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AEDES AEGYPTI ABUNDANCE IN AN INDUSTRIAL TOWN OF ASSAM AND KNOWLEDGE ATTITUDE AND PRACTICE OF RESIDENTS TOWARDS DENGUE VECTOR CONTROL

Medical Science

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ABSTRACT

Background: Industrial town's offer conducive environment for Aedes mosquito breeding and are vulnerable for dengue but limited data is available. **Objectives:** Aedes mosquitos' abundance in industrial ecosystem and Knowledge Attitude and Practice (KAP) of the resident about dengue, and vectors were assessed. **Material and Methods:** Thirty-cluster sampling design was adopted to search potential Aedes breeding sites. KAP about dengue and vector of 498 selected adults were assessed. **Results:** Container index (C.I.) was 38.9-66.6% in post-monsoon period followed by pre-Monsoon period 8.3-66.8%. Plastic-containers showed highest C.I. (58.4%), followed by earthen-wares 44.7, unused tyres 31.8%. Earthen-containers used for betel-nut fermentation had 81.5% C.I. None knew about Retro-orbital pain, rash and bleeding during dengue. Many (77.2%) knew, mosquito as vector, but only (60%) knew about breeding places and 43.6% day-biting behavior. Most (85%) use mosquito-net at night but 85.2% do not protect from day biting. **Conclusion:** Abundance of Aedes breeding places in industrial town and lack adequate knowledge of vector behavior increases vulnerability.

KEYWORDS

Dengue vector, Industrial town, Assam, Aedes abundance, KAP

INTRODUCTION

About 50-100 million dengue cases occur every year and 75% are at risk in the Asia-Pacific region (WHO**). [1]** National Vector borne disease control programme (NVBDCP), India, reported 157315 cases and 166 death due to dengue in India during 2019.

Most of the states of Northeastern region of India, outbreaks and sporadic cases have been reported frequently **[2,3,4,5,6]** and all these states showed abundance of *Ae. aegypti* and *Ae. Albopictus,* in different ecological settings (urban, industrial, semi urban and rural).

Industrial environments create lots of solid wastes, conducive of Aedes breeding and experiences lots of workforce movement. Labor intensity in Indian industries is higher than in the developed countries. Therefore, these towns remain endemic and have increased potential for dengue out-breaks. It is estimated that >70% of the work-force in major industries of India and Brazil would be at risk for dengue by 2030. Dengue effect in industries of USA, Japan, and Germany will also be felt through the supply chain **[7]**

Environment and solid waste disposal make the ecosystem conducive for breeding of Aedes mosquitoes in small water collection**. [8]** Climatic condition of Assam and topography is conducive for mosquito breeding. Assam has several industrial township, but till date limited data is available about Dengue vector abundance. Adaptability of *Ae. aegypti* to urban environment of industrial town and *Ae. albopictus in* semi-urban and rural environment surrounding the industrial town make them more vulnerable for diseases. **[9]** In absence of specific treatment or vaccine, prevention by vector control is the mainstay. Thus studies on Aedes mosquitoes in industrial ecosystem are becoming an essential and urgent task. Further, Knowledge Attitude and Practice (KAP) of the resident play greater role in controlling this day biting and container breeding mosquitoes.

MATERIAL AND METHODS

Study site: Duliajan a major industrial town, was purposively selected for the present study. Employees associated with Crude oil exploration and transport with production of liquefied petroleum gas are the main inhabitants of the town. Along with Oil India Ltd, another industry, the Assam Gas Company, engaged in transport of natural gas is also located in Duliajan. It is also the abode to many people (non-employee) along with their families associated with trade and business.

Sampling Design

Thirty-cluster sampling design was adopted for the study. Sanitary officer of both the organizations, doctors, teachers and local leaders were consulted about the demography, dengue situation, solid waste disposal system, and sanitation of town, before start of the study.

