BIOLOGY AND CONTROL OF INSECT AND RELATED PESTS OF SHEEP

John E. Lloyd, Professor of Entomology
Rabinder Kumar, Research Associate
Everett W. Spackman, Extension Entomologist

University of Wyoming
Laramie, Wyoming

This material was prepared under Inter-Agency Agreement EPA-78-D-f-0473 between the University of Wyoming and EPA Region VIII Denver.

Table of Contents

BIOLOGY AND CONTROL OF INSECT AND RELATED PESTS OF SHEEP

by

John E. Lloyd, Professor of Entomology
Rabinder Kumar, Research Associate
Everett W. Spackman, Extenion Entomologist
University of Wyoming
Laramie, Wyoming

Introduction

Many insects and their relatives are important pests of sheep. Not only do these pests cause losses in production, but several are vectors of diseases.

By close observation of his animals, the producer can identify insect problems and select the most appropriate control or preventive measures for his own operation.

Insecticide Use

A sound sheep management program includes prevention and control of insect and related pests. Very often, control of insect pests involves the use of an insecticide. These chemicals must be used in a manner to minimize hazards to the animal, the applicator, the consumer and the environment.

The sheep producer must first recognize the insect problem or potential problem. He might be faced with an insect infestation that requires immediate attention, or he may know from past experience that it is time to treat in order to prevent a problem.

Precautions

When it becomes necessary to use an insecticide, the label of the appropriate formulation should be read and understood. Be sure that the formulation is approved for the intended use. Some insecticide formulations are for crop use only and not for use on animals. When not in use, all insecticides should be placed in a proper storage area that can be locked securely.

Before using the insecticide, thoroughly familiarize yourself with safe handling procedures, symptoms of poisonsing, if any, and what to do in case of an accident.

Apply the insecticide in a manner consistent with directions on the label. If the compound is not ready-to-use, then it must be diluted to give the correct concentration. Prepare only as much dilute material as will be needed at one time.

Insecticide applications should be made out-of-doors to provide sufficient ventilation. Observe label precautions regarding treatment of animals that for reasons of health, age, condition, etc.,

may be adversely affected by the treatment. Also observe precautions concerning use in conjunction with other insecticides or with medications.

Observe the required time interval between treatment and slaughter of animals. The purpose of this waiting period is to avoid residue levels that may exceed established tolerances.

Insecticide Formulations

Several different kinds of insecticide formulations are available. Some, such as dusts or oil solutions are ready-to-use, directly from the original container, while others, such as wettable powders (WP) and emulsifiable concentrates (EC) must be diluted prior to application. Wettable powders are dry concentrates that are formulated with wetting agents so they will disperse in water. Agitation of the diluted material is necessary to keep the insecticide in suspension. Emulsifiable concentrate insecticides also contain a high percentage of active ingredient and must be diluted prior to use.

Preparation of Correct Insecticide Concentration

Preparation of the correct concentration of insecticide is essential for successful control. Errors in determining the quantity of the insecticide concentrate that must be mixed with water or oil can result in the use of excess toxicant that is costly, and may lead to toxicity or residue problems.

The concentration of insecticide in wettable powders or emulsifiable concentrates is expressed on the label. The concentration of a wettable powder is expressed as a percentage, for example, 25% malathion wettable powder. The concentration of an emulsifiable concentrate may be expressed as percent active ingredient, or pounds of active ingredient per gallon of concentrate. Fifty-seven percent malathion emulsifiable concentrate contains 5 lb. of malathion per gallon.

The problem of determining the quantity of wettable powder or emulsifiable concentrate that will be needed to prepare a certain volume of dilute spray or dip liquid can be solved rather easily with the help of either a dilution table or a formula as presented below.

Dilution Table

To prepare a spray or dip with a desired percentage of active ingredient, only the concentration of the formulation need be known to use the Dilution Table. The figures presented in the table represent the amount of pesticide formulation for each 100 gallons.

For example:

A 0.125% concentration of coumaphos (Co-Ral®), is recommended for sheep ked control. To make a 0.125% spray using a 25% wettable powder (WP), the Table tells us to mix 4 lb. of the wettable powder in 100 gallons of water.

Formulas

Emulsifiable concentrates. - Two different formulas may be used to determine the amount of emulsifiable concentrate needed to prepare a spray or dip containing a given percentage of active ingredient. In the first, the concentration of emulsifiable

DILUTION TABLE

Formulation	Percentage of actual chemical wanted					
	0.0313%	0.0625%	0.125%	0.25%	0.5%	1.0%
			Wettable Powder (WP)			
15% WP	1 2/3 lb	3 1/3 lb	6 2/3 lb	13 1/3 lb	26 2/3 lb	53 1/3 lb
25% WP	1 lb	2 lb	4 lb	8 lb	16 lb	32 lb
40% WP	5/8 lb	1 1/4 lb	2 1/2 lb	5 lb	10 lb	20 lb
50% WP	1/2 lb	1 lb	2 lb	4 lb	8 lb	16 lb
75% WP	1/3 lb	2/3 lb	1 1/3 lb	2 2/3 lb	5 1/3 lb	10 2/3 lb
			Emulsifiable Concentrate (EC)			
1 lb actual/gal (10-12% EC)	2 pt	4 pt	1 gal	2 gal	4 gal	8 gal
1.5 lb actual/gal (15-20% EC)	1 1/2 pt	3 pt	6 pt	1 1/2 gal	3 gal	6 gal
2 lb actual/gal (25% EC)	1 pt	2 pt	4 pt	1 gal	2 gal	4 gal
3 lb actual/gal (33-35% EC)	3/4 pt	1 1/2 pt	3 pt	6 pt	1 1/2 gal	3 gal
4 lb actual/gal (40-50% EC)	1/2 pt	1 pt	2 pt	4 pt	1 gal	2 gal
5 lb actual/gal (57% EC)	7/16 pt	7/8 pt	1 3/4 pt	3 1/2 pt	7 pt	1 3/4 gal
6 lb actual/gal (60-65% EC)	3/8 pt	3/4 pt	1 1/2 pt	3 pt	6 pt	1 1/2 gal
8 lb actual/gal	1/4 pt	1/2 pt	1 pt	2 pt	4 pt	1 gal

lb = pounds
pt = pints
gal = gallons

concentrate is expressed as lb. of active ingredient per gallon. In the second, the concentration is expressed as % active ingredient.

$$\frac{\text{gal spray wanted} \times \text{\% active ingredient wanted} \times (8.3)}{\text{lb. active ingredient/gal of concentrate} \times (100)}$$

or,

$$\frac{\text{\% active ingredient in concentrate}}{\text{\% active ingredient wanted}} = \text{number of parts of finished spray or dip that must contain 1 part of the concentrate}$$

For example:

How many gallons of 25% lindane (2 lb./gal) emulsifiable concentrate are needed to make 100 gallons of spray containing 0.25% lindane?

