



**COMPARATIVELY PREDATORY EFFICIENCY OF *COCCINELLA  
SEPTEMPUNCTATA* AND *PROPYLEA QUTTUORDECIM PUNCTATA* AGAINST  
*RHOPALOSIPHUM PADI***

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**ABSTRACT**

*Coccinellids* beetles have significant importance as biological control tools because of its potential to consume many soft body insects especially the aphid on which both its larvae and adult feed vigorously. The studies carried out in the Bioassay Laboratory, Plant Pathology Research Institute, Faisalabad to determine the predatory efficiency of two ladybird beetles, *Coccinella septempunctata* (seven spotted beetle) and *Propylea quattuordecimpunctata* (fourteen spotted beetle) against *Rhopalosiphum padi* (bird cherry-oat aphid) at room temperature of 22° C to 25°C. The results recorded indicated that a single larva of *Coccinella septempunctata* consumed significantly more aphids (56) per day as compared to single larva of *Propylea quattuordecimpunctata* (32.25) per day. Similarly, the adult of *Coccinella septempunctata* was found to be most efficient than the adult of *Propylea quattuordecimpunctata* by consuming 54.57 and 34.37 aphids per day respectively. Therefore, concluded that both larva and adult of *Coccinella septempunctata* have higher rate of predation than *Propylea quattuordecimpunctata*. Moreover, it also observed that the incubation period was 4 days in both the species while the total life cycle from egg to adult lasted for 28 days in *Coccinella septempunctata* and 26 days in *Propylea quattuordecimpunctata*.

**Keywords:** *R.padi*, *C.septempunctat*, *P.quattuordecimpunctat*, biological control, efficacy comparison

## INTRODUCTION

Wheat (*Triticum aestivum* L.) is a major crop with the largest area under cultivation in Pakistan and plays a significant role in the economic stability of the country [1, 2]. Due to higher nutrition content, wheat (*Triticum aestivum* L.) a high-calorie food has an important role to ensure food security in current climate change patterns worldwide [3].

The number of insect pests attack on wheat crop, among them serious damage is caused by aphids. Aphids cause yield losses either directly (35-40%) by feeding or indirectly (20-80%) by transmitting viral and fungal diseases in winter cereals (Barely yellow dwarf virus-BYDV and Cereal yellow dwarf virus-CYDV) [4-8].

Aphids are minute insects that damage horticultural, crop, fruits and ornamental plants and due to their capacity to proliferate tremendously called plant lice [9, 10]. They secrete honeydews facilitate the growth of sooty mold which ultimately hinders the photosynthesis process of attacked plants [11]. [12] Observed that aphids remove nutrients and plant sap, causing to withering and death of plant.

The population of aphid has been increasing for the last few years and is attaining the status of an alarming pest in Pakistan. Aphids

attack wheat, barley, oat, other cereal crops also on fruits and vegetables. Fourteen species of aphids have been recorded attacking wheat crop. The common and economically important species of aphids on wheat plants in Pakistan are *Schizaphis graminum*, *Rhopalosiphum padi*, *Rhopalosiphum maidis* and *Sitobion avenae* [13]. Among them, *Rhopalosiphum padi* is becoming common and frequent, even abundant throughout all development stages of wheat plants [6, 8]. The intensity of damage of *R. padi* depend on various factors such as development stages of plants and number of aphids per unit of time [14] where the initial stages of wheat plants are more susceptible of aphids injury [15, 16]. Like other sucking insects pest, both nymphs and adults suck the sap from plants, particularly from their ears, and thus lower the plant vigor.

During spring season (February-March), when aphids population increase, at the same time bio-control agents like *coccinellids* also increase as a natural check on this pest [17]. Nevertheless, the effectiveness of *coccinellids* as aphid predators can be improved by the selection of *coccinellids* races that are not so restricted by the climatic conditions, as the aphids are already present. On the other hand, varieties of plant

characteristics that would permit more efficient aphid capture by the *coccinellids* could be selected [18, 19].

Seven-spotted ladybird beetle (*Coccinella septempunctata* Linn) feed primarily on aphids, also preys on both adult and immature soft-bodied crop pests [20, 19]. The ladybird beetle has a high reproductive potential and long ovi position period. The successful natural enemies are those who have high reproduction rate and the good searching ability for its host, adaptability in different environmental conditions and synchronization with its host [21]. *Coccinella* reproduce so rapidly when the prey species are increasing in number and become sluggish when the prey population is also declining [22]. The other important hosts of *coccinellids* include whiteflies, mealybugs and rice brown plant hopper.

