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Short Communication Paper
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« Evaluation of Cross Infection of Sorghum Genotypes by *Ustilago cynadontis* (Henn. & Henn.), the Causal Agent of Smut in Couch grass [*Cynodon dactylon* (L.) Pers.] In South Sudan »

'A Note

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Abstract:
Cross infection trials of Sorghum by smut of couch grass incited by (Ustilago cynadontis Henn. & Henn.) were conducted in 20L pots at University of Juba during 2017/2018 cropping season; located at latitude 4050, 529'N and longitude 31035, 417'E and at an altitude of approximately 400m above sea level. Six local sorghum genotypes were planted in pots replicated four times and arranged in a randomized complete block design; prior to planting each pot was artificially inoculated with teliospores from fifteen air dried Ustilago cynadontis sori. Results showed no cross infection in all six sorghum genotypes tested. The study recommends similar studies to be re-conducted to include a larger number of local sorghum genotypes since couch grass; Cynodon dactylon is a known alternate host of Sporisorium sorghi which is an established causal agent of covered kernel smut of sorghum.

Keywords: Cross infection, Sorghum genotypes, artificial inoculation, Ustilago cynadontis, Teliospores

I. Introduction:

Sorghum, [*Sorghum bicolor* (L.) Moench] is an important staple food grain and the fifth most important cereal in the world after wheat, rice, maize and barley. It is thought to have originated in North Eastern Africa where a large variability in the wild and cultivated species still exists today and was probably domesticated in Ethiopia between 5000 and 7000 years ago [1]. It is the energy source for more than 500 million people in most developing countries of the world. It is cultivated in an estimated area of about 42.54 million hectares in 98 countries in Africa, Asia, Oceania and the Americas. Nigeria, India, USA, Mexico, Sudan, China and Argentina are the major producers in the world. Nigeria leads in Africa with 6.15 million tons followed by Ethiopia, 2.6 million tons and Sudan, 2.3 million metric tons; other sorghum producing countries in Africa are Niger, Mali, Burkina Faso and Cameroon [2], [3]. In South Sudan sorghum is a major staple followed by maize, root and tuber crops, millets and aroids (*Colocassia* spp. and *Xanthosoma* spp.)

The production of sorghum is however seriously constrained by other factors that include insect pest attacks namely, (stalk borers- *Sesamia* spp. and *Chilo* spp.) and most recently the fall armyworm, *Spodoptera frugiperda* Smith; parasitic plants [*Striga hermontheca* (Dell.) Benth.] and diseases; the most important of which are the basidiomycete smuts namely, head, loose, covered and long smuts [4], [5]. Losses due to these biotic and other abiotic production constraints are immense. Witch-weed, (Striga spp.) infests more than 50% of total cereal production in sub-Saharan Africa [6]. And, smuts could inflict losses of up to 70% and 100% depending on intensity of incidence and variety planted [3], [7]. Nevertheless, [8] indicated that for every 10%

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increase in farm yields, poverty was reduced by about 7% in Africa and hence, this underscores the importance and need of maintaining steady sustainable yields, through the selection from local materials (genotypes) of resistant or tolerant genotypes. Recently, widespread occurrences of smut on couch grass, *Cynodon dactylon* (L.) Pers., were observed in Yei River and Juba counties of Central Equatoria State [9]. Also, most basidiomycete fungi are known to hybridize easily therefore, it is on this backdrop that this study was incepted to test some of the most popular local sorghum genotypes for infectivity or cross infection by *Ustilago cynadontis* Henn. & Henn., the causal agent of smut of couch grass which was positively reported by some workers [10], [11]. Hence, the need to test this phenomenon under South Sudan conditions given the widespread occurrence of smut on couch grass and the high dependence on sorghum production by the local communities as a major energy source.

II. MATERIALS AND METHODS

A. LOCATION

The study was conducted in (20L capacity plastic pots) at the Department of Agricultural Sciences Nursery, University of Juba during 2017/2018 cropping season; located at latitude 4050, 529'N and longitude 31035, 417'E, and altitude of approximately 400m above sea level.

