J. Agric. Sci. Mansoura Univ., 30 (9): 5641 - 5645, 2005

A COMPARATIVE STUDY OF CERTAIN BIOLOGICAL ASPECTS OF THREE CEREAL APHID SPECIES REARED ON BARLEY

El-Fatih, Monira. M.; El-Shiekh, M. A. K.* and El-Hariry, M. A.
Piercing-Sucking Insects Research Department, Plant Protection Research Institute,
Agriculture Research Center, Dokki, Giza, code 12618, Egypt
***Department of Economic Entomology and Pesticides, Faculty of Agriculture,Cairo University, Egypt**

ABSTRACT

The different biological aspects of the bird cherry-oat aphid, *Rhopalosiphum padi* (Linnaeus), the rose grain aphid, *Metopolophium dirhodum* (Walker) and the Russian wheat aphid, *Diuraphis noxia* (Mordvilko) were studied at 25 °C and 58 - 75 % RH, using barley seedlings for feeding and maintaining aphids.

The obtained results revealed that *M. dirhodum* had the longest life cycle duration (7.7 ± 1.1 d) followed by *D. noxia* (6.6 ± 1.7 d) and *R. padi* (5.59 ± 1.0 d). The longest generation time (8.8 ± 1.5 d) was recorded for *D. noxia* followed by *M. dirhodum* (8.3 ± 0.9 d) and *R. padi* (6.35 ± 1.06 d). The fecundity rates for both *M. dirhodum* and *R. padi* were 24.66 and 24.12 progeny/female, respectively. The lowest rate of fecundity (5.43 progeny/female) was recorded for *D. noxia* at 25°C.

M. dirhodum had the longest (19.1 ± 2.8 d) life span duration followed by *R. padi* (15.65 ± 2.47 d) and *D. noxia* (15.4±2.1d).

Key Words: barley, cereal aphids, biology.

INTRODUCTION

Studies have been conducted on various biological aspects of cereal aphids. The bird cherry-oat aphid, *Rhopalosiphum padi* (Linnaeus) biology was studied by Walgenbach *et al.*, 1988; Michel and Behle, 1989 and Austin *et al.*, 1991. Other investigators studied the biology of the Russian wheat aphid, *Diuraphis noxia* (Mordvilko) (Basky and Jordaan, 1997 and Girma *et al.*, 1990). The survival rates of the rose grain aphid, *Metopolophium dirhodum* (Walker), *R. padi* and the English grain aphid, *Sitobion avenae* (Fabricius) decreased with the increase of temperature and the fecundity reached its maximum at 20 °C (Dean, 1974).

The optimum temperature range for *R. padi* on barley was 18-24°C. The highest rate of increasing was at 22°C. Heat stress at 30°C reduced reproduction and fecundity in *R. padi* (Richter and Balde, 1993).

The biology of the greenbug aphid, *Schizaphis graminum* (Rondani) and *R. padi* on wheat were studied by Abdel-Rahman (1997) and Abdel-Rahman *et al.* (2002). They reported that 24°C was the optimum temperature for both aphids.

The biology of *R. padi* on wheat was studied also by El-Fatih (2000) under laboratory conditions of 22 ± 2.5°C. He found that the mean durations of the first, second, third, and fourth instars were 1.58 ± 0.58, 1.44 ± 0.55, 1.64 ± 0.65 and 1.8 ± 0.587 d, respectively. Also, he determined the life cycle, life span as well as viviparity durations which were 7.375, 11.94 and 5.38 d, respectively.

El-Heneidy *et al.* (2004) reported that maturity were 96 and 53 % of both *R. padi* and *S. graminum* on wheat plants while their percentages reached to 100 and 85% on barley plants, respectively.
The present investigation has been proposed aiming to study certain biological aspects of three cereal aphid species.

MATERIAL AND METHODS

Aphid forms (apterous mothers) were collected from a barley field located at Giza Governorate. The newly-borne progenies by field-collected mothers were gently transferred separately (using a fine hair brush) to filter paper discs inside clean Petri-dishes containing barley seedlings.
A culture of *R. padi*, *M. dirhodum* and *D. noxia* was maintained in the incubator at 25°C and 58 - 75 % RH on barley seedlings (Giza 124 variety).
Nymphs were monitored daily until death and the following observations were recorded:
- Developmental durations of each nymphal instar.
- Durations of adult stage (apterous viviparous females) and life span.
- Fraction of progeny reached maturity.
- Survival of individuals throughout their developmental duration

RESULTS AND DISCUSSION

The obtained results of this study are presented in Table (1). *M. dirhodum* had the longest nymphal durations for first, second, third and fourth instars (1.8 ± 0.6, 1.8 ± 0.6, 1.8 ± 1.8 and 2.2 ± 0.7d) followed by *D noxia* (1.8 ± 0.8, 1.7 ± 0.7, 1.4 ± 0.6 and 1.7 ± 0.5 d) and *R. padi* (1.59 ± 0.51, 1.29 ± 0.47, 1.24 ± 0.44 and 1.47 ± 0.51d).

