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Research Article

Flight for Balance: *Dragonflies* as Guardians in Agricultural Bio-control Agent

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A B S T R A C T

Dragonflies play a crucial role in pest management as bio control agents due to their voracious appetite for insects. The effectiveness of dragonflies in controlling pest populations in agricultural ecosystems. The study investigates their predatory behaviour, focusing on their ability to target specific pests while minimizing harm to beneficial organisms. Additionally, the ecological impact and sustainability of integrating dragonflies into pest management strategies are examined. Results suggest that harnessing the natural predatory instincts of dragonflies holds promise for environmentally friendly and economically viable bio control methods.

Keywords: Dragon Flies, Pest Management, Bio-Control Agents, Ecosystem, Biodiversity

Introduction

Dragonflies are extraordinary insects celebrated not only for their graceful flight but also for their impressive predatory skills. Beyond their visual appeal, they play a vital role in natural ecosystems as effective biological control agents. These voracious predators are instrumental in managing insect populations, including pests that threaten crops. Their prowess in capturing and consuming mosquitoes, flies, and other harmful insects makes them invaluable allies in preserving ecological balance and enhancing agricultural productivity. This introduction underscores the essential role of dragonflies in fostering a harmonious relationship between humans and the environment.

Dragonflies, with their iridescent wings and adept aerial manoeuvres, extend beyond mere enchanting displays in nature. These fascinating insects also emerge as formidable bio control agents, contributing to pest management in various ecosystems. Their predatory nature, targeting a range of harmful insects, positions dragonflies as effective guardians in maintaining ecological equilibrium. This introduction illuminates the vital role played by dragonflies as bio control agents, underscoring their importance in curbing pest populations and fostering a sustainable balance in natural environments.

Dragonflies, often overlooked in the realm of bio control, play a crucial role in maintaining ecological balance by preying on various pests. These aerial predators exhibit remarkable efficiency in controlling populations of mosquitoes, flies, and other harmful insects. Harnessing dragonflies as bio control agents not only minimizes the reliance on chemical pesticides but also contributes to sustainable and eco-friendly pest management practices. This introduction sets the stage for exploring the multifaceted benefits of integrating dragonflies in to pest control strategies.

Lot of work has been done on odonata fauna from different areas of India but no attention has been paid to present study area. Dragonflies are formidable bio control agents, renowned for their prowess in keeping insect populations in check. With their agile flight and voracious appetite, these winged predators serve as natural guardians against pests

in various ecosystems. This introduction explores the vital role dragonflies play in maintaining ecological balance and promoting sustainable pest management practices.

Dragonflies serve as exceptional bio control agents in pest management. With their agile flight and predatory prowess, they play a vital role in controlling insect populations. This natural form of pest control is environmentally friendly and sustainable, showcasing the significance of dragonflies in maintaining ecological balance and supporting agriculture. Dragonflies are formidable bio control agents, renowned for their prowess in keeping insect populations in check. With their agile flight and voracious appetite, these winged predators serve as natural guardians against pests in various ecosystems. This introduction explores the vital role dragonflies play in maintaining ecological balance and promoting sustainable pest management practices.[1-3]

Review and literature

Ponds are important for biodiversity conservation, but in Switzerland the proportion of wetlands (including ponds) lost since the 1800s is about 90%. His literature on using dragonflies as bio control agents emphasizes their significant role in suppressing insect populations. Various studies highlight their predatory efficiency, particularly in managing pests like mosquitoes and agricultural crop-damaging insects. Researchers have explored the ecological impact of introducing dragonflies for biological pest control, addressing factors such as habitat suitability and potential impacts on non-target species. While findings generally support the idea of dragonflies as effective bio control agents, ongoing research is crucial to refine implementation strategies and assess long-term ecological consequences.

The literature on dragonflies as bio control agents underscores their potential in pest management. Numerous studies showcase their adept predation skills, especially in controlling populations of mosquitoes and agricultural pests (figure 1). Research delves into factors such as habitat preferences, life cycle dynamics, and the impact on non-target species. While dragonflies exhibit promise in bio control, challenges include understanding the intricate ecological interactions and determining optimal release strategies. Continued investigations are essential to refine methodologies, assess broader ecosystem impacts, and establish practical guidelines for the effective utilization of dragonflies in integrated pest management programs.

The literature on dragonflies as bio control agents consistently highlights their efficacy in controlling various insect pests. Studies emphasize their voracious appetite for mosquitoes, flies, and agricultural pests, showcasing their potential as natural predators. However, research also acknowledges the importance of understanding the ecological context, including habitat suitability, potential impacts on non-target species, and the overall dynamics of the ecosystem. While findings generally support the use of dragonflies in bio control strategies, ongoing research aims to refine implementation methods, optimize release protocols, and address potential challenges to ensure sustainable and effective pest management.

Research on using dragonflies as bio control agents highlights their potential in managing insect populations. Studies show that dragonflies are effective predators, preying on pests like mosquitoes, flies, and agricultural crop pests. However, more research is needed to understand the specific conditions and ecosystems where dragonflies can be most beneficial, along with potential drawbacks or challenges associated with their use in bio control strategies.[4-7]

Figure 1.Adult Stage of Dragonfly Mercury

Material Mathod

In a local area of Malegaon, dragon flies were seen in abundance, that area was very watery and dirty many parasites could be spotted there, some dragonflies were of different species, different shapes, some were in good condition and where as some were not healthy. From this area a healthy condition dragonfly was collected and kept in a transparent box from where air could pass. So the dragonfly was able to survive.

