OBSERVATION ON THE EFFECTS OF RELEASING STERILE SCREW-WORM FLIES IN NORTHERN VERACRUZ, MEXICO

by

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Screew-worms [*Cochliomyia hominivorax* (Coquerel)] have been successfully eradicated from the southeastern part of the United States through the release of sterile male flies. Both natural and regulatory barriers help prevent the reintroduction of screw-worms into this area. In the present eradication program in the Southwestern States, the reintroduction of screw-worm flies must be prevented by the continuous release of sterile flies over extensive areas in northern Mexico. The purpose of this field test was to obtain more information on the most efficient aerial methods of releasing sterile flies consistent with adequate control of native screw-worm populations in such barrier zones.

Baumhover et al. (1959) reported 70% sterile egg masses after 3 months from a weekly release of 500 sterile males per square mile dispersed from aircraft in 1-mile swaths. In this test conducted over a 2000-square-mile area in Florida, 6-mile flight lanes were flown on alternate days to obtain the weekly coverage. Screw-worms had previously been eradicated from the island of Curacao through the release of 400 sterile males per square mile per week. Since population control and not eradication is the primary objective in barrier zones, a knowledge of the effects of releases of minimum numbers of sterile males dispersed in wide swaths is desirable. In this test, sterile flies were released at the rate of 200 males per square mile per week on invariable 8-mile flight lanes over a 2000-square-mile area in northern Veracruz, Mexico. The test was conducted for 3 months during the summer and fall of 1964.

Procedure

Northern Veracruz was selected as an experimental area because environmental conditions appeared favorable for screw-worm activity, and it was far enough away from present release areas in northern Mexico to prevent the ingress of sterile-mated native or released flies. The center of the release zone was 3 miles west of Poza Rica. The zone was bounded on the east side by the Gulf of Mexico and on the west side by the first uplift of the Sierra Madre Oriental Mountains.

The terrain varied from a narrow strip of coastal plain on the east side to rolling hills less than 200 meters above sea level in the central part. The steeper hills on the western side rose to altitudes of more than 200 meters. Much of the original tropical forest has been cleared for pastures or groves of citrus and bananna plants. Patches of original vegetation remain along some of the water courses and on the hill tops.

Most of the ranches are small, cross-fenced, and stocked almost exclusively with Zebu or Zebu-Brown Swiss cross cattle. Other domestic animals found in the area included horses, pigs, and a few small, well-tended flocks of sheep and goats. Most of the sheep were found in the higher northwestern part of the experimental area. According to reports from the ranchers, rabbits, coyotes, and opossums are not uncommon in the area, but deer are scarce.

The climate of northern Veracruz, by Thornthwaite's classification, is hot and humid. According to meterological reports, the rainfall this year during August, September, and October was 50 to 75% below normal in the release area. This reflects the general drought which probably reduced screw-worm populations in all of northern Veracruz and southern Tamaulipas. However, the distribution of the rains in the experimental area also affected the local distribution of screw-worm flies in the vicinity of the sheep pens.

The screw-worm flies used in these releases were reared, irradiated, and dispersed by previously described techniques (Graham and Dudley 1959, Baumhover et al. 1959). Six flight lanes, 8 miles apart and 50 miles long were used as guides in releasing the sterile flies. The same flight lanes were used throughout the experiment. The first release was made on August 11, 1964, and 10 subsequent releases were made at 7-day in-

tervals until October 27, 1964. An off-schedule release was made on August 16, and no release was made during the week of September 26 to October 2.

Estimates of screw-worm activity were made from egg masses collected from pens wounded sheep. The percentages of sterile egg masses in these collections were used to estimate the effects of the fly releases. Eleven animal pens were set up during the period from July 27 to August 10. The pens were located at known distances from the flight lanes in the following pattern:

Distance from flight lane (miles)	Pen No.
0	1, 3
1	4, 10
2	2, 5, 9
4	6, 7
control	11

Each pen was stocked with 3 sheep, and an effort was made to keep one animal infested with screw-worms and a second with a recently infested open wound at all times. The wounds were examined for egg masses daily except Sundays. All collected egg masses were held on moistened paper in small plastic petri dishes for 24 hours to allow all the fertile masses to hatch. Those masses which failed to hatch in 24 hours were held an additional 12 hours before determination of sterility was made.