B. TRIAL DESIGN AND DATA COLLECTION

Twenty litre (20L) capacity plastic containers measuring 20×20x50 cm were used in the trials. These were filled with black river soil and 15 sun dried smut sori collected from inflorescences of *Cynodon dactylon* (L.) Pers. infected with *Ustilago cynadontis* Henn. & Henn., in and around the University of Juba Atla-Bara campus were added to the pots; and, the spores were admixed thoroughly with the top 15-20 cm of soil in each pot. About 5-10 sorghum seeds from each of six genotypes were sown in their assigned respective pots and later thinned to two plants per pot. The trial was arranged in a randomized complete block design and replicated four times.

Smut incidence was monitored every two weeks, and data on other agronomic parameters namely, number of green leaves and leaf area index were recorded, data were analyzed by the statistical software MSTATC and means separated by the LSD procedure at $P<0.05$ probability level and results interpreted accordingly as per the methods of [12].

III. RESULTS AND DISCUSSION

A. SMUT INCIDENCE

The results showed no significant differences ($P\leq 0.05$) amongst the other tested agronomic parameters namely, plant height, number of leaves, leaf area index (LAI) and plant biomass evaluated. Also, no smut infections occurred across all the six sorghum genotypes tested, vide the soil inoculation methods used as demonstrated in Table 1. Thus, in these trials we were not able to achieve any infection through induced artificial soil inoculation methods under conditions of the Hills and Mountains Agro-ecological zone, South Sudan. Elsewhere, [13] working on sorghum diseases and other cereal smuts indicated couch grass *Cynodon dactylon* (L.) Pers. as an alternative host for covered smut disease of sorghum caused by the fungus *Sporisorium sorghi* Ehrenb. Ex Link, and, thus ushering in a possibility of a reverse infectivity of sorghum by *Ustilago cynadontis* Henn. & Henn., nevertheless, there was no indication given on the inoculation methods used.

From past experiences [9] showed that on sugarcane cane smut disease incited by the fungus *Ustilago scitaminea* Sydow (syn. *Sporisorium scitamineum* (Syd.), M. Piepenbring) also another basidiomycete the Taiwanese pin-prick and dipping methods (dipping of sugarcane seed setts in spore suspensions at 1g/L water) were excellent in elucidating physiological and structural resistance in sugarcane varieties, respectively. However, in these trials we did not attempt soaking sorghum seeds in spore suspensions of *U. cynadontis* which therefore may offer an avenue for further investigation and attention by workers in the field.

TABLE 1: SOME AGRONOMIC GROWTH AND YIELD PARAMETERS AND SMUT INCIDENCE IN SIX SORGHUM GENOTYPES TESTED

Sorghum genotype	PHt.	NGL	LA (cm^2)	Biomass (g)	PSI (%)
Rapcol	113.9	5.0	344.8	190.4	0.0
Yar	164.8	5.0	324.8	205.7	0.0
Rapher	90.1	6.0	266.5	227.1	0.0
Malwal	168.4	6.0	372.3	206.3	0.0
Luel	154.4	6.0	272.0	197.1	0.0
Aher	191.3	6.0	199.8	263.6	0.0
CV (%)	27.5	16.3	37.5	46.3	-
SE (±)	10.1	0.2	29.4	24.5	-
Sig. level	ns	ns	ns	ns	-

Key: PHt. = Plant height (cm); LA = Leaf area; PSI = Percentage smut incidence; NGL = number of green leaves; ns =not significant.

RECOMMENDATIONS

From the findings in this work the local strains of *Ustilago cynadontis* tested all failed to infect the six sorghum genotype entries tested, therefore, farmers can continue to freely cultivate sorghum without fear from this disease. However, the study also recommends the inclusion and deployment of several 'high inoculums pressure' artificial inoculation methods in the future to further test this objective.

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