

In this issue : • Parasitic Desert Broomrape-A Source of Herbal Drugs • Forthcoming Conferences and Events • Recent CAZRI Publications • Visits Abroad • Institute News in brief

PARASITIC DESERT BROOMRAPE-A SOURCE OF HERBAL DRUGS

Introduction

Parasitic plants are diverse group of flowering plants that rely on host plants for growth and development. They depend partially or completely on host for carbon, nutrients and water which they require by attaching to it by special multicellular structures known as austoria. The site of attachment to the host classifies the parasite as either root or shoot parasite. The presence or absence of functional chloroplasts defines the parasite further as being either hemiparasitic or holoparasitic, respectively. Parasitic plants are common in many ecosystems from tropical rain forests to the high arctic and even in desert areas. It has been reported that about 1% of the flowering plants, approximately 3000 species in total, are parasitic. In the Thar Desert, four genera of parasitic plants namely Orobanche, Cuscuta, Striga and Cistanche which belong to the families Cuscutaceae and Orobanchaceae of the Dicotyledons are present.

Members of the family Orobanchaceae are often fleshy, usually covered with scale leaves. Both the leaves and stem are devoid of chlorophyll and are parasites on roots of a number of plants. These plants are parasitic, annual or perennial herbs or shrubs growing on roots of a host. The plants are succulent and covered with small, membranous, simple and sessile leaves which are arranged in a spiral manner. No well developed stomata, rather a hydathode, are present for the exchange of gases and water vapours. Flowers are aggregated in spikes. 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. The plants are attached to the host by means of haustoria formed at the base of roots which transfer nutrients to the parasite from the host. The family is economically important because genera like Orobanche, Aeginetia etc., cause damage to the many host plants. One member of the family viz., Cistanche tubulosa along with C. deserticola Y. C. Ma occurs usually in sandy habitats and parasitizes a variety of desert plants. C. tubulosa has also been reported from China, India and Pakistan etc., and is a yellow to yellow-brown herb, with simple, unbranched, erect, glabrous often 40 to 60 cm tall stem. They are called as Desert broomrape or hyacinth.

1. Distribution and Host range:

Cistanche tubulosa (Schenk) R. Wight is flower bearing plant parasite which is unable to synthesize chlorophyll directly therefore plant grows on the roots of desert shrubs such as *Salvadora persica* and *S. oleoides* (Fig.1 & 2). The parasite plant is able to tolerate saline environment. It is a rare and endangered plant species but mostly found in arid and semi arid regions of India (Rajasthan), China and Pakistan. Genus *Cistanche* has about 18 species which is distributed in arid and semi arid regions of the world. All the species of Cistanche, and the entire plant family to which they belong (Orobanchaceae), are parasitic plants: they cannot photosynthesize therefore lack green pigment and get their nutrients and water from other host plants. In western parts of Thar desert it mostly grows on the roots of Salvadora (Mustard) tree in saline affected arid area. C. tubulosa occurs usually in sandy habitats and inhabit a growth of variety of desert plants. Parasitic plants have also been reported on Capparis decidua L (Capparidaceae), Calligonum polygonoides L (Polygonaceae), Calotropis procera L. (Asclepiadaceae) and Tamarix indica Willd (Tamaricaceae) in desert areas. The seed germinates on the host root which is near the soil surface and produces haustoria which then penetrate into the deeper layers of the root i.e. to the centre of metaxylem to tap the nutrition from the host, where it is parenchymatous in nature.

Botanical name : Cistanche tubulosa,

Family : Orobanchaceae

Common name :Desert Broomrape or Hyacinth, Fox radish, Lonki-ka-mula

2. Nature of Attack:

Recent survey of *Salvadora* species conducted in western Rajasthan revealed that various pathogens and plant parasite (*C. tubulosa*) use to attack both the species of Salvadora. The seeds of parasitic C. tubulosa germinate on the host roots (6-15 cm underneath) which are near the soil surface and produces haustoria which then penetrate into the deeper layers of the roots (Fig. 3 & 4) i.e., to the centre of metaxylem to tap the nutrition from the host. The parasitic plants emerged from the ground and produced a dense pyramid shaped spikes having bright yellow flowers topped by maroon to violet-tinted buds in



Fig 1-4 Desert Broomrape-A Plant Parasite on Salvadora Trees in Saline Arid Land

the month of April-June (Fig. 3). Parasitic plants were succulent and covered with small, membranous, simple and sessile leaves, arranged in a spiral manner. Underground plants were light yellow, with simple, unbranched, erect, glabrous and tall stem in bunches (25 cm to 40 cm) (Fig. 4). Flowers formed spikes and were 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. They produce many tiny seeds may remain dormant for years until the ground moisture and roots of its host plant are close enough to trigger germination.

