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OCCURRENCE OF RICE KERNEL SMUT INCITED BY *Tilletia barclayana* IN DAKAHLIA GOVERNORATE

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ABSTRACT

Rice kernel smut incited by *Tilletia barclayana* (Bref.) was reporeted on some rice plantation at El-Beda village, Temi El-Amdid district, Dakahlia Governorate, Egypt in 1999 growing season on Giza 171 and Giza 178 rice cultivars. Disease infection ranged from 2 to 7 %, while the disease severity varied from 2 to 10 %. Disease incidence and disease severity percentages were high in Giza 171 and Giza 178 followed by Sakha 101, while Riho cultivar had the lowest levels of disease incidence and disease severity. Total count of *T. barclayana* teliospores per one gram of rice seeds ranged from 4×10^5 to 15×10^5 spores.

INTRODUCTION

Rice is the major summer field crop in Egypt. Rice diseases are considered serious constraint for maximum yield production. Kernel smut is a common disease in most of rice growing countries, which causes economic losses and serious damage to rice flour due to the dark color from the smutted grains. Fulton (1908) and Morwood (1966) reported that rice kernel smut caused crop losses of 2 – 5 % in Burma. Rays (1933) noticed that when smutted seeds of rice were sown, the seedlings were stunted the number of tillers were reduced. Hassan (1971) reported that rice panicle infection due to this diseases was up to 87 % in Pakistan. Whitney and Frederiksen (1972) found that the disease also caused losses in rice production in USA. Gutierrez *et al.* (1998) stated that kernel smut caused by *Tilletia barclayana* occurred on semi-dwarf cultivars in the Corrientes and Formosa provinces. Cartwright *et al.* (1998) reported that kernel smut of rice continues to be a major problem in Arkansas, USA causing severe yield and quality losses. Biswas (1999) reported that the maximum percentage of infection with kernel smut disease of rice was 5 % and all tested cultivars were infected by *Tilletia barclayana* in West Bengal, India.

So, the present study aimed to confirm the presence of rice kernel smut disease and to conduct survey on the disease incidence in infected areas as well as to determine the percentage of disease incidence and disease severity. Also, it aimed to describe the disease symptoms, identify the pathogenic fungus and determine total count of teliospores per gram of rice seeds.

MATERIALS AND METHODS

1. Survey studies:

During summer growing season of 1999, rice feild at El-Beda village, Temi El-Amdid district, Dakahlia Governorate, Egypt, exhibited a new

symptoms on rice plants. Farmers were complaining from an infection of the rice panicals with some symptoms. According to these information survey was carried out by chose ten around the infected area. Five random samples were taken from each field, every sample contained one hundred plants. Mean percentage of infection was determined. Percentage of disease severity was also calculated by the following equation:

$$\text{Disease severity} = \frac{\text{Number of infected grains in penical X 100}}{\text{Total grains in penical.}}$$

2. Symptoms:

Figure 1 revealed that symptoms were seen only in maturity stage of rice plants. Few grains in certain panicles were infected. Symptoms of infection resembled that were described by Rays (1933), Hassan (1971), Bernhardt (1999) and Cartwright *et al.* (1999).

3. The pathogen:

Smut sori that produced within the ovaries were covered with glumes. Smutty kernel was containing black powdery mass of smut spores. Spores were examined using light microscope and described. The pathogen was identified according to Hassan (1971) and Kalman (1987).

4. Cultivars reaction:

Percentages of disease incidence and disease severity were calculated in the infected area for the different cultivars. These cultivars were Giza 171, Giza 177, Giza 178, Sakha 101 and Sakha 102.

5. Counted spores of *Tilletia barclayana* carried on rice seeds of different cultivars:

Samples of one gram of each cultivar (Giza 171, Giza 177, Giza 178, Sakha 101 and Sakha 102) were taken. Every seed sample for each cultivar was soaked in 100 ml of sterilized distilled water for 2 hours with mechanical shaking. One ml of the resulted spore suspension was examined under a microscope by using a Hemicytometer and spores were counted and estimated per one gram of seeds.

RESULTS AND DISCUSSION

Data in Table 1 indicate that the percentage disease incidence of kernel smut varied from 2 to 7 %, while the percentage of disease severity ranged from 4 to 10 % depending on the field site. Data in Table (2) show that the disease incidence percentage varied from one cultivar to another, where highest percentage of infection (7 %) was recorded with Giza 171 cv. followed by Giza 178 cv. (6 %) and Sakha 101 cv. (5 %), while, Rhio cv. and Giza 177 were the lower cvs. infected by kernel smut (2 % & 3 % respectively). Also, disease severity percentage differed according to the

cultivar. These results agreed with those obtained by Templeton (1961), Ou (1985), Biswas (1999) and Sharma *et al.* (1999). These results might be due to occurrence of infection from seeds or soil as well as the ambient conditions of soil and air were more appropriate need for the growth and reproduction of the pathogen in area than another.

Table 1: Mean percentage of disease incidence and disease severity of rice kernel smut (for Giza 178 rice cv.) in 10 field sites.

Field No.	Disease incidence%	Disease severity %
1	6	5
2	2	5
3	7	9
4	4	7
5	7	10
6	5	9
7	5	8
8	6	6
9	3	7
10	2	4
L.S.D. at 5 % =	1.8	2.9

Table 2: Reaction of some rice cultivars to the percentages of disease incidence and disease severity of rice kernel smut.

