

Anopheles culicifacies breeding in polluted water bodies in Loonkaransar city of Bikaner (Rajasthan) district

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Abstract

Background & Objective: *Anopheles culicifacies* is the major vector of malaria in India, is known to breed in clean and clear water. In Western Rajasthan the vector fauna and transmission dynamics therefore is not understood properly. The main objective of the study was to detect the breeding habitat diversity of *An. culicifacies*.

Method: The adult *Anopheles* were collected over a period of two years by using aspirator as well as light traps while larval stages collected and rear in laboratories than identified as per using standard keys.

Result: A total of 706 larval specimens representing 4 *Anopheles* species were reported from 9 different breeding habitats. According to density Cretarion, *An. stephensi*, *An. annularis* and *An. culicifacies* were observed as constant in relation to their distribution. The most productive breeding site for *An. culicifacies* was households, temporary water bodies at construction sites; pipe leakage, Puddles, ponds and small pits along-side of railway tracks.

Conclusions: These result indicate that *An. culicifacies* has adapted to breed in a wide range of water bodies including in saline brackish water although they were earlier considered to breed only in clean and clear water.

Keywords: *Anopheles*, breeding site, malaria

Introduction

Malaria is one of the most prevalent parasitic vector borne tropical disease, which has etched highly varied patterns into humans history. There are 422 species of *Anopheles* worldwide, many of them sibling species that can only be identified using genetic techniques, of their, about 70 are malaria vector but only 40 are important. These are six recognized primary vectors of malaria in India, viz: *Anopheles culicifacies*, *An. stephensi*, *An. sundicus*, *An. fluviatilis*, *An. dirus* and *An. minimus* vectors of secondary importance are *An. annularis*, *An. varuna*, *An. jeyporiensis* and *An. phillipinensis* (Rao 1984)

Anopheles culicifacies is a major vector of transmission of the malaria diseases. It is known to breed in temporary clean and clear water. The *An. culicifacies* is a prolific breeder and its preferred habitats are numerous and varied, irrigation channels, seepages, unused well; waste water, rainfilled small borrow, its along side of railway tracks.

District Bikaner situated in the north-western part of Rajasthan is characterized by extremes of temperature, both in summer as well as in winter and low an erratic rains. Loonkaransar tehsil lying in Bikaner district is a canal

irrigated area whose ecology has changed drastically due to the introduction of Indira Gandhi canal. There is an increase in vegetation leading to enhanced ambient relative humidity and availability of water logging at number of places resulting from the canal seepage. After the initiation of irrigation activities in the region, there has been a tremendous increase in the number of malaria cases.

Loonkaransar is small, closed dry basin surrounded by dunes at north eastern margin of Thar Desert. The basin receives input from the groundwater and direct rain and no input from streams. The dry lake bed and this water is saline with composition, that include Na, Ca, Mg, Cl, So etc.

Due to heavy rainfall (cloud burst) temporary lake is established in Loonkaransar (in Dec. 2000). The water fell in inches. The rain come in torrents. It provide another breeding site to *Anopheles* species.

In this region very few entomological investigations were carried out, the presence of vector of malaria attract to the in order to explore scientific information an the vector biology and malaria burden profile and plan proper strategies for malaria control and eradication.



District Map of Bikaner

Fig 1: Area map of Loonkaransar

Material & Methods

For the present investigation six areas of Loonkaransar city were selected which lying between 28°17'– 29°03' N latitudes & 73°05'–74°12' longitudes. Periodic investigation were undertaken from Nov 2011 to Dec 2013. Mosquitoes and larval stages were collected with the help of suction tube and torch and dipping method for larval stage. Specimens were reared in laboratory and identified using standard taxonomic keys as given by Roy & Brown (2003) [14].

After cloud burst, a temporary lake was established near the state highway since last 15 years birds are attracted to this

water body. Due to presence of some chemical & the water minerals, ecology has been drastically changed and turned in polluted state.

Result

During the investigation the mosquito larval stages were reported from this lake along with other surveyed area, (Table 1). Due to local practice and animals waste material, dead organic matter the water turned polluted and brackish in nature. It was not earlier observed in this area.

