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# INFLUENCE OF NUTRITION' S ON LONGEVITY AND FECUNDITY THE COCCINELLID PREDATORS, *Coccinella undecimpunctata* L. (COLEOPTERA: COCCINELLIDAE).

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## ABSTRACT

The average biology of *Coccinella undecimpunctata* L. were showed that when it was reared on *Sitobion avenae* Fab. The incubation period, total larval stage period , pre-pupal period, pupal and adult male and female periods was 7.0 ± 0.0, 13.4 ±0.7, 1.4±0.5, 6.6 ± 0.5, 63.7 ± ٢٣.7 and 78.7 ± 9.3 days, respectively, whereas on *Schizaphis graminum* Rond., these periods were 7٠. ± 0.0, 14.8 ± 0.7, 1.4±0.5, 6.٠± 0.7 and ٦١.٠± ٨.٠ and 82.3 ± 11.7 days, respectively. The mean fecundity of *C. undecimpunctata* on *S. avena*e and *S. graminum* were 415 ± 154.٧ and 406.٧ ± 51.7 eggs per female, respectively. Total longevity of male and female *C. undecimpunctata* on *S. avena*e and *S. graminum* were 92.1 ± 24.6 and 90.2 ± 8.4 and 107.1 ± 10.2 and 111.5 ± ١٢.٢ days, respectively.

## INTRODUCTION

The aphid is one of the most destructive pests and its distribution is worldwide. Both nymphs and adult cause damage by sucking the sap from the flowers, buds, pods, tender shoots and reduce the market value of the product Srivastava and Singh (1986). At the time of infestation plants fail to give flowering and pods setting resulting in considerable yield loss (Islam, 2007). Insecticidal control is not only expensive but also its residues left over the sprayed surface of the crops or in the soil and have become a matter of concern of environmental pollution. The indiscriminate use of pesticides causes phytotoxicity and destruction of beneficial organisms such as predators, parasitoids, microorganism and pollinators Luckman and Metcalf (1978). Also, inducing pest out break because of pest resistance. These entomological backlashes have compelled the scientists to be concerned with entomologically compatible pest management program Hodek (1967). Now days, Integrated Pest Management (IPM) is well known to all of us where all the suitable pest control techniques are being used to find ecologically sound and environmentally safe ways of pest control. Biological control should be regarded as the backbone of any IPM program and about 90% of all potential pests are already under biological control Debach and Rosen (1991). The biological control is one of the most effective means of achieving insect control Pedigo (2004). In recent years, pest control particularly for aphids has been revolutionized by the application of predators and parasitoids Bari and Sardar (1998). The coccinellid beetles are considered to be a great economic importance in agro-ecosystem through their successful employed in the biological control of many injurious insects Agarwala *et al.* (1988). The

ladybird beetles have been known worldwide as a predator of a number of insects. They are the most commonly known of all beneficial insects. They are the great economic important as predaceous both in their larval and adult stages on various important crop pests such as aphids, coccids and other soft bodies insects including aphids Hippa *et al.* (1978) while the species *C. undecimpunctata* is predaceous on various types of aphids (rose aphid, green peach aphid, green bug aphid and green mustard aphid). It is found in many habitats, including fields, gardens, forests, sea coast, mountains and cities Ali and Rizvi (2009). The study of the biology of *C. undecimpunctata* on different aphid species would help to use this insect of proper biological control. But the reviews of biology of *C. undecimpunctata* are limited. So, the present study was undertaken to observe the biology of *C. undecimpunctata* on two different species of aphid under the laboratory conditions.