Using 2 lb. active ingredient/gal

$$\frac{(100) \times (0.25) \times (8.3)}{(2) \times (100)} = 1 \text{ gal}$$

or,

Using 25% active ingredient

$$\frac{25\%}{0.25\%} = \frac{100}{1}$$

The dilution is one part 25% lindane in 100 parts of finished spray or dip. This would be equivalent to 1 gallon 25% lindane to 99 gallons water.

Wettable powders. - The following formula is used to determine the lb. of wettable powder needed to prepare a spray or dip containing a given percentage of active ingredient.

$$\frac{\text{gal spray wanted} \times \text{\% active ingredient wanted} \times (8.3)}{\text{(\% active ingredient in WP)}}$$

For example:

How many pounds of lindane 25% wettable powder are needed to make 100 gallons of spray containing 0.03% lindane?

$$\frac{(100) \times (0.03) \times (8.3)}{25} = 1 \text{ lb.}$$

Methods of Insecticide Application

Application techniques commonly utilized in the control of several different pests are discussed here. More specific information is presented later along with the individual pests. The purpose is to familiarize the reader with common application techniques and terminology.

Dip Vat

Dipping is a highly effective method for controlling several parasites of sheep (Figure 1). Although the initial cost of the vat plus the insecticide is high, no method provides more thorough coverage of the animals.

Dip vats should be located in areas where there is no problem of contamination of ground water, streams or ponds. They should also be provided with a drain pen so that excess insecticide solution will drain back into the vat.

Vats must be thoroughly cleaned and freshly charged prior to dipping. Check with State Department of Agriculture or Health Department officials for current procedures of disposal of unwanted insecticide.

The vat should be charged immediately prior to dipping. The volume of the vat should be determined prior to charging. This can be determined by pouring water into the vat from a measured drum or tank, by metering the water into the vat, or if the dimensions of the vat are known, by calculating the volume. Both emulsifiable concentrate and wettable powder formulations should be suspended in water in a premix tank before being added to water in the vat.

If a vat is to be replenished during dipping, it is advisable to situate a tank or drum adjacent to the vat. It should empty directly into the vat. This container can also be used in preparation of the initial charge.

Thorough mixing of the insecticide solution prior to dipping is essential. Periodically, a device should be dragged along the bottom of the vat to suspend insecticide that might have settled to the bottom. If a wettable powder insecticide is used, it should be mixed with a small quantity of water and converted to a slurry prior to addition to the vat.

Certain precautions must be observed in dipping sheep. Sheep are susceptible to chilling if dipped during cool weather. They should be dipped during the early part of the day and given sufficient time to dry before the sun goes down. Lambs should be dipped separately to reduce the danger of drowning.

Dilute Spray

Application of insecticide by means of a high pressure spray, i.e., 300 to 350 lbs. per square inch is a method that provides penetration into the fleece (Figure 2). Of course, this method requires fairly expensive equipment. A fairly high volume of spray, around 1 to 2 gallons, is required for complete coverage of one mature animal.

For control of sheep keds, low pressure sprayers or even sprinkler cans (Figure 3) can be used to apply about one quart of liquid insecticide per animal. It is not necessary to thoroughly soak the animals in order to control keds in this manner. To use the sprinkler can, crowd the sheep in a small pen (out-of-doors) and walk among them sprinkling the insecticide over the heads, necks, tops and sides.

Pour-On

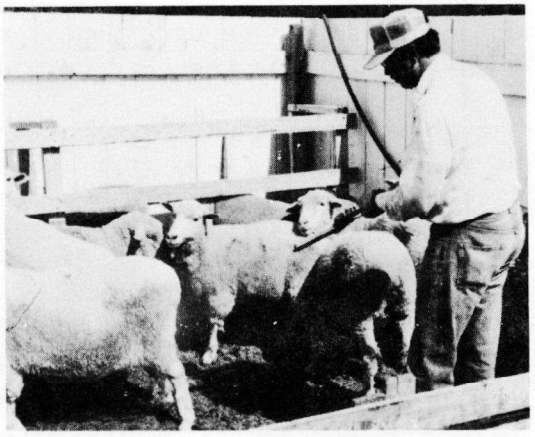
The pour-on method used for ked control on sheep involves topical application of a few cc to a single spot on the fleece (Figure 4). A calibrated syringe is used to apply the material since a very small volume of liquid is involved. Several insecticides are approved for use as pour-ons for cattle, but be sure that the material you are using is approved for use on sheep.

Dust

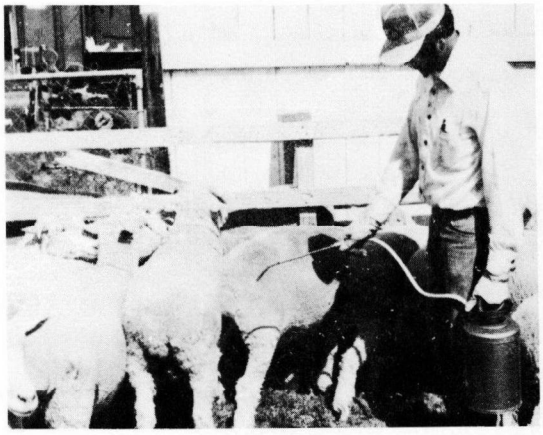
Dusting of sheep has been a popular method of treating sheep for many years. Sheep dusted in the spring of the year do not become wet and are therefore not subjected to chilling. Dusting is less hazardous to the sheep than is dipping.

Dusting by hand is a suitable method for small numbers of sheep (Figure 5). The method is time-consuming because animals have to be caught individually, then dust is sifted onto the wool then rubbed in lightly to work the dust down to the skin.

1



2



3a 3b

Figure 1. Dipping sheep.

Figure 2. Application of a high pressure spray to sheep.

Figure 3. Insecticide application by means of a low pressure compressed air sprayer (3a) and sprinkler can (3b) for control of sheep ked.

Power dusting by means of a sheep duster has been popular for large range flocks (Figure 6). After shearing, the sheep are crowded into a chute. Then, the duster is started and the sheep are driven through the curtain of dust.

Spot Treatments

Various kinds of application devices are available for spot treatment of areas on an infested animal. For example, insecticidal smears and foams can be used to prevent or treat a wool maggot infestation in the fleece (Figure 7) or a dust or spray or oil solution may be applied into the ear canal for control of the spinose ear tick (Figure 8).

Residual Wall Spray

Wall sprays are applied at low pressure, e.g. 80 p.s.i., to produce a coarse spray. Various kinds of sprayers, large or small may be used. Spray should be applied to resting places of flies, for example, to fences and walls (Figure 9) with care to avoid spraying feed and water. Animals should be removed from buildings prior to spraying. One application of an appropriate insecticide may give fly control for several weeks.

