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Efficacy of "PESTA" Granular Formulation Myco-herbicides of *Aspergillus niger* spores in *Striga hermonthica* (Del.) Benth Biocontrol

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Abstract

Aspergillus niger spores were isolated from diseased Striga plants at the Demonstration Farm Faculty of Agriculture, Shambat was used as a mycoherbicide for the biocontrol of Striga hermothica plant.

Sterilized dried sorghum straw, Alfalafa hay and sucrose were used, as solid state substrates for growth and multiplication. These were used in different formulations coated to sorghum seeds or mixed with soil or added after Striga emergence to spores of Aspergillus niger .

The results indicated that the formulation camposed of ٧٠٪ sterilized sorghum straw , ٢٥٪ alfalfa hay formulation and ٥٪ sucrose was the best as it yielded the highest number of spores as compared to other formulations. Therefore, this formulation was selected for further application and was applied for inoculation of *Striga* seeds in the presence of its host (sorghum) seeds in different ways in the glass house at Shambat, Faculty of Agriculture.

Application of this selected formulation as a seed dressing (for sorghum seed resulted in complete inhibition of *Striga hermonthica* seed germination and consequently improved sorghum production. This technology is cheap and can be easily produced and applied by farmers and it well solve *Striga* problem. Moreover, the results also indicated that the selected formulation was the best for the multiplication of *Aspergillus niger* spores and that treatment of crop seeds with biocontrol agents seems to be an effective way of biocontrol and has a limited environmental impact .

المستخلص

أستخدمت جراثيم فطر***Aspergillus niger*** التي تم عزلها من نباتات بودة مصابة في مزرعة الجامعة ،كلية الزراعة،شمبات للمكافحة الحيوية لطفيل البودة .

أستخدمت سيقان نبات الذرة الجافة المعقمة والبرسيم والسكروز بتراكيب مختلفة تم خلطها مع بذور الذرة او مع التربة او بعد بروز نبات البودا التضاعف وتكاثر جراثيم الفطر.

أوضحت النتائج أن التركيبية(اللقاح) المكونه من ٧٠% بودرة السيقان الجافة المعقمة لنبات الذرة و٢٥% بودرة السيقان الجافة لنبات البرسيم و٥ % من السكروز هي الافضل لتكاثر جراثيم الفطر مقارنة بالتراكيب الأخرى .

تم إختبار هذه التركيبه لتطبيقها على نبات البودة في وجود مضيفة نبات الذرة بطرق مختلفة في البيت الزجاجي في كلية الزراعة - شمبات .

تم استخدام هذه التركيبة بتغليفها مع بذرة الذرة ، ونتج عن ذلك تثبيط كامل لانبات بذور نبات البودا وبالتالي تحسين إنتاجية نبات الذرة مقارنة بالتراكيب الاخرى وانها رخيصة التكلفة ويمكن للمزارع عملها وتطبيقها لحل مشكلة نبات البودا. أوضحت النتائج ايضا أن التركيبة المختارة هي الأفضل لتضاعف جراثيم *A.niger* وهي طريقة فاعلة ولها تأثير محدود على البيئة.

Introduction :

Striga hermonthica (Del.) Benth. is the most destructive semi-parasitc weed on cereals in Africa.Twenty one million hectares of lands are estimated to be infested with *Striga* (Sauerborn , *et al.*,٢٠٠٧). It is considered the most serious biotic factor that threatened cereals (sorghum , maize and pearl). In Sudan, infestation of sorghum field with *Strige* results in yield losses of ٧٠-١٠٠٪ (Babiker , ٢٠٠٢). Therefore, *Striga* is considered the major threat to Sorghum production, which is the main staple food for the majority of Sudanese people.

Several means of control are adopted to control *Striga* either culturally, chemically or physically, however, they are either inefficient or too expensive. Biological control has been considered as an additional tool for the control of parasitic weeds in the last two decades (Abbasher & Sauerborn , ١٩٩٢ ; Berner , ٢٠٠٣ , Kroschel and Muller – Stover , ٢٠٠٤ and Saureborn *et al.* , ٢٠٠٧) .

The problem can be overcome by adopting appropriate formulation technology of Granular formulations using some fungi (Connick *et al.*, ١٩٩١ ; and Schaub *et al.*, ٢٠٠٦). The treatment of crop seeds with biocontrol agents seems to be an effective delivery system with a limited environmental impact (Mcquilken, *et al* ., ١٩٩٨) .

The objectives of this study were to create An attractive delivery system for mycoherbecides production using cheap and available materials (sorghum straw, sucrose and alfalfa hay) as biocontrol strategy for the control of *Striga hermonthica* and consequently enhancement of sorghum production.

Methodology:

Preparation of Mycoherbicide granules

Sterilized sorghum straw, alfalfa hay and sucrose were used as a solid state for growth

and multiplication of spores of *Aspargillus niger*. Four inoculum formulations were investigated and the growth was allowed to go on for seven days after which the spore count was determined.

