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Invitro Studies on the Direct Effect of Garlic Cloves and Different Botanical Extracts against *Bipolaris sorokiniana* (sacc.) Shoem Causing Foliar Blight of Wheat

Joru Prashanth[1]*, S.S. Vaish[1] and S. Omprakash[2]

[1]Department of Mycology and Plant pathology, Institute of Agricultural Sciences, BHU, Varanasi, U.P. 221005, India.
[2]Department of Entomology an Agricultural Zoology, Institute of Agricultural Sciences, BHU, Varanasi, U.P. 221005, India

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Foliar blight of wheat is mainly caused by Bipolaris sorokiniana (Sacc.) Shoem. syn. Drechslera sorokiniana (Sacc.) have emerged as serious concern for cultivation of wheat in warmer and humid regions of the world. A study has been conducted at Department of Mycology and plant pathology, Institute of Agricultural sciences, BHU, Varanasi on in vitro evaluation of direct effect of garlic cloves and different botanical extracts viz garlic (Allium sativum L.) clove extract, ginger (Zingeber officinale L.) rhizome extract, neem (Azadiracta indica L.) leaves extract, onion (Allium cepa L.) bulb extract, tulsi (Ocimum sanctum L.) and marigold (Tagetus erecta L.) leaves extract were evaluated against foliar blight of wheat. The reduction in growth of the fungus measured to the difference in radius of the colony covered with cloves and kept uncovered exhibited 45% reduction in growth of B. Sorokiniana four days after the clove treatment and out of the six test botanicals, garlic clove extract showed complete inhibition of spore germination followed by ginger rhizome extract and neem leaves extract at the 5.0 percent concentration (P=0.05).

Keywords: Wheat, *Bipolaris sorokiniana*, Efficacy, botanicals, garlic cloves.

Wheat (*Triticum aestivum* L.) is the first important and strategic cereal crop for the majority of world's populations. It is the most important staple food of about two billion people (36% of the world population). Worldwide, wheat provides nearly 55% of the carbohydrates and 20% of the food calories consumed globally (Breiman and Graur, 1995) .Foliar blight of wheat is mainly caused by *Bipolaris sorokiniana* (Sacc.) Shoem. syn. *Drechslera sorokiniana* (Sacc.) teleomorph (*Cochliobolus sativus*) have emerged as serious concern for cultivation of wheat in warmer and humid regions of the world. This fungus act as a causal agent for various diseases like head blight, seedling blight, foliar blight /spot blotch, common root rot and black point of wheat, barley and other small cereal grains and grasses (Wiese, 1998). Among the all diseases, caused by this pathogen foliar blight of wheat is considered as one of the most important diseases in those mega environment which is characterised by high temperature (coolest month greater than 17ÚC) and high humidity (van Ginkel and Rajaram 1993). During past two decades, substantial economic loss in wheat production has occurred due to the severity of foliar blight/spot blotch, affecting the livelihood of millions of small-scale farmers. Application of fungicides and plant extracts is an effective means of disease prevention. Several sources have also been identified for improving resistance among

* To whom all correspondence should be addressed.
E-mail: joruprashanthkumar@gmail.com

Table 1. Effect of botanicals on spore germination of *Bipolaris sorokiniana*

S. No.	Botanicals	Spore germination (%) Concentration (%)				
		0.5	1	2	2.5	5
1	Garlic (*Allium sativum* L.)	50 ^{bc}	10^{cd}	4^{d}	3^{d}	0^{d}
	cloves extract	-50	-90	-96	-97	-100
2	Ginger (*Zingeber officinale* L)	75^{ab}	65^{ab}	60^{ab}	55^{b}	50^{b}
	rhizome extract	-25	-35	-40	-45	-50
3	Neem (*Azadiracta indica* L.)	80^{ab}	75^{ab}	65^{ab}	60^{ab}	55^{b}
	leaves extract	-20	-25	-35	-40	-45
4	Onion (*Allium cepa* L.)	90^{ab}	80^{ab}	60^{ab}	55^{ab}	50^{ab}
	bulb extract	-10	-20	-40	-45	-50
5	Marigold (*Tagetus erecta* L.)	90^{bc}	85^{ab}	85^{ab}	85^{ab}	85^{ab}
	leaves extract	-10	-15	-15	-15	-15
6	Tulsi (Ocimum sanctum L)	90^{ab}	90^{ab}	90^{ab}	90^{ab}	90^{ab}
	Leaves extract	-10	-10	-10	-10	-10
7	Control	100^{a}	100^{a}	100^{a}	100^{a}	100^{a}
	(Sterile Distilled water)	0	0	0	0	0