Results

Weekly egg mass collections from all the sheep pens are given in Figure 2. The decline in collections from August 24 to September 11 coincided with a period of hot, dry weather. A heavy general rain fell on September 28, and the first cold front of the season passed through on October 5. A decided increase in screw-worm activity was noted after

the general rain. The first peak of screw-worm activity occurred during the week ending August 7, and a second peak occurred during the week ending October 30. It is not known whether the summer decline in activity is typical of this area of whether it occurred this year because of the abnormal lack of rain. Egg mass collections were below the expected levels at all the pens. Most of the cattle in the area are treated for ticks at 2-week intervals and are seen frequently by ranch workers. Natural wounds from thorny brush are much less common in this part of Veracruz than in the more arid northern states. The scarcity of egg masses during the test was perhaps attributable to good husbandry practices, lack of natural wounds, and unfavorable weather.

The weekly percentages of sterile egg masses collected from all the pens along with the dates of the sterile fly releases are also given in Figure 2. The highest percentage of sterile egg masses was obained during the week ending October 2. After the peak of 68% sterile masses the percentages of sterile masses declined as total collections increased. No release was made during the week ending October 2. However, the effects of this omission cannot be assessed owing to the concurrent general increase in screw-worm activity.

Since all the pens were located at known distances from the flight lanes, this allowed for comparisons of percentages of sterile egg masses collected from pens at 0, 1, 2, and 4 miles from the lines of release. These data for the period from August 29 to November 6 are given in Table 1. No real differences attributable to distance from the release line could be demonstrated among the pens.

Percentages of sterile egg masses from pens within 5 miles of the center of the release zone were compared with those from pens located 6 to 12 miles from center and from pens 13 to 20 miles from center. These data for the same period are given in Table 2. No real differences attributable to distance from the center of the release zone could be demonstrated among the pens.

The local distribution of the screw-worm populations, as sampled by daily egg mass collections, is shown in Figure 3. Pens 1, 2, and 10 were located on the eastern side of the release zone. This area was isolated from reinfestation on the east side by the Gulf of Mexico and partially isolated on the north side by an area of extreme drought. The latter was confirmed by meager egg mass collections from 2 unlisted pens in

that area. One unlisted pen was operated on the south side of the zone, but it yielded only 4 egg masses during a 3-week period ending October 16. No rain fell in the vicinity of Pens 1, 2, and 10 until September 28. Pens 3, 4, 5 and 9 were in the foothills on the western side of the zone. These areas near the mountains received 3 more rains during August and September than the lower eastern pens. Pen 7 was not in the foothills, but it also received the rains. The period from August 29 to November 6 included the 2 major seasonal fluctuations in screw-worm populations during this experiment. During this period, an average of 43.1 egg masses per pen was collected from pens 3, 4, 5, 6, 7, and 9 as compared to an average of 9.6 egg masses from pens 1, 2, and 10. The percentages of sterile egg masses were 25.8 in the former group and 62.0 in the latter. Thus comparisons made between groups of pens without regard to the local distribution of the native population are of doubtful value.

Eight fly traps were operated at 4 sheep pens 0, 1, 2, and 4 miles from the lines of release from October 19 until December 1. The catches of native and sterile female flies up to November 19 are shown in Figure 4. After the last release on October 27, sterile flies outnumbered native flies at all 4 stations for 10 days. Native flies outnumbered sterile flies at all the stations by November 14. On November 19, 23 days after the final release, only 2 sterile flies were recovered. During the trapping period 21 fertile egg masses were collected from the 1-mile pen along with 16 from the 4-mile pen. No sterile masses were collected from either pen after October 24. This may indicate a lack of correlation between the local distribution of sterile female flies and the percentages of sterile egg masses expected, of the inability of the sterile males to successfully compete with native males with these population ratios.