Collection Of Sample And Identification:

Presence of containers in and around the household and road-side dump of solid waste were searched for presence mosquito larvae/pupae. About 20% of all types of containers were sampled repeatedly in three seasons viz; Pre-monsoon (February to May), Monsoon (June to September) and Post Monsoon (October to January). All the collected larvae/pupae were shifted to the laboratory quickly and linked reared inside cages in plastic containers till emergence of adults for identification and calculating container index (CI). Emergence up to 20 days were recorded and non-emerged or dead larvae were discarded after 20 days. Emerged mosquitoes were identified, using standard keys and related publications of mosquito nomenclature. **[10]**

Data collection for Knowledge Attitude and practice

Two adults (preferably male and female) from identified household were interviewed for symptoms of dengue, transmission and vector, vector bionomics, participants' attitude towards dengue, personal protection and the mosquito control, using a predesigned and pretested questionnaire. A total of 500 individuals were targeted.

Larval density of Aedes mosquitoes *(Ae aegypti and Ae. albopictus)* were calculated separately. Similar containers were grouped together for describing container type and density.

b) Density of adult dengue vector: Adult density was studied from resting habits of the vector mosquitoes in different seasons using drop nets outdoors and aspirators from indoor at dusk.

RESULTS:

The township has six different patterns of colonies—Bungalow for officers, quarters for employees, settlement plots, and utility services. Houses of non-employees, and some utility establishments were also included. More than 40 different types of containers were recorded with potential to accumulate water during rain. Nine types of container like indoor plants, flower tub, Iron tins or earthen pot used for fermentation, air conditioners and water storage devises**. (Fig-1)**

Fig-1: Showing some of the potential dengue breeding places within the household and in the campus.

1a: Decorative green plants kept in the Living room; 1b: Artificial decorated pond created within the premise to grow aquatic plant; 1c: Discarded earthen pot used for fermenting betel nut; 1d: Discarded plastic cups; 1e: Decorated tin pots used for growing plants; 1f: Discarded plastic containers.

Plastic containers, disposable cups, unused drums, earthen pots, broken enamel or iron containers, leaf axils, iron goods, buckets, small water pool etc. were prominent outdoors**.** Bamboo stump or iron pipes used for fencing were also included**.** Besides these, unused vehicle tyres and empty battery boxes, coconut shells, broken utensils in roadside, near small vendors or vehicle repairing shops were observed. **(Fig-2)**

Fig-2: Showing some of the potential mosquito breeding sites in roadside and near small vendors

2a: Discarded tyres near motor vehicle repairing shop; 2b: Broken iron goods act as small water holding places; 2c: Cut bamboo stump used as fencing material; 2d: Discarded plastic packet in the market place

During Post Monsoon out of 28 types 13 with mosquito larvae had container index between 38.9 to 66.6 %. Similarly in Pre-Monsoon C.I. was 8.3-66.8%. Cumulative C.I. of plastic goods was highest 58.4% (23.1-87.1%), followed by earthen wares 44.7%, unused tyres 31.8%, Bamboo stumps 25.3%. But interestingly containers used for fermenting betel-nut had C.I. of 81.5%. (**Table-1)**

Highest density in indoor resting mosquitoes was recorded in December and lowest density in January. However, all mosquitoes belonged to other genus except few *Ae. vexans vexans*. Collection by drop net in the bushes showed highest densities of mosquitoes in December and lowest being in July.

Interviewed persons (n=498) were in the age of 18-76 years and 59.2% of them were male. Only 4.3% were illiterate among the participants and 26.5% were graduate and 16.6% were with professional qualifications. Half of the participants were currently employed or retired. About 10% of the participants were daily wage earner. While 2.7% had cattle in their house, about 1/3rd had pets in their house.

Most of the participants (72.3%) knew, fever is the main symptom of dengue, headache (20.9%) and body ache (25.3%). However, none is aware of pain in eye **(**Retro-orbital pain), rash and bleeding. Most of the people (82.3%) take dengue as a serious disease but 47.3% of them think that their family members are not at risk**.** Only about 45% people know that dengue is caused by virus. Most of the participant knew that dengue is spread by mosquito (77.2%). However, many opined that it is spread by fly (17.4%), air, water or blood transfusion (3%). **(Table-2)**

Table-2: Knowledge about Dengue and its vector

1. Knowledge about Dengue		
A)	Symptoms of Dengue	Response (Yes)
	Fever	72%
	Head ache	20.90%
	Body ache	25.30%
	Joint pain	18.60%
	Bleeding	0.30%
	Do not know	17.60%
B)	What spread Dengue?	Response
	Mosquito	77.20%
	Fly	17.40%

