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Survey, races identification and host range of wheat seed gall nematode *Anguina tritici* in Duhok province, Kurdistan region – Iraq

Sulaiman Naif Ami Ibrahim EsaTaher
Department of Plant Protection, Faculty of Agriculture and Forestry, University of Duhok, Kurdistan Region - Iraq

Abstract: *A survey of silos of Duhok province which involved silo of Zakho, Faydeyi, Shekhan in 2010 and 2011 revealed that the highest percentage of infested seeds by seed galls were 10.76 and 13.03% for samples of bread and durum wheat respectively in Faydeyi silo in 2011.*

Among durum wheat cultivars (c.vs) Arey cv. was more susceptible to wheat seed gall nematode Anguina tritici which was infected by 65.33% compared to 37.12% in Wahe cv.as the lowest percentage of infection. In Bread cvs.the highest percentage of infection by nematode was 72.85% in Maxipak cv. While the lowest was 42.17% in Cham-4 cv. Detection of the pathogen host range on several poaceae plants indicated that weed plants which were involved Oat (Avena fatua), Ray grass (Bromus inermis),darnel or cockle (Lolium temulentum) and small canary grass (Phalaris minor) with two barley cvs. (Abae99, Aksad13) did not affected by this nematode except Triticale (Rowaeda cv.) which was infected by b 20.32%. Results of host range study referred to the existence of new race of this nematode in Duhok province due to its ability to parasitism on both durum and bread wheat cultivars.

Keywords: *Anguina tritici,surveying, identification of races, host range study.*

I. Introduction

Anguina tritici (Steinbuch, 1799) Filipjev, 1936 (Anguinidae ,Tylinchida) was observed at the first time in England by John Needham in 1743 (Perry and Moens, 2006). Bhatti,et al.,(1978) stated that Ear- cockle was the oldest reported disease of wheat which was caused by *A. tritici*. It is one of the major aerial diseases in tropical and sub-tropical countriesthat causes sustainable losses in wheat (Kort,1972), and It ispresent wherever wheat is grown and this pest still common in Eastern Europe and in part of Asia and Africa (Agrios, 2005). It is one of the major aerial diseases in tropical and sub-tropical countriesthat causes sustainable losses in wheat (Kort,1972), and It isIn Iraq, the first record of ear-cockle disease reported by Rao in 1921. This nematode still an important nematode pest in Iraq occurred in the most wheat growing areas by 22.9 to 45% on mexipak c.v. of Wheat. (Al-Beldawi et.al.1974) increased to 75% on the same cultivar in Duhok Province in 1989 (Stephan and Antoon,1990), Ami, et.al.,(2004) reported records of nematode detection in the USA included California, Georgia, Maryland, New York, North and South Carolina, Virginia and West Virginia (CABI, 2005). In Iraq, the first record of ear-cockle disease reported by Rao in 1921. This nematode still an important nematode pest in Iraq occurred in the most wheat growing areas by 22.9 to 45% on mexipak c.v. of Wheat. (Al-Beldawi et.al.1974) increased to 75% on the same cultivar in Duhok Province in 1989 (Stephan and Antoon,1990), Ami, et.al.,(2004) reported that the percentage of infestation by galls reached its maximum value (50%) in bread wheat in Bashika - northern of Iraq. Ear- cockle disease reduces human consumption and market price of wheat (Paruthi and Bhatti, 1988),with significant reduction in the protein and gluten contents of the flour product of infested wheat with seed galls (Mustafa , 2009).

The aim of this study is to determine the occurrence of ear –cockle disease in wheat seeds sent to silos of Duhok province and then identifications nematode races studying its pathogenicity and host range.

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II. Material and Methods

II.1**-Calculation percentage infestation in wheat seeds by wheat seed galls in silo of Zakho, Faydia and Shekhan (Esefni) during summer 2010 and 2011:**

Samples were taken with an aid of sample collector tool to get clear idea of infection percentage of ear-cockle disease in wheat fields at Duhok province. 100 Samples at the rate of 50 samples for each of bread and durum wheat were taken randomly, samples were brought to laboratory and percentage of wheat seed infestation was calculated for each sample.

II.2-Seed galls (ear-cockle) collection: Galls were collected handmade from infested samples of wheat (Cham-6 c.v.) obtained from Kamaka village – Duhok.

