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Feeding Efficacy of Coccinellid Beetles (*Coleoptera– Coccinelliedae*) From Agricultural Ecosystem of Kolhapur District of Western Maharashtra, India

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ABSTRACT

Coccinellid beetles (Coleoptera: Coccinellidae) represent one of the most important groups of predatory insects used in biological control programs due to their ability to effectively suppress populations of soft-bodied agricultural pests. The present study investigates the feeding efficacy of eight species of predatory Coccinellids commonly found in the agricultural fields of Kolhapur district, Western Maharashtra. Field-collected adults were reared under laboratory conditions following standardized methodologies, and their progeny were maintained through successive cultures to obtain sufficient larvae for experimental observations. Feeding potential was assessed across all developmental stages—four larval instars and adults—using aphids as the prey species. The findings revealed a consistent and progressive increase in predatory activity from the first instar to the adult stage across all species examined. Early instars exhibited comparatively lower feeding capacity, while third and fourth instars demonstrated a substantial rise in prey consumption. Adult beetles showed the highest feeding efficiency, reflecting their maximum predatory potential. Among the species studied, Coccinella transversalis and Hippodamia convergens emerged as the most efficient predators throughout their life cycle. The study highlights the strong biocontrol potential of these species and underscores their suitability for incorporation into Integrated Pest Management (IPM) programmes under local agro-ecological conditions

Keywords: *Biological control, Pests, feeding potential.*

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Introduction

The Coccinellid (Coleoptera), commonly known as ladybird beetles, constitutes an ecologically and economically significant group of predatory insects. They are renowned for their role as efficient biological control agents against a wide range of phytophagous pests, particularly soft-bodied insects such as Aphids, Whiteflies, Jassids, Coccids, Mealy bugs, and psyllids [3][5][9] Both the larval and adult stages of coccinellid beetles exhibit predaceous behavior, thereby contributing substantially to the suppression of pest populations in agricultural ecosystems.

Globally, more than 6,000 species of Coccinellids have been described [12], displaying remarkable diversity, adaptability, and ecological plasticity across a wide range of habitats. Their successful employment in biological pest control programs underscores their immense economic value [1]. Coccinellid beetles are considered to be beneficial insects, feeding on pest species such as psyllids, aphids, scale insects, whitefly, mealybugs, mites, small Lepidoptera and Coleoptera larvae[2][4][8]. The use of Coccinellids as natural enemies of crop pests represents an eco-friendly, sustainable, and long-term alternative to chemical pesticides, thereby mitigating environmental pollution and the risk of pest resistance development.

In recent decades, the artificial rearing and field release of predatory Coccinellids have become an integral component of Integrated Pest Management (IPM) strategies. However, the feeding efficiency, developmental rate, and reproductive performance of these beetles are profoundly influenced by various biotic and abiotic factors, including prey quality, temperature, humidity, and habitat characteristics. A clear understanding of these parameters is essential to enhance the efficacy and field performance of coccinellid beetles as reliable biocontrol agents. The Kolhapur district of Western Maharashtra, India, represents a prominent agricultural region characterized by diverse cropping systems and favorable climatic conditions for insect activity. Despite the abundance of Coccinellid species in this region, comprehensive studies on their feeding potential and predatory efficiency under local agro-ecological conditions remain limited.

Materials and Method

Biological control potential viz., feeding efficacy of Coccinellid beetles were studied by the methodology [6][7][10][11]. Samples were collected from various agriculture filed of the Kolhapur district of Maharashtra. Coccinelid is a predator of aphids, the pest aphids collected with all life stages and brought into the laboratory.

The screening took place of infested plant leaves under a stereoscopic microscope. Adult male and female Coccinellid were collected separately and allowed to feed together on collected aphids. After 1-month predator nucleus culture has developed properly, later on, makes multiple cultures by shifting 2 – 2 male-female adult pairs of Coccinellid in new plastic container size 20 cm x 10 cm, it will help to maintain the culture in large amount, which is useful to the biological study of Coccinellid. After mating females start to lay eggs on infested leaves. Freshly laid pale yellow Coloured, oval eggs by Coccinellids observed in containers, infested leaves from containers were screened for separating the eggs. Later they were kept individually and placed 10 numbers of eggs in every single cavity block with a lid for incubation. After hatching predatory 4 grubs placed into Petri plate, were provided infested leaves with a known number of Aphids. Observations were made on the number of aphids preyed at 24 hours. The second batch of Coccinellid predatory grubs was also allowed to feed on a known number of 04 to 12 days older aphids, similar observations have been made on the larval period of grubs. Daily provided infested leaves of pest with 04 to 12 days, old nymphs to first and second instars predatory grubs until pupation. Then predatory grubs go into pupation. At last, adults were emerged out, both male and female kept together for mating and provided known number of aphids and observations were made on the number of aphids preyed at 24 hours.

