



Ants (Formicidae) and their predatory conduct in relation to biological control in District Wardha, Maharashtra, India

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Abstract

Ants are scavengers and predators in several agricultural crop fields. There is a growing interest in ant predatory behaviour in agricultural fields, although the practical applications are limited. The Vidarbha region includes District Wardha, which has amazing agricultural land. In the present study, the predatory behaviour of ants on pest of crop field in district Wardha has been studied. Soybean, cotton, maize, gram, wheat and pigeon pea are principal crops of the region. There are number of insect pest (Lepidoptera) which infest to crop. The ants positively impact on agricultural system as biological control agents. The predatory ants *Tapinoma*, *Pheidole*, *Crematogaster* and *Componotus* control the pest population in crop field. The method of controlling pests by employing naturally occurring ant species to reject input of chemical pesticide must be continued to save environment.

Keywords: Crops, Pest, Predatory Ant, Biological Control.

Introduction

The application of pesticide in crop field have intensified harmful effect on environment safety and light on natural enemies of pest in agricultural system (Agrawal et al., 2007). The use of ants in integrated pest management (IPM) increases crop output in field (Way and Khoo, 1992). The demand for food, attracted ants as biological control agents in crop field. Ants are significant due to their presence in terrestrial animal biomass, numerical and ecological dominance (Bolton et al., 2006). The parasite and predators are use in biological control program. There is some drawback of use of ant in classical biological system due to lack of its specificity but the generalist ants are ideal predators in agroecosystems. They attack and rapidly consume their prey in agricultural crop field (Risch and Carroll, 1982).

Generalist predator ant on Lepidopteran and Hemipteran pest in crop field like cereals revealed significant reduction in damage level and they also control pest explosion by creating obstacle in feeding (Janzen, 1966; Bentley, 1977; Symondson et al., 2002). Release of generalist ants as natural pest control

also improves quality of soil, may increase soil nutrients and its impact is significant on ecosystem (Gotwald, 1986).

The history of biological control reveals the significance of ants in agriculture. The first case reported as an instance of BC is in citrus field. Citrus farmers collect generalist predatory ants and release on bamboo strips, which is tie in between the trees throughout the orchards (Huang and Yang, 1987).

With the small group of ant population, the foraging activity starts with morning light. After the successful searching of food source, they communicate with the other ants by pheromones. Ants play vital role of transporting of nutrients, predators, dispensers of seeds, and transmitters of N₂-fixing bacteria (Detrain and Deneubourg, 2006; Hölldobler and Wilson, 2009).

In the present study, the predatory behaviour of ant in agroecosystem to natural reduction of insect pest has been observed. Imagine the influence of these populations if encouraged or manipulated more efficiently to control pests.

Material and Method

Studies were conducted in agricultural fields of eight tehsil places of district Wardha, in the state of Maharashtra in India i.e. Seloo, Wardha, Deoli, Arvi, Ashti, Karanja, Hinganghat,

Samudrapur. The geographical location of district Wardha is 20.8049° N, 78.5661° E. The observations were carried out from 2019 to 2022, during the respective cropping season (Fig.1).



Fig. 1 Affected agricultural crops (A) Soyabean *Glycine max*, (B) Pigeon pea, (C) Maize *Zea mays*, (D) Cotton *Gossypium*, (E) Gram (chana) *Cicerarietium*, (F) Wheat *Triticum*, (G) *Brassica oleraceavar. capitataf. rubra*, (H) *Brassica oleraceavar. italica*, (I) enlarged view on *Brassica*, (J) *Solanumly copersium*, (K) enlarged view on *Solanum*, (L) *Brassica oleraceavar. botrytis*

Results and Discussion

Many generalist ants naturally occur in the agricultural cropping system observed in the present study. Experimentally placement of these ants also helps in irradiation of approximately 70-80% pests from field. *Pheidole* sp. reduces the number of pests and crop damage by diamondback moths from cauliflower agroecosystems. We investigated how *Pheidole* sp. affected lepidopteran pests in crop plants' aerial and ground portions. Under natural field conditions, predatory ant species have been seen bringing larval and adult stages of *P. xylostella* to their nests.

Oecophylla smaragdina are very aggressive on green locust. Speciality of *Oecophylla* is, it is a biologically control agent, directly predate on pest and indirectly by the ability to eliminate any intruders in their territory. *Tapinoma* sp., ghost ant decrease leaf damage caused by leaf eating caterpillar,

Spodoptera litura in soyabean agroecosystem and reduces pod borer damage and pest number of *Helicoverpa armigera* in gram crop field.

