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RESEARCH ARTICLE

ANTAGONISTIC ACTIVITIES OF PLANT EXTRACTS AGAINST THE PHYTOPATHOGEN *SCLEROTIUM ROLFSII,* DURING PRE-HARVEST HORTICULTURAL PRACTICE - A COMPONENT OF INTEGRATED DISEASE MANAGEMENT

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ABSTRACT

Nine botanicals were collected from nearby locality regarding to their medicinal values and extracts, were used for the evaluation of their efficacy against the phyto-pethogenic fungi i.e. *Sclerotium rolfsii* which causing collar rot disease in plants by following Poison Food Technique. Garlic (*A. sativum*) at 3% concentration exhibited 100% inhibition on the growth of the fungus followed by turmeric (67.7%) at 20% concentration. The fungi-toxic property of garlic might be attributed to the presence of sulphur-containing compounds. So that, it can be concluded that the above mention plant extracts can be used against the fungal pathogen as a component of integrated disease management.

Key words: Poison Food Technique, fungi-toxic, *Sclerotium rolfsii*, anti-fungal activity.

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INTRODUCTION

The oldest, richest and most diverse traditional culture of india has also been associated with the use of medicinal plants to cure of several diseases (Adewumni and Ojewole, 2004). In Indian system of medicine, maximum practitioners use medicinal plants in preventive, promotive and curative applications. However, Dubey *et. al*., (2004) has also been reported that World Health Organisation (WHO) provides the guidelines to the member states to ensure about genuine use of plants and their parts before their use for health. According to the current report by Srikumar *et. al.,* (2007), about 80% of the people on developing countries still relies on traditional medicine. It is estimated that about 25% of all modern medicine are directly or indirectly derive from higher plants (Calixto, 2000). Plant extract of many higher plants have been reported to exhibit antimicrobial, antifungal, and insecticidal properties (Satish *et. al., 2007*). plant based antimicrobials have a large source of medicines and recently much attention has been paid to extract the biologically active compounds from the plant species, because of the side effects and the resistance that pathogenic micro-organisms build against antibiotics (Parekh *et. al.,*2005). Plants generally produce secondary metabolites which constitute an important source of micro-biocides, pesticides and many pharmaceutical importances, still remain the principle source of pharmaceutical agents used in traditional medicine (Ibrahim, 1997; Ogundipe *et. al*., 1998). Plants are the sources of natural pesticides that make excellent leads for new pesticide development (Arokiyaraj *et al*., 2008; Gangadevi *et al*., 2008; Satish *et al*., 2008; Brinda *et al.,*2009; Swarna Latha & Reddy, 2009; Vetrivel Rajan *et* al., 2009). Medicinal plants represent a rich source of antimicrobial agents (Mahesh and Satish, 2008), used in traditional medicine are readily available in rural areas at relatively cheaper than modern medicine (Mann *et. al*., 2008). Antifungal substances obtain from plants has no side effect i.e. ecofriendly to environment and, having significant advantages. Commercial pesticide those are uses in day-today against plant diseases is might be harmful and causes destruction to human health and our surrounding environment. However, the effectiveness of synthetic fungicides has been reduced by the frequent development of resistance by the pathogens. Hence there is a great demand for safer, alternative and effective chemotherapeutic agents (Maria, 2016). By because of this, conducting a research of alternative control methods comes into prominence for minimizing used commercial pesticide (Abdurrahman Onaran and Hayriye Didem Sağlam, 2016). One of the most important spice crops of Manipur, *Allium hookerii* is found to be affected by collar rot disease caused by *Sclerotium rolfsii* which is soil borne; beside, it is consistently found to be associated with rice seeding blight in Manipur. It is caused collar rot in sunflower

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and Sclerotium rot of peanut. Diseases are one of the major constraints to reduce the productivity leading to huge loss in yield and quality. Therefore, a new sustainable, eco-friendly measures and methods for the control of diseases are needed. Since the previous review of literatures, we decided to take up a review research works as their finding were how so far reliable and applicable during pre-harvest horticultural practices as a component of integrated disease management.

MATERIALS AND METHODS

The experimental materials utilized and methods adopted during the course of investigation are given below:

Preparation of culture medium: Potato Dextrose Agar (PDA) was prepared as culture medium in Petriplates and test tubes as slants were used for isolation of pathogens from the diseased samples and multiplication of pathogens during investigation.

Isolation of plant pathogenic fungi, Sclerotium rolfsii: The plant pathogen, Sclerotium rolfsii was isolated directly by taking the sclerotium formed at the collar region of the diseased sample of *Allium hookerii*. The tissue segment method was adopted for isolating the organism that grows on artificial media. The culture was purified by hyphal tip cut method (W. Brown, 1924) and the pathogenic fungi were maintained in PDA throughout the work by following Mohana, D. C. and Raveesha, K. A. (2007).

