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COMPARISON OF RESISTANCE RATE IN TEN WHEAT *(TRITICUM AESTIVUM)* VARIETIES AGAINST COMMON BUNT DISEASE CAUSED BY *(TILLETIA TRITICI)*

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Abstract

Pots experiment has been conducted in the 2017 – 2018 season in plant protection directory / Abu-ghreeb / Baghdad. Ten wheat varieties were used in recent study (Bohooth10, Bohooth22, Bohooth95, Bohooth158, Ipaa99, Sham6, Abu-ghreeb, Adenh, Latefiya and Rasheed), to study their resistance and susceptibility to the one *T.tritici* isolate which causing common bunt disease on wheat crop. Seeds of wheat contaminated with teliospors of *T. tritici* isolate and sowing in pots at three replication for each variety, the incidence ratio, plant height and length of spike was estimated at the end of growth season. Lowest incidence ratio observed in Rasheed, Bohooth 95 and Bohooth 10 (0.0, 1.5, 1.8) % respectively without significant differences between them, highest incidence ratio was recorded in Bohooth 22 variety 33% with significant differences comparison with other varieties. Other tested variety recorded incidence ratio about (23-27) %. Result from this study show reduction in plants height and length of spikes in the all bunted plants with significant differences comparison with the control (healthy plants). from recent study can be concluded, wheat varieties differs in their resistance and susceptibility to common bunt disease, and this disease caused reduction in the plant height and length of spike in the bunted plants.

Key words : common bunt, wheat, resistance, susceptibility.

Introduction

Wheat *(Triticum aestivum*) is one of the most important cereal crop in the world (Mokhtar, and Dehimat, 2013), its importance due to frequently experienced food shortage and its role in world trade (Majeed, *et al.*, 2017). Wheat rank first among the cereal crops accounting for 30% of all cereal food worldwide and major food for over one- third of world people, that provide about 20% of the total food calories directly or indirectly for human (Namvar, and Khandan, 2013). Wheat seed are a favorable medium for pathogenic mycoflora and carrying them (Mokhtar, and Dehimat, 2013), common bunt is the major seed born disease posing a threat to wheat production, its caused by two closely related fungi *(Tilletia caries* [syn.*T. tritici*] and *T.laevis*[syn. *T.foetida*) (matanguihan, and Jones, 2011), (Yarullina, *et al.*, 2014).This disease has been observed in different areas all over the world and it's still a major problem especially,in north Africa and west Asia (El-Naimi, *et al.*, 2000) and (Waldo, and Jahn, 2007).This problem resulting in losses in yield and seed quality.

Common bunt is not easily identified until the time wheat is in heading stage. Infected plants generally produce fewer and smaller ears or spikes and may be slightly stunted due to common bunt. At flowering, infected spikes look more slender than healthy spikes and appear dull with a blueish-grey cast, remaining green longer. At maturity, infected spikes stand erect because of their light weight, and look plumper and open compared to normal spikes. Kernel tissues within the seed coat are replaced by a mass of black spores that turn oily and acquire a foul odor, Bunt balls become visible after the soft dough stage and begin to break open, revealing the black powdery spores (teliospores). Bunt balls of common bunt are about the same size and shape as the kernels they replace. (Schultz and French, 2009)

In Iraq this disease considered one of the most

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important disease, its attack all wheat varieties (rough and smooth) especially in the north region, and also in the middle and south governorates. (Hassan, 2006).

In past resistance to bunt was not important for traditional breeders and farmers due to the availability of effective chemical treatment in conventional farming (Poyraz, and Gumus 2016). But, strong use of chemical composition in agriculture disturbed ecological balance of the soil and cause pollution of environment (majeed, *et al.,* 2017). Organic farming demand a reduction in chemical seed tools for control of plant disease such as common bunt,the use of partially and complete resistant wheat varieties is one of the important bunt protection strategy, besides of fungicide treatments (Waldo, and Jahn, 2007).

The aim of this study is to detect resistance and susceptible varieties in ten wheat varieties cultivated in Iraq for common bunt disease and the secondary effect of the disease on the infected plants.

Material and Methods

The study was carried out in plant protection directory /ministry of agriculture Abu- ghreeb/ Iraq, in 2018 -2019 season.

Wheat varieties

Ten wheat varieties were used in this study obtained from state broad of agriculture research/ ministry of agriculture Abu- ghreeb (Table 1).

Table 1: Wheat varieties used in this study.

Treatments	Wheat varieties
T_1	Bohooth 10
T_2	Bohooth22
T_3	Bohooth95
T_4	Bohooth158
T_5	Ipaa 99
T_6	Sham 6
T_7	Abu- ghreeb
T_8	Adenh
T_9	Latefiya
T_{10}	Rasheed

Implementation of experiment

Seeds of ten wheat varieties were contaminated with *T.tritici* isolate spores obtained from Dr. Ali Kareem Al_ taei /college of agriculture / Mosel university. The seeds of wheat mixed at 3 gm of teliospores/1Kg seeds (Shams Allaha, 2005), mixed them very well until the kernels were fully covered with the spores. The inoculation seeds were sowing in pots, each one containing 10 Kg sterile soil, twice, at 121 C _ 1 bar for 1 hr.

