OPERATIONAL AND SCIENTIFIC NOTES

A COMPARISON OF FOUR BLOOD SOURCES FOR EGG PRODUCTION IN *ANOPHELES STEPHENSI*[1]

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The fact that the blood source affects egg production in mosquitoes can be important to insectary operations. The U.S. Naval Medical Research Institute (NMRI) has maintained a colony of *Anopheles stephensi* Liston since 1971. Although Meller (1962) reported that rabbits were the preferred hosts for *An. stephensi* under laboratory conditions, Stahler and Seeley (1971) showed that guinea pig blood produced significantly more eggs than rabbit, human, or chicken blood. Accordingly, our colony has been routinely maintained on guinea pig blood since its establishment. Recently, in an effort to increase mosquito production for studies related to the U.S. Navy's malaria vaccine program, several additional blood sources were evaluated. The current study reports the effects of 4 easily obtainable types of blood on egg production of *An. stephensi*.

Mosquitoes used in this study were from the NMRI colony which was obtained from the Illinois Institute of Technology. Approximately 200, six- to seven-day-old female mosquitoes were removed from a stock cage and placed in each of four, 9.52 x 15.87 cm Plexiglas cylinders covered with 32 mesh nylon screen. The mosquitoes were then allowed to feed to repletion on either a guinea pig (Hartley), mouse (NMRI), commercially prepared defibrinated bovine blood (Flow Laboratories, Rockville, Md.) or sheep erythrocytes in Alsevers solution (Microbiological Associates, Walkersville, Md.). The last two were offered to the mosquitoes in an animal membrane (Young Rubber Corporation, Atlanta, Ga.) after being warmed to about 37°C.

During the feeding time, the membranes were periodically reheated. Fully engorged females were then individually removed and placed in similar Plexiglas cylinders containing a glass oviposition cup. Cooked raisins and a 10% sucrose solution were supplied as a carbohydrate source and a moistened cotton pad was placed on top of the cylinder to provide moisture. The cylinders were held in an insectary maintained at 28°C with 80 ± 5% R.H. Over a 2-month period, a total of 155 mosquitoes each were fed on guinea pig and mouse blood while 110 and 75 mosquitoes were fed on bovine and sheep blood respectively. Total egg counts per engorged mosquito were tabulated at the end of each oviposition period. Data were analyzed using a *t* test, and 95% confidence limits were calculated.

The mean number of eggs per blood source is given in Table 1. Mouse blood produced significantly ($P < 0.05$) more eggs compared to the other 3 blood sources. There was no significant ($P > 0.05$) difference between guinea pig, sheep and bovine sources when compared to each other. The mean for guinea pig blood of 45.52 eggs per engorged female agrees closely with the mean of 50.4 eggs per engorged female obtained by Thompson (1964) for the same blood source. The large-scale mosquito mortality reported by Stahler and Seeley (1971) did not occur when the mosquitoes were switched from guinea pig to other blood sources. Both the mouse and guinea pig were observed to be more attractive to mosquitoes than were either of the bloods contained in the membrane in terms of the number of mosquitoes engorged per unit of time.

The study showed that the often overlooked

Table 1. The mean number of eggs laid by 6–7 day-old *Anopheles stephensi* after a meal on different blood sources.

Blood	$\bar{x}$ Number of Eggs
Mouse	71.44 ± 18.56[a]
Guinea Pig	45.52 ± 15.66[b]
Sheep's RBC's	40.69 ± 13.82[b]
Bovine	39.27 ± 11.19[b]

[a] Identical letter indicates no significant ($P < 0.05$) differences between groups.

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laboratory mouse is a superior blood source for *An. stephensi* under insectary conditions. Significantly more eggs were laid by mosquitoes fed on mouse blood than by those fed on guinea pig, sheep erythrocytes or defibrinated bovine blood. The differential response on egg production to different blood sources was also confirmed.

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Literature Cited

Meller, H. 1962. Vergleichende Beobachtugen uber die Biologie von *Anopheles atroparvus* and *Anopheles stephensi* unter Laboratoriumsgenungungen. Z. Tropenmed. Parasitol. 13:80–100.

Stahler, N. and D.C. Seeley, Jr. 1971. Effect of age and host on oviposition of *Anopheles stephensi* in the laboratory. J. Econ. Entomol. 64:561–562.

Thompson, E.G. 1964. Laboratory studies on the biology of *Anopheles stephensi* Liston. M.S. Thesis. Oklahoma State University Library. Oklahoma State University, Stillwater, Oklahoma. 42 pp.

CULEX TARSALIS, AEDES SOLLICITANS, AEDES GROSSBECKI: NEW DISTRIBUTION RECORDS FROM SOUTHWESTERN ONTARIO[1]

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In 1976, a large scale surveillance program for St. Louis encephalitis virus was initiated in Ontario. As an integral part of this program mosquitoes were trapped at weekly intervals from May to October, 1976 and 1977, at 11 sites in the southwestern region of the province. In this paper we report new distribution records for 3 species of mosquitoes and their possible significance.

A single *Culex tarsalis* Coquillett was collected from a CDC trap located in Windsor during mid-July 1976. This was the first record of the species from Ontario. In 1977, 49 adult females of *Cx. tarsalis* were captured as far east as Toronto (Table 1). A single *Cx. tarsalis* larva was also collected in Guelph.

Table 1. Dates of collection of *Culex tarsalis* by CDC and other traps, Ontario, 1977.

Collection Week of:	Location	Number Collected
July 20	Sarnia	6
	Windsor[1]	3
July 27	Sarnia	2
	Windsor[1]	5
August 3	Sarnia	2
	Toronto[2]	2
	Windsor	4
August 10	Leamington	9
	Sarnia	1
	Windsor	6
August 17	Sarnia	2
	Toronto[2]	1
	Windsor	5
August 24	Windsor	1
	TOTAL	49

[1] Specimen in ovipositional trap.
[2] Collected by New Jersey light trap.

Since the species is the principal vector of WEE and SLE in western North America, it is desirable to monitor populations to ascertain if they are increasing. In 1976, ca. 100,000 mosquitoes were collected of which ca. 13,000 were *Culex* females. In 1977, using the same trapping sites and trapping techniques, only 38,000 female mosquitoes were collected of which ca. 5,500 were *Culex* including 44 *Cx. tarsalis*. The population of *Culex* sp. was much lower in 1977 than in 1976 yet populations of *Cx. tarsalis* were considerably higher. It appears that low level populations of *Cx. tarsalis* are now established throughout much of southern Ontario. This is not surprising since a single *Cx. tarsalis* specimen has now been reported as far eastward as New Jersey (Lesser et al. 1977).

Thirty-six *Aedes sollicitans* (Walker) females were captured in Sarnia from July 12 to August 22, 1976. This represents the first record from

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