

The Study of Emerging Fungal Diseases of Some Important Medicinal Plants in West Bengal - A Threat

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Abstract: A survey was conducted on the fungal diseases of medicinal plants for two consecutive years of 2013 and 2014 in and around different places of North 24 Parganas, West Bengal and also recorded the climatic condition of this period. During survey, eight fungal diseases namely leaf spot (*Alternaria brassicae*) and rot (*Fusarium oxysporum*) of *Aloe vera*, leaf blight (*Alternaria* sp.) of *Ocimum sanctum*, leaf shot hole (*Phomopsis* sp) and blight (*Alternaria alternata*) of *Bacopa monnieri*, leaf blight (*Alternaria tenuis*), blotch (*Cercospora serpentinae*) and anthracnose (*Colletotrichum gleosporioides*) of *Rauvolfia serpentina* were recorded. Leaf spot & rot diseases of *Aloe vera* and leaf blight of *Ocimum sanctum* were found all though two consecutive years. Among all these diseases shot hole and leaf blight disease of *Bacopa monnieri* are first recorded. Anthracnose, blotch and blight disease of *Rauvolfia serpentina* were found mainly between June to October. Shot hole disease of *Bacopa monnieri* was recorded June to December but leaf blight disease occurred between May to October. With the spreading of these fungal diseases on medicinal plants may be a set back to the industry associated with the formulation of its medicinal products. Therefore, this work may encourage other workers to study these diseases and their proper management.

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Key words: Medicinal plants; Fungal disease; Disease occurrence

1. Introduction

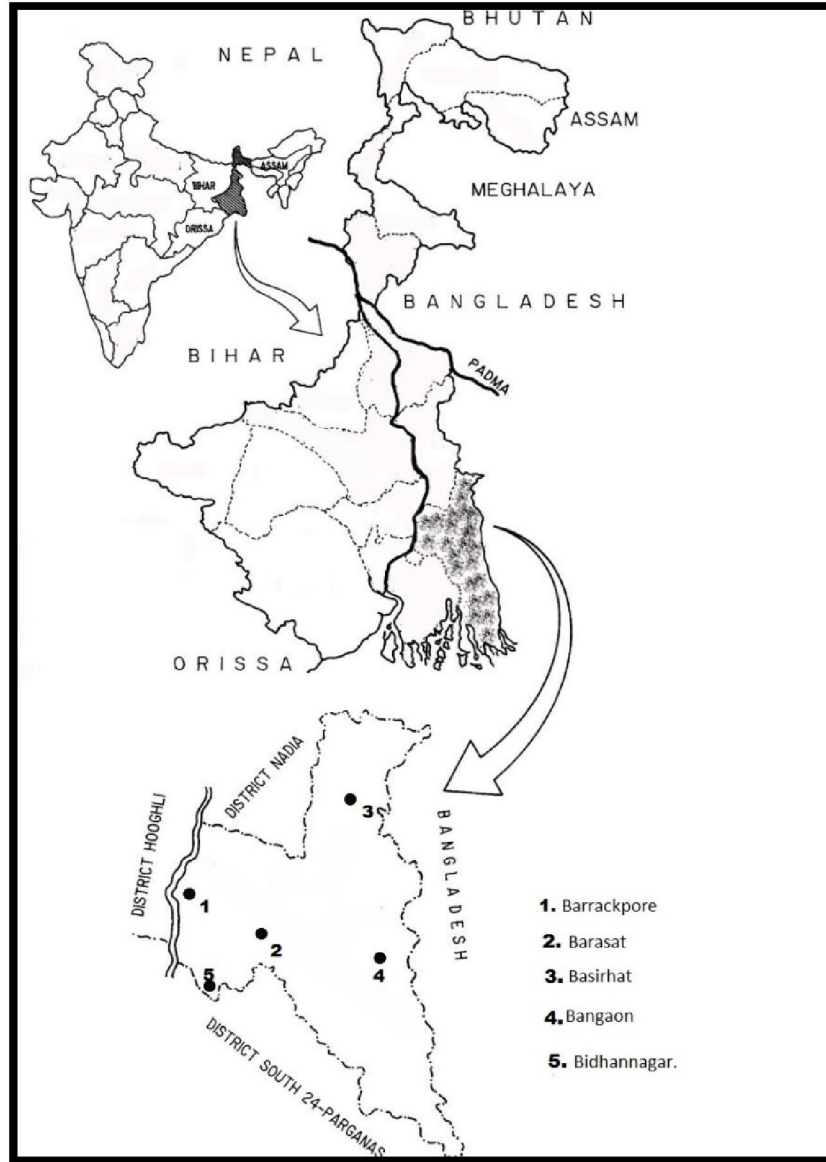
The plants are an important source of medicine since ancient time and they are an important component of the health care system in human culture. In the Indian systems of medicine, most practitioners formulate and dispense their own recipes, hence this requires proper documentation and research. In west also the use of herbal medicines is growing with approximately 40 per cent of population reporting use of herb to treat medical diseases within the past year. General Public, academic and government interest in traditional medicines is growing rapidly due to the increase side effects of the adverse drug reactions and cost factor of the modern system of medicine. There are about 45,000 medicinal plant species in India, with concentrated spots in the region of Eastern Himalayas, Western Ghats and Andaman & Nicobar Island. The officially documented plants with medicinal potential are 3000 but traditional practitioners use more than 6000. India is the largest producer of medicinal herbs and is called the botanical garden of the world. It is one of the very important facts that although we are heavily dependent on these plants for preparation of different herbal drugs by using their active principles but we are not that focused about the "health of these healthy plants". These medicinally important plants are facing serious problems of the fungal attack. Various pathogens adversely affect the medicinal plant parts

