Plant Pathology Journal

ISSN 1812-5387

Pakistan Journal of Plant Pathology, Vol. 1 (1): 9-10, 2002

Development and Fecundity of *Sitobion avenae* (F.) (Hom.: Aphididae) on Some Wheat Cultivars in Laboratory Conditions

Nihal Özder
Department of Plant Production, Faculty of Agriculture, Trakya University, Tekirdağ, Turkey

Abstract: Nymphal development time and fecundity of *Sitobion avenae* (F.) were determined on nine widespread wheat varieties cultivated in Tekirdağ Region in Turkey. Tests were carried out in controlled environment chambers (25±1°C, 65±5 % R.H. and 16:8 light and dark cycle). Developmental time ranged from 5.75±0.25 to 7.20±0.20 day. Fecundity was found the highest (12.87±1.50) on cv. Sana. Cv. MV-17, cv. Miryana, cv. Pehlivan and cv. Saraybosna were found particular resistant wheat varieties against *S. avenae*.

Key words: Insecta, fecundity, developmental time, wheat, host resistance

Introduction

Aphids are major agricultural pests and cause reduction in crop yield by direct feeding damage and by transmission of viruses. The wheat aphids and their natural enemies were determined by previous researches in Tekirdağ (Özder and Toros, 1999a,b). English grain aphid *Sitobion avenae* (F.) was found the most common species on the wheat in this region. It is also known as the wide spread aphid over the world (Dean, 1974; Kiechefer, 1975; Kolbe and Linke, 1974; Markkula, 1980; Robinson and Hsu, 1963). Biology and effect of wheat varieties on main life parameters of *Sitobion avenae* have been studied separately (Araya *et al.*, 1987; Celis *et al.*, 1997; Di Pietro and Akli, 1987; Dixon, 1973; 1987; JunXiang *et al.*, 1999; Leszczynski *et al.*, 1995; Markkula and Myllymaki, 1963; Markkula and Roukka, 1972; Theime and Heimbach,1996; Watt, 1979; Watt and Dixon, 1981). The nymphal development duration, longevity and fecundity are the most important indices identifying the resistance of wheat varieties (JunXiang *et al.*, 1999). In addition to the quantification of the impact of resistance varieties on the aimed pest is important for the effective use of plant resistance as a part of management strategy.

This research was conducted at Agricultural Faculty of Tekirdağ to determine the effects of wheat varieties on *S. avenae* development and fecundity using nine wheat varieties on *S. avenae* and determining particular resistant wheat varieties for Tekirdağ Region of Turkey.

S. avenae adults were obtained from wheat cultivar Kate-A-I in the field of the Faculty. *S. avenae* was cultured as a stock culture on each wheat variety in laboratory conditions after they collected from the field. Kate-A-I, Miryana, Pehlivan, Flamura 85, MV-17, Saraybosna, Sana, Primoretz, Prostor are the most widespread cultivated *Triticum aestium* varieties in Tekirdağ. The experiments were conducted on this wheat varieties at 25±1°C, 65±5 % R.H. and 16:8 light and dark cycle. Each wheat variety was grown up individually in 10 cm diameter plastic pots. In order to determine nymphal development newly born nymph were settled individually on two plant leaves of each wheat variety. Afterwards, they nymph was observed daily for molting and survivoship. The presence of exuviae was used to determine molting. Daily reproduction per adult and adult mortality were recorded every day after they reached adult stage still they died. There were 35 replicates for each wheat variety and each traits.

For the analysis of nymphal development all of the data were normalized by the arcsine$\sqrt{(x+1)}$ transformation (square-root transformed). Development data (each stadium) and fecundity were analyzed separately by one way analysis of variance (ANOVA) and comparisons were made using Duncan's Multiple range tests (SAS Institute, 1987).

Wheat varieties had significant effects on total nymphal development period, preoviposition period and the mean nymph number of reproduction of *S. avenae* ($P<0.5$).