Discussion

Promising results were obtained with an 8-mile swath width and a release rate of 400 flies per square mile per week in an area of low screw-worm populations partially isolated from areas with large population centers. Persistent population centers in more favorable environments possibly sustained by flies dispersing in from outside the release zone were not controlled. It is expected that in the latter situation less

than 40% of the native female flies would mate with released males even under locally unfavorable environmental conditions. This percentage is not sufficient to prevent population increase upon the return of favorable conditions.

Table 1

PERCENTAGES OF STERILE EGG MASSES COLLECTED AT 0, 1, 2, AND 4 MILES FROM THE RELEASE LINE (8/29 TO 11/6/64)

Distance (miles)	Pen Number	No. Egg Masses Fertile	Sterile	Percent Sterility
0	1	2	12	
	3	34	12	
Total		36	24	40
1	4	35	2	
	10	5	2	
Total		40	4	9
2	5	18	10	
	2	4	4	
	9	33	17	
Total		55	31	36
4	6	47	12	
	7	25	14	
Total		72	26	27

Table 2

PERCENTAGES OF STERILE EGG MASSES COLLECTED AT VARIOUS DISTANCES FROM THE CENTER OF THE RELEASE ZONE (8/29-11/6)

Pen Number	No. Egg Masses Fertile	Sterile	Percent Sterility
Pens Within 5 Miles of Center			
9	33	17	
4	35	2	
10	5	2	
Total	73	21	22
Pens Within 6 to 12 Miles of Center			
2	4	4	
5	18	10	
6	47	12	
Total	69	26	27
Pens Within 12 Miles of the Edge of the Release Zone			
1	2	12	
3	34	12	
7	25	14	
Total	61	38	38

RESUMEN

Observaciones sobre los efectos de liberar moscas estériles de "gusano barrenador del ganado" en el norte de Veracruz, México

Moscas estériles de gusano barrenador del ganado o gusano tornillo [*Cochliomya hominivorax* (Coquerel)] fueron liberadas a razón de 200 machos por milla cuadrada por semana, en una franja invariable de vuelo de 8 millas, sobre un área de 2000 millas cuadradas en el norte de Veracruz. Las liberaciones se efectuaron de agosto a octubre 1964. Las estimaciones sobre la actividad del gusano barrenador fueron hechas a partir de masas de huevos colectados en corrales con ovejas heridas; el porcentaje de masas de huevos estériles obtenidos en estas colectas, fue utilizado para evaluar los efectos de las liberaciones de moscas.

Después de un máximo de 68% de masas de huevos estériles, colectado durante la semana que terminó el 2 de octubre, el total de masas de huevos colectado aumentó y el porcentaje de esterilidad bajó al 10%. No se pueden atribuir diferencias reales en los porcentajes de masas de huevos estériles a las diferentes distancias de los corrales con ovejas en relación con las líneas de vuelo, o en relación con el centro de la zona de liberación. Sin embargo, los porcentajes de esterilidad eran consistentemente bajos en áreas con centros persistentes de poblaciones de moscas. Las condiciones climáticas favorables para la actividad del gusano barrenador, así como la llegada de moscas fértiles de fuera de la zona de liberación son considerados como factores importantes en los resultados obtenidos con esta prueba de liberación.

REFERENCES CITED

Baumhover, A. H., C. N. Husman, C. C. Skipper, and W. D. New. 1959. Field observations on the effects of releasing sterile screw-worms in Florida, *J. Econ. Entomol.* 52:1202-6.

Graham, A. J., and F. H. Dudley. 1959. Culture methods for mass rearing of screw-worm larvae, *J. Econ. Entomol.* 52:1006-8.

