Plant Archives Volume 20 No. 1, 2020 pp. 1113-1120 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

BIOLOGICAL ASPECTS AND PREDATION EFFICACY OF *COCCINELLA UNDECIMPUNCTATA* L. ON TWO APHID SPECIES UNDER LABORATORY CONDITIONS

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Abstract

The biological aspects and predation efficacy of *Coccinella undecimpunctata* L. fed on two aphid species namely; *Rhopalosiphum padi* (L.) and *Schizaphis graminum* (Rond.), colonized on wheat plants were studied under laboratory conditions of 26±1ºC and 65±5% RH. The obtained data are summarized as follow: The 1st, 2nd, 3rd and 4th larval durations averaged 2.50, 3.00, 3.17 and 4.00 days when the larvae of the predator were fed on *R. padi*, respectively, wheras it was 2.00, 3.75, 3.58 and 4.25 days on *S. graminum*, successively. The total larval duration lasted an average of 12.67 and 13.58 days on *R. padi* (L.) and S. *graminum*, respectively. The total developmental period was 23.58 and 25.58 days on *R. padi* and *S. graminum*, successively. The total consumption aphids during the larval stage varied according to aphid species as it averaged 340.67 and 321.33 aphids on *R. padi* and *S. graminum*, respectively. The 4th larval instar is the most efficient as they consumed 57.20 and 54.40 % of the total consumed preys, when the larvae of predator were fed on *R. padi* and *S. graminum*, successively. The pupal stage lasted an average of 5.17 and 6.0 days of the previously prey species, consecutively. The shortest and longest oviposition period of *C. undecimpunctata* was 66.29 and 72.86 days on *R. padi* and *S. graminum*, respectively. The total consumed preys during the pre-oviposition, oviposition, post- oviposition periods averaged 104.08, 332.75 and 226.50 aphids per female on *R. padi*, whereas it was 119.75, 398.67 and 269.50 preys on *S. graminum*, respectively. The highest mean number of eggs laid per female was 521.42 eggs was noticed on *S. graminum*. While the lowest value of 480.25 eggs was recorded on *R. padi*. Rearing on *S. graminum* gave the best results for egg hatching (89.33%). Longevity of female was prolonged (82.14 days) on *S. graminum* and was shortened (31.29 days) on *R. padi*.

The total consumed aphids by the adult averaged 584.17and 729.17 preys per female on *R. padi* and *S. graminum*, successively.

The adult female is considered the most efficient predatory stage as it consumed about 1.8 and 2.3 times as much as that of the larva on *R. padi* (L.) and *S. graminum*, consecutively.

Key words : *Coccinella undecimpunctata* L., *Rhopalosiphum padi* (L.), *Schizaphis graminum* (Rond.), biological characteristics, predation efficacy, Biological control.

Introduction

Biological control is an important component of integrated pest management. It involves the control of pest population by natural enemies (Solangi *et al.,* 2007). Aphid ranks among the most noxious insects attacking cereal crops allover the world. By their piercing sucking mouth parts, aphid extracts large amounts of phloem sap resulting in greater than 50% yield reductions (Salman *et al.,* 2014). In Egypt, *Rhopalosiphum padi* (L.), *Schizaphis graminum* (Rond.), were recorded to attack cereal crops in the studies of Youssif *et al.,* 2017). Among the previous aphid species, *R. padi* reported as the most damaging aphids in wheat fields in Egypt (El-Maghraby *et al.,* 2006). Ladybirds beetles (Coleoptera: Coccinellidea) are among the most important insect predators that attack aphid pests world wide (Obrycki and Kring, 1998). Coccinellids are considered among the most important predaceous insects attacking aphids, mealy bugs, spider mites, thrips, jassids, whitefly, scale insects and eggs of lepidopterous. Gautarm, 1989; Obrycki and Kring, 1998 ; Bahy El-Din, 2006). Eleven spotted ladybird beetle, *Coccinella undecimpunctata* L. is considered to be an important and successful predator of a number

of pests attacking cotton, sunflower, citrus (Naveed *et al.*, 2007 and Saeed *et al.*, 2007). Wheat and vegetable crops (Ibrahim and Afifi, 1991, El-Hag, 1992, El-Heneidy, 1994, Abou-El- Hagag and Abdel-Hafez, 1998, El-Heneidy *et al.*, 2004, Naveed *et al.*, 2007 and Saeed *et al.*, 2007).

