Evaluating Fly Nuisance Source

flies tagged with radioisotopes used as a field test to establish migratory tendencies of a normal fly population

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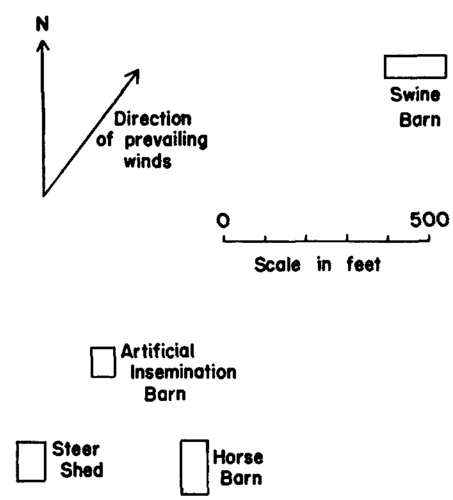
Radioactive tracers were used in a test at Davis—involving four animal barns—to determine the feasibility of identifying a source of a fly nuisance by means of radioisotopes.

The test consisted of isotopic labeling of flies in the steer shed—the only barn with evidence of fly breeding—and observing the appearance of the labeled flies in the nearby artificial insemination, horse, and swine barns.

Labeling and sampling of the various fly populations were accomplished by hanging treated strings from the ceiling of the steer shed. The release of colony-raised and labeled flies was considered undesirable since such flies might have a different behavior from the normal barn population. Also, increasing the barn fly population might alter the migratory tendencies of the flies.

Ten strings, each 3′ long, were soaked in a 5% sugar solution containing three millicuries of radioactive phosphate and then dried under a heat lamp. The terminal few inches of each string were impregnated with paraffin to prevent contact contamination of the barn ceiling

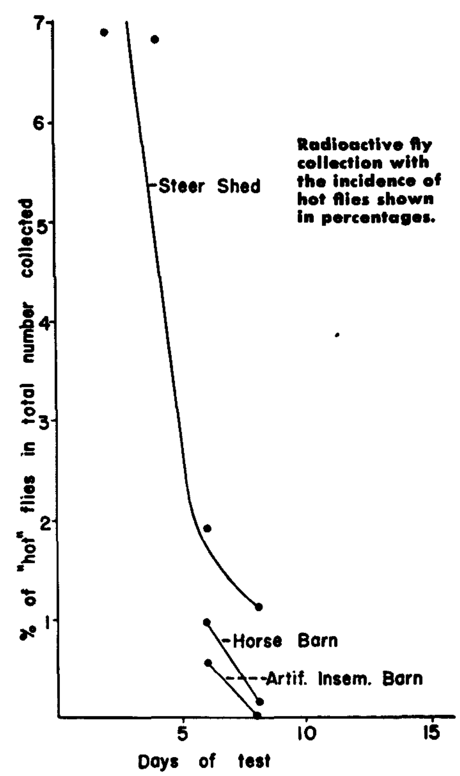


Fly-tracing test area showing locations of the four barns involved in the test.

to which they were attached and also to furnish nonradioactive portions of the strings by which they might be more safely handled. There seems to be no significant contamination resulting from the preparation or hanging of the radioactive strings. Rubber gloves worn in the processes were found to be uncontaminated, and a radiological examination of the areas involved revealed no contamination by materials shed from the strings. However, adequate warning was given to persons in the area during labeling to prevent accidental contact with the strings. External irradiation occasioned by passing near the strings would not be a hazard.

The radioactive strings were stapled by one end to the ceiling of the steer shed. The strings were distributed throughout the shed to offer equal chance of contact to the barn's fly population. The strings were exposed in the steer shed for a period of 24 hours. However, most of the contact with flies occurred during the night hours involved.

Samples of the fly populations were collected from each of the four barns. Strings treated with a sugar-insecticide mixture were hung from the barn ceilings following removal of the radioactive strings. A pan to collect the dead flies was attached to the botttom of each string. An hour's exposure of 10 such strings yielded an adequate sample of about 600 flies.



Radioactive fly collection with the incidence of hot flies shown in percentages.

The dead flies in each sample were sorted into two categories by means of a monitor-type Geiger counter. The flies that caused 200–400 counts per minute were classed as hot. Flies causing less than 100 counts per minute were considered cold.

Soon after the labeling of the flies at the steer shed, 7% of the contained fly population was found to be hot. About one day later, 1% of the horse barn flies and 0.5% of the artificial insemination barn flies were found to be hot. At no time were radioactive flies observed in the swine barn. Since each radioactive fly entering from the steer shed was accompanied by 13 nonradioactive flies from the same source, this indicates that 14% of the flies in the horse barn and 7% of the flies in the artificial insemination barn had originated in the nearby steer shed.

The rate of renewal of the fly population at the steer shed could be estimated by the decreasing incidence of hot flies in the steer shed after the removal of the radioactive strings. On succeeding days, the incidence of labeled flies decreased about 30% per day, indicating that 30% of the steer shed fly population was renewed daily.

The results of this experiment indicate that the isotopic labeling of flies at a breeding site may be useful in determining the contribution of that site toward a fly nuisance existing elsewhere. It is also likely that several breeding sites might be suspect as sources of a particular fly nuisance, and consequently it would be desirable to determine simultaneously their individual contribution toward that nuisance. This could be done by labeling each site with a different isotope.

If the relative sizes of the fly populations at the various sampling sites could be estimated, it would be possible to determine whether or not all avenues of departure of flies from the labeling site were known. Such population estimates might be made from the size of areas involved and the density of fly populations as indicated by the number of flies killed per insecticide-treated string in equal periods of time.

