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Research Article

MANAGING MOSQUITOES ON THE FARM: AN ENCOURAGING ECO-FRIENDLY APPROACH

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ABSTRACT

Aedes aegypti (Ae aegypti) mosquitoes find suitable breeding grounds in agricultural practices such the use of irrigation during rice cultivation, the use of ponds for fish farming, and the storage of water in tanks for livestock. The anopheles' mosquito is the most prevalent *Aedes aegypti* (Ae aegypti) mosquito in Tamil Nadu, India, and it is mostly responsible for the morbidity and mortality linked to dengue and malaria. As a result, farmers are particularly vulnerable to malaria and dengue fever, two diseases that have a negative effect on agricultural productivity. Regrettably, there is a dearth of data on farming methods and behavioral predisposing variables among farmers that could help Dengue and malaria programmers develop and carry out interventions to lower farmers' risk of infection. Therefore, an assessment was conducted among farmers in rural farming communities in Coimbatore District, Tamil Nadu, on their understanding of dengue and malaria, as well as agricultural practices that encourage mosquito breeding.

Keywords: *Aedes aegypti*, Focus Group Discussions (FGDs), Natural Water Associated with Farms.

INTRODUCTION

Anthropophilic mosquitoes can find adequate breeding grounds in agricultural operations like using irrigation to grow rice and ponds to store water for cattle tanks. The anopheles mosquito is the most prevalent anthropophilic mosquito in Tamil Nadu and is primarily responsible for a large portion of the morbidity and mortality linked to malaria. As a result, farmers are highly susceptible to dengue fever, which has a negative effect on agricultural output. Sadly, there is a dearth of data on farming methods and behavioral predisposing variables that could help malaria programmers design and carry out interventions to lower the risk of infections among farmers. Farmers' awareness of malaria and agricultural methods that encourage mosquito reproduction in Tamil Nadu State's rural farming communities. Only a few urban, coastal, and riverine locations in Tamil Nadu the Corporation of Chennai, Ramanathapuram, Paramakudi, Thoothukudi, Kanyakumari, Krishnagiri, Dharmapuri, and Thiruvannamalai are immune to dengue and malaria. All PHCs and government hospitals have dengue and malaria screening facilities. By obtaining blood smears and using both Active Case Detection and Passive Case Detection, all fever cases have been evaluated for malaria. These slides will be reviewed in a day, and if Dengue and Malaria are found, immediate treatment will be administered in accordance with the NVBDCP medication regimen. The department's aggressive control efforts have resulted in a significant decrease in the prevalence of malaria and dengue. Compared to 2017 (5444 cases), the incidence of dengue and malaria has reduced for the year 2023 (3058 cases). Chennai accounts for 75% of instances reported in Tamil Nadu. In all districts and states, the 12th five-year plan for dengue and malaria aims to lower the annual parasitic incidence (API) to less than 1.

The invasive mosquito species *Aedes aegypti* pose a serious threat to human health. Because the eco-friendly approach is selective, non-persistent in the environment if releases are halted, and ecologically benign, it is proving to be a potent complement to the most widely-used approaches in controlling the abundance and spread of these arboviral pathogen vectors. Decision-makers, implementers, non-specialist scientists, and stakeholders will all benefit from this. By implementing these ideas, one

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may make sure that, with sufficient funding, there is a solid foundation for conducting field tests in the area and gaining expertise with the method in preparation for a possible practical implementation. The extant literature, along with the expertise and current understanding of the contributing writers who are experts in this topic, form the basis of this synthesis. With the four parallel development streams of Laboratory, Field, Stakeholder Relations, and the Business and Compliance case, we outline a typical route to successful pilot testing. We offer a visual framework that outlines the requirements that must be fulfilled in order to move forward (Dylan A. Tussey *et al*., 2023).

With an anticipated 228 million clinical cases and 405,000 fatalities in 2018, dengue and malaria continue to be serious public health issues. Nonetheless, with the use of indoor residual spraying (IRS) and long-lasting insecticidal nets (LLINs), significant progress has been made in the past 20 years in the management of malaria. Unfortunately, the emergence and spread of pesticide resistance in mosquitoes poses a threat to this success. In fact, the majority of the malaria epidemic is focused in Africa, where pesticide resistance is rising. Resistance to pesticides has developed and spread as a result of practices connected to the expansion of agriculture. Numerous researches indicate that the heavy application of pesticides in farming leads to the selection of resistant genes in malaria vectors. There is a dearth of studies on people's knowledge about resistance to currently used insecticides and the causes leading to resistance, including how people cope with the growing resistance, despite prior research on farmers' knowledge, attitudes, practices, and beliefs (KAPB) on pesticides used in agriculture (Bedjou *et al*., 2020).

