

## Survey on fungal diseases of *Swertia chirayita* in Darjeeling district of West Bengal, India

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### Abstract

Surveys for fungal disease incidence were conducted at eleven selected chirata growing areas to know the occurrences and intensity during 2011 and 2012. *Swertia chirayita*, an endangered high value medicinal plant was examined *in situ* for disease symptoms as well as samples being collected for laboratory analyses. Fungi were identified using morphological characteristics. Pathogenicity test confirmed chirata as a host and the survey showed that three fungi being identified from infected chirata plants which are predominantly found across all the different altitudinal sites. It caused undesirable effects on yield. These fungal pathogens were detected for the first time in Darjeeling district of West Bengal.

**Keywords:** DUB *Swertia chirayita*, Survey, fungal, disease, Incidence, New records

### Introduction

*Swertia chirayita* (Roxb.ex Flem.) Kart (Family: Gentianaceae), commonly known as chirayita or kirata tikta or bhunimba is a high value endangered medicinal plant used in traditional therapies. The species is distributed in temperate Himalayas at an altitude of 1200-1500 m from Kashmir to Bhutan and in the Khasi hills in Meghalaya. The dried herbage is the source of raw drug. The species is valued for its bitter principles as hepatic stimulant, blood purifier, tonic etc. The bitterness, antihelmintic, hypoglycemic and antipyretic properties are

attributed to amarogentin (most bitter compound isolated till date) 1, swerchirin, swertiamarin and other active principles of the herb (Chassot, 2000). The species is on the verge of extinction due to massive unscientific exploitation from its wild natural areas. The situation is so alarming that it has been classified as critically endangered plant species and has been put in negative export list of Ministry of Commerce, GOI. This is one of the 32 species short listed by NMPB for extensive cultivation and research. Most of the domestic demand is met from imports from

Nepal and other areas. Due to overexploitation of this species and Low germination percentage, viability of seeds, long gestation periods and delicate field-handling are some of the factors which discourage commercial cultivation and created lot of pressure on its natural resources which has led to considerable depletion of it stock. Due to lack of genuine raw material of this species and great demand from industries, substitute species like *S. angustifolia*, *S. paniculata*, etc. and even *Andrographis paniculata* are traded in the name of *S. chirayita*. Considering the demand and importance of genuine *chirayita*, work on exploration, domestication and development of cultural practices and chemical profiling of *S. chirayita* has been initiated at AICRP on MAP&B Kalimpong on 2006 under the aegis of Uttarbanga Krishi ViswaVidyalaya. Commercial cultivation of *Chirata* is being initiated in many places of Darjeeling district both for domestic and for exporting purpose. But disease incidence becomes a major problem in cultivation of *Swertia chirayita*. The quality of plant is affected due to the occurrences of this disease as whole plants part being used as medicinal purpose. Informations on diseases of *S. chirayita* is scanty. The primary aim of the present

survey was to identify fungal pathogens associated with *chirata* plants grown in Darjeeling district of West Bengal (Table 1). The data obtained from these surveys may help to understand the host-pathogen association in a better way and also can be used to prepare mitigation strategies. Hence, the present investigation deals with the detection and identification of the pathogen from the infected *Swertia chirayita* plant.

### Materials and methods

Sites for survey were selected based on the naturally *chirata* growing places of Darjeeling district. A total of eleven areas (Table1) were surveyed during 2011 and 2012. From each area, three sites were selected and from each site, three infected *chirata* plants were examined for visual disease symptoms, especially foliage pathogens causing leaf spots as well as diseases causing plant collapse. Infected plant parts (leaves, stems or roots) were collected and placed into individually labeled plastic bags and sealed. A total of 99 diseased plant samples were collected over the two year period. The survey was done based on sampling of observed disease symptoms.