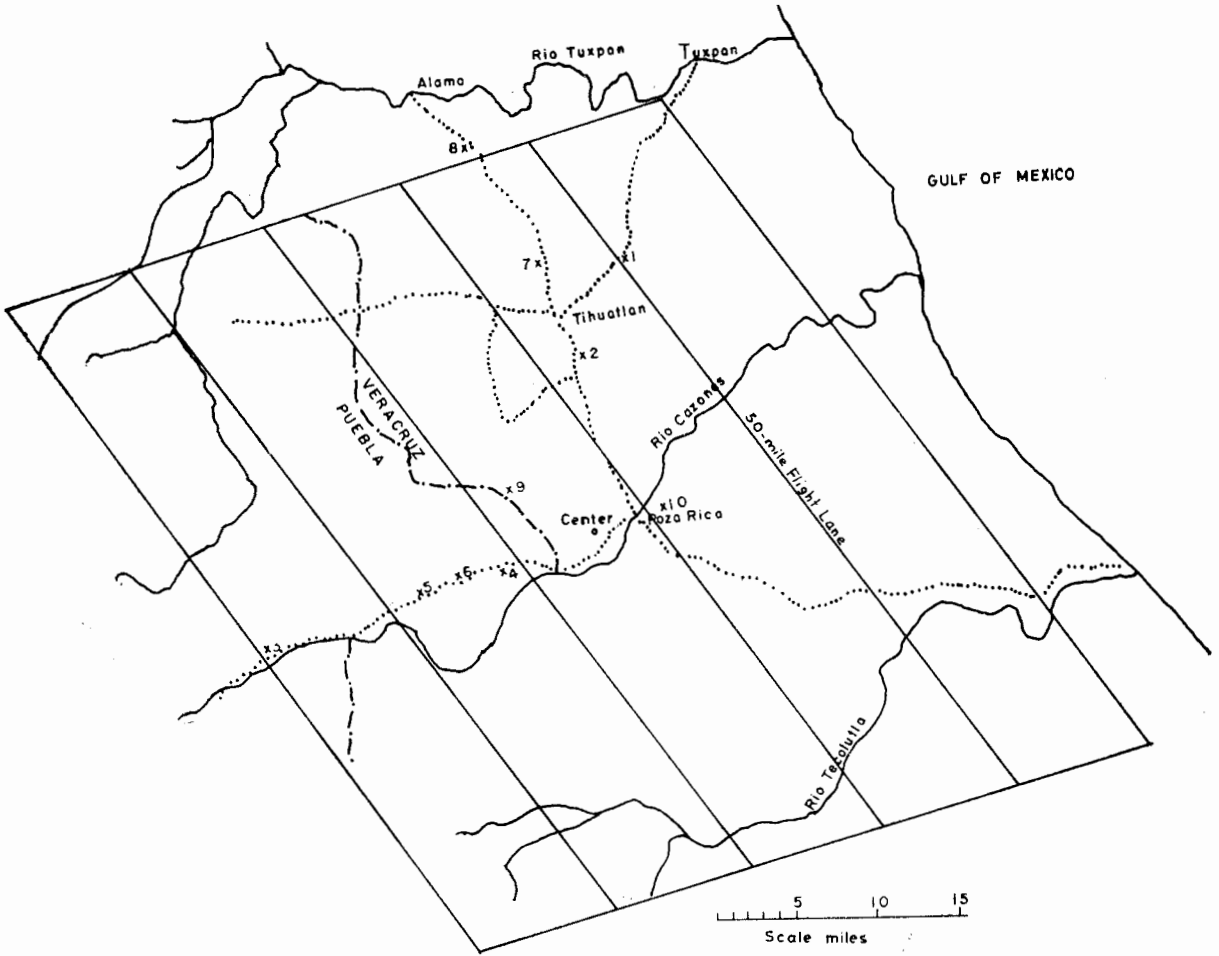

Fig. 1.—Locations of Sheep Pens in the Poza Rica Field Studies.

