Biocontrol of *Striga hermonthica* (Del.)Benth. in Sorghum

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Dr. Somia Basheir Mohammed Ali
University of Khartoum
Faculty of Education
Prof. Ahmmed Ali Mahdi
University of Khartoum
Faculty of Agriculture

المكافحة الحيوية لطفيل البردا فى الزرة

د. سمية بشير محمد على
قسم الاحياء – كلية التربية
جامعه الخرطوم
بروفسير . أحمد على مهدي
قسم ..... – كلية الزراعة
جامعة الخرطوم

مستخلص الدراسة :

تم الحصول علي عشرين عزلة فطرية من نباتات بودا بدت عليها أعراض المرض من الحقل التجريبي بكلية الزراعة و من مزرعة جامعه الخرطوم و من مشروع الجزيرة ، بعد التعرف علي هذه العزلات أتضح ان 18 عزلة تنتمي إلي نوع *Aspergillus niger* بينما تم التعرف علي عزلتين أخريين تنتميان إلي نوع *A.flavus* .

أثبتت أختبارات مقدرة هذه الفطريات علي أمراض نبات البودا في المختبر و البيت الزجاجي اثبت القدرة الكامنة لهذ الفطريات في المكافحة الحيوية لنبات البودا .

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Dr. Somia Basheir Mohammed Ali
University of Khartoum
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ABSTRACT

Twenty fungal isolates were collected from diseased *Striga* plants at the Faculty of Agriculture Demonstration Farm , University of Khartoum Farm and the Gezira Scheme .

Eighteen isolates were identified as *Aspergillus niger* while only two of the isolates were identified as *A. flavus* .

Pathogenicity tests of these fungi on *Striga hermonthica* in vitro and in the glasshouse revealed the potential to utilize *Aspergillus spp*. in *Striga hermonthica biocontrol* .

Introduction

Sorghum bicolor (L.) Moench. is a major grain cereal of tropical savanna region. It has many alternative uses: The grains are used as human food as well as animals feed where as the stem and foliage are used as green chop and hay besides their use in animal feeding.
Sorghum root can be attacked by *Striga hermonthica* . Yield losses due to *Striga hermonthica* vary from 0.0 to 100% (Agrios, 1988; , Kiriro , 1991). Striga is a problem in many countries uncluding.

Nigeria (Akpa *et al* ., 1996) , Chad(Nekoaum , 1993), Kenya (Kiriro , 1991) and in all sub – saharan Africa (Abbasher *et al* ., 1998). In Sudan, infestaltion of sorghum field with *Striga* resulted in yield losses of 70-100% (Babiker , 2002) Therefore, the parasite is considered the major threat to sorghum production , which is the main staple food for the majority of the Sudanese people.

Several means of control are adopted for *Striga* either culturally , chemically or phyisically, 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 and Sauerborn, 1992; Berner *et al* .,2003; Kroschel and Muller – Stover, 2004 ; Sauerborn *et al* ., 2007) .

The witch – weed , *Striga hermonthica* (Del.) Benth.,is a flowering root parasite and it is considered as a hemi – parasitic plant.It belongs to the family Scrophulariaceae .It is a parasitic weed of roots of food crops , eg , rice (*Oryza stavia L*.) ,millet (*Pennisetum glaucum* (L.) Moench , maize (*Zea mays L*.) and sorghum (*Sorghum bicolor* L. Moench (Press *et al* ., (Andrews, 1947, Carson, 1988; Daziel, 1963; Hutchinson and Tarr , 1962 ,).

Striga hermonthica is widespread in the tropics and sub tropics of Gambia, Ghana Mali , Nigeria and Sudan, In Sudan, it is locally named as ،"Al Buda"(Chouldhury et al ., 1998)

The objectives of this study were to identify the fungi associated with *Striga hermonthica* biocontrol and to evaluate their pathogenicity against this hemi – parasitic weed .

Materials and Methods:

Striga hermonthica plants, showing signs of disease, were carefully uprooted and collected from the Faculty of Agriculture Demonstration farm at Shambat, Khartoum University Farm and from the Gezira scheme during the year 2007.

Infected Striga leaves were disinfected with 1% sodium hypochlorite, cut to pieces and carefully placed in prepared Potato Dextrose Agar (PDA) .Then incubated for 48 hours at 33°c, and examined for fungal growth and then purified through repeated streaking on (PDA) medium. They were then identified using the following growth media:

Czapek Agar (CZ) and Potato Sucrose Agar (PSA)

Spezieller Nahrs farmer Agar (SNA) and Potato Dextrose Agar (PDA) .

Spores of the each identified fungius were prepared at an inculum 2×10^5 spores/ ml . Each inoculum was added to sorghum seeds and cleaned preconditioned *Striga* seeds prepared in sterile plates . The percentages of germination of *Striga* and sorghum seeds were abtained and compared with control *Striga* grown in distilled water only.

The inocula were tested for their effect on the germination and growth of *Striga* and sorghum plants raised in plastic pouches in the glasshouse .

Pouches containing 2kg sterilized soil (2:1 clay : sand), 0.03g sterilized *Striga* seeds and five sterilized sorghum seeds were put in each pouch .There were 20 treatments represented by the 20 fungal inocula, each replicated four times in addition to the control which received distilled water only .

