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FLORAL MORPHOLOGY AND ETHNO-MEDICINAL IMPORTANCE OF *CISTANCHE TUBULOSA* – A ROOT PARASITE GROWING IN CHURU REGION, A PART OF THE THAR DESERT

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ABSTRACT:

Cistanche tubulosa (Schenk) R. Wight (Orobanchaceae) was observed growing as root parasite on host plant *Calotropis procera* L. in sandy habitats of western Rajasthan, especially in Churu region. During reproductive phase of the parasite, only tuberous, massive inflorescence axis emerges out from ground level, whereas vegetative part remains underground nearby host root system. Several nutritive compound and water withdrawn from host roots are being accumulated in inflorescence part which is medicinally important. Ethno-medicinally the species is used in different health problems like jaundice, diabetes, male and female genital problems, whooping cough etc

KEY WORD: *Cistanche tubulosa*, *Floral morphology*, *Ethno-medicinal*, *Calotropis procera*.

INTRODUCTION:

Cistanche tubulosa (Schenk) R. Wight belongs to the family Orobanchaceae, locally known as “Bhampore,” “Oont-bagra” and very much liked by goats for grazing. Its distribution is reported from Central Asia, Arabia, Pakistan (Sind) and India. In India, it is mainly found in Rajasthan and Punjab states. The plant is succulent and covered with small, membranous, simple and sessile non photosynthetic leaves which are arranged in a spiral manner. Flowers are aggregated in tuberous spikes. Inflorescence is the only visible part of the plant which is purplish – yellow, leafless, massive scape emerging from ground surface in vicinity of host species *i.e.* *Calotropis procera*. The flowers are bracteate and small with each occurring in the axil of a scale. A hypogynous disc is present at the base of flower which is fleshy (Watson & Dallwitz, 2008). The stem usually remains underground during the early developmental

stages and is achlorophyllous. The stem after emerging out of the ground surface in spring produces flowers which are arranged in such a way that the inflorescence looks like a pine cone and does not become green. The peduncle is crimson when young which then becomes yellow or whitish yellow as the parasite matures. In Rajasthan plant has been reported from various districts viz., Ajmer, Barmer, Bikaner, Jaipur, Jaisalmer, Pali (Shetty and Singh, 1991) and from Churu also (Pandey et al, 1985). Recently it has attracted a lot of interest due to its morphology and ethno-medicinal properties.

STUDY AREA:

Floristic survey of Churu District is carried out from year 2008 to 2012. During field study an interesting plant *Cistanche tubulosa* (Schenk) R. Wight was collected from three different localities of the district viz., village Shyopura and Depalsar in Churu, Pulasar in Sardarshahar, Satyun and Chalkoi in Taranagar sub divisions.

MATERIALS AND METHODS:

To ascertain the host-parasite association, the soil was dug to expose the underground parts of the species. The soil was mainly sandy with loose and retained by the host roots. Samples were collected in March-April 2012, properly dried and mounted on herbarium sheets for record. A detailed morphological study of the fresh material was carried out including reproductive parts of flower. During the field trips plants were collected with detailed information regarding their use by the local people of Churu district. The method of collecting information about the plants was based on personal interview with tribal and backward people of various age groups residing in rural, semi-urban areas of the region. During collection of medicinal plants, village headman, spiritual leader, Ojha, Vaidhya, Hakims, Priest and other people who could give correct information about the mode of use and with their collaboration the know-how of the plant were collected. The data collected were compared and cross linked with already available data to ascertain its integrity. Moreover it was found that the tribal village members were found to be acquainted with quite a number of medicinal properties of the plants. Ethno botanical data was collected along various lines in different manners – by enquiry, observation, interview and participation. Selected tribal were taken on excursion where only ethno botanically important voucher specimens were collected. Whenever possible, the most common plants and ethno-botanically important plants were photographed. The proposed study was based on personal interview with tribal and backward people of various age groups residing in rural areas of the district.

