

EFFECT OF HOST APHID SPECIES, TEMPERATURE AND FOOD SUPPLY ON SOME BIOLOGICAL CHARACTERISTICS OF THE TWO APHID PARASITIDS, *Diaeretiella rapae* (M'INTOSH) AND *Aphidius* SP (NEES) (HYMENOPTERA: APHIDIIDAE).

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ABSTRACT

The duration of immature stages and adult longevity of the two aphid parasitoids *Diaeretiella rapae* and *Aphidius* sp. were studied at different temperatures and food supply. The results indicated that the incubation period of eggs, larval, and pupal durations of the parasitoid *D. rapae* were significantly affected by different host species. The total developmental period of this parasitoid averaged 16.07 days when reared on *Brevicoryne brassicae* while it was 11.93 days when reared on *Aphis craccivora*. The total developmental period of *Aphidius* sp. reared on *Sitobion avenae* showed an average of 13.85 days. The results also indicated that the average longevity of the two parasitoids were decreased linearly with the increase of temperature. The mean longevity of adult parasitoids was prolonged when they were supplied daily with 10% sugar solution.

INTRODUCTION

The hymenopteran parasitoids *Diaeretiella rapae* (M'Intosh) and *Aphidius* sp. (Nees) are well known as potential bio-agents for many aphid species in different countries (Abou Fakar and Kawar, 1998; Saleh, 2000, and Ragab *et al.* 2002). In Egypt, Ibrahim (1987) studied the biology of *Aphidius uzbekistanitus* (Luz) a parasitoid of *Sitobion avenae*, and *Rhopalosiphum padi*. Kolaib (1991) also in Egypt studied the most suitable temperature for the adult longevity of *D. rapae*, while Liu and Tsai (2002) in USA studied the effect of temperature on development and fecundity of *Lysiphledia mirzai*, a parasitoid of *Toxoptera citricida*. The life span of *D. rapae* a parasitoid of *Brevicoryne brassicae* was also studied in Brazil by Bueno and Souza (1992). However, the present study was conducted to follow the effect of different host aphid species on the biology of the two aphid parasitoids, *D. rapae* and *Aphidius* sp. The effect of temperature and food supply on adult life span of both parasitoids were also investigated.

MATERIALS AND METHODS

To study the biology of the parasitoids *Diaeretiella rapae* and *Aphidius* sp., laboratory cultures of the three aphid species, *B. brassicae*, *Aphis craccivora* and *Sitobion avenae*, were maintained under laboratory condition. These aphid species were reared on caged young seedlings of their hosts. A

laboratory culture of each of the adult parasitoids, *D. rapae* and *Aphidius sp.* was obtained from the field by collecting the parasitized aphids (mummies). The mummified aphids were placed singly in small glass tubes until emergence of the adult parasitoids which were fed on sugar solution.

To determine the duration of different immature stages of the parasitoids *D. rapae* and *Aphidius sp.*, three experiments were carried out. The first was designed to determine the duration of *D. rapae* on the nymphs of *A. craccivora* on broad bean seedlings. The second aimed to study the duration of *D. rapae* on the nymphs of *B. brassicae* on cabbage seedlings, while the third to determine the duration of *Aphidius sp.* on *S. avenae* on wheat seedlings. In each experiment the nymphs of the host aphid were exposed to enough numbers of newly emerged females and males of the parasitoid in a glass chimney for 2-6 hours.

Twenty five nymphs of each parasitized host aphid were dissected daily to observe the development of different immature stages of each parasitoid. To determine the effect of temperature and food supply on the adult longevity of the parasitoids *D. rapae* and *Aphidius sp.*, forty mated females and forty males of each parasitoid species were obtained from the laboratory culture (24 hours) after adults emergence. Each individual was confined in a small glass tube (9×2 cm). The females and males of each parasitoid species were divided into four groups, each of ten replicates. Group (A) of females and males were starved while group (B) of both sexes were supplied daily with 10% sugar solution and kept at room temperature (average 19-22°C). Group (C) of adult females and males were also starved, while group (D) was supplied daily with 10% sugar solution but kept in a refrigerator at 10 °C. The obtained data were statistically analyzed using (Duncan's Multiple Range Test). The Sex ratio of *D. rapae* reared on *A. craccivora* and *B. brassicae* was also determined depending on the ratio of females: males emerged from the whole number of aphid mummies of each aphid host.