Pouch were irrigated with sterile distilled water only every 48 hour for 45 days and left at room temperature (37°c).

At sampling time all plants were uprooted carefully, washed and labeled and the following parameters were assayed :- plant height , number of leavese per plant , shoot fresh and dry weight , root fresh and dry weight (oven drying at 75-80 °c for 48 hours), root length and number of *Striga* plants per pouch .

Data on *Striga* and sorghum paramenters were analyzed using Duncan`s Multiple Range Test .

Results & Discussion

All identified isolates were found to belong to the genus *Aspergillus* (18 isolates of *A. niger* , and two isolates of *A. flavus*) . It was found that the growth of *Striga* was highy reduced by all fungal spores at inocula 2×10^5 spores / ml.

There was an appreciable improvement in all the parameters (height, shoot fresh and dry weight, root fresh and dry weight, root length and number of leaves/plant sorghum) of sorghum plants that were measured due to the inhibition of *Striga* growth (Table I).

The results of the present study agree with those of Nekouam and Marely *et al* (1999) who reported that *Aspergillus niger* , *A.flavas* and A.fumigatus were among the most promising fungi for use in the biocontrol of *Striga hermonthica*.

The results were also in accordance with other studies which indicated that *Aspergillus spp*. had a high potential in the biocontrol of *Striga hermonthica* (Abbasher et al ., 1998;Marely & Nekouam , 2003)

Table (1) : Screening of the effect of fungal spores on germination and growth of *Striga* and sorghum seeds in pouches :

TREATMENT	NUMBER OF STRIGA PLANTS/POUCH	SORGHUM PLANT HEIGHT (CM)	SORGHUM ROOT LENGTH (CM)	SORGHUM SHOOT FRESH WEIGHT (G)	SORGHUM SHOOT DRY WEIGHT (G)	SORGHUM ROOT FRESH WEIGHT (G)	SORGHUM ROOT DRY WEIGHT (G)	SORGHUM NUMBER OF LEAVES/PLANT
Untreated (ds)	5.50a	35.2b	24.6ab	2.0c	0.45d	2.578b	0.5675b	7.25ab
Ds + F01	0.01c	39.9ab	29.2ab	2.7bc	0.69bcd	1.78b	0.55b	7.75ab
Ds + F02	0.051c	42.8ab	34.3ab	4.9abc	1.22abc	2.93b	1.03ab	8.25a
Ds + F03	0.76c	43.4ab	30.1ab	4.8abc	1.12abcd	3.09b	0.81b	8.75a
Ds + F04	0.10c	42.3ab	38.3ab	4.3abc	0.9abcd	6.60ab	1.05ab	7.5ab
Ds + F05	2.00bc	41.3ab	33.6ab	3.5bc	0.75bcd	3.67b	0.84ab	7.5ab
Ds + F06	0.26c	46.5ab	29.9ab	3.6bc	0.83bcd	1.85b	0.65b	7.75ab
Ds + F07	0.75c	43.3ab	37.0a	4.3abc	094abcd	2.49b	0.68b	8.0ab
Ds + F08	1.50c	48.4ab	33.1ab	3.8abc	0.89abcd	2.65b	0.78b	8.0ab
Ds + F09	0.26c	38.5ab	31.8ab	2.2c	0.47d	1.49b	0.50b	7.75ab
Ds + F10	0.51c	41.6ab	27.1ab	2.9bc	0.70bcd	1.84b	0.69b	8.0ab
Ds + F11	0.01c	45.7ab	25.7ab	2.0c	0.54cd	1.54b	0.39b	7.8ab
Ds + F12	0.76c	55.2a	35.5ab	5.6ab	1.33b	4.03b	1.78ab	8.5b
Ds + F13	0.10c	47.5ab	33.5ab	4.1abc	0.99abcd	2.41b	0.71b	8.25a
Ds + F14	0.51c	46.5ab	37.6a	3.5bc	0.92abcd	2.40b	0.88ab	7.25a
Ds + F15	4.00ab	54.9a	32.8ab	6.7a	1.58a	7.92ab	1.58a	8.75a
Ds + F16	1.75c	44.9ab	22.6b	3.2bc	0.81bcd	2.09b	0.07b	6.5b
Ds + F17	0.01c	41.5ab	26.3ab	3.4bcd	0.73bcd	11.43a	0.76b	8.0ab
Ds +	1.26c	47.6a	27.6a	3.6bc	0.81b	2.54b	0.67b	7.25ab

F18		**b**	**b**		**cd**			
Ds + F19	**0.26c**	**51.2ab**	**32.6ab**	**3.7abc**	**0.94abcd**	**2.06b**	**0.66b**	**8.0ab**
Ds + F20	**0.01c**	**45.8ab**	**28.5ab**	**3.1bc**	**0.73bcd**	**2.08b**	**0.66b**	**8.0ab**

***Values in the same column followed by the same letter(s) are not significantly different by Duncan Multiple Test .**

All isolates were identified as *A. niger* except F06 and F19

Ds = sorghum + *Striga* F = fungus

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