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# Olfactory responses of mealybug predator, *Cryptolaemus montrouzieri* Mulsant (Coleoptera: Coccinellidae) to the kairomones of prey arthropods, their host plants and the predator itself

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**ABSTRACT: The studies made under laboratory conditions using olfactometer indicated that the larvae as well as adults of *Cryptolaemus montrouzieri* Mulsant could sense the prey liberated chemicals and use them in reaching the source. The first instar larvae and adults were attracted to the kairomones of *Planococcus citri* (Risso) in significantly more numbers than to the kairomones of other preys and non-preys namely *Pulvinaria regalis* Canard, *Mamestra brassicae* (Linnaeus), *Acyrthosiphon pisum* (Harris), *Aphis fabae* Scopoli and *Myzus persicae* (Sulzer). The predator did not respond to the kairomones of preys' hosts significantly but the presence of prey on the host plants enhanced the olfaction as indicated by the more number of predators attracted to them. Furthermore, the adults were lured to the odour of their own individuals in significant numbers but not the larvae.**

**KEY WORDS**: *Cryptolaemus montrouzieri*, kairomones, olfactometer, non-preys, preys

Most predators are known to search their preys in response to the olfactory stimuli they perceive. The larvae and adults of coccinellids are known to detect their preys either by olfactory or visual stimuli (Stubbs, 1980). *Nemozoma elongatum* (Linnaeus) was observed to use kairomone 'chalcogram' released by its preys to orient itself to the source (Heuer and Vite, 1984). The olfactory responses of *Coccinella septempunctata* Linnaeus to different aphids and their host plants were studied by Garcia and Ribeiro (1983) and found predator's significant preference for aphid infested plants over plants without aphids. Studies made using eight armed air flow population olfactometer ascertained differential response by this predator to the

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kairomones produced by the preys, non-preys and individuals of the predator itself (Sengonca and Liu, 1994).

The mealy bug predator, *Cryptolaemus montrouzieri* Mulsant is an important olygophagous predator reared and released for the biological control of pseudococcids all over the world. It is particularly found effective against mealybugs and scales in citrus, guava, grape, and plantation crops in India (Singh, 1994). However, much is not known about the olfaction by different stages of this predator except for the study made by Heidari and Copland (1992). Hence, the present study was undertaken to measure its olfactory responses to prey arthropds, their host plants and own individuals.

## MATERIALS AND METHODS

The studies were conducted under the laboratory conditions at the Institute of Phytopathology, University of Bonn during 1994. The predator, *C. montrouzieri* used in this study originated from the culture maintained in the Institute. For testing the olfactory responses, certain population of the predator from the first day of their hatching, was reared individually in small Petri-plates. Required number of individuals of *C. montrouzieri* was deprived for 4, 8, 8, 12, and 24 h in the case of first, second, third, fourth instar larvae and adult, respectively. Larvae were subjected to starvation after one day of moulting in each instar and the adults after 10 days of eclosion and were provided with wet cotton wad during the period of starvation (Sengonca *et al.*, 1994).

About 30 nymphs of three species of aphids namely, *Acyrthosiphon pisum* (Harris), *Aphis fabae* Scopoli (both bred on *Vicia faba* L.) and *Myzus persicae* (Sulzer) (bred on *Brassica oleracea* L.), 30 crawlers of *Planococcus citri* (Risso) (bred on germinating potato tubers) and *Pulvinaria regalis* Canard collected from open garden on *Aesculus hippocastanum* L., four fourth instar larvae of *Mamestra brassicae* (L.) reared on cabbage, 100 individuals (nymphs and adults) of *Tertranychus urticae* Koch (bred on *Phaseolus vulgaris* L.) were tested as odour sources in the first experiment. Four fully opened young leaves of *V. faba*, five pieces of potato germs and five pieces one $cm^2$ leaf bits of *A. hippocastanum* were considered as odour sources of host plants in the second experiment. Ten individuals of the predators of same age were also tested as one of the odour sources along with prey and preys' host plants in the third experiment. All these experiments were conducted using eight armed air flow population olfactometer developed by Liu and Sengonca (1994) at evening hours under laboratory conditions of 20 ± 2°C temperature and 40 ± 5 per cent relative humidity. The experimental insects along with host plants were brought to the laboratory from the insect breeding chambers at least 3h before starting the experiment so as to make them adapt to the slightly altered conditions. Every time, each experiment started with filling the odour chambers with definite odour sources, placing 15 test predators in the sample chamber of the olfactometer and switching on the vacuum pump immediately. The apparatus was covered with a paper box so as to provide similar light conditions to the predators under test as that in the breeding cage. The number of predators lured by different odour sources within one hour of release was recorded. Each experiment was repeated six times, every time changing the test population and the positions of the odour chambers.

The results of the individual experiments after testing for the homogeneity were subjected to one way analysis of variance and averages were compared by means of Tukey's HSD multiple range test (Mudra, 1958).