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FLY NUISANCE

Continued from preceding page

If all of the major avenues of departure of flies from the labeling site were known, the sum of the percentage values—the fly population at the labeling site which migrates daily to a particular sampling site—for all sampling sites should be equal to the daily renewal rate for the labeling site. For example, if it is assumed that the fly populations for the horse barn, the artificial insemination barn, and the steer shed were equal at the time of this experiment, then the 14% influx of flies at the horse barn and the 7% influx of flies at the artificial insemination barn would represent a 21% daily loss of the steer shed fly population. Since the daily renewal rate was calculated at 30% per day, this does not account for all of the fly loss from the steer shed. If it is further assumed that the mean life span of flies at the steer shed is two weeks, then a 7% daily loss of the fly population could be attributed to death. Thus 28/30—essentially all—of the flies leaving the steer shed daily would have been detected. This assumption further implies that flies leaving the steer shed are proportionately of all ages.

The results obtained in this test are not subject to general interpretation since in different areas, or in the same area under different weather conditions, they might have been considerably different. This variability of a fly population's migratory tendencies, which is not predictable by standard entomological information, indicates the need for a field test such as this, which can be used when necessary.

The health hazard resulting from the random distribution of the radioactive flies is negligible. If it is assumed that the average labeled fly caused 400 counts per minute on a Geiger counter with 20% efficiency—20% of the total disintegrations are detected—then one microcurie of radioactive phosphorus would be contained by 1,100 labeled flies or by 15,700 flies of the total population if 7% are hot. The human body tolerance for radioactive phosphate—the quantity of the radioisotope which can be borne indefinitely with no ill effect—has been estimated by the National Bureau of Standards to be 10 microcuries. Thus individuals would have to ingest and retain all of the radioactive phosphorus from at least 157,000 of the flies at the labeling site to contain this permissible dose. The relatively short half-life of the isotope used and the fairly rapid mortality of flies also serve to reduce the radiation hazard.

A field test—in the evolution of a fly control program—using this method would depend on the availability of radioactive material, radiation detecting equipment, and technically trained personnel.

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DEER

Continued from page 10

deer are shifting to a summer diet that is primarily browse. Browse plants do not generally provide a suitable habitat for the worm larvae which at most only travel a short distance above the ground level.

When winter rains, which usually start in November, bring up the new growth of grass and herbaceous plants, deer eagerly turn to this protein-rich source of food. With favorable conditions again present, the pastures are soon seeded with worm larvae and the cycle of infection is re-established. Infections of worms produce deleterious effects either by causing direct anemia through their blood-sucking activities or such severe irritation to the walls of the fourth stomach and intestines that cases of scours result. Toxins may also be secreted that further add to the debility of the host and, in the case of lungworms, fatal lobar pneumonia often follows.

Another factor complicating this problem is the transference of many of these species of worms between domestic livestock and deer. On the station alone, twenty species of worms which are common to both sheep and deer have been found.

If a deer survives a worm infection, it builds up an immunity to further infection even though larvae are ingested. Thus older animals usually carry relative few worms. Also there is a direct correlation between the plane of nutrition of the host animal and the effect of the parasites. Well-fed animals can withstand infections much better than those competing for forage on overstocked ranges. In addition, the greater the density of livestock or deer on a range, the greater is the chance for reinfection and the rapid build-up of worm numbers.

Under these conditions, fawns born in the spring usually pick up infections in early winter and with the energy-deficient diet of grass and herbs which they obtain at this season, they often suffer considerable loss. The progressive pattern of fawn losses through the winter of 1951–52 was revealed by herd composition counts. A small proportion of fawns barely survived their first winter but were so weakened that they succumbed as yearlings the following summer.

Because of the fundamental differences in the nutritional basis for malnutrition during the summer—protein shortage—and winter—energy shortage in the forage—records were divided into a summer period of from May through October and into a winter period of from November through April. In certain instances, parasites were very likely the primary mortality factor, but in most cases the underlying cause was probably poor nutrition. Most older deer dying from natural causes were judged to have succumbed either directly to uncompli-

Concluded on page 14

All Losses of Deer May, 1951–April, 1955

Age	Natural Deaths			Accidents			Hunting		Collections		Subtotal		Subtotal		Subtotal		Total	
	M	F	Sex Unknown	M	F	Sex Unknown	M	F	M	F	M	%	F	%	Sex Unknown	%	No.	%
Fawn	91	56	38	7	11	7	0	0	36	21	134	22	88	15	45	8	267	44
1	6	9	0	3	3	0	1	0	8	19	18	3	31	5	0	0	49	8
2	2	4	0	0	0	0	25	0	6	7	33	5	11	2	0	0	44	7
3	5	5	0	0	0	0	34	0	3	6	42	7	11	2	0	0	53	9
4	2	8	0	0	0	0	35	0	1	6	38	7	14	2	0	0	52	9
5	0	8	0	0	2	0	18	0	1	6	19	3	16	3	0	0	35	6
6	1	12	0	0	0	0	16	0	1	4	18	3	16	3	0	0	34	5
7	1	11	0	3	0	0	7	0	1	5	12	2	16	3	0	0	28	5
8+	2	18	0	0	1	0	5	0	0	5	7	1	24	4	0	0	31	5
Unknown	0	5	0	0	0	0	0	0	2	4	2	0	9	0	0	0	11	2
Total	110	136	38	13	17	7	141	0	59	83	323		236		45		604	
Per cent	18	23	6	2	3	1	23	0	10	14	53		39		8		100	