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Full Length Research Paper

The distribution of Russian Wheat Aphid, *Diuraphis noxia* (Kurdjumov) (Hemiptera: Aphididae) in Turkey

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The Russian wheat aphid, *Diuraphis noxia* (Kurdjumov) (Hemiptera: Aphididae), is one of the most economically important and widely distributed pests of wheat in the world. In 1962, *D. noxia* caused crop losses between 25 and 60% in the central province of Konya, Turkey. In this study, the current status of the pest in wheat-producing areas of Turkey was investigated along a route from Izmir to Manisa, Usak, Kutahya, Eskisehir, Aksehir, Ankara, Konya, Aksaray, Nevsehir, Yozgat and Erzurum. *D. noxia* was detected in 58 of the 100 wheat fields surveyed in most fields and wheat was at the heading stage. The population density of the pest was low in 23 fields, medium in 22 fields and high in 13 fields. The percentage of infestation was low in 31 fields, medium in 12 fields, and high in three fields and very high in three fields. *D. noxia* was collected from bread or durum wheat plants (71%), barley plants (10%), volunteer oats (8%) (*Avena fatua*), volunteer wheat (6%), false barley (*Hordeum murinum*) (4%) and natural grasses (1%). According to results of the study, population density, damage and infestation rates of *D. noxia* were higher in high altitudes.

Key words: *Diuraphis noxia*, Russian wheat aphid, distribution, damage rate, wheat.

INTRODUCTION

Russian wheat aphid, *Diuraphis noxia* (Kurdjumov) (Hemiptera: Aphididae), is one of the most damaging pests of small grains in the world. The presumed area of origin of *D. noxia* is central Asia (Stary, 1996; Lukasova et al., 1999; Stary et al., 2003) and the Caucasus region bordered on the north by Russia, on the west by the Black Sea and Turkey, on the east by the Caspian Sea, and on the south by Iran (Kazemi et al., 2001; Pathak et al., 2007). *D. noxia* was first reported in 1901 in the Crimea (Kovalev et al., 1991), and spread from the original site of its accidental introduction to the former Soviet Union (Moldova and Ukraine) in 1912, South Africa in 1978 (Walters et al., 1980), Central America (Mexico) in 1980 (Gilchrist et al., 1984), USA in 1986 (Stoetzel, 1987; Webster et al., 1987) and Canada in 1988 (Kindler and Springer, 1989). Grain production in South Africa and the United States has been limited by *D. noxia* since being introduced (Stoetzel, 1987; Shufran et al., 2007; Liu et al., 2010). In Egypt, Sudan and Ethiopia, *D. noxia* had been a minor pest until it flared up in Kenya in 1995 where it has remained the most important pest of wheat and barley (Pathak et al., 2004). *D. noxia* has also spread to Central Europe from its area of origin (Lukasova et al., 1999). Various populations of Russian wheat aphid, now widely distributed in South Africa, French and Central and North America, have a common ancestral origin from Turkey (Puterka et al., 1993). Classification of their geographical and genetic distance indicated random establishment by commerce rather than

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migration. The same ancestral origin was identified for the French population, which was attributed to the presumed spread of Russian wheat aphid from the east to west Mediterranean area (Puterka et al., 1993). Turkey is therefore geographically important for the distribution of *D. noxia.*

Two expansion routes for the spread of *D. noxia* in Central Europe were suggested by Stary (1999). The first route may originate in the Ukraine, extending to Moldovia, Romania, Serbia and Hungary. The second route may originate in Turkey, extending through Macedonia to Serbia and Hungary. In Turkey, *D. noxia* was first recorded in Bitlis province in 1959 and a few years later in Isparta and Ankara provinces, wider areas of Central Anatolia and some areas of Adiyaman and Malatya provinces (Tuatay and Remaudière, 1964). Crop losses ranging from 25 to 60% were caused by the pest in Konya province in 1962 (Duran and Koyuncu, 1974; Altinayar, 1981).

D. noxia causes longitudinal chlorotic streaks, spike deformation, leaf rolling and stunting in the host plant, which results in lower grain yield and poor grain quality (Fouche et al., 1984; Stary, 1999; Smith et al., 2004). *D. noxia* has limited grain production in South Africa and the United States since it was being introduced (Stoetzel, 1987; Shufran et al., 2007; Liu et al., 2010). The pest generally prefers drier sites, poorly fertilized or neglected fields, especially border areas or those where plants are widely spaced or relatively weak owing to lower fertilization and/or drought (Stary, 1999).)

