since the lack of air movement indoors prevented the drying of laundry.

When the EVS mosquito trap was employed inside a farm building where the unscreened windows were always open (Table 1), the numbers of female *Cx. quinquefasciatus* were double that of males indicating the chicken was a food source.

On the farm premises this species was noted resting in dimly lit areas during the day. Larvae (1-2/dip) were found in irrigation canals on the farm that had previously been treated with petroleum oil. Larvae were not found in ponds built for the maintenance of fish.

Populations of *Cx. quinquefasciatus* in the city of Guangzhou reach their highest population level from January to March, then their population declines from May through July during the season of the rains before a second subpeak is reached between September and November. The recent and vigorous on-going construction activities in the Guangzhou area of China are believed to be a factor contributing to higher mosquito populations. Activities underway by the Health and Anti-Epidemic Station of Guangzhou to reduce mosquito numbers consist of the elimination of standing water and the leveling of ground depressions that can fill with water in the future and constitute larval breeding sources; the use of mosquito fish in areas where permanent water exists and spraying petroleum oils in areas that are unsuitable for fish production. The insecticide dichlorvos is sprayed indoors in domiciles as an adulticide.

One specimen of *Aedes albopictus* Skuse noted resting on a farm pillar near lactating dairy cattle on May 22 was the only other species of mosquito observed during this period. Numbers of this species can be considerably reduced when breeding occurs in artificial containers as was the case during the Fushan epidemic of dengue in 1978 (Luh and Zhu 1983). They noted however, that *Ae. albopictus* breeds in cut bamboo stems which are widespread wherever bamboo is growing in southern China. Cut bamboo poles were in great demand particularly for use in the expanding building industry. Ideally bamboo poles should be cut at the upper edge of nodes so a hollow is not formed that can fill with water during rainy periods and support populations of *Ae. albopictus.*

The house fly, *Musca domestica vicinae,* considered a major economic pest in many of the northern areas of China according to Pal (1982), is also increasing in importance as a pest in Guangdong Province. Both house flies and the Norway rat reach peak abundance from February to April in the city of Guangzhou. The authors also noted that house flies were pests on dairy and poultry farms outside of the city. Numbers of house flies on a herd of lactating dairy cattle on the S.C. dairy farm averaged 19.3 flies/cow when counts were made on 15 animals within a period of 5 minutes on May 31.

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GENETIC SEXING IN *ANOPHELES STEPHENSI* USING DIELDRIN RESISTANCE

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The efficiency of insect control programs involving the release of sterilized insects can be greatly increased if a genetic sexing system is incorporated into the mass rearing (Robinson 1983). For malaria vectors in which females are responsible for disease transmission, elimination of females prior to release has a much higher priority. *Anopheles stephensi* Liston is an important malaria vector in the Indian subcontinent and has been the subject of many genetic studies with the aim of developing genetic control techniques (Sakai et al. 1983). However, attempts to produce an efficient genetic sexing system in this species have failed despite repeated attempts (C.F. Curtis, personal communication; Lines and Curtis 1984). This paper reports the production of such a strain using dieldrin resistance and a male-linked translocation. Similar systems have been constructed in other malaria vectors (Seawright et al. 1978, Baker et al. 1981, Curtis et al. 1976, Curtis 1978).

In *An. stephensi* dieldrin resistance is coded for by a gene located on linkage group 3 (Akhtar et al. 1982) probably on 3L (Sakai et al. 1983) and DDT resistance, (unrelated to pyre-

throid resistance) is controlled by a single gene also on chromosome 3 (C. Malcolm, personal communication). These two resistance genes were combined into a single strain and this strain was used as a target population for the induction of male-linked translocations. Males of the DDT and dieldrin resistant line were irradiated with 5 krad of X-rays and crossed to susceptible females. Backcross progeny descending from semi-sterile families were retained and reared to F_2 adults. The F_2 adults were inbred and large numbers of F_3 fourth instar larvae were exposed to discriminating doses of both insecticides, 5 ppm DDT and 0.15 ppm dieldrin for 24 hours. The surviving larvae were checked for sex, and families showing a strong sex ratio distortion in favor of males were retained. In total 216 semisterile F_3 families have been checked resulting from 2,430 F_1 ovipositions. Several lines were retained, amongst them T(Y-D1)35 which shows extremely close linkage between the male determining chromosome and dieldrin resistance. The history of this line is as follows. In the F_3 generation the line was checked only for linkage to DDT as there were not sufficient larvae for a dieldrin test. The line was inbred again at the F_4 and the F_5 larvae exposed to 0.15 ppm dieldrin and only male pupae survived the treatment (see Table 1). The line was retested at generations 7, 8 and 10 with a total of 7,489 larvae being exposed to discriminating doses of dieldrin of which 3,219 survived. From these only 11 female pupae were produced none of which emerged (Table 1) and 3,208 male pupae. The line has now been reared to the 18th generation in very large numbers without any sign of loss of the linkage between dieldrin resistance and the male sex.

