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MOSQUITO EGG RAFT PREDATION BY DRAGONFLY LARVA: PROSPECTS FOR BIOLOGICAL CONTROL

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Abstract. This study documents mosquito (Diptera: Culicidae) egg raft consumption by a dragonfly larva (Odonata: Anisoptera). Identified as *Pantala* sp., the dragonfly larva consumed about seven egg rafts of the culicine mosquito *Culex tritaeniorhynchus* in mosquito-rearing trays. The average time taken by the larvae for consumption of an egg raft (egg count 132.333 ± 13.642, length 3.19 ± 0.317 mm, mean ± SE) was 56.57 ± 2.22 seconds (n = 7). While mosquito egg predators are known from different taxonomic groups, the present observation provides evidence for an alternative mode of biological control for mosquitoes, considering that dragonfly and mosquito larvae coexist in similar habitats.

INTRODUCTION

Mosquito larval habitats are quite diverse in shape, water holding capacity and biotic assemblage. During development, the larvae are vulnerable to multiple predators, which is a significant constraint for the successful emergence of adult mosquitoes. Many of these predators, as well as pathogens, are known as mosquito biocontrol agents owing to their ability to consume the larval stages, thereby reducing the population (Mogi 2007; Quiroz-Martínez and Rodríguez-Castro 2007; Saha et al. 2012). Few predators, however, consume mosquito eggs. For instance, there are several reports on the predation of eggs of *Aedes albopictus* by the fire ant *Solenopsis invicta* and the lady beetle *Curinus coeruleus* (Burnham et al. 1994; Yang 2006; Duhrkopf et al. 2011) and different species of tadpole and cockroach *Periplaneta americana* on the eggs of *A. aegypti* (Russell et al. 2001; Bowatte et al. 2013). There are 11 families of aquatic mites whose nymphs and adults feed on the mosquito eggs (Smith 1983). The fish species *Poecilia reticulata* and *Gambusia affinis* consumed egg rafts of *Culex quinquefasciatus,* while the larvae of predatory mosquito *Toxorhynchites splendens* destroyed the egg rafts of *C. quinquefasciatus* (Pramanik and Raut 2008, 2010). Empirical studies found that backswimmers, *Notonecta maculata,* destroyed egg rafts while the dragonfly *Sympetrum fonscolombii* predated on the egg rafts of the mosquito *Culiseta longiareolata* (Mukherjee and Blaustein 2019).

In the present study, a chance observation of a larval dragonfly consuming the egg raft of the *Culex* mosquito is documented, highlighting the significance of the trophic interactions for mosquito regulation. The predation pattern of the larval Odonata, though different from the general mode of consumption, emphasizes the variability in the predation ecology and the significance for conservation biological control.

MATERIALS AND METHODS

Dragonfly larvae were collected in the course of the sampling of the mosquito immatures and co-occurring macroinvertebrates from the rice fields and associated wetlands in Baruipur (22°37'43" N, 88°35'92" E), South 24 Parganas, West Bengal, India, during September 2023. The collection was carried out using a 200 µm mesh size circular plastic net, following the appropriate protocol (Robert et al. 2002). Assorted samples comprising different species of macroinvertebrates were brought to the laboratory in plastic bags (24 × 36 cm). All the species were carefully segregated using a glass dropper and a soft paintbrush. When a single egg clutch of *Culex tritaeniorhynchus* from the laboratory rearing stock was offered to a dragonfly larva, it engulfed the whole egg raft, leading to the compilation of this note. After the introduction of the egg raft into the container (250 ml volume, 100 ml of distilled water) of the dragonfly larva, at first, it showed

