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Seasonal Prevalence of *Culex* Mosquitoes in Udaipur District of Southern Rajasthan

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Abstract

An investigation of the relationship between the seasonal prevalence and the relative abundance of Culex species was carried out in the Udaipur district of Rajasthan, India. There were 777 Culex mosquitoes discovered between April 2021 and March 2023. Four distinct species of Culex have been identified from various locations within the district of Udaipur. The findings showed that Culex quinquefasciatus had a high relative abundance (45.43%), followed by Culex pseudovishnui (35.52%), Culex vaganus (14.02%), and Culex whitei (5.01%). Seasonally, the rainy season (April 2021 to March 2023) had the largest abundance of Culex species (40.92%), followed by the summer season (36.16%) and the winter season (22.90%). The research area's seasonal prevalence of Culex species is mostly caused by fluctuations in temperature, relative humidity, and average rainfall throughout the year, as indicated by the climatic parameters. The findings demonstrated that variations in climate, demography, and geography affect the population dynamics of Culex vectors. The study's findings indicated that correct and efficient mass surveillance as well as appropriate mosquito control measures must be implemented immediately in these vulnerable areas.

Keywords: *Culex*, Seasonal Prevalence, Climatic Parameters, Abundance, Population Dynamics

INTRODUCTION

More than 3000 species of mosquitoes that belong to the Culicidae family have been identified around the world. Mosquitoes are holometabolous insects that experience complete change throughout their life history including egg, larva, pupa and adult. The underlying three phases are aquatic and keep going for 5 to 13 days, contingent on species and encompassing temperature. Commonly mosquitoes breed in stagnant water and specific rearing environment depending on the species. The important common genera of mosquitoes are *Aedes*, *Culex*, *Anopheles* and *Mansonia*, each containing hundreds of species with their unique characteristics and ability to transmit various diseases (Clements, 1992).

An increase in mosquito abundance was observed on warmer degree days and an increase in MIR was associated with increased mosquito abundance. These models can be utilized in other mosquito monitoring and surveillance studies in different climate types and environments (Rehbein *et al.*, 2024). Temperature, salinity, nitrate and conductivity had positive correlation with mosquito larval density. The results proved that uncultivated wells and pools are a good and permanent source of mosquito breeding (Baz *et al.*, 2024).

Various factors, including water temperature, vegetation, water currents, water sources and water quality, influence the distribution of mosquitoes (Rattanarithikul *et al*., 2005). Vast agriculture lands, open networks of rivers and irrigation channels provide natural breeding grounds for these mosquitoes (Ilahi and Suleman, 2013). Various aspects of mosquitoes including prevalence, seasonal distribution, abundance and stratification of *Aedes*, *Culex*, *Anopheles* and *Armigerous* including district Peshawar, district Buner and Landi Kotal (Suleman *et al*., 1996; Ali and Rasheed, 2009; Khan *et al*., 2015).

Such processes are challenging to model, especially as surveillance typically focuses on monitoring only the adult stage during peak transmission seasons because it is adult females that spread the disease, with adults being comparatively easily implicated and monitoring resources are often constrained (Schaffner *et al*., 2014).

MATERIAL AND METHODS

Study Area

Udaipur is situated at 24.525049"N-73'67 7116". Rising 598.00 meters (1962 feet) above sea level, the city occupies an area of 64 km². It is in the southern Rajasthan close to the Gujarat boundary. Udaipur district covers 11724 km². Hilly terrain with hills in the west and south, a raised plate au in the north and plains in the east defi ne the district. The usual temperature of Udaipur is 24.2°C (75.7°F). The yearly rain fall comes at 689mm. During the monsoon, the humidity gets as high as 90%.

Mosquito's collection and morphological identification

The entomological research of *Culex* species in these areas was focused to generate fundamental information. Adult mosquito specimens were collected from various Udaipur district and regions in great detail for an observational study. Following approved acceptance of the resident s, from April, 2021, until March, 2023, suit able random sampling villages were chosen from various tehsil of every district based on already existing data with regard to *Culex* endemicity and according to probability of work in these villages. Three seasons were chosen for full research: wet, winter, and summer. Every locality underwent three times of mosquito collecting during every season. Every fort night i n every month, *Culex* mosquitoes were gathered from human homes and livestock barns from particular communities all around the year. Every village chose huma n houses and cattle sheds for collecting. Using an oral aspirator and a bright torch, we gathered for this aim resting insects on several sides. Through a cut on the side of the plastic containers, gathered mosquitoes were placed in plastic containers. Its was covered on its top with cloth netting and wrapped by rubber band. Mosquitoes were transported to Department of Zoology, University College of Science, MLSU, for further identification.