Aim of the present work is to evaluate the role of *Coccinella undecimpunctata* as an important biological control agent in suppressing aphids, *R. padi* and *S. graminum* by studying its biological aspects and predation efficacy under laboratory condition.

Materials and Methods

The present investigation was carried out in Plant Protection Department, Faculty of Agriculture, Zagazig University Egypt, under constant temperature of 26±1ºC and 65±5% RH.

Two aphid species namely, *Rhopalosiphum padi* (L.) and *Schizaphis graminum* (Rond.), were used as preys for the predator, *Coccinella undecimpunctata* L. The adults of *C. undecimpunctata* were collected from wheat fields and reared on cereal aphid, *S. graminum* colonized on wheat plants. The culture of the predator, *C. undecimpunctata* was examined daily, provided with the aphids as prey.

The egg-masses were transferred into plastic vial (7x2 cm). The egg-masses were observed daily until hatching. Forty newly hatched larvae of the predator were kept separately in plastic vial (as previously described).

Twenty replicates were used for each prey and provided daily with enough known number, ca. 60 individuals, of different stages of aphids, *R. padi* and *S. graminum* on pieces of wheat plants. The examination was done daily, whereas the devoured aphids were recorded and the rest of aphid individuals and the plant pieces were removed from plastic vial before introducing the new aphid individuals.

Number of consuming aphid individuals were recorded daily until each larva was developed into a pupa. Larval durations, pupal period, pupating percentages, total developmental period, percentages of the adults emergence and sex ratio were recorded. The newly emerged adult, male and female, of *C. undecimpunctata* were paired or coupled in petridishes (10 cm diameter) (one female and one male each) and provided daily with enough known number of aphids. The dishes were inspected daily. The effect of prey species during the predator larval stage of the adult was determined considering the following parameters:

Fecundity, the daily number of consumed preys, fertility, hatchability, incubation period of the eggs, pre-oviposition, oviposition and post- oviposition periods and longevity of each female and male. The differences between treatments averages and their variances were estimated according to COSTAT.

Results and Discussion

Biological aspects and predation efficacy of *Coccinella undecimpunctata* L. on two aphid species under laboratory conditions

Larval stage

Predation efficacy

Data presented in table 1 showed that the averages of the daily feeding capacity of the first larval instar were 6.93±0.45 and 6.67±0.52 preys of *R. padi* and *S. graminum*, respectively. The daily consumed aphid by the 2nd larval instar varied from (18 - 39) and (15 - 35 preys) with an averages of 24.75±2.18 and 23.83±2.21 individuals of *R. padi* and *S. graminum*, respectively.

Analysis of data revealed insignificant differences between first and second larval instars means.

The 3rd larval instar fed on 48.68±6.60 and 24.91±1.13 individuals of *R. padi* and *S. graminum*, respectively. The 4th larval instar consumed an averages of 85.19± 6.79 and 42.50±6.75 preys of the previously preys species, respectively. Analysis of data cleared that there are highly significant differences between third and fourth larval instars means.

The daily consumed aphids during the total larval stage averaged 165.54±13.5 and 97.91±7.77 preys when larvae of *C. undecimpunctata* were fed on *R. padi* and *S. graminum*, respectively. The differences between means are highly significant.

The total consumed aphids during the 1st larval instar were 22.08±1.20 and 20.00±1.54 individuals of the previously preys species, respectively. The 2nd larval instar consumed 49.50±4.36 and 47.67±4.42 individuals of *R. padi* and *S. graminum*, respectively. The 3rd larval instar fed on 74.42±3.25 and 74.75±3.41 preys of *R. padi* and *S. graminum*, respectively. The 4th larval instar consumed 194.67±26.3 and 169.92±27.01 individuals of *R. padi* and *S. graminum*, respectively. Analysis of data reaveled that the differences among means are insignificant for all larval instars.

Throughout the total larval stage, the larva of *C. undecimpunctata* fed on the mean numbers of 340.67±8.86 and 321.33±10.49 aphids of *R. padi* and *S. graminum*, successively. The differences between total larval stage means are significant.

The 1st, 2nd, 3rd and 4th larval instars consumed 6.50, 14.50, 21.80 and 57.20% of the total consumed preys during the whole larval stage when larvae of predator were fed on *R. padi*, respectively. The four larval instars consumed 6.40, 15.30, 23.90 and 54, 40%, successively of the total consumed preys during the whole larval stage when larvae of predator reared on *S. graminum*.