A concerning rise in the frequency of transboundary pest and animal disease outbreaks poses a threat to food security. These illnesses and pests threaten food security and have negative effects on the environment, society, and economy as a whole. The rise in zoonotic illnesses, which can have detrimental effects on human health, such as swine flu and avian influenza, is concerning. I made an effort to give a succinct and up-to-date summary of the state of the field of mosquito and tick research in the current study. *Aedes aegypti* mosquitoes are a significant advancement in procedures for an eco-friendly strategy that encourages the management of wild populations of disease-transmitting mosquitoes, according to a recent study conducted by researchers in Tamil Nadu (Kallista Chan *et al*., 2022).

Methods of farm management

In this descriptive cross-sectional study, twenty randomly chosen farmers were interviewed using semi-structured questionnaires and eight Focus Group Discussions (FGDs) were used to gather data. Four farms were chosen at random to provide observations of agricultural methods, which were added to these sets of data.

Natural water associated with farms

Given that farms may contain ponds, streams, and other types of wetlands, growers and dairy farmers frequently act as stewards of natural waters. Numerous creatures can be found in natural waters, including as fish, amphibians, ducks, dragonflies, and fairy shrimp. ANR article 8117 (http://anrcatalog.ucdavis.edu/pdf/8117.pdf) discusses managing mosquitoes in surface-flow constructed treatment wetlands, although it is outside the purview of this article. In most natural lakes, the mosquito avoidance tips in this section are applicable. Because these permanent, pure natural waters support healthy populations of fish and/or predatory insects, they produce very few mosquitoes. However, particularly if they get manure or fertiliser, extremely weedy and shallow waters can become seriously infested with mosquitoes. Therefore, it is important to prevent this kind of runoff by installing buffer zones between fields and wetlands, using fertilisers sparingly, and properly draining irrigation systems. It is unpleasant and typically illegal to drain, fill, or significantly alter natural wetlands, in contrast to stagnant waters produced by farming activities. Additionally, some wetland vegetation is protected. It is forbidden for private individuals to add fish to natural waters. Natural predators can more successfully hunt mosquito larvae when weeds are controlled. For instance, remove old leaves and thin out cattails and rushes once a year. Temporary, shallow wetlands can be mowed once they dry up. If a stream on your land creates solitary, stagnant pools, use small ditches to join the pools to the main channel. This can help stream flow, which drowns mosquitoes, and makes it easier for fish and other predatory insects to detect and devour mosquitoes. When the tides or rains flood some coastal farms, mosquitoes breed there. Create and maintain trenches that let water drain out when the tide is low to help manage this issue. To lessen or stop salt water from entering during high tide and enable fresh water to flow out during low tide, you might need to build a levee with a tide gate.

Dairy operations

Mosquito swarms can be bred by dairy manure. Large-scale issues in wastewater management are faced by dairy farms. Although a detailed explanation of dairy construction is outside the purview of this article, you can reduce mosquito output by following the advice in this section. After draining a dairy, store the liquids appropriately or utilise them for irrigation. Dairy runoff is prohibited by law from contaminating surface water or seeping into groundwater. If you cultivate crops (including feed crops), storing the nutrient-rich liquid in a dairy lagoon for use in an irrigation system is a great way to get rid of a mosquito breeding ground. Fertiliser expenditures can be significantly reduced by using liquid manure. Concrete surfaces for barns and pens should have a slope of 2 to 3 percent, or 1/4 to 3/8 of an inch per foot, or 2 to 3 centimetres per metre, to a drain. Transfer liquid manure and wash water to a separator, followed by a holding lagoon. Corrals and other earthen outdoor work areas are to be arranged in accordance with the facility's general drainage plan and graded at least three percent. This keeps garbage and rainwater from collecting. To get rid of muddy spots and ponding, regrade as necessary. The lagoon should be at the lowest height, and the corrals and milking parlour at the highest. By placing

holding basins and ensuring proper drainage and cleansing, you can also reduce the risk of illness.