Results

Name of coccinellid species.	Ist Instar larva (Mean ± S. D.)	IInd Instar larva (Mean ± S. D.)	IIIrd Instar larva (Mean ± S. D.)	IVth Instar larva (Mean ± S. D.)	Adult (Mean ± S. D.)
Cheilomenes sexmaculata Fabricius	25.25± 0.957	29.25±0.957	55.25± 2.5	72.25±5.0579	90.75±1.892
Brumoides suturalis Fabricius	22.25±0.957	28±1.1547	52.25±2.061	68.25±5.909	88.75±4.031
Coccinella transversalis Fabricius	24.75±1.5	28.25±0.957	55.75±2.061	74.25±3.5	94.25±1.707
Harmonia axyridis Pallas	21.5±1.290	27.75±1.905	51.75±2.217	67.75±1.707	89.25±2.986
Hippodamia variegata Goeze	25±2.160247	31.25±0.957	57.25±3.774	75.5±4.654	91.25±4.787
Hippodamia convergene Guerine-Meneville	26.25±2.362	30.5±1.732	56.75±4.425	76.25±4.425	94.5±2.886
Hippodamia septemmaculata De Geer	24.5±2.516	31.25±2.2173	59.5±3.316	75.25±4.5	92±2.581
Hippodamia parenthesis Say	25.75±2.061	30.25±2.217	57.5±3.109	76.25±4.856	91.5±3.415

The feeding efficacy of the studied coccinellid species exhibited a progressive increase from the early larval stages to adulthood. During the first instar, all species showed relatively low predatory activity, as expected for this initial developmental stage, although some species, particularly members of the genus *Hippodamia*, displayed slightly higher feeding responses compared to others. The second instar larvae demonstrated a noticeable improvement in feeding capacity across all species, with *Hippodamia* and *Coccinella* species generally showing more active predation than *Harmonia axyridis*, which consistently remained among the lower feeder.

A marked increase in predatory potential was observed during the third instar, where all species exhibited a substantial rise in prey consumption. Species such as *Hippodamia septemmaculata* and *Hippodamia convergens* showed particularly strong feeding performance at this stage, indicating their robust developmental progression. By the fourth instar, feeding activity reached one of its highest points, with almost all species demonstrating vigorous predation. Species like *Coccinella transversalis* and *Hippodamia convergens* emerged as especially efficient feeders, reflecting their enhanced capacity to consume prey before pupation.

Adult beetles exhibited the highest feeding efficacy among all developmental stages. Adults of *Coccinella transversalis*, *Hippodamia convergens*, and *Hippodamia variegata* showed notably high predatory activity, highlighting their strong potential as effective biological control agents. Overall, the results clearly indicate that feeding capacity increases consistently with each successive instar and reaches its maximum at the adult stage. Among the species studied, *Coccinella transversalis* and *Hippodamia convergens* stood out as the most efficient predators throughout their developmental stages, underscoring their suitability for use in biological control programs.

M. sexmaculatus B. suturalis C. transversalis H. axyridis

H, variegate H. convergene H. septammaculata H. parenthesis

Conclusion

The present study demonstrates that the feeding efficacy of coccinellid beetles increases progressively with each developmental stage, reaching its peak in adulthood. All eight species evaluated exhibited predatory potential, but notable interspecific differences were observed. Early larval instars showed limited feeding activity, whereas the third and fourth instars displayed a substantial rise in prey consumption, indicating their critical role in aphid suppression under natural conditions. Adult beetles emerged as the most efficient predators, highlighting their significance in long-term pest regulation. Among the species studied, *Coccinella transversalis* and *Hippodamia convergens* consistently exhibited superior feeding performance across all stages, underscoring their strong potential as reliable biological control agents. These findings affirm the ecological value of coccinellid beetles in managing aphid populations and support their incorporation into Integrated Pest Management (IPM) programs. Understanding species-specific feeding responses and developmental dynamics can further enhance mass-rearing protocols and optimize their field application in sustainable pest management strategies.

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References

1. Agarwala, B. K., & Dixon, A. F. G. (1992). Laboratory study of the functional response of *Coccinella transversalis* (Fab.) (Coleoptera: Coccinellidae). *Journal of Applied Entomology, 113*(3), 184–189.
2. Hagen, K. S., (1962) Biology and ecology of predaceous Coccinellidae. Annual Review of Entomology **7:** 289–326.
3. Hippa, H., Koponen, M., & Saarenmaa, H. (1978). Notes on the biology and ecology of some Coccinellidae (Coleoptera). *Annales Entomologici Fennici, 44*, 101–106.
4. Hodek I, (1967). Bionomics and ecology of predaceous Coccinellidae. Annual *Review of Entomology* 12: 79–104.
5. Kring, T. J., Gilstrap, F. E., & Michels, G. J. (1985). Role of the Coccinellidae in biological control of aphids. *Journal of the Kansas Entomological Society, 58*(1), 118–122.
6. Mani, M. S., & Thontadarya, T. S. (1987a). Observations on the biology and feeding potential of *Coccinella septempunctata* Linnaeus. *Entomon, 12*(1), 21–25.
7. Mani, M. S., & Thontadarya, T. S. (1987b). Studies on aphidophagous coccinellids in South India. *Indian Journal of Entomology, 49*(2), 175–181.
8. Obrycki J. J., Kring T. J, 1998. Predaceous Coccinellidae in biological control. Annual *Review of Entomology*,43:295–321.
9. Omkar, & Pervez, A. (2000). Biodiversity of predaceous Coccinellids (Coleoptera: Coccinellidae) in India: A review. *Journal of Aphidology, 14*(2), 91–118.
10. Santha Kumar, C. M., Jaganath, B., & Thontadarya, T. S. (1994). Feeding potential of certain predatory Coccinellids on aphids under laboratory conditions. *Current Research, 23*, 53–54.
11. Santha Kumar, C. M., Jaganath, B., & Thontadarya, T. S. (1996). Studies on the predatory efficacy and biology of ladybird beetles. *Mysore Journal of Agricultural Sciences, 30*, 150–155.
12. Vandenberg, N. J. (2002). Coccinellidae Latreille, 1807. In R. H. Arnett, Jr., M. C. Thomas, P. E. Skelley, & J. H. Frank (Eds.), *American Beetles, Volume 2: Polyphaga: Scarabaeoidea through Curculionoidea* (pp. 371–389). CRC Press.