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Case Study

Identifying New Common Mosquito Breeding Sites in Flood-Affected Areas of Shahdara South Zone of MCD and Adopted Strategies for Preventing and Controlling Dengue Malaria Cases in the Year 2023

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A B S T R A C T

Flooding significantly alters ecosystems, creating new potential habitats for mosquitoes. These changes can increase the risk of vector-borne diseases such as malaria, dengue, and chikungunya. This paper discusses a case study of a Yamuna flood-affected area in Delhi to identify new common mosquito breeding sites and adopted strategies for the prevention and control of vector-borne diseases. We have examined the post-flooding environmental changes, the types of new breeding sites, and proposed methods for the identification and control of these sites to mitigate the associated health risks.

Keywords: Dengue, Post-Flood Disease, Vector, Drone, Integrated Vector Control

Introduction

Floods disrupt ecosystems and human habitats, often leading to standing water that serves as ideal mosquito breeding sites. Mosquitoes are vectors for many diseases, making it crucial to identify and manage these new breeding sites promptly. Among all kinds of disasters, flood is the most important type of natural disaster. Earlier floods in Yamuna River in 2010 brought huge devastation causing heavy damage to life and property.[1] The same situation of flood repeated mid of July in the year 2023 resulting in the shifting of approximately 1.5 lac populations from their temporary houses along the riverine belts in relief camps. Long-term water stagnation in these places particularly water collection in many pits after the receding of water led to the creation of a large number of potential sites for mosquito breeding. This case discussion aims to analyse the environmental impact of flooding on mosquito breeding habitats, identify new common breeding sites, and suggest strategies for monitoring and control.[2]

Case Study Area

Around 481 big relief camps were established under jurisdiction in one of the zones of MCD Shahdara South

at 6 different locations by the Government of Delhi on a temporary basis along the riverine belt of Yamuna River to accommodate the shifted population. Besides this, 32669 temporary camps were also established by citizens themselves on roads and below flyovers. All these temporary camps fall under the jurisdiction of 9 wards of Shahdara South namely Patparganj, Pandav Nagar, Lalita Park, Shakarpur, Geeta Colony, Krishna Nagar, Gandhi Nagar, Mayor Vihar, and Shastri Park. Further, these 9 wards out of 35 existing wards of the Shahdara South zone are located near the Yamuna riverine belt hence there was a high chance of spreading vector-borne diseases. Flood causes significant exacerbation of the spread of vector-borne diseases like dengue, malaria, and chikungunya due to increased breeding sites for mosquitoes that may grab the population of these 9 wards and those who reside in these relief camps. This study focused on these 9 wards and 6 camps sites.

Methodology

A dedicated Rapid Response Team with dedicated staff was deployed for focused supervision of anti-mosquitoes measures and related activities in the localities of all 9 flood affected wards and sites of temporary camps to contain mosquito menace by way of detection and destruction of breeding, anti-larval spray and anti-adult measures from mid of July to September 2023.

A Rapid Response Team comprising of two staff called Domestic Breeding Checker and field workers along with 1 supervisor called the malaria inspector under the guidance of an entomologist had identified the potential sites of mosquito breeding and its species for further necessary containment strategies/ plan.

Six dedicated teams, consisting of 2 breeding checkers and 1 field worker equipped with a manual knapsack sprayer, were diverted to all 6 different locations where temporary camps were established by the citizens or the government of Delhi for identification of mosquito breeding and destruction and for anti-larval spray and anti-adult measures.

One power spray tanker having a capacity of 3000 L was also deployed dedicated to all major drains located near the camps for ensuring anti-larval spray.

One drone having a tank capacity of 10 L was also outsourced for 1 week. To ensure anti-larval spray i.e., liquid Abate near the camp site in unapproachable water bodies and pockets with water stagnation for a long period. Said drone having 4 nozzles was utilised for 3 rounds of spray each day for 10 minutes in each round from the flight height of 3 to 4 meters from the ground. Considering the battery limitation that can be used for a maximum of 15 minutes only in one round and the engagement of additional manpower for carrying said drone, this has been discontinued.