These findings indicated that the greatest number of aphids was consumed by the 3rd and 4th larval instars. These results are in agreement with those of Ahmed (2000) who mentioned that the 3rd and 4th larval instars are the most efficient in predation, as they fed on 78.06% of the total number of consumed aphid (*Rhopalosiphum maidis*) during the larval period. El-Aish-Hana *et al.* (2004) reported that the larva of *Coccinella septempunctata* L. consumed daily 26.9 individuals of cereal aphids at room temperature. These results are similar with those El-Maghraby *et al*., (2006) who stated that the 1st, 2nd, 3rd and 4th larval instars consumed 9.39, 19.81, 27.64 and 43.16% of the total consumed preys (*R. padi*) during the whole larval stage, respectively.

Imam, (2015) reported that the 1st, 2nd, 3rd and 4th larval instars consumed an average of 21.76, 55.67, 107.86 and 231.03 preys, when the larvae were fed on aphids, respectively.

Larval duration

The *C. undecimpunctata* had four larval instar. The results given in table 2 indicated that the mean durations of the 1st, 2nd, 3rd and 4th larval instar were 2.50±0.15, 3.00±00.00, 3,17±0.52 and 4.00±0.73 days, when the larvae of predator were fed on *R. padi*, respectively. The data revealed that the mean larval duration was recorded in 1st larval instar (2.00±0.00), 2nd larval instar (3.75 ±0.20), 3rd larval instar (3.58 ± 0.27) and 4th larval instar (4.25±0.75) days when the larvae fed on *S. graminum*.

Analysis of data revealed that the differences between 1st, 3rd and 4th larval duration means are insignificant and highly significant for 2nd larval instar. These results are in disagreement with these of Ahmed (2000) stated that the four larval instars of *C. undecimpunctata* preyed on *R. maidis* colonizing maize plants lasted 2, 1.57, 1.05 and 1.68 days, respectively. El-Aish-Hana *et al*., (2004) revealed that the 1st, 2nd, 3rd and 4th larval instars of *C. septempunctata* reared on cereal aphids infesting wheat plants lasted 3,2, 2 and 4 days, successively.

These results are in harmony with the finding of El-Maghraby *et al*., (2006) who revealed that the 1st, 2nd, 3rd and 4th larval instars of *C. undecimpunctata* lasted an averages of 2.00±0.00, 2.94 ± 0.04, 3.03±0.07 and 3.55±0.11 days, consecutively

Mari *et al.,* (2016) reported that the first, second, third and fourth instars ranged between 6.50, 5.60, 7.90 and 8.01 days, respectively, when the larvae were fed on aphid, *R. maidis* infested maize plants.

Total larval duration

As shown in table 2 the mean total duration periods of larval stage reached 12.67 ±1.88 and 13.58 ±1.54 days with ranges of 12-15 and 11- 15 days, on *R. padi* and *S. graminum*, respectively. The differences between means are insignificant.

These results are in disagreement with those of Ahmed (2000) mentioned that the total larval stage lasted an average of 6.30 ± 0.24 days.

These results are agree with these of El-Maghraby *et al*., (2006) who reported that the total larval duration of *C. undecimpunctata* ranged between 11 and 13 days, with an average of 11.55±0.12 days, when the larvae fed on *R. padi*.

El-Heneidy *et al*., (2008) stated that the total larval duration of the predator was 13.60 days.

Imam, (2015) reported that the total larval duration was 23.40 days on *Aphis craccivora* Koch.

Concerning the pupal stage, the results in table 2 showed that the mean durations of pupal stage were 5.17±0.44 and 6.0±1.09days, when the larvae fed on *R. padi* and *S. graminum*, successively. The differences between means are insignificant.

These results are in harmony with the findings of El-Maghraby *et al*., (2006) who stated that the pupal period ranged between 3 and 6 days, with an average of 4.33±0.14 days, when the larvae were fed on *R. padi*.

Imam, (2015) revealed that the mean pupal stage was 5.30 days on *A. craccivora*.

Bakhtawar *et al*., (2017) reported that the mean pupal period was 11.0 days on *Lipaphis erysimi*.

Mari *et al.,* (2016) stated that the mean duration of pupal sage was 4.01 days on *R. maidis*.

Adult stage

Pre-oviposition period

Data in (Tables 3, 4) indicated that the pre-oviposition period varied from 2-8 and 4-6 days, with an averages of 5.57±0.75 and 5.14± 0.40 days, when larvae of predator were reared on *R. padi* and *S. graminum*, respectively. During this period, the female consumed an average of 23.17±1.36 and 25.18±1.41 preys daily of *R. padi* and *S.*

Table 1: Predation efficacy of *Coccinella undecimpunctata* L. Larvae reared on two prey species under laboratory conditions of 26 ± 1ºC and 65 ± 5% R.H.