II. 3-Races identification of *A. tritici* and their host range:

Four durum wheat cultivars ″c.vs.″ (Aras, kreso, LD357E, wahe), four bread wheat c.vs.(Maxipak, Abae99, Abo-goreb3, Cham4), Two Barley c.vs. (Abae99, Aksad13) and Triticale (rowaeda c.v.), Oat (Avena fatua), Smooth brome grass (*Bromus inermis*), darnel or cockle (*Lolium temulentum*) and small canary grass (*Phalaris minor*), were sown in 15/ January-2011 (five seed for each) in pots 20 cm in diameter containing sterilized soil (by formalin 1%) and infested with five wheat seed galls of bread wheat c.v. brought from kemeka village- Duhok- Kurdistan region- Iraq. Galls were buried intervals between seeds in 1cm holes at the rate of one gall / hole, Pots were plunged randomly in the trenches. This experiment carried out in one of the fields of Faculty of Agriculture and Forestry, University of Duhok. Pots irrigated when needed.This trail consisted of 120 experimental units (15 plant c.vs. × 2 level of infestation "infested and non-infested soil" × 4 replicates) and conducted in Factorial Randomized complete Block Design (RCBD).In the end of the growing season the Following criteria were calculated:

a-Percentage of infection = (number of infected plants / total number of plants in pots)×100

b- Number of seed galls.(galls/spike or plant). c- Weight of seed galls.(mg/gall). d- Population density of second stage juveniles / dry gall. e- % Reduction of seed weight = ({ seed weight in non – infested soil (control) – seed weight in infested soil }) ÷ Seed weight in control treatment] × 100

Data were analyzed using SAS program and means were compared using Duncan's Multiple Range test P=0.05 (SAS, 1999).

III. Results and discussion

III.1- Differences of silos,years and wheat type in percentage infestation of with galls of *A. tritici* : Faydeyi silo had more infested wheat seeds with galls (8.14%) followed by Zakho silo While less infestation (3.66%) recorded in Shekhan silo. In general wheat seeds produced in 2011 were more infected (7.2%) compared to (3.8%) wheat seeds of 2010 which may be due to planting of the same contaminated wheat seeds. Bread wheat seeds were more infestation (5.87%) with galls than that of Durum wheat seeds 5.12% (Fig.1) .

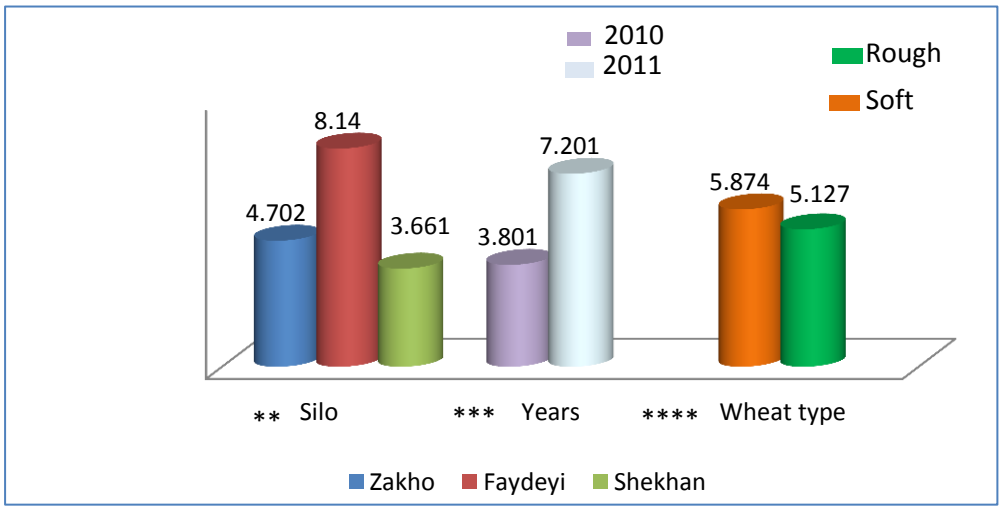

Fig.(1) Difference of silos, years and wheat type in percentage of infestation with galls of *A. tritici**means followed by different letters are significantly differ based on Duncan's Multiple Range test (P=0.05).