Table-1 Season wise distribution and density of mosquito larvae in different containers

		Monsoon			Post-Monsoon			Pre-monsoon		
Sl.No	Type of container and location	Number of container sampled	Number of container with larvae	C.I (%)	Number of container sampled	Number of container with larvae	C.I	Number of container sampled	Number of container with larvae	C.I
1	Flower tub	78	12	15.4	3	2	66.6	156	16	10.3
2	Flower vase	4	0	0	4	2	50	10	0	0
3	Indoor plant in container	5	0	0	4	2	50	12	1	8.3
4	Enamel container	14	12	85.7	5	4	80	1	1	100
5	Glass container	5	4	80	4	0	0	4	0	0
6	Earthen pot used for fermenting betelnut	4	4	100	1	1	100	1	0	0
7	Iron tin for fermenting betel nut	1	1	100	2	2	100	1	0	0
8	Water storage drum	8	7	87.5	5	2	40	5	1	20
9	Air conditioner	10	0	0	11	0	0	11	0	0
10	Plastic container	121	117	96.7	57	29	50.9	34	10	29.4
11	Unused drum	7	4	57.1	0	0		1	0	0
12	Gourd Shell	1	1	100	0	0		1	0	0
13	Earthen pot	19	14	73.7	18	7	38.9	35	24	68.6
14	Leaf axil (Banana, Arum, Pine apple)	19	3	15.8	2	1	50	6	3	50
15	Coconut shell	4	1	25	14	0	0	38	0	0
16	Broken iron goods	5	1	20	3	0	0	7	0	0
17	Plastic packet	1	1	100	1	0		0	0	
18	Plastic bottle	1	1	100	19	0	0	3	3	100
19	Disposable cups	32	18	56.3	5	2	40	44	6	13.6
20	Plastic gallons	1	1	100	2	1	50	2	0	0
21	Plastic bucket	1	1	100	2	0		8	2	25
22	Leather good (deflated football)	2	2	100	1	0		0	0	
23	Iron utensil	2	0	0	16	4	25	0	0	
24	Cement tank	2	0	0	4	2	50	8	2	25
25	Thermocol box	2	0	0	1	0	0	1	1	100
26	Betel nut leaf "Dakua"	1	0	0	1	0	0	15	4	26.6
27	Bamboo stump	61	21	34.4	10	0		24	3	12.5
28	Iron stump	40	13	32.5	12	0		77	17	22.1
29	Used discarded Tyres	57	14	24.6	31	14	45.2	0	0	
30	Discarded Battery box	4	2	50	2	1	50	0	0	
31	others (Jholna, shoe,small water pool)	2	1	50	0	0		4	4	100

	Air	1%
	Water	1.30%
	Food	1%
	Person to person	0.70%
	Blood transfusion	3%
	Others	0.70%
	Do not know	6%
C)	What causes dengue?	Response
	Virus	45.60%
	Bad air	12.20%
	Food	6.70%
	Water	13.30%
	Not sure	22.20%
2.	Knowledge about Dengue vector	
A)	When Dengue vector bite?	Response
	Day	43.60%
	Night	24.70%
	Dusk	33.40%
	Dawn	5.20%
B)	Where Dengue vector rest?	
	Indoor objects	20.20%
	Small bushes outside house	38.50%
	Anywhere out-door	25.70%
	Cattle shade	10.00%
	Not sure	4.30%
	Do not know	1.30%
C)	Where Dengue vector breed?	Response
	Small water collection	59.20%
	Large water body	3%
	River	2%
	Soil	6.20%
	Open field	0.20%
	Garbage dump	14.90%
	Animal excreta	7.70%
	Not sure	2%
	Do not know	5.30%

Only 43.6% knew day biting nature of dengue vectors. About 60% of participants had the correct knowledge of vector breeding places. Though 77.7% of them feel that dengue vector can be controlled but 16% feel vector control is the responsibility of Government. Most participants (85%) use mosquito net at night but majority (85.2%) do not protect from day biting mosquito. Indoor mosquito breeding places were common like flower vas (67.2%) and >26% throw solid waste near the household. **(Table-3)**