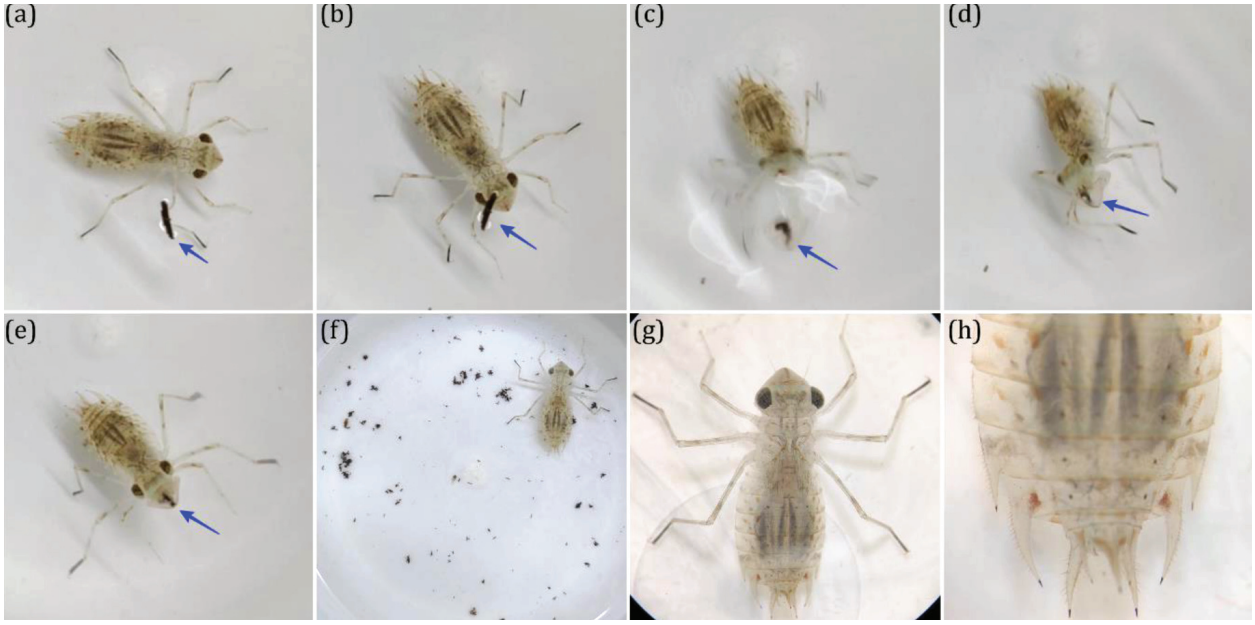

Figure 1. Predation on *Culex tritaeniorhynchus* egg raft by the dragonfly larva *Pantala* sp.: (a) after the introduction of the egg raft, (b) after a few seconds, the dragonfly larva positioned itself under the egg raft, (c) and (d) dragonfly larva consumed the egg raft, (e) egg raft in the mouth of the dragonfly larva, (f) egg cases egested through faeces, (g) and (h) photograph of the dragonfly larva *Pantala* sp. under a binocular stereoscope (SZ2-ILST, Olympus®, Japan). The arrow indicates the position of the egg raft.

no movement. However, after getting the visual cues, the dragonfly larva positioned itself under the egg raft and engulfed the whole raft simultaneously (Figure 1). This observation of mosquito egg raft predation by dragonfly larva was replicated seven times.

RESULTS

To swallow the whole egg raft, the dragonfly larva takes 48–64 seconds (number of observations 7; 56.571 ± 2.223 seconds, mean ± SE). The size of the dragonfly larva was 16.3 mm and it weighed 124.66 mg (taken in an electronic pan balance, Afcoset®, India). The photograph of the dragonfly was taken under the binocular stereoscope (SZ2-ILST, Olympus®, Japan) using the camera (DGI 510, Dewinter®, India) and identified as *Pantala* sp. using the proper identifying key (Edmondson 1963). When more egg rafts (length 3.19 ± 0.317 mm, weight 0.84 ± 0.047 mg, and egg count 132.333 ± 13.642) were offered to the larva, it was observed that the larva consumed two egg rafts at once. Within an hour, the dragonfly larva consumed seven egg rafts of the mosquito *C. tritaeniorhynchus*.

DISCUSSION

The efficiency of dragonfly larvae as biocontrol agents of different vector mosquito larvae is well-established throughout the world (Saha et al. 2012; Ramlee et al. 2022). Earlier studies mainly focused on the larval predation of mosquito larvae, while here we report the predation on egg rafts of *C. tritaeniorhynchus* mosquito by the dragonfly larva *Pantala* sp. Predation on egg rafts is much more effective than predation on mosquito larvae. The vector of Japanese encephalitis *C. tritaeniorhynchus* breeds in rice field habitats (Lytra and Emmanouel 2014; Roy et al. 2016a, b) and lays eggs in clutches. A single egg raft of *C. tritaeniorhynchus* contains more than a hundred eggs and shows more than 80% hatchability (Reisen et al. 1979), and predation on a single egg raft means eliminating all the eggs at once. In addition, egg rafts float on the water surface and show no behavioural response, although mosquito larvae show anti-predator behavioural responses in the presence of predators. Therefore, predators need to invest much energy either in searching or in handling, while it is easy to locate the egg raft and engulf all the eggs of the raft without investing more energy. Predation on egg rafts not only regulates the abundance of the vector mosquito species but also determines the fitness and shapes the population dynamics of the vector mosquito species.

The findings of this study highlight that biocontrol agents preying on mosquito eggs can play a more effective role in reducing mosquito populations. Therefore, identifying these agents and evaluating their predation efficiency across diverse habitats is essential for designing successful vector control programs.

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Author's contribution

Conceptualized by GA and GKS; Field collections, observation, data curation and photographs by SDM; Manuscript preparation by SDM and GA.

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Conflict of interest statement

As authors of this article, we declare that we do not have any conflict of interest.