RESULTS AND DISCUSSION

1. Life cycle of *D. rapae* reared on *B. brassicae* and *A. craccivora*

The results given in Table (1) indicate that the incubation period of the eggs of the parasitoid differed significantly on both aphid species. It lasted 2 to 4 days with an average of 3.40 ± 0.14 days on *B. brassicae*, while it was 2 to 3 days with an average 2.40 ± 0.11 days on *A. craccivora*.

The larval stage showed an average of 8.44 ± 0.13 days and fluctuated between 7 and 9 days on *B. brassicae*, while it was 6.61 ± 0.05 days with a range of 7 - 8 days on *A. craccivora*.

The pupal stage varied from 3 to 5 days, with an average of 4.23 ± 0.25 days on *B. brassicae*, while, it was shortened to 2 - 4 days with an average of 2.92 ± 0.19 days on *A. craccivora*.

The total developmental period of the parasitoid lasted 12 to 18 days with an average of 16.07 ± 0.39 on *B. brassicae*, while it was 11 to 15 days with an average of 11.93 ± 0.36 on *A. craccivora*. These results are in

agreement with these of Nahif and Madel (1993) who mentioned that the parasitoid *D. rapae* completed its life cycle on *B. brassicae* in 11 to 19 days at 20 °C. Mened these results partially disagreed with these of Bueno and Souza (1992) who reported that the parasitoid completed its life cycle in a period of 8 to 18 days at 26°C ± 1 °C. However, Ragab (1996) studied the biology of *T. angelicae* on *A. craccivora* and found that the parasitoid completed its developmental cycle within 15.4 days at 21.7 °C and RH 61.34 %.

2. Life cycle of *Aphidius sp.* reared on *Sitobion avenae*

The data given in Table (2) show that the incubation period of the eggs of the parasitoid *Aphidius sp.* lasted 1 to 3 days with an average of 2.24 ± 0.11. The larval period exhibited an average of 5.35 ± 0.15 days.

The pupal stage varied from 5 to 7 days, with an average of 6.65 ± 0.13. The total developmental period differed from 10 to 15 days with an average of 13.85 ± 0.29. However, Ibrahim (1987) in Egypt, investigated the developmental period of *A. uzbekistanicus* and found that this period increased as temperature decreased.

Table 1. Effect of aphid host species on the duration of the immature stages of the parasitoid *D. rapae* at 19.5°C & 63.63% RH.

Stage	<i>B. brassicae</i> Mean ± S.E. (Range)	<i>A. craccivora</i> Mean ± S.E. (Range)
Egg	3.40 a ± 0.14 (2 - 4)	2.40 b ± 0.11 (2 - 3)
Larval	8.44 a ± 0.13 (7 - 9)	6.61 b ± 0.05 (7 - 8)
Pupal	4.23 a ± 0.25 (3 - 5)	2.92 b ± 0.19 (2 - 4)
Total developmental period (egg - adult)	16.07 a ± 0.39 (12 - 18)	11.93 b ± 0.36 (11 - 15)

Table 2. Duration of various developmental stages of the parasitoid *Aphidius sp.* reared on *S. avenae* at 21.70°C & 61.34 RH.

Stage	Duration in days	
	Range	Mean ± S.E.
Egg	1 - 3	2.24 ± 0.11
Larval	4 - 6	5.35 ± 0.15
Pupal	5 - 7	6.65 ± 0.13
Total developmental period (egg - adult)	10 - 15	13.85 ± 0.29

3. Effect of temperature and food supply on adult life span of *D. rapae* and *Aphidius sp.*

The results given in Tables 3 , 4 and 5 showed the following:

- 1- The adult longevity of starved females was longer than that of starved males when kept at room temperature (Group A).
- 2- Females lived longer than males when fed at room temperature (Group B).
- 3- Starved or fed females lived, longer than males kept in the refrigerator (Group C).
- 4- Starved or fed females and males kept in the refrigerator lived longer than those kept at room temperature (Group D).