Prey species	Daily consumed aphids / Range of values					Total consumed aphids					Consumption (%)			
	1st instar	2nd instar	3rd instar	4th instar	Total larval	1st instar	2nd instar	3rd instar	4th instar	Total larval	1st instar	2nd instar	3rd instar	4th instar
Rhopalosiphum padi (L.)	6.93± 0.454-8.7	24.75± 2.1818-39	48.68± 6.617.5-100	85.19±6.79 50.3-135.3	165.54±13. 597.6-268	22.08± 1.2012-28	49.50±4.36 38-79	74.42± 3.2552-89	194.67±26. 370-400	340.67±8.8 6201-541	6.50	14.50	21.80	57.20
Schizaphis graminum (Rond.)	6.67± .523.3-8.7	23.83± 2.2115-35	24.91±1.13 17.7-30	42.50±6. 7517.5-88.8	97.91±7. 7764. 2-137.1	20.00± 1.5410-26	47.67± 4.4229 -70	74.75± 3.4153-90	169.92± 27.0170 -355	321.33± 10.49190 -483	6.40	15.30	23.90	54.40
T	0.43	0.30	3.79	9.99	7.95	1.03	0.30	0.07	1.89	2.28				
P	0.68 Ns	0.77 Ns	0.003**	0.0001**	0.0001**	0.32 Ns	0.77 Ns	0.95 Ns	0.08 Ns	0.04*				

- NS indicates that the differences between treatments are not significant.

-*, ** indicates that the differences between treatments are significant and highly significant at 0.01 level of probability.

Table 2: Effect of prey species on the durations of *Coccinella undecimpunctata* L. immature stages under laboratory conditions of 26 + 1ºC and 65 + 5% R.H.

Prey species	Mean duration (days)															
	Egg stage		Larvel stage										Pupal stage		Total developmental period	
			1st instar		2nd instar		3rd instar		4th instar		Total larval stage					
	Range	Mean±S.E.	Range	Mean±S.E.	Range	Mean±S.E.	Range	Mean±S.E.	Range	Mean±S.E.	Range	Mean±S.E.	Range	Mean±S.E.	Range	Mean±S.E.
Rhopalosiphum padi (L.)	5-7	5.75±0.75	2-3	2.50±0.15	3-3	3.00±0.00	2-4	3.17±0.52	3-5	4.00±0.73	12-15	12.67±1.88	3-7	5.17±0.44	24-31	23.58±5.17
Schizaphis graminum (Rond.)	5-7	6.00±1.09	2-2	2.00±00.00	2-3	3.75±0.20	3-4	3.58±0.27	3-5	4.25±0.75	11-15	13.58±1.54	5-7	6.0±1.09	22-27	25.58±3.72
T	0.89		3.3		5.74		1.60		1.0		2.11		1.89		2.54	
P	0.39 Ns		0.003*		0.000008**		0.14 Ns		0.34 Ns		0.06 Ns		0.09 Ns		0.03*	

- NS indicates that the differences between treatments are not significant.

-*, ** indicates that the differences between treatments are significant and highly significant at 0.01 level of probability.

Table 3: Effect of prey species on longevity, fecundity, fertility and hatchability of *Coccinella undecimpunctata* L. adults under laboratory conditions of 26 ± 1ºC and 65 + 5% R.H.

Prey species	Mean / Range of values					Fecundity	Fertility %	Hatchability %
	Pre - oviposition period	oviposition period	Post - oviposition period	Longevity female	Longevity male			
Rhopalosiphum Padi (L.)	5.57±0.752-8	66.29±4.2550-80	6.29±1.133-12	31.29±1.9623-38	24.86±3.2310-36	480.25±21.70360-612	80.27±3.17	85.18±2.40
Schizaphis graminum (Rond.)	5.14±0.404-6	72.82±3.4160-83	5.71±0.873-8	82.14±4.2365-93	63.86±2.3655-72	521.42±29.40352-650	84.63±1.23	89.33±1.72
T	0.48	1.25	0.44	10.75	3.43	1.62	1.19	1.66
P	0.65 Ns	0.26 Ns	0.67 Ns	0.001*	0.001*	0.13 Ns	0.26 Ns	0.1 Ns

- NS indicates that the differences between treatments are not significant.

-* indicates that the differences between treatments are significant at 0.01 level of probability.