## RESULTS AND DISCUSSION

### Reaction to the odours of preys and non-preys

When the choice was given among seven arthropods and compared with control, all the stages of *C. montrouzieri* were attracted first to mealybug *P. citri* and next to scale *P. regalis* in significantly more numbers ($P < 0.05$) suggesting that the predator uses the kairomones produced by these preys as cue in reaching the source once they were in the prey habitat (Table 1). The first instar larvae and adults could differentiate between the mealybug and the scale indicating that these stages are better decision makers in selecting more appropriate prey than rest of the stages as the number of these stages lured at the odour sources was significantly more. But the finding of Sengonca and Liu (1994) indicated that in the case of *C. septempunctata* only adults were the active decision-makers in selecting an appropriate prey and larvae were passive.

The results of the present findings that the larvae as well as adults of

Table 1. Response of *C. montrouzieri* to odours of preys and non-preys

| Odour source | No. of different stages of *C. montrouzieri* attracted within one hour (Mean±SD) | | | | |
|---|---|---|---|---|---|
| | 1st instar | 2nd instar | 3rd instar | 4th instar | Adult |
| *A. pisum* | 0.67±0.21a | 0.83±0.31a | 0.67±0.33a | 0.83±0.17a | 1.17±0.31abc |
| *A. fabae* | 0.83±0.17a | 0.67±0.33a | 0.83±0.30a | 0.50±0.22a | 0.67±0.21a |
| *M. persicae* | 0.67±0.21a | 0.83±0.17a | 0.83±0.17a | 0.83±0.17a | 1.00±0.17a |
| *M. brassicae* | 1.00±0.00ab | 0.50±0.31a | 1.17±0.17ab | 1.00±0.22a | 1.33±0.33abc |
| *T. urticae* | 0.33±0.21a | 0.50±0.22a | 0.33±0.21a | 0.50±0.22a | 0.50±0.22a |
| *P. citri* | 2.83±0.31c | 3.17±0.21b | 2.67±0.21c | 3.00±0.25b | 3.33±0.33d |
| *P. regalis* | 1.66±0.21b | 2.33±0.22b | 2.17±0.17bc | 2.33±0.21b | 2.33±0.21c |
| Control | 0.33±0.21a | 0.50±0.22a | 0.33±0.21a | 0.33±0.21a | 0.17±0.17a |

Means in coloumns followed by the same letters are not significantly different ($P<0.05$) (Tukey's HSD Multiple Range Test).

*C. montrouzieri* are able to respond positively to the kairomones produced by their prey, are in line with the earlier reports of Stubbs (1980) and Heuer and Vite (1984) on other coccinellids. However, partly contrary to the finding of Heidari and Copland (1992) who observed the olfaction only by the adults but not by the larvae of *C. montrouzieri*, which may be assigned to the variation in selecting the test animals as the earlier authors tested the fourth instar larvae subjecting them to starvation for 24h immediately after moult.

### Reaction to the odours of preys and preys' host plants

Looking to the acceptance of *P. regalis* by *C. montrouzieri*, it was considered as one of the preys and *A. hippocastanum* as prey's host plant. Thus, when the choice was given between odours of preys and their host plants, significant difference was observed in the predators' selection between the prey odours and the odours from the prey's host plant (Table 2). The significant difference was once again confirmed in the tendency showed by the first instar and adult, and the fourth instar in differentiating the *P. citri* and *P. regalis*.

### Reaction to the odours of prey, prey with host plant and the predator itself

When the choice was given among the prey, prey + host plant, and the predator itself the attraction by the first instar and fourth instar larvae as well as adults of *C. montrouzieri* to the odours of prey with and without host plant was on par but significantly higher compared to the odours of only host-plant and the predator itself. But the presence of prey on the host plant, namely potato germs, increased the number of predators attracted (Fig. 1). Garcia and Ribeiro (1983) reported significant attraction of *C. septempunctata* to the host plant with aphids than to the host plant alone. Adults showed significantly higher response to the odours of their own individuals than to the odours of prey's host-plants and control. Even though the same tendency was observed with larvae

Table 2. Response of *C. montrouzieri* to the odours of prey-arthropods and their host plants

| Odour source | Number of predators attracted within one hour (Mean±SD) | | |
|---|---|---|---|
| | Instar 1 | Instar 4 | Adult |
| *A. pisum* | 0.67±0.21a | 0.83±0.22a | 0.67±0.21a |
| *P. citri* | 3.83±0.31c | 2.83±0.31b | 3.50±0.22c |
| *P. regalis* | 2.17±0.17b | 2.17±0.17b | 2.83±0.31b |
| *S. tuberosum* | 0.83±0.17a | 0.50±0.21a | 0.67±0.21a |
| *A. hippocastanum* | 0.83±0.17a | 0.33±0.21a | 0.33±0.21a |
| *V. faba* | 0.50±0.22a | 0.50±0.22a | 0.50±0.22a |
| Control 1 | 0.33±0.21a | 0.17±0.21a | 0.33±0.21a |
| Control 2 | 0.50±0.22a | 0.33±0.21a | 0.17±0.21a |

Means in coloumns followed by the same letters are not significantly different (P<0.05) (Turkey's HSD Multiple Range Test).