Space Sprays or Aerosols

This is a method for quickly clearing spaces of flying insects. A machine is used that produces a very fine mist or fog (Figure 10) that remains suspended in the air for several hours. Usually the application is most effective indoors and must be repeated daily.

The Pests and Their Control

Numerous insect and related pests attack sheep. In some areas of the world, certain pests severely limit sheep production. The following are important pests of farm and range flocks in some areas of the United States.

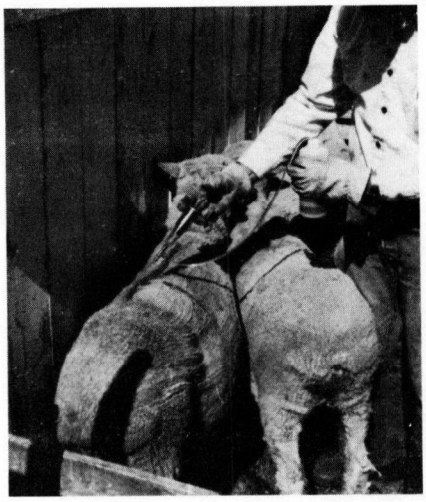
Biting and Nuisance Flies

Flies are familiar to everyone. Those that are particularly bothersome to sheep are horn flies, stable flies, horse flies, deer flies, mosquitoes, black flies, biting midges, and house flies. Flies severely affect the performance of sheep. They hinder grazing and cause sheep to bunch up or lie down in order to be freed from annoyance. They can remove considerable blood, and many flies are important in transmission of disease-causing organisms.

Black Flies

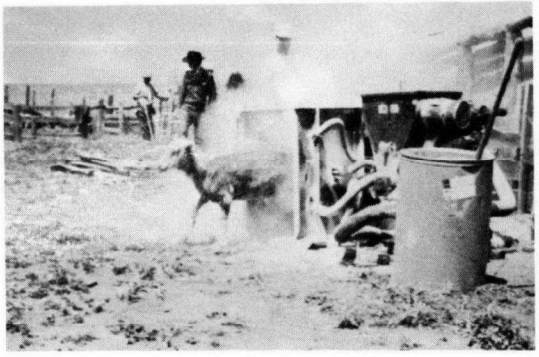
There are many species in the black fly family Simuliidae, and they are among the smallest of the biting flies. Frequently, they are called buffalo gnats because of their "humped back" appearance. Black fly may be a misnomer because some species are frequently tan or yellowish in color.

The four life stages of the black fly are illustrated in Figure 11. The duration of the life stages varies considerably with the different species. Several hundred eggs may be deposited on or in the water by the adult female. Larval and pupal black flies spend their lives in rivers or streams where fresh, running water provides sufficient aeration. These aquatic stages are attached to objects such as stones, logs and submerged vegetation. After emergence, the adult flies are capable of moving



4

5



6

7

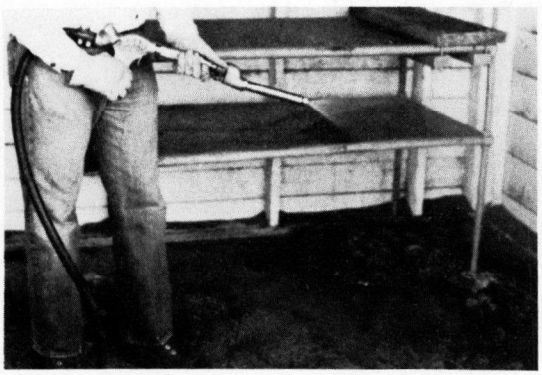
Figure 4. A low volume pour-on application for control of sheep ked.

Figure 5. Hand dusting of sheep.

Figure 6. Power dusting of sheep.

Figure 7. Spot treatment for control or prevention of a wool maggot infestation.

8



9

10a

10b

Figure 8. Puff duster treatment of ear for control of ear ticks.

Figure 9. Application of a residual wall spray.

Figure 10. A mist applicator (10a) and a fogger (10b).

considerable distances from the waters of their origin. Females are blood suckers and may occur in large swarms.

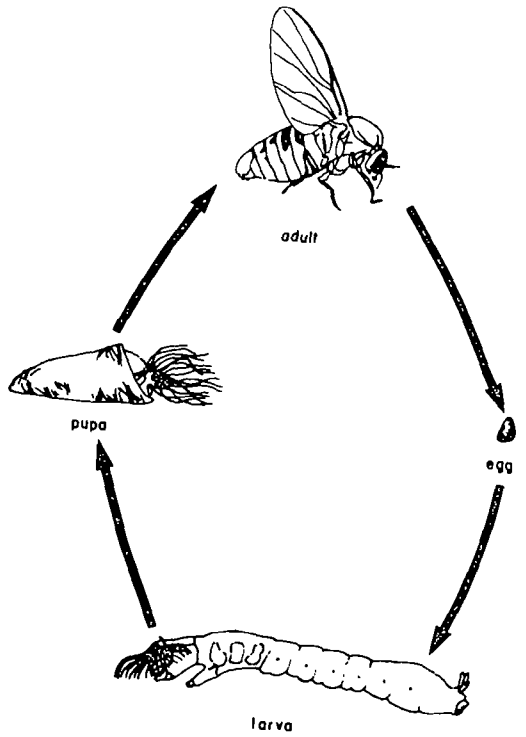


Figure 11. Life stages of a black fly. The adult of this species is approximately 3.5 mm.

Female black flies are attracted in large swarms to the host animal. They may fly about and get into the nose, eyes, ears and mouth. They feed either on exposed areas of skin or deep within the hair coat. They lacerate the skin and suck oozing blood. Strong anticoagulants in their saliva prevent coagulation of the blood for some time after the bite. A large, painful welt may develop at the site of the bite.

Black flies can significantly affect the performance of sheep, and during severe outbreaks, death losses have been reported.

Biting Midge

The very tiny bloodsucking midge or gnat, Culicoides variipennis, is a common pest of sheep in the United States (Figure 12). The females may attack in large swarms, primarily in the evening. These flies may be responsible for sores and scabby areas on the undersides of animals. In the United States, C. variipennis is the primary vector of bluetongue, a virus disease of sheep and other ruminants.