Findings

Enhanced Vector Surveillance and Monitoring

- Total Days of Larval Surveillance by Dedicated Rapid Response Team in 9 Flood-Affected Areas and 6 Campsites during the Span of July 13, 2023 to September 31, 2023 = 34 Days
- Total Number of Places Checked during 34 Days of Surveillance = 245
- Total Number of Water-Filled Containers Found = 2616
- Total Number of Containers Found Positive = 995
- CI = 38.03%

Regular monitoring of mosquito populations through larval mosquito surveys helped in assessing the potential source and types of mosquitoes prevalent in flooded areas. The most common potential sites where breeding was detected are:

1. Temporary collection of water in green belt at the base of sapling and tree holes
2. Temporary collection of water in dents of canvas used for tents
3. Small containers used for storage of water
4. Temporary pockets of water after the receding of flood water
5. Discarded water bottles and food packets after food distribution
6. Floating plastic garbage at the edge of water bodies
7. Edges of water bodies
8. Temporary puddles in low-lying areas
9. Potholes and road depressions
10. Waterlogged gardens and parks

During the survey mixed breeding of *Anopheles* and *Aedes* mosquitoes were found in 13 different places out of 245.

Strengthening of Vector Control Measures by Adopting Newer Technology besides Conventional Methods

Larval Source Management

Efforts were intensified to eliminate mosquito breeding sites by adopting the following strategies:

- **Source reduction:** 6 dedicated teams comprised of two domestic breeding checkers cross-checked in and around areas of camps on a daily basis for identification and destruction of mosquitoes breeding in containers and potential sites suggested by the Rapid Response Team.

Common containers were found positive during entomological checking in flood-affected areas in the Shahdara South Zone indicating maximum breeding in scrap in open and water collections (Figure 1).

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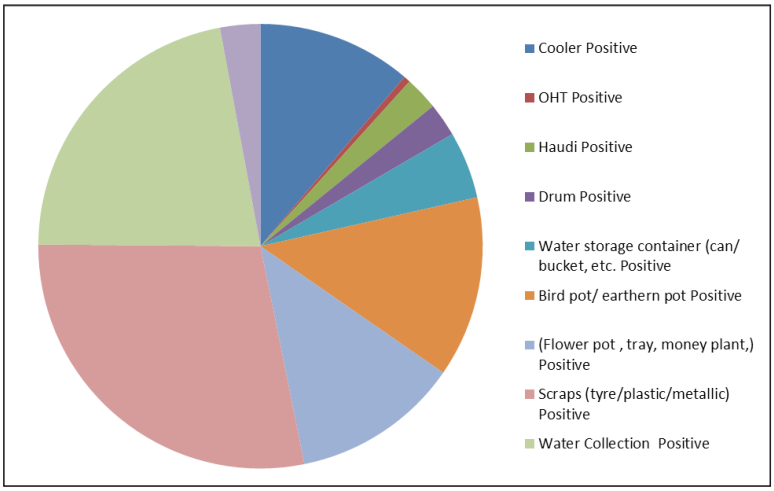

Figure 1.Breeding Positive Containers

- **Spraying of larvicides:** 6 dedicated teams were formed comprising field workers to ensure the spraying of anti-larval insecticides in all identified small approachable water collections and drains through the Knapsack sprayer pump. Approachable bigger water bodies and drains were covered through a power sprayer tanker to ensure anti-larval spray on a fortnightly basis.
- **Adoption of newer technology:** One drone having a tank capacity of 10 L was also outsourced for 3 to 4 days to ensure anti-larval spray i.e., liquid Abate near the campsite in unapproachable water bodies and pockets with water stagnation for a long period. Said drone having 4 nozzles was utilised for 3 rounds of spray each day for 10 minutes in each round from the flight height of 3 to 4 meters from the ground. Considering the battery limitation that can be used for a maximum of 15 minutes only in one round and the engagement of additional manpower for carrying the said drone, this was discontinued.