## MATERIALS AND METHODS

The experiment was conducted at the plant protection Laboratory of Sakha Agriculture Research Station, during the period from January to May 2014 under laboratory conditions. A culture of large number of larvae and adult predator of *Coccinella undecimpunctata* L**.** was established in the laboratory in order to supply necessary insects for the experiment. The experiment was carried out on five replicates for immature stages and three replicates for mature stages. For this some males and females of the *C. undecimpunctata* were collected by sweep net from the unsprayed fields and were confined in Petri- dishes. Two aphid species English grain aphid, *S. avenae* and green bug aphid, *S. graminum* were also collected daily with infested wheat plants, from the same unsprayed field and supplied as food. These beetles were sexed and paired in Petri- dishes (6.0×1.0 cm) according to Shukla and Jadhav (2014). The bottoms of the Petri- dishes were covered with the blotting paper. After eggs hatching, the grubs were transferred to medium sized Petri- dishes and fed on these two species of aphids, *S. avenae* and *S. graminum*. The eggs laid by each female during 24 hours were counted and kept in separate petridish to determine the total number of eggs laid per female and also hatching period was recorded. After hatching, young larvae were then transferred individually in Petri- dishes (6.0 × 1.0 cm), containing the blotting paper at the bottom. During feeding on two aphid species instar period were recorded. The pupae were kept undisturbed in the respective Petri- dishes until the emergence of adult. At the same time pre-pupal and pupal period was recorded. The adult emerged were also provide two aphid species as food and the adult period, preoviposition, oviposition and post oviposition period were also recorded. Statistical analysis was carried by ANOVA to get the variations between the feeding of the two aphid species.

## RESULTS AND DISCUSSION

The data represented in Tables (1 and 2). Showed that the biology aspects of the *C. undecimpunctata* were under the following headings.

Egg: During the present study, it was observed that *C. undecimpunctata* did lay eggs where aphid colonies presented in the field condition. In laboratory condition, the eggs were laid on the undersurface of lid and periphery of petridish. The egg was usually laid singly or in groups of 6 to 11 and each group continues of 3 to 32 eggs. The freshly laid eggs of *C. undecimpunctata* were cigar shaped bright yellow in colour with smooth chorion and without any reticulations. The eggs turned blackish with age advancement and became completely black before hatching. The similar description of egg laying pattern, shape and colour was also reported by Lyla *et al.,* (2008) on *Coccinella transversalis* (Fabricius). Incubation period was completed on 7.0±0.0 days when reared on both aphid species *S. avenae* and *S. s graminum*. Shukla and Jadhav (2014) mentioned that the egg period of *Coccinella transversalis* were 2.70 ± 0.76days, when it was reared on three aphid species *Aphis craccivor* (viz.)*, Lipaphis erysimi* (Kalt.) and *Myzus persicae* (Sulzer) respectively.

During the present studies, *C. undecimpunctata* was observed to pass through four larval instars were observed when reared on two different aphid species.

First instar - The newly hatched larva was silvery shine pale black in colour with shining dark head capsule and legs later on it turns black in colour and having spiny structure over body. This is partially in accordance with the larval description given by Tank and Korat (2007) on *Cheilomenes sexmaculata* (Fab.) and Lohar *et al.,* (2012) from Pakistan on *Hipppdamia convergence* Guir. The development of first instar larva of *C. undecimpunctata* was completed on 4 to 5 days in all species of aphid with an average 4.2±0.4 days during feeding on both species of aphides *S. avenae* and *S. graminum* which reared on, respectively (Table 1). According to Lyla *et a*l. (2008) first instar larva of *C. transversalis* lasted for one day on *A. craccivora*. This is in accordance with the present findings.

Second instar - Freshly moulted second instar larva is slender globular in shape and glistening black in colour with pale yellow head capsule and black legs. Development of orange coloured transverse points was observed on meso thorax and also on fourth and sixth abdominal segment. Larval bodies possess the spiny structure. The second instar larva lasted for 3 to 4 days with an average 3.0±0.0 days when reared on *S. avenae* and 3.4±0.5 days when reared on *S. graminum* respectively (Table 1). Sattar *et al.,* (2008) reported that the *Coccinella septempunctata* Linn. second instar larva required an average 4.6 ± 0.47 days when fed on cotton aphid, *Aphis gossypii* Glover, second instar larva of *Menochilus sexmaculatus* Fab. and *C. undecimpunctata* lasted for 4.3 ± 0.2 and 4.4 ± 0.1 days, respectively when fed on alfalfa aphid, *Therioaphis trifolii* Monell. Lohar *et al.,* (2012) also

reported that the second instar period for *H. convergence* was 2.4 days when fed on *L. erysimi.*