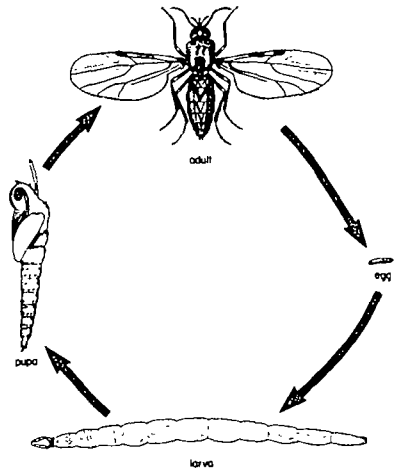


Figure 12. The life stages of Culicoides variipennis, a biting midge. The adult is approximately 2 mm.

Ideal larval breeding sites for C. variipennis usually consist of non-vegetated, open areas of soft silty mud, exposed to direct sunlight. Such areas may be found in natural marshy areas or along the margins of alkaline bodies of water in the West. Very dense populations of larvae can occur as a result of pollution by livestock or human wastes, e.g., near feedlots or inadequate human sewage facilities.

Mosquitoes

Adult mosquitoes are small (body length about 6 mm or less) delicate organisms with a conspicuous long snout

or proboscis. Mosquito life stages are egg, larva, pupa and adult. The eggs are laid on or near water. When in contact with water the eggs hatch and produce the aquatic immature stages. The larvae or "wigglers", with very few exceptions, are found in standing water with relatively little movement or wave action.

In the larval stage the mosquito attains most of its growth. After four larval stages of increasing size, larvae molt to the pupal stage. The pupa or "tumbler" moves about in the water by a tumbling action. After a few days, the pupa swims to the surface of the water, and the adult mosquito emerges from a slit in the "back" of the pupa.

Usually, the adult male mosquitoes emerge first and remain near the larval habitat and fertilize females shortly after their emergence. Most fertilized female mosquitoes then require a blood meal before egg-laying.

Female mosquitoes of the genera Aedes and Culex are serious pests. Examples of the two genera are presented in Figure 13. Note that these genera can be distinguished by the shape of the tip of the abodmen.

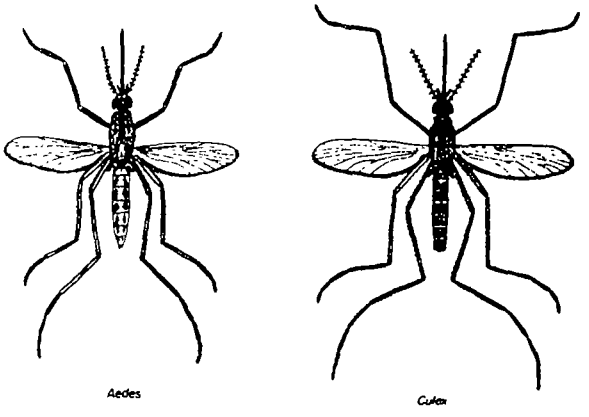


Figure 13. Female mosquitoes of two genera. The tip of the abdomen is pointed in Aedes and blunt in Culex. These specimens are approximately 5-6 mm long.

Aedes, flood water mosquitoes are extremely important pests because there are many species, and they appear in tremendous numbers. They are produced in vast inundated areas such as marshes, flood plains, snow pools and irrigated meadows. The adult females are avid feeders on both man and his animals. While most bites occur during the early morning and evening hours, some species will readily feed during the daylight hours.

The life cycle of a typical Aedes mosquito is presented in Figure 14. The eggs of these species are laid in moist soil in areas subject to reflooding and where the females are somewhat protected from the wind. The eggs may survive for several years before flooding. In temperate areas, Aedes mosquitoes overwinter in the egg stage, then hatch in the spring due to spring runoff or irrigation. Repeated flooding through the warm months will produce additional broods of some species.

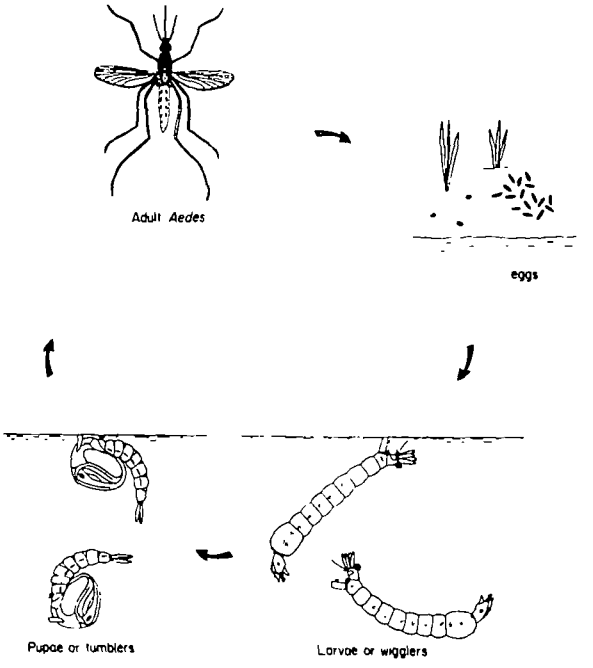


Figure 14. The life cycle of Aedes.

The life history of Culex (Figure 15) differs from that of Aedes. The eggs are deposited on the surface of standing water in groups called "rafts", and they hatch shortly thereafter. These mosquitoes are able to utilize many different kinds of standing water, fresh or polluted, usually in open, sunlit locations. Examples of suitable habitats are ponds, ditches, puddles in corrals, and artificial containers such as poorly maintained stock tanks or discarded drums, barrels and cans. These mosquitoes overwinter in sheltered locations as hibernating adults.

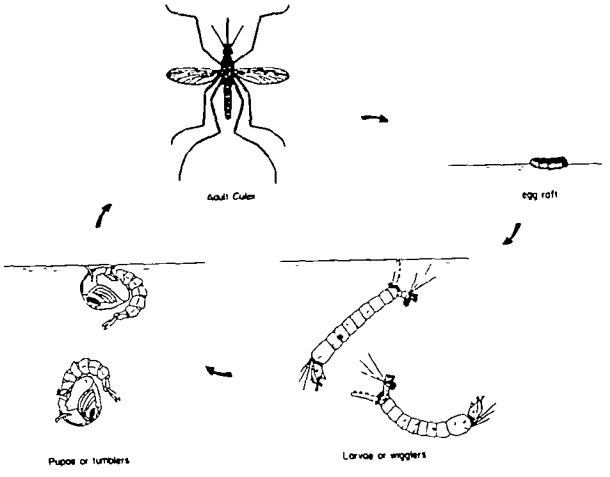


Figure 15. The life cycle of Culex.

Horse Flies and Deer Flies

Horse flies and deer flies belong to the same insect family, the Tabanidae, and are similar in many ways. Many species of horse flies and deer flies attack livestock and three are illustrated in Figure 16. Deer flies are usually about the same size or a little larger than the ordinary house fly, and frequently have distinct patterns on their wings. Horse flies are larger and darker than deer flies. Some are quite large.

