Plant Quarantine in 1928. He has conducted research on insects affecting animals in many sections of the United States. He received his undergraduate and graduate training at Kansas State College. In 1951 he was named director of the southeastern region of the Bureau of Entomology and Plant Quarantine, with headquarters in Gulfport, Miss. He directs regulatory, control, and administrative functions in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee.


Cattle Grubs

Ernest W. Laake, Irwin H. Roberts

Cattle grubs, or heel flies, have been known to man from time immemorial. Few parasitic insects that attack man or domestic animal have received more attention from naturalists than these.

The introduction of the two species of cattle grubs we have in North America undoubtedly dates from the time of the first importation of European cattle. The spread of one, now called the common cattle grub, in the United States advanced with the progress of settlement to all parts of the country. The other, the northern cattle grub, has spread throughout the Eastern, Middle Northern, and Northwestern States. It is moving southward, but we doubt that it will ever invade the States farthest south.

The life history of the two species is similar. The eggs are securely fastened near the base of the hair on the host.

The adult of the northern species generally lays its eggs one at a time on the hind legs above the hocks, on the flanks, and on the sides of the abdomen. It is bold and vicious in its attack.

The adult of the common cattle grub lays its eggs in rows on the heel when the animal is standing or, when it is lying down, on any part of the body that touches the ground. It makes sneaking attacks. Often the animal is unaware of the fly. When the egg is 4 or 5 days old, the eggshell splits at the free end and the first-stage cattle grub emerges, crawls down the hair, and immediately bores into the skin. After migrating through and feeding on the host’s tissues for a month or more, the young grub reaches the esophagus or the abdominal viscera, where it moves about for about 6 months to continue its development at
Cattle Grubs

the expense of the host animal. It then migrates on through the tissue under the skin to the back of the animal. The young larvae of the northern species do not invade the esophagus and abdominal viscera but migrate instead through the spinal canal on their way to the back of the animal. The grubs of both species usually locate along the median line of the back between the shoulders and hips and then cut holes through the skin in the choicest part of the hide.

After opening the hole through the skin, the grub molts to the second stage and becomes encysted under the hole. At this stage, small swellings on the back of the animal indicate the presence of the second stage of the heel fly grub. Having ample access to both food and air in the second stage, the grub grows rapidly for about 3 weeks and then molts again into the third, or last, stage. Up to this point the grub is opaque. As it goes through its third stage and completes its residence in the back of the animal it becomes dark brown or black in about 20 days, when maturity is reached, and it leaves the host animal through the hole in the skin.

Shortly before the mature grub leaves its host it partially dehydrates itself, shrinks considerably in size, and at the same time greatly enlarges the hole through the skin of the animal. These changes in the grub make possible a rapid and easy escape from the host and the dehydration keeps the grub from freezing after it leaves the body of the animal. The grub is not seriously affected by a sudden drop in temperature from around 103 °F., the usual body temperature of cattle, to an outside air temperature of zero or lower. Few other insects can stand such drastic changes in their environments without suffering serious injury or death.

When the grub falls to the ground it crawls under nearby objects for protection and pupates for its transformation to the adult stage. The pupal period may range from 16 to 75 days, depending on prevailing temperatures. The adult fly does not feed. Its sole purpose is to reproduce. Mating is followed immediately by egg laying, which may take place within an hour after the adult emerges from the puparium.

The only method of control which has so far been successful in the United States has been to destroy the grubs by applying a larvicide during the time when the larvae, or grubs, inhabit the backs of animals. This method of treatment has been developed to the point where it is more effective than any other method known and is probably the only one that is practical and economical under our large-herd system of ranching.

Hundreds of materials have been tested, including such chlorinated hydrocarbons as DDT and benzene hexachloride, but rotenone is the only toxicant recommended for cattle grubs. Rotenone occurs in the roots of derris and cube plants; when the roots containing at least 5 percent rotenone are ground to a fineness that permits 90 percent or more to pass through a 200-mesh screen, the powder can be formulated so that it may be applied to the infested cattle as a dust, wash, spray, or dip.

Power spraying is the most rapid method of applying the powder in suspension to large herds of cattle. The dust or wash application usually is preferred by owners of small herds. The dust application is well adapted for use in very cold climates. If dipping vats are available and large herds are to be treated, the rotenone can be applied as a dip. Because the spray, dust, and wash are applied only to the grub-infested area of the animal, they are cheaper than the dip treatment, even for large herds.

Rotenone should be applied 30 to 45 days after the appearance of the first grubs in the backs of cattle and thereafter every 30 or 40 days during the grub season. Correct timing of the treatment, regardless of the method of
application, is essential for satisfactory control.

Individual attempts to reduce cattle grub infestations are usually unsuccessful. If the grub population is to be satisfactorily reduced, control programs must be based on a community or area basis.

Time and again the value of organized community efforts to control cattle grubs has been proved. Grubs were practically eliminated on Clare Island, off the coast of Ireland, in 1920 after a 5-year program that involved the systematic destruction of grubs by all cattle owners working together. In Denmark, legislation in 1922 required that all cattle owners take measures to destroy the heel fly larvae in their herds; at the end of 3 years the percentage of infested hides in Denmark dropped from 20.5 to 2.5. In Prowers County in Colorado, a 6-year program, organized in 1928 and involving 22,500 head of cattle over 900 square miles, reduced the average infestations from 35 to 5 per head. Those programs were carried on largely without chemicals—cattlemen then had to squeeze the grubs out of their cysts in the backs of the cattle with the fingers, remove them with small forceps, or in limited trials to destroy them by inserting toxic materials into individual grub sacs.

