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REACTION OF WHEAT GENOTYPES TO INFECTION BY *ANGUINA TRITICI*

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Anguina tritici (Steinbuch, 1799) Filipjev, 1936 is an important parasite of wheat in some regions of the world including Iraq. The disease occurs in most Provinces of Iraq and all wheat cultivars planted are susceptible with the exception of cv. Saberbeg which is highly resistant or " immune " (Al-Beldawi, Stephan & Alwan, 1977; Al-Beldawi *et al.*, 1977).

This work was done to evaluate the reaction of 32 genotypes of wheat to infection by *A. tritici.*

Twenty five seeds of each genotypes (Tab. 1) were sown in the field on January 27, 1987 for 1987 season and December 15, 1987 for 1988 season. Seeds were planted in plots 100 × 50 cm in a single line and 4 cm deep. Seeded lines were covered to depth of about 1 cm with 500 ml of sandy soil before inoculation with the nematodes : aqueous suspensions (50 ml) of second stage juveniles of *A. tritici,* prepared by extracting the nematodes from 0.1 g of seed galls, were spread evenly over each seed line. Inoculated lines were covered with soil to a height of 3 cm and watered with 250 ml of tap water. This method of inoculation produced the highest disease incidence (Fattah, 1988). Each treatment was replicated three times and RCBD was used. At spike maturation percentages of infected plants were calculated.

The results indicated a differential reaction of the genotypes tested to infection by *A. tritici.* Significant ($P = 0.05$) differences in percentages of infections are clearly represented in Fig. 1. This differential reaction was mainly related to the genetic variation of the genotypes. Some of the genotypes tested are variants resulting from selections after fast neutron treatments of hybrids between Saberbeg and Mexipak wheat cultivars. The former is highly resistant or " immune " (Al-Beldawi, Stephan & Alwan, 1977) and the latter is very susceptible (Fattah, 1988).

Table 1

Tested wheat genotypes

Index	*Genotype**	*Variant or mutant origin*	*Treatment*	*Generation*	*Index*	*Genotype*	*Variant or mutant origin*	*Treatment*	*Generation*
13	336	Saberbeg x Mexipak	400 r (Nf)**	F_6M4	19	723	Sab. x Mexipak	1 200 (Nf)	F_6M4
7	337	Saberbeg x Mexipak	400 r (Nf)	F_6M4	24	749	Sab. x Mexipak	1 200 (Nf)	F_6M4
9	339	Saberbeg x Mexipak	400 r (Nf)	F_6M4	20	800	Sab. x Mexipak	1 200 (Nf)	F_6M4
29	342	Saberbeg x Mexipak	400 r (Nf)	F_6M4	18	802	Sab. x Mexipak	1 200 (Nf)	F_6M4
27	345	Saberbeg x Mexipak	400 r (Nf)	F_6M4	8	1 462	Sab. x (Mex. x Abg 4)	400 (Nf)	F_6M4
30	346	Saberbeg x Mexipak	400 r (Nf)	F_6M4					
31	347	Saberbeg x Mexipak	400 r (Nf)	F_6M4					
25	350	Saberbeg x Mexipak	400 r (Nf)	F_6M4	6	1 463	Sab. x (Mex. x Abg 4)	400 (Nf)	F_6M4
17	351	Saberbeg x Mexipak	400 r (Nf)	F_6M4	3	1 464	Sab. x (Mex. x Abg 4)	400 (Nf)	F_6M4
32	352	Saberbeg x Mexipak	400 r (Nf)	F_6M4	15	1 465	Sab. x (Mex. x Abg 4)	400 (Nf)	F_6M4
					1	1 466	Sab. x (Mex. x Abg 4)	400 (Nf)	F_6M4
28	405	Saberbeg x Mexipak	400 r (Nf)	F_6M4					
12	538	Saberbeg x Mexipak	800 r (Nf)	F_6M4	23		Sab. x Mexipak	–	F_6
22	582	Saberbeg x Mexipak	800 r (Nf)	F_6M4	16		Sab. x (Mex. x Abg 4)	–	F_6
11	583	Saberbeg x Mexipak	800 r (Nf)	F_6M4	5		Mexipak	–	F_6
21	588	Saberbeg x Mexipak	800 r (Nf)	F_6M4	4	Mut. I	Saberbeg	13 000 r (γ)***	M_{10}
26	619	Saberbeg x Mexipak	800 r (Nf)	F_6M4	10	Mut. II	Saberbeg	13 000 r (γ)***	M10
14	650	Saberbeg x Mexipak	800 r (Nf)	F_6M4	2	Mut. III	Saberbeg	13 000 r (γ)***	M10

* Wheat genotypes were provided by Dr. I. F. Ibrahim, Dept. Pl. Prot., Facu. Agr. & Biol. NRC PO Box 765, Baghdad, Iraq.
**Nf = Fast Neutrons. Irradiated at Baha Baha, Indian NRC at rates of 71.43 r/min.
*** γ = Gamma rays.

