

RESEARCH ARTICLE

Preliminary screening of fungal pathogens of water hyacinth (*Eichhornia crassipes*) for biological management in Jabalpur

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SUMMARY

During the survey of various water bodies in Jabalpur. it was observed that water hyacinth (*Eichhornia crassipes*) is associated with a variety of fungal diseases such as petiole rot, root rot, die back, leaf blight, leaf spot. 10 fungal isolates belonging to different genera were isolated. Maximum infection was observed in the Lamina of the leaves along with the expression minimum symptoms. *Alternaria alternata*, (FCWH#15) was found in maximum frequency and hence, it would be the best fungal candidate for biological management of water hyacinth.

Key Words : Lamina, Water hyacinth, Fungal pathogens, Petiole rot, Root rot, Die back, Leaf blight, Leaf spot

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Water hyacinth (*Eichhornia crassipes*) is a very harmful aquatic weed, which is seen floating, submerged and emergent and creating problems and has spread over thousands of water bodies in India and is resulting in the death of several species of aquatic flora and fauna. The heaviest infestations are

found in ponds, reservoirs, irrigation and drainage systems and in River Narmada where the flow rate of water is low. This obnoxious weed spread by vegetative reproduction as their spreading capacity is very fast (Sculthorpe, 1967). Therefore, it needs to be eradicated as it is responsible for the deterioration of the quality of water in various water bodies. Extensive surveys have been conducted to find the most potential pathogen for the biological management of Water hyacinth. The success of the host specific fungi *Cercospora rodmanii* in controlling water hyacinth greatly stimulated the interest in the management of this weed using fungal pathogens (Conway and Freeman, 1977.) Charudattan (2005) has given an indepth view of the selection of the weed targets for a good Bio-control programme. In this research paper, we have discussed the isolation and identification of fungi from infected water hyacinth and

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recorded their frequency in the infected samples. We have isolated, identified and screened the most widely occurring fungal pathogens associated with water hyacinth in Jabalpur and determined their frequency on the water bodies.

MATERIAL AND METHODS

Survey and collection :

Water hyacinth plant parts with disease symptoms were collected by Periodical survey, from various pools, ditches, ponds, etc., from the Jabalpur. The main water bodies surveyed were Ganga Sagar, Gullauatal, Ranital, Supatal, etc. The plant specimens were collected and stored in polythene bags and brought to the laboratory where isolation and purification of the fungi was attempted.

Isolation of fungi :

Pieces of about 2 mm were segmented from the margins of necrotic or chlorotic lesions on the surface of the lamina and petiole. They were then surface sterilized with 1 per cent sodium hypochlorite solution for about three minutes, followed by rinsing with sterile water to remove any possible contamination (Hawker, 1950 and Chopada *et al.*, 2014). These pieces were then placed on earlier prepared Petri-plates containing potato dextrose agar medium amended with 75 mg/1 streptomycin pinhead amount of rosebengal. This was incubated for 3-4 days at 26°C in BOD. (Agrawal and Hasija, 1986). All the emergent fungi were isolated pure cultures were obtained (Johnston and Booth, 1983 and Marak *et al.*, 2014).

Purification and maintenance of fungal culture :

The fungal species isolated earlier were purified by streak-plate sub culturing techniques (Agarwal and Hasija, 1986). The purified cultures of the 15 isolates were multiplied on PDA plates. The stock cultures of the microorganisms were maintained on PDA slants. The other slants were kept in the BOD incubator at 25 ± 1°C routinely transferred into fresh slants for experimental purposes.

Identification of the fungi :

Identification of fungi was done after studying the morphological cultural characteristic with the help of manuals monographs papers of various workers. Identification of isolated of fungi was done on the basis

of the morphological characteristics with the help of available literature (Subramaniam, 1971; Ellis, 1971; Barnet and Hunter, 1972 and Arx, 1974; Sutton, 1980).

Frequency of fungi:

Study the distribution of fungi isolated earlier from the various samples the percentage frequency of various species were detected. Frequency as introduced Raunkier (1934) indicates the number of sampling units in which a given species occurred thus, expresses the distribution or dispersion of various species in a community. From this, percentage frequency is calculated as follows:

$$\text{Percentage frequency} = \frac{\text{Number of sampling units in which the species occurred frequency}}{\text{Total number of units studied}} \times 100$$

RESULTS AND DISCUSSION

During a periodical survey of various water bodies in Jabalpur, it was observed that petiole rot, root rot, die back, leaf blight, leaf spot, etc., diseases were associated with water hyacinth. 15 different fungal species *viz.*, *Aspergillus niger* FCWH#01, *Alternaria* sp. FCWH#02., *Cephalosporium* sp. FCWH#03, *Cladosporium* sp. FCWH#04, *Colletotrichum dematium* FCWH#05, *Curvularia lunata* FCWH#06, *Drechslera indica* FCWH#07, *Epicoccum nigrum* FCWH#08, *Fusarium oxysporium* FCWH#09, *Fusarium solani* FCWH#10, *Helminthosporium* sp. FCWH#11, *Phoma* sp. FCWH#12, *Rhizoctonia solani* FCWH#13, *Sclerotium* sp. FCWH#14, *Alternaria alternata* FCWH#15, were recovered from various parts of water hyacinth. Maximum infection was observed in the Lamina of the leaves along with the expression of minimum symptoms. (Table 1).

