Pakistan J. Zool., vol. 38(3), pp. 191-196, 2006.

Population Dynamics of Grain Aphid, *Sitobion avenae* F. (Aphididae: Homoptera) and Barley Thrips, *Limothrips cerealium* H. (Thripidae: Thysanoptera) on Wheat and Barley in Highland Balochistan

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Abstract.- The observations on the population dynamics of Grain aphid, *Sitobion avenae* F. and Barley thrips, *Limothrips cerealium* H were taken from the fields of wheat and barley at AZRC farm and Agricultural College, Quetta during the season 2002-03. Data indicated that the population of aphid was significantly higher on wheat as compared with barley during 1st week of April and 1st week of May. The overall mean population of aphid was 1. 78/tiller on wheat and 1.25/tiller on barley. The population of thrips was also significantly higher on wheat as compared with barley during 2nd and 3rd week of April. The mean population of thrips was 2.38/tiller on wheat and 1.44/tiller on barley. In the 2nd experiment on population dynamics of these insects on five wheat varieties, *viz:* AZRI-96, local, S-98, Local Zamindar and ICW, local showed significantly highest resistance against aphids than any other variety. While significantly higher population of aphids was recorded on ICW during the 2nd fortnight of April. In contrast, local proved to be susceptible to thrips as maximum number of thrips were observed on local during 2nd fortnight of April. The population of either insects (aphids or thrips) was significantly different among genotypes, among sampling dates and no statistically significant interactions were observed between genotypes and sampling dates.

Key words: BYDV, resistance, Gramine, *Bostrytis*.

INTRODUCTION

Wheat and barley are most important dual-purpose crops of Balochistan. When there is scarcity of green fodder it is a common practice of grazing sheep and goat in these fields. If fanners are unable to harvest the crop for seed in a dry season, the stubbles of the crop are of considerable value as a source of animal feed (Khan *et al.,* 1997*).* Their grain and straw are mainly useful for animal feed. Both wheat and barley are prone to a number of insect pests. Among which the aphids are the most important pests particularly from the disease point of view. They possess piercing and sucking mouthparts, which are used to suck juices from various parts of plant and cause indirect damage by transmission of barley yellow dwarf virus (Gair *et al.*, 1983; EI-Yamani and Hill, 1980; Carter *et al.,* 1980; Mann *et al.,* 1997). In South East Asia, Das (1918) reported corn leaf aphid, *Rhopalosiphum maidis* (Fitch), *Melanophis sacchari* (Zehtner), grain aphid *Sitobion avenae* (Fabricious) and green bug, *Schizaphis graminum* (Rondani) attacking barley. Hamid (1983, 1984, 1987) surveyed Pakistan and reported *S. graminum,* grain aphid, *Sipha maidis* as the damaging pests of barley in the northern hills of Pakistan. He also reported that *Sipha maidis* was an important pest of gaminacious plants. The attack is more severe on wheat in December and March and on maize in June to September.

In addition to this, a number of other insect pest species were found attacking wheat and barley although to a much lesser extent, in particular the grain thrips *(Limothrips cerealium)* are commonly found on wheat and other cereals (Tantawi, 1985). These are known as thunder flies of black or brown insects with piercing and sucking mouthparts. Little is known of precise importance of thrips damage.

0030-9923/2006/0003-0191 $ 8.00/0

However, in 1978, thrips damage to spikelets of wheat was confinned in Yorkshire and occasionally associated with a subsequent disease of spikelets caused by *Bostrytis* (Gair *et al.,* 1983). As no work has been conducted from the plant protection point of view in Balochistan. Therefore, an initiative was carried out to identify the pegt problem of wheat and barley in Balochistan.

MATERIALS AND METIIODS

The studies were conducted at Arid Zone Research Centre (AZRC) farm and Balochistan Agricultural College, Quetta during the year 2002-2003 on the population dynamics of aphids and thrips on wheat and barley.