and decrease the medicinal value of the their plant part. It may be harmful to the human body while using these infected parts as a medicine. (Chavan and Korekar, 2011). The pathogen, pathogenic regularity of disease of introducing medicinal plants in South China Botanical Garden were reported. And it is suggested that some measures should be taken to control them.(Liu et al.,2003). But in West Bengal the research in diseases of medicinal plants is very few or nil.

Particularly many fungal pathogens are responsible for the production of mycotoxins which alter the potentiality of these economically essential plants (Anthony, 2009). In our research we have surveyed the fungal diseases of medicinal plants like *Ocimum sanctum*, *Aloe vera*, *Rauvolfia serpentina* and *Bacopa monnieri* for two consecutive years of 2013 and 2014 and also recorded the climatic condition in order to trace out the correlation between the occurrence of disease and weather condition.

2. Materials and methods

An extensive survey was carried out in order to record the disease occurrence by monitoring cultivation of *Ocimum sanctum*, *Rauvolfia serpentina*, *Aloe vera* and *Bacopa monnieri* from January 2013 to December 2014 at few selected areas of North 24 Parganas (Fig: 1). The fields were visited once in a week regularly throughout the year for the purpose.



Subdivisions and some study spots:

1. **Barrackpore** a) Naihati b) Halishahar
2. **Basirhat** a) Hasnabad b) Hingalgunj
3. **Barasat** a) Badu b) Nilgunj
4. **Bongaon** a) Duttafulia b) Gopalnagar
5. **Bidhannagar** a) Rajarhat b) Mohishbathan

Fig 1 Map of North 24 Parganas showing different collection zones in five subdivisions

The temperature (Minimum & maximum) and humidity (minimum & maximum) of every day were recorded in the study area and they were averaged month wise.

Study of Symptoms

The infected leaves were carried to the laboratory in sterilized biodegradable polythene bags and the symptoms studied under hand lens and simple microscope.

Isolation and purification of pathogen from diseased parts

The diseased leaves of medicinal plants were carried into the laboratory in air tight sterilized biodegradable polythene bags. The collected leaf samples were washed in sterile distilled water and soaked in alcohol to remove the surface impurities. The leaf samples were cut into small pieces of 3-5 mm in size from the diseased portion. Then they are

passed through 0.1% of HgCl₂ solution for one minute for surface sterilization and washed in three changes of sterile distilled water. These leaf cuttings were blotted between sterile filter papers and aseptically plated on Potato Dextrose Agar (PDA). In each plate a single piece was placed and incubated at BOD (28± 2°C) for 7 days. After appearance of mycelial growth it was transferred on to fresh PDA slant. For purification of isolated pathogen, single hyphal tip method was taken. The purified isolate of the fungal pathogen was labelled. The entire procedure for isolation of the disease was done under laminar air flow.

