

Research Article

Coexistence of Copepods and Mosquito Larvae in Different Standing Water Bodies of Punjab, India

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Abstract: Copepods are tiny crustaceans (zooplankton) inhabiting the water bodies having rich mosquito breeding grounds and are known to act as voracious predators of first instar mosquito larvae. During the present study a survey at three districts of Punjab state (India) was carried out from various standing water bodies (n=45) to explore the occurrence of copepods coexisting with mosquito larvae. Results obtained showed the existence of copepods along with mosquito larvae in fish ponds, paddy fields and also in other small temporary water bodies. Copepod count was found to be highest in fish ponds (803.99±47.28/litre), however no copepods were observed in the water samples of village ponds. Three orders of copepods i.e. calanoida, cyclopoida and harpacticoida were observed with predominance of cyclopoids (56%). Mosquito larval population/litre was found to range from 18.84±5.66 to 182.73±21.63 from various water bodies.

Keywords: Copepods, Cyclopoids, Mosquito larvae, Standing water bodies

INTRODUCTION

Mosquitoes are incredibly successful blood sucking insects and often inhabit standing water bodies like ponds, swamps, marshes, paddy fields and manmade reservoirs. The increase in environmental modifications as a result of urbanization is usually being associated by the increase of breeding sites for mosquitoes which most often lead to increase in the incidence of mosquito borne diseases [1, 2]. Mosquitoes breed in the varied habitats and different genera have shown specific habitat and breeding preferences like *Anopheles* species are associated with fresh water habitats, where as *Culex* species may also be found in polluted conditions including septic tanks and *Aedes* species breeds in peridomestic and other small water collections including desert coolers [3]. Several types of insecticides are being used against larval and adult mosquitoes. But, continuous use of these pesticides has generated chemical resistance among mosquitoes in addition to seriously harming the environment. Problems associated with resistant mosquitoes and the effects of chemicals on non-target species evoke a reason to find alternative methods for control of mosquito. As a sustainable alternative, increased attention is being paid worldwide to biological means, which includes the utilization of natural predators, pathogens and parasites [4, 5]. Like many predators in aquatic environments, copepods (a type of zooplankton) are known to feed voraciously on the first instar mosquito larvae resulting in strongly

influencing the structural and functional organization of mosquito communities [6,7]. The copepods especially the larger cyclopoid species like *Mesocyclops*, *Macrocyclops* and *Cyclops* have been known to have the ability to utilize mosquito larvae as food [8]. These copepod species have been proved to be effective for practical mosquito control than any other invertebrate predator of mosquito larvae, as they exhibited the capacity to kill more than 30-40 first instars larvae/copepod/day [9-11]. Field surveys of different mosquito breeding habitats have shown that natural copepod population substantially reduce, or even eliminate mosquito production and trials in temporary pools, marshes and paddy fields have demonstrated that introduction of right copepod species to right habitat at right time can eliminate mosquitoes [12]. Hence, there is a need to explore the copepods coexisting copepods in standing water bodies and to understand their relationship with mosquito larvae population. Therefore, the present study was initiated with the objective of exploring the occurrence of mosquito larvae existing with mosquito larvae in standing water bodies under local conditions of Punjab (India). This study may provide a base line data for the existing copepods in local water bodies which can be further tested for their predatory potential and usage as environment friendly agents to control mosquito in future.

MATERIAL AND METHODS

To check the coexistence of copepods and mosquito larvae, a survey from villages of three districts viz., Ludhiana, Bathinda and Mukatsar of Punjab state was carried out from both permanent standing water bodies (village ponds and fish ponds) and temporary water bodies (paddy fields, orchards, ditches, desert cooler etc.) from the month of May, 2013 to October 2013. For collection of mosquito larvae, water samples were systematically taken by dipping the plastic dipper of 1000 ml capacity at 5 sites/water body (3 scoops/site). From the collected water samples total mosquito larval count *i.e.* number of larvae/litre was calculated. For collection of copepods water was sieved at 5 sites/permanent standing water body (approx. 50L *i.e.* 10 litre/site) and 5 sites/temporary body (approx 5 litre/site) through zooplankton net. Copepods were identified up to order level by following the standard identification keys [13] and their number was counted in sedgewick rafter counter under microscope.

RESULTS AND DISCUSSION

Survey conducted at various permanent and temporary standing water bodies (n=45) of three districts of Punjab from May, 2013 to October, 2013 showed the prevalence of copepods in fish ponds as the average population count of copepods/litre was found to be maximum *i.e.* 803.99 ± 47.28 in water samples collected from fish ponds (Fig. 1). This high number in copepod count may be because of the fact that fish ponds are regularly supplied with organic and inorganic fertilizers to maintain the population of zooplankton which act as food of fishes. On the other hand copepod count/litre was less in paddy fields (248.23 ± 37.51) and in other water bodies (150.97 ± 16.87). No copepods were found from water samples of village ponds (Fig. 1) as these ponds were highly polluted due to domestic sewage discharge. Actually copepods are known as bio-