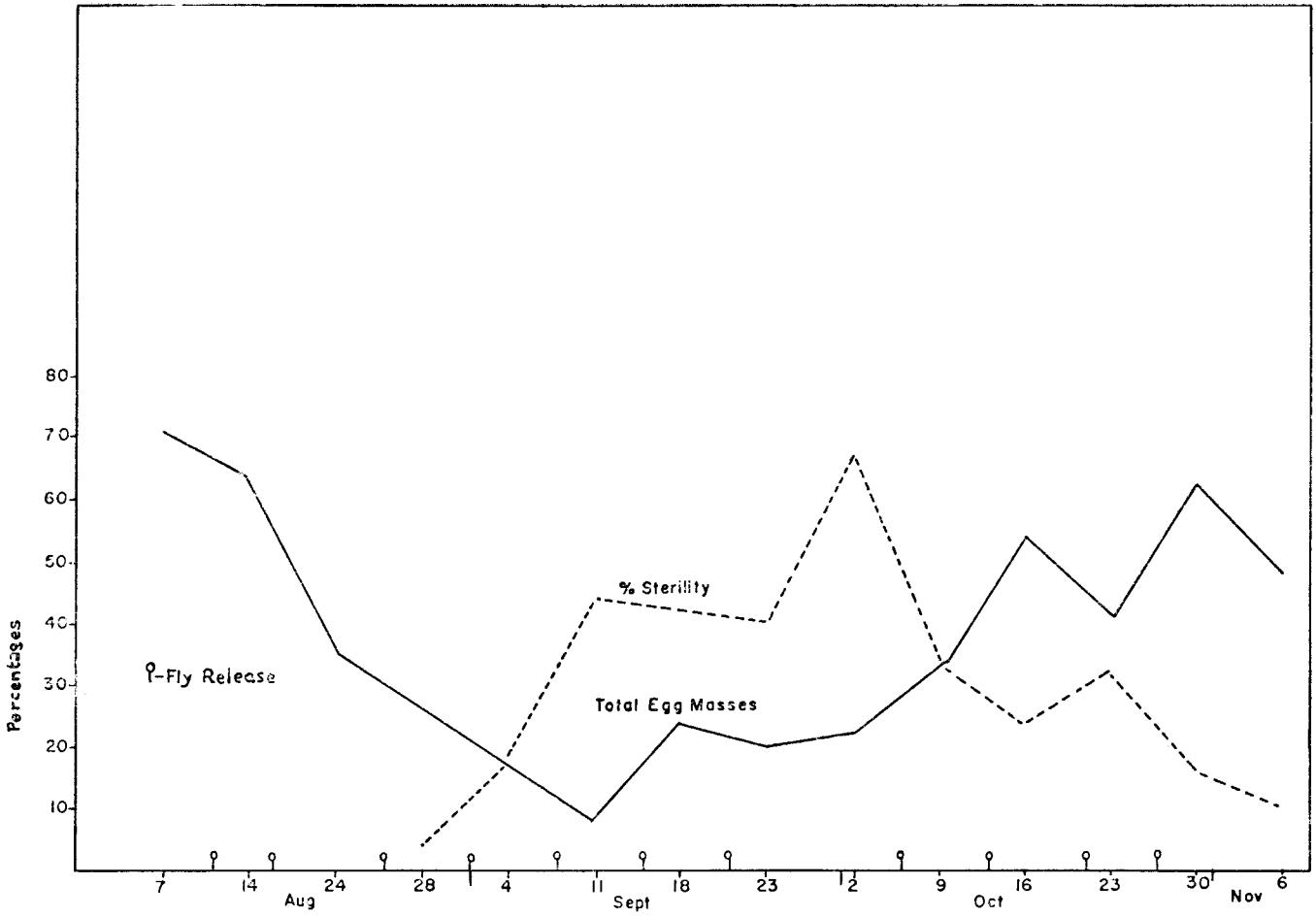

Fig. 2.—Weekly Screw-Worm Egg Mass Collections and Percentages of Sterility From 11 Sheep Pens Near Poza Rica, Veracruz.