New biotypes of *D. noxia* discovered in several important wheat-producing countries have damaged wheat varieties that were previously considered resistant (Haley et al., 2004; Mirak et al., 2004; Smith et al., 2004; Burd et al., 2006; Tolmay et al., 2007).

This research was conducted to determine the current status of the Russian wheat aphid in major wheat-producing areas of Turkey. The aims of the study were to: 1) determine the distribution of Russian wheat aphid, 2) identify wheat-producing areas with potential yield losses due to this pest, and 3) provide a guideline for grain industries in Turkey. Information from this study should assist government agencies and wheat breeding companies in developing strategies for minimizing yield losses due to Russian wheat aphid.

MATERIALS AND METHODS

Survey of *Diuraphis noxia*

This study was carried out throughout the major wheat-producing areas of Turkey in May 2010. One-hundred wheat fields were surveyed along a transect of approximately 1900 km from Izmir to Manisa, Usak, Kutahya, Eskisehir, Aksehir, Ankara, Konya, Aksaray, Nevsehir and Yozgat. The area around Erzurum was also surveyed. Along the survey route, a wheat field was examined every 20 km. Five to ten random plant samples were evaluated in various parts of each field. Records of occurrence, population density, percentage of infestation and damage rate of *D. noxia* for about 50 plants were taken from each field. The GPS co-ordinates and altitude of each field were recorded and the distribution was plotted on a map.

Occurrence

Plants were checked visually for damage symptoms in each field and the field was recorded as infested (at any level) or uninfested (no symptoms). When symptoms were detected, more detailed data on population density, percentage of infestation and damage rate were taken which were as follows: longitudinal chlorotic streaks, spike deformation, leaf rolling and stunting in the host plant.

Population density

Aphid population density was graded on a scale of 1 to 3 where 1 = 1 to 10 individuals, 2 = 11 to 100 individuals and 3 = >100 individuals per plant (Jankielsohn and Oelofse, 2010).

Percentage infestation

The percentage of *D. noxia* infestation was calculated by evaluating 50 plants within each field. It was scored low if the infested plants were 1 to 10%, medium 11 to 30%, high 31 to 50% and very high 51 to 100% (Jankielsohn and Oelofse, 2010).

Damage rate

Damage caused by the pest was determined using a 1 to 5 scale where 1= no damage, 2= chlorotic spots on leaves, 3= striping on leaves, 4= rolling of leaves and 5= dead plant (Jankielsohn and Oelofse, 2010).

Host plants

Observations were made in different parts of each field to determine the main and alternative host plants of the pest.

RESULTS

Occurrence

D. noxia occurred in 58 of the 100 fields surveyed; wheat fields in the vicinity of Izmir, Manisa, Usak, Kutahya, Eskisehir, Aksehir, Ankara, Konya, Aksaray, Nevsehir and Yozgat were infested. None of the sampled fields in the vicinity of Erzurum were infested; it was the only uninfested province in the whole survey area (Figure 1). The co-ordinates and altitude of each field are shown in Table 1.

Population density

The population density of *D. noxia* was low (1 to 10 individuals per plant) in 23 fields, medium (11 to 100 per plant) in 22 fields and high (>100 per plant) in 13 fields