Identification

The collected mosquitoes were brought to the laboratory and identified with standard (Reuben *et al.*, 1994; Rattanarithikul *et al*., 2005) keys.

RESULT AND DISSCUSSION

In the study of two consecutive years (April, 2021 to March, 2022 and April, 2022 to March, 2023), it was found that the highest number was *Culex quinquefasciatus* 45.43% or 353, second was *Culex pseudovishnui* 35.52% or 276, third was *Culex vagans* 14.02% or 109 and the least was *Culex whitei* (5.01% or 39).

When I compared the locality-I and locality-II of the three seasons from April, 2021 to March, 2022; it was recorded that 38.95% *Culex* mosquitoes were recorded in the rainy season, followed by a minimum margin of 38.08% *Culex* mosquitoes were recorded in the summer season and the lowest percentage of *Culex* mosquitoes was found in winter season in 22.96%.

A previous study reported significant differences between desert (Jodhpur) and coastal (Kolkata) strains of *Aedes aegypti* for biological straits such as survival and fecundity and suggested that the desert strain follows more r-strategies than the coastal strain (Sharma *et al*., 2022).

I found in locality-I that *Culex quinquefasciatus* 43% and in locality-II 48.48% while *Culex pseudovishnui* was found 37.98% in locality-I and 35.15% in locality-II. while *Culex vagans* was found 15.08% in locality-I and 10.30% in locality-II. similarly, *Culex whitei* was found 3.91% in locality-I and 6.06% in locality-II.

Physico-chemical factors that temporarily affect the mosquitoes egg laying process and important disease vector species. Include salts, dissolved organic and inorganic matter, eutrophication conditions, turbidity, presence of suspended mud, presence and absence of plants, temperature, light and shade and hydrogen ion concentration (Mogi, 1978; Amerasinghe *et al*., 1995; Gimning *et al*., 2001).

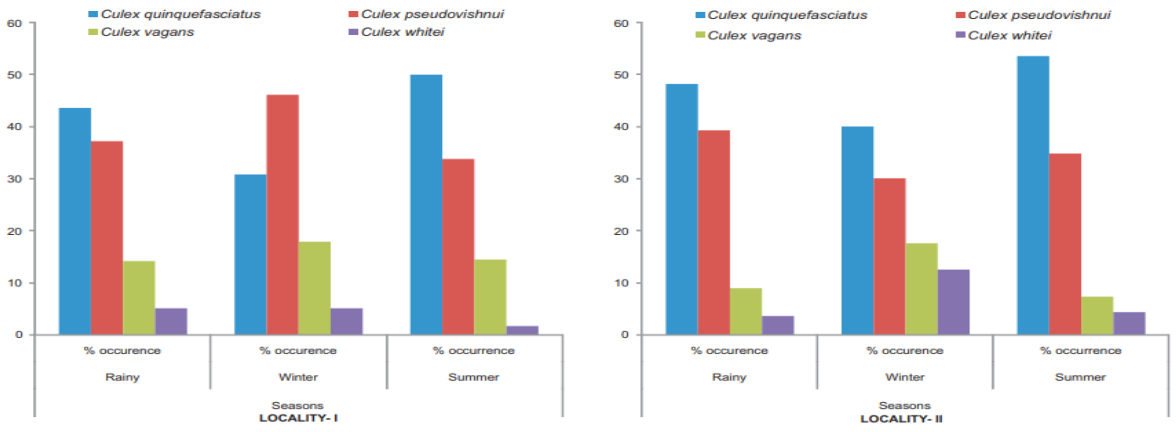
When the survey was conducted from April, 2022 to March, 2023, a total of 433 mosquitoes were caught. *Culex quinquefasciatus* was found highest in locality-I and locality-II with 44.61% and 45.79%, followed by *Culex pseudovishnui* with 34.87% and 34.45%, while *Culex vagans* was found with 15.08% locality-I and 14.28% in locality-II. the lowest percentage of *Culex whitei* was found with 4.61% in locality-I and 5.46% in locality-II.

Mosquito are poikilothermic in nature and are highly dependent on the prevailing native environmental conditions (Paupy *et al*., 2003). When we compared season wise, it was found that the highest number of mosquitoes were found in the rainy season at 42.49%, followed by 34.64% mosquitoes were found in the summer season while the least number of mosquitoes were found in the winter season with 22.86%.