**Table 1: *Swertia chirayita* growing area in Darjeeling district of west Bengal where survey were carried out during the 2011 and 2011 surveys.**

Sl no	Name of site	Latitude and Longitude	Elevation
1	Sukhiapokhri	27.0000°N, 88.1400° E	2,194 m
2	Sonada	26.9360°N, 88.2484° E	1872.35m
3	Lava	27.0500°N, 88.3900° E	2200m
4	Ghoom	27.0000° N, 88.1400° E	2,225 m
5	Rimbick	27.10513°N, 88.20075°E	1965.36
6	Algarah	27.0600°N, 88.4700° E	1,780 m
7	Takdah	27.0333° N, 88.3667° E	1474m
8	Kalimpong	27.0600°N, 88.4700° E	1247m
9	Mirik	26.8855° N, 88.1873° E	1,495 m
10	Pedong	27.1500° N, 88.6200° E	1,240 m
11	Mongpoo	27.060007°N, 88.469993°E	1800 m

Standard hygiene procedures were carried out at each site to prevent the potential spread of plant pathogens between sites. These included disposable overalls and decontamination of all sampling equipment. All samples were given a unique identification number.

The identification of fungi present was made either directly by microscopic examination or indirectly by isolation to agar culture. Plant tissues showing infection were excised and surface sterilized for 1 min in 1% sodium hypochlorite, followed by a 1 min wash in sterile water. Small pieces of tissue from the margin of diseased and healthy tissues were plated directly onto Potato dextrose agar medium and incubated at 20°C±1°C for up to 10 days or until sufficient growth or sporulation enabled identification. Pathogen identifications were carried out to species level using standard morphological characteristics.

#### Pathogenicity on *Swertia chirayita*

Pathogenicity test was carried out to find out, following standard procedure, whether the isolated fungal culture was capable of producing typical symptoms of under artificial inoculation condition on chirata plants or not

#### Results and discussion

Ninety nine diseased plants were sampled and analyzed for plant diseases during the surveys carried out in 2011 and 2012. Significant plant pathogens that affect primary production were also detected. Three fungal species were identified as

pathogenic to plants. Their significance varied but all cause considerable economic loss to chirata production as well as farming community.

#### Pathogenicity on *Swertia chirayita*

The fungal propagule artificially inoculated to 6-month chirata plants. The first symptoms of the disease observed on an average 15 days after each inoculation. Symptoms on the leaves were similar to those of a naturally occurring diseased plant. The fungal pathogen was consistently re-isolated from inoculated plants.

#### New disease records

During this survey, three fungi, *Cladosporium tenuissimum*, *Alternaria alternata*, *Rhizoctonia solani* were recorded in Darjeeling for the first time (Table 2). *Cladosporium tenuissimum*, and *Alternaria alternata* were associated with leaf lesions, predominantly on Lava and Algara, whereas *Rhizoctonia solani* was associated with root on Algara. It was found that these leaf spot pathogens are present and widely distributed throughout the chirata growing region. It is also reported as an endophyte (Fisher and Petrini, 1992) and a facultative plant pathogen, causing blights, leaf spots, and seed, fruit and blossom-end rots (Pandey and Gupta, 1983; Xiang *et al.*, 1989; Dohroo and Sharma, 1992; Sharma and Majumdar, 1993; Fujii *et al.*, 1995; Dhal *et al.*, 1997; Moricca *et al.*, 1999). It is observed that the chirata plant is severely affected by fungal pathogen.

**Table 2: Fungi as pathogenic to *Swertia chirayita* identified for the first time in Darjeeling district of West Bengal during the 2011 and 2011 surveys.**

Sl no	Name of the disease	Causal organism	Pathogenicity Test
1	Seedling blight of Chirata	<i>Rhizoctonia solani</i>	Confirmed
2	Leaf blight of Chirata	<i>Cladosporium tenuissimum</i>	Confirmed
3	Leaf spot of Chirata	<i>Alternaria alternata</i>	Confirmed

### Conclusion

*Swertia chirayita* plant is prone to fungal pathogens. Leaf blight, Leaf spot and Seedling blight are the predominant disease across all the altitude where chirata grown.

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