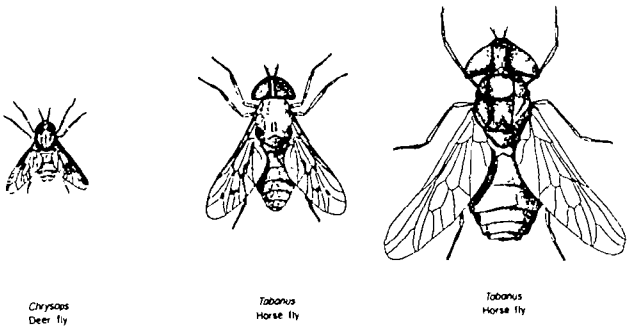


Figure 16. Adult deer fly and horse flies. These specimens range in size from 9 to 28 mm.

Adult horse flies and deer flies usually appear in large numbers at certain times during the season. Females attack animals, and the bite, which is extremely painful, causes considerable flow of blood. Frequently clusters of other kinds of flies will surround pools of blood formed by the feeding of horse flies.

The life stages of a horse fly are presented in Figure 17. Usually, the female flies lay their eggs, often attached to vegetation, near the damp or wet soil of streams, marshes, lakes or ponds. After a short incubation period of approximately one week, larvae hatch, then develop in water or wet soil. Later in the season, or possibly the following year, full grown larvae migrate to drier soil. Each forms a pupal case, from which an adult fly will eventually emerge.

Stable Fly

The stable fly, Stomoxys calcitrans looks much like a house fly except that it has a prominent beak (Figure 18).

Eggs of the stable fly are deposited in wet and decaying organic matter. Wet feed or hay contaminated with manure, urine, and mud are particularly good media for development of stable

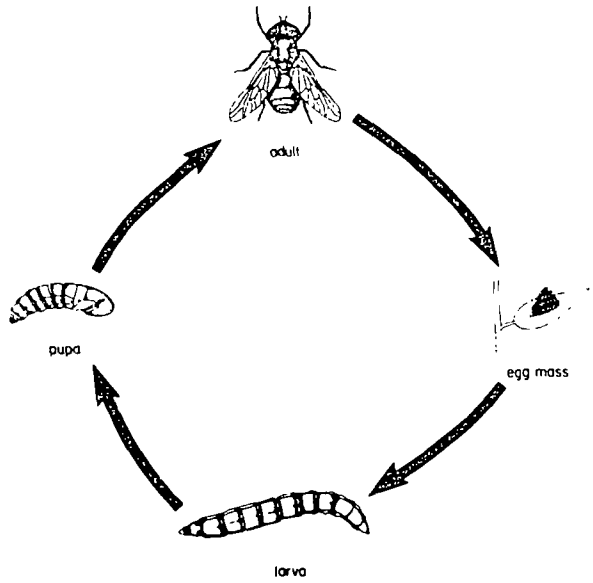


Figure 17. Life stages of a horse fly.

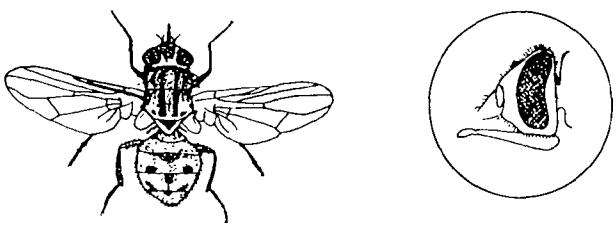


Figure 18. The adult stable fly, and enlarged, side-view of head and piercing mouthparts. The specimen is approximately 8 mm.

fly larvae or maggots. In areas where bodies of water occur, stable fly may be abundant because piles of decaying "seaweed" are good larvae media.

The life stages of the stable fly are presented in Figure 19. After egg hatching, the larvae pass through three stages of increasing size. After the larval stage a pupal or inactive stage is formed. Eventually an adult fly emerges from the pupal case. Because of rapid development from egg to adult, about 24 days, stable fly can produce several generations per season.

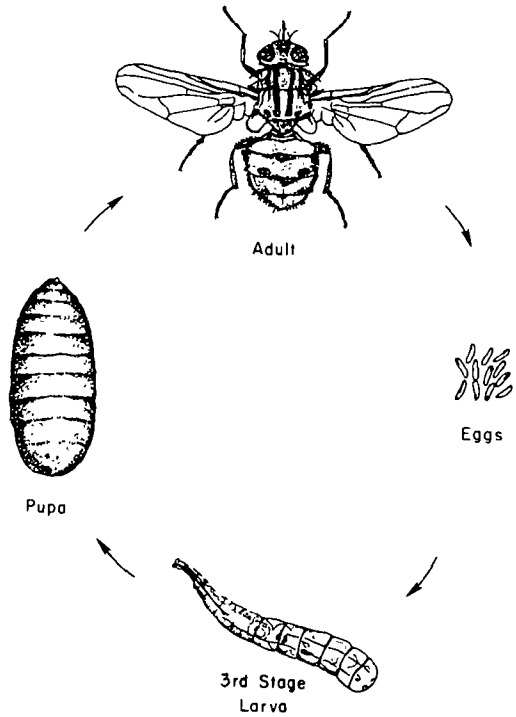


Figure 19. The life stages of the stable fly.

Both male and female stable fly readily attack animals. They have a stout proboscis with which their pierce the skin and suck blood. The bite is painful.

Stable fly is a particularly serious problem in areas where there is considerable medium for production of larvae. Such conditions frequently exist in and around livestock buildings and lots where stable fly can be found in doors as well as out.

Horn Fly

The adult horn fly, Haematobia irritans, looks much like a miniature stable fly (Figure 20). Both sexes

of the horn fly have beaks which they utilize to obtain blood meals. The horn fly is primarily a pest of cattle, but is occasionally seen on sheep. Ordinarily the flies congregate on the shoulders and sides of the animal. During extremely hot sunshiny or rainy weather the flies may congregate on the underside of the belly.

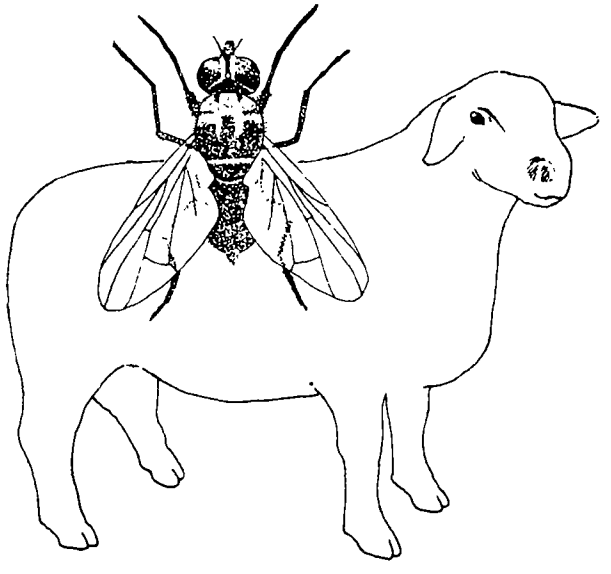


Figure 20. The horn fly. The adult is approximately 4 mm.

