, alternate sparse, lower leaves recurved, upper leaves erect, linear, 30-60 × 1-3 mm, pubescent or glabrous, light green to red, apex acute, circinate in vernation, usually in basal rosettes, the upper portion of leaf copiously fringed with very fine gland tipped tentacles, responsible for trapping small insects; petioles 5-10 mm, glabrous; stipules absent or reduced and hair like. Inflorescence - Extra axillary glandular racemes. Leaf opposed,1-30 flowered; peduncle up to 12 cm long; bracts linear, 6-8 mm long. Flower-bisexual, actinomorphic, hypogynous, pedicel filiform, glandular hair present. pedicels 0.6-1.5 mm long. Calyx- sepals 4-8, , basely connate, 3-5 x 1-2 mm, segment oblong-lanceolate, sub-acute, persistent, aestivation imbricate, glandular. Corolla: petals 4-8, (5) 5-10 × 3-4 mm, obovate to oblanceolate, red, rose or pink, (white, Cooke 1: 499), spathulate, slightly linear. Androecium- stamen as many as petals or 5 papillose, 3-5 mm long, anther 2-celled, divergent extrorse. Gynoecium: 1-3 carpellary, superior, subglobose,1-2 mm across, unilocular with parietal placentation, ovules numerous, style- 3, often forked. Usually incurved, stigma as many as styles, simple, 2-3 mm long. Fruit-Loculicidal capsule, 3-valved. Seeds: numerous, minute, obovoid, reticulate and ridged, Black. Flower/Fruit: Sept.-January.

Occurrence in Bhopal

It is commonly found growing in wet shallow and poor nutrient soils, overlaying rocks and in wet muds, in swamps, marshes, pools and streams, and in open humid soils. A very rare plant in this region. However, found abundant in a localized wet or swampy or bog like habitats in the Shimla Hills -south- slope in a dripping water channel and opposite Prempura Ghat, Lalghati near Upper Lake Area and beside Kaliasote dam in a water channel, more abundant during rains associated with Uticularia and Eriocaulon species.

***Drosera burmanii* Vahl.**

Common Name: Sundew

An annual or biannual herb, with few fibrous roots. Stem: unbranched, extremely short. Leaves- forming a flat rosette, sub sessile or petiolate, stipulate, connate with petiole at base, trifid, lobes laciniate, petiole short or absent, leaf blade yellowish green, or red or reddish violate, cuneate to obovate- spathulate, base attenuate, with glandular trichomes, glabrous, apex fimbriated. Inflorescence- scapiform. Racemes 1-2, glabrous or with white or red to reddish violate glands. 2-19 flowered, bracts simple, hastate. Calyx- sepals -5, united at base, light green, red or reddish violet, striate, tuberculate, abaxially with short, glandular hairs and white gland. Corolla- petals white to light red to reddish violet, obovate. Androecium- stamens 5. Gynoecium - ovary sub globose, placenta 5, stigma tooth like. Fruit-capsule- 5 valved, seeds dark brown to black, veined. Flower/Fruit- August-December.

Occurrence in Bhopal

It is found in marshy places. A very rare plant in this region. However, found abundant in a localized wet or swampy or bog like habitats in the Shyamla hills south-slope and opposite Prempura Ghat, Lalghati near Upper Lake Area and beside Kaliasote dam in a dripping water channel, more during rains associated with Uticularia and Eriocaulon species.

In Andhra Pradesh, *D. indica* L. is a red listed medicinal insectivorous plant (Jayaraman & Prasad, 2006) and is locally used by farmers for biological pest control based on ethnic knowledge, where it is found growing naturally on raised partitioning mid-walls between rice fields. Ever increasing use of pesticides and phyto-sociological disturbance may be responsible for its decrease in number. It is also being used as ethno medicine by the local healers as one of the ingredients of ethnic-polyherbal formulation.

Lentibulariaceae (Bladderwort family)

Genus *Utricularia* L.

