

FIRST REPORT OF SEABUCKTHORN WILT CAUSED BY FUSARIUM SPOROTRICHOIDES IN INDIA

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ABSTRACT

Hippophae salicifolia D.Don (seabuckthorn) is a deciduous tree species that yield highly nutrient- and antioxidant-rich fruits, the health protecting properties of which have been known since time immemorial. Seabuckthorn is also a good fodder, provides strong fencing material, has nitrogen fixing and soil binding properties, and possesses wide edaphic adaptation. The plant is restricted to the Himalayan region, between 1500-3500 m a.m.s.l. found in dry temperate forests of western Himalayas, sloppy areas near river banks and on sandy soil. Research on medicinal properties and other aspects of seabuckthorn has received much attention in recent past, but there is no information regarding pathogenic diseases of *Hippophae salicifolia* D.Don in India. During this study seabuckthorn wilt caused by *Fusarium sporotrichoides* was reported for the first time from Chamoli region of Uttarakhand Himalayas in India.

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Antioxidant; Chamoli; *Fusarium sporotrichoides*; Himalayas; Uttarakhand.

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INTRODUCTION

Hippophae salicifolia D.Don commonly known as Seabuckthorn is a multipurpose, deciduous, dioecious thorny and nitrogen fixing shrub-tree growing widely on high altitude regions of Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand. It is tolerant to extremes of temperature (-43 to +45^o C), resistant to drought conditions and well adapted to the salinity and alkalinity [1,2]. It is supposed to be a store house of nutrients, vitamins and many items like jams, soft drinks, sauces, and pickles. In Indian Himalayan region, Seabuckthorn plant can offer benefits of nutrition, food, medicine, cosmetics etc. to the rural people for their socio-economic development. Seabuckthorn leaves are used for antioxidant and other properties. During a study on the occurrence of pathogenic diseases of *Hippophae salicifolia* inhabiting Garhwal Himalayas of India, Seabuckthorn wilt caused by *Fusarium sporotrichoides* was reported in this paper as a new record from India.

MATERIAL AND METHODS

In June 2015, samples of seabuckthorn plants (*Hippophae salicifolia* D.Don) showing wilt symptoms were collected during survey of naturally growing seabuckthorn populations from different locations of district Chamoli in Uttarakhand state viz. Rangad, Hanuman Chatti, Govindghat, Pandukeshwar, Badrinath, Niti, Mana. Infected plants were bagged, labelled and brought to the laboratory for further diagnosis and microscopic examination. Symptoms of the disease consisted of chlorosis, stunting, wilting and death. Isolation of the pathogen was made from infected tissues by performing moist chamber incubation method [3] and pure cultures of the isolated mycoflora were prepared using various culture media viz. Potato Dextrose Agar, Malt Yeast Agar and Czapek Dox Agar [4,5]. Identification of the isolated species was done by using standard literature and further confirmed from National Fungal Culture Collection of India-Agharkar Research Institute, Pune, India. Pathogenicity tests were conducted on twenty, 4 month old rooted cuttings under greenhouse conditions. Each plant was planted in a separate pot containing 0.7 litter of sterile soil. Inoculum for artificial infection was prepared with sterilized mixtures of wheat and barley seeds (10g of each). Seeds were inoculated with *F.sporotrichoides* spore suspension (10⁶ conidia/ml) and inoculated at 22^o C for 10 days. Non inoculated seeds served as controls. Ten seeds were placed under the soil surface around the root of each plant. Plants were irrigated and placed in a greenhouse (22^o C and 12 hr day/night photoperiod).

RESULTS

The species was isolated from Rangad site and was identified as *Fusarium sporotrichoides* Sherbakoff, C.D. 1915 (NFCCI Accession No. 3672). Fusaria of potatoes. Memoirs of the Cornell University, Agricultural Experimental Station 6:87-270. Synonym=*Fusarium sporotrichiella* var. *sporotrichoides* (Sherb.) Bilais.

Morpho-taxonomic features

Colonies were initially white, but with age became red, and red pigments were produced in agar. Conidia at the tip of conidiophores which branch irregularly or dichotomously, non-, one, two or three septate; globose, ellipsoid, or pear shaped, often with a basal papilla of attachment, scattered dustily in the mycelium. Conidia in the sporodochia and pionnotes more or less three- to five- septate, spindle-sickle- shaped, with larger and smaller spores mixed, both narrow and thick, sometimes with parabolic curvature, both ends tapering, foot cell real or slight, in mass ochre to salmon or orange red [Figure-1 and -2].

