

ROLE OF PADDY WEEDS IN ANNUAL RECURRENCE OF FALSE SMUT DISEASE OF RICE

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ABSTRACT

Ustilagoidea virens(Cke.)Tak. The causal agent of false smut disease of rice was recorded on some paddy weed for the first time in Egypt .An extensive infection was observed in the most common weed namely :Barnyard grass (*Echinochloa crus-galli*(L.)Beauv and on knot grass (*Paspalum distichum*) out of 14 rice weeds . Severity of false smut disease on rice varied in different locations in Northern Governorates and on different rice cultivars .Symptoms were compared on paddy and weed. This study discuss the role of weeds distributing in rice plantations in providing a new source of inoculum for rice infection .

Keywords: False smut , *Ustilagoidea virens* ,paddy weeds.

INTRODUCTION

False smut regarded as a minor disease in rice -growing areas in many parts of the world including Gabon (Manser,1984) China(Wang-Xiaoli,1987; Du-Yi *et al.*,1990;Chen-Young`shui,1991 and Liu *et al.*,1993), India (Anand *et al.*,1985,Singh,*etal.*,1987;Ram-D.1994) , Japan (Yaegashi *et al.*, 1989), Puerto-Rico (Pantoja and Medina-Gaud,1988) and recently in Arkansas, USA (Cartwright *etal.*,1998). The presence of the rice false smut pathogen on *Digitaria marginata*,a common rice weed ,was confirmed in 85% of the rice fields surveyed in India in 1983.Spores from *D.marginata* caused disease when used to inoculate rice panicles. (Shetty and Shetty, 1985).*Ustilagoidea virens* was also found in India on the grass *Panicum trypheron* around paddy fields.On cross inoculation,Chlamydo spores from *P.trypheron* infected rice plants and vise versa .It is concluded that weeds are important source of inoculum between seasons.(Shetty and Shetty, 1987)and Lu *et al.* ,1996).The aim of this study is to know the role of weeds grown in rice plantations in providing a new source of inoculum for rice reinfection with false smut disease .

MATERIALS AND METHODS

Isolation:

Panicles exhibiting false smut were collected from rice-production regions throughtout Behaira Governorate.Single,well-separated balls were excised,surface-sterilized and transfered to vials of steril distilled water .Conidi spores of the fungus causing weeds false smut were grown on potato dextrose agar media (PDA)using techniques suggested by Riker &Riker (1936).Identification of isolates was carried out according to the key reported by Mulder and Holliday (1971).

Inoculation tests:

Artificial inoculation tests were carried out in pots supplied with autoclaved sandy loam soil during mid June 1999 season .Pots were previously sterilized in 7% formaldehyde solution for ten minutes ,allowed to dry ten days before plantation , each pot received soaked seeds of the tested following plants as follow:

- 1-Rice seeds of Giza 171,Giza 181,Sakha 101, and Sakha 102, the available rice cultivars in Egypt .
- 2-Seeds of (*Chenopodium ambrosioides* L.; *Cyperus difformis* L.; *C.longus* L.;*Digitaria sanguinalis* L. Scop.; *Echinochloa colonum*(L.) Link;*E.crus.galli* L.; *Panicum repen* L.;*Paspalum diatichum*; *Polygonum monspeliensis* ;*P.salicifolium* Brouss;*Setaria glauca* L.;*S.verticillata*; *S.viridis* L. and *Typha elephantina* Roxb. As common weeds species around paddy fields. Four different techniques have been used in inoculation prosscetes: seed dressing, plant injection ,brushing and foliar spraying. Inoculation techniques were attempted by using suspension of conidiospores, produced on potato sucrose agar medium. Artificial inoculation tests were accomplished at three intervals : one month after the seeding emergence,at boot stage and at the heading stage .Pots didn't receive fungal suspension were served as check . Three replicates were used for each treatment. Inoculated plants were kept in an air conditioning room for 2 days at 15^oc,transferred to a moist chamber for 5 days at 26 c and then maintained in the green house (25-35 c) till the smut balls appeared (Fujita *et al.*,1989) .Inoculation periods carried out in July , August and September during the growing season, 1999 .