In the first stage of screening of 15 isolates, 5 of the most virulent ones were selected for further screening. Based on the frequency of their infection and severity of symptoms, *Alternaria alternata* FCWH#15, *Alternaria* sp. FCWH#02, *Fusarium oxysporum* FCWH#09, *Aspergillus niger* FCWH#01 were found maximum in the infected parts of water hyacinth. *Alternaria alternata* FCWH#15, *Fusarium oxysporum* FCWH#09, *Aspergillus niger* FCWH#01 were found to be highly pathogenic. They caused leaf spots and leaf blights which were enlarged to various sizes on the leaves and maximum infection occurred in the Lamina of the leaves along with the expression of minimum symptoms. It occurred that all the pathogens showed

higher and rapid infection during the experiments in the infected Water hyacinth.

Amongst these pathogens, they were again screened at a later stage at earlier and *Alternaria alternata* FCWH#15 was found to be the most pathogenic. *Alternaria alternata* FCWH#15 causes some of the most important foliar diseases. The symptoms on the leaves vary from the occurrence of small spots to severe blight, sometimes leading to the death of the foliage. The best pathogen also caused the severe blight to water hyacinth.

The infection started on lamina and petiole in the form of small circular to black spots of 1 to 5 mm in diameter. The spots enlarged to coalesced into each other to cover the entire surface of the leaves ultimately causing the death of the plant. The *Alternaria alternata* FCWH#15 culture isolated in the present investigation proved to be mildly pathogenic in the growth chamber test.

The pathogens of the genus *Alternaria*, *Fusarium* and *Aspergillus* are facultative parasites and do not have much specialized mechanisms for their entry into the host (Aneja *et al.*, 1993). Leaf spot or early blight incited by a lot of fungi such as *Colletotrichum dematium* FCWH#05, *Fusarium oxysporum* FCWH#09 and *Alternaria* sp. FCWH#01 also (Marak *et al.*, 2014).

The pathogens of genus, *Fusarium*, *Alternaria*, *Curvularia* are facultative parasites do not have much specialized mechanisms for their entry into the host

(Aneja *et al.*, 1993). Several highly virulent fungal parasites have been reported to cause diseases of water hyacinth. Among them *Acremonium zonatum*, *Alternaria alternata*, *Alternaria eichhorniae*, *Bipolaris* spp., *F. chlamydosporum*, *Helminthosporium* spp., *Cercospora rodmanii*, *Myrothecium roridum*, *Rhizoctonia solani* *Uredo eichhorniae* were able to cause significant damages in water hyacinth (Charudattan 1982). An isolate of *Colletotrichum* sp. collected in China were found to be highly virulent with a disease index of 65.28 per cent after 30 days of inoculation. However, an isolate of *Alternaria* from the same place was found to cause 67 per cent disease index (DI) upon 7 days of inoculation (Ding *et al.*, 2008). Therefore, evolution of this fungus makes it a potential bio-control agent.

Biological control using plant pathogens has shown substantial impact on the weed. In Jabalpur periodic survey of various aquatic bodies was conducted. Water hyacinth plant or leaves with disease symptoms were collected and all the emergent fungi were isolated and about 15 fungal isolates were recovered from this weed. Amongst them, maximum damage to the test plants was caused by *Alternaria alternata* FCWH#15. Contradictory to many reports by various other workers, (Nagraj and Ponappa, 1967; Charudattan and Rao, 1982; Shabana *et al.*, 1995a and b; Shabana *et al.*, 2000a and b; Molo and Ogwang, 2001; Hubballi *et al.*, 2010; Pathak and Kannan, 2011).

Table 1: Percentage frequency of various fungi associated with infected water hyacinth

Sr.No.	Name of fungi	FCWH No.	Infected plant part	Symptoms	Frequency (in %)
1.	<i>Aspergillus niger</i>	FCWH#01	Lamina, petiole and root	No symptoms	42.1
2.	<i>Alternaria</i> sp.	FCWH#02	Lamina, petiole	Leaf spot/ leaf blight	60.4
3.	<i>Cephalosporium</i> sp.	FCWH#03	Leaf	No symptoms	20.0
4.	<i>Cladosporium</i> sp.	FCWH#04	Petiole	No symptoms	31.0
5.	<i>Colletotrichum dematium</i>	FCWH#05	Lamina	Leaf spot	38.1
6.	<i>Curvularia lunata</i>	FCWH#06	Lamina	Slight lesion	40.0
7.	<i>Dreschlera indica</i>	FCWH#07	Lamina, petiole	Leaf spot	32.0
8.	<i>Epicoccum nigrum</i>	FCWH#08	Lamina, petiole	No symptoms	25.0
9.	<i>Fusarium oxysporum</i>	FCWH#09	Lamina, petiole	No symptoms	51.2
10.	<i>Fusarium solani</i>	FCWH#10	Lamina, petiole	Lesion	41.6
11.	<i>Helminthosporium</i> sp.	FCWH#11	Lamina	Leaf spot	38.2
12.	<i>Phoma</i> sp.	FCWH#12	Lamina	Leaf spot	42.1
13.	<i>Rhizoctonia solani</i>	FCWH#13	Lamina, petiole	Leaf spot/ blight	30.0
14.	<i>Sclerotium</i> sp.	FCWH#14	Petiole	Necrosis	16.0
15.	<i>Alternaria alternata</i>	FCWH#15	Lamina	No symptoms	66.6

FCWH: (Fungal culture no. water hyacinth)

Conclusion :

Studies conducted indicate and all observations show the frequency and phyto-toxicity of *Alternaria alternata* FCWH#15 found to be the most virulent strain, so, it was selected as a biological agent for the management of the noxious weed water hyacinth.

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