Biological control agents being important components of IPM are receiving serious attention of Entomologists as well as policymakers these days. Biological control is one of the most effective means of achieving insect control [23, 24]. The biological control with *coccinellids* contributed greatly and suppressed the pest below economic damage [25]. To protect the plants and environment, biological control of aphids is a good replacement of high toxic

insecticides, is a common practice for its control [26].

Keeping in view the importance of biological control, the predator efficiency of two species of ladybird beetles, *Coccinella septempunctata* and *Proylea quattuordecimpunctata* against wheat aphid was determined in the laboratory.

#### MATERIAL AND METHODOLOGY

The study conducted in the Bioassay laboratory of Plant Pathology Research Institute, Faisalabad, Pakistan. For this research, the adults and larvae of *Coccinella septempunctata* and *Proylea quattuordecimpunctata* collected from Bioassay laboratory of Entomological Research Institute, Ayub Agriculture Research Institute Faisalabad, Pakistan.

The adult and larvae kept singly in a small plastic cup with a lid so that the adult and larvae may not escape. Wheat panicles with a counted number of aphids provided to them as food daily to raise a uniform culture of both the species and to run a blank experiment to observe the predatory potential. After the formation of the adult stage, five pairs of adults of each species kept in the separate petri-dish, filter paper at the bottom for oviposition and placed in the laboratory at room temperature ranged from 22° C to 25° C.

The Wheat panicles with aphid on them provided as food. The eggs laid by the female of each species collected and placed in other separate dishes. To determine the predatory efficiency of larva of seven-spotted ladybird beetle, *C. septempunctata* and fourteen-spotted ladybird beetle, *P. quattuordecimpunctata*, the newly hatched larva of both the species placed singly in small plastic cups covered with lid. The experiment conducted according to RCD with four replications. A counted number of aphids on wheat panicles offered to them daily and substituted each day with new panicles having more number of aphids than the previous day. The unconsumed/alive aphids counted from old panicles. This practice continued up to the pupal formation stage. Afterward, the adults so emerged from pupae also provided with a counted number of aphids on wheat panicles daily and substituted each day with new panicles having more number of aphids than the previous day. The alive/unconsumed aphids counted from the old panicles to observe the predatory potential of adults of both species. During the experimentation, the duration of egg hatching, each larval instar, total larval period and duration of adult of *C. septempunctata* and *P. quattuordecimpunctata* also recorded. To

check the significance of treatments data processed statistically. SPSS used to analysis. Independent sample *t*-test used and LSD calculated.

## RESULTS AND DISCUSSION

After data analysis, results revealed that a single larva and adult of *C. septempunctata* has a significantly higher rate of predation [27], consuming 56 and 54.57 mean bird cherry-oat aphids per day as compared to single larva and adult of *P. quattuordecimpunctata* consuming lower aphids 32.25 and 34.37 per day respectively

### Figure 1.

We also observed the larval and adult life duration of both species. Mean larval duration of *C. septempunctata* and *P. quattuordecimpunctata* are same i.e. 12 days. Mean adult duration of *C. septempunctata* is 6 days while *P. quattuordecimpunctata* is 5 days **Figure 2.**

The consumption of aphid increased with an increase in larval instars of both the species and reached maximum in 4<sup>th</sup> instar. These results are in conformity with previous a study [28] but they used *Coccinella transversalis* against *Aphis cracivora*.

Similarly, [29] it is also reported that the total number of bean aphids consumed by each larva of *Micraspis discolor* during its total larval development period were 38-58 aphids

with an average of  $48.68 \pm 2.04$  aphids during their entire larval period. The adult of *C. septempunctata* consumed significantly more number of aphids (54.48) per day than the adult of *P. quattuordecimpunctata*, consumed only 34.51 aphids per day. The feeding efficacy of *C. septempunctata* is more (16.2) as compared to *P. quattuordecimpunctata*, (9.00) after 16 hours [30].

The maximum mean consumption by adult *C. septempunctata* was observed against green aphid 408.33, whereas 55.22, 102.66, 172.00 and 315.00 aphids were consumed by 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> larval instars as compared

to black and yellow aphids [31]. Moreover, incubation period and development duration of all stages of *C. septempunctata* and *P. quattuordecimpunctata* [32] also present in **Figure 3**.

