PERSPECTIVES

Semi Field Trial Competitive Power Married Made Sterile Aedes Albopictus as Method of Vector Control: A Current Vector Controlling Method

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Abstract

Aedes albopictus is a plant that causes Dengue Hemorrhagic Fever is not as prevalent as Aedes Aegypti is not a disease given by Aedes albopictus mosquito is not much different from Aedes Aegypti mosquito. The Case Fatality Rate (CFR) of Dengue Fever is very high in Indonesia, at 41.4% at the beginning of dengue cases in Indonesia. Innovation continues to create for disease vector control to break the chain of disease. The use of sterile insect techniques is a useful thing in the things that need to be socialized in the community.

Keywords: dengue hemorrhagic fever, vector control, Indonesia

Introduction

What is Aedes albopictus

Aedes albopictus is also a DHF vector, although not as crucial as Ae. aegypti. In the laboratory, these two species of mosquitoes can transmit the Dengue virus through female drugs to eggs to their offspring, although Ae. albopictus is quicker to do so. Aedes albopictus is mostly a forest species that adapt to the human environment in rural, suburban, and urban areas1.

Aedes albopictus is a secondary mosquito that causes Dengue Hemorrhagic Fever (DHF) is not as popular as Aedes aegypti, but the effects given by Aedes Albopictus mosquitoes are not much different from Aedes aegypti mosquitoes.

Sterile Insect Techniques

Sterile Insect Techniques is a relatively new, potential, and compatible pest control technique with other techniques. These techniques include irradiation of insect colonies in laboratories.
with γ, n or x rays, then periodically released in the field so that the level of marriage probability between barren insects and fertile insects grew from the first generation to the next generation due to the decreasing percentage of fertility of the insect population in the field. The effect of the release of sterile insects (with a ratio of 9:1 to the natural male insects and the reproductive potential of each female parent insect in each generation yielded offspring of 5 female insects) to the model of insect population decline was discussed conceptually.

**DHF Situation in Indonesia**

Dengue Haemorrhagic Fever (DHF) is an infectious disease caused by one of 4 different dengue viruses and transmitted by mosquitoes, especially Aedes aegypti and Aedes albopictus which are found in the tropical and subtropical regions of the archipelago in Indonesia to the north of Australia.

Dengue Haemorrhagic Fever (DHF) is still one of the major public health problems in Indonesia. Along with the increasing mobility and population density, the number of sufferers and the extent of the spreading area is increasing. In Indonesia, dengue was first discovered in the city of Surabaya in 1968, where as many as 58 people were infected, and 24 of them died, with Mortality (AK) reaching 41.3%. Since then, the disease is widespread throughout Indonesia (Ministry of Health, 2010).

In 2015, there were 126,675 DHF patients in 34 provinces in Indonesia, and 1,229 of whom died. The number is higher than the previous year, which is 100,347 people with DHF and as many as 907 patients died in 2014. This can be caused by climate change and low awareness to maintain environmental cleanliness.

**Life Cycle of Aedes Mosquitoes**

Aedes mosquitoes are from Brazil and Ethiopia. The adult stature is smaller when compared with other mosquitoes, optimum life at hot temperatures between 28-32°C with moisture greater than 75%.

Both species are found throughout Indonesia, live optimally at altitudes below 1,000 above sea level, but from some reports can be found in areas with altitudes of up to 1,500 meters, even in India reported to be found at 2,121 meters altitude as well as in Colombia at an altitude of 2,200 meters.

Aedes Albopictus mosquito eggs are black, which will become more black in color when the hatch is approaching, the oval shape with one end is, and the size is approximately 0.5 mm.

Aedes albopictus larvae, cylindrical round head, short and smooth antennae with brush hairs on the front of the head, in the abdominal section VIII there is a distinctive
and thorny tooth comb on the lateral part of the thorax (which distinguishes it from Ae aegypti), size approximately 5 mm. In distinguishing instar from Ae larvae, albopictus can be used wide difference as in Ae. aegypti namely: - instar I with a head width of approximately 0.3 mm, instar II width of the head approximately 0.45 mm, instar III head width of approximately 0.65 mm, instar IV head width of approximately 0.95 mm.

Aedes albopictus pupa is a coma-like shape with a thick cephalothorax, the abdomen can be moved vertically in a semicircle, the color begins to form rather pale turns brownish and then black when it comes to maturity, and the head has a mouthpiece that is shaped like a long, slender trumpet.