Wheat and barley trial

The research work was earned out at Arid Zone Research Centre (AZRC) farm, Quetta on population dynamics of aphid, *Sitobion avenae* and thrips, *Limothrips cerealium* from wheat and barley fields during the 2002-2003 season. The population dynamics of aphids and thrips was recorded at weekly intervals. Twenty-five tillers at the tillering stage and whole plant at initial stage were examined at random from the field of wheat and barley. Both the fields were sampled weekly beginning with 4th week after planting until maturity. The counting was performed of the number of nymphs and adults of aphids and thrips present on each tiller. The identification of aphid and thrips was earned out using keys for identification (Blackman and Eastop, 1985). The data were analyzed using the T- test and P was set at<0.05 (Anderson *et al*., 1974).

$$\text{Variance} = S^2 = 1/n_1 + n_2 - 2\ (\sum x_1^2 - (\sum x_1)^2/n_1 + \sum x_2^2 - (\sum x_2)^2/n_2)$$

$$T = x_1 - x_2/S \int [1/n_1 + 1/n_2)]$$

Wheat and varietal trial

A field trial containing five wheat varieties including local was conducted m the research field of Balochistan Agriculture College, Bulleli, Quetta during 2002-2003. The experiment was laid out m a randomized complete block design (RCBD) with three replications. Five wheat varieties (AZRI-96, S-98, ICW, Local Zamindar and Local) were sown m plot measuring 112.5 m^2 (7.5x15 m) and each variety was sown m five rows with row to row distance of 30 cm. The seed was applied @ 100 Kg/ha and no irrigation or insecticide was applied. The data were recorded fortnightly beginning with week after planting until maturity. At seedling stage five plants from each variety were examined at random, while at tillering stage five tillers from randomly selected five plants from each variety were examined to know the population dynamics of aphids and thrips. The identification of aphid and thrips was carried out using keys for identification (Blackman and Eastop, 1985). The counting was performed of the number of nymphs and adults of aphids and thrips present on each tiller. The data was analysed using MSTAT programme and P was set at<0.05 and <0.01.

RESULTS AND DISCUSSION

Aphid population was significantly higher on wheat than barley at two times (Table I). Infestation started on the edges of the wheat and barley crops near ditches and channels where wild weeds were observed. Aphid infestation was first observed on 15th March on wheat (0.6/tiller). This coincided with the onset of rise in temperature (Table IV). There was a significant increase in population density over the growing season (*i.e.,* significant week effect) across both the crops. The highest densities of aphids on wheat were recorded in the first week of May 2003 which was 4.2 aphids /tiller (Table I). The aphid population declined the last two weeks of sampling on 8th and 15th May when the crop senesced and drying except for the seed in May. The aphid population on barley was appeared in the third week of March and continued upto the 1st week of May. Singh *et al.* (1985) studied that aphids appeared in the first week of January and the infestation reached a peak in the first week of February, but started declining in the first week of March as crop started maturing. It may be due to the severe cold and frequent rains this season. The temperature decreases up to -10°C (Table IV). Stary and Lagasova (2002) also studied that cool and wet weather in some periods of the season generally suppressed the cereal aphid population in the Czech

Republic. The maximum population of aphids on barley was recorded in the third week of April (2.44/tiller, Table I) and during that stage population of aphids moves to earheads that indicated the preferable stage for aphids. The minimum population of aphids on barley was observed in the third week of March, which was 0.4/tiller (Table I). The overall mean population of aphids was higher on wheat (1.78/tiller) as compared with barley (1.25/tiller). The population was disappeared around the first week of May on barley because of short duration of barley than wheat and plants become dry earlier than wheat. While, population of aphids on wheat was continued upto the third week of May. These results are in confirmation with the results of Tantawi (1985) nom Cairo, Egypt. Resistance to aphids in barley has been attributed to physical factors, *e.g.* thickness of Schlerenchyma cells and number of vascular bundles (EI-Serwiy *et a1*., 1985) or surface wax on the leaves (Tsumuki *et al.,* 1987) or to chemical composition of the leaves. Another chemical causing resistance to cereal aphids in barley is gramine in the leaves (Salas, 1991).

Table I.- Average per tiller population of aphid, *S. avenae* on wheat and barley.