Pathogenicity test of the pathogen

Pathogenicity test was done following the Koch postulate.

Characterization and Identification of the pathogen

The identification of the pathogen was done phenotypically following Dhingra & Sinclair (1986), & Nagamoni et al.(2006)

3.Results

The data represented in the Table 1 and 2 revealed that in case of *Ocimum sanctum*, leaf blight (Fig 2) was present everywhere while leaf spot was absent in all studied zones. The leaf spot (Fig 3) and rot of *Aloe vera* (Fig 4) were present in all places in 2013 and 2014. The survey revealed two new diseases of *Bacopa* – shot hole (Fig 5) and blight (Fig

6) Among all these diseases shot hole and leaf blight diseases of *Bacopa monnieri* are first recorded in this work. There are no previous reports of any fungal diseases on *Bacopa monnieri* all over the world. Blotch (Fig 7), blight (Fig 8) and anthracnose (Fig 9) of *Rauvolfia* sp were present in maximum places. The occurrence of disease in four selected hosts in different zones of North 24 Parganas is almost similar to the result of previous year with only exception in the absence of shot hole disease in *Bacopa monnieri* at few regions namely Basirhat, Barrackpore, Nahata and Gopalnagar.

Data available from Table 3 clearly revealed that leaf spot (*Alternaria brassicae*) & rot (*Fusarium oxysporum*) of *Aloe vera* were found all though two consecutive years. Leaf blight of *Ocimum sanctum* (*Alternaria* sp) also present throughout both the years among the studied areas. Anthracnose disease (*Colletotrichum gleosporiodes*) of *Rauvolfia serpentina* was found between June to October in both the years. Whereas for leaf blight disease (*Alternaria tenuis*) the occurrence was recorded in July to September. Leaf blotch disease (*Cercospora serpentinae*) in this was found between July to September (2013) & June to October (2014). Shot hole disease (*Phomopsis* sp) of *Bacopa monnieri* was recorded from June to December for 2013 & 2014. But leaf blight disease (*Alternaria alternata*) has its effect between May to October(2013) & June to September(2014).

Table 1. Occurrence of disease in *Aloe vera* and *Bacopa monnieri* at our survey areas

Places	<i>Aloe vera</i>				<i>Bacopa monnieri</i>			
	Spot		Rot		Shot hole		Blight	
	2013	2014	2013	2014	2013	2014	2013	2014
Barasat	+	+	+	+	-	-	-	-
Noihati	+	+	+	+	-	-	-	-
Basirhat	+	+	+	+	+	-	-	-
Moishbathan	+	+	+	+	-	-	-	-
Barrackpore	+	+	+	+	+	+	+	+
Nilgunj	+	+	+	+	+	+	+	+
Haroa	+	+	+	+	-	-	-	-
Basanti	+	+	+	+	-	-	-	-
Duttapukur	+	+	+	+	+	-	-	-
Bongaon	+	+	+	+	-	-	-	-
Habra	+	+	+	+	+	+	+	+
Kalyani	+	+	+	+	+	+	+	+
Halishahar	+	+	+	+	-	-	-	-
Taki	+	+	+	+	+	-	-	-
Hingalgunj	+	+	+	+	-	-	-	-
Nahata	+	+	+	+	+	+	+	+
Gopalnagar	+	+	+	+	+	-	-	-

*(+) indicates occurrence of disease and (-) indicates absence of disease

Table 2. Occurrence of disease in *Ocimum sanctum* and *Rauvolfia serpentina* at our survey areas