** Silo means: each number is mean of 200 values (2 years × 2 wheat types × 50 replications).

*** Years means: each number is mean of 300 values (3 silo × 2 wheat types × 50 replications).

**** Wheat type means: each number is mean of 300 values (3 silo × 2 years × 50 replications).

However increasing of bread wheat infection may be due to its severe susceptibility to *A. tritici* , in addition to its widespread cultivation upon which bread production is dependent (Pomeranz, 1987).

III.2-The percentage of wheat seeds infestation as affected by wheat type during 2011-2012 in different silos:

The less infestation of bread wheat seeds was 2.68% compared to 1.96% of durum wheat seeds brought from silo of Shekhan in 2010 (Table.1) .This result also reported by Ami. *et al.,* (2004) who confirmed that infestation of Bread wheat was more than durum wheat in Shekan silo in 2001, whereas the highest infestation of bread seeds (10.76%) was found in Faydeyi Silo in 2011 compared to 13.03% of durum wheat seeds. These variances between seeds infestation during 2010-2011 in the silos might be due to crop rotation (sowing of other crops or other wheat c.v.) which decreased inoculum source for next years, this also recorded in Zakho Silo on Durum wheat in which infestation percentage declined from 5.21% in 2010 to 4.98 % in2011 or planting of the same wheat c.v. which led to increase seed infestation for next year as in other silos.

Table (1):The percentage of wheat seeds infestation as affected by wheat type during 2011-2012 in different silos.

Years	Silos	Infestation percentage of wheat Seeds (%)	
		Bread wheat	Durum wheat
2010	Zakho	4.18 bc	5.21 bc
2011		4.42 bc	4.98 bc
2010	Faydeyi	6.46 abc	2.30 c
2011		10.76 ab	13.03 a
2010	Shekhan	2.68 c	1.96 c
2011		6.72 abc	3.27 c

*Means followed by different letters are significantly differ based on Duncan's Multiple Range test (P=0.05)*Eeach value is a means of 50 replicates.

III.3-Host range and race(s) identification of *A. tritici*:

The highest infection among durum and bread wheat cultivars were (37.12 %), (65.33%) in Arey and Maxipak cultivars respectively. Susceptibility of Maxipak c.v. comport with the results of the previous studies in Iraq **(**Al-Beldawi*et al.,* 1977**,** Fattah, 1988**,**Saleh and Fattah, 1990andStephan *et al.,* 2000**).** Triticale (rawaedac.v.) was also infected by 20.32%. Barley cultivars and the other plants of Poaceae did not infected by *A. tritici* (Fig. 2).

This result rejects the idea that nematode isolated from bread wheat invaded only bread wheat cultivars and nematode from durum wheat attacked durum wheat cultivars. Thus, races had been recorded by Stephan *et al.,* (1991) in addition to another new race of *A. tritici*, collected in 1998 recorded for the first time by Stephan *et al.,* (2000) based on differences in their effects on wheat plants such as spikes number and seeds production.

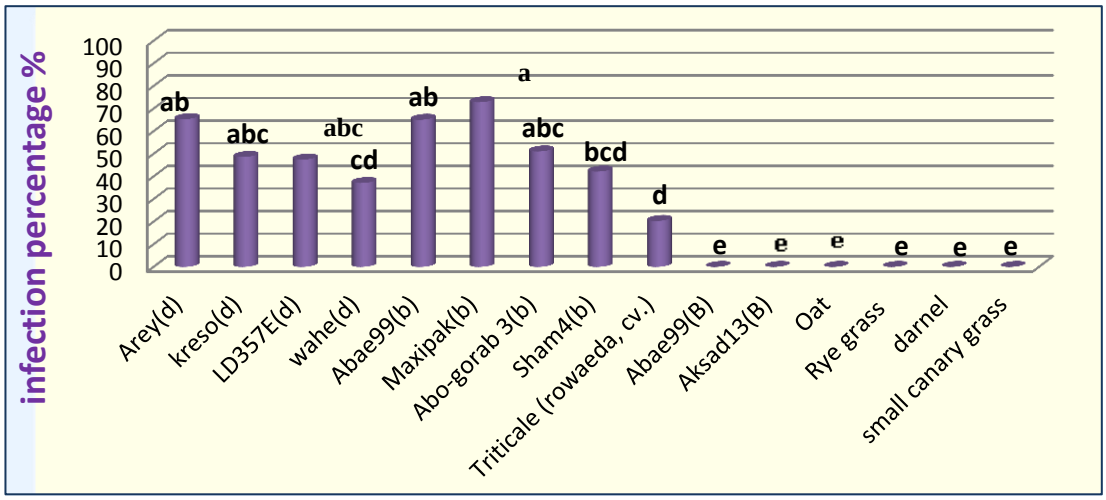

Figure (2) Susceptibility of Wheat, Barley cultivars and some Poaceae plants to *A. tritici*.