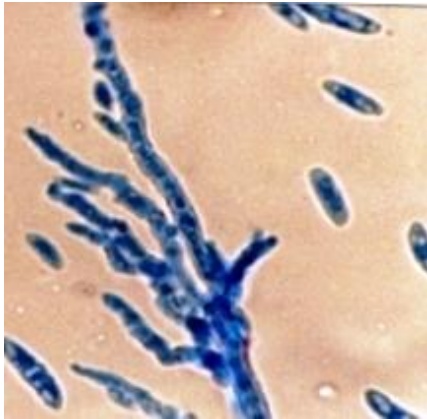


Fig:1. Macroscopic colony of *F. sporotrichoides*



Fig:2. 10 days old colony of *F. sporotrichoides*

Pathogenicity test

Pathogenicity tests also confirmed the presence of *F. sporotrichoides*. After Sixteen days of inoculation, 80% of inoculated plants were wilted. Symptoms on infected plants were similar to those observed in the field. The pathogen was reisolated and confirmed from the infected leaves, thus fulfilling Koch's postulates. [Figure- 3]



Fig: 3. Potted plants of seabuckthorn under green house conditions

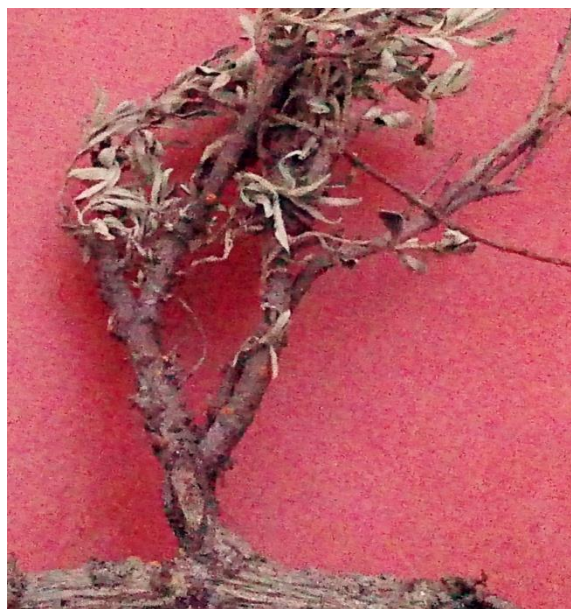


Fig: 4. Seabuckthorn showing Fusarium wilt

DISCUSSION

Diseases and insects/pests which affect almost every stage/part of the seabuckthorn are the factors affecting its cultivation. At present few pests and diseases of seabuckthorn have been reported; however more are likely to be identified as the number of plantations grow [6]. The major fungal disease reported on seabuckthorn includes verticillium wilt, fusarium wilt, damping off, brown rot, scab and dried shrink disease in China. The other common pathogenic fungi include the species of *Fusarium*, *Alternaria*, *Pythium*, *Fomes*, *Monilia*, *Stigmata hippophae* and *Valsa* [7]. 47 pathogen species were reported from Russia including *Fusarium sporotrichiella* causing maximum damage. In addition *Monilia altaica*, *Stigmata hippophae*, *Alternaria sp.*, *Valsa sp.* and *Pythium sp.* have reported to cause damage in Russia and Liaoning, Shanxi and Gansu provinces of China [8]. Damping off can be caused by a number of soil-borne fungi such as *Alternaria*, *Fusarium* and *Botrytis*. *Fusarium* spp. were previously considered minor pathogens on sunflower [9] but currently in United States of America and Argentina, *Fusarium* is causing serious problems where damage upto 80% has been reported. Among the twelve *Fusarium* species identified in Russia, *F.oxysporum* var *orthoceras* was the most widespread, and *F. sporotrichoides* was the most aggressive [10]. In 2009, *F.sporotrichoides* and *F. acuminatum* were reported causing pink discoloration of the sunflower pith in addition to *F.oxysporum* in northern Great Plains [11]. *Fusarium sporotrichoides* has been reported to cause foliar spots on Forage Corn in Chile. Certain graminaceous plants such as *Zea mays* and *Triticum aestivum* serve as host for *Fusarium sporotrichoides* [12]. *Fusarium sporotrichoides* is a frequent pathogen in corn silage [13] and cereal crops [14, 15].