The adult female is usually found on cattle and leaves only to deposit eggs in fresh cattle droppings. After hatching, the larval stages develop rapidly in the cattle dung pat. Pupation usually takes place in the soil beneath the pat. Adults emerge from pupae and seek out a host. The cycle can take less than two weeks in warm weather.

House Fly

The house fly, Musca domestica, is a widespread pest that is familiar to everyone. Though it does not inflict a painful bite because of the nature of its mouthparts (Figure 21), it is a very annoying insect and can torment sheep considerably.

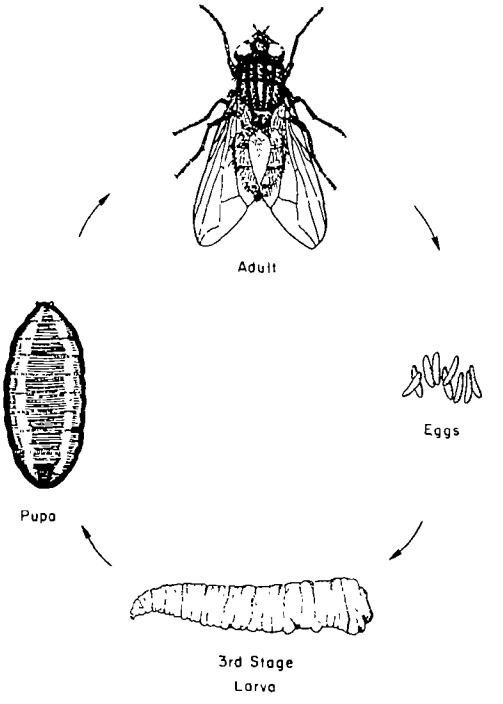


Figure 21. The life stages of the house fly.

The four life stages of the house fly, egg, larva, pupa and adult are presented in Figure 22. The complete life cycle from egg to adult requires approximately two weeks in warm weather.

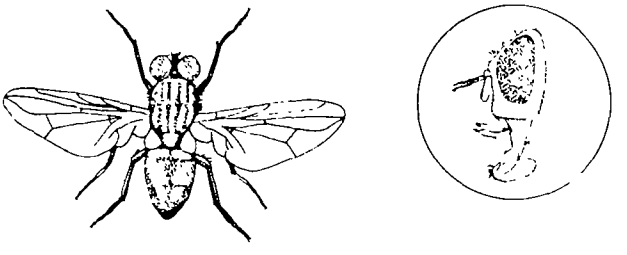


Figure 22. The adult house fly and an enlarged side-view of the head and sponging-type mouthparts. The specimen is approximately 7 mm.

The house fly is a pest closely associated with man's activities. It is able to utilize many kinds of organic matter, such as found in garbage, as a larval medium. It is

able to utilize all sorts of decaying excrement. Primarily, it is considered a pest in and around livestock buildings and feedlots.

Control of Flies

Several different insecticides may be applied to sheep as a dilute spray or dip for control of horn fly. These treatments may also provide some relief from attack by other fly species.

Much can be done to alleviate house fly and stable fly problems around livestock buildings and feedlots through sanitation and proper management of manure. Basically this means either elimination of larval habitat or modification in such a way as to make it unsuitable for fly production. Prompt and regular removal and dispersal of manure, soiled bedding and spilled feed is a good fly preventive measure, as is elimiation of wet areas in pens and lots.

Insecticide-based control is possible when a fly problem gets out of hand around livestock housing facilities. Residual sprays, applied to walls, ceilings, fences and other favored resting places are effective and may last several weeks. For fly control in buildings various insecticide baits are effective against house fly if used properly. For fast but temporary control of flying insects in confined areas, fogs, aerosols or mist applications are effective.

Out-of-doors, mist applications that involve a finely divided spray will disperse quite rapidly. The dispersed droplets kill flies they contact. This method, including ground and aerial application, can be used, however, for temporary relief from a serious outbreak of flies.

Many populations of the biting midge, Culicoides variipennis are produced inadvertently on farms and ranches, and may be eliminated through management or cultural practices. Examples of such larval breeding sites are: sites where water-borne human sewage flows out onto the ground; puddles contaminated with manure such as those that occur near water tanks and in livestock pens; and dirt stock ponds where manure has been trampled into the shallow water along the edge.

Mosquito annoyance may be reduced through source elimination, i.e., elimination of water that provides a suitable habitat for mosquito larvae. Mosquito larvae can also be eliminated through the removal of protective emergent vegetation from places such as drainage ditches and the edges of ponds and lagoons.

In several locations, communities as well as smaller groups of farmers and ranchers have organized for mosquito control. Primarily these programs have involved aerial application of larvicides to vast areas of flooded land.

Sheep Bot Fly

The sheep bot fly, Oestrus ovis (Figure 23) is a common pest of sheep and goats. The persistency of the adult flies in depositing larvae in the nostrils excites the animals and interferes with handling and grazing. The larval stages of the fly, known as head grubs, live as parasites within the nasal passages and frontal sinuses. They may irritate membranes lining the nasal cavities and predispose the sheep to bacterial infection. The resultant nasal discharge leads to the term "snotty nose."

The life history of the sheep bot fly is presented in Figure 24. During

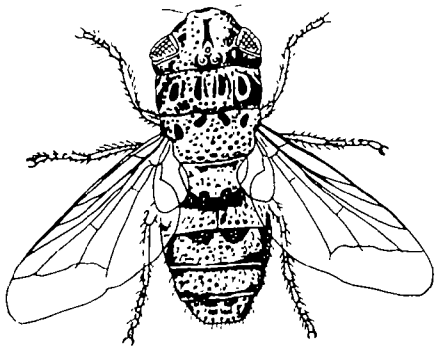


Figure 23. The sheep bot fly. The adult fly is approximately 13 mm.

the warmer months of the year very small, first-stage larvae are deposited in the nostrils by female flies. These small larvae remain in the nasal passages for a time, then migrate to the frontal sinuses for further development. After reaching full growth in the sinuses, larvae work their way out of the nostrils and drop to the ground, where they bury themselves and pupate within a few hours. The pupal period lasts about one month.