Anti-Adult Mosquito Measures

Fogging using hand-held fogging machines and spraying of insecticides were carried out in affected areas to reduce the adult mosquito population. This was done particularly in the early morning and evening when mosquitoes were most active (Table 1).

Table 1.Anti mosquitoe measures taken at camp sites during period of flood

Ward No.	Ward Name	Total No. of Relief Cam Site (Approx.)	Total No. of Family affected	Total No. of Camps (Approx.)	Total No. of Population (Approx.)	Total No. of Camps Covered by IRS	Total No. of Houses Checked By DBC	Total No. of Breeding Found	Total No. of Breeding Destroyed
197	Patparganj	283	28250	19279	78450	617	1947	643	643
200	Pandav Nagar	60	632	800	3590	76	627	9	9
201	Lalita Park	35	90	36	110	2	41	1	1
202	Shakarpur	45	8191	7504	42650	655	1624	0	0
210	Geeta Colony	0	0	0	0	0	156	16	4
211	Krishna Nagar	0	0	0	0	0	1098	35	29
212	Gandhi Nagar	21	504	397	2447	30	630	4	6
213	Shastri Park	37	2157	4653	13968	364	1392	74	49
Total		481	39824	32669	141215	1744	7515	782	741

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Public Awareness

All 6 dedicated teams for 6 campsites were provided with a megaphone for the purpose of educating residents residing in camps about preventive measures, and symptoms of vector-borne diseases.

Intersectoral Coordination

- **Health Camps:** Temporary health camps and mobile clinics were set up in flood-affected areas to provide immediate medical care and facilitate early diagnosis and treatment of vector-borne diseases by the local health facilities run by the Delhi government.
- **Collaboration with Other Agencies:** Coordination with sanitation departments and non-governmental organisations helped in implementing integrated vector management strategies.

Impact of Strategies and Limitations

Reduction in Disease Transmission

The combined efforts in surveillance, vector control, and public awareness led to a significant reduction in the transmission of vector-borne diseases in the flood-affected areas (Table 2).

Limitations

The challenge was not confined to the flood-affected regions alone. Even in areas unaffected by floods, the habit of storing water in and around households provides ample opportunities for mosquitoes to breed.

The complexity of the issue was further compounded by the potential co-existence of multiple mosquito vectors in the same breeding sources. Residents of campsites were vulnerable to both diseases due to the mixed breeding of both dengue-carrying *Aedes* mosquitoes and malaria-carrying *Anopheles stephensi* mosquitoes responsible for malaria transmission.

Diversion of staff to the flood-affected area resulted in compromised anti-mosquito measures in non-flood-affected areas (Table 3).

Table 2.Year-wise Distribution of the Cases of Dengue in Different Wards

S. No	Ward No.	Dengue Year 2020		Dengue Year 2021		Dengue Year 2022		Dengue Year 2023	
		Reported	Confirm	Reported	Confirm	Reported	Confirm	Reported	Confirm
1.	197	3	2	27	10	49	7	49	10
2.	200	8	5	111	23	111	11	85	25
3.	201	1	0	31	13	46	10	63	3
4.	202	5	1	77	17	90	7	54	12
5.	210	2	1	69	14	46	1	38	6
6.	211	4	4	83	9	50	1	67	10
7.	212	3	0	128	24	75	8	27	7
8.	213	6	1	119	19	108	2	77	14

Table 3.Distribution of Dengue Cases According to Seasons

S. No.	Months	Year 2022		Year 2023	
		Reported Dengue Cases	Reported Malaria Cases	Reported Dengue Cases	Reported Malaria Cases
1	Pre-monsoon season (January to June)	68	2	64	7
2	Monsoon season (July to September)	202	4	704	33
3	Post-monsoon season (October to December)	1322	2	893	1

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Conclusion

Floods create numerous new mosquito breeding sites, posing a significant public health risk. Identifying and managing these sites through community engagement, environmental management, and technological intervention is crucial. This case discussion highlights the importance of a multi-faceted approach to effectively prevent and control mosquitoes in flood-affected areas and mitigate the spread of vector-borne diseases.

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