Very few reports are available regarding the pathological aspect of *Hippophae* spp.in India. Incidence of powdery mildew of Seabuckthorn was recorded in Himachal Pradesh [16]. Three fungal endophytes *Aspergillus niger*, *Mortierella minutissima* and a sterile mycelium and four species of VAM spores (*Glomus albidum*, *G. fasciculatum*, *G. macrocarpum* and *Gigaspora margaritata*) have been isolated from different plant parts and soil samples [17]. Root rot caused by *Rhizoctonia solani* is major problem at nursery stage in Uttarakhand [18]. Thus to my knowledge there is no record of occurrence of genus *Fusarium* in association with *Hippophae* species in India and *Fusarium sporotrichoides* is being reported for the first time from leaves of *Hippophae salicifolia* D. Don causing seabuckthorn wilt.

CONCLUSION

The present study provides comprehensive information on pathological aspect of this wonder plant so that proper disease management of this multipurpose species could occur which favours the development and economic potential of seabuckthorn to improve socio economic status of the people residing in its natural habitat. The study will open up new horizon for local farmers and policy makers to develop effective action plan for sustainable use

and conservation management of seabuckthorn in cold desert region in particular and Indian Himalayan region in general.

CONFLICT OF INTEREST

The author declares no competing interest in relation to the work.

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FINANCIAL DISCLOSURE

Nil

REFERENCES

- [1] Jen Kumar V. [2003]-Sea buckthorn: A potential bio resource in Himalayas. *Invent. Intell* 159-167.
- [2] Jodha NS, Banskota M, Pratap T. [1992]-Sustainable Mountain Agriculture: Perspective and Issue. Jodha N.S., Banskota M & Pratap T. (Eds.), Vol.1 Oxford and IBH Publishing Co. Ltd., New Delhi, pp: 38.
- [3] Shutleff MC, Averre CW. [1997] The Plant Disease Clinic and field diagnosis of abiotic diseases, American Phytopathology Society, St. Paul MN.
- [4] Agrios GN. [1997] Introductory Plant Pathology 4th ed. Academic Press, New York, NY.
- [5] Waller JM, Ritchie BJ, Holderness M. [1998] Plant Clinic Handbook, CAB International New York, NY
- [6] Kalia RK., Singh R, Rai MK., Mishra GP, Singh SR. & Dhawan AK. [2011] Biotechnological intervention in Sea buckthorn (*Hippophae L.*): Current status and future prospects; *Trees* 25:559-575.
- [7] Li TSC. [2003] Taxonomy, natural distribution and Botany In: Sea buckthorn (*Hippophae ramnoides L.*): Production and Utilization. Li, TSC & Beveridge THJ (eds), PRC Research Press, Ontario, pp 7-12.
- [8] Singh V. [2008] Seabuckthorn (*Hippophae L.*): A multipurpose wonder plant, 3: 166, 38. Daya Publishing House, New Delhi, India
- [9] Gulya T, Rashid KY, Masirevic SM. [1997] Sunflower diseases: Phoma black stem in: Schmeiter, A.A. (Ed.), Sunflower Technology and Production. Agronomy Monographs no. 35 ASA, CSSA, SSSA, Madison, WI, USA, pp. 319-322.
- [10] Orellana RG. [1971] Fusarium wilt of sunflower, *Helianthus annuus*: First report. *Plant Disease* 55:1124-1125.
- [11] Leslie JF, Summerell BA. [2006] The Fusarium: Laboratory Manual Blackwell Publishing Professional, Hoboken NJ P-256
- [12] Tomoya A, Makoto K, Takumi N. [2012] The defence response in *Arabidopsis thaliana* against *Fusarium sporotrichoides*. *Proteome Science* 10:61.
- [13] Baath H, Knabe O, Lepom P. [1990] Occurrence of Fusarium species and their mycotoxins in corn silage. 5. Fusarium infection in corn silage. *Arch. Tiermahr* 40:397-405 (in German, English abstract)
- [14] Leslie JF, Summerell BA. [2006] The Fusarium: Laboratory Manual Blackwell Publishing Professional, Hoboken NJ P-256
- [15] Vargo RH, Baumer JS. [1986] *Fusarium sporotrichioides* as a pathogen of spring wheat. *Plant Disease* 70: 629-631.
- [16] Bharat NK. [2006] Occurrence of powdery mildew on Sea buckthorn in Himachal Pradesh. *Indian Forester* 132(4):517
- [17] Kumar S, Sagar A. [2007] Microbial associates of *Hippophae ramnoides* (Sea buckthorn) *Plant Pathology Journal* 6(4):299-305.
- [18] Singh K.P, Prasad & Yadav VK. [2007] The first report of *Rhizoctonia solani* on Sea buckthorn (*Hippophae salicifolia D. Don*) in Uttarakhand Himalayas. *Journal Mycology Plant Pathology* 37:126-127.

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