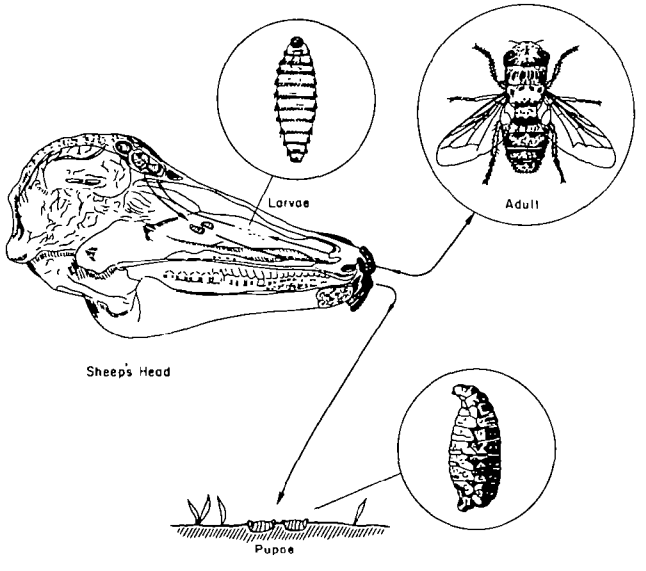


Figure 24. Life cycle of the sheep bot fly.

Currently, there is no practical, approved method for control of this pest.

Wool Maggots

The larvae of many species of blow fly have been reported to invade wounds of livestock. Several species, however, do not necessarily require a wound in order to parasitize sheep. The larvae of these flies are called wool maggots or fleece worms.

The adult flies (Figure 25) are often about the same size as the house fly and dark bluish-green in color with a metallic luster. The larvae look like typical fly maggots.

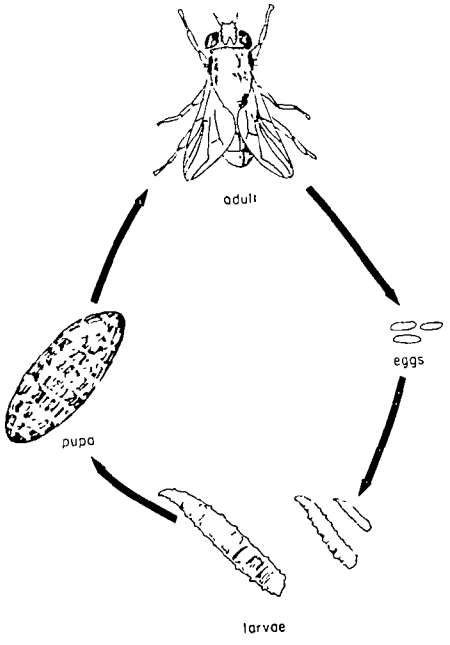


Figure 25. The life stages of a typical blow fly or wool maggot. The adult varies in size from 6 to 11 mm.

The factors surrounding strike or egg-laying are not completely known, however, several predisposing causes have been reported. The primary cause for strike is bacterial activity in the wool, which can be stimulated by contamination with urine, feces, sweat

or an existing maggot infestation. Maggots may live in the fleece, or they may attack the skin and produce lesions. The lesions and the maggots irritate the animals. The sheep become restless, stamp their feet, constantly wag their tails, and bite at the site of the trouble. They do not feed properly, and become poor in condition. Death may occur within a few days.

Life histories of the several species of wool maggots are similar (Figure 26). The usual larval breeding places are in carrion, but under certain conditions they find a favorable environment for development on living sheep. Eggs hatch in a few hours and maggots develop rapidly completing growth in three to four days. They then drop from the host and enter the ground, where they transform to the pupal stage. After seven to ten days adult flies emerge from pupal cases. Several generations develop each year.

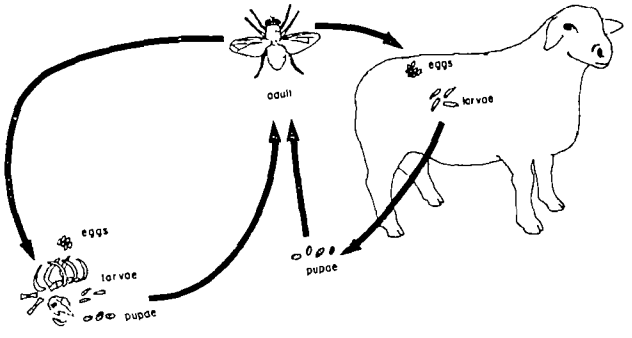


Figure 26. The life cycle of a wool maggot.

Much can be done to avoid maggot infestation of animals through flock management. Soiling of fleece should be avoided, but if the breech area becomes saturated with urine and feces during the blow fly season, wool should be clipped from the crutch area. In order to avoid wounds that may become maggot infested, sheep should be handled gently and with safe chutes and corrals. Lambing and shearing early in spring prior to the blow fly season is advisable.

Insecticides are used for prevention as well as control. Preventive dips or sprays may be applied if animals scour during the warm months. Wounds may also be treated. Infested animals may be dipped or sprayed with dilute insecticide. If only a few animals become infested, spot treatment of the infested site is a possibility.

Sheep Ked

The sheep ked, Melophagus ovinus is a common pest of sheep. It is a wingless fly that has a tick-like appearance (Figure 27). Two stages of the insect may be seen on sheep, the adult and the pupa. Both stages are most commonly found on the underside of the host, although they are not restricted there.

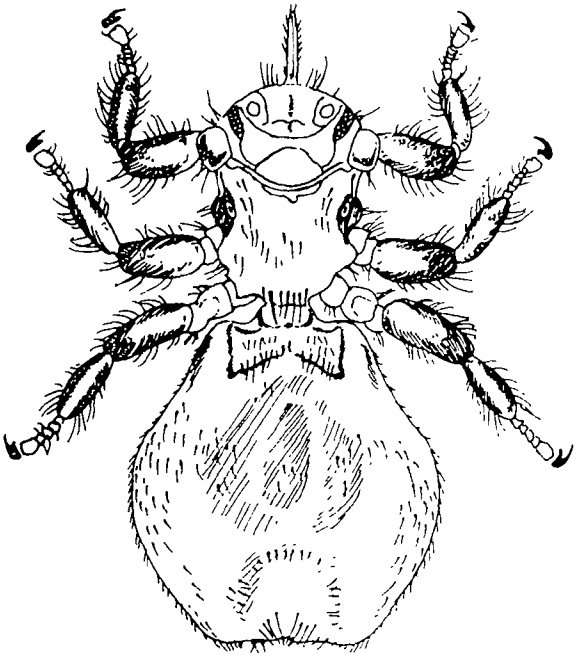


Figure 27. The sheep ked. The adult is about 7 mm.

The sheep ked is a blood feeder, and it crawls rapidly through the fleece of the host animal. Damage results from bites of the ked and irritation to the sheep.

The entire life of a sheep ked is spent in the fleece of the host (Figure 28). Adult keds spread from one host to the next by direct contact. This is how keds transfer from ewes to newborn lambs.