To separate solids from liquid manure, it is recommended to first pass it through a mechanical separator, a small separator pond, or another type of separation structure such as an apron, sump, or basin. Solids create floating mats that provide cover for mosquitoes and promote the growth of weeds. Additionally, too much fibre can irritate crops and clog pipelines. It is possible to spread and dry separated solids to stop the growth of flies. Having a backup system for mechanical separators is a good idea because they break down occasionally. Separator ponds ought to be somewhat small, with a maximum width of sixty feet (18 metres). If necessary, a narrow pond with a good road alongside might be treated with insecticides to cover its whole surface. Solids crusts can become problematic if they create water-retaining fissures where a large population of mosquitoes and flies can grow. Insecticides can also be stopped by crusts from killing mosquito larvae. If solids begin to crust over, ponds can be emptied out and stirred with water. Solids can be composted away or thinned out to dry. The separator pond should have steep sides, just like any other artificial pond, and weeds should be kept under control along its perimeter. Control additional dividing structures to prevent water from standing for longer than four days.

Biological and chemical mosquitoe control

Applying chemical or biological treatments to control mosquitoes is an addition to practicing proper water and weed management as preventive measures. Other species do not have defences against fish, thus it does not replace them. If you believe your scenario qualifies for mosquito fish, get in touch with your local National Vector-Born Disease Control Programme (NVBDCP). The use of biological or chemical treatments may not be necessary until it is too late, or the treatments may not be successful for a variety of reasons, thus prevention is essential. Mosquito generation is decreased by reducing mosquito habitat. Employees of the NVBDCP may treat mosquitoes with chemical or biological controls. If you want to use insecticides to control mosquitoes in Tamil Nadu, you will typically need to collaborate with NVBDCP as pesticide applicators require certain authorization to administer insecticides. The materials that are frequently used to kill adult or larval mosquitoes are covered in this section. It is possible to manage mosquito larvae by adding certain chemicals straight to the water. These materials could be organisms that eat them, biological components that poison them or give them deadly illnesses, chemicals that interfere with their physiology or growth, or films and oils that smother them. Although biological controls have a lower impact on non-target creatures than chemical controls, they are typically more costly. Predators like water bugs, dragonflies, and other insects that consume mosquito larvae naturally limit mosquito populations by preserving nontarget creatures.

Mosquito abatement and vector control districts

To implement local mosquito control, publically funded mosquito abatement districts and mosquito vector control districts have been established in numerous locations. It could be a county or any other kind of political division. Residents of Tamil Nadu can visit https://www.nhm.tn.gov.in/en/nhm-programscommunicable-diseases/national-vector-borne-disease-control-programme-nvbdcp to see if they reside in a mosquito abatement district.

Community co-operation

Public agencies will never be able to completely eradicate all mosquitoes on every site, as you may have anticipated from looking at this publication's remarkable list of mosquito habitats. Collaboration within the community is crucial.

RESULTS AND DISCUSSION

Although ponded water might attract mosquitoes, there are easy ways to lessen the number of mosquito breeding sites. For instance, if a reservoir has appropriately graded sides and bottom, minimal emergent vegetation, and fish that consume insects, it won't attract mosquitoes. The least amount of trouble is sometimes provided by a steep-sided pond that is at least three feet (1 metre) deep (to hide weeds that grow on the bottom). Remove any weeds that are growing near the pond's edge to assist prevent larvae from having anywhere to hide. To reduce the area where floodwater mosquitoes can lay their eggs, keep the water level steady. Install float valves on water sources to keep the water level stable. The newly updated guide, Best Practices for Integrated Mosquito Management, from the American Mosquito Control Association demonstrates the five essential strategies for managing mosquitoes using an integrated strategy (Figure 1). Table 1 demonstrates the respondents' understanding of the causes of malaria and dengue in and around Coimbatore's farms and rural areas. Figure 2 illustrates the life cycle of mosquitoes and how various objects, such as leaky irrigation piping, old tyres, birdbaths, tarps that generate puddles, clogged gutters, paint cans, upright-stored boats or wheelbarrows, open garbage cans and lids, and pet food bowls, create regions where mosquitoes can spawn. Examine our property and make any necessary repairs, cleanups, inversions, punctures, or routinely flush out any possible trouble spots. Each of these tiny shelters can support hundreds of biting mosquitoes since they usually have few or no predators. (Figure 3) illustrates how mosquitoes attack exposed human body areas. Table 2 lists the main agricultural activities that have been seen to mosquito breeding on farms.