Date	Wheat	Barley	t-test
15-03-2003	0.60±.725	0.40±0.57	1.07 N.S.
22-03-2003	0.88±.725	0.60±0.64	1.47 N.S.
01-04-2003	2.20±2.16	1.08±1.50	2.17*
08-04-2003	1.64±2.23	1.73±4.57	-0.08 N.S.
15-04-2003	1.36±1.73	2.44±2.90	-1.59 N.S.
22-04-2003	1.72±1.43	1.00±2.29	1.34 N.S.
01-05-2003	4.20±7.4	0.56±1.29	2.49*
08-05-2003	2.48±5.55	-	-
15-05-2003	0.96±1.27	-	-
Mean	1.78±1.09	1.25±0.78	

Table II indicated the average per tiller population of thrips on wheat and barley. Thrips was recorded for the first time in the winter wheat and barley fields in Balochistan. The population of thrips was also observed on 3rd week of March and continued to increase upto the 3rd week of April on barley and 2nd week of April on wheat (Table II). The population was mostly observed on developing earheads and flowers. Zhichkina and Kaplin (2001) studied in the samara region of Russia and recorded that the peak of adult *Haplothrips tritici* (Kurdj.) occurred in June and did not always corresponds with stages of the wheat crop optimum for oviposition. The absolute abundance of all thrips stages was maximum at the flowering stage on wheat during the 2nd week of April (3.56, Table II) and on barley in the 3rd week of April (2.06, Table II). These results were also in agreement with the. results of Tantawi (1985) who recorded that the number of thrips was higher during April and early May. The overall mean population of thrips was significantly higher on wheat (2.38/tiller, Table II) compare to barley (1.44/tiller, Table II). The considerable number of thrips was observed on barley only during the ear head formation. It was observed from the comparison that wheat is more preferable food for aphid and thrips than barley. However, during the earhead development stage aphid population was higher on barley as compared with wheat. Thrips also preferred to feed on earhead than to leaves or stem.

Table II.- Average per tiller population of thrips, *Limothrips cerealium* on wheat and barley.

Date	Wheat	Barley	t-test
15-03-2003	1.28±0.54	1.16±0.37	0.93 N.S.
22-03-2003	1.56±0.84	1.20±0.40	2.01*
01-04-2003	1.32±1.84	1.04±0.50	2.415*
08-04-2003	3.56±6.13	1.52±0.71	1.68 N.S.
15-04-2003	3.20±2.04	2.04±1.17	2.52*
22-04-2003	2.84±4.24	1.36±0.49	1.76*
01-05-2003	1.92±2.21	-	-
Mean	2.38±0.58	1.44±0.31	

Table III indicated the average per tiller population of aphids and thrips on different wheat varieties. Population of aphids and thrips was significantly affected by wheat cultivars. There were significant differences among genotypes. The aphid population was started to appear in the 1st fortnight of March on all the varieties and continued upto the 2nd fortnight of May. Aphids and thrips population was minimum on 2nd fortnight of April during the initial heading on all genotypes (Figs. 1, 2). Aphids feeding at the seedling stage the mean densities of 25-30 aphids/stem/tiller resulted in losses of about

Table III.- Average/tiller population of aphids and thrips on different wheat varieties during 2002-2003.

Variety	Aphids	Thrips
AZRI-96	4.36±3.79	3.16±1.68
S-98	5.23±4.14	2.70±1.95
ICW	6.28±5.22	1.89±1.73
Local Zamindar	3.86±3.95	5.74±3.35
Local	3.33±2.78	6.78±5.58

Analysis of variance

K value	Source	Degrees of freedom	S.S.	M.S.	F value	Prob.
Aphids						
1	Replication	2	69.817	34.908	4.1560*	0.0206
2	Factor A	4	130.788	32.697	3.8928**	0.0072
4	Factor B	5	1016.557	203.311	24.2052**	0.0000
6	Factor AB	20	164.294	8.215	0.9780 N.S.	0.312
7	Error	58	487.170	8.399		
Total	89		1868.626			
Thrips						
1	Replication	2	29.956	14.978	2.3914 N.S.	0.1005
2	Factor A	4	229668	57.417	9.1672**	0.0000
4	Factor B	5	619.218	123.844	19.7729**	0.0000
6	Factor AB	20	232.486	11.624	18559 N.S.	0.0351
7	Error	58	363.271	6.263		
Total	89		1474.60			

Table IV.- Average temperature (°C) of Quetta valley during 2002-2003.