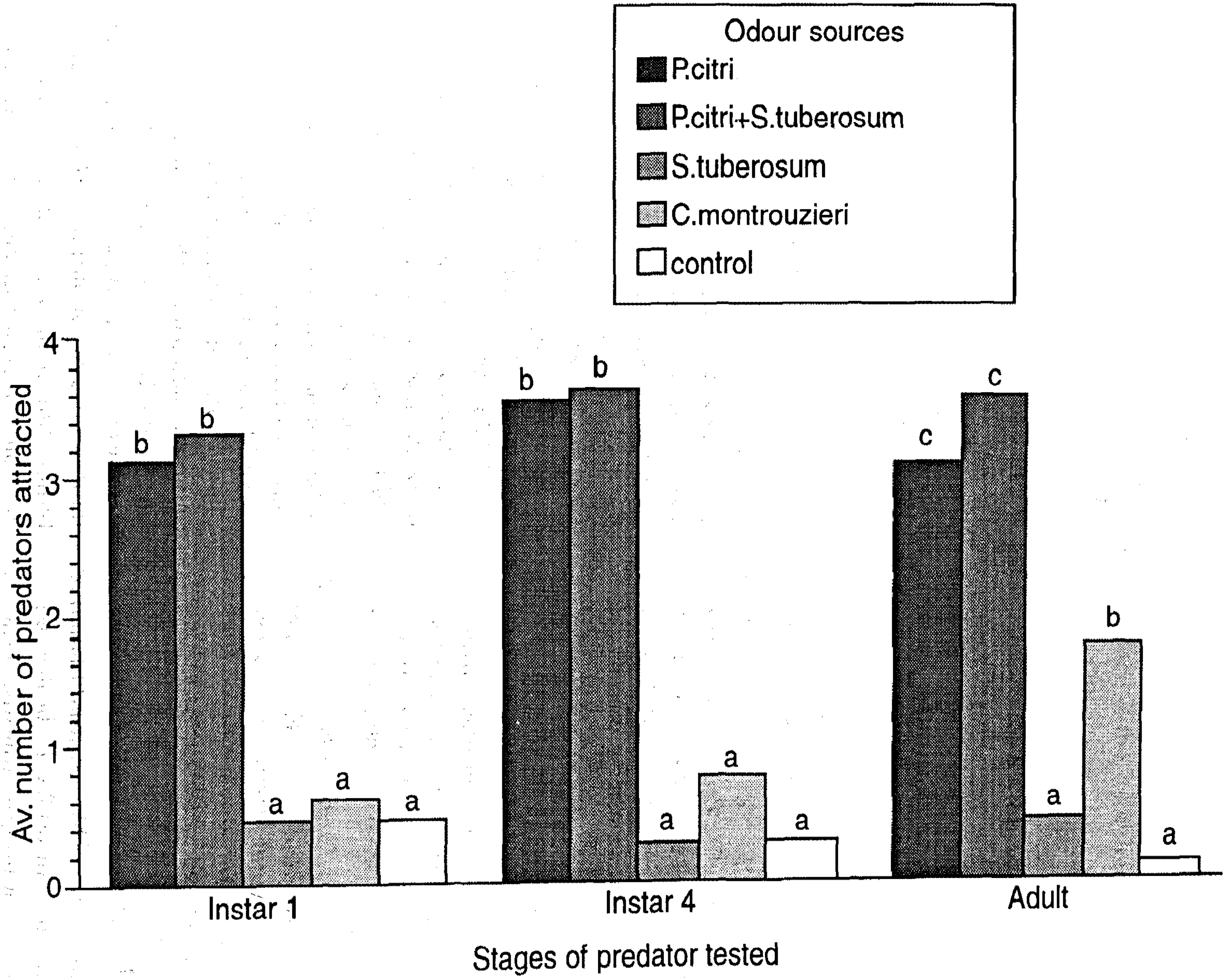


Fig. 1 Mean number of different stages of *C. Montrouzieri* attracted to the odours of prey, prey with host plants and the predator itself

(Fig. 1), the number attracted to their own individuals was not significantly superior over attraction showed to the odours of preys' host plant and control. Sengonca and Liu (1994) have reported that some percentage of *C. septempunctata* was attracted to the odours of their own individuals which tendency they attributed to the predators cues from their own individuals who have reached the source before.

Thus, it is evident that both larvae and adults of *C. montrouzieri* sense the prey-liberated chemicals and use the same in reaching the source. Such of the chemicals need to be identified for further exploitation of the predator in the biological control of mealybugs in different crop ecosystems.

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