Mosquitoes in droves can be generated by septic systems. A suitably designed and maintained septic tank or cesspool ought to feature a sufficient soakage pit, lid, vent, and overflow outlet. Verify the standards with your local health agency. Because these waters have few predators,

even relatively minor potholes and road ruts might harbour mosquitoes if water remains in them during warmer months.

The accumulation of rainwater in treeholes, as depicted in Figure 4, might serve as a perfect habitat for the larvae of the western treehole mosquito, which typically develops during the winter and spring months. Dogs should be protected against dog heartworm, a dangerous disease that is carried by this insect. Along with wild trees, aged orchard and landscaping trees can develop treeholes. Rot, burn injuries, or pruning that leaves a depression in the middle of the tree can all result in holes. Cement or another material can be used to plug tree holes. Remember that during the dry months, tree-holes can serve as a habitat for bird nests. To avoid this, remove any debris that plugs the holes and drill drains from the base of the treehole to the outside. If a treehole appears in a valuable or potentially dangerous tree, speak with an arborist. Before the holes fill up or at any point before the mosquitoes pupate and replace them yearly, add methoprene pellets to stop them from growing. The ponds and natural pools that animals drink have the potential to develop into significant mosquito breeding grounds (Figure 5). Hoofprints make puddles where mosquitoes can hide from predators, and animal excrement enriches the water with nutrients that mosquitoes like. If possible, construct a single access area by fencing off ponds along the edge. This prevents the animals from trampling the whole edge, though they may still make ruts if there is too much space between the pond and the fence. Paving the entrance point might help minimize puddles, but make sure the animals have sturdy feet. Mosquito hiding sites are reduced when weeds are controlled. If the fish are not already resentful, it could be required to add insect-eating fish or treat the ponds on a regular basis with a biological larvicide. Mosquitoes can readily establish a home in troughs and other animal watering places (Figure 5). Also show in animal hooves frequently causes the ground surface surrounding the troughs to become uneven, creating hundreds of tiny water pockets. Make permanent corrections by paving the area or installing drainage for this possible mosquito source. A biological larvicide applied to the water or weekly water flushing, provided that the drainage beyond the trough area is adequate, can provide a short-term benefit. Chemical insecticides should never be added to water that livestock may drink. To stop mosquitoes from growing, regularly clean cow troughs and tanks. You could also add mosquito fish to help with control. Tanks or troughs that are not in use should be removed or destroyed.

Dairy lagoons built correctly help reduce mosquito issues. Lagoons should have steep sides and regulated weed growth around the edges, just as separating ponds. An agitating pump or a solids filter can be used to stop the growth of algal mats and loose surface crusts. Wide lagoons with a diameter of more than 100 feet (30 meters) may be subject to wind activity, which offers some natural crusting control, depending on the topography. Use narrower lagoons so that pesticide sprays can reach the entire surface if this doesn't happen. For each non-irrigation day, the storage volume per cow should be 15 cubic feet (0.42 cubic meters). Overflow is avoided during the wet season with this volume. Regularly draining the water for irrigation can help reduce mosquito populations, but excessive irrigation can spread the mosquito problem into the fields. To reduce weed development along edges, replenish lagoons and maintain them at a constant level following irrigation, if at all possible. To avoid flooding, lagoons should only be kept shallow very close to the start of the rainy season. Lastly, construct a decent access road around the lagoon so that it may be maintained, weeded, and occasionally treated with mosquito larvicide, if needed. Employees specializing in mosquito abatement are legally authorized to examine and treat properties that harbor mosquitoes. One way to prevent the spread of livestock infections among dairy farms is to have truck and boot disinfection stations close to the facility entrance. If it's feasible, you could want to construct an access road that bypasses the animal pens and leads to the holding and separation ponds. Make that the professionals working for your local National Vector-Born Disease Control Program (NVBDCP) adopt the necessary safety measures. Small top-feeding minnows called mosquito fish (*Gambusia affinis*) are frequently employed in mosquito control efforts. Tamil Nadu is not home to the mosquito fish, but it has spread to numerous waterways as a result of introductions made to suppress mosquito populations or escapes. While introducing fish into Tamil Nadu's natural waters is prohibited for private individuals, mosquito fish are acceptable in tanks, containers, and man-made ponds. During floods, avoid stockpiling locations that may be connected to natural waters. The mosquito fish works best in waters with minimal vegetation growth since in such settings, they could endanger other predators more than mosquitoes. Because many invertebrates and other animals in vernal pools lack fish defenses, mosquitofish are inappropriate in these environments. If you believe your scenario qualifies for mosquito fishing, get in touch with your local National Vector-Born Disease Control Program (NVBDCP).