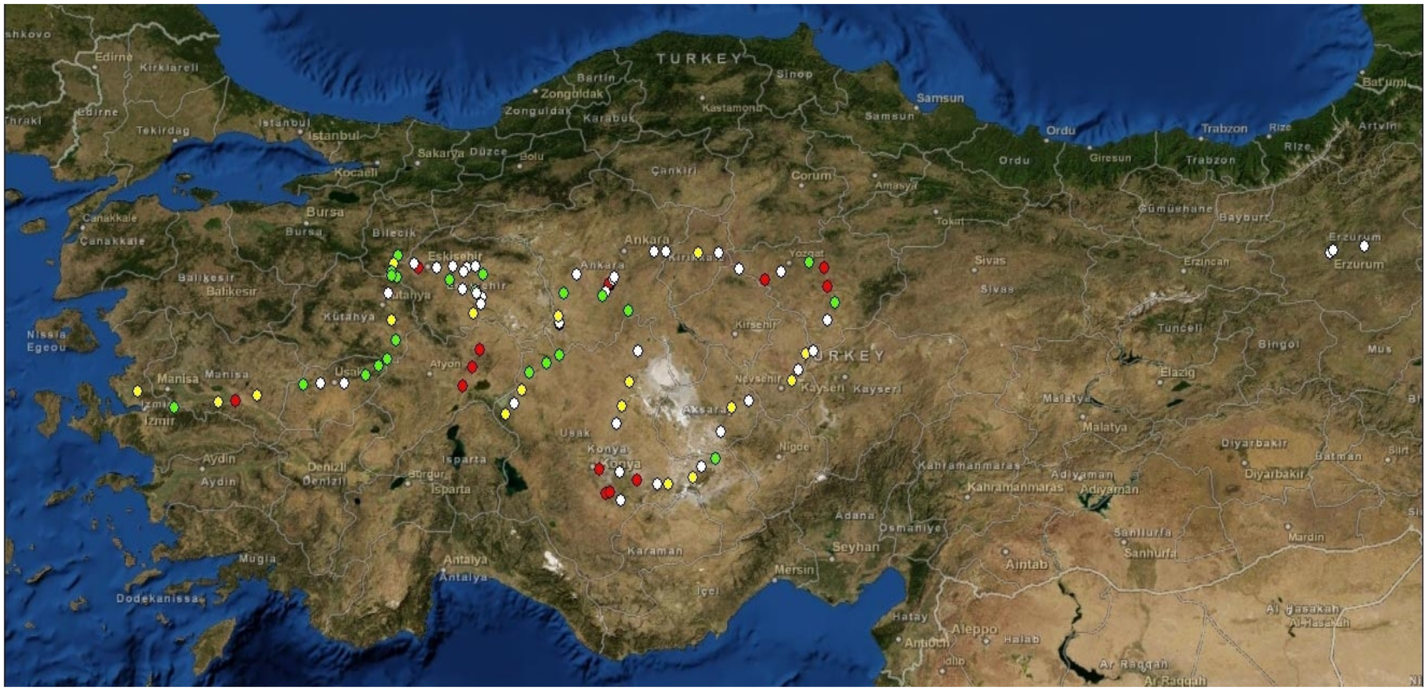

Figure 1. Sampling points in the Russian wheat aphid survey in Turkey. Population densities: white spots= no individuals; green spots= 1 (1-10 individuals/plant); yellow spots= 2 (10-100 individuals/plant); red spots= 3 (more than 100 individuals/plant).

(Table 1). Numerous factors may influence the population density of *D. noxia* at different localities including environmental factors such as temperature, rainfall, humidity and growth stage of the plant. In most of the sampled fields, the wheat plants were at the heading stage. Wheat plants at or before the flag leaf stage generally had larger populations of *D. noxia* and a higher percentage of infestation (Figure 1 and Table 1).

Percentage infestation

The percentage of infested plants was low (1 to 10%) in 31 fields, medium (11 to 30%) in 12 fields, high (31 to 50%) in three fields and very high (51 to 100%) in three fields. In nine fields, the pest was sampled on alternative host plants such as volunteer oats and *Alopecurus myosuroides* (Poaceae). The percentage of infestation was very high in all fields where the growth stage was at or before flag leaf stage (Table 1). At this growth stage, wheat is more vulnerable to infestation than at later growth stages and the pest can spread quickly through the crop.

Damage rate

The damage score was three in 40 of 58 infested localities, and four at 13 localities with noticeable leaf rolling (Figure 2). This damage coincided with high population density and high percentage infestation (Table 1).

Host plants

In this survey, most of the *D. noxia* (71%) was collected from bread or durum wheat; 10% from barley, 8% from volunteer oats (*Avena fatua*), 6% from volunteer wheat, 4% from false barley (*Hordeum murinum*) and 1% from natural grasses. Alternative host plants are important for the survival of Russian wheat aphid when wheat is not available for feeding. Volunteer oats and wild barley that were abundant in and around many of the wheat fields can serve as alternative hosts. *D. noxia* was also sampled from a grass species, *A. myosuroides* which had purple streaking as a result of feeding damage. It is a common plant in wheat-growing areas and may be a good alternate host plant for the pest.

