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Fish prove an alternative bioagent in mosquito control

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Aquarium fish: A delight to the eye and an alternative in mosquito control.

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JAKARTA (JP): The insecticides used in mosquito control harm the environment more than they eradicate mosquitoes. And, although the high toxicity of insecticides on non-target species has been questioned in the past few decades, due to the evolution of insecticide-resistant mosquitoes the toxicity is increasing. In the 1950s, tropical diseases were minimized through intensive use of diphenyl dichloro trichloroethan (DDT). The diseases returned after the vector insects developed increased multiple resistance to most chemical insecticides.

The use of environmentally friendly alternatives is therefore essential to vector control. The World Health Organization (WHO) integrates various potential methods to control the disease spreaders. The methods cover biological and chemical solutions, source reduction, health education and personal protection.

Biological vector control is the most reasonable and environmentally friendly alternative to the use of chemicals. The biological method of mosquito control covers the utilization of natural enemies of vectors, repetitive application of microbial insecticides, and various genetic methods such as sterile male-vector release techniques. A meeting on the on the use of fish in mosquito control was held in Geneva, Switzerland in 1981. It explored the role of larvicidal fish as a simple, cost-effective and self-tool agent of vector control.

Aedes aegypti

Predatory fish were first used against the *Aedes aegypti* larvae to control yellow fever in Havana, Cuba at the turn of the century. Since then, there have been numerous reports of the effectiveness of predatory fish in reducing mosquito larval populations.

The *Aedes aegypti* mosquito is notorious throughout urban areas in Southeast Asian. This container breeding mosquito is the major vector of the dengue virus which causes dengue hemorrhagic fever. Dengue hemorrhagic fever is a leading killer of children in Southeast Asia. According to WHO, dengue is confined to Southeast Asia and the Western Pacific. At present, outbreaks occur both in large cities and small towns, and it spreads to villages wherever *Aedes aegypti* exists.

Dengue hemorrhagic fever has been a problem in Indonesia since 1779, but the first confirmed case was only recorded in 1969. The biggest outbreak of dengue hit Indonesia in 1988, with 47,373 cases being reported resulting in 1,527 deaths. The outbreak appears to have a five-year cycle and tends to intensify with every occurrence.

Aedes aegypti breeds in still freshwater in and around the home, and depends on human's blood to survive. It is therefore an extremely efficient vector of dengue. The species is the only dengue vector in most endemic countries.

The mosquito breeds in:

1. Temporary water collectors, including discarded or unused water jars, old tires, broken bottles and debris holding rainwater;

2. Permanent water containers such as reservoirs and domestic containers for storing water for washing, drinking and bathing on account of a lack of freshwater or unreliable supply of piped water; and

3 Natural habitats such as tree or bamboo stumps near human habitation. The mosquito is also known to breed in brick lined and mud lined wells.

Vector control is still considered the main weapon in dengue prevention. Research and training has concentrated on the use of insecticides to control adult insects or mosquito larvae. The mosquito's resistance to insecticides, as well as prohibitive operational costs, has shifted the control of *Aedes aegypti* in urban areas to the reduction of man-made containers suitable for larval breeding.

Hungry fish

Larvicidal fish can be introduced in essential water containers, such as large drums, cement tanks and other containers holding large quantities of water, to decimate the mosquito larvae.

Fish with superior mouths are the best candidates since they are usually carnivorous or omnivorous, and they swim and feed at or near the water surface where many mosquito larvae and pupae rest. Promising larvicidal fish are usually small (6 cm long), fusiform in shape, and their terminal or superior mouths are provided with teeth. Larvicidal fish are generally omnivorous and may feed on algae, crustaceans and dipterous larvae. There are no fish only eat larvae.

Larvicidal fish exist in most subtropical and tropical countries. *Gambusia affinis* from southeastern North America is widely used for mosquito larva control. The efficacy of this species has made it popular in many countries. Other tropical fish are effective in mosquito control, such as the Indian top minnow (*Aplocheilus panchax*), guppies (*P. reticulata*), and the carp *Tilapia mossambica* and *Cyprinus carpio*.

The capability of guppies to decimate mosquito larvae has been investigated both in the laboratory and the field in Cuba, India and Indonesia. The introduction of this fish in 17 wells in suburban Ram Nagar, India, reduced the mosquito population in 70 percent of the wells within two weeks. In rural areas in Varanasi, India, 40 percent of the 17 wells were mosquito free two weeks after the fish were introduced.

Throughout tropical Asia, water is stored in different shaped containers made from cement, ceramics, unglazed earthenware, plastic and metal. The practice differs with cultural needs or prevailing local conditions. In areas where freshwater is scarce, such as coastal or rural areas, the community usually relies on rainwater. They hold it for long periods in open containers. These, in turn, are breeding places for *Aedes aegypti*. Because it is impossible to empty the containers to clean them of mosquito larvae, introducing larvicidal fish to the containers is the simplest solution.

Customs and cultural sensibilities are the main constraints to this solution. Most people are not accustomed to seeing fish swimming in their water containers.

An answer to this obstacle is the predatory capability of three freshwater-aquarium fish. The common guppy, a familiar pet with the spectacular male and more voracious females can be found in fishponds on the outskirts of Jakarta or at any pet market. Unfortunately, rapid suburban development has destroyed their natural habitats. Another voracious species is *Colisa lalia*, a beautiful aquarium fish with the popular Indonesian name of *sepat rälis*. It is also available at pet markets.

To get around the problem of fish excrement, first place the fish in another container and starve them for 12 hours so they can excrete as much as possible before being introduced to a domestic container. The fish will immediately gorge themselves as soon as they are place in a larvae infested domestic container. They can be returned to the aquarium after a half hour so they will not pollute the water in the domestic container. The number of fish introduced depends on the number of larvae and the size of the container.

The feeding frenzy is only needed once a week because *Aedes aegypti* grow from eggs to the big larvae in five to seven days. The mosquito larvae never make it to the adult stage without the use of harmful chemicals.

With so many fish available for mosquito control, it is logical to ask why they are not more often utilized for this purpose. One reason, of course, is the availability of a number of excellent fast-acting insecticides that can be quickly and uniformly applied to large and varied areas. Fish, on the other hand, are seldom readily obtainable, and are difficult and expensive to maintain. They are also restricted to a distinct habitat. Fish and other forms of natural control alone will never succeed in replacing chemicals. Nevertheless, insecticides have increased in price while decreasing in effectiveness, making it imperative that new biological vector controls be found to replace the environmentally harmful chemical treatments.

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