The *Bacillus thuringiensis israelensis* (Bti) bacterium is one often utilized biological control. The mosquito's digestive system triggers the toxin that this bacterium produces. Mosquitoes and a few other flies, such as blackflies and certain midges, are poisoned by Bti. It is produced as a concentrated form of non-infectious bacteria. Floating briquettes for mosquito control in small bodies of water, granules that may sift through vegetation and a sprayable liquid are some of the formulations available. For a few days (liquid or granules) or up to three weeks (floats), Bti kills mosquitoes. Garden retailers frequently carry it. Bti's ineffectiveness against mosquito pupae or larvae close to pupation stems from the fact that pupating mosquitoes do not eat and might not consume a deadly amount. Mosquitoes are also poisoned by *Bacillus sphaericus* (Bs), another bacterium. Bs is marketed as a living organism that can infect mosquitoes. This bacterium affects various Anopheles, Ochlerotatus, and Psorophora species of mosquitoes, but it is particularly efficient against those of the genus Culex. To use it effectively, you must identify the

species of mosquito present as it is ineffective against many species. Bs is ineffective against mosquito pupae but harmless for nontarget organisms. Using a certain amount can kill mosquitoes for up to several weeks. While copepods, which are freshwater crustaceans and some nematodes are also good mosquito repellents, they are not economically produced in large quantities. When it comes to repelling mosquitoes, chemical controls usually work quite well. However, mosquitoes may become resistant to the poisons if they are applied across a wide region and against numerous generations of mosquitoes. This occurs as a result of certain mosquitoes carrying genes that reduce their sensitivity to the poison. After surviving the treatment, these mosquitoes eventually develop resistance, making it impossible to restrict their number with the same poison. Because mosquitoes with resistant genes are less likely to survive different treatments in different years, rotating the classes of chemicals used to control mosquitoes prevents resistant populations from growing. Since chemical control is a potent defense against major mosquito-borne diseases like malaria and West Nile fever, it is imperative to stop the evolution of resistant insects.

Figure 1. Get to know the five core tactics to manage mosquitoes using an integrated approach in the American Mosquito Control Association's newly updated guide, *Best Practices for Integrated Mosquito Management*. (Image courtesy of American Mosquito Control Association, 2021).

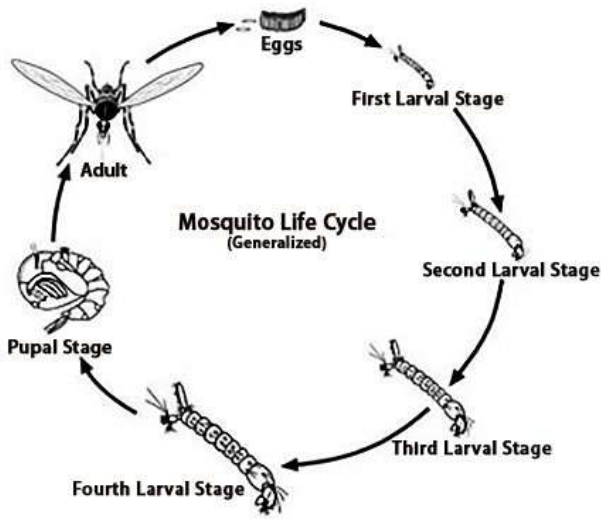

Figure 2. Life cycle of mosquitoes.

Certain chemical chemicals mimic naturally occurring molecules that control insect development, keeping mosquitoes from reaching adulthood. One often used insect growth regulator is methoprene. One batch of mosquitoes can be killed by applying it as a liquid, or it can be used to kill mosquitoes for several months or thirty days by applying it as briquettes or pellets. Methoprene kills mosquito larvae as they start to change into adults, not when they die instantly. At the rates used to control mosquitoes, it is safe for other kinds of life, while it may impact certain other insects, like larvae of midges, and maybe some crustaceans. The benefit of insect growth regulators is that they delay killing insects, allowing them to remain viable as prey further up the food chain. Methoprene, like biological controls, is ineffective against mosquitoes that are pupating. Because the pellet and briquette forms of methoprene last so long, there is a risk that mosquitoes will develop resistance to them. They ought to be applied sparingly or in combination with other forms of control.