Aquatic free floating; peduncles without any floating vesicles ———— *U. flexuosa*

Aquatic free floating; peduncles surrounded by a whorl of large spongy floating vesicles below the

inflorescence ———— *U. stellaris*

Aquatic free floating: peduncles with a scale in the middle ———— *U. exoleta*

A terrestrial herb fixed to wet ground ———— *U. wallichiana*

Utricularia flexuosa Hooker4:329, Duthie2:38, Maheshwari: 256,

Common Name : Bladderwort, Annual, predominantly insectivorous, stolons- terete much branched. Leaves- alternate, dimorphic, with submerged leaves finely divided and bearing insectivorous bladders of complex structure, and aerial leaves composing a floating rosette or reduced to scale like enations or absent. Bladders (traps), ovoid, usually many on the leaves, young bladders greenish and transparent, older one's dark brown to black. Inflorescence: raceme. Flower- bracteate, bracteolate, pedicellate, bisexual, zygomorphic, without any floating vesicles. Calyx- 2-5 lobed or divided, the segment open. Corolla- petals-5, gamopetalous, imbricate- aestivation, bilabiate, the lower lip saccade or spurred, often personate, spur nearly as long as the lower lip, conical, acute. The lower lip longer than the upper. Androecium- stamen- 2, with 2-staminodes arising from extreme base of corolla tube, anther 1 celled dehiscing longitudinally no disc produced. Gynoecium- carpel- 2, syncarpous, unilocular, ovary- superior, placentation - free central, ovules- numerous, style- 1, stigma bilobed. Fruit – capsule, 4-valved, sub globes, seeds large. Flower/Fruit : September-December.

A plant species more or less similar to *Uticularia stellaris* but with longer peduncles, larger bracteate flowers and pedicel deflexed after flowering, without any floating vesicles but occasionally inflated upper leaf rachises is seen growing along with it.

Occurrence in Bhopal

Common after the rains in the fields, tanks and other fresh water wet places and in upper lake. Found in dried up water logged fields and ponds, near Bada Talab or Upper Lake. Collected from Bairagarh and Bhadbhada side of Upper Lake, and habitation side of Shahpura Lake. Also recorded from near nala side of under bridge, Ekant Parkside of Shahpura.

Utricularia stellaris L. Hooker4:328, Duthie 2:38 Maheswari: 255

Common Name : Bladderwort. An aquatic root less herb, submerged except the inflorescence and free-floating. Stolons slender or filiform, not much branched. Leaves- pinnately divided into capillary segments, with insectivorous small bladders at their bases in whorls of 4-5 at the node. Inflorescence-few flowered aerial raceme. Flower- held up by a whorl of spongy floats with filiform external pinnules at their apices bisexual, zygomorphic, hypogynous. Calyx- sepals- 2, lobes up to 2.5mm long, accrecent, ovate. Corolla- petals- 5, blipped, spurred at back, spur sub-cylindrical, a little shorter than the lower lip, stout, blunt, slightly curved, yellow or cream coloured. Androecium-stamen- 2, with 2 staminodes polyandrous, anthers monothecous. Gynoecium- carpel-2, syncarpous, ovary superior, unilocular, placentation free central. Fruit- capsule, globose, 4mm across, surrounded by calyx. Seeds-many, minute, 5 angled, narrowly winged. Flower/Fruit- September to November.

Occurrence in Bhopal

Common in the shallow, temporary ponds, puddles, ditches and in standing fresh water tanks. Banganga side of lower lake and Bhadbhada side of Upper Lake.

Utricularia wallichiana Hooker 4 : 332.

Common Name : Bladderwort. Very slender plant, twining or reduced to a short, erect, filiform stem attached to the wet substratum with root-like structures which possess minute bladders, linear evanescent leaves. Inflorescence-a few flowered racemes. Flower-with straight tapering pointed spur about as long as or longer than the lower lip, pedicels very minute. Bracts ovate, acute, bracteoles filiform. Zygomorphic, bisexual, hypogynous. Calyx- sepals- 2, ovate, 2mm long. Corolla- petals- 5, gamopetalous, bilipped, upper lip 4mm long, sub orbicular, yellow. Androecium-stamen- 2, polyandrous, 1-celled anthers. Gynoecium- Bicarpellary, syncarpous, superior ovary, unilocular, placentation- free central. Fruit-capsule, lenticular, surround by a persistent calyx, seeds small. Flower/Fruit- July – September.

Occurrence in Bhopal

Found in profusion in bogs and other wet places along side stream and on their banks; also found on rocky wet substratum with very little soil and seeping water. Collected from in the southern slope of Shyamla hill towards North T.T. Nagar in a wet area. It is growing in association with *Drosera indica* and *Eriocaulon* etc.

***Utricularia exoleta* :** Hooker 4 : 329.

Common Name : Bladderwort.

