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Insect-pest and diseases disturbances associated with an endangered plant *Commiphora wightii* (Arnott) Bhandari in Western Region, India

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ABSTRACT

As the plant holds important medicinal value and is endangered due to poor tapping methods, over tapping and lack of insect pest and disease management strategy, present review tried to enlist insect pest and disease problems associated with the *C. wightii* to attract the researchers to look into its integrated management for saving this important asset of Rajasthan and Gujarat.

Key words: *Commiphora wightii*, Insect pest and disease

Introduction

Medicinal plants, as a group, comprise approximately 8000 species and account for about 50 % of all the higher flowering plant species in India. A large number of the country's rural population depends on medicinal plants for treating various illnesses as well as a source of livelihood. About 1.5 million practitioners of the Indian systems of Medicine and Homeopathy (ISM & H) use medicinal plants for preventive and curative applications (Maiti, 2004). In spite of adverse climatic conditions and high biotic pressure, the Indian arid region supports a large number of plant species including medicinal and aromatic of which a few are endemic, threatened and rare in the arid desert (Bhandari and Shringhi, 1987; Mertia, 1990).

Commiphora wightii (Arnott) Bhandari is an arid region medicinal plant, also referred as guggulu or Indian bedellium, genus *Commiphora* (Family: Burseraceae) has about 165 (Barve and Mehta, 1993) to 185 species (Reddy and Meena, 2012). *C. wightii* is

highly valued for its medicinally important guggul gum-resin being used at large scale in preparation of Ayurvedic medicines. Many Guggal's products are accessible in the market and local people use guggal gum for making Dhup for Puja (Rakholia *et al.*, 2010). In India, Rajasthan and Gujarat have been identified as the main commercial centers (Mertia *et al.*, 2010). Shetty and Singh (1993) reported that, in Rajasthan, the distribution range of this species is in Indian Desert and Aravallis. The species is endemic to arid region and found in wild form in the drier parts of Rajasthan and Gujarat. In Rajasthan, it is reported from Sawai-Madhapur, Bundi, Kota, Jalore, Sirohi, Pali, Nagaur, Sikar, Churu, Bikaner, Ajmer, Alwar, Jaipur, Jaisalmer, Udaipur, Jodhpur, and Jhunjhunun (Tiwari *et al.*, 2001). A large plantation (30ha) exists in Mangliawas, Ajmer district of Rajasthan. Studies by CIMAP signify the presence of high guggulsterones in the cuttings taken from Mangaliaswas, Ajmer (Rajasthan) and Kottakhpat, Bhuj (Gujarat) (Bhatt and Dixit, 1974). Kulloli *et al.*, (2011) gave geospatial distribution of guggal in

Western Rajasthan. An estimate says that the annual demand of guggulu is almost 1000 tones, while the utilization of this drug is almost 2300 tonnes in many preparations of medicine (Sharma and Bharillya, 2019). The oleo resin of guggul is imported nearly 500-1000 tonnes from Pakistan annually (Sharma, 2004). *C. wightii* is now a threatened species as its population is depleting fast in its natural habitat (Reddy *et al.*, 2012) and is listed in IUCN's Red Data List of threatened plants (Natesh and Mohan Ram, 1999). This plant is becoming endangered due to lack of systematic cultivation, over-exploitation, invasion of foreign species in the natural habitat, biotic and abiotic factors etc. As *C. wightii* (Arnott) Bhandari is a plant of immense medicinal importance therefore, it is imperative to conserve this endangered species with the study of major factors responsible for its depletions of which biotic factors (insect pest and diseases) are among the notable one.

The natural regeneration of *C. wightii* is through seeds is very limited. The species is dimorphic in nature with predominance of female plants, while the male plants are very rare. Existing natural populations of this species has been affected by wrong oligo-gum resin production technique, climatic conditions, soil erosion, low rainfall, termite infestation, over-grazing by domestic animals, mining activities and habitat destruction (<https://www.iucn.org/content/workshop-guggul-tree-conservation>). These prevailing abiotic factors coupled with the mass destruction, poor regeneration and non-survival due to poor tapping methods has caused a major setback to the plant stands in natural habitats (Kasera and Prakash, 2005). *Commiphora wightii* populations are considered to have declined to less than 50% of their original size, leaving isolated sub-populations (Parmar, 2012). More recently, a conservation threat assessment by Reddy *et al.*, (2012) suggested that this species is threatened across all of Rajasthan and Gujarat. It is listed in IUCN's Red Data List of threatened plants and now it is becoming endangered owing to above reasons.

Diseases and insect pests have considerable impacts on forests and the forest sector. They can adversely affect tree growth and the yield of wood and non-wood products. A large number of insects and diseases are known to cause damage both in naturally regenerating forests as well as plantations although little statistics are available on the area affected by these insects. Guggul can be propagated by

seeds and vegetative both. In vegetative propagation, stem cuttings and air layering is successful in this plant (Kant *et al.*, 2010). But whichever way the plants are raised they often get affected by termites and root rot. The infested plants become dry showing yellow appearance of leaves, eventually resulting in death of the plants (Sharma *et al.*, 2004; Reddy *et al.*, 2012).



Dried plant of *C. wightii*

The decline of *Commiphora wightii* in Rajasthan is caused by several factors, one of them is plant decay caused by pathogens and insect pest usually post gum extraction. There is little knowledge about the plant pathogens and insect pests threatening this species and possible countermeasures to protect this slow growing plant. Present review enlist the work done on *Commiphora wightii* in Rajasthan and way forward to manage the plant decay caused by pathogens and insect pest.