*Means followed by different letters are significantly different based on Duncan's Multiple Range test (P=0.05). *d= durum, b= bread and B= barley

These three races don't resemble to the 2nd stage juveniles (J_2) population used in this study in its behavior of infection and this might be referred to new races of *A. tritici* which have ability to infect different cultivars of durum and bread wheat and incapable to infect Barley cultivars. This result have been found by Mustafa (2009) who reported that *A. tritici* isolated from wheat plants could not parasite on barley plants. Al-Talib*et al.*, (1986) recorded a new race of barely plants named barley race.

Therefore, there are five races of *A. tritici* in Iraq on wheat and barley. Oat (*Avena fatua*), darnel or cockle (*Lolium temulentum*) and small canary grass (*Phalaris minor.)* were not infected and this result also proved by Stephan *et al.*, (2000). Smoth brome grass (*Bromus inermis*) also did not infect. Disinfection of the barley cultivars and other tested poaceae plants may be attributed to their possessing genetic characters prohibit nematode attraction to them as a result of releasing repellent materials for nematodes (Allelopathy) by their roots (root exudates) or disability of J_2 to parasite on them after climbing their seedlings. Results of infection criteria demonstrated that wheat cultivars and triticale had significant effect on the number of galls appeared as a result of infection, no galls were found in each of Abae99,

Table (2) response and susceptibility of wheat cultivars to seed gall nematode *A. tritici.*

criteria / cultivars	Galls/plant	Numbers of J2/gall	Seed weight(gm/plant)		Seed weight Reduction percentage (%)
			Infested soil	Non infested soil	
(d)	13.71 ab	6125 a	10.4 efg	19.05 a	45.6 b
Kreso(d)	13.83 ab	6000 a	8.4 gh	13.23 dce	36.5 bc
LD357E(d)	8.203 bc	6175 a	6.4 h	14.63 bcd	56.3 a
Wahe(d)	9.79 b	6183 a	9.99 efg	13.55 bcde	26.2 d
Abae99(b)	0 d	0 b	9.95 efg	13.32 cde	24.3 d
Maxipak(b)	18.80 a	9623 a	8.36 gh	12.05 def	30.6 c
Abo-ghoraib3(b)	0 d	0 b	9.45 fgh	14.73 bcd	36.5 bc
Cham4(b)	0 d	0 b	10.9 efg	15.91 abc	31.6 c
Triticale (rowaeda)	9.93 b	9199 a	10.5 efg	16.86 ab	38b c
Control (not infested)	0 d	0 b	×××××××××××××××××××××××××××××××× ××××××		

*Means followed by different letters are significantly different based on Duncan's Multiple Range test (P=0.05).
*Each number is means of 4 replication.

Abu-ghoraib3 and Cham4, while the highest number of galls (18.8 gall/plant) was found in bread wheat cultivars Maxipak with significant difference with each of Arey and Kereso as durum wheat cultivars (Table. 2). Results also indicated that J_2 density in each gall didn't differ significantly among all tested hosts, in general the highest number (9623 J_2/gall) was found in Maxipak cv. While the lowest (6000 J_2/gall) in Kerso (durum wheat).More reduction percentage in seed yield (56.3%) as a result of infection was harvested from durum wheat (cv.LD357E) followed by the c.v. Arey (d) (45.6%) then Triticale (38%), while the lowest reduction percentage in seed yield (24.3%) was observed on Abae99(b) cv. with decreasing of seed yield from 13.32 to 9.95 gm.

Differences in gall number/plant and J_2/gall are due to host genotypes and their susceptibility to *A. tritici* (Hamood and Fattah, 1989).No galls formed in Abae99, Abo-ghraib3 and Cham-4 cultivars which indicated that *A. tritici* Have not been able to complete their life cycle after climbing of seedlings, due to the fail of these cultivars to supply adequate essential nutrients for nematode juveniles. Yield reduction in the same host plant may be attributed to the effect of J_2 on seedlings and heading of mature plants.

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