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Biological control of *Alternaria brassicae* (BERK.) Leaf spot disease of *Brassica campestris* Linn. By antagonist *Streptomyces carcinomycicus* strain

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Abstract
The *Streptomyces carcinomycicus* strain was able to reduce the incidence of *Brassica campestris* Linn. leaf spot disease to a considerable extent, when the culture filtrate or spore suspension of the antagonist was sprayed on leaf spot disease. The reduction in leaf spot disease was achieved by spraying the spore suspension of *Streptomyces carcinomycicus* on *Brassica campestris* Linn. plant at the time of inoculation with *Alternaria brassicae* (Berk.). The corresponding reduction when the culture filtrate instead of spore suspension was sprayed.

Keywords: leaf spot disease control of *Brassica campestris* by *Streptomyces carcinomycicus*

1. Introduction
Brassica campestris Linn. plant [1] belong to the Crucifereae-Family and commonly known as *Sarson*. It is an important Rabi crop with about 3,560 thousand hectare under cultivation and production is about 1,475 thousand tons annually. The *Sarson* plant is a very important seed oil crop in India and are used for cooking and medicine [2, 3]. In the present investigation a new species of *Streptomyces* (S-9) designated as *Streptomyces carcinomycicus* [4] was isolated from Sewla soil at Agra, which was strongly antagonistic to *Altrenaria brassicae* (Berk.). The control of *Alternaria brassicae* (Berk.) leaf spot disease by spraying the culture filtrate of spore suspension of *Streptomyces carcinomycicus* over the *Brassica campestris* Linn. plants. *Alternaria brassicae* (Berk.) are also depending on the host susceptibility and environmental factor [5]. The different biotic factors responsible for low yield of Sarson in U.P. and diseases have been recognised as one the major factors[6]. There is no available information on the resistant sources of *Sarson* although some short of tolerance to the disease has been reported [7].
Alternaria brassicae (Berk.) attack crucifers on *Brassica campestris* Linn. plant, when too many spots are formed on leaves, the latter die prematurely thus affecting the yield. The chemical seeds treatments have not proved effective because they are not selective and toxic to the target organisms also. Antibiotics to prove useful in such cases because most of them are specific, systemic in nature [8] and are active in low concentration. They are generally applied as soil and seed treatment and as foliar spray. Leaf spot disease are also controlled by spraying the antibiotics on the aerial parts of the *Sarson* plant had a marked success in the controlled of the number of plant diseases [9]. Present investigation were carried out to probed the control of leaf spot disease of *Brassica campestris* Linn. by direct use of the antagonist, *Streptomyces carcinomycicus* on test fungi *Alternaria brassicae* (Berk.) when cultivated in the soil.

2. Materials and Methods
The one month old leaf spot disease of *Brassica campestris* Linn. in 9-inch earthen ware pots were transplanted and it sprayed with 1 litre spore suspension of *Alternaria brassicae* (Berk.), 15 spores per drop and added *Streptomyces carcinomycicus* strain. The spore suspension of the antagonist was sprayed simultaneously with a week before and week after spraying the spore suspension of the pathogen. Whereas in the second series, its culture filtrate instead of the spore suspension of the antagonist was sprayed. The leaf spots were kept for two days just after spraying in moist chamber. Thus the antibiotic substance [10] was available to the plants in the form of a solution which could remain in direct contact with spores of the pathogen and antagonist for a long time. The culture filtrate was obtained by growing *Streptomyces carcinomycicus* strain glycerol-glycine broth i.e. glycerol 20 gm, magnesium sulphate 0.5 gm, calcium carbonate 0.2 gm, sodium chloride 2.0 gm, dipotassium hydrogen phosphate 1.0 gm, glycine 2.0 gm, ferrous sulphate 0.1 gm and distilled water 1.0 litre at pH 6.8 under shallow and stationary phase condition of the fermentation for 15 days at 28^0C ($\pm 2^0$C).
The experiment was planned to study the effect of inoculating the antagonist in the soil plant debris to collected from *Brassica campestris* Linn. field crop on the incidence of leaf spot disease. The earthenware pots about 9 inch were taken then sterilized and filled with soil collected from *Sarson* fields which had been earlier sterilized at 15 lb pressure for half an hour. The equal number of unsterilized soil were also taken by *Streptomyces carcinomycicus* (S-9) and *Alternaria brassicae* (Berk.) was grown on oat meal agar medium in 10 cm diameter petriplates. The pots of both sterilized and unsterilized series were infested with 10 days old culture of the antagonist strain *Streptomyces carcinomycicus* (S-9) and the pathogen *Alternaria brassicae* (Berk.) and results are given in Table-1.