There were no significant differences in 1, 2 and 3 nymphal development period among the wheat varieties. But 4 nymphal period was found the shortest on cv. Pirimoretz. Total nymphal developmental time of *S. avenae* was shortest on cv. Pehlivan (5.75±0.25) and cv. Primoretz (5.80±0.20). The maximum development time were found on cv. Saraybosna (7.20±0.209). Mean nymph number were found the highest on cv. Sana (12.87±1.50). The lowest nymph number was found on Pehlivan

Table 1: Nymphal development period and mean of nymph number of *Sitobion avenae* on different wheat varieties

Wheat varieties	1.nymphal period(day)	2.nymphal period(day)	3.nymphal period(day)	4.nymphal period(day)	Total nymphal development(day)	Preovi. perod(day)	Ovipos. period(day)	Mean numbers of nymph
MV-17	1.20±0.45 (1-2)	1.40±0.55 (1-2)	1.80±0.45 (1-2)	2.40±0.55 (2-3) b [x,y]	7.00±0.31c (6-8)c	1.75±0.50 (1-2)ab	5.25±2.06 (3-7)	9.25±0.95 (6-15)a-c
Prostor	1.50±0.58 (1-2)	1.25±0.50 (1-2)	2.00±0.0 (2-2)	2.25±0.50 (2-3)b	7.00±0.40 (6-8)c	2.33±0.58 (2-3)abc	4.33±1.53 (3-6)	10.66±1.92 (4-24)a-c
Miryana	1.60±0.55 (1-2)	1.40±0.55 (1-2)	1.80±0.45 (1-2)	2.20±0.45 (2-3)b	7.00±0.31 (6-8)c	2.50±0.58 (2-3)abc	5.50±3.11 (3-10)	8.09±1.28 (2-16)ab
Kate-A-I	1.20±0.45 (1-2)	1.40±0.45 (1-2)	1.60±0.55 (1-2)	2.40±0.55 (2-3)b	6.60±0.24 (6-7)abc	1.33±0.58 (1-2)a	5.00±1.0 (1-2)	10.62±1.13 (7-16)a-c
Primoretz	1.20±0.45 (1-2)	1.20±0.45 (1-2)	1.60±0.55 (1-2)	1.40±0.55 (1-2)a	5.80±0.55 (5-6)ab	2.75±1.26 (1-4)bc	3.50±1.0 (3-5)	10.00±1.50 (3-18)a-c
Flamura-85	1.00±0.01c (1-1)	1.60±0.55 (1-1)	1.80±0.545 (1-1)	2.40±0.55 (2-3)b	6.80±0.37 (6-8)c	1.33±0.58 (1-2)a	4.67±0.58 (4-5)	10.12±1.55 (5-18)a-c
Saraybosna	1.60±0.89 (1-3)	1.40±0.55 (1-2)	1.80±0.45 (1-2)	2.40±0.55 (2-3)b	7.20±0.20 (7-8)c	3.67±0.58 (3-4)c	4.33±0.58 (4-5)	11.63±1.19 (1-11)bc
Pehlivan	1.00±0.0 (6-8)	1.50±0.58 (1-2)	1.25±0.50 (1-2)	2.00±0.82 (1-3)ab	5.75±0.25 (5-6)a	1.50±0.58 (1-2)ab	4.50±1.29 (3-6)	6.50±1.55 (5-20)a
Sana	1.60±0.89 (1-3)	1.40±0.55 (1-2)	1.80±0.45 (1-2)	2.40±0.55 (2-3)b	7.00±0.31c (6-8)c	2.67±0.58 (2-3)abc	5.33±1.53 (4-7)	12.87±1.50 (8-25)c

[X] Within columns, mean followed by the same letter do not differ significantly $P<0.05$. [Y] Figures are values ± S.E.; in parantheses, the range of minimal and maximal values.

Corresponding Author: Nihal Özder, Department of Plant Production, Faculty of Agriculture, Trakya University, Tekirdağ. Turkey

(6.50 ± 1.55) for *S. avenae*. The shortest preoviposition period was found on Flamura 85 (1.33-0.58) and Kate-A-I (1.33-0.58). There were no significant differences on oviposition period among the wheat varieties (Table 1).