Aspergillus Niger spores count at zero time was ٣.٦×١٠^٢ spores / g substrate. The effect of the Mycoherbicides using A. *niger* spores on sorghum seeds growth in the presence of *Striga hermonthica* seeds was investigated in pouches in the glasshouse. The fermenting formulation consisting of ٧g sorghum straw + ٢.٥g alfalfa hay and ٠.٥g sucrose was chosen for this purpose as it yielded the highest number of spores. The inoculation treatments were as follows :-

١- coating sorghum seeds and *Striga* seeds with the inoculum (Mycoherbicides ١,٠ g to sorghum , *Striga* seeds)

٢- Soil inoculating was done just before sowing (١٠٠ g / pouch).

٣- Surface application on emerged *Striga* plants (١٠٠ g added)

All treatments were replicated four times and each treatment received five surface – disinfected sorghum seeds and ٠٠٣ g *Striga* seeds (soil prepared in pouches ٢:١ clay : sand). After ٤٥ days of sampling, sorghum and *Striga* plants were carefully uprooted, washed and the following parameters were measured: plant height, number of leaves, root length, shoot and root fresh and dry weight and number of *Striga* plant / pouch. The data were statistically analyzed and means were analyzed using Duncan's New Multiple Range Test.

Results and Disscussion :

Complete reduction (١٠٠٪) in *Striga* seeds germination was observed and that the best sorghum growth was obtained when the fungal inoculum Mycohebicides was

used to coat sorghum seeds. Substantial improvements in the parameters measured in sorghum plants were observed (Table ٢ and plates ١-٣).

The results indicated the efficacy of using the isolated *A.niger* spores in controlling *Striga* seeds germination.

Sterilized sorghum straw together with alfalfa hay and sucrose proved to be the most suitable fermenting medium and that the spore count of *Asp.niger* was ١.٥×١٠^{٥} / g substrate after incubation for seven days (Table ١).

Many workers in the field of using myconherbicides against parasitic weeds adopted the use of different formulation as amedium for mass production of spores (Elzein , ٢٠٠٣ and Muller -Stover , ٢٠٠١; Zahran, E.*et al*, ٢٠٠٨ and Zarafi , A. B. *etal.*, ٢٠١٥). Several agricultural byproducts have been used, including cotton cake, maize, wheat and sorghum straw. Elzein & Kroschel *et al* , (٢٠٠٤) obtained a maximum production of *Fusarium oxysporum* spores at inoculum ٤.٧ × ٧ after incubation for ١٢ days. Moreover, Elzein *et al* ., (٢٠٠٦) obtained ٧٧-٨١٪ reduction in healthy emerged *Striga* shoots when using *Fusarium oxysporum*. They concluded that mycoherbicides were very effective in controlling *Striga hermonthica*.

Similarly Ciotola *et al.*, (٢٠٠٠) succeeded in completely preventing *Striga hermonthica* emergence after coating sorghum seeds with Mycoherbicides containing spores of *Fusarium oxysporum* .

It can therefore be concluded from these results that mycoherbicides, visually application of *Aspergillus niger* spores inoculum can be one of the most useful tools in controlling the noxious weed *Striga hermonthica* .

The technology is simple and can be easily applied by the local farmers and it can be widely disseminated in rural areas.

Table (١). Solid – state fermentation of *Aspergillus niger* spores for seven days in different carrier materials.

Carrier composition	Number of spores after seven days inoculation × $١٠^{٥}$ /g substrate
١٠ g sorghum straw	٠.٦١
٩.٥ g sorghum straw + ٠.٥ g sterile sucrose	١.١
٧ g sorghum straw + ٢.٥ g alfalfa hay straw + ٠.٥ g surose	١.٥
٧g sorghum straw + ٣g alfalfa hay	٠.٧

***Table(٢). Effect of diferent inoculation treatments with *Aspergillus niger* on the growth of *Striga hermonthica* .**

Treatment	Number of *Striga* plant/pouch	Sorghum number of leaves	Sorghum root length (cm)	Sorghum plant height (cm)	Sorghum shoot fresh weight (g)	Sorghum shoot dry weight (g)	Sorghum root fresh weight (g)	Sorghum root dry weight (g)
Untreated (control)	١٤.٠ a	٦.٠ b	٢٩.٨ b	٥٠.٤ c	١.٥ c	٠.٣ c	١.٠ c	٠.٤ c
Inoculum coated to seeds	٠.٠ b	٨.٣ a	٤١.١ a	٧٠.٣ a	٤.٠ a	١.٥ a	٨.٣ a	٢.٩ a
Inoculum mixed with soil	٣.٥٠ b	٧.٣ ab	٣٣.٦ b	٦٣.١ b	٢.٩ ab	١.٠ b	٦.٤ ab	١.٧ b
Inoculum sprayed after *Striga* emergence	٧.٠ b	٦.٨ ab	٣٢.٠ b	٥٧.١ bc	٢.٢ bc	٠.٧ b	٤.٧ b	١.٢ bc

- ***Values in the same column followed by the same letter (s) are not significantly different according to Duncan's New Multiple Range Test.**

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