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Comparative analysis of the predatory habits of Gambusia and Poecilla fishes in environmental control of mosquitoes

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Abstract
Adult Gambusia could eat up to 150 mosquito larvae in an eight-hour period. This makes them an excellent biological tool for mosquito control because they eat the larvae before they have a chance to develop into adult mosquitoes. However, the use of Gambusia and Poecilla /guppy fish as biological weapons to control mosquito menace have had also been reported to have the opposite effect as well.

Keywords: predatory habits, Gambusia and Poecilla fishes, mosquitoes

Introduction
The mosquitos were become a threat to the mankind in a different way by introducing dengue and malaria like highly infectious disease which leads to the decrease in immunity of a person. In order to fight these the ecologist suggested larva gobbling fishes who feeds on the mosquito larva in ponds where they grow in thousands number eradicate the mosquito threat biologically. And the little guppy Poecilla reticulata has developed a big reputation. For decades, the fish has been championed as a mosquito fighter and dumped into ponds and ditches to eat up the insect's larvae. But among scientists, it has a different reputation—as an invasive species with a remarkable ability to reproduce and spread. Now, as health officials in regions facing mosquito-borne viruses consider expanding use of these predatory fish, ecologists are urging them to think twice. In a paper published online today in Biology Letters, a group of ecologists argues that the guppies—and other nonnative fish used for mosquito control—haven't actually proven very effective mosquito fighters, but are known to pose ecological risks. "It all sounds like it's magical—you put the guppies in, they eat the mosquitoes, everything is fine," says Rana El-Sabaawi, an ecologist at the University of Victoria in Canada and lead author on the new paper. "Our concern is that you have a potentially invasive species that is being introduced haphazardly."
Larva-gobbling guppies may have been cutting-edge technology for U.K. colonialists aiming to rid the empire of mosquitoes at the turn of the century. While "randomly Googling guppies," she came across news reports from Pakistan that health officials had released thousands of the fish into the ponds and sewers of Karachi in 2013 to fight the transmission of dengue fever. Guppies are efficient invaders. They're hearty and fertile, surviving in relatively polluted water, reproducing often, and giving birth to fast-growing, live young. A combination of accidental aquarium releases and mosquito control projects have spread the species from its native range in the Caribbean and the northern coast of South America to at least 69 countries, according to a 2011 survey.

Advantages of this type of fish
- These fishes are self-perpetuating after their establishment and continue to reduce mosquito larvae for a long time.
- The cost of introducing larvivorous fish is relatively lower than that of chemical control.
- The use of fish is an environmentally friendly method of control.
- Larvivorous fish such as Gambusia and Poecilla prefer shallow water where mosquito larvae also breed.

Breeding season of fish

Gambusia breeds throughout the year after maturity, especially in tropical conditions. In relatively colder climates such as is found in the north and north-west India breeding period lasts from May to September and in the warmer climate of southern India from April to November.

Experimental design

As suggested by the breeding season of these fishes the fishes needs more protein source before breeding so the best time to introduce these fishes for experiments were selected to April-may months. The three ponds were created with equal amount of mosquito larvas in it. The equal amount of fishes was introduced in each ponds and one pond has been subjected to equal amount of each fish. Each pond has been set in experimental setup for certain period during mosquitoes breeding condition.

Table 1: The feeding tendency of the Gambusia and Poecilla fishes in control pond

Fishes	Eggs	1 st instar larva	2 nd instar larva	3 rd instar larva	Juvenile larva	Adult larva	Total
Control	100	100	100	100	100	100	600
Gambusia	71	75	66	22	15	7	256
Poecilla	82	25	31	40	49	60	287
Gambusia and Poecilla	44	15	22	17	12	14	124

