PESTICIDE APPLICATOR CERTIFICATION TRAINING

MANUAL NO. 1

AGRICULTURAL PEST CONTROL

b. Animal

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. W. E. Skelton, Dean, Extension Division, Cooperative Extension Service, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061.

AGRICULTURAL PEST CONTROL - ANIMAL

A Training Program for the Certification

of Pesticide Applicators

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INTRODUCTION

This training manual is intended to provide information necessary to meet the EPA's Standards for Certification for the Agricultural Pest Control - Animals. It should prepare you to pass the certification examination prepared and administered by the Virginia Department of Agriculture & Commerce.

The emphasis in this manual and the standards set forth are on the principles involved in the application of pesticides to domestic animals and their environment so as to not only be effective, but safe for the animals, man, and the environment.

We wish to credit the Georgia Cooperative Extension Service for developing the original outline which we have modified for specific application in Virginia.

Further information and new developments will be made available to you through the Cooperative Extension Service at Virginia Polytechnic Institute and State University.

THE CLASSIFICATION OF DOMESTIC ANIMALS

Types of Animals

For the purposes of this training manual, the domestic animals will be classified as being either food animals or non-food animals.

Beef and dairy cattle, swine, sheep, goats, rabbits, and poultry all ultimately end up as meat on our tables. In addition, dairy cows and goats produce milk and chickens produce eggs, both of which are used for human food. Consequently, these animals are all food animals.

On the other hand, dogs, cats, and horses are raised for work or pleasure and are seldom used for human food in this country. For this reason they are classed as non-food animals. Animals in this classification are often referred to as "companion animals."

Meat, milk, and eggs are sampled and tested by the USDA for pesticide residues. The presence of even a small amount of pesticide residue can result in the condemnation of the meat, milk, or eggs. An investigation is made to determine the source of the residue and, when indicated, legal proceedings are brought against those persons responsible.

Non-meat animals are not checked for pesticide residues since they are not used for human food.

Pests of Animals

Pests are plants or animals that live in or on other plants or animals. These are commonly called "parasites."

Parasites that live within an animal's body are called internal

parasites and their control is the responsibility of the veterinary profession. Parasites that live on an animal's body are called external parasites and their control is the primary concern of pesticide applicators. This manual will deal only with external parasites.

EXTERNAL PARASITES OF ANIMALS

The external parasites of domestic animals are flies, mosquitoes, fleas, lice, ticks, and mites. It is estimated that these parasites cost the livestock industry in the United States $500,000,000 each year. They lower an animal's resistance to disease, cause anemia due to blood loss, reduce weight gains, reduce feed efficiency, and transmit several important animal diseases including equine infectious anemia of horses, anaplasmosis of cattle, and heartworms of dogs.

In order to effectively control these parasites it is necessary to be able to identify them and to have some knowledge of their habits and life cycles.

FLIES AND MOSQUITOES

Flies and mosquitoes are flying insects which have only one pair of wings. The sheep ked also belongs in this group, but is wingless, and consequently, cannot fly.

Except for the sheep ked and the sheep nasal bot fly, the life cycles of all of these insects are similar. There are four stages in the life cycle: egg, larva (maggot), pupa (cocoon), and adult. The only variations in these life cycles are the length of time spent in the various stages and the locations where the eggs are laid and where the larval and pupal stages take place. A knowledge of these facts is helpful in the control of these insects.

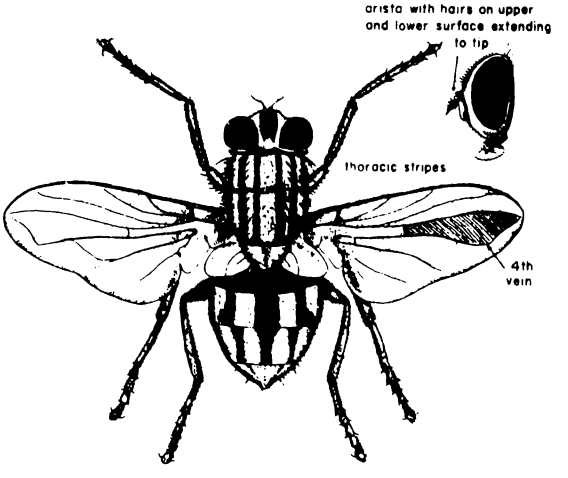
The life cycles of the sheep ked and the sheep nasal bot fly differ

from the above only in that the eggs hatch in the female fly and are laid in the form of larvae or pupae.

House Flies

House flies breed in many types of organic matter such as garbage, animal manure and accumulations of waste feed. As many as 1,000 can complete development in one pound of suitable breeding material.

House flies usually become active in early spring. Adult house flies mate and females lay eggs on decaying organic matter. Between 100 and 150 eggs are laid at a time, each female laying a total of 500 eggs during her 30-day life. In 8 to 30 hours, the eggs hatch into tiny, white, legless maggots which begin developing in the breeding material. When the maggots reach maturity - 1 to 2 weeks later - they change into the pupal or transformation stage. After 3 to 10 days, the adult emerges from the pupal case. From 1 to 3 weeks are required to complete the life cycle from the egg stage to the emergence of the adults from the pupal case.

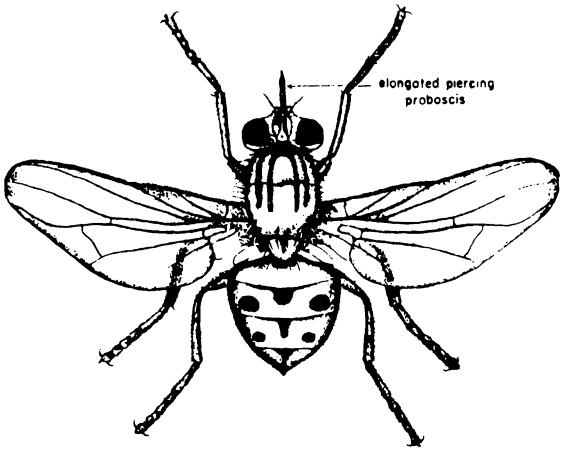


HOUSE FLY

House flies overwinter as full-grown larvae or pupae in or beneath breeding materials. Some adults probably survive the winter in warm, protected areas in buildings. In periods of warm weather during the winter, these overwintering flies become active. If the warm weather is of sufficient duration, adult flies can emerge from protected pupal cases.

Stable Flies

In some animal operations, especially dairies and horse stables, this is the most troublesome external parasite. In appearance, adults look like adult house flies, except stable flies have needle-like mouth-parts that protrude from underneath the head and are used to puncture the skin and suck blood from livestock. Feeding takes place primarily on the legs and lower sides of animals. Flies that feed on the legs are difficult to control because the legs don't retain insecticides for long periods. They only visit animals to feed. Since they are in contact with the animal only a short time, control is difficult to obtain.