Componotus sp.. decrease damage of cotton bolls and reduces the pest number of cabbageworm, *Evergestis rimosalis* and cabbage lopper, *Trichoplusia ni*. Diamondback moth larva *Plutella xylostella* and aphids *Myzus persicae* are severe pest on red cabbage. Its number is successfully reduced by experimental introduction of Pharaoh ant, *Monomorium*. *Crematogaster* sp. is abundantly found in district Wardha. It is generalist ant species found in maize agroecosystem, decreases corn ear and tassel damage caused by fall armyworm *Spodoptera frugiperda*. Pigeon pea legume and seed loss caused by larval stages of *Helicoverpa armigera*. During the present study, it is observed that the generalist ant *Solenopsis* carry larval stages to their nest under natural field condition (Fig. 2) (Table 1).

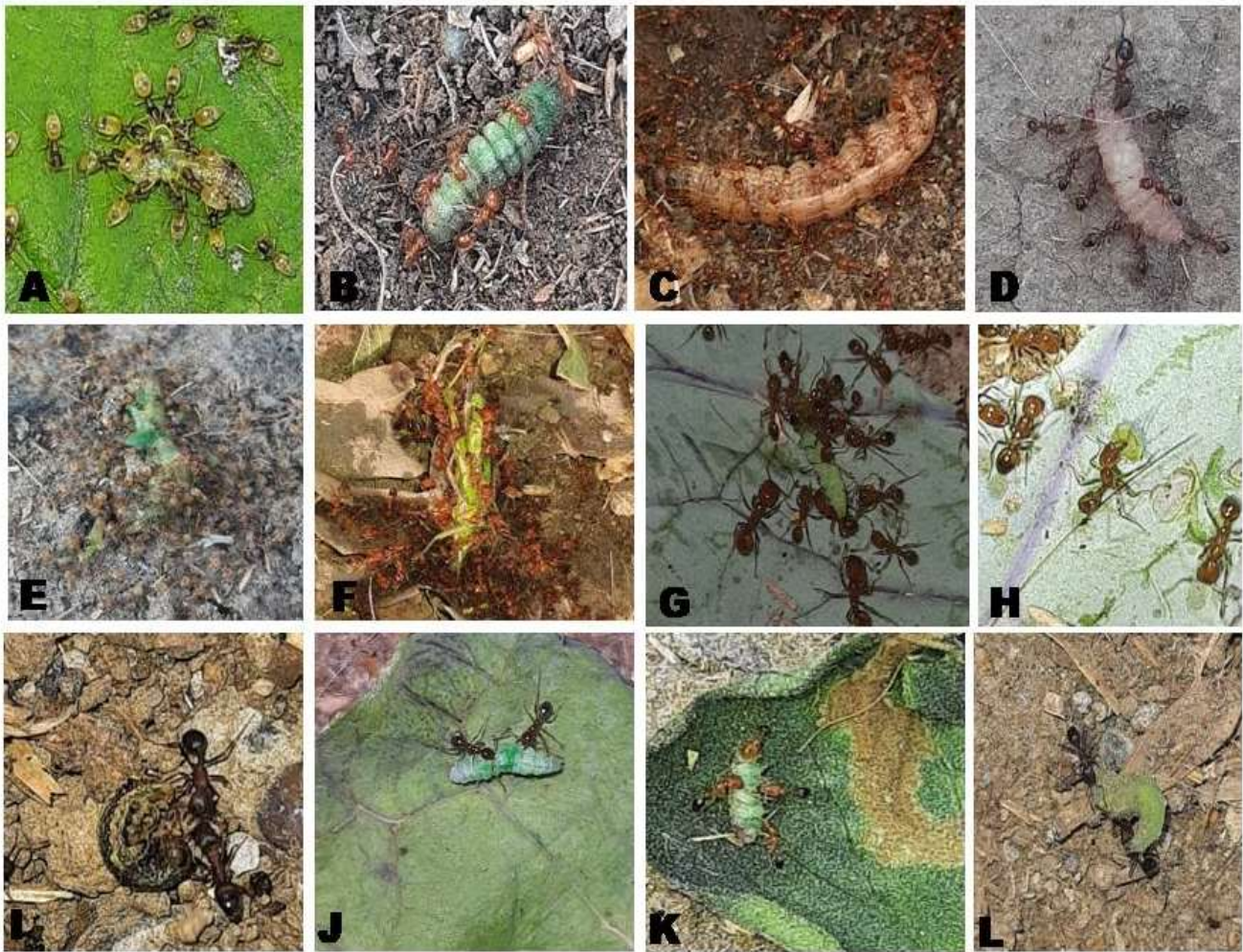


Fig. 2 Pest and Predatory ants (A) Leaf eating caterpillar *Spodoptera litura*, (B) *Helicoverpa armigera*, (C) Fall armyworm *Spodoptera frugiperda*, (D) *Pectinophora gossypiella*, (E) *Helicoverpa armigera*, (F) Green locust, (G) Diamondback moth larva *Plutella xylostella* (on cabbage), (H) Aphid *Myzus persicae*, (I) Cross-striped cabbageworm *Evergestis rimosalis*, (J) Diamondback moth larva *Plutella xylostella* (on cauliflower), (K) *Tuta absoluta* Tomato leafminer, (L) Cabbage looper *Trichoplusia ni*

Ants specifically *Solenopsis sp.* and *Oecophylla sp.* are efficient predators in agricultural systems (Sterling et al., 1984; Way and Khoo, 1992). The damage to maize plants by *Spodoptera frugiperda* was significantly reduced by generalist ant predators (Perfecto, 1991). The ant *Pheidole sp.* reduces the pest insects like diamondback moth and black cutworm larvae from cauliflower agroecosystem (Agarwal et al., 2007).

We examined the effects of *Pheidole sp.* on aerial parts of crop plants as well as on Lepidopteran pests on the ground. Predatory ant species have been found to carry *P. xylostella*

larval and adult stages to their nests in natural field circumstances (Agarwal and Rastogi 2005).

Neither the farmers reported any nuisance value from the nine *Componotus sp.*, nor were bites or stings seen during the studies. Four ant species, *Pheidole sp.*, *P. tesserinoda*, *T. Melanocephalum*, and *Tetramorium sp.*, retrieved baits of DBM larvae dropped at random in the cauliflower agroecosystems and carried them to their separate nests. *Pheidole sp.* shows significantly successful predation, captures higher number of larvae in crop field (Agrawal et al., 2007).