3. Role of Saline Arid Environment:

Saline arid environmental conditions of Western Rajasthan favour the attack of parasite. The parasite requires low organic matter and slightly alkaline soils ranging pH from 7.7-8.8. In the Jalore and Pali districts of Rajasthan, the parasite grows on S. oleoides on roots having pulverized, lose, sandy loam soils having sufficient moisture. Host-parasite association usually found under the tree canopy area (2-5 feet away) from the main trunk near root zone having tender soft roots. Plants growing near pond or river sides are more parasitized with desert broomrape due to available soil moisture for the germination of seeds. This indicates that for infection and germination of C. tubulosa seeds require moisture up to 6-15 inches soil depth. During* good rain fall years, C. tubulosa appears also on other desert trees.

4. Ethnopharmacology:

C. tubulosa features in the daily diet of the local population who enjoy one of the longest life expectancies in the world (http://www.supersmart.com/en--Cistanche-tubulosa-Extract-200-mg--Specific-products--0528). Many of them attribute their longevity to regular consumption of *C. tubulosa*. A decoction of the entire plant is used against jaundice. Locally the drug is administered for treatment of whooping cough and stomach aches. Recently it has attracted a lot of interest due to its medicinal properties, especially those related with fertility

problems of both the males and females including other reproductive system disorders such as profuse menstrual bleeding or leucorrhea.

Use of *Cistanche* has evolved over nearly 2,000 years. *Cistanche* was described in the oldest surviving herb classic, Shennong Bencao Jing (ca. 100 A.D.) (Yang, 1998), as follows:

"Cistanche is salty. It mainly treats the five taxations and seven damages, supplements the center, eliminates cold and heat and pain, nourishes the five viscera, strengthens yin, and boosts essence qi. In females, it makes pregnancy possible and treats concretions and conglomerations. Protracted taking may make the body light."

Now, various compounds of pharmacological interest have been isolated from different species of the genus Cistanche. The active ingredients isolated from Cistanche include iridoid and phenylpropenoid glycosides. It also contains acteoside (polyphenol), which is a powerful antioxidant. The herbal products are now available in market. Research conducted jointly by a Japanese company, a pharmaceutical laboratory in Shanghai and the University of Beijing, showed that C. tubulosa extract helps prevent ageing of the brain and skin, increases sexual vigour and accelerates fat metabolism. Studies are underway to isolate various active compounds synthesized by the plant along with ethno-botanic importance.

5. Future Thrust:

Detailed studies of the *C. tubulosa* regarding seed germination, seedling establishment, parasitehost relationship and assessment of losses to the host are needed for better understanding of parasitic aspects and disease management. Ethnopharmacology, the study of traditional plants and herbal remedies- is promising field and further research is this direction will help to identify the medicinal values of this parasitic plant.