STABLE FLY

In most areas, stable flies overwinter as pupae in wet straw piles or strawy manure. In early spring adults emerge, mate and soon lay eggs - usually in manure mixed with straw. Extreme populations may develop in green chop, etc., causing very high populations on dairy farms. About 30 days are required for development from the egg stage to the adult.

Sanitation helps control stable flies where breeding sites are removed and destroyed. Stable flies have been shown to migrate up to 70 miles in only two days. So breeding areas could be some distance from the farm. Insecticides can be applied in a number of ways but care must be taken to thoroughly cover the legs and lower sides. Residual wall sprays can kill stable flies that are resting after taking a blood meal.

Horse Bot Fly

The adult of this bot fly resembles a bee. It attaches its eggs to hairs on the legs or bodies of horses. As soon as the eggs become infective, the larvae pop out when they are brushed by the warm, moist lips of the horse. These larvae are spiny and they become attached to the horse's lips or tongue and thus are easily swallowed. They may, however, burrow through the mucous membranes of the mouth and make their way to the stomach through various tissues. The larvae attach themselves to the lining of the stomach. After some months of feeding, the maggots pass from the horse's body with feces, drop to the ground and pupate. Adult flies emerge from the pupae and when they start laying eggs the life cycle is complete.

Horses should be routinely treated by a veterinarian for "bots"

(the horse bot fly larvae) in the fall after several killing frosts.

Horse Flies and Deer Flies

These pests are vicious, persistent, blood-sucking external parasites of animals. After alighting on an animal, if they are not dislodged, they cut through the skin with their knife-like mouthparts and suck blood. When they fly away, blood usually comes out of the wound. They are efficient vectors of both cattle and horse diseases.

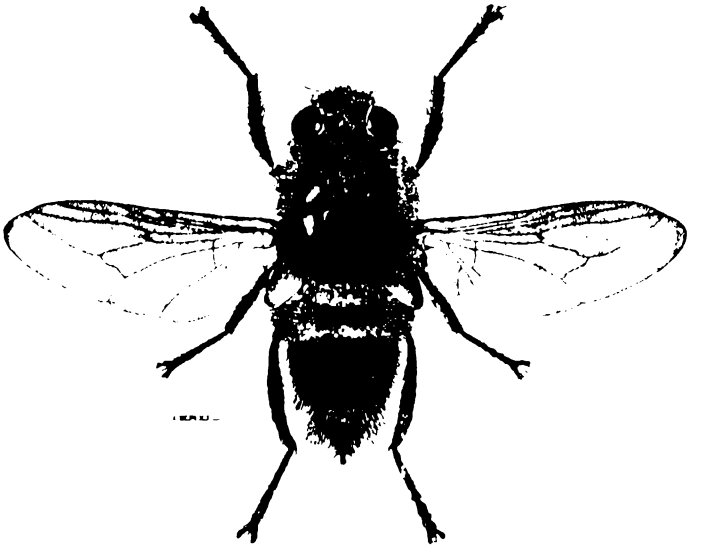
Development takes place in water or soil in damp, wooded areas. Some species require more than one year to complete development. The winter is passed as larvae in soil around lakes, streams or swampy areas. Adults can fly long distances. They are most troublesome in or near wooded areas.

Fencing animals away from wooded areas and providing artificial shade can help reduce horse and deer fly attacks. Larval control is not feasible due to the large larval breeding areas involved. Insecticides that are recommended are effective in controlling horse flies but their ability to reinfest treated animals from long distances make control difficult to obtain.

HORSE FLY

The Ox-Warble Fly and the Heel Fly

These flies are stout and hairy, black and yellow, and look a little like bees. In the spring each female fly lays hundreds of eggs on the leg or body hairs of cattle. In a few days the eggs hatch into tiny, white spiny larvae which crawl down the hairs and burrow through the skin. For several months the larvae wander around the intestines, liver, heart, muscles, or other organs. When the worst of the winter is over, they migrate to the back and produce small swellings or warbles in the skin. They make a tiny hole in the skin for air and they grow in size to about an inch in length. During this period, they turn dark brown. In spring or summer, the grubs, or maggots, emerge through the holes and drop to the ground and pupate. They crawl under loose soil or trash, and after two to seven weeks the adult flies emerge.



OX WARBLE FLY

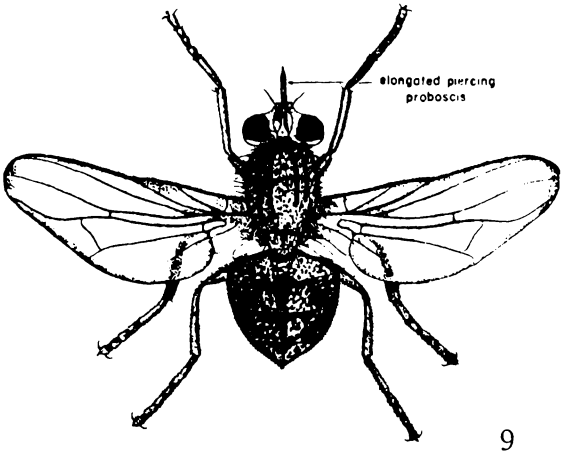
Horn Flies

These pests are serious external parasites of beef cattle and dairy cattle. During the summer months, it is not uncommon to find 500 to 2,000 per animal hovering over their backs and crawling down among the hairs on the withers, back or belly. They suck blood and 500 can remove one half pound of blood daily. They look like stable flies but are only half as large.

Horn flies generally overwinter as larvae or pupae in or beneath cattle droppings. When the weather warms, adults begin to appear. Adults feed on cattle, mate and lay eggs on fresh cattle droppings. Development from the egg to adult stage requires about two weeks. Adults remain on cattle most of the time. They will leave the animal to deposit eggs and some fly short distances to infest other cattle.

Since adult horn flies remain on animals during most of their life, control is relatively easy to obtain using recommended insecticides. Rubbing devices are particularly effective against this pest. Larvae can be controlled by feeding animals on insecticide treated mineral, salt, and ration mixtures. For effective control, animals must consume recommended amounts of the insecticide daily. This external parasite is the most prevalent and damaging pest found on beef cattle in the southeastern states yet it is the easiest to control.

HORN FLY



Face Flies

Face flies are common external parasites on horses, beef cattle, and dairy cattle in many sections of the United States. In appearance, they closely resemble house flies. Face flies are very persistent feeders. They mostly feed around the natural openings on the animal's face. Their mouthparts are of the sponging type and cannot pierce the skin of the host. They are capable of transmitting the organism which causes "pink eye." Face flies probably spend the winter as adults in protected locations as in attics of homes. Adults emerge and mate when the weather warms. Female face flies lay their eggs in fresh cattle droppings. The maggots develop in the manure, pupate in the adjacent soil and emerge as adults. A female fly lays 25 to 50 eggs during her 30-day life. The total life cycle - from the egg stage to the adult stage - requires 2 to 3 weeks.