The Tukey test at a level of 5% of probability was applied. The averages followed by the same letter do not differ statistically between themselves. Figures in parentheses showing percent inhibition of spore germination

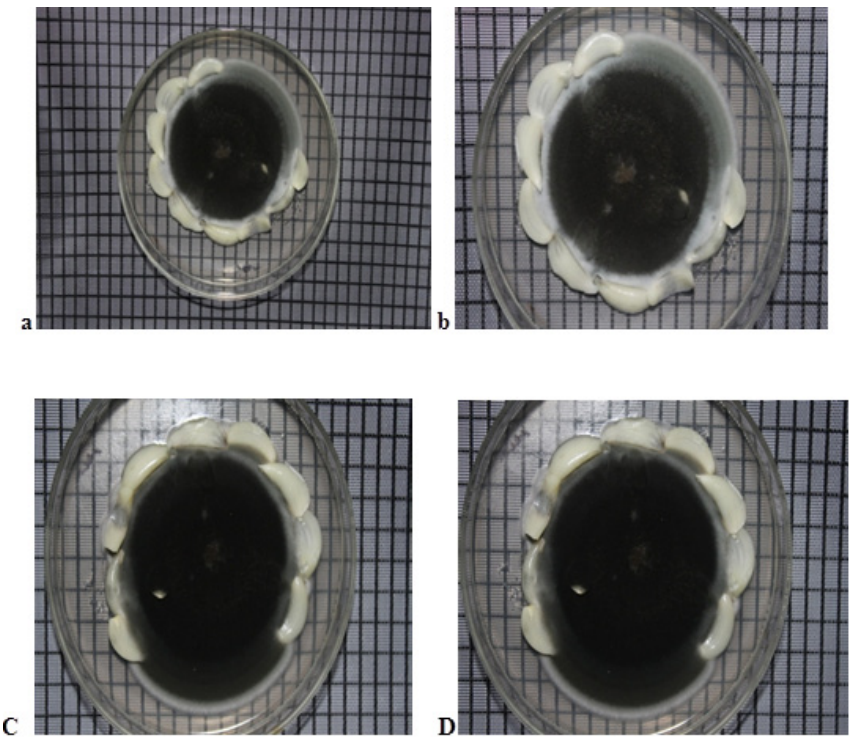

Fig. 1. Direct effect of garlic cloves on growth and spore formation of *Bipolaris sorokiniana*, A and B, growth of the fungus after 24 h garlic clove treatment; C and D, growth of the fungus 48 h after garlic clove treatment

susceptible commercial cultivars. Although a number of attempts have been made to control the disease, still, field results show that foliar blight of wheat continues to cause substantial grain yield reductions and underscore the need for further research.

MATERIAL AND METHODS

Laboratory evaluation was conducted on effect of botanicals on spore germination of *Bipolaris sorokiniana* and direct effect of garlic clove on the growth of *Bipolaris sorokiniana*. at department of Mycology and plant pathology, Institute of Agricultural sciences, BHU, Varanasi. Two hundred micro litre (µl) of sterile distilled water was taken into a clean sterilized cavity block. The spores of *Bipolaris sorokiniana* were harvested with the help of a brush from the 7 day old culture of the fungus grown on PDA in the Petri-dish and transferred into a cavity block. Then homogenized spore suspension was prepared by using a micro pipette. From this spore suspension, 10 µl was taken onto a test cavity slides containing each testing botanicals viz garlic (*Allium sativum* L.) clove extract, ginger (*Zingeber officinale* L.) rhizome extract, neem (*Azadiracta indica* L.) leaves extract, onion (*Allium cepa* L.) bulb extract, tulsi (*Ocimum sanctum* L.) and marigold (*Tagetus erecta* L.) having the different concentrations (0.5, 1.0, 2.0, 2.5 and 5.0 %). Cavity slides having only sterilized water were served as control. After 2 h, the slides were examined under high magnification of stereoscopic microscope for recording the inhibition percentage of conidial germination by using the following formula:

Inhibition % of conidial germination = Total no of conidia - no of germinated conidia ×100/Total no of conidia

The experiment was conducted in C.R.D and statistically analysed and Tukey test was used for the calculation.