Table-3: Attitude and practice about dengue vector

1. Attitude towards dengue disease, vector and control			
	Yes	No	Not sure
A) Is dengue a serious disease	82.3	4.6	13.1
B) Is your family is also at risk	20.7	47.2	32.1
C) Dengue patients need treatment	46.6	30.1	23.3
D) Dengue vector can be controlled	77.7	13.5	8.8
E) Treatment for dengue is available	19.2	60.1	20.7
F) Use of repallent	89.3	3.7	7
Dengue vector can be controlled	BY	(%)	
	Personal effort	28	
	Community effort	17.2	
	Government effort	16.6	
	combined effort	38.2	
Where insecticide is sprayed	site	(%)	
	Indoor	5.7	
	Out door	50.5	
	not sure	43.8	

2. Practice towards Dengue disease and vector control			
	Yes	No	occasional
A) Bed net use			
At night	85	12	3
At Day for children	10.1	85.2	4.7
B) Screening of house		83.3	5
C) Insecticide spray	43	44.7	12.3
D) Water storage inside house	27.5	5.4	67.8
E) Cover stored water	26.8	5.4	67.8
F) Keep surrounding clean	82.3	9.7	8
G) Disposing solid waste near house	26.4	61.2	12.4
H) Keep flower pot	67.2	26.8	6
I) Screen windows and doors	11.7	83.8	5
J) Practice personal protection	61.8	34.2	3
Repellent use for personal protection at work	Yes		
Oil	23.50%		
Cream	6.40%		
Repellent use for household			
Smoke	3.70%		
Mosquito coil	46%		
Evaporating chemical	9.40%		
Non specific	6.40%		

DISCUSSION

Present study showed highest density of Aedes larvae, in post Monsoon, perhaps with receding rainfall, containers hold small quantity of water, sufficient for *Aedes* breeding. Relatively lower density during monsoon may be attributed to washing away of the accumulated water during heavy rainfall in Northeast region. Of course, density goes down in winter due to dry spell, making the containers relatively unsuitable for breeding.

Industrial towns are though well kept, by its good sanitation, yet solid waste disposal system and other potential breeding sites leaves the gap for mosquito breeding and mosquito borne diseases.

Studies in Nepal suggested that education and socio-economic status **[11]** play a role in prevalence and control of dengue. Of course in our study area only 4.3% were illiterate and 10% of the participants were daily wage earner.

Most of the participants (72.3%) recognize fever as main presenting symptom. However, body ache and headache were recognized by less than a fourth participants. This finding is similar to studies elsewhere. **[12]** In a multi-country study (India, Indonesia, Myanmar, the Philippines and Thailand), majority (>90%) responded affirmatively, hearing about dengue except for a few in the Philippines **[13]**. However, many participants (including ours), were unaware about cardinal symptoms like pain in eye (Retro-orbital pain), rash and bleeding.

Though most people knew the role of mosquito in spreading dengue in our study, yet knowledge about Aedes mosquito as vector was poor. Studies elsewhere also documented that knowledge of mosquito spreading dengue varied from 56.6 – 93% in different studies but knowledge about Aedes mosquito as vector (including Nepal) was only 5-8%. Only 43.6% knows that dengue vectors are day biters. However, this knowledge is recorded to be much lower in other studies (7-14%).

About 3% of the participant in the present study believed that dengue can be contracted through blood transfusion. However, studies elsewhere recorded much higher belief (66.8-92%). **[11, 12]** It is noteworthy that there is increasing evidence of Dengue virus (DENV) transmission by blood products **[14].** Studies in Singapore during 2005 **[15]** recorded estimated risk of DENV through blood transfusion range from1.6 to 6 per10,000 blood transfusions and in Puerto Rico 7 per 10,000 transmission during 1995 to 2010 **[15]**.

About 60% of participants had the correct knowledge about the dengue vectors breeding places and they have positive attitude for dengue prevention. **[11]** About 16% felt vector control was the responsibility of Government in this study, but studies elsewhere in India observed about 50% dependence on Government machinery for vector control. **[12]**

Studies in India or elsewhere recorded, mosquito-net use at night by majority but did not protect children during day from mosquito bite, similar to our findings.

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