DISCUSSION

This paper presents the results of a survey of Russian wheat aphids including sampling locations, varieties and developmental stages of host plants, infestation and damage rates. According to previous studies, the distribution of the pest *D. noxia* in Turkey has been limited to central Anatolia (Isparta, Ankara, Adiyaman, Malatya and Konya) (Tuatay and Remaudière, 1964; Elmali,

Figure 2. Damage symptoms and different populations densities of *Diuraphis noxia*. a), b), d) longitudinal streaking (Damage score 3); c) trapping of head in rolled flag leaf (Damage score 4); d) population density score 1 (1-10 individual/plant); e) population density score 2 (11-100 individuals/plant).

1993). However, in the survey conducted here, Russian wheat aphid occurred in nearly all (85%) wheat-producing areas in western and central Anatolia. Konya, Eskisehir and Yozgat provinces, which are the main wheat-producing areas, were densely populated with Russian wheat aphid. Wheat is the major agricultural crop in these regions and the presence of this pest is significant and poses a high risk for significant yield losses.

This study showed that population levels of the pest on young plants were usually higher than the older plants.

Table 1. Global Positioning System (GPS) information, altitude, host plants and pest status in sampling points of the *Diuraphis noxia* survey.

S/N	Sampling dates	GPS co-ordinates of locations	Altitude (m)	Aphid density	%Infection	Damage	Host plants	Growth stage of host plant
1	18/05/2010	N38°34.115'E27°02.401'	16	2	30	3	Bread wheat	Heading (Ripe)
2	19/05/2010	N38°26.885'E27°30.412'	70	1	1	3	Bread wheat; Oats	Heading (Ripe)
3	19/05/2010	N38°29.608'E28°02.066'	98	2	2	3	Bread wheat	Heading (Ripe)
4	19/05/2010	N38°30.358'E28°13.891'	150	0	0	0	Bread wheat	Heading (Ripe)
5	19/05/2010	N38°33.319'E28°29.622'	735	2	2	3	Durum wheat	Heading (Ripe)
6	19/05/2010	N38°34.117'E28°43.897'	517	3	5	4	Durum wheat	Heading (Ripe)
7	19/05/2010	N38°39.578'E29°02.691'	509	1	1	3	Durum wheat	Heading (Flowering)
8	19/05/2010	N38°40.415'E29°14.447'	710	0	0	0	Bread wheat	Heading
9	19/05/2010	N38°40.586'E;29°31.902'	898	0	0	0	Bread wheat	Heading
10	19/05/2010	N38°45.087'E29°46.589'	926	1	1	3	Durum wheat + Volunteer	Heading (Flowering)
11	19/05/2010	N38°50.623'E29°55.728'	1059	1	1	3	Durum wheat	Heading
12	19/05/2010	N38°54.394'E30°02.112'	1126	1	1	3	Barley/ Rye	Heading
13	19/05/2010	N39°05.162'E30°08.190'	1010	1	1	3	Durum wheat	Heading
14	19/05/2010	N39°16.333'E30°05.350'	1100	2	3	3	Bread wheat	Heading
15	19/05/2010	N39°31.822'E30°03.276'	911	0	0	3	Bread wheat	Heading
16	19/05/2010	N39°40.912'E30°09.233'	909	0	0	0	Bread wheat + Barley	Heading
17	19/05/2010	N39°44.464'E30°25.050'	974	1	1	3	Bread wheat and Barley	Heading
18	20/05/2010	N39°46.450'E30°24.389'	793	3	30	3	Bread wheat	Heading
19	20/05/2010	N39˚46.497'E30˚24.406'	750	2	3	3	Bread wheat	Heading
20	20/05/2010	N39°53.329'E30°10.126'	857	1	1	3	Oats	Heading
21	20/05/2010	N39°48.889'E30°06.565'	881	2	0	0	Volunteer oats	Heading
22	20/05/2010	N39°44.527'E30°05.075'	965	1	0	0	Volunteer oats	Heading
23	20/05/2010	N39°41.927'E30°05.407'	934	1	0	0	Volunteer oats	Heading (Ripe)
24	20/05/2010	N39°46.287'E30°37.779'	776	0	0	0	Bread wheat	Heading
25	20/05/2010	N39°47.522'E30°49.271'	796	0	0	0	Bread wheat + Barley	Heading (Milk stage)
26	20/05/2010	N39°46.511'E30°59.103'	820	0	0	0	Bread wheat	Heading
27	20/05/2010	N39°44.513'E30°56.812'	785	0	0	0	Bread wheat	Heading
28	20/05/2010	N39°47.503'E31°04.947'	786	0	0	0	Barley	Heading
29	20/05/2010	N39°43.017'E31°10.777'	781	1	0	0	Volunteer oats	Heading
30	20/05/2010	N39°33.230'E31°05.243'	929	1	0	0	Volunteer oats	Heading
31	21/05/2010	N39°39.497'E30°46.410'	922	1	1	3	Bread wheat + Barley	Heading
32	21/05/2010	N39°34.414'E30°56.254'	917	0	0	0	Bread wheat + Barley	Heading
33	21/05/2010	N39°31.848'E31°06.349'	897	0	0	0	Bread wheat	Heading
34	21/05/2010	N39°29.983'E31°09.974'	942	0	0	0	Bread wheat	Heading
35	21/05/2010	N39°26.044'E31°09.029'	861	0	0	0	Bread wheat	Heading