Table 4 : Predation efficacy of *Coccinella undecimpunctata* L. adult reared on two prey species under laboratory conditions of 26 ± 1ºC and 65 ± 5% R.H.

Prey species	Daily consumed aphids/ Range of values					Total consumed aphids				
	Pre - oviposition period	oviposition period	Post- ovi position period	Longevity female	Longevity male	Pre - oviposition period	oviposition period	Post- ovi position period	Longevity female	Longevity male
Rhopalosiphum padi (L.)	23.17± 1.3618-31.7	31.49± 1.1526-37.5	27.95± 1.4720-35	29.52± 0.6026.1-32	27.68± 1.0421.6-33	104.08± 2.2048-202	332.75± 9.76168-466	226.50± 13.4170-380	584.17± 24.31282-865	601.25± 76.04262-1165
Schizaphis graminum (Rond.)	25.18± 1.4115-31.8	31.73± 0.9726-36	28.02± 1.1120-34	30.38± 0.8225-34	29.33± 0.8024-33	119.75± 2.2350-200	398.67± 5.35256-482	269.50± 9.6175-385	729.17± 70.49293-1104	713.83± 47.78263-895
T	0.86	0.20	0.03	1.06	1.40	0.92	2.12	1.46	1.51	1.52
P	0.41 Ns	0.84 Ns	0.97 Ns	0.31 Ns	0.19 Ns	0.38 Ns	0.06 Ns	0.17 Ns	0.16 Ns	0.16 Ns

- NS indicates that the differences between treatments are not significant.

graminum, respectively. The total consumed preys by one female during this period were 104.08±2.20 and 119.75±2.23 aphids of the previously prey species, respectively. The differences between means are insignificant.

These results are in harmony with the finding of Ahmed (2000) stated that the total consumed aphid by one female during the pre-oviposition period was 112.40±23.63 preys of *R.maidis*.

El-Maghraby *et al*., (2006) who revealed that the mean pre-oviposition period was 4.82 ± 0.31 days, during this period the female consumed an average 23.38 ± 0.51 aphids daily. The total consumed preys by one female an average 113.94 ± 9.04 aphids, when the larvae were fed on *S. graminum*.

Mari *et al.*, (2016) reported that the pre- oviposition period of the predator was 4.02 days on *R. maidis*.

Oviposition period

Data presented in (Table 3,4) showed that the oviposition period averaged 66.29±4.25 and 72.82±3.41 days, when the larvae of *C. undecimpunctata* were fed on *R. padi* and *S. graminum*, respectively. The averages of the daily feeding capacity of the female were 31.49 ± 1.15 and 31.73 ± 0.97 individuals of *R. padi* and *S. graminum*, successively. The total consumed aphids by one female during this period were 332.75±9.76 and 398.67±5.35 aphids of *R. padi* and *S. graminum*, respectively. Analysis of data reaveled that the differences between oviposition period means are insignificant.

The present results are in harmony with these of Ahmed (2000) who reported that the greatest number of consumed aphids by adult female was during the oviposition period.

These results are in disagreement with these of El-Maghraby *et al*., (2006) who stated that the oviposition period of the predator averaged 10.76 ± 0.74 days, when the larvae were fed on *S. graminum*.

El-Heneidy *et al*., (2008) revealed that the total feeding capacity of the predator adult was the highest during the oviposition period, it was 207 preys.

Mari *et al.*, (2016) stated that the oviposition period of the predator was 24.22 days on *R. maidis*.

Post- oviposition period

As indicated in (Table 3, 4) the post- oviposition period averaged 6.29±1.13 and 5.71±0.87 days, when the larvae were reared on *R. padi* and *S. graminum*, respectively. During this period, the female consumed an average of 27.95±1.47 and 28.02± 1.11 aphids daily of the previously prey species, respectively. The total consumed aphids during this period averaged 226.50±13.41 and 269.50±9.61 preys per female on *R. padi* and *S. graminum*, successively.

Statistical analysis revealed insignificant differences between means in this parameter

These results are in agreement with these of El-Maghraby *et al*., (2006) reported that the mean post-oviposition period was 6.59 days. During this period, the female consumed an average of 28.96 aphids daily. The total consumption averaged 192.18 aphids per female, the larvae of *C. undecimpunctata* were fed on *S. graminum*.

Mari *et al.*, (2016) stated that the post-oviposition period of the predator was 4.66 days when reared on *R. maidis*.