Figure 3. Mosquitoes bite present.

Figure 4.Treeholes like this one may provide habitat mosquitoes.

Figure 5. A mosquitoe (circled) emerges from a water filled hoof print caused by putting livestock on wetland.

Table 3. Shows that Demographic and socio-economic characteristics of respondents. Aedes mosquitoes spread the viral disease dengue fever (DF), which is prone to outbreaks. Fever, headache, rash, nausea, vomiting, and aches in the muscles and joints are the hallmarks of DF. Dengue Hemorrhagic Fever is caused by certain infections (DHF).The four dengue viruses, DEN 1, 2, 3, and 4, which are closely related antigenically, are the cause of DF and DHF. Lifelong immunity to one serotype of the virus is provided by infection, but not to the others. The primary vector species of DF/DHF in India is *Aedes aegypti* (Ae aegypti). It is widespread in most urban areas due to poor water management, the presence of non-biodegradable tires and durable plastic containers, the growth of urban agglomerations, and frequently the incapacity of the local community to address the need to eradicate mosquito breeding sites. The main habitats are often above-ground storage tanks and ground water storage tanks. Near homes, factories, and construction sites are man-made water containers where Aedes aegypti grows nearly exclusively. Though they are uncommon, natural larval habitats include coconut shells, leaf axles, and tree holes. The amount of rainfall and humidity affect the *Ae aegypti* population. There is a higher chance of virus transmission during the wet season since survival is longer. Aedes's rural spread is a relatively recent development linked to an increase in breeding locations. Thirty Sentinel Surveillance Hospitals (Medical College Hospitals, Zonal Entomological Teams, Institute of Vector Control and Zoonoses, Hosur, District Headquarters Hospitals, Cuddalore, and Ramanathapuram) and one Apex laboratory (King Institute of Preventive Medicine and Research, Guindy) have been identified by the Government of India for the diagnosis of Dengue and Chikungunya in Tamil Nadu. To control Aedes mosquitoes that spread dengue fever, the Public Health department regularly implements anti-larval measures by reducing the source of vector breeding places, such as artificial containers like broken utensils, discarded tyres, plastic waste cups, and broken bottles. This is done in coordination with local bodies and other departments. In 2017, the State recorded 23294 instances; by 2018, that number had dropped to 4486 cases. In addition to traditional therapy, Indian medicines including papaya juice extract, Nilavembu, and Malaivembukudineer are used to treat dengue. The sickness is currently under control and surveillance is conducted every day.

Table 1. Respondents knowledge of the cause of Dengue and Malaria in Coimbatore in and around farms and rural area.

S. No	Cause of Dengue and Malaria	Rural community(N=199) Frequency (%)	Farm community(N=204) Frequency (%)	Total (%) Frequency (%)
1.	Consumption of contaminated Food/water	146 (41.2)	83(28.1)	229(34.65)
2.	Staying long in the sun	52 (14.8)	82(27.9)	134(21.35)
3.	Dirty surroundings	53 (14.2)	37(12.8)	90(13.5)
4.	*Mosquito bite	40 (10.2)	41(13.9)	81(12.05)
5.	Stress	41(11.4)	26(8.9)	67(10.15)
6.	Rainy/cold weather	14(3.7)	18(6.2)	32(4.95)
7.	Body pains and headache	7(2.1)	3(1.0)	10(1.55)

*Mosquito bite (most appropriate answer)

Table 2. Observed major agricultural practices that favour mosquito breeding on the farms.

S.No	Observations	Rural community(N=20) Frequency (%)	Farm community(N=20) Frequency (%)	Total (%) (N=20) Frequency (%)
1.	Farm environment	9(45.0)	11(55.0)	20(50.0)
2.	Plastic containers	10(50.0)	10(50.0)	20(50.0)
3.	Presence of dug trenches	6(30.0)	6(30.0)	12(30.0)
4.	Practice of irrigation	5(25.0)	5(25.0)	10(25.0)
5.	Presence of fish pond used for fish farming	3(15.0)	3(15.0)	6(15.0)

**Only observed practices which promote mosquito breeding are displayed

Table 3. Demographic and socio-economic characteristics of respondents.