Direct effect of garlic clove on the growth of *Bipolaris Sorokiniana*

Present investigation was undertaken to test direct effect of garlic cloves on the growth of *B. Sorokiniana* (Sacc.) Shoem. Fresh cloves of garlic were washed with double distilled water and were cut vertically with stainless blade under aseptic conditions. The vertical halves arranged on the periphery of 3 days old fast growing culture under aseptic conditions then the radial growth was measured after 24 hours and 48 hours.

RESULTS

A perusal of data on the effect of the various botanical viz., garlic (*Allium sativum* L.) clove extract, ginger (*Zingeber officinale* L.) rhizome extract, neem (*Azadiracta indica* L.) leaves extract, onion (*Allium cepa* L.) bulb extract, tulsi (*Ocimum sanctum* L.) and marigold (*Tagetus erecta* L.) leaves extract at the various concentrations i.e., 0.5, 1.0, 2.0, 2.5 and 5.0 percent showed varying effect on spore germination of *B. sorokiniana* (Table. 1) . The spore germination was noticed to be reduced with increase in the concentration irrespective of the botanicals over control. Out of the six test botanicals, garlic clove extract showed complete inhibition of spore germination followed by ginger rhizome extract and neem leaves extract at the 5.0 percent concentration (P=0.05). It was also noticed that the test botanicals showed significant increase in spore germination up to 2.0 percent concentration. Among crude extract of onion, marigold and tulsi, onion extract was found superior to marigold and tulsi in its effect on spore germination of *B. Sorokiniana*. The direct effect of garlic cloves cut vertically into two equal halves following their placement around the 3/4th of the periphery of a three day old culture of *B. sorokiniana* revealed inhibition of the mycelial growth as well as formation of spores of the fungus (Fig.1). The inhibition of spore production was clearly marked by the white band adjacent to the inner lining of the cut cloves 24 h after their placement around the periphery of the colony. Further, it was also noticed that the fungus showed its luxuriant growth where the periphery of the colony was not covered with the cut garlic clove pieces. However, this growth showed very less production of spores that caused its very light greenish brown colour. It was also observed that 48 h after garlic clove treatment white band adjacent to the inner lining of the cut cloves became thinner but still did not allow spore formation.

DISUCCIONS

Our studies on effect of the different botanicals viz., garlic (*Allium sativum* L.) clove extract, ginger (*Zingeber officinale* L.) rhizome extract, neem (*Azadiracta indica* L.) leaves extract, onion (*Allium cepa* L.) bulb extract, tulsi (*Ocimum sanctum* L.) and marigold (*Tagetus erecta* L.) leaves extract on *Bipolaris sorokiniana* causing foliar blight of wheat showed their inhibitory effect on growth as well as formation of spore of the fungus. Out of the aforementioned six test botanicals, garlic clove extract was found to be more effective to suppress the growth of *Bipolaris sorokiniana* and formation of spores and Vertically cut garlic cloves arranged around the 3/4th of the periphery of a three days old culture of *B. sorokiniana* inhibited mycelial growth as well as formation of spores of the fungus. It was clearly noticed that garlic has antifungal effect against the fungus that may attributed to presence of various sulphur compounds like alien, allicin, ajoene, allylpropl-diallyl-trisulfide, sallylcysteine, vinyldithiines, S-allylmercaptocystein, and others. Besides sulfure compounds garlic contains 17 amino acids and their glycosides, arginine and others. Minerals such as selenium and enzymes like allinase, peroxidases, myrosinase, and others. Similar effect of garlic has been reported by several workers. Singh *et al.,* (1990) reported that ajone, a compound derived from garlic *(Allium sativum L.),* inhibited spore germination of *Alternaria solani, Alternaria tenuissima, Alternaria triticina, Collrtotrichum sp., Curvularia sp., Fusarium lini, Fusarium oxysporum*. Slusarenko *et al.,* (2008) reported to effectiveness of garlic juice against a range of plant pathogenic bacteria, fungi and oomycetes *in vitro* and reported that Allicin has effectively controlled seed borne *Alternaria* spp. in carrot.

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