EFFECT OF SPACED RELEASES ON THE EFFICIENCY OF CHEMOSTERILIZED MALES OF *CULEX FATIGANS*

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ABSTRACT

Chemosterilized males were released at various intervals of up to 4 days to determine their relative efficiency in introducing sterility into a natural population of *Culex fatigans* Wiedemann. The results of outdoor cage studies indicated that regardless of the release interval, the same degree of sterility resulted when the total numbers of sterile males being released into normal populations were equal. By releasing at more than 1-day intervals, a larger area can be covered in a sterile male release with less time and manpower than if daily releases were necessary, providing rearing and sterilizing are not the limiting factors.

The use of sterile males to control mosquitoes has gained world wide attention in the past few years with the successful use of the sterile male technique to control small indigenous populations of both *Culex* and *Anopheles* (Laven 1967, Patterson et al. 1970, Lofgren et al. 1974). However, if large areas were to be involved it might not be practical to make daily releases because of limitations in manpower and in the number of insects produced. If releases could be made at less frequent intervals with no adverse effect on the overall degree of sterility being interjected into the indigenous population, it would have certain inherent advantages in a control program.

METHODS AND MATERIALS

To test the effects of release schedules a series of release studies in field cages (8 m^3) were made with chemosterilized *Culex fatigans* Wiedemann. The total number of sterile and normal males released were the same, however, the number of sterile males released on different days was varied in the different cages. The basic design is shown in Table 1.

The releases were conducted for 12 consecutive days and replicated twice, once in the spring and again in the fall.

All the insects used in these studies were reared in the laboratory by the technique described by Singh et al. (1972) and sexed in the pupal stage by the method developed by Sharma et al. (1972). The males to be sterilized were placed as pupae 2-26 hr old in a 0.6% tris (1-aziridinyl)phosphine sulfide (thiotepa) solution for 3 hr, then rinsed twice with tap water. The untreated males and females were of the same sibling group as the treated males. The pupae were placed in pans in the field cages located in a shaded area on the grounds of the WHO/ICMR Research Unit in New Delhi, India.

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TABLE 1. DESIGN OF *Culex fatigans* STERILE MALE RELEASE TEST.

	Number of insects being released/day					
	Normal		Sterile Males			
Day	Male	Female	Cage A	Cage B	Cage C	Cage D
1	500	500	500	1,000	1,500	2,000
2	500	500	500	0	0	0
3	500	500	500	1,000	0	0
4	500	500	500	0	1,500	0
5	500	500	500	1,000	0	2,000

Both young chickens and fresh solutions of 1% glucose as nutrient sources were placed in each cage for the duration of the study. A week after the releases were started, an oviposition medium consisting of 1% fermented yeast water infusion in a clay pot was introduced into each cage. Egg rafts were collected daily from the 8th to 26th day from each cage, placed individually in 5 dr vials containing a small volume of water and held for 3 days to observe for hatch. An egg raft was considered to be sterile if there were less than 4 larvae present, since the thiotepa exposure produced an average of $99 \pm 1\%$ sterility in the males.

RESULTS AND DISCUSSION

Based on an equal sterile to normal male ratio, if the males were competing equally then half of the eggs rafts should be sterile. Since we released a standard number of normal males daily but varied the number and release schedule of sterile males, the sterile:normal male ratio would vary from day to day, as daily mortalities in the caged population influenced the number of survivors from day to day. Daily mortality rates for *C. fatigans* in the field may often be as low as 10-20% during favorable conditions, based on field data collected by Rajagopalan et al. (1972). They also found it to be much higher during most of the year, therefore, we assumed a 33.3% daily mortality. Theoretically, then, if the males are competing equally on the first day of release the sterile:normal male ratio would be 1500:500 (3:1) which should give 75% sterility. On day 2 with the 33.3% daily mortality, the ratio would be 1000:833 which should give 54.5% sterility, and on day 3 the ratio would be 666:1055 giving 39% sterility, etc., with an average of 50% sterility being interjected into the static population over a period of time. A simple formula for this effect on a static population would be the ratio of Nx of normal males to $\frac{\Sigma Nx}{2}$ of the sterile males when they are released on alternate days. For releasing every third day it would

be $\frac{\Sigma Nx}{3}$ The overall average of all the ratios from any of these releases should be equal to the overall average from any of the other releases. The formula terms are defined as follows:

ΣNx = Total number of insects in the population on day x.

$\Sigma Nx = No\ (S^1 + S^2 + S^3 - - - + S^x)$

No = Number of adults eclosing into a population each day; in this study it would be 500 for the normal males.

S = Daily survival rate; for this study it was theoretically 66.67%.

Nx = Number of No surviving on day x.

Theoretically, if the sterile males survive and compete equally, spacing of releases of a few days could be made without affecting the results. Our daily sterility fluctuated ±10%; however, this was probably due more to oviposition patterns caused by the weather than to the releases. When averaged over a 2-wk period for the 2 releases, sterility was 44% when the males were released daily, 48% when released every 2nd day, 44% when released every 3rd day and 49% when released every 4th day. Apparently there was some reduction in competitiveness as indicated by less than 50% sterility, but it was not more pronounced in any of the interval releases. Therefore, it appears that none of the release intervals adversely affected the degree of sterility being induced into the population.

Thus, in an experimental release program cost for weekend work could be avoided; also the area of release could be larger since the number of sterile insects or the sterilizing technique itself would be the major limiting factor, rather than the timing of the releases.

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