indicators and they cannot survive in contaminated water. Researchers have also noticed that copepods disappear as pollution level in the aquatic habitat got increased [14]. Mosquito larval count was also calculated from same water samples and results indicated the coexistence of mosquito larvae and copepods with their variable count/litre *i.e.* 18.84 ± 5.66 from fish ponds, 144.00 ± 19.13 from paddy fields, 48.02 ± 6.14 from village ponds and 182.73 ± 21.63 from other water bodies (Fig. 1). The occurrence of less population of mosquito larvae in fish ponds and paddy fields may be due to regular insecticidal sprays in these water bodies and their low count in village ponds is due to contaminated water. Coexistence of copepods and mosquito larvae in various standing water bodies of Punjab with variability in their population depends on number of ecological factors which are needed to be study further. This fact is also well established that in nature only about 10% of aquatic habitats where mosquitoes breed might contain natural population of those copepods which can drastically reduce the survival of mosquito larvae [15, 7]. Identification of copepods during the present study revealed the occurrence of three orders of copepods these are calanoida, cyclopoida and harpacticoida with their relative abundance as 43%, 56% and 1% respectively (Fig. 2.). This finding showing the predominance of cyclopoida order is of great importance, as it indicated that various local water bodies of Punjab have sufficient population of cyclopoid copepods, which indeed are the one having efficient predatory potential against mosquito larvae [9, 10]. The preliminary results obtained during the present study are encouraging and offer a platform for testing of these cyclopoids present in local water bodies of Punjab for their use as promising biological control agents against mosquito larvae in future.

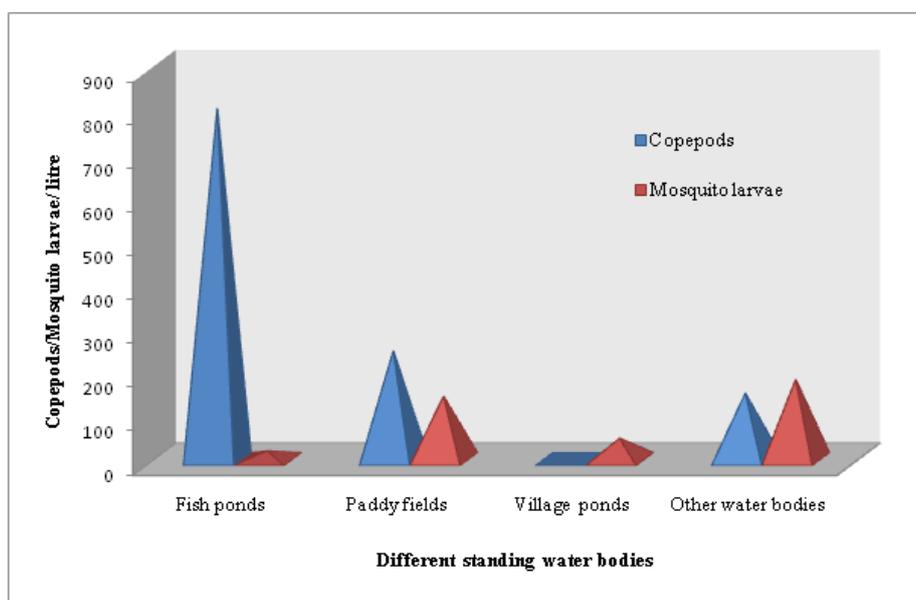


Fig. 1: The extent of coexistence of copepods and mosquito larvae in different standing water bodies of Punjab

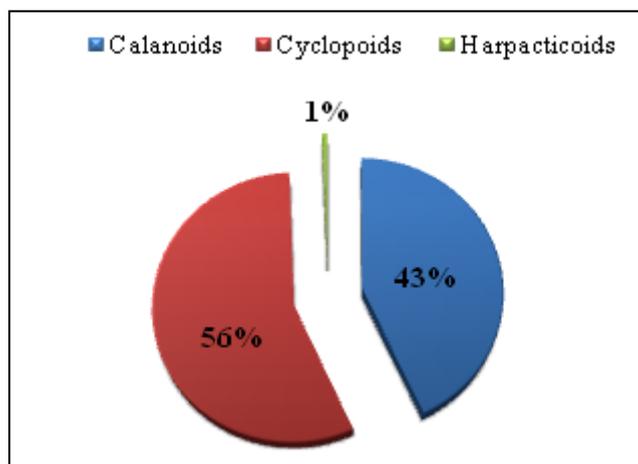


Fig. 2: Relative abundance of different orders of copepods in standing water bodies of Punjab

CONCLUSION

During the present study, survey done from various standing water bodies of Punjab indicated the coexistence of copepods and mosquito larvae. Copepods were found to be maximum at fish ponds, while no copepods were observed in village pond water. The order cyclopoida, one having copepods with voracious predatory potential against first instar larvae of mosquito was present predominantly (56%) along with two other orders (calanoida and harpacticoida) of copepods. The occurrence and prevalence of cyclopoid copepods in local water bodies of Punjab and their coexistence with mosquito larvae presents a positive sign for further exploration of predatory behaviour of copepods, so to use them as bio-control agents to control mosquito population in the state.

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