Table 1. Contd.

36	21/05/2010	N39°20.664'E31°03.418'	885	2	2	3	Bread wheat	Heading
37	21/05/2010	N39°31.848'E31°06.349'	1000	0	0	0	Bread wheat	Heading
38	21/05/2010	N38°59.713'E31°07.936'	1017	3	60	4	Barley	Heading
39	21/05/2010	N38°49.502'E31°02.591'	1124	3	20	4	Bread wheat	Heading
40	21/05/2010	N38°49.502'E31°03.579'	997	3	20	4	Durum Wheat	Heading
41	21/05/2010	N38°23.129'E31°26.648'	985	2	20	3	Bread wheat	Heading
42	21/05/2010	N38°29.095'E31°32.617'	961	0	0	0	Bread wheat	Heading
43	21/05/2010	N38°36.982'E31°38.146'	992	2	20	4	Bread wheat	Heading
44	21/05/2010	N38°46.476'E31°43.695'	964	1	10	3	Durum wheat	Heading
45	21/05/2010	N38°52.192'E31°55.712'	911	1	0	3	Volunteer oats	Heading
46	21/05/2010	N38°56.428'E32°04.986'	918	2	1	3	Bread wheat	Heading
47	21/05/2010	N39°14.227'E32°04.965'	818	0	0	0	Bread wheat	Heading
48	21/05/2010	N39°14.785'E32°04.785'	805	0	0	0	Bread wheat	Heading (Ripe)
49	21/05/2010	N39°18.989'E32°04.445'	759	2	30	3	Bread wheat	Heading
50	21/05/2010	N39°32.054'E32°08.410'	842	1	0	3	Volunteer wheat	Heading
51	21/05/2010	N39°42.489'E32°17.057'	787	0	0	0	Bread wheat	Heading
52	22/05/2010	N39°36.593'E32°40.788'	1050	1	1	2	Barley	Heading
53	22/05/2010	N39°36.873'E32°40.426'	1070	2	20	3	Bread wheat	Heading
54	22/05/2010	N39°37.036E32°40.334'	1082	3	15	3	Bread wheat	Heading
55	22/05/2010	N39°32.494'E32°38.122'	1198	0	0	0	Bread wheat	Heading
56	22/05/2010	N39°30.652'E32°35.561'	1278	1	10	3	Bread wheat	Heading
57	22/05/2010	N39°39.398'E32°43.577'	1067	0	0	0	Bread wheat	Heading
58	22/05/2010	N39°40.995'E32°44.368'	1023	0	0	0	Bread wheat	Heading
59	24/05/2010	N39°21.856'E32°54.462'	1067	1	1	2	Bread wheat/ wild rye and wild barley	Heading
60	24/05/2010	N38°58.894'E33°00.985'	1098	0	0	0	Bread wheat	Heading
61	24/05/2010	N38°41.561'E32°55.271'	990	2	1	3	Bread wheat	Heading
62	24/05/2010	N38°27.605'E32°49.784'	981	2	10	3	Barley	Heading
63	24/05/2010	N37°51.471'E32°33.821'	1004	0	0	3	Bread wheat	Heading (Ripe)
64	24/05/2010	N37°51.717'E32°33.129'	1006	3	5	4	Bread wheat	Heading
65	24/05/2010	N37°37.282'E32°37.991'	1015	3	20	4	Bread wheat	Heading (Ripe)
66	24/05/2010	N37°33.813'E32°48.735'	1015	2	5	3	Bread wheat	Heading (Ripe)
67	24/05/2010	N37°33.813'E32°48.735'	1011	0	0	0	Barley+ Vicia sativa+ wheat	Heading (Ripe)
68	24/05/2010	N37°38.441'E32°41.077'	1010	0	0	0	Barley	Heading
69	24/05/2010	N37°38.441'E32°41.077'	1010	3	30	4	Bread wheat	Heading

Table 1. Contd.