Third instar - The third instar larva of *C. undecimpunctata* was similar in general appearance to the second one, except larger in size and very active. In third instar larva the spiny structure were little larger than in second instar. Freshly moulted third instar larva was dark black in colour. The colour pattern was more intensified with additional development of orange transverse points on mid-dorsal line of other segments except prothorax. Lyla *et al.,* (2008) mentioned that after moulting of *C. transversalis* they turned black with a pair of yellowish orange patch on dorsal side near head. The duration of third instar was in the range of 3 to 4 days in all prey species with an average of 3.4±0.5 days when reared on both species *S. avenae* and *S. graminum*, respectively. Chowdhary *et al.,* (2008) found that the duration of the third instar larvae of *Micraspis discolor* (Fab.) lasted from 2 to 4 days with the mean 3.10 ± 0.17 days when fed on bean aphid. Further, Tank and Korat (2007) reported that the third instar larvae of *C. sexmaculata* lasted was 1.88 ± 0.53 days when reared on *A. gossypii.* This is supported with Solangi *et al.,* (2007) who reported that third instar larvae of *C. undecimpunctata* required lasted 3.5 ± 1.26 days when reared on mustard aphid, *L. erysimi*. The third instar period of *H. convergence* was 2.6 days when reared on *L. erysimi* (Lohar *et al.*, 2012).

Fourth instar - The fourth instar larva of *C. undecimpunctata* was similar in general appearance to third instar larva, excluding larger in size. Larvae were deep black in colour, when freshly moulted but changed to black in colour before pre-pupation. It developed additional rectangular dark orange spots in a continuous series mid-dorsally on abdominal segments, whereas the spots on fourth abdominal segment were orange. Here also, the spiny structure were little larger as compared to the third instar and when larvae disturbed, it excludes a yellow fluid from the dorsal surface of the body for defensive purpose, also larval body turn into 'C' shape. After third moult of *C. undecimpunctata* orange coloured points turned to a ring like pattern on the dorsal and dorsolateral side as reported by Lyla *et al.* (2008). The duration of fourth instar larvae of *C. undecimpunctata* varied from 2 to 3and 3 to 5 days with an average 2.8±0.4 and 3.8±0.8 days when reared on *S. avenae* and *S. graminum* respectively (Table 1). Mean duration of fourth instar larvae of *C. sexmaculata* was 1.96 ± 0.73 days when reared on *A. gossypii* Tank and Korat (2007). However, Solangi *et al.,* (2007) recorded that fourth instar larvae of *C. undecimpunctata* lasted for 3.3 ± 0.94 days when reared on mustard aphid, *L. erysimi*. Khursheed *et al*., (2006) found that the mean duration of fourth instar larvae of *C. septempunctata* was 4.0 ± 0.58 days when reared on *L. erysimi,* while it was 2.1 days in case of *H. convergence* when fed on *L. erysimi* Lohar *et al.*,(2012).

**Total larval period**

The total larval development period of *C. undecimpunctata* recorded a highly significant when feed on *S. avenae* and *S. graminum*, the variation ranged from 13 to 14 and 14 to 16 days with an average, 13.4±0.7 and 14.8±0.7 days when reared on *S. avenae* and *S. graminum*, respectively. According to Lyla *et al.,* (2008) mentioned that larval stage of *C. transversalis*

lasted for 10.3 days when fed on *A. craccivora*. Jagadish and Jayaramaiah (2004) found that the total larval period of *C. septempunctata* was 11.86 days when fed on tobacco aphid. Shukla and Jadhav (2014) mentioned that the total larval period of *C. transversalis* were 12.90 ± 1.44, 12.68 ± 1.63 and 12.98 ± 1.93 days, when it was reared on *A. craccivora*, *L. erysimi* and *M. persicae*, respectively.