Forthcoming Conferences and Events: 7th Australia - New Zealand Climate Change & Business Conference, 01.08.2011 to 02.08.2011, at Wellington, New Zealand. Contact: secretariat@climateandbusiness.com SER2011 World Conference on Ecological Restoration, 21.08.2011 to 25.08.2011, at Merida, Mexico. Contact: info@ser2011.org 2nd World Biodiversity Congress, 08.09.2011 to 12.09.2011, at Kuching, Sarawak, Malaysia. Contact: http:// worldbiodiversity2011.com	 UN Convention to Combat Desertification COP 10, 10.10. 2011 to 21.10. 2011, at Changwon City, Republic of South Korea. Contact: http://www.unccd.int/cop/cop10/menu.php Non-CO₂ Greenhouse Gases (NCGG-6) Science, Policy & Integration, 02.11.2011 to 04.11.2011, at Amsterdam, The Netherlands. Contact: office@ncgg.info
Recent CAZRI Publications Kachra (<i>Cucumis melo</i>) An Under Utilised Gift of Nature. Eds: Pratibha Tiwari, M. Seena, Y.V. Singh and M.M. Roy. 4p. 2010, CAZRI, Jodhpur. Dissemination of Technologies through Farmer's Participatory Approach in Kachchh, Gujarat. Eds: Devi Dayal, Bhagirath Ram, M. Shamsudheen and Y.V. Singh. 24p. 2010, CAZRI., RRS Kukma - Bhuj.	 CAZRI Foundation Day Lecture. 12p. 2010, CAZRI, Jodhpur. Gaze Through the Year Passe. Oct. 2009 to Sept. 2010. 6p. 2010, CAZRI, Jodhpur. XXI Meeting of ICAR Regional Committee No. VI Agenda Notes and Status of Centre State Coordination for R&D Linkages in Agricultural Research Education & Extension. October 21-22, 2010. 214p. 2010, CAZRI, Jodhpur.
Visits Abroad Dr. Suresh Kumar, Cambridge, U.K. from 28.6.2010 to 9.7.2010 to attend International Training on "DUs Testing and Plant Variety Protection. Dr. Priyabrata Santra, Triesty, Itlay, from 30.8.2010 to 10.9.2010 to attend training programme of the subject College on Soil Physics: Soil Physical Properties & Processes under Climate Change at International Centre for Theoretical Physics (ICTP). Shri Shamsudeen, M., Nottingham, U.K., from 29.9.2010 to 28.9.2013 for Ph.D. Programme in Soil Science and the ICAR International Fellowship 2009-10. Dr. P.R. Meghwal, Agadir, Morocco, from 17.10.2010 to	 22.10.2010 to attend the VIIth International Congress on Cactus Pear & Cochineal. Dr. Dheeraj Singh, Hanover, Germany, from 2.11.2010 to 6.11.2010 for participation in Our Common Future Conference. Dr. R.S. Mertia, Alexandria, Egypt, from 6.11.2010 to 9.11.2010 for participation in 8th International Workshop on Sustainable Management of Marginal Drylands Phase-2 (SUMAMAD-2). Dr. M.M. Roy, Egypt, from 12.12.2010 to 15.12.2010 to attend 10th International Conference on Development of Dryland (ICDD).
Institute News in Brief Selection Dr. (Mrs.) Amtul Waris, Sr. Sci. from CAZRI, Jodhpur to P.S., Dir. of Rice Res., Hyderabad Dr. Y.V. Singh, H.D. VI from CAZRI, Jodhpur to Zonal Project Director, Zonal Project Directorate, Zone-IV, CAZRI. Dr. Arun Kumar Misra; H.D., Div. of Livestock Production System & Range Management Dr. R.K. Bhatt, H.D., Div. of Plant Improvement, Propagation & Pest Management New Appointment Sh. Hari Mohan Meena (Scientist, Agri. Meterorology) Dr. Soma Srivastava, (Scientist, Food & Nutrition) Transfer Sh. Sanjay Bokolia, C.A.O. from SAO IVRI, Izatnagar to CAZRI, Jodhpur Sh. Susanta Saha, SAO from CAZRI, Jodhpur to CICR, Nagpur. Superannuation/Retirement Dr. D. Kumar, P.S.	Sh. Bhawarlal, T-5 (Driver) Sh. M.D. Sharma, T-5 (T.O.) Sh. Bhawar Singh (SSS) Sh. Mod Singh (SSS) Smt. Sayar (SSS) Dr. L.N. Harsh, P.S. Sh. V.C. Issac, T-9 Mrs. Annama Varghese, P.S. to SAO Sh. Abdul Saleem, Peon Smt. Chuki Devi, (R/M) Sh. Kan singh, (R/M) Sh. Kan singh, (R/M) Sh. Harish Kumar, P.A. Rodent Sh. Babulal Prajapati, T-5 Smt. Mansukhi (R/M) Smt. Dhapu (R/M) Sh. Mhaitab Homage Sh. Chanda Ram (Mali) Sh. Harish Choudhary (Driver)
Superannuation/Retirement Sh. Chanda Ram (Mali) Dr. D. Kumar, P.S. Sh. Harish Choudhary (Driver) Central Arid Zone Research Institute, Jodhpur 342 003, INDIA	

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