Since these pests feed mostly on the animal's face and fly long distances to reinfest treated herds, control is extremely difficult to obtain. Insecticides do not adhere readily to the animal's face and insecticides applied to the face are frequently diluted or washed away.

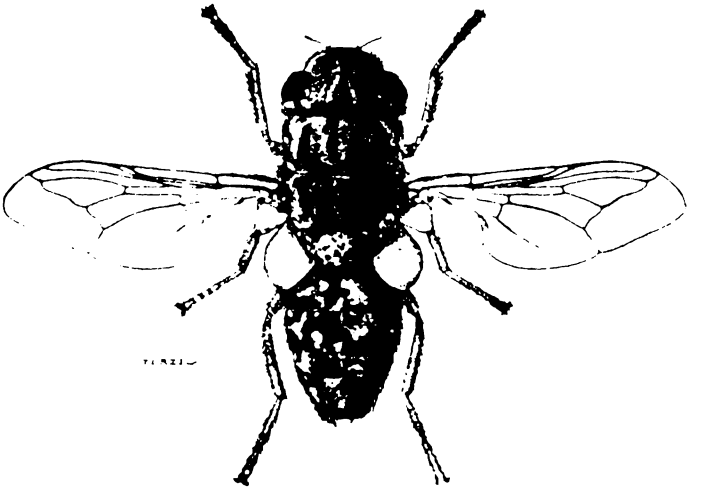
Frequent application of effective insecticides to the animal's face is required. Daily forced use of rubbing devices such as dust bags offers the best means of reducing face fly populations in most situations. Sprays over the animal's body are effective for short periods only.

Sheep Nasal Bot Fly

Instead of laying eggs, these flies deposit their larvae or maggots

in the nostrils of sheep, goats, and a few other mammals such as deer. The maggots crawl into the nasal passages, and during the next few weeks, they molt twice. When fully grown and about an inch long they come out of the nose, drop to the ground and pupate. From the pupa the adult fly emerges.

This fly may attack shepherds or other persons who have recently eaten goat's milk products and whose breath smells of such food as cheese. The fly deposits its larvae in the shepherd's nostrils, on his lips, or even on his eyes, and sometimes it causes considerable damage.



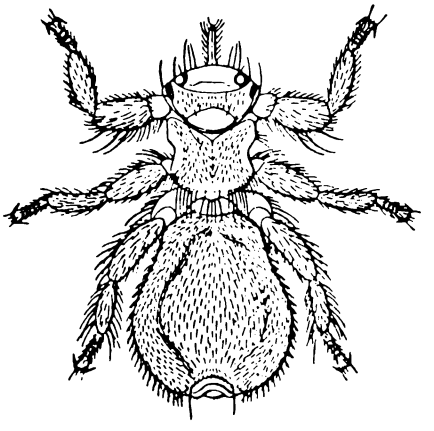
SHEEP NASAL BOT FLY

Sheep Ked (Sheep Tick)

In the United States the sheep ked is often called the "sheep tick." It is not a true tick but a wingless fly. It is a dark brown

insect less than ¼ inch long and readily observed by parting the wool on the neck, shoulder, belly, or thighs. It spends its entire life cycle on the body of the sheep and is abundant especially during the winter months. The female incubates the egg within her body and extrudes it as a pupa which is cemented to the wool fiber. They are deposited every 7 or 8 days; each female is limited to 12 to 15 during a lifetime. The young tick emerges from the case in 19 to 24 days. Within 3 or 4 days after emergence, it reaches sexual maturity, mates, and is ready to lay eggs 8 to 10 days later.

Normally the mature female attaches herself to the skin and sucks blood from the host but on warm days she may travel over the wool or drop off and crawl onto other sheep. Sheep ticks live only a short time off the host.



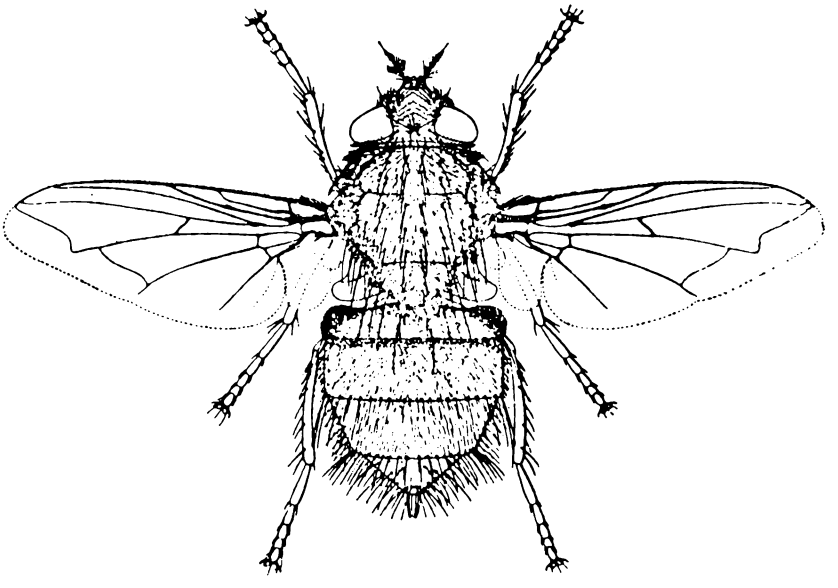
SHEEP KED

Wound-Infesting Flies

Examples of blow flies are the blue bottle fly, the green bottle fly, and the screwworm fly but many other species of flies can attack

animal wounds and cause injury and sometimes even death of animals. Adult flies lay eggs on wounds. The eggs soon hatch into tiny, legless maggots which then infest the wound. When the larvae reach maturity, they drop to the ground and develop into pupae. From this stage, adult flies emerge. Primary screwworm larvae are of most concern as wound-investing larvae because they feed on living tissues. They can eventually kill an animal. Other fly larvae also infest wounds but they feed mostly on dead tissues. Constant checks of wounds are necessary to reduce damage by wound-infesting larvae.

If open wounds are found infested with larvae, the larvae should be submitted for identification. Treat the wound and surrounding area with insecticides. These can be applied as dusts, aerosol sprays or wetting sprays. Repeat applications if necessary.