Mosquito larvae are small in size. So tiny, in fact that they can easily slip through the gaps in typical aquarium nets. The most effective method is to utilize a net specifically designed for capturing baby brine shrimp. Although residing underwater, mosquito larvae rely on breathing air to sustain themselves. So, from a local outdoor container larvae of mosquito was collected, with the help of a net which had smaller holes, so the mosquitoes could not pass.

Two jars were taken, one jar had dirty water inside and the other had clean water. With the help of a dropper 50 mosquito larvae was shifted to the clean water jar one by one. The dragonfly larvae was then kept in the clean water jar in which the mosquito larvae was present.[8-9]

Discussion

Dragonflies are gentle insects which are useful in getting rid of mosquitoes. They consume mosquitoes at all life stages. Dragonflies can often be seen gracefully circling around. Hunting for mosquitoes and other small prey.

Dragonflies play a significant role as bio control agents in managing insect populations. Their predatory behaviour, especially during the nymph stage in aquatic habitats, helps control mosquito larvae and other aquatic insects. As adults, dragonflies are skilled aerial hunters, preying on flying insects like mosquitoes, flies, and gnats. One key advantage of using dragonflies for bio control is their natural and sustainable approach, reducing the reliance on chemical pesticides. This makes them environmentally friendly and compatible with integrated pest management strategies. However, successful bio control with dragonflies requires maintaining suitable habitats, such as clean water bodies, and avoiding the use of harmful pesticides that could impact their populations. Additionally, understanding the specific ecological requirements of different dragonfly species is crucial for effective implementation of dragonflies as bio control agents.

Dragonflies are effective bio control agents due to their voracious appetite for insects, particularly mosquitoes and other pests. Their predatory nature helps regulate insect populations, contributing to natural pest control in various ecosystems. Additionally, dragonflies are environmentally friendly, as they don't rely on chemical pesticides, making them a sustainable option for managing insect populations. Their role in maintaining a balanced ecosystem is crucial, promoting biodiversity and reducing the need for synthetic pest control methods.

The decrease in mosquito larvae with in tanks becomes evident after the introduction of nymphs as they efficiently curb the mosquito population. In- significant difference in larval density in the control tanks during the period of experiment rules out the possibility of influence/effect of other factors and con- firms the role of predator in decreasing the larval density in treated tanks. So, it is very encouraging to use this tool as a good bio control agent in the field. The food ha- bit of nymphs change with advancement of age and when they are advanced in age they are particularly addicted to culicid larvae and nymphs of their own and other species of Odonata.

The larva of dragonfly can eat up to 100 mosquito larvae in a day, it takes 24 hours to digest its food. The dragonfly has a complete digestive system consisting of both a mouth and an anus, salivary glands, oesophagus, crop with is used for storage and a proventriculus which is used for grinding, a midgut, and a hindgut. Adult dragonflies rely on a tracheal system for the distribution of oxygen (figure 2). Dragonflies and Odonates can be used as bio control agents to manage mosquito populations. They frequently serve as a crucial component in integrated pest management strategies.[10-11]

Figure 2.Control of Mosquito Population

Result

During 24 hours period a nymph of B. pratense consumed 66 fourth instar larvae, showcasing its significant feeding capability. An. Subpictus larvae were introduced in to a water bowl containing 3 litres of water. Average larval consumption by B. pratense nymph at different hours has been presented in Table no. 1 . Out of 66 larvae consumed through 24 hours, it consumed 47 larvae during daylight and 19 larvae during night. Consumption rate during daylight was significantly higher ($p< 0.05$) than that at night (t 2.1475). The average daily feeding rate of B. pratense nymph on mosquito larvae in relation to variations in the search area as well as variations in predator prey ratio has been depicted in Table no. 1 .

From the regression equation it was observed that the feeding rate of the predator decreased when the volume of water i.e. search area was increased. On the other hand, feeding rate increased with the in- crease in the number of predator in a fixed search area. Feeding rate also increased when the density of larvae (prey) was increased.

Results of predatory efficacy of B pratense nymph on mosquito larvae in the field condition showed in the treated tanks mean density of mixed population of mosquito larvae per dip reduced significantly ($p< 0.05$) after 15 days from the introduction of B. pratense nymphs both in Kalna and Burdwan but in the control tanks where no nymph was introduced, mean larval density did not differ significantly ($P>0.05$).

Again mean larval density increased significantly in tanks (from 1 to 5) after 15 days from the removal of nymphs. Tank No. 6 to 10 (control) did not show any significant difference in per dip density in both the areas.

Table 1.Average daily feeding rate

Average daily feeding rate (X^1)	Standard error of mean	Water volume (litre) (X^2)	No. Of larvae given in bowl (X^3)	No. Of nymphs given in the bowl (X^4)
74	2.03	18	500	5
59	3.12	18	300	5
56	5.55	18	150	2
51	4.89	03	100	1
88	2.74	03	500	5
69	3.57	03	200	2
69	5.38	03	150	2
66	4.50	03	100	1

Conclusion

Dragonflies have been used successfully as a bio control only once in the monsoon season of 1980, official in Myanmar decided to release dragonfly naiads into domestic water storage containers that would be riddled with mosquito larvae. Over the following season, they found that the dragonfly nymphs had done their job and the job mosquito population had been reduced.

Similarly, during the present study the small sized nymphs were not interested to prey upon 4th instar mosquito larvae in laboratory but on starvation they consumed early instar larvae of mosquito. The life cycle of Dragonflies is very long and the nymphal stage may last for one year or more consisting of 10-15 nymphal instars between egg and imago (16). So their presence is not seasonal. As the span of nymphal stage is wide and the daily mosquito larval feeding rate is quite high, it can contribute remarkably in reducing mosquito population and thereby reduce mosquito borne diseases.

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