Similar results were recorded for same nymphal instars for *R. padi* on wheat plants as 1.58 ± 0.58, 1.44 ± 0.55, 1.64 ± 0.65, and 1.8 ± 0.587 d, respectively at 22±2.5°C by El-Fatih (2000). Abdel-Rahman *et al.* (2002) reported 1.24 ± 0.51, 1.53 ± 0.39, 1.97± 0.38 and 1.37 ± 0.59 d, respectively for *R. padi* at 24°C, while they reached 1.22 ± 0.42, 1.11±0.31, 1.24±0.44 and 1.16±0.37 d, respectively at 26°C (Abdalla, 2002). Also, these results go in line with those obtained by El-Heneidy *et al.* (2004) for *R. padi* as 1 ± 0, 1.17 ± 0.38, 1 ± 0 and 1.36 ± 0.49 d, respectively and for *S. graminum* as 1 ± 0, 1.17 ± 0.38, 1 ± 0 and 1.36 ± 0.49 d, respectively on barley.

M. dirhodum had the longest life cycle duration (7.7±1.1 d) followed by *D noxia* (6.6±1.7 d) and *R. padi* (5.59±1.0 d). These findings are near to those obtained for *R. padi* (7.76-9.41 d) (Mohamed, 1992), 7.375 d (El-Fatih, 2000) and (15.59± 2.14 d and 14.6 ± 1.6 d on wheat and barley, respectively) (Abdalla, 2002).

R. padi had the longest pre-parturation period (0.76 ± 0.56 d) followed by *M. dirhodum* (0.7 ± 0.8 d) and *D. noxia* (2.2 ± 0.7 d). The same range (1-2 d) was observed previously for *R. padi* by Mohamed (1992), (0.79 ± 0.89 d) as recorded by Abdel-Rahman *et al.* (2002) and less than one day as observed by (Abdalla, 2002). While in case of *S. graminum* it lasted for 5-6 d on wheat and barley plants (Abdalla, 2002).

The longest generation time (8.8±1.5 d) was recorded for *D. noxia* followed by (8.3 ± 0.9 d) for *M. dirhodum* and (6.35 ± 1.06 d) for *R. padi*. These results are close to those obtained by Feng and Yang (1987). They found that *S. graminum* completed a generation in an average of 4.8 d at 30°C and 16.8 d at 10°C. Also, similar results were obtained for *R. padi* (5.81 d) and *S. graminum* (6.74 d) on barley (El-Heneidy *et al.*, 2004). While this duration was longer (13.34 d) for *R. padi* at 24 °C (Abdel-Rahman *et al.*, 2002)

The longest viviparity duration (9.6 ± 2.6 d) was recorded for *M. dirhodum* followed by *R. padi* (7.94 ± 2.68 d), while *D. noxia* (4.3 ± 1.3 d) came third in that order. These results are in agreement with those obtained by El-Fatih, 2000 (5.38 d) and disagree with those obtained for *R. padi* on wheat (26.8 ± 0.65 d) by Mohamed (1992), (16.62 ± 2.66 d) by Abdel-Rahman *et al.* (2002) and (37.78 ± 13.89 and 35.93 ± 10.59 d on wheat and barley, respectively) by Abdalla, 2002.

The fecundity rate for *M. dirhodum* was 24.66 progeny/female and for *R. padi* was 24.12 progeny/female. The lowest rate of fecundity was recorded for *D. noxia* (5.43 progeny/female). These results are close to those obtained for *S. graminum* by El-Gantiry *et al.* (1999) (26.77 individuals/female) and (26.38 ± 1.76 and 27.54 ± 2.36 progeny/female on wheat and barley, respectively) as mentioned by Leather *et al.*, 1989.

D. noxia had the longest post parturation period (2.3 ± 1.6d) followed by *R. padi* (1.35 ± 0.7d) and *M. dirhodum* (1.2 ± 0.5d). However, Mohamed (1992) recorded a longer period for *R. padi* (4.8 ± 0.33 d).