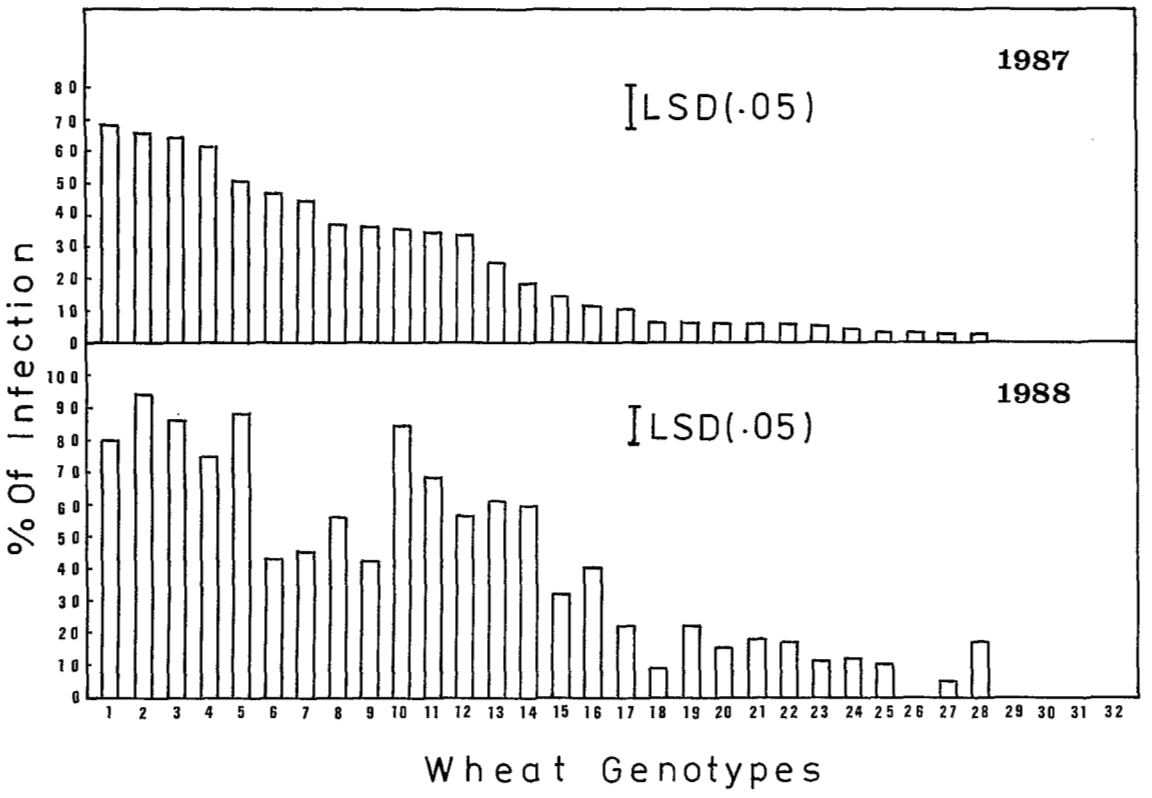

Fig. 1. Incidence of ear-cockle disease (% of infected plants) on 32 genotypes of wheat caused by inoculation whith second stage juveniles of *Anguina tritici* extracted from 0.1 g of seed galls. See Table 1 for explanation of genotypes names.

An interesting result of this work is that four genotypes, 342, 346, 347 and 352 (see Tab. 1) were highly resistant to infection by the nematode in two successive planting seasons (Fig. 1). These genotypes are hybrids (Saberbeg × Mexipak) irradiated with 400 r Nf at their F2 generation. A combination of mutagenesis treatments with hybridization is very effective for the induction of useful mutations (Savov, 1969; 1973). Furthermore, irradiation of hybrids at their earlier generation is among the most recommended methods to induce mutations (Konzak, 1956; Borojovic, 1979). However, gamma irradiation (13 000 r) render an originally highly resistant cultivar (Saberbeg) susceptible to *A. tritici* (Tab. 1, Fig. 1).

Variants with index no. 18-28 (see Tab. 1) showed an infection percentage below 10 % in 1987 test (Fig. 1). Furthermore, most of the genotypes tested showed similar reaction to infection by *A. tritici* in 1987 and 1988 tests. However, some of the test genotypes showed different reaction to infection. This is possibly due to their genetic unstability and/or environmental differences in the test seasons. It is worthy to note that a reduced percentage of infected plants was observed in 1987 experiment compared to 1988. This could be due to the relatively delayed sowing time and/or extreme weather conditions of 1987.