RESULTS AND DISCUSSION

False smut, caused by *Ustilagonoidea virens* (Cke.)Tak. Was first observed on rice plantation just before maturity at Hosh-Easa,Behaira Governorate ,at the late summer, 1999 . The disease was later reported in other Governorates on different rice cultivars at variable infection levels .Infection rate was reported on the four majour rice cultivars namely : Giza 171 ,Giza 181,Sakha 101and Sakha 102 (Fig 1). Rate of infection ,however ,varied from less than 1% to 20% according to rice tested cultivars as well as the location. Short cultivars as (Sakha 101 and Sakha 102)were more vulnerable than tall ones (Bhardwaj,1990). Results showed that there was correlation between disease sevirity (number of infected kernels) and the increasing of the last internods length (neck) in the infected rice plants .Generally disease was highly severe in Behaira and least severe in El-Sharkia and Dakahlia . False smut balls were found growing on both *E.crus-galli* and *P. distichum* out of the 14 tested rice weeds .Disease symptoms were noticed clearly on each Barnyard grass (*E.crus- galli*) inflorescance ,the compact and the expanded one (Fig 2a,b and c).Symptoms developing as globose to circular or irregular shape spore balls , either on rice or tested weeds .Spore balls emerge through glums replacing the kernels with a

diameter equal to five times as kernel diameter (Fig 3a ,b and c). Spore balls are yellowish golden at first . the color gradually turns to olive or olivaceous-black. The inner most core of the ball consists of hard and tightly woven fungal mycelium . Remained floral parts are usually incorporated in to the spore ball. Full mature spore balls are often turn one to several hard irregular dark variable size sclerotia .Generally few kernels of the panicle are affected. More than 65% of the infected rice spikes carry less than 3 balls of smut, whereas 1% of the infected spikes recorded more than 20 balls .

Table (1): Effect of false smut on rice grains

No.smut balls*	Infected Plants %	Spike wt.(gm)	No.grains/spike	1000grains wt.(gm)
0	0	5.1	225	23.3
1	29.0	4.9	207	21.9
2	25.6	3.8	193	21.6
3	11.6	3.43	190	21.1
4	2.7	3.35	189	19.7
5	5.8	2.95	155	19.5
6	7.0	2.69	141	18.1
7	7.0	2.69	143	18.0
8	3.5	2.56	132	17.7
9	1.2	2.43	132	17.1
10	2.7	2.22	129	16.1
11	3.5	2.17	121	15.8
21	1.0	1.6	99	14.1

*Values are means of ten replicates.

Increasing the number of infected rice kernels decreases the number of healthy grains per the spike and decrease grain weight (Table 1). Barnyard grass is an annual plant which is the most persistent weed in rice seed and commercial rice production .Early in season it is difficult to differentiate between the young rice seedlings and those of grasses due to the quite similarity in both species .The present study indicated that the false smut balls of *U.virens* grow on *E.crous-galli* and *P.distichum* in some inspected rice fields .The obtained results showed that infection was occurred during a short period before heading stage. Ovaries could be infected with chlamydospores suspension , but mature seeds could not be infected .This was in line with (Yoshino and Yamamoto , 1952); (Ikegami,1960) and(Kulkarni and Moniz , 1975) they reported that successful inoculation was observed after injection chlamydospores and ascospores in to the leaf sheath enclosing the panicle. Conidia were trapped one week before the appearance of field infection during June –September :the spore concentration increase progressively around the time of flowering . There were more conidiospores at the booting stage .Whereas, chlamydospores were associated the smutted grains .These finding was in line with Shetty&Shetty, 1985 who found that the common weed *Digitaria marginata* was infected with false smut in 85% of the field surveyed ,thus suggesting the probable cause of infection to rice .