The incubation period in *C. septempunctata* Linn was  $4.3 \pm 0.81$  days and mean duration of 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> larval instars and pupal period were 2.00, 2.00, 3.00, 5.00 6.00 days respectively [33]. The pupal stage might last from 3-12 days depending upon the availability of food and temperature, while the present studies also showed that the pupal period was 6 & 4 days in both the species [34].

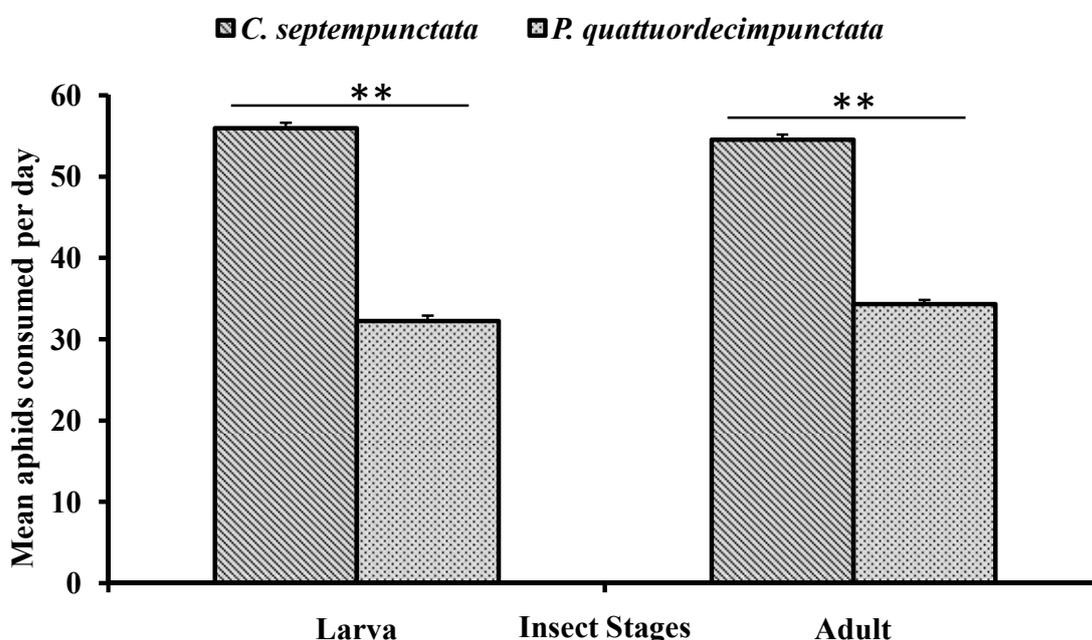


Figure 1: Larval and adult predation rate of *C. septempunctata* and *P. quattuordecimpunctata* against *Rhopalosiphum padi*. Data are presented means  $\pm$  SE based on four independent experiments (\* $P < 0.005$ , \*\* $P < 0.001$ , Independent sample  $t$ -test)