70	25/05/2010	N37°49.871'E32°48.249'	1022	1	0	0	Volunteer Oats	Heading
71	25/05/2010	N37°45.014'E33°00.528'	1012	3	60	4	Durum+ Bread wheat	Flag leaf + Heading
72	25/05/2010	N37°42.759'E33°14.868'	1012	0	0	3	Durum wheat	Flag leaf + Heading
73	25/05/2010	N37°42.768'E33°22.294'	1010	2	50	4	Bread wheat	Flag leaf + Heading
74	25/05/2010	N37°46.661'E33°40.196'	1000	2	1	3	Bread wheat	Heading
75	25/05/2010	N37°53.012'E33°46.203'	1053	0	0	0	Bread wheat	Heading
76	25/05/2010	N37°57.570'E33°56.101'	1082	1	10	3	Bread wheat	Heading
77	25/05/2010	N38°13.332'E34°00.139'	1009	0	0	0	Wild rye	Heading (Flowering)
78	25/05/2010	N38°27.003'E34°08.058'	1187	2	10	3	Barley	Heading (Flowering)
79	25/05/2010	N38°30.811'E34°19.956'	1185	0	0	0	Barley	Heading (Flowering)
80	25/05/2010	N38°33.170'E34°33.505'	1303	0	0	0	Bread wheat	Heading (Flowering)
81	26/05/2010	N38°42.247'E34°51.170'	1025	2	60	4	Bread wheat	Heading
82	26/05/2010	N38°48.396'E34°55.821'	1011	0	0	0	Bread wheat	Heading
83	26/05/2010	N38°57.551'E35°01.128'	1170	2	1	2	Bread wheat	Heading
84	26/05/2010	N38°58.670'E35°06.021'	1151	2	50	4	Barley	Flag leaf + Heading
85	26/05/2010	N39°08.331'E35°12.914'	1112	0	0	0	Durum wheat	Heading (Flowering)
86	26/05/2010	N39°16.890'E35°16.412'	1136	0	0	0	Durum wheat	Heading
87	26/05/2010	N39°26.628'E35°21.660'	1174	1	0	3	*Alopecurus myosuroides* (Poaceae)	Heading
88	26/05/2010	N39°35.732'E35°16.102'	1118	3	20	3	Bread wheat	Heading (Flowering)
89	26/05/2010	N39°46.272'E35°14.068'	1052	3	40	4	Bread wheat	Heading (Flowering)
90	26/05/2010	N39°49.472'E35°03.216'	1134	1	5	3	Bread wheat	Heading (Flowering)
91	26/05/2010	N39°43.971'E34°43.250'	1048	0	0	0	Bread wheat	Heading (Flowering)
92	26/05/2010	N39°39.443'E34°31.977'	885	3	10	3	Bread wheat	Heading (Flowering)
93	26/05/2010	N39°46.239'E34°12.924'	703	0	0	0	Bread wheat	Heading (Flowering)
94	26/05/2010	N39°55.248'E34°58.838'	1170	0	0	0	Bread wheat	Heading (Flowering)
95	26/05/2010	N39°54.822'E33°44.179'	861	2	10	3	Bread wheat	Heading (Flowering)
96	26/05/2010	N39°55.574'E33°20.969'	737	0	0	3	Barley	Heading (Flowering)
97	26/05/2010	N39°55.596'E33°12.522'	736	0	0	0	Bread wheat	Heading
98	27/05/2010	N39°55.0129'E41°15.0846'	1900	0	0	0	Bread wheat	Before Flagleaf
99	27/05/2010	N39°56.4453'E41°17.0956'	1668	0	0	0	Bread wheat	Before Flagleaf
100	27/05/2010	N39°56.4453'E41°17.0956'	1784	0	0	0	Bread wheat	Before Flagleaf