**Pre-pupa**

The fourth instar larvae stopped feeding and then searched for a suitable place and became stationary and sluggish. This was the beginning of pre-pupal stage. The caudal region was firmly attached to the substratum; the body was shrunken during the formation of pre-pupa. Pre-pupa formed by C. *undecimpunctata* larva was more or less rectangular in shape, formed 'C' shaped. The colour of pre-pupa was similar to the last larval instar. It undergoes a very short pre-pupal period. Similar observations have been made by Tank and Korat (2007) in case of *C. sexmaculata*. The duration of pre-pupal stage varied from 1 day to 2 days with an average 1.4 ± 0.5 days when reared on *S. avenae* and *S. graminum*, respectively. Khursheed *et al.,* (2006) mentioned that the mean pre-pupal period of *C. septempunctata* was 1.5 0.29 days when reared on *L. erysimi*.

**Table (1): Duration period of the immature stages of *C. undecimpunctata* reared on two aphid species under laboratory conditions**.

| Immature stages | | *S. avenea* | | *S. graminum* | | signification |
|---|---|---|---|---|---|---|
| | | **Range** | **Av. ± S.D.** | **Range** | **Av. ± S.D.** | |
| **Incubation period** | | 7 – 7 | **7.0± 0.0** | 7- 7 | **7.0± 0.0** | **N. s** |
| Larval Stage | 1st | 4- 5 | 4.2 ±0.4 | 4- 5 | 4.2 ±0.4 | |
| | 2nd | 3- 3 | 3.0 ± 0.0 | 3- 4 | 3.4 ±0.5 | |
| | 3rd | 3- 4 | 3.4 ± 0.5 | 3- 4 | 3.4 ±0.5 | |
| | 4th | 2- 3 | 2.8 ± 0.4 | 3- 5 | 3.8 ±0.8 | |
| Total larval stage | | 13- 14 | 13.4±0.7 | 14- 16 | 14.8 ±0.7 | ** |
| Pre-pupal period | | 1- 2 | 1.4 ±0.5 | 1- 2 | 1.4 ±0.5 | N. s |
| Pupal stage | | 6- 7 | 6.6 ±0.5 | 5- 7 | 6.0 ±0.7 | N. s |
| Life cycle | | 27- 29 | 28.4±0.9 | 29- 30 | 29.2±0.4 | N. s |

** **Highly significant at the 1% level.**

**Pupa**

When the larva was about to pupate, the spiny structure was disappeared. Freshly formed pupae were shining yellow in colour and later on turned to pale orange yellow. There were symmetrically orange black spots on each segment. The body turned into orange in colour later on blackish orange in colour and attached itself on dry leaf surface. The obtained observation is in accordance with the report of Tank and Korat (2007) on *C. sexmaculata*. The duration of pupal stage varied from 2 to 4 days in all species with an average 6.6±0.5 and 6.0 ± 0.7 days when reared on *S. avenae* and *S. graminum* respectively (Table 1). This is partially in

accordance with Khursheed *et al.*, (2006) who recorded that pupal period of *C. septempunctata* was 6.0 ± 0.58 days. Shukla and Jadhav (2014) mentioned that the pupal period of *C. transversalis* were 2.62 ± 0.63, 2.62 ± 0.69 and 2.52 ± 0.61 days, when it was reared on *A. craccivora*, *L. erysimi* and *M. persicae*, respectively.

**Total life cycle:** The total life cycle was 28.4 ± 0.9 and 29.2 ± 0.4 days when reared on *S. avenae* and *S. graminum*, respectively.

**Mature stages**

Newly emerged adults were soft bodied, yellowish in colour without any marking which turned shining yellow or warm buff with black spots which developed gradually. The adult was medium sized, the colour is orange after pupal moulting then, darkling bite by bite to reach standard colour red and black coloured ladybird beetle, with elongate oval. Head is black with a pair of creamy yellow. Abdomen is yellow. Tarsi black or amber brown, tibiae bicolored yellow, outer edge with piceous or testaceous line, or extensively darkened. Males were smaller in size than females. The last abdominal segment of male beetle was roundish, while in case of female it was pointed, for egg laying.