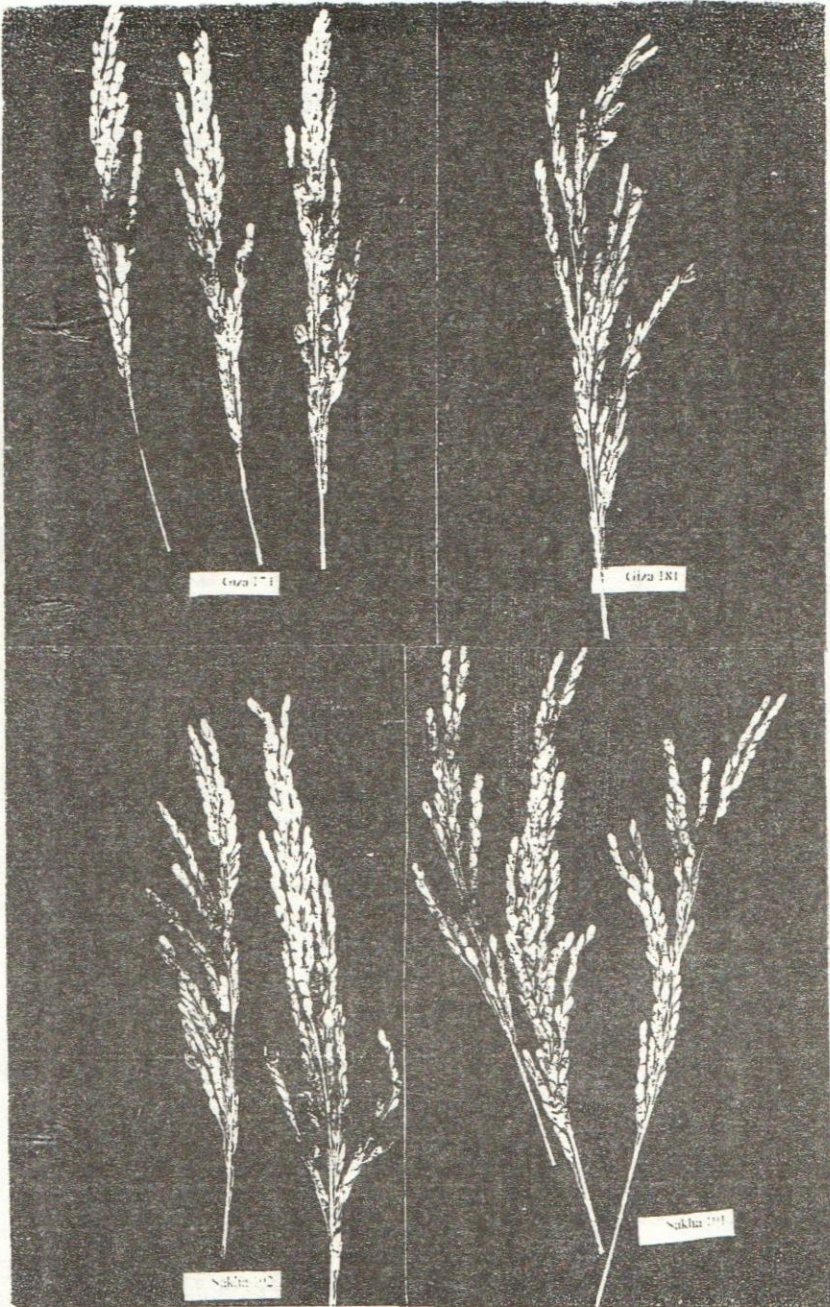
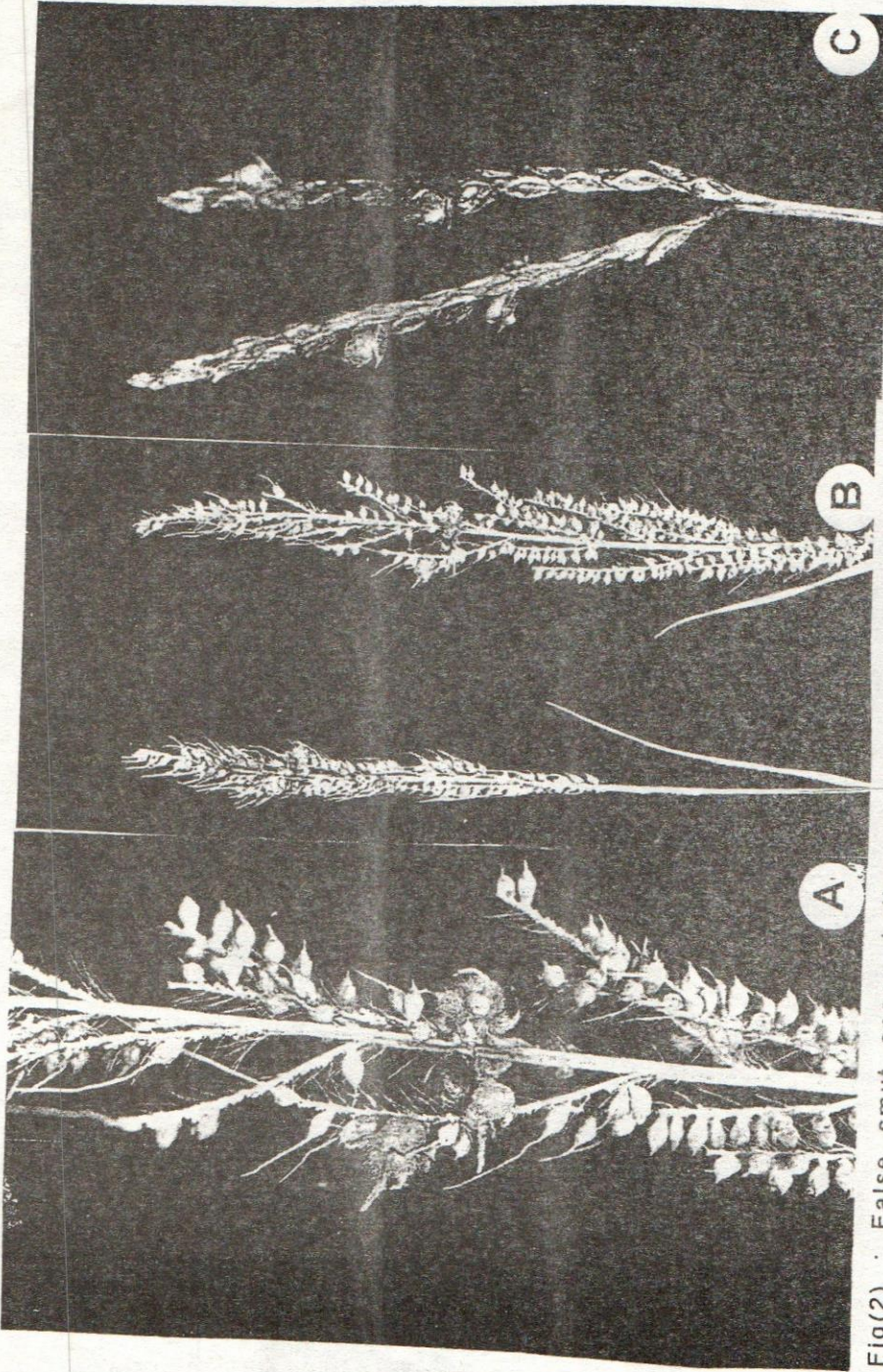


