Impact of Bacillus thuringiensis var. israelensis (VCRC B17) for Mosquito Larvae Control

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Abstract

Bacillus Thuringiensis var. Israelensis [BTI] (VCRC B17), is a strain of the bacterium widely recognized for its larvicidal activity against mosquito larvae. It is a suitable means of controlling mosquito vectors and holds a significant contribution to vector control programs. This short research communication summarizes key findings related to environmental safety and people's perceptions of BTI, VCRC B17 in controlling mosquito populations.

Keywords: Bacillus thuringiensis var. israelensis; Biopesticide; Environmental safety; Larvicidal efficacy; Mosquito control; VCRC B17

Introduction: Mosquito-borne diseases, such as malaria and dengue fever, pose significant public health challenges globally (Du *et al.*, 2021). The use of chemical insecticides for mosquito control has raised environmental and health concerns (Saré *et al.*, 2018). In this context, biological control agents like Bacillus thuringiensis var. israelensis [BTI] (VCRC B17) have emerged as a viable alternative due to their specificity and reduced environmental impact(Geetha, Regnakumari and Manonmani, 2017). A water-dispersible powder formulation of BTI was developed using fly ash as a carrier material. The most effective formulation contained bacterial biomass, fly ash, and carboxymethyl cellulose. It showed high efficacy against the larvae of major mosquito vector species, including Culex quinquefasciatus, Aedes aegypti, and Anopheles stephensi (Tamilselvan, Manonmani and Jambulingam, 2017). The formulation was also found to be safe for non-target organisms associated with mosquito larvae and mammalian systems (ICMR, 2021). The study suggests that FA can be a suitable replacement for commercially available carrier materials in biopesticidal formulations (Nartey et al., 2013). Understanding public perception is crucial for the successful implementation of environmentally friendly mosquito control strategies. This literature and survey-based research communication explores the perception of the population regarding the impact of BTI (VCRC B17) as a biopesticide for mosquito larvae control.

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Methodology

A comprehensive survey, designed to assess public perceptions influenced by a programmed intervention, was conducted across a varied participant pool and diverse geographical locations within the urban slum areas of Kageshwori Manohara Municipality, specifically focusing on Ward Number 5 and 9. The survey encompassed inquiries pertaining to awareness, acceptance, and concerns regarding the utilization of VCRC B17 for mosquito larvae control. Additionally, an in-depth literature review was conducted to explore the implications of BTI (VCRC B17) across various countries. It also reviewed the government's guidelines, bills, policy, declaration, notice and the circular.

Results

In 2023 AD, Nepal launched a Bio larvicides [BTI] (VCRC B17) program for mosquito control. The initiative commenced in the Kathmandu metropolitan city, with Mayor Balen Sah sharing details on his official Facebook page. Subsequently, numerous districts, municipalities, and wards underwent the spraying process. The Public Health Research Society Nepal, in collaboration with ward and police offices and with technical support from the In-Country Micro-Projects Scheme, Irish Aid, extended the initiative to urban slum areas of Kageshwori Manohara Municipality, specifically targeting Ward Numbers 5 and 9.

Awareness and Knowledge: Most respondents displayed limited awareness of BTI, VCRC B17, indicating a need for increased public education on biopesticides and their role in vector control. A significant proportion of participants expressed willingness to support environmentally friendly alternatives such as VCRC B17 for mosquito control. Positive attitudes were linked to concerns about the environmental and health impacts of chemical insecticides. The findings indicate that in Nepal, particularly during the rainy season, it will be essential to conduct weekly larviciding using commercially available microbial agents, specifically Bti. This is due to the relatively low cost of Bti and the unlikely development of resistance. The research reveals that extremely low dosages of 0.2 kg/ha and 0.4 kg/ha effectively suppress both mosquito larvae and pupae, aligning with the consistent results obtained.

Concerns: While many participants welcomed the idea of using VCRC B17, some expressed concerns about its long-term effects on ecosystems, potential unintended consequences, and perceived lack of information on its safety. Gandaki province in Nepal announced on November 1, 2023, that they aim to eradicate mosquitoes within the next three years. The declaration received unanimous support from various stakeholders in the health sector. Trust in government agencies and regulatory bodies played a key role in shaping public perceptions. Participants who had confidence in regulatory oversight were more likely to endorse the use of VCRC B17.

Efficacy Against Mosquito Larvae: VCRC B17 demonstrated high efficacy in controlling mosquito larvae across different life stages. Larvicidal activity was observed against Aedes, Anopheles, and Culex species. VCRC B17 exhibited a high degree of specificity, targeting mosquito larvae without adversely affecting non-target organisms, including beneficial insects and aquatic fauna.

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Conclusions

Public perception of Bacillus thuringiensis var. israelensis (VCRC B17) for mosquito larvae control generally leans towards the positive, reflecting a willingness to embrace environmentally friendly alternatives. However, addressing concerns related to potential long-term environmental impacts is paramount, and transparent information dissemination is crucial for building public trust and acceptance. Engaging in efforts to increase awareness and involving the public in decision-making processes can significantly contribute to the successful integration of VCRC B17 in mosquito control programs. Bacillus thuringiensis var. israelensis (VCRC B17) emerges as a promising biopesticide for controlling mosquito larvae, demonstrating notable efficacy and environmental safety. Its specificity, persistence, and minimal impact on non-target organisms render it an asset in integrated mosquito management strategies. To maximize its impact in vector control programs, further research is needed on application methods, dosage optimization, and community-level interventions.

Recommendations

Applying the VCRC B17 biopesticide which is regarded for its environmental safety, efficacy, and affordability is essential to improving public health by reducing mosquito populations, which is a crucial step given Nepal's vulnerability to illnesses spread by mosquitoes.

Conflict of interest: There is no conflict of interest among the authors in the publication of this article.

Ethical issues: This study does not involve ethical issues.

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