**Adult longevity**: The longevity of male varied from 38 to 84, and 53 to 69 days when reared on *S. avenae* and *S. graminum* with an average 63.7 ± 23.7 and 61.0 ± 8.0 days, respectively. The female longevity varied from 68 to 85 and 69 to 91 days with an average 78.7 ± 9.3 and 82.3 ± 11.7 days, respectively. Data in Table (2). Cleary showed that highly significant in female longevity when feeding on *S. avenae* and *S. graminum*. According to Mari *et al.,* (2004) the mean longevity of male *M. sexmaculatus* and *C. undecimpunctata* were 29.7 ± 1.2 and 50.7 ± 4.2 days, respectively whereas female longevity were 34.9 ± 4.8 and 56.7 ± 5.8 days when reared on alfalfa aphid, *T. trifolii*. Khursheed *et al.,* (2006) also recorded the mean male longevity as 15.24 ± 8.10 and female longevity was 20.18 ± 0.41 days for *C. septempunctata* when reared on *L. erysimi*. Shukla and Jadhav (2014) reported that the adult male and female periods of *C. transversalis* were 31.58 ± 3.22 and 39.10 ± 3.37 days, respectively when it was reared on *A. craccivora*, whereas on *L. erysimi* these periods were 30.12 ± 4.49 and 33.88 ± 2.56 days, respectively, while on *M. persicae* these periods were 29.08 ± 4.25 and 37.12 ± 2.27 days, respectively.

**Pre-oviposition period:** The pre-oviposition period varied from 4 to 5 days and 5 to 5.5 days when reared on *S. avenae* and *S. graminum* with an average 4.5 ± 0.5 and 5.2 ± 0.3 days, respectively (Table 2). Solangi *et al.* (2007) reported that pre-oviposition period was 4.1 ± 1.28 days for *C. undecimpunctata* when reared on *L. erysimi*. It is partially confirms the present findings.

**Oviposition period:** The oviposition period varied from 57 to 77.5 days and 63 to 80.5 days when reared on *S avenae* and *S. graminum* with an average 69.5 ± 10.9 and 74.5 ± 10.0 days, respectively (Table 2). Thus partially supports the findings of Tank and Korat (2007) who recorded oviposition period as 16.09 ± 2.54 days for *C. sexmaculata* when reared on *A. gossypii*. Solangi *et al.,* (2007) observed the mean oviposition period as 37.7 ± 6.88 days for *C. undecimpunctata* when reared on *L. erysimi*.

**Table (2): The adult longevity and fecundity of *C. undecimpunctata* reared on two aphid species under laboratory conditions**

| Biological aspects | *S. avenea* | | *S. graminum* | | signification |
|---|---|---|---|---|---|
| | Range | Av. ± S.D. | Range | Av. ± S.D. | |
| Pre- Oviposition period | 4- 5 | 4.5±0.5 | 5- 5.5 | 5.2±0.3 | |
| Oviposition period | 57- 77.5 | 69.5±10.9 | 63- 80.5 | 74.5±10.0 | |
| Post- Oviposition period | 3- 6 | 4.7±1.5 | 2- 5 | 2.7±2.1 | |
| Adult Longevity | | | | | |
| Female (♀) | 68- 85 | 78.7±9.3 | 69- 91 | 82.3±11.7 | ** |
| Male (♂) | 38- 84 | 63.66 ±23.7 | 61- 69 | 61±8 | N. s |
| Fecundity (no. of eggs) | 265- 574 | 415±154.7 | 347- 439 | 406.66±51.7 | N. s |
| Total life span (days) | | | | | |
| Female (♀) | 65- 111 | 92.1 ± 24.5 | 82- 98 | 90.2 ± 8.4 | |
| Male (♂) | 97- 114 | 107.1 ± 10.2 | 100- 122 | 111.5 ± 12.1 | |

** **Highly significant at the 1% level.**

**Post-oviposition period:** The post oviposition period varied from 3 to 6 days and 1 to 5 days when reared on *S avenae* and *S. graminum* with an average 4.7 ± 1.5 and 2.7 ± 2.1 days, respectively. Post-oviposition period of *C. undecimpunctata* was 4.00 ± 1.00 days when reared on *L. erysimi* (Solangi *et al*., 2007)