Data availability statement

The data presented in the manuscript, including the photographs, can be provided upon an authentic and reasonable request.

REFERENCES

Bowatte, G., Perera, P., Senevirathne, G., Meegaskumbura, S., & Meegaskumbura, M. 2013. Tadpoles as dengue mosquito (*Aedes aegypti*) egg predators. *Biological Control* 67(3), 469 – 474.

Burnham, K.D., Baldridge, R.S., Duhrkopf, R.E., & Vodopich, D.S. 1994. Laboratory study of predation by *Solenopsis invicta* (Hymenoptera: Formicidae) on eggs of *Aedes albopictus* (Diptera: Culicidae). *Journal of Medical Entomology* 31(5), 770–771.

Duhrkopf, R.E., Baldridge, R.S., Crino, O.L., & Dillen, J. 2011. Predation by *Solenopsis invicta* Buren (Hymenoptera: Formicidae) on eggs, larvae, and pupae of *Aedes albopictus* Skuse (Diptera: Culicidae). *Southwestern Entomologist* 36(2), 119–124.

Edmondson, W.T. 1963. *Ward and Whipple's Freshwater Biology*. 2nd Ed. New York: Johan Wiley & Sons Inc., 1248 pp.

Lytra, I., & Emmanouel, N. 2014. Study of *Culex tritaeniorhynchus* and species composition of mosquitoes in a rice field in Greece. *Acta Tropica* 134, 66–71.

Mogi, M. 2007. Insects and other invertebrate predators. *Journal of the American Mosquito Control Association* 23(sp2), 93–109.

Mukherjee, S., & Blaustein, L. 2019. Effects of predator type and alternative prey on mosquito egg raft predation and destruction. *Hydrobiologia* 846, 215–221.

Pramanik, M.K., & Raut, S.K. 2008. Destruction of *Culex quinquefasciatus* egg-raft by the larvivorous fish, guppy (*Poecilia reticulata*) and Gambusia (*Gambusia affinis*). *Environment and Ecology* 26, 2311–2314.

Pramanik, M.K., & Raut, S.K. 2010. Fate of *Culex quinquefasciatus* egg-raft exposed to predatory mosquito *Toxorhynchites splendens*. *Environment and Ecology* 28(1), 185–188.

Quiroz-Martínez, H., & Rodríguez-Castro, A. 2007. Aquatic insects as predators of mosquito larvae. *Journal of the American Mosquito Control Association* 23(sp2), 110–117.

Ramlee, S., Rashid, N., & Mohd, S.A. 2022. Odonata nymphs as potential biocontrol agent of mosquito larvae in Malaysia. *Southeast Asian Journal of Tropical Medicine and Public Health* 53(4), 426–435.

Reisen, W.K., Siddiqui, T.F., Aslam, Y., & Malik, G.M. 1979. Geographic variation among the life table characteristics of *Culex tritaeniorhynchus* from Asia. *Annals of the Entomological Society of America* 72(5), 700–709.

Robert, V., Golf, G.L., Ariey, F., & Duchemin, J.B. 2002. A possible alternate method for collecting mosquito larva in rice fields. *Malaria Journal* 1, 4.

Roy, M., Pramanik, S., Chatterjee, S., & Aditya, G. 2016a. Productivity of *Culex tritaeniorhynchus* in rice fields of West Bengal, India: Correlates of Immature and Adult Features. *Vector Biology Journal* 1, 3.

Roy, M., Pramanik, S., Chatterjee, S., & Aditya, G. 2016b. Observations on the pupal productivity of *Culex tritaeniorhynchus* in rice fields of West Bengal, India: implications for vector management (Diptera: Culicidae). *Fragmenta Entomologica* 48(1), 69–76.

Russell, B.M., Kay, B.H., & Shipton, W. 2001. Survival of *Aedes aegypti* (Diptera: Culicidae) eggs in surface and subterranean breeding sites during the Northern Queensland dry season. *Journal of Medical Entomology* 38(3), 441–445.

Saha, N., Aditya, G., Banerjee, S., & Saha, G.K. 2012. Predation potential of odonates on mosquito larvae: implications for biological control. *Biological Control* 63(1), 1–8.

Smith, B.P. 1983. The potential of mites as biological control agents of mosquitoes. In *Research Needs for Development of Biological Control of Pests by Mites,* edited by M. Hoy, G. Cunningham and L. Knutson. *Special Publication* 3304, 79–85. Berkely, CA: Agricultural Experimental Station, University of California.

Yang, P. 2006. Laboratory study of predation by *Curinus coeruleus* (Coleoptera: Coccinellidae) on eggs of *Aedes albopictus* (Diptera: Culicidae). *Proceedings of the Hawaiian Entomological Society* 38, 127–129.