Table 1: Species composition of *Anopheles* mosquitoes recorded from surveyed areas of Loonkaransar city in (2011-2013)

Area	<i>Anopheles subpictus</i>	<i>Anopheles stephensi</i>	<i>Anopheles culicifacies</i>	<i>Anopheles annularis</i>
Choudhary colony	+++	++	NR	++
Jogian Mohalla	+	++	NR	NR
Natho Ki Basti	+	++	+	NR
Bus Stand highway area	++	++	++	+
Jean Nagar	++	+	+	+
Kumhar ka Mohalla	++	++	+	+

NR: Not reported

+: 0 to 50, ++ : 50 to 100, +++ : >100

Breeding sites

The relative abundance of anopheline larvae and adult found high in three surveyed area among total six surveyed localities

(Table 2) alongwith *An. culicifacies* the *An. subpictus*. Show dominant class among the rest of fauna viz *An. annularis* was classified as the subdominant class (Table 1)

Table 2: Monthwise density (No. per man hour) of mosquito *Anopheles culicifacies* in Loonkaransar city (Nov 11 to Dec 2013) values are monthly average data of two year

Month	Choudhary Colony	Jogton Ka Mohalla	Natho Ki Basti	Bus stand Highway area	Jean Nagar	Kumharoh Ka Mohalla
November	NR	NR	0.00	3.00	NR	00
December	NR	NR	0.00	0.00	NR	00
January	NR	NR	3.00	0.00	NR	00
February	NR	NR	4.50	0.00	NR	00
March	NR	NR	3.00	1.50	NR	3.25
April	NR	NR	0.00	0.00	NR	1.25
May	NR	NR	0.00	0.00	NR	00
June	NR	NR	3.00	4.50	NR	2.25
July	3.50	NR	7.00	8.25	NR	6.75
August	4.50	NR	18.50	21.25	NR	20.25
September	4.00	NR	36.50	33.00	NR	31.75
October	3.00	NR	18.25	15.25	NR	14.25

NR: Not reported

Table 3: Occurrence and abundance (No. per man hour) of mosquito *Anopheles culicifacies* in Loonkaransar city district Bikaner (Values are monthly average of two years data) (Nov 2011 to Dec 2013)

Month	Puddles	Pond	Lake	Cattle water point	Pipe leakage	construction sites	House hold	Culverts /causeway	Fodder Room
November	-	-	-	3	1	-	3	-	-
December	-	-	-	4	1	-	2	-	-
January	-	-	-	2	1	-	1	-	-
February	-	-	-	-	2	-	1	-	-
March	2	3	4	2	4	-	5	-	1
April	3	3	5	4	5	-	5	-	2
May	-	2	3	2	7	-	7	-	4
June	4	-	-	2	7	-	9	-	4
July	5	4	3	5	-	-	7	-	6
August	4	3	2	7	6	2	8	-	3
September	-	5	4	7	6	3	7	-	5
October	-	2	1	4	4	1	2	-	4
Total	18	22	22	42	44	6	57	-	27