**Total life span**

The total life span of male varied from 92.1 ± 24.5 and 90.2 ± 8.4 days when reared on *Sitobion avenae* and *Schizaphis graminum*, respectively. While in case of female it varied with an average 107.1 ± 10.2 and 111.5 ± 12.2 days, respectively. The difference in entire life span might be due to the different prey species and due to the variation in the host nutrition. According to Jagadish and Jayaramaiah (2004) the total life cycle of *C. septempunctata* was 62.2 days when reared on tobacco aphid, *M. nicotianae*. Shukla and Jadhav (2014) reported that the total life cycle of male and female of *C. transversalis* when reared on *A. craccivora*, *L. erysimi* and *M. persicae* were 50.80 ± 3.92, 49.12 ± 4.87 and 48.28 ± 5.38 days and 58.32 ± 3.92, 52.88 ± 3.48 and 56.32 ± 3.07 days, respectively.

**Fecundity**

The egg laying capacity of laboratory reared female beetle varied from 265 to 574 and 434 to 447 eggs when reared on *Sitobion avenae* and *Schizaphis graminum* with an average 415 ± 154.7 and 406.7 ± 51.7 eggs, respectively. Female usually ladies eggs periodically, each one continues some days. The difference in fecundity might be due to different rearing conditions and the prey species on which it was reared. Tank and Korat (2007) observed the mean fecundity of *C. sexmaculata* as 382 ± 163.17 eggs per female when reared on *A. gossypii*. Mari *et al.,* (2004) also observed mean fecundity as 602.3 ± 13.8 and 761.6 ± 1.00 eggs for *M. sexmaculatus* and *C. undecimpunctata*, respectively, when reared on alfalfa aphid, *T. trifolii*. Shukla and Jadhav (2014) reported that the mean fecundity of *C.*

*transversalis* when reared on *A. craccivora, L. erysimi* and *M. persicae* were 376.46 ± 47.32, 364.88 ± 27.44 and 377.36 ± 28.96 eggs per female, respectively.

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## تـأثير التغذيـه علـى فتـرة الحيـاه والكفـاءه التناسـليه للمفتـرس أبـو العيـد ذو الإحـدى عشرنقطـه- غمدي الأجنحـه- فصيلية أبو العيد

**عبدالبـــــديع عبدالحميـــــد غـــــانم*، فهمـــــى الـــــدكرورى عبـــــدالله** و أحمد عبدالعزيزعبدالعاطى عبدالعزيز****

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إجريت هذه التجربه للوقوف على مدى تأثير التغذيه على نوعين من المن المتخصص على القمح وهما : *Sitobion avenae* و *Schizaphis graminum* فى فترة حياتة والكفاءه التناسليه للمفترس غمدى الأجنحه .L ***C**occinella undecimpunctata* وكانت النتائج كالتالى.

أوضحت النتائج أن طور البيضه ، إجمالى طور اليرقه ، فترة ماقبل العذراء ، طور العذراء والطور الكامل للذكور والإناث سجلت ٠.٠±٧.٠ ، ١٣±٠.٧ ، ١.٤±٠.٥ ، ٦.٦± ٠.٥ ، ٦٣.٦±٢٣.٦ و ٧٨.٧±٩.٣ يوماً بالترتيب عند التغذيه على النوع الأول و ٠.٠±٧.٠ ، ١٤.٨±٠.٧ ، ١.٤±٠.٥ ، ٦±٠.٧ ، ٦١ ±٨ و ٨٢.٣±١١.٧ يوماً بالترتيب عند التغذيه على النوع الثانى ، وكانت الكفاءه التناسليه لإناث ٤١٥±١٥٤.٧بيضه/ الإنثى عند التغذيه على النوع الأول و ٤٠٦.٧±٥١.٧ عند التغذيه على النوع الثانى وأخيراً سجلت دورة حياتة كاملةً للذكور والإناث ٩٢.١±٢٤.٥ و ١٠٧.١±١٠.٢يوماً عن التغذيه على النوع الأول و٩٠.٢±٨.٤ و١١١.٥± ١٢.٢ عند التغذيه على النوع الثانى. أوضحت النتائج كذلك وجود فرق معنوى بين التغذيه على النوعين المذكورين فى طورى اليرقه والأناث الكامله.