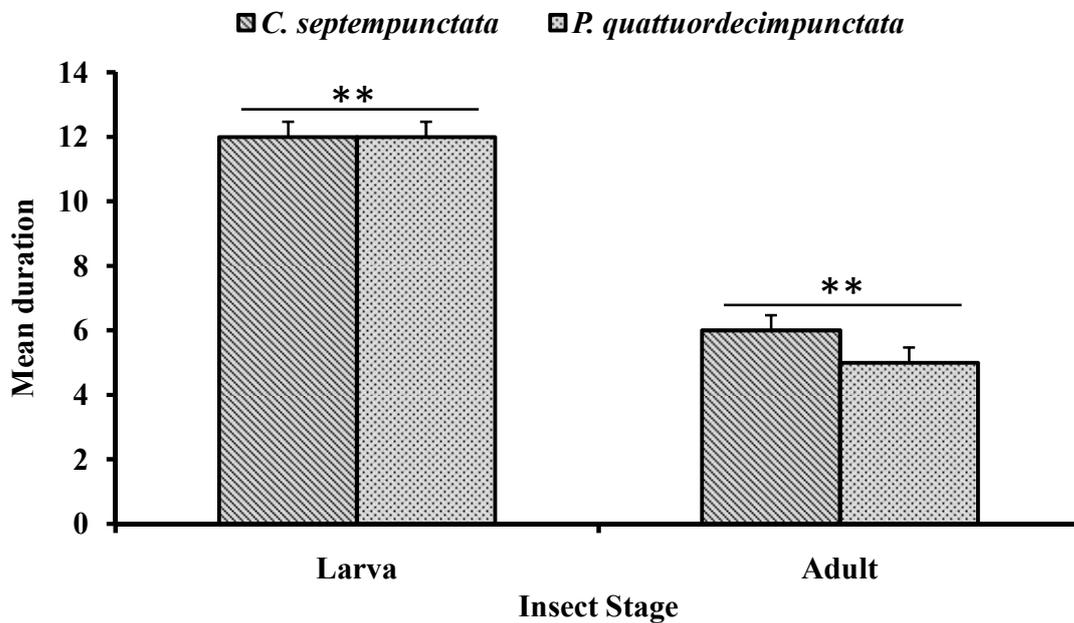


Figure 2: Mean duration (days) of larvae and adults of *C. septempunctata* and *P. quattuordecimpunctata*. Data are presented means ± SE based on four independent experiments (\* $P < 0.005$ , \*\* $P < 0.001$ , Independent sample  $t$ -test)

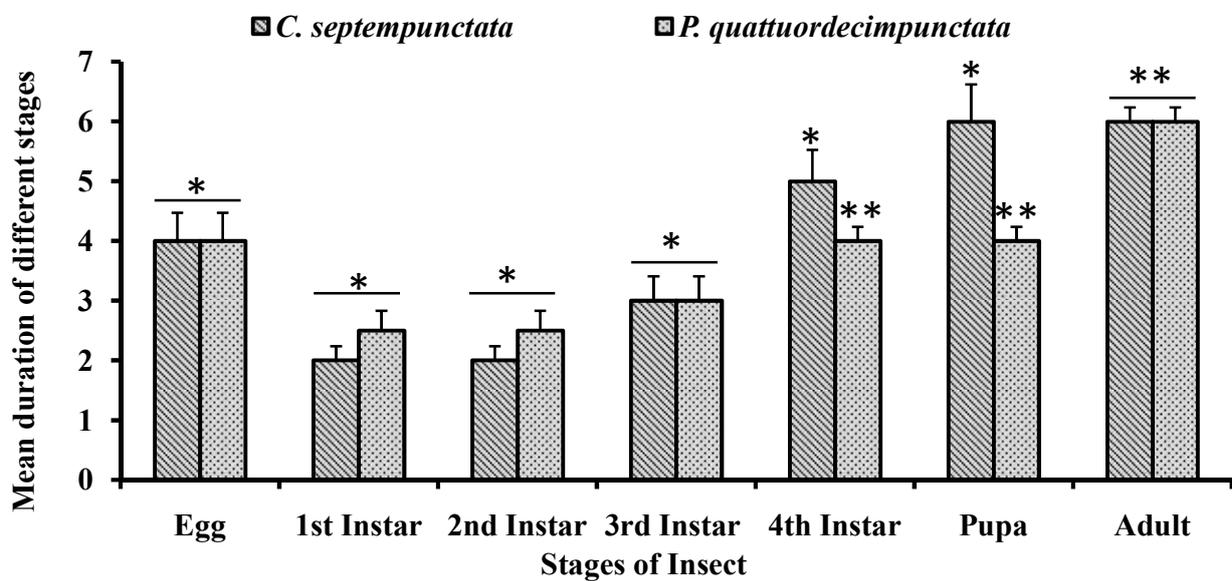


Figure 3: Duration of different stages of *C. septempunctata* and *P. quattuordecimpunctata* at 22-25°C temperature. Data are presented means ± SE based on four independent experiments (\* $P < 0.005$ , \*\* $P < 0.001$ , Independent sample  $t$ -test)

## CONCLUSION

It concluded from this study that seven-spotted ladybird beetle *Coccinella septempunctata* has higher rate of aphid predation than fourteen-spotted *Propylea quatuordecimpunctata*. In other words, we can manage the aphids in wheat crops by using *C. septempunctata* who feed tremendously. Its life duration is longer than other lady beetles, so can manage the pest for long time without applying any other control strategy.

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