The variants resulted from Nf treatments which showed no nematode infection, want further screening and selection studies so that an *A. tritici* resistant cultivar can be developed.

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PHOTOSYNTHETIC RATE IN RICE AS INFLUENCED BY THE ROOT-KNOT NEMATODE, *MELOIDOGYNE GRAMINICOLA*, INFECTION

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The root-knot nematode, *Meloidogyne graminicola* Golden & Birchfield, 1968 is associated with loss in grain yields in rice and widely distributed in India (Prasad, Panwar & Rao, 1987). The symptoms of root damage by the nematode results in stunted and chlorotic plants (Rao, 1985). Reduction in chlorophyll a and b fractions (20 to 39.5 %) has been reported due to infection by this nematode (Rao, Jayaprakash & Mohanty, 1988; Swain & Prasad, 1988). In contrast a resistant variety, Udaya demonstrated a 43.5 and 24.3 % increase in a and b fractions of chlorophyll, respectively (Swain & Prasad, 1988). Reduction in photosynthetic rates of tomato and bean leaves due to root-knot nematode infection has been reported (Loveys & Bird, 1973; Melakeberhan, Webster & Brooke, 1984). Changes in photosynthetic rate in the resistant and susceptible rice varieties, following the root-knot nematode infection are reported in the present studies.

The seeds of five rice varieties (resistant : Annada, IR 36 and Udaya and susceptible : Annapurna and Parijat) isolated by Swain, Prasad and Rao (1986) were each sown in 30 polypots (one seed/pot) containing 200 g steam sterilised soil. When the seedlings were five days old, fifteen seedlings from each variety were inoculated with 100 infective juveniles of *M. graminicola* per pot. Thirty days after inoculation, the second leaf from top of the main tiller of each plant was excised under water, stabilised at 40 k-lux light for one hour and transferred to a photosynthetic chamber connected to an infra red gas analyser (Make ADC, Series 225, UK). Air containing 320-330 ppm carbon dioxide was drawn through the photosynthetic chamber at the rate of 0.25 l/min and depletion in carbon dioxide inside the chamber was recorded with infra red gas analyser. The initial and final readings were recorded and the photosynthetic rate per unit leaf area (Po) was calculated as mg CO_2 dm^{-2} h^{-1} with the following formula (Nayak, Padhi & Murty, 1983) :

$$Po = \frac{44\,000 \times \text{flow rate (l/h)} \times \text{difference in ppm of } CO_2 \text{ as recorded by IRGA}}{0.08205 \times \text{temperature in } ^oK\ (273^o + \text{ambient temp.}^o) \times \text{leaf area in } dm^2)}$$

The temperature of the photosynthetic chamber was 30°. The photosynthetic rate per unit leaf area of infected and non-infected plants was compared. The % reduction in photosynthetic rate in each rice variety was calculated basing on the means of fifteen replications of infected and non-infected treatments.

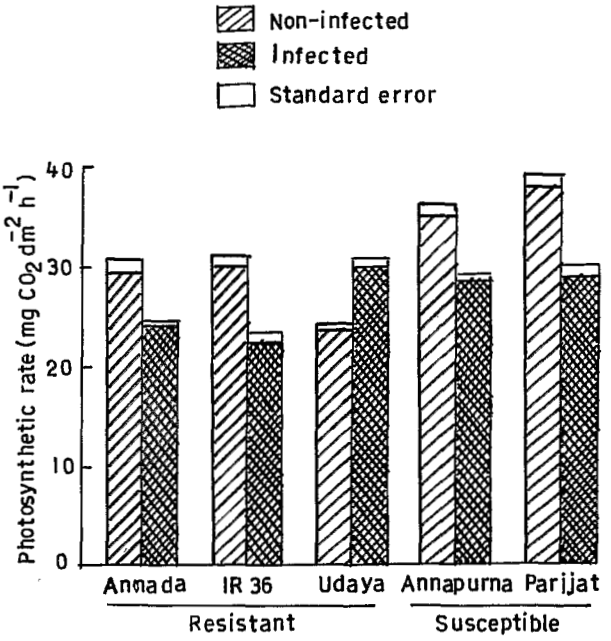

Fig. 1. Influence of root-knot nematode on the photosynthetic rate in five rice cultivars (mean of fifteen replication).

The photosynthetic rate in non-infected plants ranged from 23.6 mg in Udaya to 37.9 mg in Parijat (Fig. 1). The photosynthetic rate of var. Udaya was lowest followed by Annada and IR 36. Both the susceptible varieties, Annapurna and Parijat, produced highest photosynthetic rate which were similar to one another.

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