Fecundity

Data given in table 3 cleared that the mean numbers of deposited eggs laid per female averaged 480.25±21.70 and 521.42±29.40 eggs, when larvae were fed on *R. padi* and *S. graminum*, respectively. The differences between means are insignificant.

These results are in disagreement with these of El-Maghraby *et al*., (2006) stated that the number of deposited eggs per female averaged 98.67±8.11 eggs.

El-Heneidy *et al*., (2008) found that the single mated female deposited 729 eggs when rearing on aphids.

Imam, (2015) revealed that the mean number of eggs per female was 195.0 eggs when reared on aphids.

Mari *et al.*, (2016) stated that the mean number of eggs 621 was recorded when reared on *R. maidis*.

Fertility

Data obtained in table 3, showed that the mean percentages of laid fertilized eggs per female were 80.27±3.17 and 84.63±1.23 %, when larvae of *C. undecimpunctata* were reared on *R. padi* and *S. graminum*, successively.

Statistical analysis revealed insignificant differences between means in this parameter

Female longevity

Data in (Table 3, 4) indicated that the adult female longevities averaged 31.29±1.96 and 82.14 ±4.23 days, when the larvae were reared on *R. padi* and *S. graminum*, respectively. The differences between means are significant.

The female consumed an average of 29.52±0.60 and 30.38±0.82 preys daily of *R. padi* and *S. graminum*, successively. The total consumed aphids by one female during its life span averaged 584.17±24.31 and

729.17±70.49 individuals, of the previously prey species, respectively. Statistical analysis cleared insignificant differences between means in this parameter.

These results are in agreement with these of El-Maghraby *et al*., (2006) reported that the female of *C. undecimpunctata* consumed 26.1 to 30.5 aphids daily, with an average of 29.09 individuals the total consumed aphids by one female varied from 287 to 854 preys with an average of 643.82 preys.

El-Heneidy *et al*., (2008) stated that the female longevity of *C. undecimpunctata* averaged 78.05 days, when the larval were fed on aphids.

Mari *et al.,* (2016) reported that the female adult beetle life span was 35.00 days on *R. maidis*.

Male longevity

As indicated in (Table 3, 4), the adult male longevities averaged 24.86±3.23 and 63.86 ±2.36 days, when the larvae were reared on *R. padi* and *S. graminum*, respectively.

Statistical analysis revealed significant differences between means.

One male during its longevity consumed an average of 27.68±1.04 and 29.33±0.80 preys daily on *R. padi* and *S. graminum*, respectively. The total consumed aphids by male during its life span were 601.25±76.04 and 713.83±47.78 aphids, of the previously prey species, successively. Analysis of data revealed that the differences between means are insignificant.

These results are in agreement with these of El-Maghraby *et al*., (2006) revealed that the male during its longevity consumed an average of 28.54 preys daily. The total consumed aphids by male during its life span 563.63 individuals on *R. padi*.

Mari *et al.,* (2016) stated that the male adult beetle life span was 30.00 days on *R. maidis*.

Egg stage

Incubation period

Mated females lay eggs in small groups of 10 to 30 eggs. Data given in table 2 revealed that the incubation period of laid eggs by the adults of *C. undecimpunctata* were insignificantly different owing to the species of prey during larval stage. They were 5.75±0.75 and 6.00±1.09 days, when the larvae were fed on *R. padi* and *S. graminum*, respectively.

Mari *et al.,* (2016) stated that the mean incubation period of *C. undecimpunctata* eggs laid by females reared on *R. maidis* was 6.50 days.

Hatchability

As shown in table 3 the highest mean percentage of hatchability (89.33±1.72%) was recorded when the larvae of predator were reared on *S. graminum*, while, the lowest one (85.18 ± 2.40%) recorded on *R. padi*. The differences between means are insignificant.

These results are in agreement with these of El-Heneidy *et al*., (2008) reported that the mean percentage of hatchability was 81.00%.

Imam, (2015) stated that the highest mean percentage of hatchability 96.3% was obtained when the larvae were reared on aphid, *A. craccivora*.

Mari *et al.,* (2016) reported that the hatch percent of eggs was 70.21 % when reared on *R. maidis*.

Total developmental period

Data tabulated in table 2 clearly showed that the total developmental period of *C. undecimpunctata* were 23.58±5.17 and 25.58±3.72 days, when the larvae were fed on *R. padi* and *S. graminum*, respectively. The differences between means are significant.

Mari *et al.,* (2016) stated that the total developmental period of the predator was 38.52 days on *R. maidis*.

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