mosquitoes (Diptera:Culicidae). Ann. Entomol. Soc. Amer. 40(3):522–27.
Paine, R. W. 1934. The introduction of *Megarhinus* mosquitoes into Fiji. Bull. Entomol. Res. 25:1–31.
Peterson, G. D. 1956. The introduction of mosquitoes of the genus *Toxorhynchites* into American Smoa. J. Econ. Entomol. 49(6):786–89.
Ramalingam, S. and J. N. Belkin. 1976. The immature stages of *Aedes* (F.) *samoanus* and the status of *Toxorhynchites* in American Samoa. Mosquito Systematics. 8(2):194–99.
Yasuno, M. and R. J. Tonn. 1970. Bionomics of *Toxorhynchites splendens* in the larval habitats of *Aedes aegypti* in Bangkok, Thailand, WHO Bull. 43(5):762–766.

COLORLESS-EYE, A RECESSIVE AUTOSOMAL MUTANT OF *ANOPHELES STEPHENSI*

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ABSTRACT. A recessive autosomal *colorless-eye* mutant has been found spontaneously occurring in a laboratory colony of *Anopheles stephensi* Liston. Mosquitoes of this genotype express *colorless-eye* at the larval, pupal and adult stage.

INTRODUCTION.

Because of the resurgence of malaria, research is being directed toward the genetics of *Anopheles stephensi* Liston, a major vector of malaria. A mutant with white-eye color has been isolated from our laboratory colony. In addition to the phenotypic expression of this mutant in eye, the body color is also reduced so that individuals can be distinguished from wild type larvae as early as in the 2nd instar, with the naked eye. Eye-color mutants provide an easy and workable expression in genetic studies and have been reported in several mosquito species (Gilchrist and Haldane 1947, Wild 1963, Iltis et al. 1965, Barr and Meyers 1966, Bhalla 1968). A white-eye sex linked mutant in *An. stephensi* var. *mysorenis* has been reported by Aslamkhan (1973). We have designated this mutant as *colorless-eye* which is a recessive autosomal. This paper describes the mode of inheritance of this mutant.

MATERIAL AND METHODS

Specimens were collected from Sonepat (Haryana State) in 1973 and reared following a procedure evolved at this laboratory. Mosquitoes were held in standard laboratory cages, 30 × 30 × 30 cm in size, and maintained at 27-28°C and 70-80% RH. *Colorless-eye* individuals were observed both in rearing pans and in the adult colony. *Colorless-eye* mosquitoes were isolated and established as pure lines. In genetic crosses, *colorless-eye* mutants and wild eye individuals were used.

RESULTS AND DISCUSSION

Results of genetic crosses are given in Table 1. Results revealed that when *colorless-eye* females (*c*/*c*) were crossed with wild eye males (+/+), F_1 progeny consisted of all wild eye individuals (cross 1). When F_1 progeny of phenotypically wild individuals were inbred the F_2 progeny consisted of 366 wild eye and 140 *colorless-eye* individuals i.e. in a ratio of 3:1 ($\chi^2 = 2.08$ n.s.). In the reciprocal cross (cross 2), 347 wild eye and 125 *colorless-eye* mosquitoes were scored, i.e. again in a ratio of 3:1 ($\chi^2 = 0.48$ n.s.). Backcross of F_1 heterozygous females (+/*c*) from the above cross with *colorless-eye* males (*c*/*c*) produced 212 wild

Table I. Inheritance of *colorless-eye* in *Anopheles stephensi*

Cross No.	Parental phenotype and genotype ♀	♂	Total pupae collected	Eye color of the pupae wild Female	Male	Total	Colorless Female	Male	Total	$\chi^2 = 3.84$ 1, 0.05
1 P	Colorless (*c/c*)	x Wild (+/+)	61	28	33	61	0	0	0	–
FI	Wild (*c*/+)	x Wild (*c*/+)	506	164	202	366	70	70	140	2.08 (n.s.)
2 P	Wild (+/+)	x Colorless (*c/c*)	270	132	138	270	0	0	0	–
FI	Wild (+/*c*)	x Wild (+/*c*)	471	174	173	347	61	64	125	0.48 (n.s.)
3	Wild (+/*c*)	x Colorless (*c/c*)	444	122	90	212	122	110	232	0.9 (n.s.)
4	Colorless (*c/c*)	x Wild (+/*c*)	1017	270	234	504	274	239	513	0.08 (n.s.)
5	Wild (+/*c*)	x Wild (+/+)	605	307	298	605	0	0	0	–
6	Wild (+/+)	x Wild (+/*c*)	150	67	83	150	0	0	0	–