**Severity and Death from DHF**

Case Fatality Rate (CFR) of DHF is very high, that is equal to 41.4% at the beginning of dengue cases spread in Indonesia. However, it declined to 24% in 1969 to 0.97% by 2015. The decrease in CFR is possible because the management of cases is getting better and the community's early awareness of DHF is increasing. The decrease in CFR from 1968-2015. However, when viewed from the absolute number of deaths, the number of deaths fluctuates even though the CFR continues to decline.

**Modernization of mosquito eradication for vector control**

*History of Vector Control from Time to Time*

Control of vector-borne diseases is still based on insecticide use. The use of insecticides has several disadvantages such as the emergence of a population that is resistant to insecticides, the occurrence of environmental contamination and killing non-target organisms.

Insecticide resistance is one form of adaptation of insects to survive against various selection pressures and is the most convincing example of Darwin's evolution theory. Faced with tremendous pressure due to the use of insecticides, weak members of the population (having no resistance genes) will be eliminated, while other population members with resistant genes will survive. At first in a normal population, the number of individuals with a resistance carrier gene is meager, but from this small amount, after going through several generations of reproduction and still obtaining insecticidal selection pressures will form a population of resistant insects. The change of gene frequency in a population over a period, as occurs in the insecticide resistance process, is called microevolution (accumulation of variation within a certain time). But the role of chemical insecticides has a very vital role,
especially when the occurrence of an increase in cases or extraordinary events vector disease13.

The negative effects of insecticide use triggered the development of a new method, one of which is a genetically modified mosquito (GMM). Strategies currently under development in GMM are the release of sterile male insects already exposed to radiation into the population as well as the dominant lethal gene integration under the influence of specific promoters on adult male insects. This GMM technology can be applied and adapted to other vector control methods. Also, it can be integrated into the integrated vector control program14.

Another technique is kemosterilisasi. This technique is done by immersing pupa in a certain time range in standard solutions of alkylating aziridinyl compounds such as thiotepa or cancer. The use of this method has been greatly reduced as it relates to the safety of workers exposed to mutagenic chemicals15,16.

Kemosterilisasi effectively increase the level of sterility and competitiveness of insects compared to radiation exposure but requires a high-security standard that seems difficult to apply to field conditions17.

The technique of barren insects has been widely used and managed to control several types of pest species, including eradication of new world (New World) screwworm, flies, Cochliomyia hominivorax in the United States, Mexico and throughout Central America, control of Mediterranean fruit fly Ceratitis capitata and eradication of tsetse fly Glossina austeni on Zanzibar Island. South Africa has now successfully used TSM to control the Mediterranean fruit fly (Medfly) in the valley of Hex River18.

Vector control using the technique of sterile insects (TSM) is very little known by ordinary people, they prefer vector control by spraying insecticides as often known as Fogging. In addition to the easy process and assessed it can make one of the primary prevention after the extraordinary occurrence in the certain area compared to using the technique of insect barren (TSM). However, the impact is going to happen insect resistant insecticide because insects adapt to survive.

**Sterile Insect Technique Control vector mosquito for Aedes Albopictus with using barren male mosquitoes**

*The use of nuclear power for barren male mosquitoes*

Mosquito population control with Sterile insect Mosquitoes approach is not always successful, and neither still fails. One of the causes of the failure of Sterile insect Mosquitoes to control mosquito populations is that the barren male released is of poor quality when it competes with the
At that time Chinese farmers placed ant nests made of paper in orange trees. The nests can be moved from one tree to another. Alternatively, they also use wooden sticks to help the movement of predatory ants from one tree to another. The activity is also a source of income for the sellers of ant colonies. Until now the practice of using predatory ants to control pests is still used in China as an alternative to chemical control (insecticides).

Efforts to increase the number of predatory ants on plantations and increase their effectiveness as predators are the first notes on insect biological control. Seen once by a deliberate attempt to manipulate the populations of living things, known as natural enemies, to reduce the number of pests or reduce the amount of damage inflicted by pests.

Around the year 1775, the Yemeni people moved the predatory ants from the mountain areas to the oases to control the date-eating pests. It became the first documentation of a natural enemy transfer case from a place far enough away for biological control purposes.

In the 18th century, the red grasshopper became a serious pest that attacked sugarcane in Mauritius. To control the red locust then in 1762 and 1770 imported mynah bird from India as its predator and managed to control the red grasshopper. The success is the first record...
of the international transfer case of the biological control agent.

From the above note, it appears that the first biological control agent utilized by humans is a predator. The most logical reason, of course, is because predators are easily observed through careful observation of animal behavior.

The first person to give insight into the existence of insect parasitism was Ulysses Aldrovandi who published descriptions of the Apanteles glomeratus larvae (Braconidae tribe) that emerged from the Pieris rapae (L) butterfly in 1602. Unfortunately, he misinterpreted it by mistaking the parasitoid cocoon as egg butterfly.