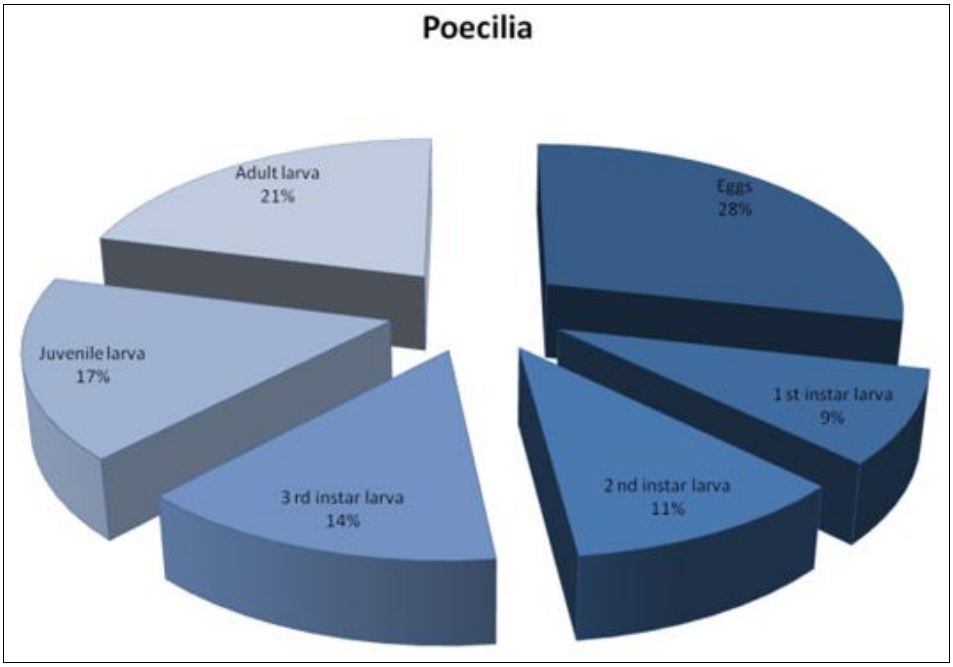

Fig 1: The feeding habits of Gambusia on mosquito larva

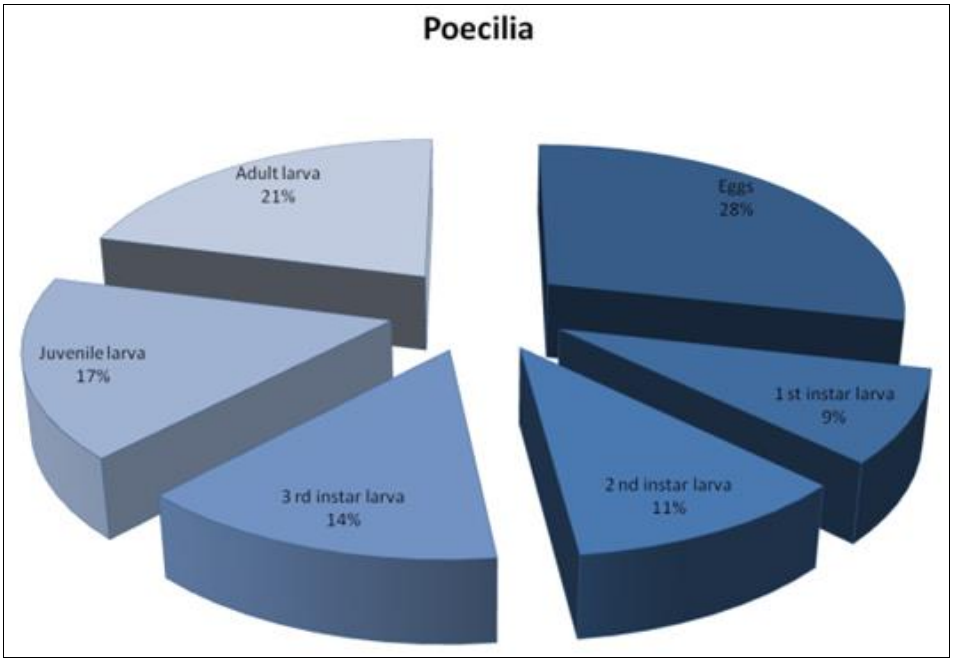

Fig 2: The feeding habits of Poecilla on mosquito larva

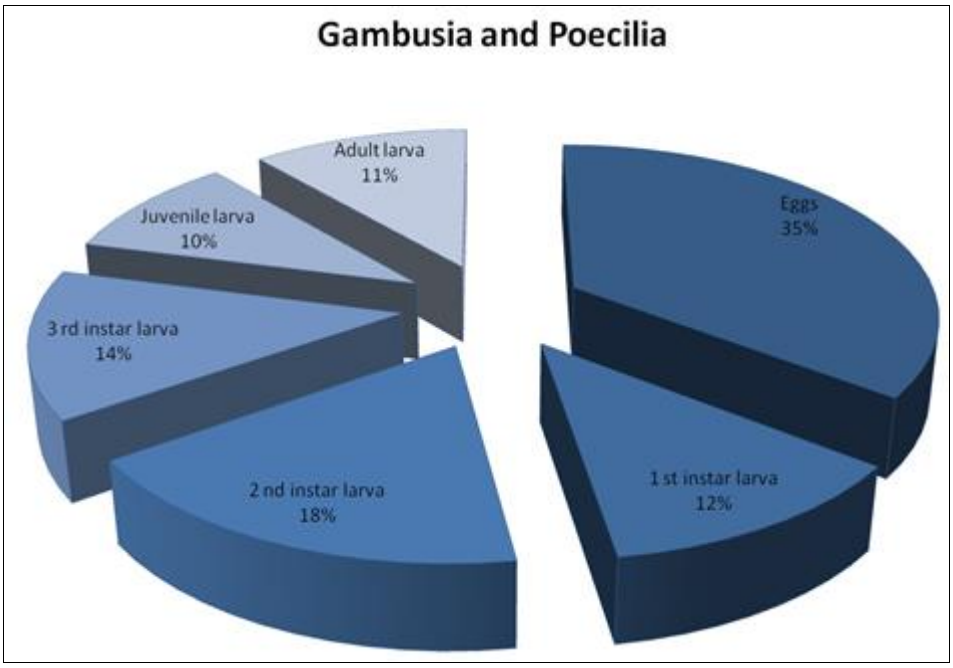

Fig 3: The feeding habits of both predatory fishes on mosquito larva

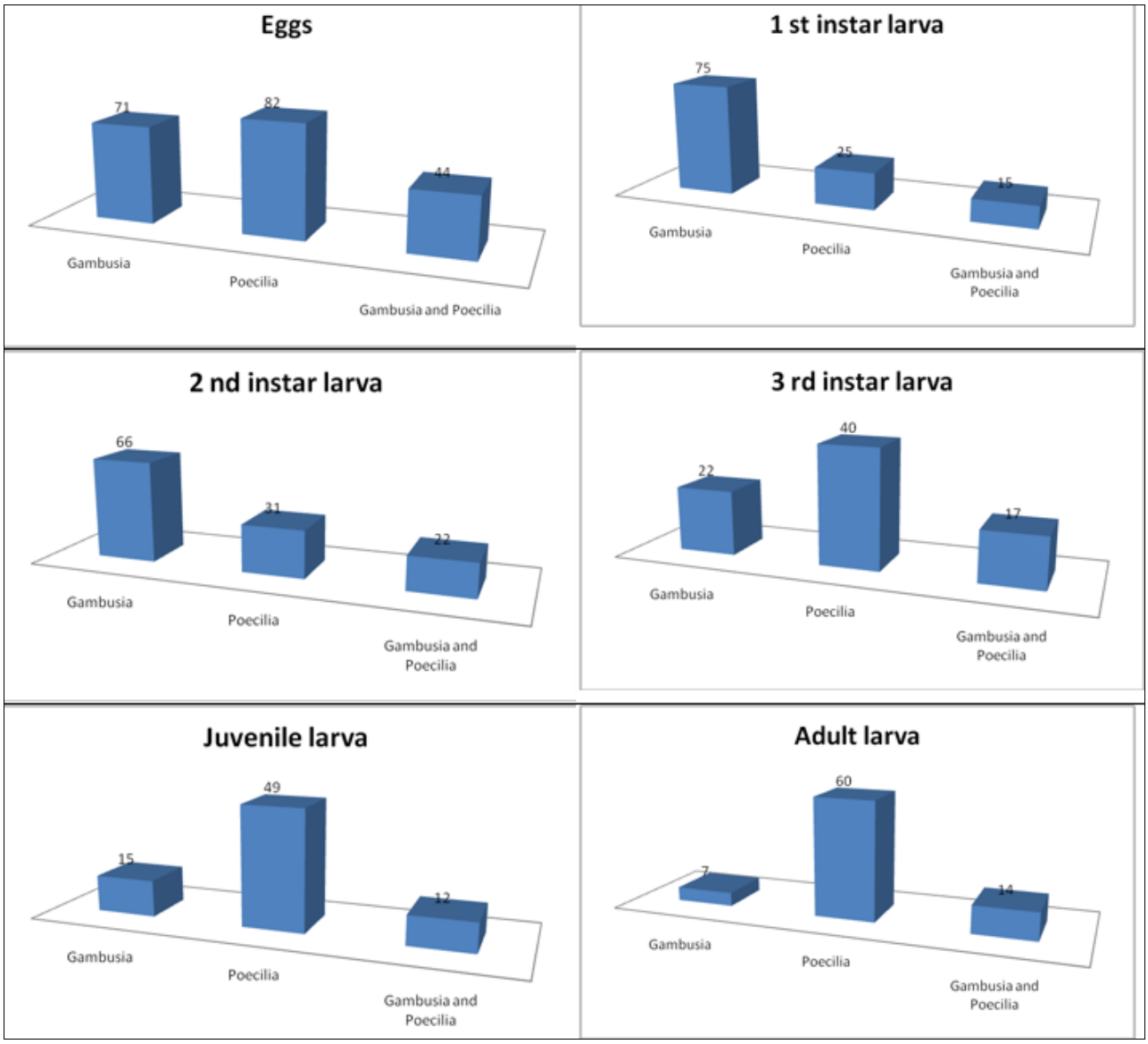

Fig 4: Comparative predatory effect of both fishes individual and in combination on different mosquito larva stages

Result and Discussion

Under laboratory conditions Poecilla was more successful than Gambusia in preying upon the 3rd, 4th and pupal stages of mosquitoes. The reverse was found for the first two instars. However. Poecilla consumed more 2nd instar larvae under the cover of vegetation when larger fish were able to penetrate shallow water and feed on the mosquito larvae. The two species showed a similar prey-size selection except for Poecilla of the medium size (31–35 mm) which ate larger larvae than Gambusia of the same size range. When provided access to the surface, neither fish species showed any adverse effect at oxygen levels as low as 0.5 mg l-1 (6% saturation). When denied access to the surface, both species behaved 'normally' at oxygen levels as low as 1.3 mg l-1 (15% saturation).

Conclusion

This study suggests that Gambusia affinis and Poecilla reticulata can complement each other as mosquito control agents in different habitat conditions. We suggest that in mosquito infested situation which are characterized by high organic matter and low oxygen levels biological control could best be achieved by introduction of a range of sizes of both fish species. Repeated introductions of the fish, in large enough numbers, may be required for ad-hoc alleviation of a mosquito problem. Best results are thus to be expected in relatively small water bodies such as oxidation ponds.

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