Ten seeds of each variety were sowing in each pot at three replication, for each variety, and three pots sowing with normal kernels of wheat without contaminating with teliospores for each variety as a control treatment.

The experimental design was complete randomized design CRD. At the end of growth season, plants height, length of spikes and the percent of incidence ratio was scrod on each variety.

Incidence ratio (I.r) estimated y using the following :

I.r = number of bunted or infected spikes / total number of spikes per experiment unit *100 (Shams Allaha, 2005, murad *etal* 2018).

The percent of plant height and length of spike reduction calculated as following :

Reduction percent = differences between the two value/ highest value * 100 (Dumalasova and bartos 2007).

wheat varieties was classified depending on their susceptibility and resistance to common bunt infection into five classes (Shams Allaha, 2005):

Infection

Incidence	Reaction class
0 – 10 %	resistance R
11- 30%	moderate resistance MR
31 – 50 %	moderate susceptible MS
51 - 70	susceptible S
Over 70%	highly susceptible HS

Analysis of variance was carried out using Genstate computer software packages. Comparison of mean was investigation using L.S.D. at 0.05 % probability.

Results and Discussion

The results shows in table 2, bunt incidence ratio differs from one variety to another. Rasheed variety recorded the lowest incidence ratio 0.0%, whereas, Bohooth 22 recorded highest incidence ratio 33%. All control treatments of all varieties showed no infection with this disease with 0% incidence infection.

Table 2 shows the lowest incidence ratio was in three wheat varieties, Rasheed, Bohooth 95 and Bohooth 10 with (0.0,1.5,1.8) % respectively, without significant differences between them. Abu –ghreeb variety recorded 8% incidence ratio with a significant differences from other varieties. Table 2 shows, highest incidence ratio which, 33% recorded in Bohooth 22 variety with a significant differences comparison with all other tested wheat varieties. Other varieties recorded different

Table 2: Common bunt incidence ratio against ten wheat varieties in pots experiment.

Wheat varieties	Incidence ratio%
Bohooth 10	1.8
Bohooth22	33
Bohooth95	1.5
Bohooth158	25.5
Ipaa 99	27
Sham 6	25
Abu- ghreeb	8
Adenh	27
Latefiya	23
Rasheed	0
L.S.D.	2.23

incidence ratio (23 – 27)% depending on their susceptibility to this *T.tritici* isolate.

According to (Shams Allaha, 2005) our results classified the ten tested wheat varieties into three groups, Rasheed, Bohooth 10, Bohooth 95 and Abu-ghreeb as resistant verities, whereas Bohooth158, Ipaa99, Sham6, Adenh and Latefiya considered as moderate resistant varieties, then Bohooth 22 considered as moderate susceptible variety to this *T.tritici* isolate (Table 3).

The resistant varieties may be due to presence a

Table 3: Susceptibility and resistance of ten tested wheat varieties to the *T. tritici* isolate.

Wheat varieties	Incidence ratio%	Class of infection
Bohooth 10	1.8	R
Bohooth22	33	MS
Bohooth95	1.5	R
Bohooth158	25.5	MR
Ipaa 99	27	MR
Sham 6	25	MR
Abu- ghreeb	8	R
Adenh	27	MR
Latefiya	23	MR
Rasheed	0	R

resistance gene/s to this *T. tritici* isolate in their genome, which named (Bt) and include 16 gene (Bt1 – Bt15) and Btp. (Stefan, *et al.*, 2017).

Our result does not mean these varieties are resistance to common bunt disease because they may be susceptible to another *T.tritici* isolates, where the incidence ratio with common bunt differs in the same cultivar or variety from one *T. tritici* isolate to another. The virulence of certain isolate differs from one wheat variety to another (Dumalasova and bartos 2007).

The susceptibility of these varieties to this certain isolate may by returned to lack the resistance gene/s in their genome or because dysfunctional mutant in Bt gene form (Poyraz, and Gumus 2016).

Identification the resistance and susceptible wheat varieties to common bunt disease required tested many isolates of the pathogen and mixture from different isolates against many wheat varieties, and repeat the experiment for more than one growth season (Dumalasova and bartos 2007); (Poyraz, I. and N. Gumus 2016).

Genetic detection for resistance Bt gene/s by using DNA marker techniques also very important for determination and identify the resistance and susceptible wheat varieties for common bunt disease. (Poyraz, and Gumus 2016); (Stefan, *et al.*, 2017).

The Secondary effect of common bunt on wheat varieties are shown in table 4.

The observation from table 4 the inoculation plants of all the ten verities recorded reduction in their height of plant and length of spike comparison with the control to each variety.