In 1668 Francisco Redi described parasitism by the parasitoids of the Ichneumonidae, but he did not understand the actual process. Simultaneously also, in 1701-1710, some people, including van Leeuwenhoek, described the interactions between types of insects including the parasitoid Aphidius sp. which arises from aphids. An understanding of the interaction between parasitoids and hosts has spurred numerous publications on the biology of various parasitoids in the 1750s.

The person who first commented about the possibility of using a parasitoid insect to control pests is Dr. Erasmus Darwin in 1800.

The presence of disease in insects has long been known to people long before people understand the infectious illness itself. At first, the description only focused on insects that have economic interests, such as honey bees and other insects. The writings were listed in Aristotle's book Historia animalium about 2300 years ago and Virgil, a Roman writer, who commented on the disease in honeybees about 300 years later.

Descriptions of diseases affecting silkworms were published in Japan about 1000 years ago. Silkworm itself has been preserved in China for about 3000 years ago, so there is a possibility that literature relating to it has previously existed. Silkworms play a central role in the pathology of insects as a discipline and may be considered central to the development of the whole concept of infectious diseases in insects.

With the passage of time silkworm cultivation spread from Asia to Europe and North America. Often there is an outbreak of a disease that destroys the entire population of insects that are kept so that it needs a supply of silk-free silkworms from elsewhere. One of the challenges to studying the epidemic was Agostino Maria Bassi who studied silkworm disease known as calcium in Italy and muscardine in France. He shows that the disease is caused by a kind of mold (fungus) that grows on
silkworms. The growth of fungi in silkworms results in the death of silkworms and can be transmitted to healthy individuals through contaminated contact or food. He was able to cope with the disease by using specific chemical compounds. The discovery occurred in 1833, although he did not disclose his invention until 1834.

Around 1865 Louis Pasteur managed to isolate several microorganisms (bacteria and protozoa) from every kind of disease that attacks silkworms. He also pointed out the existence of a condition now known cause is the RNA virus. Of course, at that time he was unable to identify it.

A Russian named Krassilstschik first performed scientific field testing of pest control using microbes Krassilstschik. He uses molds to control Curculionidae beetles that attack bit plants. In his research, Krassilstschik observed pest deaths of 50% - 80% in experimental plots.

The program of eradication of disease done one of them through vector control that has been done is to use insecticide (chemically). However, this method causes many problems such as the death of animals is not the target and the emergence of vector resistance. According to WHO (World Health Organization), vector control efforts will be more effective if done with several methods in an integrated manner.

The technique of sterile insects (TSM) is an alternative to pest control including potential disease vector. This technique is relatively new and has been reported to be an environment-friendly, highly effective, species-specific vector/insect control method, and compatible with other control measures. The fundamental principle of TSM is straightforward to kill insects with insects. Itself (autocidal technique). This technique involves irradiation of male insect colonies in laboratories with y, n, or X-rays, then periodically removed in natural vector habitats, so that the level of maternity probability between barren and fertile male insects becomes more significant from the first generation to next generation. This will result in a decrease in the fertility proportion of the insect population in its habitat, and theoretically, in the 4th generation the fertility population proportion reaches its lowest point to 0010 (5th generation nil).

Nuclear engineering is one of the most modern and potential techniques and has undergone rapid development in various fields of science and technology, such as chemistry, biology, health or medicine agriculture. Etc. Nuclear engineering is a technique that utilizes radioisotopes to solve health R & D problems because it has chemical properties and physical properties similar to common
chemicals but has the advantage of material properties emit active radio rays. Excess physical properties as radioactive light transmitters have been utilized to solve the problems of various R & D sectors such as industry, agriculture, medicine or health, biology, agriculture, and environment. Factors considered to cause infertility in irradiated insects are the dominant lethal mutase. In this case, the nucleus of the egg or core of the sperm runs damage as a result of irradiation so that the gene mutation occurs. The dominant lethal mutations do not inhibit the formation of male and female gametes, and the sight that happens is also not frustrated, but the embryo will die. The fundamental principle of this mechanism of infertility for further development as a basis for the development of insect control techniques called the Technical Male Barren which in its development is called Insect Insect Technique. This paper aims to estimate the number of sterile insects that must be released into the field after the known number of field population that must be controlled21.

Innovations continue to be created to control the spread of disease vectors to break the chain of disease. The use of the sterile insect technique is practical, but in the case of applying it, there has been no proper socialization in the community. Also, seen again constraints faced by policyholders are usually related to budget and coordination across sectors if TSM application will be applied in the region.

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