Places	<i>Ocimum sanctum</i>				<i>Rauvolfia serpentina</i>					
	Spot		Blight		Anthracnose		blotch		blight	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Barasat	-	-	+	+	+	+	+	+	-	-
Noihati	-	-	+	+	+	+	+	+	+	+
Basirhat	-	-	+	+	+	+	-	-	+	+
Moishbathan	-	-	+	+	+	+	-	-	+	+
Barrackpore	-	-	+	+	+	+	-	-	-	-
Nilgunj	-	-	+	+	+	+	+	+	-	-
Haroa	-	-	+	+	+	+	+	+	+	+
Basanti	-	-	+	+	+	+	-	-	+	+
Duttapukur	-	-	+	+	+	+	-	-	+	+
Bongaon	-	-	+	+	+	+	-	-	-	-
Habra	-	-	+	+	+	+	-	-	-	-
Kalyani	-	-	+	+	+	+	+	+	+	+
Halishahar	-	-	+	+	+	+	+	+	+	+
Taki	-	-	+	+	+	+	+	+	+	+
Hingalgunj	-	-	+	+	+	+	+	+	-	-
Nahata	-	-	+	+	+	+	-	-	+	+
Gopalnagar	-	-	+	+	+	+	-	-	+	+

*(+) indicates occurrence of disease and (-) indicates absence of disease.

Table 3. Medicinal plants and its disease with causal organism at a glance

Serial no.	Host	Disease	Pathogen	Time of Occurrence
1.	<i>Ocimum sanctum</i>	Leaf blight	<i>Alternaria sp</i>	January- December, 2013& 14
2.	<i>Rouvolfia serpentina</i>	Anthracnose	<i>Colletotrichum gleosporiodes</i>	June –October, 2013 & 14
3.	<i>Rouvolfia serpentina</i>	Leaf blight	<i>Alternaria tenuis</i>	July-September, 2013 & 14
4.	<i>Rouvolfia serpentina</i>	Leaf blotch	<i>Cercospora serpentinae</i>	July-September, 2013 June –October, 2014
5.	<i>Aloe vera</i>	Leaf spot	<i>Alternaria brassicae</i>	January- December, 2013& 14
6.	<i>Aloe vera</i>	Leaf rot	<i>Fusarium oxysporum</i>	January- December, 2013& 14
7.	<i>Bacopa monnieri</i>	Shot hole disease	<i>Phomopsis sp</i>	June- December, 2013& 14
8.	<i>Bacopa monnieri</i>	Leaf blight disease	<i>Alternaria alternata</i>	May-October, 2013 June-September, 2014

Data presented in Table 4 also indicates that Temperature and moisture supports disease occurrence

Table 4. Month wise report of temperature and humidity in our study area

Month	Temperature ⁰ C		Humidity (%)	
	2013	2014	2013	2014
January	13-26	10-26	71-84	70-78
February	18-29	16-27	75-86	72-82
March	25-34	19-33	79-88	78-90
April	32-42	30-41	76-90	79-96
May	30-43	33-43	75-94	80-98
June	28-38	28-39	78-96	77-100
July	28-37	26-38	96-100	94-100
August	30-36	25-36	89-92	86-96
September	30-35	25-35	85-92	89-95
October	25-35	22-31	80-9	86-92
November	20-25	20-25	70-80	70-80
December	10-20	10-20	65-70	65-70

4. Discussion

Alam et. al. (2007) have also surveyed the diseases of medicinal plants in U.P. They have also

found all these diseases which have been reported by us except leaf shot hole and leaf blight disease of *Bacopa monnieri*. Fungi associated with base rot disease of *Aloe vera* (syn. *Aloe barbadensis*) were investigated in Niger Delta Area of Nigeria. The frequency percentage of associated fungal propagules were *Aspergillus verocosa* 28.03%, *Fusarium oxysporum* 24.24%, *Plectosphaerella cucumerina* 16.67%, *Mammeria ehinobotryoides* 15.91% and *Torula herbarium* 15.15%. None of the fungi isolated have been previously reported on *Aloe vera* in Nigeria (Ayodele and Ilondu, 2008). The leaf spot disease on *Aloe* plant first came into limelight as purple spot disease on *Aloe arborescens* Mill. caused by *Fusarium phyllophilum* (Kinshi et al, 1999) and later *Haematonectria haematococca* (anamorph: *Fusarium* sp.) causing ring spot disease on *Aloe barbadensis* (Hirooka et. al., 2007). From other states of India the disease with same type of symptoms was