However, Stary (1970) reported that the adult life span of adult parasitoids was affected by many factors such as temperature, humidity, food and presence or absence of hosts. The obtained results are generally in agreement those obtained by Ragab (1996) on *Trioxys angelicae*. Tsai (2002) reported that the average longevity of the parasitoid *Lysiphlebia mrzai* decreased linearly with increasing temperature. In addition, the mean longevity of adult parasitoid was prolonged when they were fed with honey and water.

Table 3. Effect of temperature and food supply on the adult life span of *D. rapae* emerged from *B. brassicae*

Group	Treatment	Temp. (°C)	Adult longevity in days			
			Female		Male	
			Range	Mean ± S.E.	Range	Mean ± S.E.
A	-	19.3	2 - 6	5.8 d ± 0.31	2 - 4	3.5 D ± 0.19
B	+	19.3	9 - 17	12.8 c ± 0.81	5 - 8	6.73 C ± 0.34
C	-	10.0	14 - 22	18.26b ± 0.24	5 - 13	9.74 B ± 0.78
D	+	10.0	21 - 27	25.21a ± 0.85	8 - 17	13.56 A ± 0.99

- Not supplied with sugar solution.

+ Supplied with sugar solution.

Table 4. Effect of temperature and food supply on the adult life span of *D. rapae* emerged from *Aphis craccivora*.

Group	Treatment	Temp. (°C)	Adult longevity in days			
			Female		Male	
			Range	Mean ± S.E.	Range	Mean ± S.E.
A	-	20.1	2 - 4	3.06 b ± 0.25	1 - 4	2.79 D ± 0.27
B	+	20.1	4 - 6	5.13 c ± 0.19	2 - 5	3.86 C ± 0.27
C	-	10.0	7 - 10	8.66 b ± 0.33	4 - 6	5.25 B ± 0.25
D	+	10.0	10 - 17	14.42a ± 0.78	6 - 12	9.68 A ± 0.19

- Not supplied with sugar solution.

+ Supplied with sugar solution.

Table 5. Effect of temperature and food supply on the longevity of adult *Aphidius sp.* emerged from *S. avenae*

Group	Treatment	Temp. (°C)	Adult longevity in days			
			Female		Male	
			Range	Mean ± S.E.	Range	Mean ± S.E.
A	-	21.7	2 - 5	3.95 d ± 0.36	1 - 3	2.40 D ± 0.22
B	+	21.7	4 - 6	5.48 c ± 0.21	2 - 5	3.66 C ± 0.25
C	-	10.0	6 - 10	8.80 b ± 0.58	4 - 7	5.38 B ± 0.29
D	+	10.0	9 - 17	12.46a ± 0.81	4 - 9	7.18 A ± 0.56

- Not supplied with sugar solution.

+ Supplied with sugar solution.

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تأثير نوع المن العائل ودرجات الحرارة والإمداد الغذائي على بعض الخصائص
البيولوجية لطفيلى المن *Diaeretiella rapae* & *Aphidius sp*
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تم دراسة تأثير نوع المن كعائل على مدد الأطوار غير الكاملة للطفيل *Diaeretiella rapae* وقد أوضحت النتائج أن نوع المن العائل يؤثر تأثيراً معنوياً على مدة دورة الحياة لهذا الطفيل والتي بلغت في المتوسط ١٦,٠٧ يوماً عند تربية الطفيل على من الكرنب و ١١,٠٩ يوماً عند تربيته على من البقوليات أما بالنسبة لطفيل *Aphidius sp* فقد استغرقت دورة حياته ١٣,٨٥ يوماً عند تربيته على من القمح *Sitobion avenae* . كما أوضحت النتائج أن درجة الحرارة قد تؤثر تأثيراً معنوياً على فترة حياة الأطوار الكاملة (ذكور وإناث) حيث تقل هذه الفترات بدرجة واضحة بارتفاع درجات الحرارة كما أن الإناث والذكور التي غذيت على محلول سكرى عاشت لفترة أطول من الذكور والإناث التي ربيت تحت ظروف التجويع.