Generally, mature plants had less damage and infestation than young plants. *D. noxia* was more common in wheat fields at higher than 850 m

(Table 1). The damage and infestation rates were also higher especially in wheat fields higher than 950 m. Our results were parallel with the findings of Haile (1981). In the aforementioned study, *D. noxia* was widespread in all the barley and wheat growing areas of Ethiopia in 1976 and was considered to be the leading pest of cereals in the highlands of Ethiopia. Behle and Michels (1990) further reported that nymph production was optimal at temperatures between 5 and 20°C, and the nymph production was at peak at 4 nymphs per day. This temperature range was also typical at continental climate and high altitudes between 800 and 1200 m during the growing season of wheat in central Anatolia.

In a study comparing the occurrence of *D. noxia* between localities and years (1989 and 1990 growing seasons) in Konya province, the pest was present in small numbers during autumn 1989 but increased to epidemic levels at the end of wheat heading in 1990 (Elmali, 1998). Du Toit and Walters (1984) reported yield losses between 35 and 60% as a result of damage from *D. noxia* in South Africa, and they also found that, wheat plants were most sensitive to infestation by *D. noxia* from flag leaf stage to flower initiation. In another study, yield per plant was significantly reduced by infestation during the heading stage (Girma et al., 1993). The population density of Russian wheat aphid in the Czech Republic increased in crops in late June and early July, after which aphids left the maturing wheat plants (Stary, 1999).

A study conducted in Konya province in 1962, reported that injury levels from *D. noxia* were relatively low but this was attributed to unsuitable conditions for wheat growth during the period when the pest population was increasing. Once the pest population had increased, crop losses caused by the pest ranged from 25 to 60%, indicating that the pest can cause high crop losses when conditions are suitable for the pest (Elmali, 1998).

During surveying in the present study, it was observed that sowing date may be an effective cultural practice for controlling damage by *D. noxia* during epidemic periods. In late-sown (January, 2010) wheat (Sample 73 in Table 1), 60% of plants did not produce any spikes due to damage from Russian wheat aphid. This finding was similar to that of Elmali (1998) who revealed that Russian wheat aphid populations were three times higher on late-sown (January) than early-sown (October) wheat. It can be concluded that sowing date is a crucial cultural control method for *D. noxia*. It is important to identify possible alternative host plants in any pest control program.

In this survey, alternative host plants of Russian wheat aphid were observed, for example, wild and volunteer wheat and barley, as found by Elmali (1998). In that study, it was suggested that the pest moved to *Hordeum murinum* L. sp. *glaucum*, *Phalaris* spp. and volunteer wheat and barley plants which were the main sources of infestation for winter wheat. These plants were an accepted source of new infestation in the following wheat season. In another study, *Agropyron cristatum*, *Bromus tectorum*, *Elymus canadensis* and *Thinopyrum intermedium* were recorded as non-cultivated grass hosts at field sites where specimens of the pest were collected (Aubrey et al., 2009). The importance of Russian wheat aphid in North America has increased because they can survive on a broad range of grasses that can grow throughout barley and wheat producing areas (Kindler and Springer, 1989). In the Czech Republic, during the post-harvest period in summer, *D. noxia* was often found on volunteer small-grains in stubble fields and to a lesser degree on nearby weed grasses. In the following year, new populations appear from those host plants from mid-September to mid- or late-October. Wheat, barley and triticale were identified as host crop plants and *H. murinum* was the only wild host plant established (Stary, 1999).

Conclusion

In conclusion, *D. noxia* can increase rapidly when environmental conditions are favorable, and reach damaging levels. In addition to its damage through feeding, Russian wheat aphid can also act as a vector of plant pathogenic viruses including Barley Yellow Dwarf Virus, Barley Mosaic Virus, and Sugarcane Mosaic Virus (Damsteegt et al., 1992). Damage caused by *D. noxia* can also change due to the development of new and more virulent biotypes. Since *D. noxia* has become a widespread and a significant pest of small-grain-growing areas of the world, it is important to work on a global management plan. Identifying the distribution of *D. noxia* in different areas of Turkey will also be an opportune time to search for new genetic resources conferring resistance to the pest, which would play a key role in breeding new commercial wheat cultivars for Turkey.

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