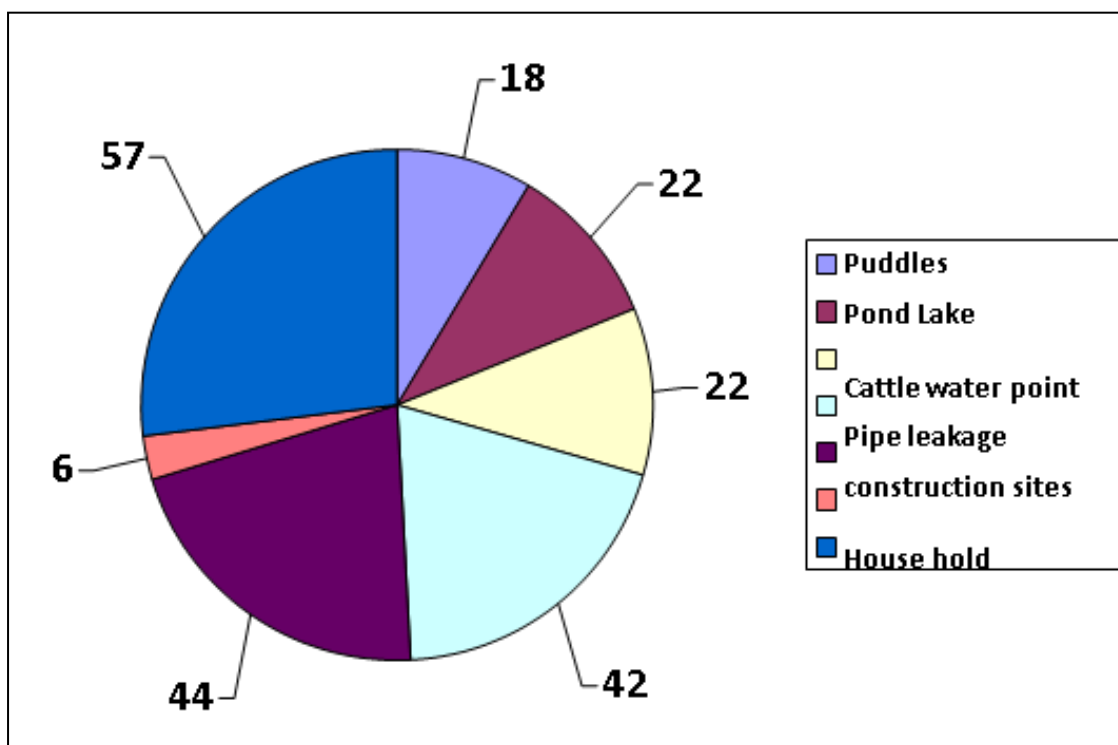


Fig 2: Occurrence and abundance (No. per man hour) of mosquito *Anopheles culicifacies* in Loonkaransar city district Bikaner (Values are monthly average of two years data) (Nov 2011 to Dec 2013)

Nine breeding site were included in observations these are puddles, pond lake, cattle water point, pipe leakage construction sites, households, culvert / causeways and fodder rooms (Table 3)

Among nine breeding site four *Anopheles* species were reported viz *An. subpictus*, *An. stephensi*, *An. culicifacies* and *An. annularis* (Table 1)

Previous studies conducted in this area evident that *An. culicifacies* was occurred only in fresh water pond. However recent study demonstrate that the occurrence of *An. culicifacies* can be seen in polluted water lake where the local practice like washing of machineries, waste faecal material addition of diary waste were very common feature.

The proffered breeding site of *An. culicifacies*, was household (57.00) followed by pipe leakage (44.00) cattle water point (41.00).

Discussion

During the present observations the anopheline species documented from Loonkaransar were *An. subpictus*, *An. stephensi*, *An. culicifacies* and *An. annularis* from the Thar desert area and Tyagi *et al.* (2001) [23], Bansal & Singh (1993) [1], Christopher (1916) [4].

Our present observation show first time *An. culicifacies* in Loonkaransar city which is part of Thar desert where ecological situations characterized by extremes of temperature, both in summer as well as in winter and low and erratic rains. Our finding is supported by Tyagi & Choudhary (1997) [22]. They suggested that alongwith *An. stephensi* the traditional malaria vector in xeric environment, *An. culicifacies* established itself in the areas extensively irrigated through canals. *An. culicifacies* population peak in monsoon and post monsoon months (Sharma & Dev 2015) [16], the peak adult density of *An. stephensi* and *An. culicifacies* were documented in the month of August by Sharma (1995) [18], while Shukla *et al.*, (2007) [19] recorded the highest density of *An. culicifacies* during July to September in Uttaranchal, supporting the present findings. Which is also have same trends.

The site from where anopheline species were collected during the present investigation included puddles, ponds, cattle water point, pipe leakage, construction sites, households, culverts/ causeways and fodder rooms. Our present study shows that the occurrence and abundance of various stages of mosquitoes were found in all type of habitats except the culverts/ causeways. The present finding is supported by the observation of Sahu *et al.* (1990) [15] they found that *An. fluviatilis*, *An. culicifacies* and *An. annularis* breed in all types of habitats.

Our present study shows that the *An. culicifacies* were also reported in polluted water lake where as it was earlier assumes that its preferred breed in clean & clear water. Our present finding is supported by the study of Surendran & Ramaswamy (2005), Gunathilaka *et al.* (2013) [8], and they Jude *et al.* (2010) [11] they documented that *Anopheles culicifacies* breed in polluted water bodies of various districts of Sri Lanka.

Conclusions

The present study reveals for the first time in Loonkaransar

the ability of *An. culicifacies* and other potential malaria vector to breed in polluted water. It is first time documented in the Loonkaransar city, it is well known vector of malaria transmission.

Taxonomist should be aware to the high diversity of malaria vector, *Anopheles* species, most of exist as complexes comprising several cryptic species that vary in vectorial capacity. *An. culicifacies* maintain endemic malaria throughout rural India and its control has become a formidable task consuming huge resources year after year.

The presence of *An. culicifacies* in this area is threatening to the workers who are engaged in control of malaria transmission work. According to National Vector Borne Disease Control Programme (NVBDCP), the 80 percent malaria control budget spends, annually in the control of *An. culicifacies*, yet it remains one of the most formidable challenges in India.

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