Annual aquatic carnivorous, herb, stolons filiform, much branched, up to 12cm long. **Leaves:** dichotomously divided in to capillary segments, bladders 1mm long ovate – reniform, many on the leaf segments. Inflorescence- solitary, axillary. Flower- zygomorphic, bisexual, hypogynous. Calyx- sepals- 5, lobes- 2, 2mm long, ovate.

Drosera indica L.

Drosera burmannii Vahl

Utricularia exoleta

Utricularia wallichiana

Utricularia flexuosa

Utricularia stellaria

Table 1 : Comparative status of diversity of two carnivorous genera (Drosera and Utricularia) in Bhopal. (World/India/Bhopal) *

Order	Family	Genus	World	India	Bhopal
Nepanthales (Rosales)	Droseraceae	Drosera	168	03	02
Scrophulariales (Personales)	Lentibulariaceae	Utricularia	234	38	04
Total			402	41	06

*Data derived from the carnivorous plant Database.

Corolla-spurred at back, 2-lipped, upper lip 3mm long, sub orbicular, erect. Androecium- stamens-2, polyandrous, anther lobe-1 celled, dehiscing longitudinally. Gynoecium-carpels- 2, syncarpous, ovary superior, unilocular, placentation- free central. Fruit-capsule, 3mm across. Flower/ Fruit- July- October.

Occurrence in Bhopal

Usually found in shallow water and water logged area. It appears as amphibious swamp plant as well as totally submerged in springs and along small streams.

Discussion

The species name *Drosera indica* was formalized in 1753 by Linnaeus based on a drawing of a plant collected from Sri Lanka. The Kew herbarium has a photo of *Drosera indica*herbarium specimens from Sri Lanka, peninsular India, and Myanmar (Burma) on one page. Planchon (1848) described *Drosera indica*. Additional names have been applied to specimen representatives of

this species complex: *Drosera angustifolia* (Mueller 1855), *Drosera hexaginia* (Blanco 1845), *Drosera makinoi* (Masamune, 1935), *Drosera metziana* (Gandoger, 1913) and *Drosera minor* (Schumacher, 1827). These names appear to be synonyms of previously named species. However, at some point any of them could be resurrected in a revision of *Drosera indica* itself. The number of recognized species in the *Drosera indica* complex was reduced to one when Diels published his major monograph on the Droseraceae in 1906. He organized and described the *Drosera* species then known as well as drawing representatives of each group.

Drosera L., is one of the largest genera of carnivorous plants (commonly known as sundews) with more than 160 species belonging to the family Droseraceae (Rice, 2006; Jayaram & Prasad, 2006), amongst which only three are found in India (Ghosh, 1997). *Drosera indica* is deciduous. *D. burmannii* is a small an annual, compact species in the carnivorous plant genus Drosera that produces large amounts of seed. Oommachan (1977) reported only one species of *Drosera indica* from Bhopal whereas, present survey reports occurrence of and additional species *Drosera burmanii* also from Bhopal.

Utricularia L., commonly known as bladderwort, has about 214 species (Taylor, 1989) distributed mostly in tropics and subtropics and a few are temperate (Cook, 1996) where in 35 species are present in India (Janarthanam and Henry, 1992). Over the next 8 years, 3 additional species have been described from India, including *U. Janarthanamii*, *U. naikii* and *U. babui* (Yadav *et al*., 2000 and 2005). An exceptionally large number of species of the subtropical to tropical Section Phyllaria of Utricularia (*U. furcellata*, *U. christopheri*, *U. brachiata*, *U. striatula*, *U. multicaulis*) are native or even endemic to north eastern India. The majority (some 20) of the remaining Indian bladderwort species not known from the extreme northeast are members of Utricularia Section Oligocista and are more or less restricted to the Deccan peninsula, predominantly in the Western Ghats (Janarthanam & Henry, 1992; Taylor, 1989). *Utricularia gibba* and *Aldrovanda vesiculosa* represent a zonal aquatic not closely tied to any climatic vegetation zone, *U. minor* L. has been recorded so far only from the Himachal Pradesh, Jammu and Kashmir at 2500-4300m altitude (Janarthanam and Henry, 1992; Taylor, 1989).

Oommachan (1977) reported only three species of *Utricularia indica* from Bhopal – *U. flexuosa*; *U. stellaris* and *U. wallichiana*. Whereas, present survey reports occurrence of one additional species of Utricularia - *U. exoleta* from Bhopal. Reporting of this additional species may be attributed to extensive surveying multiple times during various seasons over a period of 3 years.

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