type and 232 *colorless-eye* individuals (cross 3) i.e. in a ratio of 1:1 ($\chi^2 = 0.09$ n.s.). In a cross where heterozygous F_1 males (+/*c*) were crossed with homozygous *colorless-eye* (*c*/*c*) females, again a ratio of 1:1 was obtained i.e. 504 wild type and 513 wild type and 513 *colorless-eye* individuals ($\chi^2 = 0.08$ n.s.). In crosses 5 and 6 where heterozygous (+/*c*) F_1 progenies were crossed with wild eye (+/+) mosquitoes, all progenies were of wild type. Absence of mutant phenotype in F_1 progeny of crosses 1 and 2 suggests that it is a recessive mutant. *An. stephensi* has the X and Y sex determination mechanism (Aslamkhan 1973), therefore sex-linked recessive mutants express in the hemizygous (*c*/-) condition in males. But in cross 1 where females were of mutant phenotype i.e. homozygous for mutant gene *c*, there were no males with *colorless-eye* in F_1 progeny suggesting that it may not be a sex-linked mutant. This is further supported by free segregation of *colorless-eye* with sex observed in F_2 progeny of all crosses indicating that it is an autosomal mutant. As this gene has complete penetrance without any variable expression, it could be used as a good phenotypic marker in any genetic studies.

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References Cited

Aslamkhan, M. 1973. Sex-chromosomes and sex-determination in the malaria mosquito, *Anopheles stephensi*. Pak. J. Zool. 5: 127–130.

Barr. R. A. and C. M. Myers, 1966. Two spontaneous mutant of *Culex tarsalis*. Proc. Entomol. Soc. Wash. 68: 49–52.

Bhalla, S. C., 1968. White-eye, a new sex-linked mutant of *Aedes aegypti*. Mosquito News 28: 380–385.

Gilchrist, B. M. and J. B. S. Haldane, 1947. Sex linkage and sex determination in a mosquito, *Culex molestus*. Heriditas 33: 175–190.
Iltis, W. G., A. R. Barr, G. A. H. McClelland and C. M. Myers, 1965. The inheritance of yellow larva and ruby eye in *Culex pipiens*. Bull Wld Hlth Org. *33*: 123–128.
Wild, A. 1963. A red eye color mutant in *Culex pipiens* after X-irradiation. Nature 200: 917–918.

DIEL PERIODICITY OF BLOOD FEEDING IN THE MOSQUITO *CULISETA INORNATA* IN THE COACHELLA VALLEY OF SOUTHERN CALIFORNIA

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ABSTRACT. The diel periodicity of blood feeding by *Culiseta inornata* was observed during two 3-night periods, once in December 1975 and again in March 1976. Counts of blood feeding females were taken from a tethered Holstein calf employed as bait. Blood feeding activity in the December study consisted of 2 broad peaks: the first at dusk, followed by a second peak half way through scotophase. In the March 1976 study a single sharp peak of blood feeding activity was observed at dusk. No blood feeding occurred after sunrise during either the December or March study.

INTRODUCTION

Culiseta inornata (Williston) is widely distributed throughout North America, ranging from the tablelands of Mexico in the south (Owen 1942) to the Yukon and Northwest Territory of Canada in the north (Carpenter and LaCasse 1955). In the Colorado Desert of California, which includes the Coachella, Imperial and Palo Verde Valleys, this species is abundant during the fall, winter and early spring (Apperson et al. 1974).

Feeding preference studies of *Cs. inornata* have shown bovines and equines to serve as the principal blood hosts, though dog, pig, man and rodent may occasionally be fed upon (Anderson et al. 1967, Tempelis et al. 1967, Gunstream et al. 1971, Edman et al. 1972, Tempelis 1975).

During the course of a 2-year study of the ecology of *Cs. inornata*, in the Coachella Valley, certain other questions arose regarding this mosquito's biting behavior. As a result, a study was undertaken to determine (1), the time(s) of the diel in which blood feeding activity occurred, and (2), whether or not any type of periodicity was associated with such activity.

MATERIALS AND METHODS.

These studies were conducted in the Coachella Valley of southern California on 2 separate occasions: December 1975 and March 1976.

The same bait, a yearling Holstein calf, was employed during both studies. To observe mosquito feeding activity upon this animal a procedure was employed whereby the investigators' presence was required for only short periods of time. The procedure consisted of the following: 1) The calf was tethered to a stake in an open area and supplied with copious

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