Plant possesses furrowed, fleshy, pubescent scapes, terminating into 2-4 cm or even up to 35 cm long spikes (Plate I, Fig-3). Bracts were observed 2.0-2.5 cm long, oblong – lanceolate in shape. Calyx 1.2-2.0 cm long, tubular, campanulate, lobes 5-7 mm long, sub-equal, rounded (Plate I, Fig-4). Corolla yellow,

tubular, hairy at the base inside the lower half, upper half campanulate, bent outwards from the middle, lobes rounded, reflexed. Filaments pubescent at the base; anthers woolly (Plate I, Fig-5). Long styled gynoecium possess incurved stigma (Plate I, Fig- 6&7). Swollen placenta bears numerous ovules (Plate I, Fig.8). Capsule 20-25 x 8- 10 mm long, ovoid – oblong, laterally compressed, beaked. Seeds numerous and reticulately pitted. Plants prefer sandy soils (desert conditions) exhibiting xerophytic characteristics. Typical xerophyte which form association with parasite grows in the area is *Calotropis procera* (Plate I, Fig-1 &2). Survey revealed that *Calotropis procera* is common plant. The stem is white and devoid of chlorophyll. The leaves are small (scaly), alternate, arranged in a spiral having an entire lamina. These leaves contain no chlorophyll, thus are non-photosynthetic. The stem remains underground during late summer and autumn and ultimately comes out to form the inflorescence in late summer or early spring. The inflorescence/spike, after producing flowers and seeds next spring, withers. Same is the fate of the underground stem as well. All the nutritional requirements are obtained from the host. The inflorescence, being a spike (almost resembling the pine cone), is a continuation of the underground stem which usually projects above ground in spring. The spike has a bluish or crimson coloured when young while the flowers are whitish yellow at maturity. The spike is short lived and dies in 2-3 weeks depending upon the weather after release of the seeds. The underground stem usually withers up to the root tip and becomes very soft. Next year another stem usually develops below the withered inflorescence and produces a new plant which ultimately gives rise to a fresh inflorescence. The stem usually grows in a serpentine manner and remains underground throughout the year. Only the apical part of the stem comes out where the inflorescence/spike develops which withers after release of semi-mature seeds next spring, thus the stem again goes underground. Hence the plant totally relies on the host for all the nutritional requirements. Following the same pattern, next year a new branch is formed from the stem below the withered inflorescence which grows underground and develops into a spike next spring.

Locally the plant is used for treatment of different health problems. It has medicinal properties, especially those related with fertility problems of both the males and females (Dharmananda, 2004). A decoction of the entire plant is also used against jaundice (Palevitch *et al.*, 2002). The drug is administered for treatment of whooping cough, stomach aches etc. Either a concoction of the stem is made or the dried stem powdered which is then administered to the patients with sugar (Ilahi *et al.*, 2010). Studies are underway to isolate various active compounds synthesized by the plant and the ethno-botanic importance of the plant. These studies will be helpful for conservation and sustainable marketing of the drug. It is also observed plant population is decreasing day by day.

DISCUSSION:

In Rajasthan, *Cistanche tubulosa* (Schenk) R. Wight has been reported from various parts (Districts) of Rajasthan viz., Ajmer, Barmer, Bikaner, Jaipur, Jaisalmer, Pali (Shetty and Singh, 1991). From the study area i.e. Churu the parasitic plant was reported by Pandey *et al.*, 1985. It belongs to the family *Orobanchaceae* which described by Jafri, (1976). It has been reported as a parasite on *Calotropis procera*, *Tamarix indica*, *Calligonum polygonoides*, *Capparis decidua*, *Suaeda nudiflora*, *Salvadora oleoides* etc. (Jafri, 1976). During survey parasite was not observed in association with *Capparis decidua*, *Calligonum polygonoides*, *Tamarix indica*, *Salvadora* spp., and *Suaeda* spp. The sole association ship of parasite was reported with that of *Calotropis procera* roots. The parasite grows from a tiny seed which can travel long distances buoyed by winds. It has been reported that allelochemicals play a role in seed germination of the parasite on the host (Jorrin *et al.*, 1999). A survey of the area revealed that a number of plant species grow in the area but the parasite establishes connection with the specific host and none other, thus supporting the idea of host-parasite relation based on certain chemical interaction. Root of the *Cistanche tubulosa* is hard, smooth and exhibits anatomical characteristics like that of a normal root. Contrarily the stem is succulent, swollen and reasonably soft. This is probably to store water and other nutrients obtained from the host which are possibly then further biosynthesized/bioconverted for assimilation into other organic compounds for ultimate utilization by the parasite.