Female longevity for *M. dirhodum* was 11.4 ± 2.8 d followed by *R. padi* (10.06 ± 2.54 d) and *D. noxia* (8.8±1.8 d). These results are similar to the previously recorded for *R. padi* on wheat (11±2.21 d) and barley (10.93± 2.18 d) by Abdalla (2002). On the contrary, the adult longevity of *R. padi* lasted for 33.2 ± 0.62 d (Mohamed, 1992).

M. dirhodum had the longest life span duration (19.1 ± 2.8 d) followed by *R. padi* (15.65 ± 2.47 d) and *D. noxia* (15.4 ± 2.1d) came third. These results are close to that obtained by Hutchinson and Bale (1994). They mentioned that this duration reached 17.4 ± 1.14 d for *R. padi* on barley seedlings. Also, (El-Fatih, 2000) recorded it as 11.94 d for the same aphid species on wheat seedlings. This duration was longer (24.9 d) on wheat as mentioned by Foster *et al.* (1989) and (23.82 and 24.04 d) for *R. padi* and *S. graminum*, respectively on barley (El-Heneidy *et al.*, 2004).

Table (1): Biological parameters of three cereal aphid species reared on barley seedlings.

Tested parameter	Cereal aphid species		
	R. padi	*M. dirhodum*	*D. noxia*
First instar (mean ± SD) (days)	1.59 ± 0.51	1.8 ± 0.6	1.8 ± 0.8
Second instar (mean ± SD) (days)	1.29 ± 0.47	1.8 ± 0.6	1.7 ± 0.7
Third instar (mean ± SD) (days)	1.24 ± 0.44	1.8 ± 0.8	1.4 ± 0.6
Fourth instar (mean ± SD) (days)	1.47± 0.51	2.2 ± 0.7	1.7 ± 0.5
Life cycle (days)	5.59 ± 1.0	7.7 ± 1.1	6.6 ± 1.7
Generation time (days)	6.35 ± 1.06	8.3 ± 0.9	8.8 ± 1.5
Pre-parturation (days)	0.76 ± 0.56	0.7 ± 0.8	2.2 ± 0.7
Viviparity duration (days)	7.94 ± 2.68	9.6 ± 2.6	4.3 ± 1.3
Fecundity rate (progeny/female)	24.12	24.66	5.43
Post-parturation (days)	1.35 ± 0.7	1.2 ± 0.5	2.3 ± 1.6
Female longevity (days)	10.06 ± 2.54	11.4 ± 2.8	8.8 ± 1.8
Life span (days)	15.65 ± 2.47	19.1 ± 2.8	15.4 ± 2.1

REFERENCES

Abdalla, D. A. (2002). Biological and ecological studies on the parasitoid *Aphidius matricariae* Hal. (Hymenoptera: Aphidiidae) parasitizing the cereal aphid. M. Sc. Thesis, Fac. Agric., Cairo Univ., Egypt, 134 pp.

Abd El-Rahman, M. A. A. (1997). Biological and ecological studies on cereal aphids and their control in Upper Egypt. M. Sc. Thesis, Fac. Agric., Assiut Univ., Egypt, 231pp.

Abdel-Rahman, M. A. A.; A. M. Ali and A. G. Ali (2002). Reproductive potential of the oat bird-cherry aphid, *Rhopalosiphum padi* L. (Homoptera: Aphididae) at constant temperature. 2nd International onference, Plant Protection Research Insitiute, Cairo, Egypt, 21-24 December.

Austin, A. B. M.; G. M. Tatchell and J. S. Bale (1991). A method for rearing cereal aphids in a small space. Entomologia Experimentalis et Applicata, 61(1):91-93.

Basky, Z. S. and J. Jordaan (1997). Comparison of the development and fecundity of Russian wheat aphid (Homoptera: Aphididae) in South Africa and Hungary. J. Econ. Entomol., 90 (2):623-637.

Dean, G. J. W. (1974). Effect of temperature on the cereal aphids *Metopolophium dirhodum* (WLK.), *Rhopalosiphum padi* (L.) and *Macrosiphum avenae* (F.) (Hem., Aphididae). Buil Entomol. Res. 63: 401 – 409.

El-Fatih , M. M. (2000). Cereal aphids in Egypt and their impact on wheat. M. Sc. Thesis, Fac. Agric., Cairo Univ., Egypt, 146pp.

El-Gantiry, A. M.; M. M. Abou-Setta and S. F. M. Moussa (1999) Certain biological studies on *Aphis craccivora* and *Schizaphis graminum* (Homoptera: Aphididae) under different constant temperatures. J. Egypt. Ger. Soc. Zool., 30: 123-132.