Tested Cultivar	Disease incidence%	Disease severity %
Giza 171	7	10
Giza 178	6	9
Giza 177	3	4
Sakha 101	5	4
Rhio	2	3
L.S.D. at 5 %. =	2.8	3.2

It is clear from Table 3 that total count of *Tilletia barclayana* spores in one gram of rice seeds varied from one cultivar to another. The highest count of spores was recorded with Giza 178 cultivar that reached to 15×10^5 spores/ gram followed by Giza 171 cultivar (12×10^5) without significant differences between them. Meanwhile, Sakha 101 cultivar gave moderately count of spores (7×10^5). In the contrary, Giza 177 and Riho had the least count of *T. barclayana* spores, which reached to 5×10^5 and 4×10^5 spores / gram seed respectively. These results had agreement with those of Ou (1985), Sharma *et al.* (1999) and Bernhardt (1999).

The differences in resistance and susceptibility for tested cultivars might be due to the differences in genetic structure and relationship between host and pathogen under the exiting environmental conditions, which play an important role in the cultivars resistance or susceptibility.

Table 3: Total count of *Tilletia barclayana* spores, which carried on one gram of rice seed of different cultivars.

Tested Cultivar	Total count of *T. barclayana* spores
Giza 171	12×10^5
Giza 178	15×10^5
Giza 177	5×10^5
Sakha 101	7×10^5
Rhio	4×10^5
L.S.D. at 5 % =	3.9×10^5

Symptoms:

The disease was observed on rice panicle in maturity stage as illustrated in Fig 1. Smutted grains can be easily removed from panicle and they become lighter when completely smutted compared with healthy rice kernels. The hulls of smutted kernels appear dull gray and smutty. Infected kernel contained black powdery mass of smut spores. these results were similar to the results obtained by Whitney and Frederiksen (1972), Ou (1985) and Bernhardt (1999). These results may indicate that the pathogen has completed his life cycle

Fig. 1: Symptoms of kernel smut on infected rice seeds, which are containing black powdery of smut spores

Pathogen:

Smut sori were produced within the ovaries which still covered with the glumes resulted burst at the rice maturity stage. Spores granular and black mixed with few globose, hyaline to yellowish, from 10 to 30 µm in diameter. Spores globose to subglobose, were first light then dark brown at maturity as illustrated in Fig. (2). These results were in agreement with the finding of Hassan (1971), Kalman (1987), Bernhardt (1999) and Sharma *et al.*(1999).

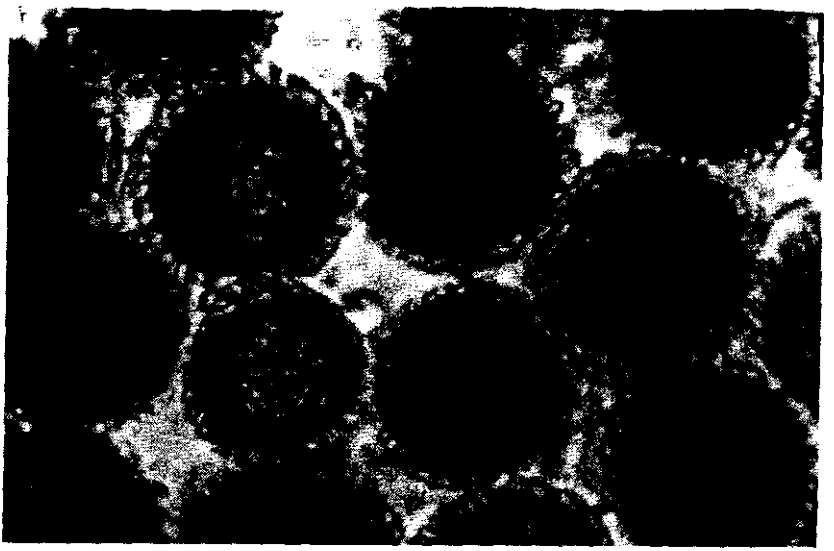

Fig. 2: Teliospores of *T. barclayana* and sterile cells obtained from infected seeds (X 800).

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حدوث مرض تفحم الحبوب في الأرز المتسبب عن *Tilletia barclayana* بمحافظة الدقهلية

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تم تسجيل مرض تفحم الحبوب في الأرز بقرية البيضا – مركز تمي الأمديد – محافظة الدقهلية على الصنف جيزة ١٧١ و الصنف جيزة ١٧٨ وقد تراوحت نسبة الإصابة بهذا المرض بين ٢ – ٧ % ، بينما تراوحت شدة الإصابة بين ٢ – ١٠ % ، وقد تم التعرف على أعراض المرض و تعريف المسبب المرضي بأنه فطر *Tilletia barclayana* ، و قد تباينت نسبة الإصابة و شدتها من صنف إلى آخر، حيث كانت مرتفعة بالصنف جيزة ١٧١ أعقبه الصنف جيزة ١٧٨، أما الصنف سخا ١٠١ فكان متوسط الإصابة، بينما كان الصنف ريهو اقل الأصناف في نسبة وشدة الإصابة، و قد تراوحت أعداد الجراثيم التيليتية المحمولة على البذرة بين ٤ ×١٠^٥ إلى ١٥ × ١٠^٥ جرثومة/ جرام بذرة.