Differences in the plant height were significant in the infection plants even in the wheat varieties with low incidence ratio comparison with control plants (Fig. 1) except in Rasheed variety which was not recorded significant differences. The most reduction in height of plant was in Latefiya, Abu- ghreeb and Bohooth 158 varieties that recorded (21%, 15.96% and 15.3% cm) respectively, whereas the lowest reduction was in Rasheed, Bohooth 10 and Bohooth 95 (2.49% 4.5% and 6.13% cm) respectively.

The differences in the reduction of plant height depend upon the variety, environmental condition and on the genotype of the pathogen. Reduction in the stem length of the infected plants may be because, to the reduction in the plants root system (Dumalasova and bartos 2007 (. The results in this recent study are similar to the (Huszar 1993) how observed reduction in plants height about 23.2%, 28.2% and 54.1% in the infected plants comparison with the control. Our results in the same line with Dumalasova and bartos (2007 (,who mentioned the common bunt infection reduce the plant height in their tested wheat varieties. But our results dose not similar to Mourad, *et al.*, (2018) who were found the common bunt infection increase the plants height in the bunted plants.

Spike length also measured in our study and we observed significant reduction in the spike length in the infected plants comparison with control in all tested varieties (Fig. 2) except in Rasheed variety that recorded

Table 4: The secondary effect of the common bunt disease on the plant height and length of spikes in tested wheat varieties.

Wheat varieties	Treatments	Plant height /cm	Reduction in plans high (in %)	Length of spike/cm	Reduction in spike length (in %)
Bohooth 10	Seed + pathogen	78.3	4.50	12.5	6.0
	Control	82.0		13.3	
Bohooth 22	Seed + pathogen	66.8	13.58	10.2	9.7
	Control	77.3		11.3	
Bohooth 95	Seed + pathogen	76,3	6.13	10.8	6.1
	Control	81.3		11.5	
Bohooth158	Seed + pathogen	69.7	15.3	10.2	17.1
	Control	82.3		12.3	
Ipaa 99	Seed + pathogen	74.0	8.64	9.3	29.5
	Control	81.0		13.2	
Sham 6	Seed + pathogen	69.8	9.35	7.1	23.6
	Control	77.0		9.3	
Abu - ghreeb	Seed + pathogen	70.0	15.96	9.5	13.6
	Control	83.3		11	
Adenh	Seed + pathogen	75.3	10.67	8.1	14.7
	Control	84.3		9.5	
Latefiya	Seed + pathogen	65.0	21.00	8.0	25.9
	Control	82,3		10.8	
Rasheed	Seed + pathogen	78.3	2.49	13.1	2.9
	Control	80,3		13.5	
L.S.D.		3.08		0.43	

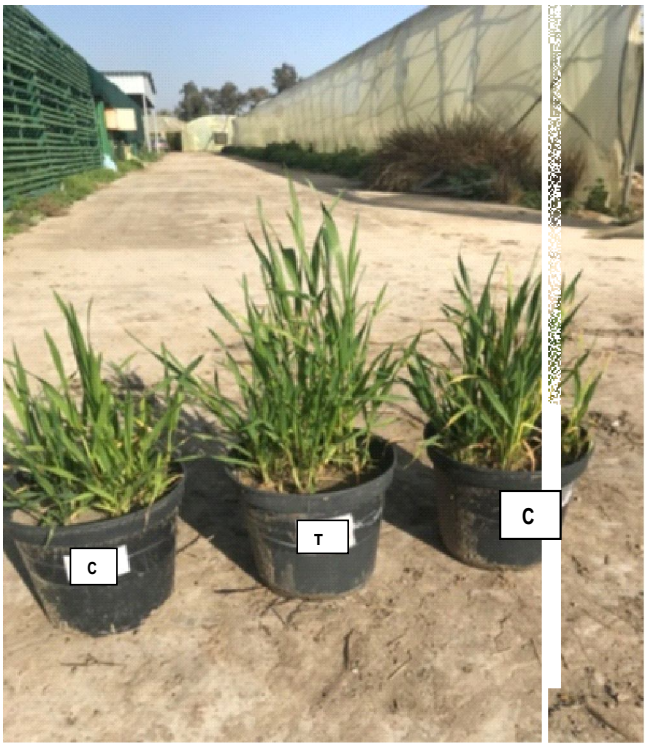

Fig. 1: Reduction in the plant height caused by Common bunt infection..T(infected plants)..C (control)

Fig. 2: Reduction in the length of spike caused by Common bunt infection..T (infected plant)..C(control).

statically non- significant reduction.

Most reduction in spike length was in ipaa99, Latefiya and Sham6 (29.5%, 25.9% and 23.6% cm) respectively,

whereas the lowest reduction was in Rashee, Bohooth 10 and Bohooth 95 varieties with (2.9%, 6% and 6.1%) respectively. The spike length were described by other author Dumalasova and bartos (2007 (who found the infection of wheat plant with common bunt caused reduction with the spike length about (6.6% and 1.7%) comparison with healthy plants. But these results not in the same line with the Murad, *et al.,* (2018) who recorded increased in the spike length in the infected wheat plant with common bunt disease.

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