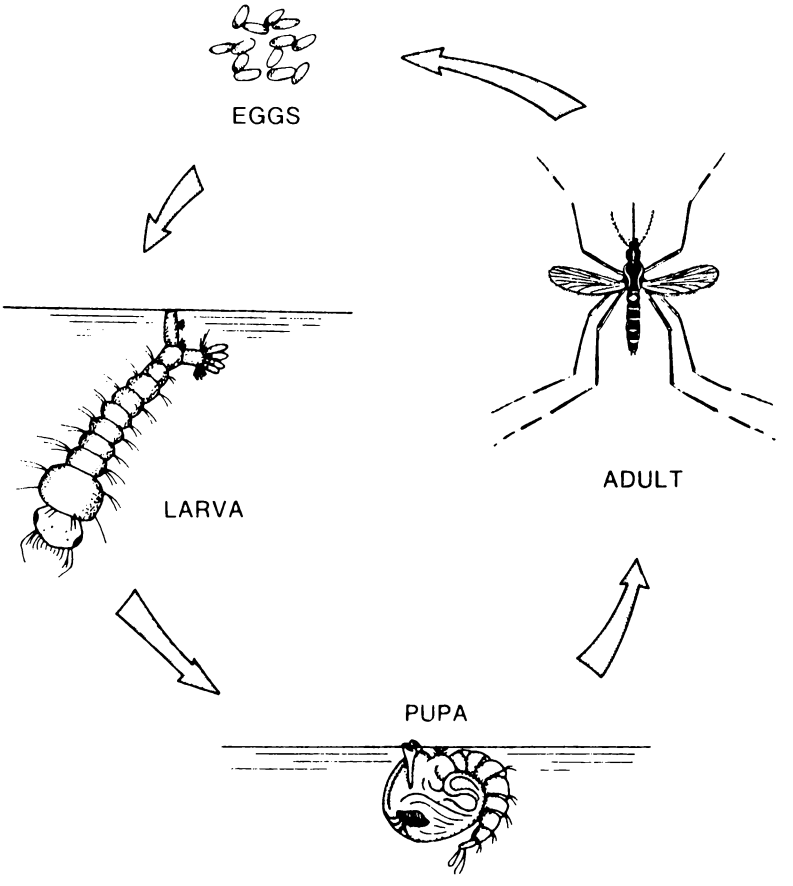


BOTTLE FLY

Mosquitoes

These very common insects have piercing-sucking mouthparts, and females suck blood from livestock. Mosquitoes breed in standing water. Adults are usually more abundant in shaded areas. Most damage to animals takes place during early morning, late afternoon and night.

Most mosquitoes spend the winter in the egg stage. Some winter as adults, others as larvae. When the weather warms, adults become active and mating takes place. From egg laying to adult emergence requires 10 days to 3 weeks. Adults normally live 30 days.

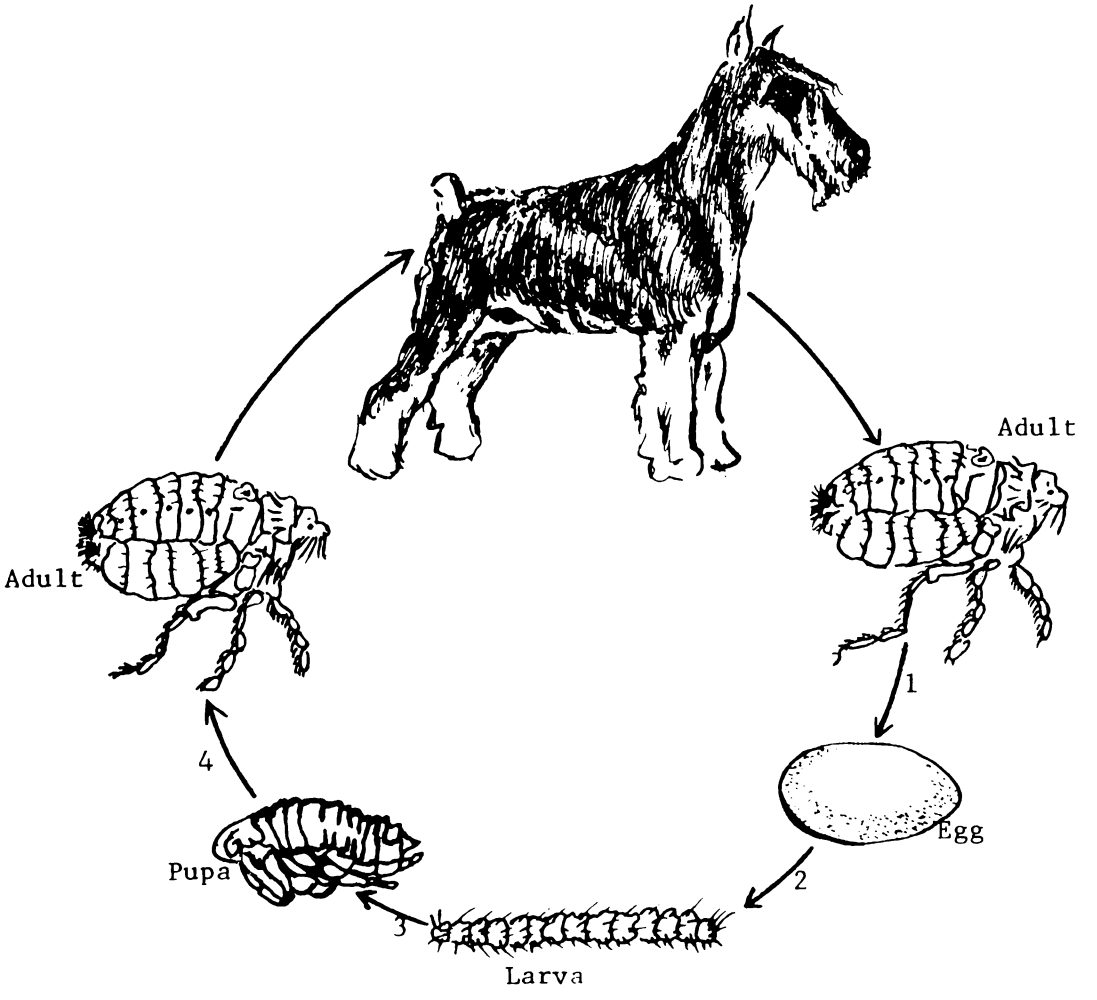


MOSQUITO LIFE CYCLE

Mosquitoes are often difficult to control. Larvae can be destroyed by draining their breeding areas or by applying larvicides. When large bodies of water are infested or when breeding sites are numerous and widely scattered, it is probably not feasible to attempt larval control. Adult control measures usually include frequent applications of insecticides to cover all animal body parts. Frequent applications are required when short residual insecticides are applied unless the population of mosquitoes subsides. Sprays are usually most effective. Residual wall sprays can help where animals are confined in stables and barns.

FLEAS

Fleas are primarily pests of dogs, cats, rodents, foxes and other small wild animals, birds, and man. Fleas are the intermediate host for a tapeworm of dogs, act as a vector in the transmission of bubonic plague and typhus fever, and cause a dermatitis in many animals.