Following the treatments in the F_5 and F_7 generations with 0.15 ppm dieldrin it became clear that the insecticide treatment was affecting emergence of the male pupae with approximately 20% mortality associated with emergence. A lower dose of dieldrin (0.1 ppm) was then used in order to try to reduce this mortality, without success and experiments with 1st instar larvae did not provide good discrimination. Subsequently a simple practical technique has been developed in which newly emerged mosquitoes are exposed to dieldrin coated paper (Robinson and Lap unpubl. results). This latter technique is now being used to produce males for release into large laboratory populations.

Testes preparation have demonstrated the presence of a multiple translocation involving all three chromosomes (Robinson and Lap unpubl. results). Males carrying the multiple translocation exhibit a high degree of sterility (Table 2). There appears to be some reduction in larval survival perhaps indicating that duplication/deficiency zygotes were surviving to the larval stage and there expressing lethality. Presence of the translocation was not associated with any effect on sex ratio.

This strain has several possible uses, including 1) the production of males for sterilization and release, 2) the production of translocation carrying males for release, and 3) the manipulation of insecticide resistance genes in populations following the release of males. As this line is susceptible to malathion, release of males into a malathion resistant population could introduce susceptibility into the population. Malathion resistance in *An. stephensi* has been clearly demonstrated in field populations in

Table 1. Effect of dieldrin on 4th instar larvae of line T(Y-D1)35 in *Anopheles stephensi*.

Generation	Dieldrin dose (ppm)	Total no. exposed	Total (%) died	Surviving pupae ♂	Surviving pupae ♀	Percent recombination
F_5	0.15	50	23 (46.0)	27	0	0.0
F_7	0.15	350	216 (61.7)	133	1	0.746
F_7	0.10	600	363 (60.5)	236	1	0.422
F_8	0.10	2467	1254 (50.8)	1210	3	0.247
F_{10}	0.15	2005	1265 (63.1)	738	2	0.270
F_{10}	0.10	2017	1149 (56.7)	864	4	0.461
Total		7489	4270 (56.9)	3208	11	0.342

Table 2. Fertility and sex ratio of males and females from the T(Y-D1)35 line in *Anopheles stephensi* when outcrossed to Lahore individuals.

Strain and sex	No. mated	No. eggs/♀ ± S.E.	% egg hatch ± S.E.	% larval survival ± S.E.	♂	♀
T(Y-D1)35	12	116.8 ± 12.1	22.1 ± 0.7	65.9 ± 3.5	102	99
T(Y-D1)35	12	112.8 ± 9.6	94.3 ± 0.7	85.2 ± 1.7	547	547

Pakistan (Roland 1985). In this system dieldrin is used to sex the population but malathion resistance is the target for dilution. Laboratory studies will be carried out to test this principle. Detailed studies in cytology, linkage data and alternative insecticide treatments will be presented elsewhere.

This research is financially supported by the Dutch Ministries of Agriculture and Fisheries, Developmental Aid and Science Policy and forms part of a collaborative programme between the Research Institute ITAL and Departments of Parasitology in Amsterdam, Nijmegen and Leiden. Wim van den Brink, Angela Heemsherk, Pieternel Mali and Gijs Schelling are thanked for the team effort.

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CACHE VALLEY VIRUS FROM *AEDES SOLLICITANS* IN NEW JERSEY[1]

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Mosquito-borne viruses of the Bunyamwera serogroup (Bunyaviridae: *Bunyavirus*) have been implicated as the causative agent of disease in man on four continents (Berge 1975). In Africa, Bunyamwera, Germiston and Ilesha have been associated with febrile illness often accompanied by a rash. In Europe, Calovo, a strain of Batai, was serologically associated with fever cases. In South and Central America, Guaroa and Wyeomyia have been isolated from patients with fever. In North America, a patient in Indiana with encephalitis showed a diagnostic rise in titer of Tensaw antibody (McGowan et al. 1973). Tensaw virus has been reported from the southeastern United States, but not Indiana. Cache Valley virus (CV), a serologically related virus, is recognized from much of the rest of North America, including the Midwest. This note reports the isolation of CV virus from *Aedes sollicitans* (Walker) in New Jersey.

During 1982, 12,606 *Ae. sollicitans* collected in southern New Jersey were tested in suckling mice for eastern equine encephalomyelitis virus (Crans et al. 1986). Cache Valley virus was isolated from 10% of the pools tested from Cape May County; the minimum field infection ratio was 1:900. All infected pools contained 100 (except one with 38) nonblooded adult female *Ae. sollicitans*. The positive pools were collected between September 13 and October 7. The isolates were identified by complement-fixation and neutralization tests.

The association between CV virus and *Ae. sollicitans* has been demonstrated in the field and in the laboratory. Cache Valley virus has been recovered from this species in Virginia (Buescher et al. 1970) and New York State (Srihongse et al. 1980). Yuill and Thompson (1970) demonstrated that *Ae. sollicitans* could be infected by feeding on as little as 0.3 BS-C-1 cell ID50; the ID50 for this species was calculated as 23 TCID50. They were able to transmit the

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