Hasn't been found any literature on the developmental time and fecundite of *S. avenae* for the wheat species studied in this research. The total nymphal development time values of these aphids was similar to what has been reported for these species (Simon *et al.*, 1991). The mean total fecundity in this study was lower than others research (Dean, 1974; Markkula and Myllymaki, 1963). But they also obtained sometimes very different values in his studies (Dean, 1974). Fecundity of *S. avenae* are dependent on aphid-plant genotype and between the aphid–plant interactions, differences of clones and vegetative parts of plant where aphids placed on it (Dixon, 1987; Gianoli *et al.*, 1997; Griiftbs and Wratten, 1979; Lowe, 1980; Radchenko, 1987; Soroka and Mackay, 1991). It is also concluded that *S. avenae* reproduced more faster on ears than leaves (Acreman and Dixon, 1989; Vereijken, 1979). The differences of the value in this study may be happened due tospecies of wheat cultivar, rearing techniques, the part of plant where this study was conducted, aphid-plant interactions and clonal factor.

As a result of this investigation, cv. MV-17, cv. Miryana, cv. Pehlivan and cv. Saraybosna were found resistant varieties against *S. avenae*. Moreover cv. MV-17 and cv. Pehlivan were found resistant wheat varieties against *R. padi* among the same wheat varieties in the Thrace Region (Özder, 1999; Özder and Bayhan, 1998). Antibiosis to *S. avenae* was observed in cultivar Regina between five winter wheat cultivars under greenhouse conditions (Havlikova, 1995).

Acknowledgments

The author thanks to Prof. Dr. Muhsin Doğaroğlu for his kind editorial comments.

References

Acreman, S. J. and A. F.G. Dixon, 1989. The effect of temperature and host quality on the rate of increase of the grain aphid (*Sitobion avenae*) on wheat. Annl. Appl. Biol., 115: 3-9.

Araya, J. E., J. E. Foster and S. E. Cambron, 1987. A study of the biology of *Rhopalosiphum padi* (Homoptera: Aphididae) in winter wheat in northwestern Indiana. The Great Lakes Entomol., 20: 47-50.

Celis-Vr-de, D. Gassen, V.L. Valente, A.K. deOliveira, V.R. deCelis and A.K. deOliveira, 1997. Longevity, fecundity and embryogenesis in *Brazilian aphids*. Pesquisa-Agropecuaria-Brasilerira, 32: 137-145

Dean, G. J., 1974. The effect of temperature on cereal aphids *M. dirhodum*, *R. padi* and *M. avenae* (Hom., Aphididae). Bull. Entomol. Res., 68: 401-409.

Di Pietro, J. P. and M. Akli, 1987. Effects des facteurs varietall et phénologique de différents cultivars de blé ïhiver sur le potentiel biotique de *Sitobion avenae* (F.) en conditions controlés. Bull. OILB/SROPX/., 1: 166-169.

Dixon, A. F. G., 1973. Biology of Aphids. The Institute of biology studies in Biology No. 44, London, Edward Arnold Ltd.

Dixon, A. F. G., 1987. Cereal aphids as an applied problem. Agric. Zool. Rev., 2: 1-57.

Gianoli, E., C.M. Caillaud, B. Chaubet, J.P. Di Pietro and H.M. Niemeyer, 1997. Variability in grain aphid. *Sitobion avenae* (F.) (Homoptera: Aphididae) performance and aphid- induced phytochemical responses in wheat. Environ. Entomol., 26: 638- 641.

Griifths, E. and S.D. Wratten, 1979. Intra and inter-specific differences in cereal aphid low-temperature tolerance. Entomol. Exp. Appl., 26: 161-167.

Havlikova, H., 1995. Verification of antibiosis to cereal aphid in winter wheat cultivars. Ochrana Rostlin, 31: 287- 295.

JunXiang, W., J. JinHu, J., S. BaoCeng and S. XiaoJi, 1999. Effects of wheat varieties on main life parameters of wheat aphids. Chinese J. Appl. Ecol., 10: 447-451 (Chinese, with English summary).

Kiechefer, R.W., 1975. Field populations of cereal aphids in South Dakota. J. Econ. Entomol., 68: 161-164.

Kolbe, W. and W. Linke, 1974. Studies of cereal aphids, their occurrence, effect on yield in relation to density levels and their control. Annl. Appl. Biol., 77: 85-87.