A female flea lays 3 to 18 fertile eggs at one time. One female may lay over 400 eggs in six months. Eggs are deposited in the bedding of

the dog or cat but may be layed in the hair of the animal and then fall off onto the floor or in the animal's bedding. In 2 to 12 days, eggs hatch into larvae. Larval stages need very little food but do eat dried blood or excrement from adult fleas or rodents. The larval stage lasts 7 to 142 days during which time there are one or two molts followed by the spinning of a cocoon. The pupal (cocoon) period lasts 7 days to 1 year depending on the temperature. An adult flea emerges from the cocoon and starts periodic feeding on the dog or cat.

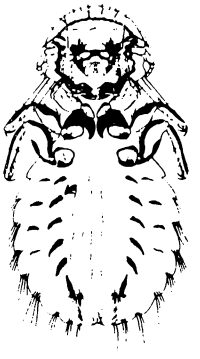
The entire life cycle may be completed in as little as 18 days or it may take many months, depending on environmental conditions. Fleas may live for a year under favorable conditions. Fleas generally remain on an animal only long enough to eat. They have been known to live 56 days without food. Dog or cat fleas prefer to feed on these animals and seldom bother the owners. However, it is not uncommon to hear of people whose house has suddenly been invaded by "man-biting" fleas. An investigation usually reveals the fact that the family pet recently died and, obviously, the fleas turned to the only source of food available - man. This also happens regularly when a pet owning family returns from an extended vacation and opens up the house. Both man and pets are attacked by hungry fleas as soon as the door is opened.

The control of fleas of pets requires the treatment of carpets and floors in the owner's house, bedding used by the pet, and the pet itself.

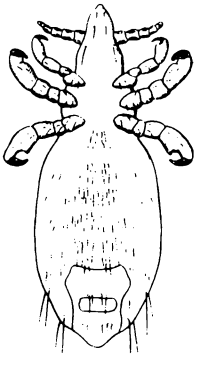
LICE

There are over 2600 species of lice in the world which can affect practically all birds and mammals. For the most part lice are "host specific" which means that hog lice affect only hogs, cattle lice affect only cattle, and bird lice affect only birds.

Some species of lice have piercing mouth parts with which they penetrate the skin. These lice tend to remain in one place sucking blood. They are called sucking lice. Other species have biting or chewing mouth parts and roam over an animal's body where they chew on epithelium, hair or feathers, and skin debris. These are called chewing lice. Both types of lice cause intense irritation.



CHEWING LOUSE



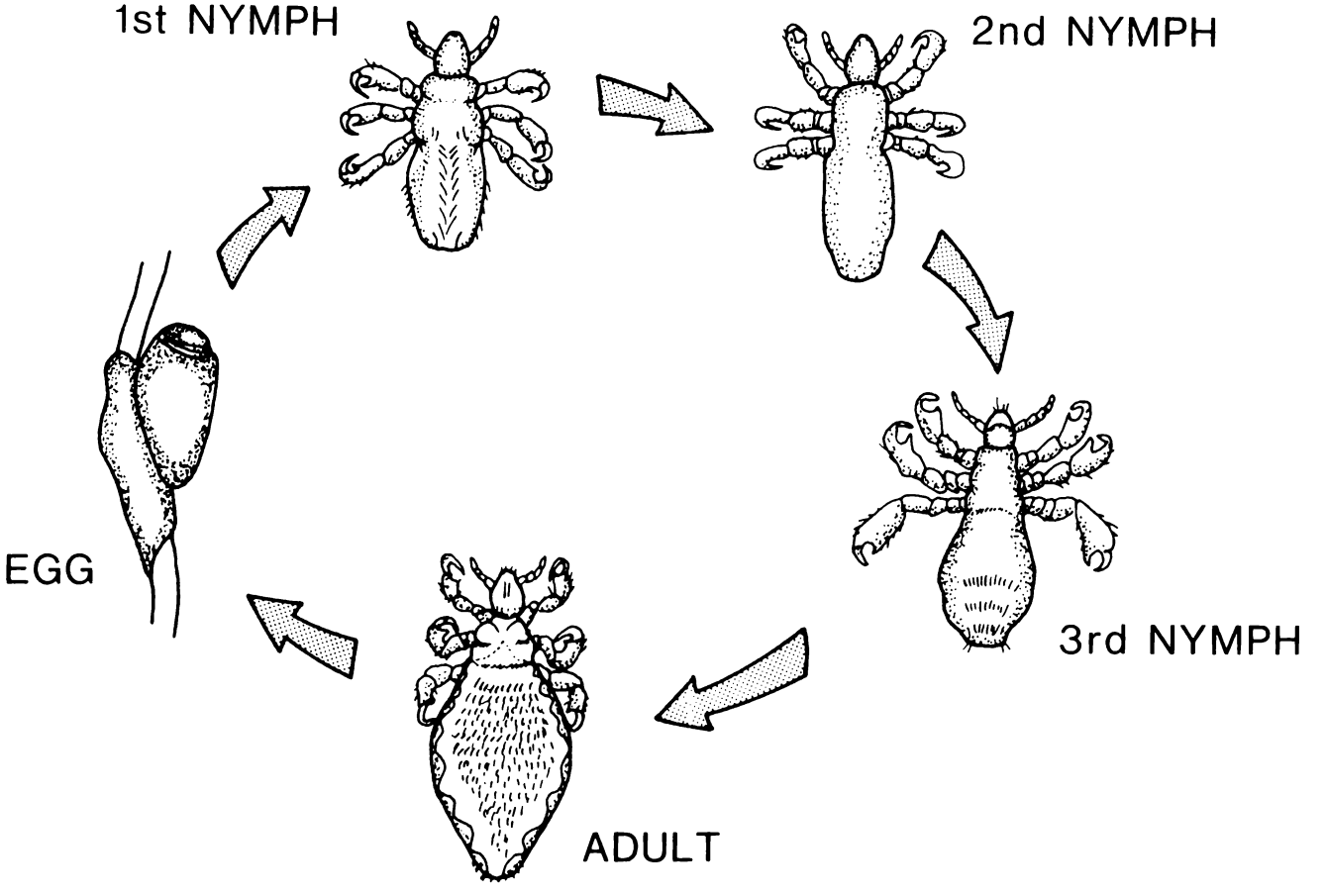
SUCKING LOUSE

Affected animals scratch, rub, and bite infested areas of the skin. They may lose weight and milk or egg production and growth rates are reduced. The haircoat is roughened and in severe infestations there is a loss of hair, wool, or feathers. Anemia can occur in extreme infesta-

tions of sucking lice due to the loss of blood.

Lice are cold weather insects and are most numerous during the winter months of January, February, and March. However, hog lice populations are not affected by temperature as much as other species.

The life cycle requires 3 to 4 weeks to complete. All growth stages occur on the animal or bird. Females lay eggs which are glued onto the hair or feathers. These eggs, or nits, hatch in 10 to 17 days. The young louse, called a nymph, feeds, molts, and reaches maturity in about 3 weeks.