Pathogenic problems encountered by *Commiphora wightii*

Reports on insect pests of Medicinal and Aromatic plants are scanty and scattered. There are about 40-45 major destructive insect-pest species found causing loss of about 50-60% to MAPs. Samantaa and Mandal, (2013) have identified a pathogenic bacterium as cause of a disease, where infection occurs during harvesting of the plant's main product, the guggul gum-resin, used in natural and ayurvedic medicine. Ramakrishnan and Sundaram (1954) reported *Ascochyta commiphorae* in living leaflets of *Commiphora caudate* at Adhuthurai, Thanjore. Patil and Ranade (1974) reported *Exosporium* spp. on *Commiphora berryi* at Tendi, Andhra Pradesh. Fungal leaf spot disease caused by fungus *Phoma glomerata*

(*Corda*) *Wollenw. et Hochapfel* is a serious problem for *Commiphora* are perhaps is the most prevalent plant disease in north eastern India. Initial stage of the disease start with the development of small black concentric ring-spots on leaf surfaces followed by brown discoloration of tissues, ultimately turning into black concentric rings (Sharma and Gaur, 1987). Other leaf spot diseases caused by *Alternaria alternata* (Majumdar *et al.*, 1988), *Cercospora* sp. (Dalal *et al.*, 1989) etc. are also reported on this plant. As this plant requires arid and semi arid land with rocky tracts, over watering especially during rainy season can cause root- rot disease due to lack of gaseous exchange and causing appearance of brown lesions on leaves. These leaves further turn yellow, wilt and finally the plant dies due to arrested growth. Chaturvedi *et al.*, 1987 reported that about 10% seedlings of *C. wightii* are destroyed by insects and pests at Mangliawas, National Herbal Farm, Ajmer in India (Rakholia, 2010) published a preliminary report that exudation of natural gum in guggal was due to infection by a *Pseudomonas* species. They also found that the bacterium was responsible for death of guggal plant. However, it was not validly published and the claim is questionable. Kurian and Sankar (2007) reported *Cercospora* leaf spot and bacterial leaf blight are common diseases affecting guggul. Orwa *et al.*, (2009) reported root rot disease in *C. wightii* which is frequent in rainy season. Collar rot disease, which is caused by *Sclerotium rolfsii* was also observed in during rainy season. Two pathogens namely, *Rhizoctonia bataticola* (Taubenh.) Butler and *Rhizoctonia solani* Khun were isolated and identified from guggal collected from Vasan Nursery, Gandhinagar (AFRI, 2004).

According to Samantaa and Mandal (2013) pathogenic bacterium *Xanthomonas axonopodis* pv. *commiphorae* (Xac) is mainly responsible for fatal plant disease and enters the plant at the cuttings from harvesting.

Orwa *et al.*, (2009) also reported *Odontoterm esobesus* (Ramb.) termites attack of the roots of the young plants (2-3 years old) in drier months. Heavy termite infestation was recorded in the guggal plantation at Kailana, Jodhpur (Ahmed, 2010). Annual report of DMAPR, Anand (2012-13) states that termite (*Microtermis mycophagus*), mealy bug (*Ferrisia vergata*) and tobacco caterpillar (*Spodoptera litura*) cause damage to guggul plant. Plants are often affected by termites particularly in summer season.

Termite causes severe damage to the plant by

making holes through buried ends of the stem or root. The infested plants become dry showing yellow appearance' of leaves and eventually result in death of the plants. (Sharma, 2008; Raut *et al.*, 2007; Reddy *et al.*, 2012). Whiteflies, *Bemisia* sp., harm guggul plant up to some extent by feeding on sap of leaves (Dalal, 1989). A leaf eating caterpillar (*Euproctis lanata* Walker) was also reported to attack guggal, though not in serious proportion Dalal *et al.*, (1989). Patel *et al.*, (1991) published the host status of Guggal to root knot nematodes. Kurian and Sankar (2007) reported that white fly (*Bemisia tabaci*) and leaf eating caterpillar (*Euproctis lanata*) are common pests of *C. wightii*.

Way Forward

Commiphora wightii is now vanishing due to crude and destructive tapping for obtaining more and more oleo-gum resin in the Indian arid zone (Kulloli and Kumar, 2013). *C. wightii* plant plays an important role in natural and ayurvedic medicine and is an important medicinal species of Rajasthan, but it is beleaguered with problems of regeneration, extremely low germination, overtapping of gum and insect pest and disease problems. Demand of *C. wightii* in medicinal products is high and the availability of natural population has decreased to drastic levels therefore present focus should be to explore ways to increase its survivability and manage problems associated with planting stock and plantations of *Commiphora wightii* and select tolerant candidate plus plants against these bio stress factors. An exhaustive check list of the major threatening agents (plant diseases and insect pests) of *Commiphora wightii* and their natural enemies to find biological based counter measures to halt the decline in plant population and developing a sound IPDM strategy against its important diseases and insect-pests can definitely helps in saving this plant from getting extinct.

Conflict of Interest

Authors declare that they have no conflict of interest.

Authors' Contribution

N reviewed the literature and contributed the manuscript and photographs. S contributed literature and drafted the manuscript. B and S contributed in preparing and critical checking of this manuscript.

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