reported by other workers (Kamalakkannan et al., 2008). The disease was also reported from Osmanabad district, Maharashtra (Chavan and Korekar, 2011). In abroad this disease of *Aloe vera* has been reported from Lousinia (Silva et al., 2012) and from Pakistan (Bajwa et al., 2010). Beside that a *Fusarium* rot disease of *Aloe vera* was reported from Bali (Kuwari et al., 2012). Some instances of anthracnose disease of *Aloe vera* caused by *Colletotrichum* sp was also reported from Lucknow (Alam et al., 2007). In our previous work we have also found *Aloe vera* as a new host for *Alternaria brassicae* (Ghosh & Banerjee, 2008)

Basil suffers from several plant pathogens that can ruin the crop and reduce yield. *Fusarium* wilt is a soil-borne fungal disease that will quickly kill younger basil plants. Seedlings may also be killed by *Pythium* damping off. A common foliar disease of basil is gray mold caused by *Botrytis cinerea*; it can also cause post-harvest infections and is capable of killing the entire plant. Black spot can also be seen on basil foliage and is caused by the *Colletotrichum*. Leaf blight of Basil, caused by *C. capsici* has been causing considerable damage to the commercial field of basil during August–September, when it appears in severe form (Alam et al 1980).

Leaf Blight disease of *Rauvolfia serpentina* (sarpagandha) caused by *Macrophomina phaseolina* was reported by Mahrotra (1976). *Colletotrichum* blight (bloom blight) caused by *C. capsici* was recorded by Shukla et al (2006). *Curvularia* leaf spot of sarpagandha has been reported from Jammu and Kashmir by Thakur et al (1974). Wilt is one of the most important and serious diseases of Sarpagandha. The disease was first reported from jammu & Kashmir (Janardhanan et al, 1964). *Alternaria* leaf blight of ashwagandha (*W. somnifera*), caused by *A. alternata* and root rot wilt is one of the serious diseases of ashwagandha in the nursery as well as in the commercial fields at Lucknow and its adjoining areas in North India (Gupta et al 2004). Alam et al (2007) in their Book 'Healthy Plants for Health' recorded some important diseases of some important medicinal plants and their management. Ghosh and Chakraborty (2012) recorded the anthracnose of sarpagandha and tried to control it by biological agents.

As per literature survey, there are no previous report for any disease on *Bacopa monnieri*. Our work establishes that even the plant *Bacopa monnieri*, with enormous medical importance, without having any past record of getting infected by any fungal pathogen, first time got victimized through fungal invasion. This work indicates that leaf blight of *Bacopa monnieri* occurs in numerous places of 24

Parganas, West Bengal in 2013 and 2014 during the summer and rainy season.



Fig 2. Leaf blight symptom on *Ocimum sanctum*



Fig 3. Leaf spot symptom of *Aloe vera*



Fig 4 Leaf rot symptom on *Aloe vera*



Fig 5. Shot hole symptom of *Bacopa monnieri*



Fig 6. Leaf blight symptom on *Bacopa monnieri*



Fig 7. Leaf blotch symptom on *Rauwolfia serpentina*



Fig 8. Leaf blight symptom on *Rauwolfia serpentina*



Fig 9. Anthracnose symptom on *Rauwolfia* leaf

5. Conclusion

In conclusion from our research, eight new diseases namely leaf spot and rot of *Aloe vera*, leaf blight of *Ocimum sanctum*, leaf shot hole and blight of *Bacopa monnieri*, leaf blight, blotch and anthracnose of *Rauwolfia serpentina* were recorded in and around different places of North 24 parganas district of West bengal. Among all these diseases shot hole and leaf blight disease of *Bacopa monnieri* are first recorded by us. There are no reports of any fungal diseases on *Bacopa monnieri* all over the world. The spreading of these fungal diseases on medicinal plants may causes a set back to the industry associated with the formulation of it's medicinal products. So this work may encourage other workers to study these diseases and their proper management.

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