LIFE CYCLE OF A LOUSE

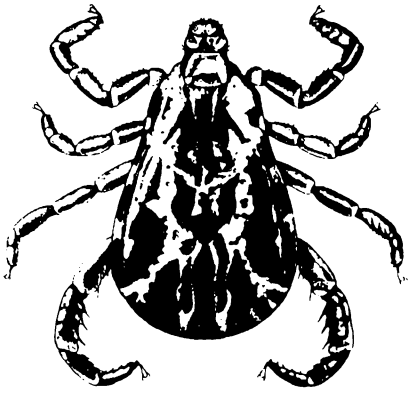
In treating animals for lice it is important to know that the eggs are relatively resistant to insecticides. Because of this, treated animals will become reinfected as the eggs hatch. A second treatment should be given after the eggs have hatched but before the young lice become mature enough to lay eggs. This treatment should be about 14 days following the first treatment.

TICKS

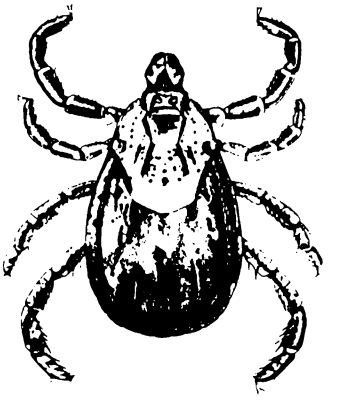
Several species of ticks parasitize animals. They are usually more abundant in wooded areas and along animal paths. Most mature ticks are fairly large, about ½ inch long when mature; flattened, leathery, eight-legged blood sucking external parasites.

Ticks can transmit a number of diseases including tularemia, anaplasmosis, piroplasmosis, Texas Cattle fever, and Rocky Mountain Spotted fever. They also can cause a paralysis of animals and man by injecting a toxin into the host when they feed close to the base of the brain. In dogs, sheep, and man, one tick alone can cause paralysis but in cattle many ticks are required.

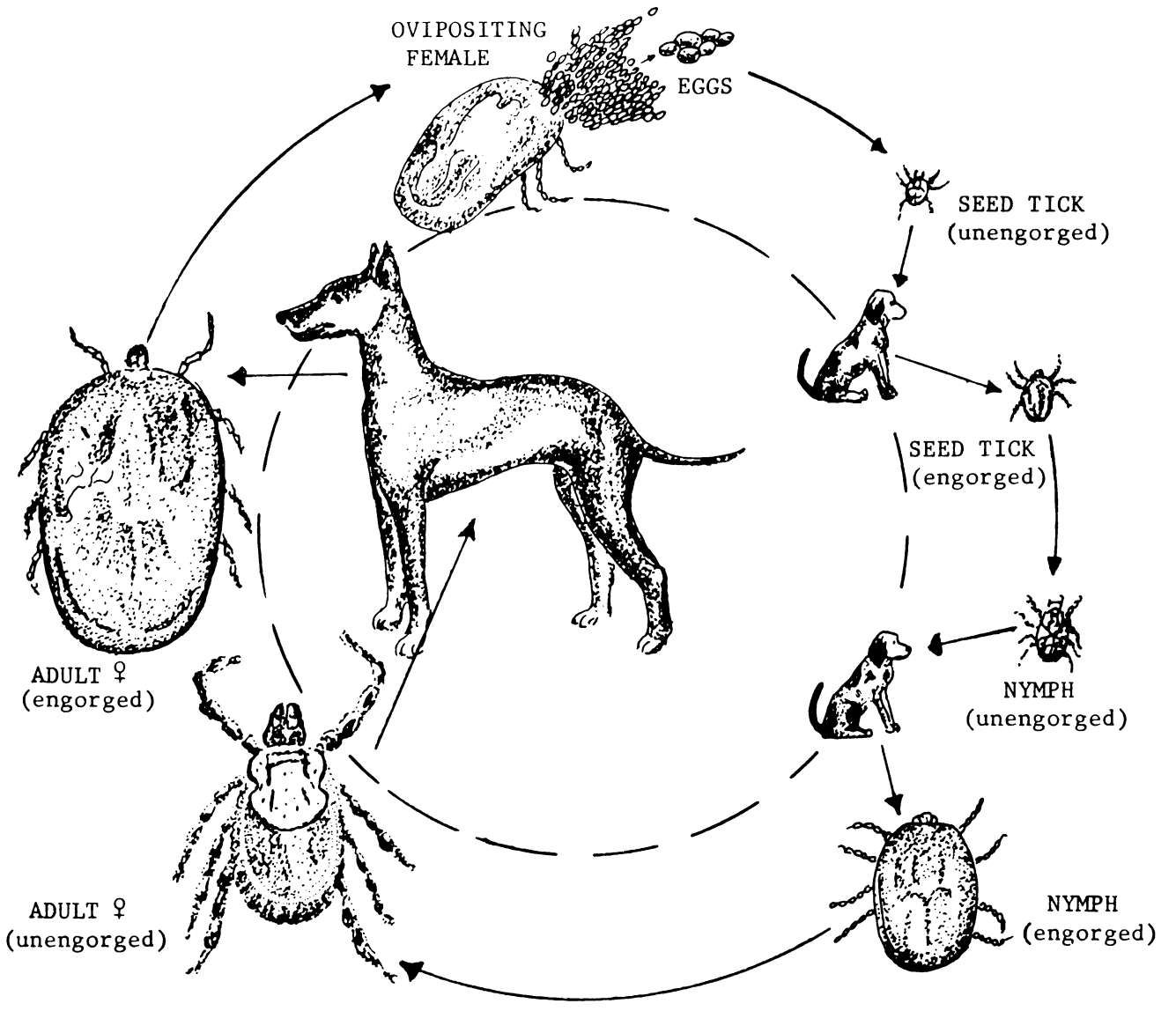
The life cycle illustrated is that of the American Dog tick, the most common tick in Virginia, but it is typical of other tick species. The final and intermediate hosts are pictured as being dogs, but any wild or domestic animal will serve as well. Field mice and rabbits are common hosts.



Male



Female



LIFE CYCLE OF THE AMERICAN DOG TICK

Stages of life cycle shown in outer circle occur on the ground.

Adult ticks become engorged with blood on the host animal and drop to the ground. Female ticks begin egg laying after 3 to 5 days. Seed ticks hatch from the eggs in about 30 days, bunch on the grass and wait

for one day to several weeks for a suitable host animal to pass by. When the host arrives, they crawl onto its body and feed for 7 to 12 days. After becoming engorged, they drop to the ground, molt, and await the coming of a second host. After becoming engorged on the second host, they drop to the ground, molt, and wait for the third and final host where they mate, become engorged, drop to the ground and start egg laying.