Fig (1) :False smut symptoms on the tested rice cultivars : Giza 171, Giza 181 and Sakha 101 and Sakha 102 .



Fig(2) : False smut spore balls on Barnyard grass inflorescence (A), on the compact and expanded Barnyard grass (B) and on knot grass (C).



Fig (3) :False smut spore balls replaced kernels of *E. crus-galli* (A), *P. distichum* (B) and *Oryzae sativa* (C)

Either chlamydospores from hibernating pseudomorphus (smutted grains) or ascospores from germinating sclerotia may act as primary inoculum to infect *D. marginata*. Kulkarni and Moniz, 1975 also suggested that chlamydospores in soil may germinate to produce secondary conidia which are dispersed by wind and rain to initiate infection. This action explains the role of other hosts in providing a new source of inoculum for rice infection which occurs at booting stage suggesting that conidiospores are the main source of infection.

It is worthy to note that the incidence of false smut disease on both Barnyard grass and Knot grass is considered a first record in Egypt.

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دور بعض الحشائش المنتشرة في زراعات الأرز في تكرار الإصابة بمرض التفحم الكاذب لمحصول الأرز
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تم تسجيل مرض التفحم الكاذب المتسبب عن الفطر يوستيلاجينويدى فيرنز لأول مرة في مصر على بعض الحشائش الشائعة بزراعات الأرز . وقد وجدت الإصابة بالمرض على الذنبية وعلى الحشيش المداد (النجيلية) وذلك من بين ١٤ نوع من الحشائش المنتشرة بزراعات الأرز . وكان التباين في شدة الإصابة بالمرض ملحوظا في مناطق مختلفة بالمحافظات الشمالية وعلى أصناف الأرز المنزرعة فى السنوات الأخيرة .

تمت دراسة الأعراض المرضية على كل من نباتات الأرز والحشائش المصابة . واطهرت هذه الدراسة الدور الذى تلعبه الحشائش المنتشرة بزراعات الأرز فى احداث العدوى بالمرض .