Specifically, higher levels of developed ground cover displayed greater *Culex* abundance than lower levels of light cover, but no significant differences were found between summer and early autumn. In gravid traps, no significant differences were found between seasons or growth levels (Yan *et al*., 2024).

Table 1: Seasonal prevalence of *Culex* mosquitoes in two localities of Udaipur district (April, 2021-March, 2022)

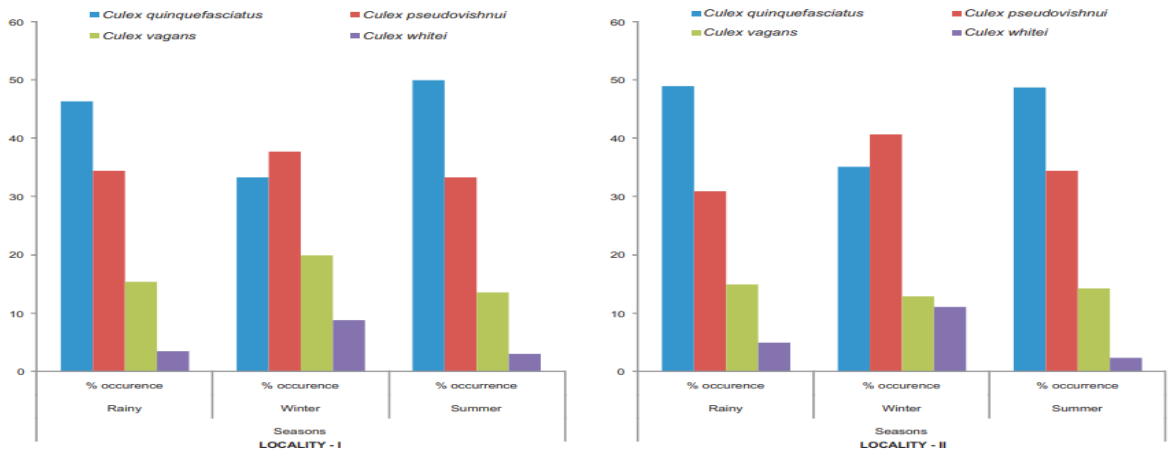
Locality	Mosquitoes collected	Seasons							
		Rainy		Winter		Summer		Total	
		Collected	% occurrence	Collected	% occurence	Collected	% occurrence	Collected	% occurence
Locality-I	*Culex quinquefasciatus*	34	43.58	12	30.76	31	50	77	43.01
	Culex pseudovishnui	29	37.17	18	46.15	21	33.87	68	37.98
	Culex vagans	11	14.10	7	17.94	9	14.51	27	15.08
	Culex whitei	4	5.12	2	5.12	1	1.61	7	3.91
	total	78	100	39	100	62	100	179	100
Locality-II	*Culex quinquefasciatus*	27	48.21	16	40	37	53.62	80	48.48
	Culex pseudovishnui	22	39.28	12	30	24	34.78	58	35.15
	Culex vagans	5	8.92	7	17.50	5	7.24	17	10.30
	Culex whitei	2	3.57	5	12.5	3	4.34	10	6.06
	Total	56	100	40	100	69	100	165	100
	% Total	**134**	**38.95**	**79**	**22.96**	**131**	**38.08**	**344**	**100**



GRAPH 1: Seasonal prevalence of Culex mosquitoes in two localities of Udaipur district (April, 2021-March,2022)

Table 2: Seasonal prevalence of *Culex* mosquitoes in two localities of Udaipur district (April, 2022-March, 2023)

Locality	Mosquitoes collected	Seasons							
		Rainy		Winter		Summer		Total	
		Collected	% occurrence	Collected	% occurrence	Collected	% occurrence	Collected	% occurrence
Locality-I	*Culex quinquefasciatus*	39	46.42	15	33.33	33	50.00	87	44.61
	Culex pseudovishnui	29	34.52	17	37.77	22	33.33	68	34.87
	Culex vagans	13	15.47	9	20	9	13.63	31	15.89
	Culex whitei	3	3.57	4	8.88	2	3.03	9	4.61
	total	84	100	45	100	66	100	195	100
Locality-II	*Culex quinquefasciatus*	49	49	19	35.18	41	48.80	109	45.79
	Culex pseudovishnui	31	31	22	40.74	29	34.52	82	34.45
	Culex vagans	15	15	7	12.96	12	14.28	34	14.28
	Culex whitei	5	5	6	11.11	2	2.38	13	5.46
	Total	100	100	54	100	84	100	238	100
	% Total	184	42.49	99	22.86	150	34.64	433	100