It generally is not feasible to attempt to control ticks from a large area. It is possible, however, to reduce the tick population in limited areas by creating an unsuitable environment for the ticks and for the potential host animals. This can be accomplished by cutting and burning brush, keeping grass mowed short, and by cultivating tillable land. Ticks can be killed in limited areas by the use of suitable chemicals.

Tick infested areas can be detected by the following method. Attach one edge of a 3 or 4 foot square of white flannel to a pole and drag it, fuzzy side first, across areas to be checked. If an area is infested, ticks will adhere to the flannel and can be easily observed.

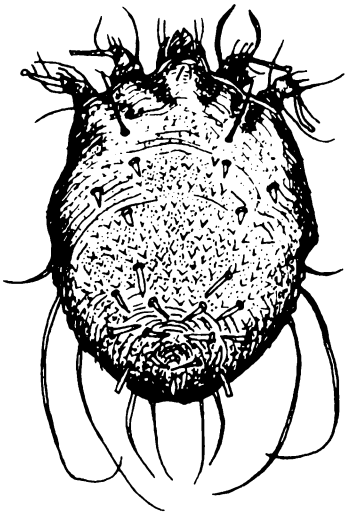
MITES

Mite infestations cause the disease commonly known as mange. Symptoms of mange are scratching, rubbing, and biting at affected areas, the loss of hair, and scab formation. The skin becomes thickened and rough. Some species of mites live in the ear canals of animals and cause intense irritation which results in rubbing or pawing in the general area of the ears. In the case of dogs and cats, the ears and surrounding area becomes raw from scratching.

Mange mites are of three types. They are those that live on the surface of the skin, those that burrow and live in shallow tunnels in the skin, and those that live deep in the hair follicles and sebaceous glands.

Adult female mites lay eggs which hatch into immature mites. These grow rapidly into adults. The entire life cycle may take less than 4 weeks to complete.

Except for ear mites and a few other species, mites affecting animals cannot be seen with the naked eye. Skin scrapings must be obtained and examined microscopically in order to see the mites.



PESTICIDES FOR AGRICULTURAL ANIMAL PEST CONTROL

Pesticide Toxicity

Pests of agricultural animals can weaken animals, thereby causing them to be unthrifty, predispose them to diseases and can even cause their death. Pesticides will protect animals from pests; however, all pesticides are poisons and can be toxic to warm-blooded as well as cold-blooded animals. For this reason, recommended pesticides must be applied properly to prevent injury to animals.

Individual animals can show toxicity to certain pesticides and materials contained in pesticide formulations. Applicators should always be aware of this. Sensitive animals should not be treated or should be treated only with pesticide formulations non-toxic to the animal. Brahman beef cattle can show sensitivity to some organic phosphate insecticides. For this reason, organic phosphate pesticides should not be applied to these animals if so indicated on the pesticide label. Poisoning is usually exhibited as excessive salivation, eye watering, defecation, urination and muscle twitching.

Animals which are under stress or which will be put under stress should not be treated.

Pesticides should not be applied in combination with other pesticides unless so stated on the label. In order to save labor, livestock producers prefer to perform as many tasks as possible when they have their animals gathered together. An example of this is treating cattle for grubs and lice, worming, and vaccinating, all at the same time. This can be done

but special care must be taken to be sure that the grubcide and worm medicine can be used safely together. Warning statements on the labels of both products should be read carefully and understood.

The skin of some horses is extremely sensitive to various pesticide formulations. Before treating horses with pesticides, it is recommended that a small patch of skin on each animal be treated with the pesticide formulation approximately 24 hours before the entire animal is treated.

Residue Potential

Most agricultural animals are raised for the human food products they produce. For this reason, it is extremely important that pesticide residues not be allowed to accumulate in illegal amounts in edible tissues. Producers should apply only approved insecticides to animals which are being finished for slaughter or are producing edible products such as milk. Some insecticides are eliminated slowly from animal tissues. Others are quickly eliminated. For this reason, intervals between application and slaughter or use of eggs and milk as human food should be strictly adhered to. For these reasons, label directions should be followed to the letter. Failure to do this can result in animals being confiscated and responsible individuals prosecuted.

Pesticide Hazards

The pesticide formulation to be used must be taken into consideration when treating agricultural animals. Sprays are generally suited for treating most animals, except, when temperatures are below freezing it is not advisable to spray or dip livestock. This can predispose them to diseases

such as pneumonia. Insecticides applied during very hot, still days may cause damage to treated animals. When applying ready-to-use oil sprays, be careful not to allow the oil to penetrate the animal's hair so it comes in contact with the skin. Some types of agricultural animals show toxic effects when oils are applied to their skin.

Individual animals can show allergic responses to certain pesticide formulations. Applicators should be aware of this and be prepared to apply remedial measures such as removing the insecticide from the affected animal. Sensitive animals should not be retreated unless a suitable pesticide formulation can be used. Pour-on and dust pesticide formulations are recommended when treating animals in freezing temperatures because they do not add excessive amounts of moisture to the animal.

Pesticide Application Techniques

When treating animals for external parasite control, it is important that insecticides be placed so that contact with the external parasites will occur. The selection of an insecticide delivery system will depend upon the animal to be treated and the pest to be controlled. For example, when treating animals for lice, mite and tick control, penetration is normally very important. Use 100-200 pounds of pressure when applying pesticides for control of these pests. Pesticides kill only the mites and lice, not the eggs, so retreatment is normally needed to control newly hatched pests.

Grub spray treatments should be applied in such a manner that the skin, not just the hair of the animal becomes thoroughly wet. Spray

pressures of 200-400 pounds per square inch are recommended depending on the thickness of the animal's coat of hair. Apply treatments after egg laying has been completed.

Power sprayers, knap-sack sprayers, compressed air sprayers and rubbing devices such as back rubbers and face rubbers are satisfactory for applying liquid insecticides to agricultural animals. Rubbing devices usually consist of a pesticide reservoir and a material on which animals rub that acts as a wick to pull the insecticide from the reservoir, thereby keeping the rubber saturated with insecticide. Homemade rubbing devices normally consist of burlap bags rolled around chains or wire. The insecticide is poured on the burlap bag to keep it charged. Automatic sprayers are commonly used to apply insecticides to animals on a frequent basis. They are commonly used to treat dairy animals as they exit milking parlors.

Dusts may also be used for control of some external parasites on agricultural animals. They may be applied by hand or in suspended, self-treatment dust bags.

Systemic insecticides are those insecticides which are picked up by the animal's blood system and transported throughout the animal's body. They can be applied as pour-ons, spot-ons, sprays, feed additives and in dipping vats. Some systemic insecticides are very effective against grubs, horn flies and lice.

Age and Size of Animals

Even when animals are healthy, their age and size are important

considerations when applying pesticides. Many insecticides are applied according to the size of the animal with less being applied to small animals and more to large animals. Many applications are applied to point of run off. Generally, this is the amount of insecticide recommended for use on animals. Systemic insecticides and ready-to-use oil sprays must be applied in exact amounts for adequate control of pests and prevention of injury to animals.