Months	Daily (Mean)	Maximum		Minimum		No. of stress days (Min. temp.)
		Mean	Highest	Mean	Lowest	
December 2002	7.2	13.8	21.2	0.5	-10.0	16
January 2003	5.4	12.2	21.6	-1.4	-6.8	19
February 2003	8.5	14.6	20.8	2.4	-3.4	9
March 2003	12.6	18.9	25.0	6.3	-4.6	4
April 2003	17.9	24.4	33.0	11.3	4.0	0
May 2003	20.5	27.1	31.5	13.9	9.0	0

50% in some yield components at this stage caused the greatest losses in yield (Nahid, *et al.,* 1991). The maximum population of aphids (14.33, Fig. 1) was observed on ICW during the second fortnight of April, followed by S-98 (10.4) and AZRI-96 (9.22). The minimum population of aphids was recorded on the date of first infestation on local. The overall maximum population aphids/tiller was observed on ICW (6.28) followed by the S-98 (5.23) and AZRI-96 (4.63) (Table III). Local was observed with lowest number of aphids per tiller (3.33). Local Zamindar was moderately infested. This may be due to antixenotic, antifeeding or antibiosis effects as previously reported by Niemeyer and Perez (1997).

Aphid population was highest in the month of April (during ear head formation) and lowest in the month of March (tillering stage) indicating that wheat is less vulnerable to aphids in early stage and

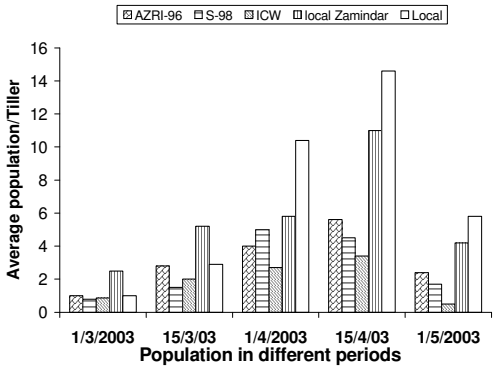

Fig. 1. Population dynamics of thrips on different wheat varieties.

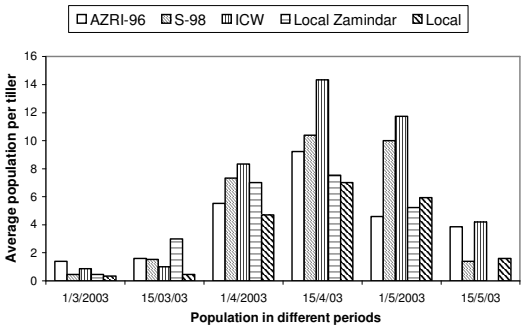

Fig. 2. Population dynamics of aphids on different wheat varieties.

susceptible at latter growth stages or it may be attributed to low temperature during early growth stage. Though the results were significantly different, but there were not much variations observed among varieties. Local proved to be the preferable food for the thrips as maximum number of thrips were observed on Local (14.6/tiller) followed by Local Zamindar (11/tiller) (Fig.2) in the 2nd fortnight of April. While, ICW was observed with mean lowest No. of thrips (1.89/tiller) (Table III). Some varieties showed greater preference for aphids, while some observed to be preferable for thrips. This variability in reaction needs further investigation. Therefore, it would be desirable to test more cultivars with wider genetic basis for resistance to aphids and thrips.

The above mentioned varieties have not been tested before, therefore, the results cannot be compared. However, the low population of aphids and thrips on these varieties does not mean that they are resistant, because at such low population, many varieties may escape infestation and also may be due to the cool and wet weather (Stary and Lukasova, 2002). Therefore, these findings warrant further investigation on the population, their sources of resistance and control measures, and to assess the economic importance of crop losses caused by aphids and thrips in Balochistan.

The comparison was also made between the crops grown at AZRC farm, Quetta and at Balochistan Agriculture College Bulleli, Quetta. Results indicated that the population of aphids and thrips was higher on wheat grown at Balochistan Agriculture College, Quetta and the population of these insects was higher on wheat as compared with barley at AZRC farm Quetta. Because, the field of College was surrounded by Orchards of Apricot and apples, which not only served as the shelter for the insect pests but also protect them from the direct effect of wind. Where as, at AZRC farm, Quetta, there was a wall around the field, which did not serve as shelter and food for them.

REFERENCES

ANDERSON, V.L. AND MCLEAN, R.A., 1974. *Design of experiments, a realistic approach*, vol. 5. Marcel Dekker, Inc. New York and Basel, pp. 4.