S.No	Variables	Rural community (%)	Farm community (%)	Total (%)
1.	Male	121(60.3)	119(57.8)	240(59.5)
2.	Female	76(37.7)	83(40.2)	159(38.95)
3.	Never attended school	38(18.6)	60(28.9)	98(23.75)

4.	Primary school	41(20.1)	31(14.7)	72(17.4)
5.	Secondary school	104(51.8)	97(57.0)	201(54.4)
6.	Higher education	12(5.5)	12(5.4)	24(5.45)
7.	Crop farming	127(60.2)	68(31.4)	195(45.8)
8.	Mixed agriculture	5(1.9)	41(17.5)	46(9.7)
9.	Livestock farming	14(6.2)	23(9.6)	37(7.9)

*Multiple answers allowed

Creating an area master drainage plan is one of the most crucial steps in cooperative mosquito control efforts. The master plan should be integrated into any new building, including land leveling, roads, canals, housing complexes, and industrial developments that generate effluent or consume water. Even while this could seem challenging in towns that are expanding quickly, a little planning and collaboration at the start of projects can save a lot of trouble down the road. Should you learn of a fresh project. It is now imperative to adopt environmentally responsible steps to repair the environment in order to prevent future long-term effects. Communities must so be informed about climate change and made aware of it. Permaculture must be practiced by communities, and biochemicals and natural pesticides must be used on the soil. concentrated on the following six elements to combat climate change: 1) Building & Cities 2) Energy 3) Reduced carbon Industrial processes and effective greenhouse gas use 4) Food and agriculture 5) Land use and forests with an emphasis on ecosystem restoration; and 6) Transportation with no emissions. In addition to constructing lower-carbon buildings and integrated green spaces, citizens and the government must make sure that planned developments take into account population density and urban services. They must also take advantage of government incentives aimed at reducing carbon emissions. In light of these concerns, World Vision Bangladesh is promoting the "City-Wide Self-Sustaining Model" and "Eco Friendly Village Development Approach," two urban development strategies that seek to maintain the globe in terms of social and cultural sustainability as well as environmental, economic, and hygienic sustainability. World Vision is pushing the community to embrace environmentally friendly practices like planting trees, building eco-friendly stoves, practicing permaculture, using compost and biopesticides, encouraging the use of hygienic latrines and the purest sources of drinking water, educating the public about eco-friendly practices, building school toilets, implementing an appropriate waste management program with partners, etc. Without sacrificing its fundamental principles of being locally owned through participatory processes, the Eco-Friendly Village model might be greatly expanded (Manuel hasda, 2021).For the National Vector-Born Disease Control Program (NVBDCP) to ensure a complete risk management approach to development at local, national, and international levels of government, policy makers, experts, and practitioners must effectively communicate and work with one another. In order to better the Godly world and nature, raise community awareness, advocate for causes, and award grants in partnership with GO, NGOs, Private Entrepreneurs, Civil Society, Teachers, Religious Leaders, Children, Youth, Students, and Other Community Members. Global leaders, development partners, donors, governments, and investors must commit more funds, time, and knowledge to restore our beautiful and environmentally friendly planet for our countries and for future generations, which translates to "Children for Environment." Lockdown, the expertise and experience of data enumerators, etc. are important. It's a new area of study for us as well. It would be better if we all took simple, quick action. It is entirely possible to restore our natural surroundings and our natural state by cooperating with one another, making wise resource investments, demonstrating readiness to engage with development partners, and adhering to the principles of the Eco-Friendly Development Approach. By 2030, all cities and human settlements should be inclusive, safe, resilient, and sustainable, with a safe environment, perhaps thanks to these activities.

CONCLUSION

The use of environmentally friendly mosquito control methods has grown in popularity as environmental consciousness keeps rising. By lowering the ecological imprint and lowering the mosquito population, these techniques protect the environment and human health. This article examines the range of environmentally friendly mosquito control options available, emphasizing their advantages and useful uses for people looking for long-term pest management solutions. Eco-friendly solutions protect birds, aquatic life, beneficial insects, and biodiversity by eschewing harsh chemicals. Numerous environmentally friendly options, like biological control agents, regulate mosquito populations over time and minimize the need for repeated applications.

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Best Practices for Integrated Mosquito Management. (Image courtesy of American Mosquito Control Association, 2021).

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