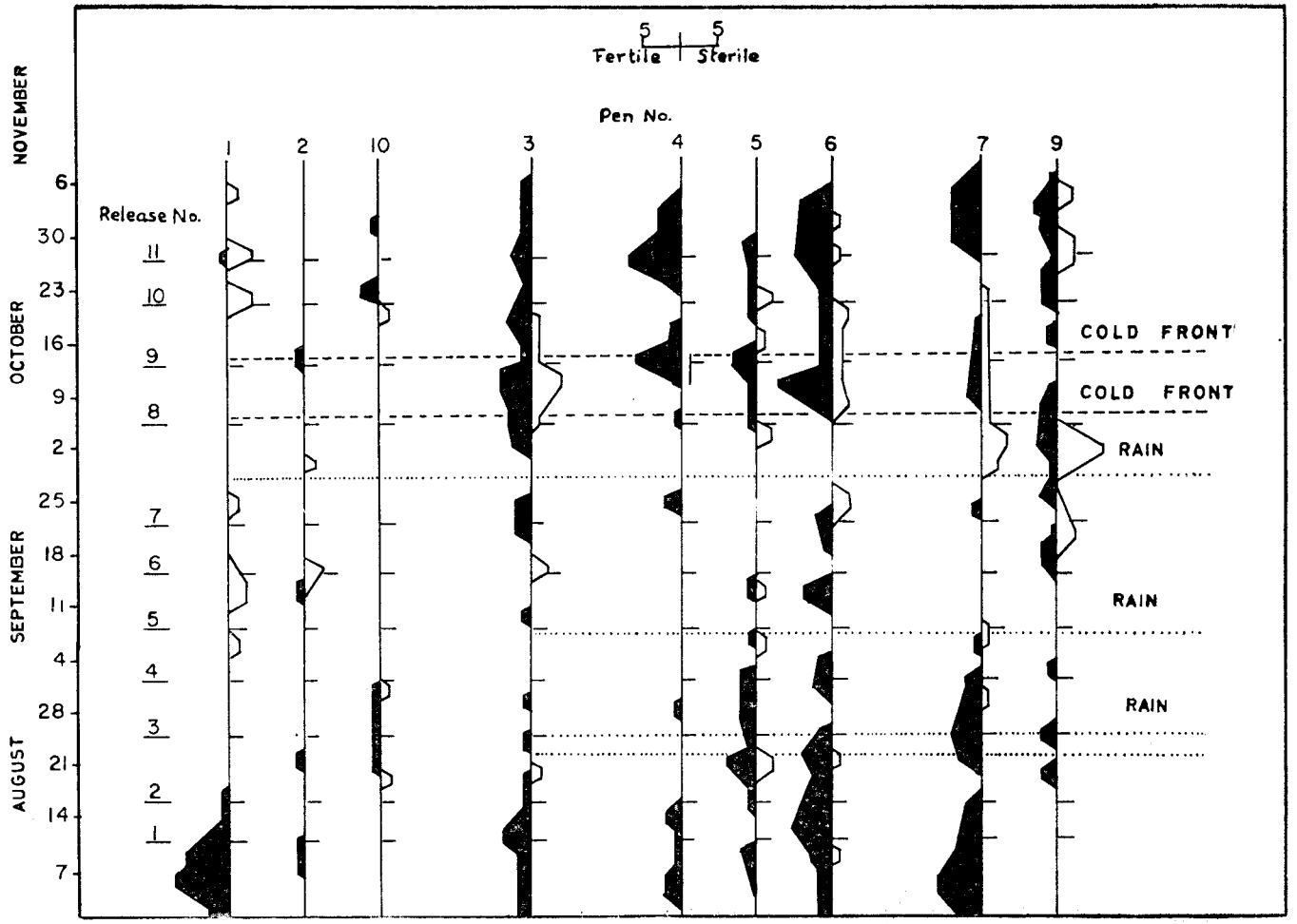

Fig. 3.—Daily Distribution of Fertile and Sterile Screw-Worm Egg Masses From 9 Sheep Pens in Veracruz, Mexico.