BHATIA, S.K. AND SINGH, V.S., 1977. Effect of corn leaf aphid infestation on the yield of barley varieties. *Entomon*, **2**: 62-66.

BLACKMAN, R.L. AND EASTOP, V.F., 1985. *Aphids on the world's crops, an identification and information guide*. Wiley, Chichester, UK.

CARTER, N., MCLEAN, L.F.G., WATT, A.D. AND DIXON, A.F.G., 1980. Cereal aphids, a case study and review. In: *Applied biology* (ed. T.H. Coakr), vol. 5, pp. 271-348. Academic Press, London.

DAS, B., 1918. The aphididae of Lahore. *Mem. Indian Mus*., **6**: 138-274.

EL-YAMANI, M. AND HILL, J.H., 1980. Identification and importance of barley yellow dwarf virus in Morraco. *Plant Dis*., **7**: 291-294.

EL-SERWIY, S., EL-HAIDARI, H.S., RAZOKI, I.A. AND RAJAB, A.S., 1985. Susceptibility of different barley strains and varieties to aphids in the middle of Iraq. *J. Agric. Water Res*., **4**: 59-71.

GAIR, R., JENKINS, J.E.E. AND LEATER, E., 1983. *Cereal pests and diseases.* Farming Press Ltd., Norwitch.

HAMID, S., 1983. Natural balance of graminicolous aphids in Pakistan: Survey of population. *Agronomie*, **3**; 665-673.

HAMID, S., 1984. Natural balance of graminicolous aphids in Pakistan. II. Survey of population on maize. *Agronomie*, **4**: 801-803.

HAMID, S., 1987. Fecundity potential of graminacious aphids in Pakistan. *Pakistan J. Zool.,* **9**: 103-107.

INSTITUTE OF AGRICULTURE RESEARCH (IAR), 1987. *IAR progress report, Barley progress report for 1985/1986.* IAR Department of field crops, Addis Ababa, Ethiopia.

KHAN, M.A., AHMAD, S., BEGUM, I., JALIL, S.A., ALI, A., ALI, A.S., MIRZA, Z., MUGHAL, S., SHAIKH, S. AND BAJOI, A.H., 1997. A new high yielding barley variety (Sanober-96). *AZRC Res. Rep*., **9**: 1-25.

MANN, J.A., HARRINGTON, R., CARTER, N. AND PLUMB, R.T., 1997. Control of aphids and barley yellow dwarf virus in spring sown cereals. *Crop Protect*., **16**: 18-87.

NAHID, M., INAYATULLAH, C. AND CHAUDHARY, M.F., 1985. Resistance of barley lines to green bug, *Schizaphis graminum* Rondani. *Rachis*, **10**: 2.

NIEMEYER, H.M. AND PEREZ, F.J., 1995. Potential of hydroxamic acids in the control of cereal pests, diseases and weeds. In: *Allelopathy: organisms, processes and application* (eds. Inderjit, K.M.M. Dakshini and F.A. Einhelling), pp. 260-270. American Chemical Society Symposium Series No. 582. Washington DC.

SALAS, M.L., 1991. Effect of environment on gramine content of barley leaves and susceptibility to aphid *Schizophis graminum. Phytochemistry*, **30**: 3237-3240.

SINGH, S.S., MAHABAT, M. AND RAM, S., 1985. Barley lines resistance to Corn leaf aphid. *Rachis*, **4**: 9-10.

STARY, P. AND LUGASOVA, H., 2002. Russian wheat aphid, *Diuraphis noxia* (Kurd.) (Homoptera: Aphididae) under adverse weather conditions. *Anz. Schadingsk*., **75**: 140-143.

TANTAWI, A.M., 1985. Studies on wheat aphids in Egypt 1. Survey. *Rachis*, **4**: 25-26.

TSUMUKI, H., KANEHISA, K., SHIRAGA, T. AND KAWADA, K., 1987. Characteristics of barley resistance to cereal aphids. II. Nutritional differences between barley strains. *Nogaku Kenkya*, **61**: 149-159.

ZICHKINA, L.N. AND KAPLIN, V.G., 2001. The biology and ecology of and damage to plants by *Haplothrips tritici* (Kurdj.) (Thysonaptera) in the forest steppe of the middle Volga area. *Ent. Obozrenie*, **80**: 830-842.

(Received 10 March 2005, revised 24 January 2006)