Since 1932 control projects in the United States and Canada have been made simpler and more effective by the use of derris and cube root powders.

On Calumet Island in the Ottawa River, Canada, a cooperative program reduced the average numbers of cattle grubs in cattle from 16 to 2 between 1933 and 1936.

In Hughes County, S. Dak., a voluntary program effected an 80-percent reduction in grubs between 1947 and 1950; yearling calves harbored only an average of 15.5 larvae in the winter of 1950, while untreated cattle on farms outside the area were infested with an average of 78 grubs. In this program, as in similar work in New Mexico and Washington, the use of high-pressure spray equipment made it possible to treat large herds of cattle quickly, effectively, and inexpensively.

A community program can be organized successfully in almost any locality where cattlemen are willing to pool their efforts in a concerted attack on the grub. Between 1944 and 1949, projects were started in South Dakota, Montana, New Mexico, Oklahoma, Colorado, Washington, and California. Some were sponsored by Federal agencies and some by the State agricultural experiment stations. Several of the programs were assisted by such organizations as the National Live Stock Loss Prevention Board, State livestock sanitary associations, and the county cattlemen's associations.

Any group of stockmen or dairymen interested in a coordinated project against cattle grubs should seek the help offered by the county agent's office. They should first establish that cattle grubs are an economic problem in the locality. In a few sections infestations are sporadic and light and the expense and labor involved in community action would be of doubtful value.

The first step in outlining a grub-control project is to establish the boundaries of the area—not less than a
township in extent—within which the work is to be conducted. A single township, in sections where dairy or feeder cattle are concentrated, may involve 100 or more owners and several thousand cattle, and will constitute therefore a satisfactory project. In regions where the carrying capacity of the range is low and there are no more than 300 or 400 cows in the township, the area selected should be much larger. In any case, the size of the area is important. The flight of the heel fly probably is limited to 3 miles or less. But even that limited movement is enough to permit flies from pastures on which untreated cattle are grazed to reinfest practically all cattle within a small grub-free area. In a larger area, flies from surrounding pastures can hardly make their way to the centrally located herds and would normally reinfest only the cattle at the periphery of the area.

It is also important that the area selected for grub control be as nearly square or circular as possible, rather than in the form of a long, narrow strip. In the latter case, flies from bordering pastures would be able to reach all farms in the area under control and quickly reinfest the grub-free cattle. Four or five townships are considered to be the optimum size for an initial project of moderate dimensions. Theoretically there is no limit in the size to which a program of this nature may grow.

Another factor to be considered is the existence of natural barriers against the return of the heel flies. The perfect place for a control project is an island. Heel flies apparently do not operate over large bodies of water, and grub-free cattle on an island a mile or more off the mainland apparently are not subject to natural reinfestation. In approximating such ideal circumstances, it is advisable to locate the area where natural barriers exist or to extend the area up to whatever barriers are at hand. Wide rivers and lakes discourage the activity of the heel fly. Mountains, forest, and even croplands from which cattle are absent are similarly effective. Less satisfactory are highways and railroad rights-of-way; the latter are not effective against the heel fly, but they may serve in many instances to define an area sharply.

Once the boundaries of the district have been established, all owners of dairy and beef cattle should be informed that 100-percent cooperation is desirable and that any untreated cattle within the area constitute a reservoir of infestation for the treated animals. Actually, if about 80 percent of the cattle can be included in the program the undertaking may be considered worth while. Participants in the project should be informed of the biology, pathology, economics, and therapeutics involved. A map should be prepared to show the boundaries, roads, and the location of farm and ranch units. A committee should be chosen to coordinate the activities.

The participant will find it useful to name an administrative head or group. If the program is a small one, the county agent or the local vocational agricultural instructor may serve in that capacity. If it is a large one, the duties may be assumed by a county cattlemen's association or a similar group.

Administrative duties will be many. Enough insecticide should be pur-
chased for the treatment of all cattle within the project. Spray equipment must be provided for large herds. Some cattlemen's groups have found it expedient to purchase their own spraying equipment. Others have made use of county-owned machinery. Still others have contracted with commercial operators to conduct the work. The owners of small herds, who may want to treat their cattle by hand, must be provided with materials needed for the application of dusts and washes. When the time to apply treatment is determined, each neighborhood leader or committeeman should be prepared to see that work is coordinated on all farms and ranches within his district. Routes should be planned in advance for spraying crews, so that a minimum of time will be spent on each farm. Farmers who choose to apply insecticides by hand should be notified when treatment of their cattle is required. Groups of small operators might well pool facilities and labor. The work of the administrating or organizing body will be determined generally by the size of the project, the interest of the participants, the extent of cooperation, the kind of livestock management practiced, the nature of the terrain, and climate.

As we stated, the treatment of cattle every 30 or 40 days during the period when grubs are in their backs is essential if the grubs are to be destroyed. Two to four treatments a year therefore must be administered, depending on the section of the country. About three consecutive years of work may be required before one can appreciate the effectiveness of the program and its results in terms of sound hides, better beef, and more milk.

Ernest W. Laake is research adviser in entomology, Office of Foreign Agricultural Relations. He has been stationed in Costa Rica and Ecuador.

Irwin H. Roberts is a parasitologist in the zoological division of the Bureau of Animal Industry.