Table 1. Predatory ants on pest throughout agricultural cropping system Dist. Wardha

S. No.	Crop	Ant species	Pest controlled	Highlight
1.	Soyabean <i>Glycine max</i> (Soyabean)	Ghost ant, <i>Tapinoma</i> sp.	Leaf eating caterpillar <i>Spodoptera litura</i>	Decrease leaf damage caused by Leaf eating caterpillar
2.	Pigeon pea (Tur)	<i>Solenopsis</i> sp.	<i>Helicoverpa armigera</i>	Decrease legume and seed loss caused by pest
3.	Maize <i>Zea mays</i> (Maize)	<i>Crematogaster</i> sp.	Fall armyworm <i>Spodoptera frugiperda</i>	Decrease corn ear and tassel damage caused by pest
4.	Cotton <i>Gossypium</i> (Cotton)	<i>Componotus</i> sp.	<i>Pectinophora gossypiella</i>	Decrease damage of cotton bolls
5.	Gram (chana) <i>Cicerarietium</i>	<i>Tapinoma</i> sp.	<i>Helicoverpa armigera</i>	Reduce pod borer damage and pest number
6.	Wheat <i>Triticum</i> (Wheat)	<i>Oecophylla smaragdina</i>	Green locust	Reduce pest number
7.	<i>Brassica leraceavar. capitataf. Rubra</i> (Red cabbage)	Pharaoh ant, <i>Monomorium</i>	Diamondback moth larva <i>Plutella xylostella</i> , Aphids <i>Myzus persicae</i>	Reduce pest number
8.	<i>Brassica oleraceavar. botrytis</i> (Cauliflower)	<i>Pheidole</i> sp.	Diamondback moth larva <i>Plutella xylostella</i>	Reduce pest number and crop damage
9.	<i>Brassica oleraceavar. italica</i> (Broccoli)	<i>Componotus</i> sp.	Cross-striped cabbageworm (<i>Evergestis rimosalis</i>), cabbage lopper <i>Trichoplusia ni</i>	Reduce pest number and prevent economic loss
10.	<i>Solanum lycopersium</i> (Tomato)	<i>Monomorium</i> sp.	Tutaabsoluta <i>Tomato leafminer</i>	Reduce leaf fall and fruit damage

Conclusion

For the natural reduction of insect pests throughout the agroecosystem, the generalist ants can be used. It promotes biological control and reduces the use of chemical fertilizers frequently.

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Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

Consent for publication

The author declares that the work has consent for publication.

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