FURTHER OBSERVATIONS ON THE PHYSICO-CHEMICAL FACTORS OF THE BREEDING PLACES OF *CULEX QUINQUEFASCIATUS* SAY=*FATIGANS* WIED[1]

V. P. SINHA

M.I.G.H.—97, Lohianagar, Patna—800020 (Bihar) India

ABSTRACT. Mosquitoes are specific and selective about their breeding places, and the physico-chemical factors of the breeding pools play a vital part in the selection of the oviposition site and subsequent growth, development and population density during the aquatic stages. The present study of the physico-chemical factors conducive to selection of breeding places of *Culex quinquefasciatus* = *fatigans* reveals that the positive factors for the high population density of the aquatic stages of this species are the high concentration of total soluble salts, free ammonia, organic carbon, nitrates and slightly alkaline pH. The negative factors are their low concentration and pH above 8. In the thin line separating the positive and negative factors present in the physico-chemical composition of the water of the breeding places may lie the key to the practical control of *Culex quinquefaciatus*=*fatigans* which has to be determined exactly by vigorous efforts in that direction.

INTRODUCTION. Physico-chemical factors influencing the breeding places of mosquitoes have not received serious attention of the entomologists although here may lie a key for the control of mosquitoes. Sinha (1969, 1970) studied the significance of the physico-chemical factors of the breeding places in relation to population density of the aquatic stages of *Culex quinquefasciatus* Say 1823=*Cx. fatigans* Wied. 1828. The present study was undertaken during February and March 1975 at Bhagalpur to investigate further the importance of the physico-chemical factors of the breeding places of this species.

METHODS AND MATERIALS. Four breeding places with large populations and two with small populations of *Cx. quinquefasciatus* were selected out of the 36 breeding pockets examined for the present study in different ecological situations.

For the physico-chemical studies, samples of water were collected from selected habitats in 2-liter bottles with glass corks. Representative samples of water were taken without disturbing the water surface by means of a white enamelled ladle of 500 cc capacity. For estimating the free CO_2, a 100 cc conical flask with rubber cork was employed and it was determined immediately.

To study the population density water samples with the egg-rafts, larvae and pupae were collected from the same breeding place after the collection of the sample for chemical examination and were transferred in a photographic tray. The egg-rafts and larvae were counted. A total of 3 samples was recorded. The collection was made with the help of a ladle of 500 cc capacity.

The physio-chemical factors considered for the investigations were: pH, free CO_2, total soluble salts, free ammonia, oxygen absorbed from $KMnO_4$ by water in half

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an hour at boiling temperature, nitrates, phosphate and sodium chloride.

The pH was estimated with a Beckmann pH meter whereas the total soluble salts were directly read by Sollometer.

Estimation of free CO_2, free ammonia, nitrates and phosphates were made according to the method recommended in the Standard Methods for Estimation of water and water waste by American Public Health Association (1960).

The determination of organic carbon and sodium chloride was carried out according to the methods described by Holstein (1954).

RESULTS AND DISCUSSION. Results are presented in Table 1. It is evident that the chemical factors of the breeding places have a distinct bearing on the growth and development of the immature stages of *Cx. quinquefasciatus*. High population densities were observed in breeding places nos. 1, 2, 3 and 4, whereas low population densities were recorded in breeding places nos. 5 and 6. The chemical factors which seem to account for the high density are high percentage of free ammonia, organic carbon, nitrates and high concentration of available salts with slightly alkaline pH. The lowest population (aquatic stages) on the other hand was observed with low percentage of ammonia, organic carbon, phosphate and traces of nitrate along with alkaline reaction. Sinha (1970) made parallel observations.

The optimum pH range was between 7.2 and 7.7, and low density was recorded in pH above 8.0.

Free CO_2 varied between 3.9 and 7.26 but the amount of free CO_2 did not seem to affect population density. Free ammonia appears to attract the gravid *Cx. quinquefasciatus* to the breeding pools.

High organic carbon concentration was noted in water with high population densities, i.e., in breeding places nos. 1 to 4. The organic carbon concentration varied between 73.8 ppm. and 253.0 ppm. at these sites whereas low concentrations, between 12.3 ppm and 26.5 ppm, were recorded in breeding places 5 and 6 where population

Table 1. Population density of the aquatic stages of *Culex quinquefasciatus* and physico-chemical factors of the breeding places.

Breeding place no.	Total no. of		Chemical factors in ppm						
	egg-rafts	larvae	pH	Free CO_2	Total soluble salts	Free ammonia	Organic carbon	Nitrates	Phosphates	Sodium chloride
1	1230	8137	7.5	5.1	17122	3.0	85.3	1.8	0.7	8945.9
2	808	6614	7.7	5.0	16111	2.2	73.8	1.9	5.0	8966.7
3	1536	19174	7.2	3.4	12827	2.0	253.0	3.3	10.0	5444.0
4	1401	8928	7.5	4.2	12673	2.2	223.0	1.0	5.5	5060.8
5	16	203	8.1	3.9	2088	0.1	12.3	trace	0.4	444.5
6	61	1122	8.07	7.26	3169	1.0	26.5	0.1	0.69	1674.2

densities were low. Hamlyn-Harris (1930) recorded a high level of oxygen absorbed from $KMnO_4$ showing that the water is highly polluted of the breeding places of *Cx. quinquefasciatus*.

According to the data in Table 1, the nitrate contents in prolific breeding places varied between 1.0 ppm and 3.3 ppm, whereas the breeding places with low population densities had lower concentrations of nitrates, 0.1 ppm or less. Therefore, the higher the concentration of nitrates in the breeding places, the greater was the population density.

A great variation in the phosphate concentration is noted in the present study, and no correlation is established between the phosphate availability in the breeding places and population density of *Cx. quinquefasciatus*.

The data in Table 1 reveal that with a high percentage of sodium chloride (5060.8 ppm and 8966.7 ppm) higher population densities of the aquatic stages of *Cx. quinquefasciatus* were recorded.

The mean maximum and mean minimum temperatures for February–March 1975 were 28.2°C and 15.3°C. The months of February and March in Bhagalpur have recorded higher population peaks of both aquatic stages and adults of *Cx. quinquefasciatus* each year (Sinha 1969).

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