Table 1: Effect of *Streptomyces carcinomycicus* (S-9) strain infested in soil on leaf spot disease of *Brassica campestris* Linn. caused by *Alternaria brassicae* (Berk.).

S. No.	Treatment	Soil Condition	Disease Development						Reduction % in disease development
			% of Infected plants (Mean of 6 repricates)			% of infected leaves per diseases plant			
			Nov.	Dec.	Jan.	Nov.	Dec.	Jan.	
1.	a.	St.	35.18	89.66	100.00	23.29	48.33	96.16	-
		Un St.	38.11	91.17	100.00	26.13	52.32	92.32	-
2.	b.	St.	12.81	32.88	46.62	06.72	18.44	35.08	60.43
		Un St.	19.62	57.11	69.81	11.33	28.16	42.66	30.11
3.	c.	St.	-	07.15	17.21	-	07.29	17.88	82.42
		Un St.	05.11	28.42	49.34	04.18	11.42	21.11	66.12
4.	d.	St.	26.40	32.92	45.21	17.21	27.36	40.90	51.66
		Un St.	27.21	62.84	79.20	26.42	30.11	52.66	21.99

Where: St. = Sterilized. Un St. = Unsterilized.
a. = Pots infested with pathogen only. b. = Antagonist infested a week before the pathogen.
c. = Pathogen and antagonist infested simultaneously. d. = Pathogen infested a week before the antagonist.

3. Results and Discussion

The results showed that the incidence of leaf spot disease of *Brassica campestris* Linn. gradually increased and reached its peak level in the month in October. Reduction in disease development was observed in all the treatments when compared with the control. The development of disease symptoms was at an early stage in control but they were delayed in the treated plants. It appears that the antibiotic substances were absorbed by the plants and it was not inactivated in the host. The reduction in disease development over the control was obtained, when the spore suspension of the antagonist was sprayed either simultaneously with a week before spraying the spore suspension of the pathogen. However, the rate of disease reduction was enhanced when the culture filtrate instead of the spore suspension was sprayed. There are a number of reports indicating the possibility of successfully biological control of *Brassica campestris* Linn. plant diseases by the use of spore suspension or culture filtrate of an antagonist [11, 12, 13]. Reduction in the plant leaf disease development was poor, when the spore suspension and the culture filtrate of the antagonist was sprayed one week after inoculation of pathogen. This may be due to the fact that the by time of the antagonist was sprayed the pathogen had established itself within the host but further development of disease was checked by the presence of the antagonist. Thus, there is a wide scope of using *Streptomyces carcinomycicus* srain or the antibiotic substance produced by it for controlling the leaf spot disease of *Brassica campestris* Linn. incited by *Streptomyces carcinomycicus* strain.

The observations were presented in the Table-1 indicates that the development of leaf spot disease of *Sarson* plant caused by *Alternaria brassicae* (Berk.) and also the percentage of infected leaves per diseased plant was maximum when *Alternaria brassicae* (Berk.) alone was infested within sterilized and unsterilized soil. The maximum reduction in diseases development was achieved when the antagonist was applied in sterilized soil a week pathogen. This reduction in disease development due to the *Alternaria brassicae* (Berk.) was 82.42% when *Streptomyces carcinomycicus* strain was infested in the soil and 70.42% was taken as antagonistic organism. The reduction in disease development due to *Alternaria brassicae* (Berk.) was 60.43% when the *Streptomyces carcinomycicus* was infested with a week after the pathogen. when the *Streptomyces carcinomycicus* strain was used as antagonist for the reduction in infected plants was higher and number of infected leaves per plant as well as the number of spots per diseased leaf was lesser.

The reduction in disease development was more effective in autoclaved than in natural soil because in the former completion from other micro-organism was least. Reduction in disease as well as in severity was apparently due to the production of antibiotic substances by *Steptomyces carcinomycicus* in soil as shown in the Table-1 is obserbed by roots and translocated upward in the plants. An attempt was also made to controlled the leaves spots disease of *Brassica campestris* Linn. caused by *Alternaria brassicae* (Berk.) with applying the antagonist strain *Streptomyces carcinomycicus.* The active principle produced by it as foliar spray [14] on the *Brassica campestris* Linn. plant in glass house conditions. Thus, there is pretty good scope of using the *Streptomyces carcinomycicus* strain with active principle produced by it for the treatment of many plant disease of microbial origin.

4. References

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