El-Heneidy, A. H.; H. M. Sobhy; S. M. N. Abd-El-Wahed and W. Z. A. Mikhail (2004). Biological aspects and life table analysis of cereal aphid species and their parasitoid, *Aphidius colemani* Viereck (Hymenoptera: Aphidiidae). Egyptian Journal of Biological Pest Control, 14 (1), 43-51.

Feng, C. C. and J. Y. Yang (1987). Influence of temperature on the growth and development of *Schizaphis graminum*. Insect Knowledge, 24 (3): 140-143.

Foster, J. E.; S. S. Stamenkovie and J. E. Araya (1989). Life cycle and reproduction of *Rhopalosiphum padi* (L.) (Homoptera: Aphididae) on wheat in the laboratory. J. Entomol. Sci., 23: 216-222.

Girma, M.; G. Wildw, and J. C. Reese (1990). Influence of temperature and plant growth stage on development, reproduction, lifespan and intrinsic rate of increase of the Russian wheat aphid (Homoptera: Aphididae). Environ. Entomol., 19. 1438-1442.

Hutchinson, L. A. and J. S. Bale (1994). Effect of sublethal cold stress on the *Rhopalosiphum padi*. J. Appl. Eco., 31(1): 102-108.

Leather, S. R.; K. F. A. Walters and A. F. G. Dixon (1989). Factors determining the pest status of the bird cherry-oat aphid *Rhopalosiphum*

padi (L.) (Hymenoptera: Aphididae), in Europe: a study and review. Bull. Ent. Res. 79: 345-360.

Michels, G. J. and R. W. Behle (1989). Influence of temperature on reproduction, development and intrinsic, rate of increase of Russian wheat aphid, greenbug, and bird cherry-oat aphid (Homp.: Aphididae), J Econ. Entomol. 82 (2). 939-949.

Mohamed, M. A. (1992). Ecological and biological studies on wheat insect pests in Egypt. Ph. D. Thesis, Fac. Agric., Al-Azhar Univ., Egypt. 144pp.

Richter, S. and M. Balde (1993). Influence of temperature on the development and reproduction of pea and oat aphids on field beans and spring barley. Mitteilungen der Deutschen Gesellschaft fur Allgemine und Angewandte Entomologie. 8 (4-6): 591-597.

Walgenbach, D. D.; N. C. Elliott and R. W. Kieckhefer (1988). Constant and fluctuating temperature effect on the developmental rates and life table statistics of the greenbug (Homoptera: Aphididae). J. Econ. Entomol., 81: 501-507.

دراسة مقارنة لبعض الخصائص البيولوجية على ثلاثة أنواع من من النجيليات المرباة على الشعير

منيرة محمد الفاتح، محمد عبد القادر الشيخ*، مجدى عبد الحميد الحريرى

قسم بحوث الحشرات الثاقبة الماصة – معهد بحوث وقاية النباتات– مركز البحوث الزراعية– الجيزة

*** قسم الحشرات الاقتصادية والمبيدات– كلية الزراعة– جامعة القاهرة**

تم فى هذه الدراسة تقدير بعض القياسات البيولوجية لثلاثة انواع من من النجيليات هى من الشوفان The bird cherry-oat aphid, *Rhopalosiphum padi* (Linnaeus), و من الحبوب الوردى The rose grain aphid, *Metopolophium dirhodum* (Walker) و من القمح الروسى The Russian wheat aphid, *Diuraphis noxia* (Mordvilko) حيث ربيت هذه الانواع على بادرات الشعير (صنف جيزة 124) تحت ظروف المعمل على درجة حرارة 25 م° ورطوبة نسبية 58– 75 %.

سجل من الحبوب الوردى *M. dirhodum* أطول دورة حياة Life cycle (7.7±1.1 يوم) تلاه النوع *D. noxia* (6.6±1.7 يوم)، ثم النوع *R. padi* (5.59 ± 1.0 يوم).

سجلت أطول فترة جيل Generation time للنوع *D. noxia* (8.8 ±1.5 يوم) تلاه النوع *M. dirhodum* (8.3 ± 0.9 يوم) ثم النوع *R. padi* (6.35 ±1.06 يوم).

وصل معدل الخصوبة (Fecundity rate) إلى (24.66 و 24.12 ذرية / أنثى) لنوعى المن *M. dirhodum* و *R. padi*، على التوالى. وسجل أقل معدل خصوبة (5.43 ذرية / أنثى) للنوع *D. noxia*.

سجلت أقصى فترة لدورة الحياة (Life span) للإناث (19.1 ± 2.8 يوم) للنوع *M. dirhodum* متبوعا بـ 15.65±2.47 يوم للنوع *R. padi*، فى حين كانت هذه الفترة 15.4 ± 2.1 يومًا للنوع *D. noxia*.