The economic benefit of the parasite could be its medicinal importance both locally and abroad (Dharmananda, 2004; Song *et al.*, 2008; Xie *et al.*, 2008; Xue, 2008). The host-parasite relationship could bind the sandy soil, hence possibly reducing erosion etc. Further the spread of the host roots and ramification of the parasite stem within the soil could provide the vegetational cover and thus conserve water resources under desert-like conditions. This characteristic habitat hence affords a medicinal parasitic herb of immense economic importance in the future (Xue, 2008). Desertification and soil erosion are major causes of fodder crisis thus increase in vegetational cover of the area with *Cistanche tubulosa*, and host species might be able to control this phenomenon.

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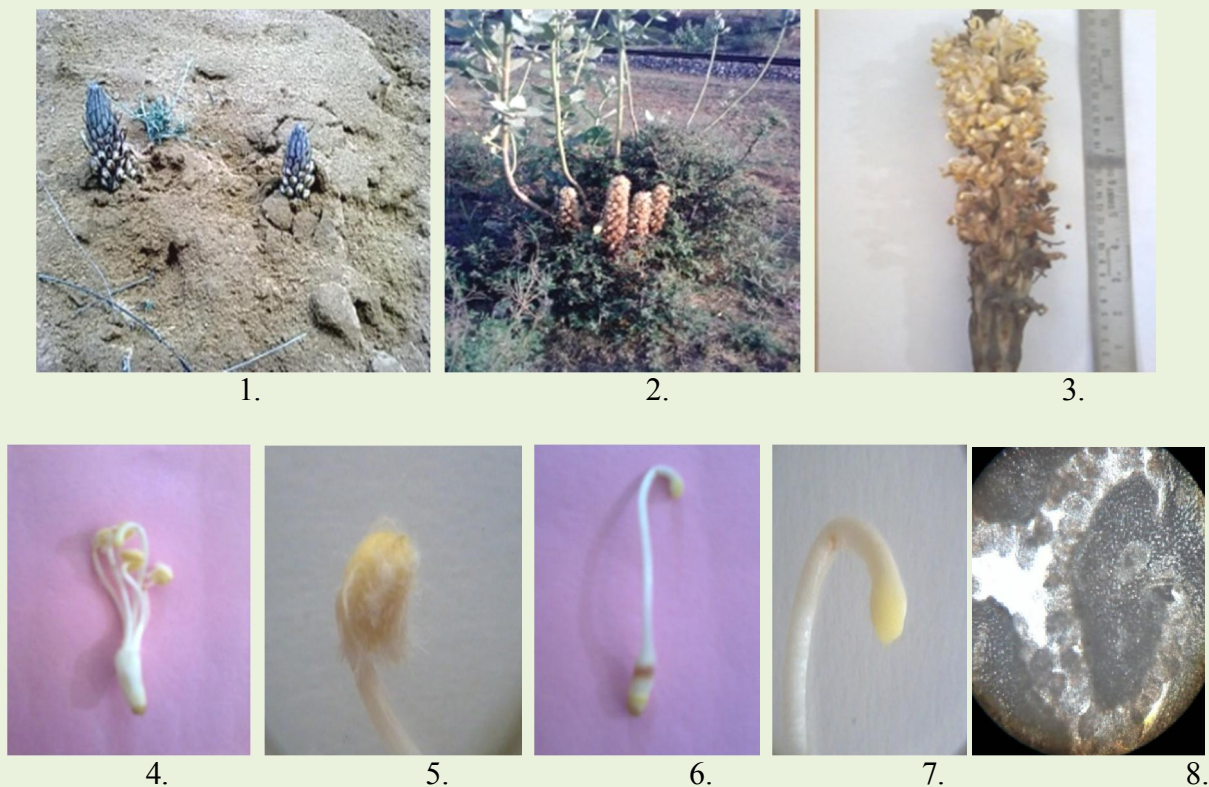
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Plate I.

Cistanche tubulosa



Description of Figures:

Figs. 1-8: Field view of young inflorescence emerging out near host roots (1), close association with *Calotropis procera* during vegetative growth of parasite (2), above ground inflorescence axis bearing numerous flowers (3), reproductive parts of single flower in close view (4), single stamen showing hairy anther lobes (5), long styled gynoeceium (6), incurved stigma (7) and swollen placenta bearing several ovules (8).