Collection of botanicals and preparation of plant extracts: Nine botanicals were collected from the nearby locality regarding to their medical value, were used for the evaluation of their efficacy against *Sclerotium rolfsii*. Aqueous plant extracts were assayed *in vitro* against the phytopethogenic fungi.

Efficacy of plant extracts on growth and sclerotial production: The efficacy of the nine plant extracts were evaluated by using Poison Food Technique by following Mohana, D. C. and Raveesha, K. A. (2007). Plant extracts from the stock solution were than measured and mixed with sterilized PDA to give desired concentrations namely 3% for garlic and 20% each for the rest.

The efficacy of plant extracts in the term of percentage inhibition on mycelial growth and sclerotial production was calculated by the formula:

% inhibition, $I = \frac{C - T}{C} \times 100$

Where,

C = mycelial growth/ sclerotial production in control.
T = mycelial growth/ sclerotial production in treatment.

The number of sclerotia produced in treatment and untreated plates were recorded after 15 days of incubation.

EXPERIMENTAL RESULTS

Isolations of plant pathogenic fungi Sclerotium rolfsi: The pathogenic fungi, *Sclerotium rolfsi* was isolated from the diseased samples collected from experimental fields of Plant Pathology Department, College of Agriculture, Central Agricultural University (CAU), Imphal, Manipur. The cultures were identified by comparing with available monographs and cultures in the laboratory.

Effect of the plant extracts on the growth and sclerotia formation of *Sclerotium rolfsi*: Antifungal activity of nine botanical extracts was assayed and data on efficacy of the plant extracts on the growth of *Sclerotium rolfsi*. Garlic (*A. sativum*) at 3% concentration exhibited 100% inhibition on the growth of the fungus followed by turmeric (67.7%) at 20% concentration. However, lantana and sweet flag showed almost similar effect on the growth of the fungus. It was further observed that Indian pennywort, ginger, Indian worm wood fleavane, periwinkle, vitex could not inhibit the growth of the at all. It was observed that the garlic at 3% could completely inhibit the growth of the fungus was resulting no formation of sclerotia i.e. 100% inhibition followed by sweet flag (74.6%), vitex (61.1%), turmeric (60.4%), and Indian pennywort (50.8%), whereas lantana and periwinkle should less than 20% inhibition on sclerotia formation of the fungus.

DISCUSSION

Efficacy of plant extracts on the growth and sclerotia production of *Sclerotium rolfsi*: This fungitoxic property of garlic might be attributed to the presence of sulphur-containing compounds like Diallyl-disulphide, Diallyl-trisulphide and Ajoene. The present finding is in agreement with Amonkar and Benerji (1971) who reported that maximum fungitoxic property of garlic extract at 5% concentration against *Pestalotiopsis*. The finding is in accordance with the finding of Choe *et. al.,* (2006) and Jacobson (1983) who reported fungitoxic properties of turmeric was to presence of curcumine and asarone in sweet-flag. Similarly, Shivpuri *et. al.,* (1997) reported that higher doses of ethanol extracts of plants were more effective than lower doses of ethanol extracts against the growth of *Aletrnaria brassicicola, Collectotrichum capsici, Fusarium oxysporum, Rhizoctonia solani,* and *Sclerotinia sclerotiorum*. Many sponin have potential antifungal properties, and hence, it has been suggested that the compounds may play a role on protecting plant against attack by fungal pathogens (Aly *et. al*., 2000) in cotton plant against *Fusarium oxysporum, R. Solani, Macrophomina phaseolina* and *S. Rolfsii.* The inhibitory effect of garlic on the growth of *R. Solani* and *S. Rolfsii* might be attributed to the presence of antifungal compounds like allicin containing sulphur. The present findings are in agreement with those of Sivaprakash, K. E. and Kurucheve (1998) who reported that Allium sativum completely inhibited the mycelia growth and sclerotia formation and germination of *S. Rolfsii*, the causal agent of sclerotium rot of peanut at 10% concentration. Similarly, Sidhan et. al.,(1998) claimed that plant extracts from leaves of neem, mint, eucalyptus, tulsi, datura, bougainvillea and rhizome of ginger were inhibitory to the mycellian growth of *R. solani* and *R. bataticola* and could increase the efficacy as the concentration of the extract increases.

Conclusion

The result revealed that, further studies are needed to determine the antifungal compound(s) in such plant extract (isolation, separation, and identification) as well as its formulation to be applicable as alternative methods to be used for treatment of plant pathogen and their pathogenesis. However, further work is necessary to find out efficacy of garlic at lower concentration which inhibited that of pathogen.

Hence, it can be concluded that the above mention plant extracts can be used against the pathogen as a component of integrated disease management.

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