Young animals, especially those under six months of age, should not be treated when information on the pesticide label specifically prevents application to younger animals.

Extent of Treatment

Many pests on agricultural animals can be controlled with very small quantities of pesticides when applied to specific areas on the infested animal. For example, when treating infested wounds on animals, only treat the wound and immediate surrounding area.

When treating livestock for fly control, it is usually more efficient to treat animals daily with small quantities of pesticides. If rubbing devices such as back rubbers and dust bags are placed where animals cannot avoid them, they will treat themselves daily with small amounts of insecticides; thus obtaining good pest control with less material. The application technique which will afford adequate control with the least excitement of treated animals and least contamination of the environment should be utlized for the most effective, economical and safe control of agricultural animal parasites.

SYMPTOMS AND TREATMENT OF PESTICIDE TOXICITY

Poisoning by the organic insecticides may be caused by their direct application to animals, by the ingestion of the compounds on feed or forage treated for the control of plant parasites, or by accidental exposure.

An ideal insecticide should kill livestock pests without the risk of injury to the livestock or the person making the application and without leaving residues in the tissues, eggs or milk. While many compounds meet some of these requirements, none of those presently available satisfies all of them. Because of this, poisoning with these kinds of agents is not uncommon.

Under present regulations, labels must carry warnings against use of many compounds on certain animals or under certain circumstances. These warnings may be concerned with acute or chronic toxicity or with the avoidance of residues in meat, milk or other animal products. In either case it is imperative that label instructions be followed to the letter.

The following information is provided so that you will be aware of the symptoms of pesticide poisoning of animals. Early treatment is essential if poisoned animals are to be saved. Since pesticide applicators are not likely to have the skills, drugs, or equipment needed to treat animals, a veterinarian should be called at the first signs of poisoning.

Petroleum Products

Petroleum products such as kerosene, motor oil, and mineral oil have been used for years as insecticides on livestock and even today it is not uncommon to see swine producers treat their hogs for lice with "used crankcase oil."

Petroleum products generally are not harmful when used in small quantities although they may cause a reddening of the skin and some discomfort. On the other hand, when large quantities are applied, severe reactions may occur, such as drying, cracking, or blistering of the skin, loss of appetite, depression, difficult breathing, salivation and occasionally death.

Some of the modern day insecticides are dissolved in oil and applied in that form. When signs of toxicity occur following the application of these products, it is necessary to determine whether the oil or the insecticide itself is responsible.

The treatment of animals adversely affected by petroleum products consists of removing the material from the skin with the aid of soap or detergents and copious amounts of water. Further treatment is dependent upon the symptoms and may include local treatment of affected skin with ointments, the administration of appetite stimulants, and the use of anti-depressant drugs.

Insecticides Derived From Plants

These include rotenone and pyrethrum, which seldom produce toxicity, and nicotine sulfate (Black-leaf 40) which is highly toxic. Rotenone or

or pyrethrins, however, should not be used simultaneously with products containing coumaphos since they apparently increase the toxicity of the coumaphos.

Animals poisoned by nicotine sulfate show tremors, incoordination, nausea, and disturbed respiration. They may go into a coma and die.

Treatment of nicotine sulfate poisoning consists of removing the material from the skin by thorough washing or, if it has been swallowed, pumped from the stomach by use of a stomach tube and water (gastric lavage). When breathing is impaired, artificial respiration is indicated.

Sulfur and Lime-sulfur

These products are relatively non-toxic and rarely cause death. They may, however, cause irritation and blistering of the skin in an occasional animal.

Treatment consists of removing the material from the skin and applying bland ointments.

Chlorinated Hydrocarbon Compounds

The chlorinated hydrocarbon compounds include DDT, TDE, Methoxychlor, lindane, BHC, Chlordane, toxaphene, dieldrin, aldrin, and heptachlor. Not all of these are used as insecticides on animals and some are no longer available. All are highly toxic to cats.

These products are all central nervous system stimulants and they produce a variety of symptoms. The first sign is an increased alertness followed by twitching of the facial muscles. The twitching progresses backward until all body muscles are involved. Trembling or shivering

movements occur and are followed by convulsions and death. Affected animals assume abnormal standing positions, often with the head down between the forelegs or pressed against a wall or fence. Many animal's exhibit continual chewing movements. Some become belligerent and attack other animals or moving objects. There is usually an excessive flow of thick saliva and frequent urination. Some animals do not show the above symptoms but are depressed and refuse to eat or drink.

There are no specific antidotes for poisoning by the chlorinated hydrocarbon compounds. When the material has been applied externally, it should be removed by washing with detergents and large amounts of water. When it has been taken internally, it should be removed by gastric lavage (pumping the stomach) and by the administration of purgatives. The use of purgatives made from oil should be avoided.

Excitement can be controlled by the use of depressant drugs. All disturbing elements of the environment should be removed. Food and water should be provided by way of a stomach tube if animals refuse to eat or drink.

Organophosphorus Compounds

These compounds include malathion, ronnel, coumaphos, diazinon, trichlorfon, ciodrin, dichlorvos, ruelene, and many others. Ciodrin is a compound of rather low toxicity except that Brahman cattle are considerably more susceptible than other breeds. Consequently, the use of ciodrin on this breed should be avoided.

Symptoms of poisoning by organophosphorus compounds are drooling of

saliva, labored breathing, signs of abdominal pain, muscular incoordination, diarrhea, and, occasionally, convulsions.

As with the other classes of insecticides, it is important that these be removed from the animal by washing the skin or pumping from the stomach. Atropine used alone or in combination with 2-PAM (pralidoxime chloride) is frequently an effective treatment. In ruminants the oral administration of activated charcoal is helpful.

PESTICIDE APPLICATOR SAFETY

Pesticide applicators must be concerned not only with the safety of the animals they treat, they must also be concerned with their own safety. Many of the insecticides used in the treatment of animals are extremely toxic to man. There are numerous case reports of human pesticide fatalities. The most recent such report concerned a 70 year old man who was recuperating satisfactorily from acute pesticide poisoning. He experienced a recurrence of acute organophosphate poisoning symptoms 19 days after the initial poisoning episode and died. Investigation revealed that on the day prior to his death he had worn the same overalls he had previously worn while spraying parathion. Analysis of the overalls showed a large residue of parathion even though they had been laundered prior to their reuse. Death was attributed to skin absorption of parathion from the laundered but still contaminated overalls.

This example emphasized the importance of wearing protective rubber or plastic outer clothing from which pesticides can be completely removed after use.

In order to prevent absorption of pesticides from exposed skin it is essential that applicators bathe the entire body immediately after exposure.

When any symptoms of illness occur following exposure to pesticides, a doctor should be consulted without delay. Be prepared to tell him what chemicals are involved.