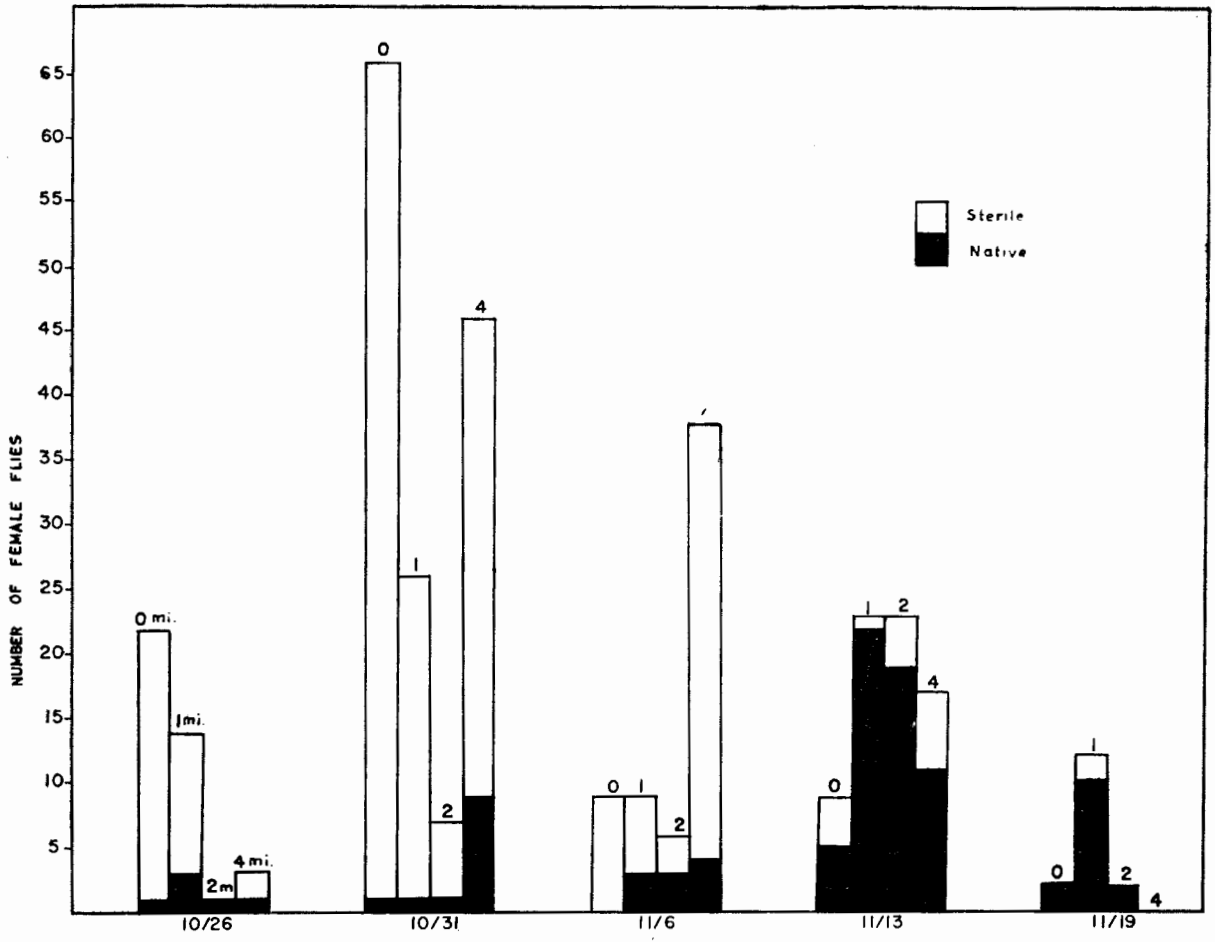

Fig. 4.—Catches of Sterile and Native Female Screw-Worm Flies From 8 Traps at 0, 1, 2, and 4 Miles From the Line of Release.