GRAPH 2: Seasonal prevalence of Culex mosquitoes in two localities of Udaipur district (April, 2022-March,2023)

CONCLUSION

Samples of *Culex* mosquitoes were taken in two locations in Udaipur district for two consecutive years, April, 2021 to March, 2022, and April, 2022 to March, 2023, to study the mosquitoes' seasonal prevalence.These four species' approximately 777 mosquitoes were captured in the rainy, winter, and summer seasons for two years in a row. The rainy season had the highest mosquito incidence at 40.92%, followed by summer at 36.16% and winter at 22.90%. The highest numbers recorded in these two years were *Culex quinquefasciatus 45.43%, Culex pseudovishnui 35.52%, Culex vagans 14.02%, and Culex whitei* 5.01%.

REFERENCE

1. **Ali, N., & Rasheed, S. B. (2009).** Determination of species composition of Mosquitoes found in Palosai *stream, Peshawar Pakistan. J Entomol., 31, 47-51.*
2. **Amerasinghe, F. P., Indrajith, N. G., & Ariyasena, T. G. (1995).** Physico- chemical characteristics of mosquito breeding habitats in an irrigation development area in Sri Lanka. *Ceylon J. Sci (Biological Sciences)*, 24, 13-29.
3. **Baz, M. M., Baeshen & *et al.*, (2024).** Ecologicaal Factors Affecting Diversity and Abundance of Mosquito Larvae in Nile Delta, Egypt. *Egyptian Journal of Veterinary Sciences*, 55(4), 991-1006.
4. **Clements, A.N. (1992).** The biology of mosquitoes: development, nutrition and reproduction. London: *Chapman & Hall*, 1, 509.
5. **Gimnig, J., Ombok, M., Kamau, L., & Hawley, W. (2001).** Characteristics of larval anopheline (Diptera: Culicidae) habitats in Western Kenya. *J. Med. Entomol.*, 38, 282- 288.
6. **Ilahi I., & Suleman, M. (2013).** Species composition and relative abundance of mosquitoes in Swat, Pakistan. *Int J Innov App Stud.*, 2(4), 454-463.
7. **Khan, J., Shah, M., Khan, B. T., Naeem, M., Ismail, M., and Abbasi, A. (2015).** A survey of adult and larval mosquito fauna in Tehsil Daggar and Gagra of District Buner, Khyber Pakhtunkhwa, Pakistan. Int *J Mos Res*., 2(3), 170- 174.
8. **Mogi, M. (1978).** Population studies on mosquitoes in the rice field are of Nagasaki, Japan, especially on *Culex tritaeniorhynchus*. *Trop. Med*., 20, 173-263.
9. **Paupy, C., Chantha, N., Vazeille, M., Reynes, J. M., Rodhain, F., & Failloux, A. B. (2003).** Variation over space and time of *Aedes aegypti* in Phnom Penh (Cambodia): genetic structure and oral susceptibility to a dengue virus. *Genetics Research*, 82, 171 -82.
10. **Rattanarithikul, R., Harbach, R. E., Harrison, B. A., Panthusiri, P., Jones, J. W., & Coleman, R. E. (2005)**. Illustrated keys to the mosquitoes of Thailand II Genera *Culex* and Lutzia. *Southeast Asi J Tro Med Pub Hea*., 36(2), 1-97.
11. **Rehbein, M. M. Viadero, R., Hunt, J. R., & Miller, C. (2024).** The Role of Temperature, Wind Speed, and Precipitation on the Abundance of *Culex* Species and West Nile Virus Infection Rate in Rural West-Central Illinois. *J Am Mosq Control Assoc*, 40(1), 1-10.

12. **Schaffner, F., Versteirt, V., & Medlock, J. (2014).** Guidelines for the surveillance of native mosquitoes in Europe. *ECDC: Stockholm*.

13. **Sharma, G., De, S., Mandal, U., Bhattacharjee, R., & Suman, D. S. (2022).** Ecological variations in adult life table attributes of *Aedes aegypti* (L.) from the desert and coastal regions of India. *Medical and Veterinary Entomology*, 1 - 6.

14. **Suleman, M., Arshad, M., & Khan, K. (1996).** Yellow fever mosquito (Diptera: Culicidae) introduced into Landikotal, Pakistan by tire importation. *J Med Entomol*., 33(4), 689-693.

15. **Yan, J., Green, K., Noel, K., Kim, C., & Stone, C.M. (2024).** Effects of seasonality and developed land cover on *Culex* mosquito abundance and microbiome diversity. *Frontiers in Microbiology*, 10, 3389.