Resistance of Anopheles farauti eggs to desiccation

[Jpn. J. Sanit. Zool. Vol. 42 No. 1 p. 65-67 1991]

Research Note

Resistance of *Anopheles farauti* eggs to desiccation*

Takao OKAZAWA,** Leslie VAISUI, Hiroshi SUZUKI*** and Nathan KERE

Medical Research and Training Institute, Ministry of Health and Medical Services, Honiara, Solomon Islands

(Received: September 6, 1990)

Key words: *Anopheles farauti*, egg, resistance, desiccation.

Anopheles farauti is the main vector of malaria in Solomon Islands. Larvae of this species were found in a large variety of water, such as ponds, lagoons, springs, seepage areas, river margins, temporary ground pools of all sizes, *etc.* (Belkin, 1962). Under natural conditions the water level of larval habitats of *An. farauti* was unstable. The habitats reduced in size after a long, dry period and expanded when it rained heavily. The water level of breeding sites near the coast was also subject to sea tides.

In the laboratory, *An. farauti* eggs were laid on the surface of water in containers. But when the water level was lowered, many eggs were stranded on the wall of containers. The same phenomenon seemed to happen in nature. Egg ability to survive under dry conditions might affect larval and adult population densities.

In Solomon Islands we sometimes found 1st-instar larvae of *An. farauti* and *An. punctulatus* in new ground pools which were dry the day before and were formed overnight. The duration of the egg stage was about 1.5 days both in *An. farauti* and *An. punctulatus* under room conditions in Solomon Islands (Suzuki, unpublished data). This suggests that the eggs had been laid before the breeding sites dried up, survived under the dry condition and hatched when water accumulated again.

Resistance of *An. punctulatus* eggs to desiccation was reported by Mackerras and Lemerle (1949) and Charlwood *et al.* (1986). But ability of *farauti* eggs to withstand drying has not been studied. In the present study we conducted some laboratory experiments to determine it.

Materials and methods

Eggs used in the experiments were obtained from a colony of *An. farauti* maintained in the laboratory of the Medical Research and Training Institute. This colony originated from larvae collected at Giltae located on the northern coast of Guadalcanal, Solomon Islands. The eggs were of the 17th and 19th generations after the establishment of the colony. Adults were reared in small cages (20×30×35 cm). The rate of inseminated females was about 50%.

We carried out two experiments. In the first experiment, engorged females were allowed to oviposit on a paper towel immersed in 2 mm depth of water in a plastic tray (13×18×2 cm). During the night eggs were laid on the wet paper. The next morning the eggs on the paper were divided into 11 groups. Except for one group, all the eggs were dried with the paper and held unsealed in the insectary at 29±2°C and 70–90% of relative humidity. Every day one group of eggs was soaked in the water brought back from the breeding site at Giltae. Hatched larvae were removed and counted every morning for 10 days.

In the second experiment, we used wet, dead leaves for oviposition instead of the paper towel. The procedure of the experiment was the same as the first one.

* This study was supported by the Ministry of Health and Medical Services, Solomon Islands (MHMS), and the Japan International Cooperation Agency (JICA).

** Present address: Laboratory of Parasitology, Faculty of Medicine, Toyama Medical and Pharmaceutical University, Toyama 930–01, Japan.

*** Present address: Institute for Tropical Medicine, Nagasaki University, Nagasaki 852, Japan.

** 岡沢孝雄: (現住所) 富山医科薬科大学寄生虫学教室 (〒930-01 富山市杉谷 2630)

*** 鈴木 博: (現住所) 長崎大学熱帯医学研究所 (〒852 長崎市坂本町 12-4)

Table 1 Numbers of eggs tested and hatched with hatching rates.

Duration of desiccation (days)	1st experiment No. of eggs			2nd experiment No. of eggs		
	Tested	Hatched	(%)	Tested	Hatched	(%)
0 (Control)	120	64	53.3	215	174	80.9
1	175	65	37.1	150	98	65.3
2	130	42	32.3	150	73	48.7
3	115	26	22.6	150	1	0.7
4	200	12	6.0	150	0	0.0
5	185	7	3.8	150	0	0.0
6	140	4	2.9	160	0	0.0
7	130	0	0.0	170	0	0.0
8	220	0	0.0	150	0	0.0
9	165	0	0.0	150	0	0.0
10	180	0	0.0	—	—	—

Results and discussion

The numbers of eggs tested and hatched are shown in Table 1. The eggs showed a potential for short-term resistance to desiccation. The hatching rate gradually decreased with the duration of desiccation and a few eggs survived on the 6th day in the first experiment, while the rate quickly dropped through the first 3 days after being dried and no egg remained viable on and after the 4th day in the second experiment. Reasons for this difference between the two experiments were not clear, but unstable relative humidity in the insectary might affect the egg survival.

Many eggs did not hatch in the control group (46.7 and 19.1% in the first and second experiment, respectively). The high rates of unhatched eggs were attributed to the unfertilized eggs laid by uninseminated females.

Similar egg resistance to desiccation was found also in *An. punctulatus* which often cohabits with *An. farauti* in temporal pools in Solomon Islands. Eggs of *An. punctulatus* remained viable for 5.5 days (Mackerras and Lemerle, 1949) or 9 days (Charlwood *et al.*, 1986) after being dried in the air. Short-term egg resistance under experimental conditions was thus confirmed for two malaria vectors in Solomon Islands. Duration of egg survival might be affected by the conditions under which they were stored. Experimental conditions were not always similar to those under which eggs were laid in the fields. Further observations are needed under natural conditions.

ACKNOWLEDGEMENTS

We thank Mr. Eric Porotaki and Mr. Allen Macartney, Medical Research and Training Institute, Honiara, for assistance in maintenance of the colony. We are also grateful to Dr. K. Kamimura and Dr. R. Arakawa, Toyama Medical and Pharmaceutical University, for reviewing the manuscript.

REFERENCES

Belkin, J. N. (1962): *Mosquitoes of the South Pacific (Diptera, Culicidae)*, Vol. I, 608 pp., University of California Press, Berkeley and Los Angeles.

Charlwood, J. D., P. M. Graves and M. P. Alpers (1986): The ecology of the *Anopheles punctulatus* group of mosquitoes from Papua New Guinea: A review of recent work. *Papua New Guin. Med. J.*, **29**: 19–26.

Mackerras, M. J. and T. H. Lemerle (1949): Laboratory breeding of *Anopheles punctulatus punctulatus*, Donit. *Bull. Entomol. Res.*, **40**: 27–41.

摘　要

Anopheles farauti 卵の耐乾性

ソロモン諸島国におけるマラリアの主媒介種である *Anopheles farauti* の卵の耐乾性を調べるために，実験コロニーより得られた卵を使って室内実験を行った．濡れたペーパータオルまたは濡れた枯葉の上に，夜間産まれた卵を翌朝そのまま室内で乾燥させ，温度 29±2°C，湿度70～90%の条件下で保存した．次の日から一部を水に浸し，孵化する卵の割合を10日間にわたって調べた．孵化率は乾燥期間が長くなるにしたがい低下したが，少数の卵は6日間の乾燥の後でも生き残り，孵化した．