Leszczynski, B., B. Rozbicka and A. Urbanska, 1995. Growth and development of population of the grain aphid *Sitobion avenae* Fabr. on spring triticale. Materialy-Sesji-Instytutu-Ochrony-roslin, 35: 91-93 (Polish, with English summary).

Lowe, H.J.B., 1980. Resistance to aphids in immature wheat and barley. Ann. Appl. Biol., 95: 129-135.

Markkula, M., 1980. Pests of cultivated plants in Finland in 1979. Annl. Agric. Fenn., 19, 1-4.

Markkula, M. and S. Myllymaki, 1963. Biological studies on cereal aphids, *Rhopalosiphum Padi* (L.), *Macrosiphum avenae* (F.) and *Acyrthosiphon dirhodum* (Wlk.) (Hom., Aphididae). Annl. Agric. Fenn., 2: 33- 43.

Markkula, M. and K. Roukka, 1972. Resistance of cereals to the aphids *Rhopalosiphum padi* (L.) and *Macrosiphum avenae* (F.) and fecundity of these aphids on Graminae, Cyperacea and Juncaceae. Annl. Agric. Fenn., 11: 417- 423.

Özder, N., 1999. Investigations on the nymphal development of *Rhapolosiphum padi* (L.) (Homoptera: Aphididae) fed on some processing wheat varieties.14th International Plant Protection Congress (IPPC); Plant Protection Towards the Third Millenium-Where Chemistry Meets Ecology Abstracts, Jerusalem, 39.

Özder, N. and E. Bayhan, 1998. Studies on some biological properties of *Rhopalosiphum padi* on some wheat varieties. Book of Abstracts 2 (Proceedings of the 6 th European Congress Entomology) Ceske Budejovice, Czech Republic, 515-516.

Özder, N. and S. Toros, 1999a. Tekirdağ ilinde buğdaylarda zarar yapan yaprakbiti türleri (Homoptera. Aphididae) türlerinin saptanması üzerinde araþtırmalar. Türk. Entomol. Derg., 23: 101-110.

Özder, N. and S. Toros, 1999b. Tekirdağ ilinde buğdaylarda zarar yapan yaprakbiti türlerinin doğal düþmanları üzerinde araþtırmalar. Entomoloji Derneği Yayınları, 9: 501-512.

Radchenko, E.E., 1987. Intra specific differences of *Sitobion avenae* in relation to breeding for resistance to the pest. Sbornik Nauchnykh Trudov po Prikladnoi Botanike Genetike. Seleksii, 110: 76-81.

Robinson, A.G. and S.J. Hsu, 1963. Host plant records and biology of aphids on cereal grains and grasses in Manitoba (Hom., Aphididae). Can. Entomol., 95, 134-137.

SAS Institute, 1987. SAS/STAT user s guide for personel computers, version 6 ed. SAS Institute, Cary, NC.

Simon, J.C., C.A. Dedryver, J.S. Pierre, S. Tanguy and P. Weogerek, 1991. The influence of clone and morph on the parameters of intrinsic rate of increase in the cereal aphids *Sitobion avenae* and *Rhopalosiphum padi*. Entomol. Exp. Appl., 58: 211-220.

Soroka, J.J. and P.A. Mackay, 1991. Antibiosis and antixenosis to pea aphid (Homoptera: Aphididae) in cultivars of field peas. J. Econ. Entomol., 84: 1951-1956.

Theime, T. and U. Heimbach, 1996. Development and reproductive potential of cereals aphids (Homoptera: on winter wheat cultivars. Bulletin-OILB-SROP., 19: 1-8.

Vereijken, P.H., 1979. Feeding and multiplication of three cereal aphid species and their effect on yield of winter wheat. Versl. Landbk. Onderz Wageningen, pp: 888: 58.

Watt, A.D., 1979. The effect of cereal growth stages on the reproductive activity of *Sitobion avenae* and *Metopolophium dirhodum*. Annl. Appl. Biol., 91: 145-157.

Watt, A.D. and A.F.G. Dixon, 1981. The role of cereal growth stages and crowding in the induction of alatae in *Sitobion avenae* and its consequences for population growt. Econ. Entomol., 6: 441-447.