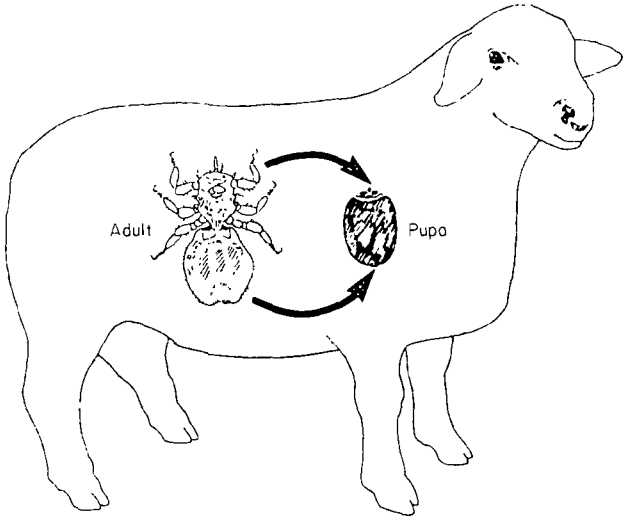


Figure 28. Life cycle of the sheep ked.

The sheep ked has an unusual means of reproducing. The larval stage of this fly develops within the adult female. A single larva develops at a time, requiring approximately eight days. The adult female ked attaches the fully developed larva to the fleece, and the larva transforms into the red, barrel-shaped puparium. A new ked emerges from the pupa after approximately 22 days.

Ked populations build up during the autumn and winter months and reach peak numbers in January and February, then decline to lower numbers that are carried over the summer.

Several methods of control are available for sheep ked. Each has its advantages and disadvantages depending on the particular sheep management program. Most often, sheep are successfully treated in the spring after shearing. All sheep in a flock must be treated, and all animals introduced into a flock should be treated in order to prevent reinfestation. Methods of application for sheep ked control include dipping, high pressure spray, low pressure spray (including sprinkler can), pour-on, power dusting and hand dusting.

Sheep Lice

Several species of lice can infest sheep. These include one species of chewing louse (the sheep biting louse) and several species of sucking lice. The sheep biting louse and the sheep foot louse (a sucking louse) will be discussed here.

The sheep biting louse, Bovicola ovis (Figure 29), is a small species with a pale abdomen, darker thorax, and reddish head. The sheep foot louse, Linognathus pedalis (Figure 29), is up to 2 mm long, has a short head, nearly as wide as it is long, and the abdomen is thickly covered with long slender bristles.

The adult, nymphs, and egg stages all appear on the host (Figure 30). The three nymphal stages resemble the adult lice in general appearance, however they are smaller in size. The eggs, which are quite small in size are glued to wool fibers and hairs.

The sheep biting louse and sheep foot louse demonstrate a pronounced seasonal fluctuation in populations, numbers being greatest in winter and early spring, and lowest in summer. Lice are spread by contact between sheep. The sheep foot louse can also

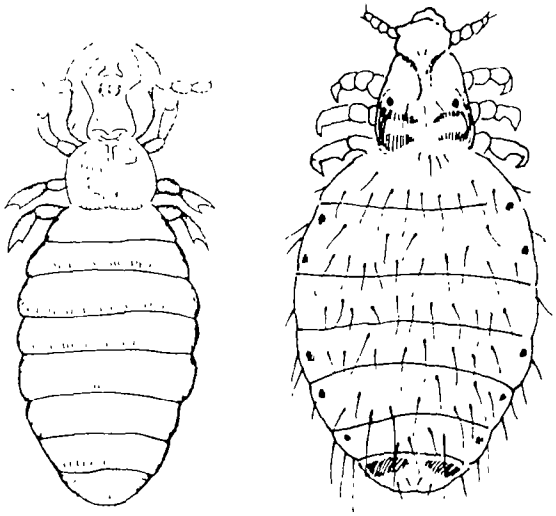


Figure 29. A, the sheep biting louse (1.8 mm) and B, the sheep foot louse (2.0 mm).

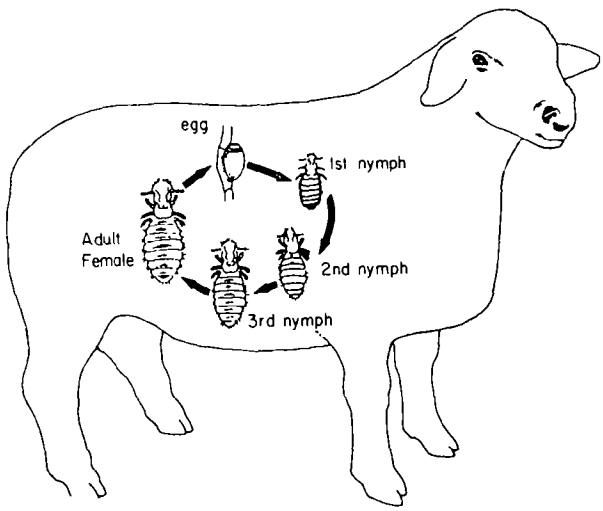


Figure 30. Life cycle of the sheep biting louse.

be acquired from an infested pasture.

The sheep biting louse is usually most abundant on older sheep and sheep in poor condition. Their preferred location is near the skin along the back and the upper sides. In heavy infestations lice may be found anywhere on the body.

Biting lice feed on the skin scurf. They cause intense irritation which sheep relieve by biting and pulling the wool and by rubbing against objects. The fleece of heavily infested sheep becomes ragged and torn.

The sheep foot louse is a sucking louse that feeds on blood. Usually this louse is not considered very injurious since feeding occurs on the hairier parts of the sheep's body, and the animal exhibits little discomfort. In severe infestations, however, it may cause some lameness.

Generally, lambs and younger sheep are more heavily infested by the sheep foot louse than are older animals. Light infestations commonly occur as small colonies of lice around the accessory digits. From this location they may spread down to the foot and up the shank. In heavy infestations they also infest the scrotum and sometimes the belly of rams.

The sheep body louse, sheep foot louse and other species that occur on sheep may be controlled by the use of an insecticide dip or high pressure spray.

Ticks

The Rocky Mountain wood tick, Dermacentor andersoni and the spinose ear tick, Otobius megnini can be serious problems when they occur in sheep producing regions. Rocky Mountain wood ticks are important pests of sheep for several reasons. Considerable blood loss and severe anemia can result from heavy infestations. These ticks may also cause tick paralysis in sheep by the feeding of females, and their injection of a toxin into the blood stream of the host. Finally, Rocky Mountain

wood ticks transmit the pathogen of tularemia to sheep.

By attaching deep in the ears, the spinose ear tick causes considerable irritation and pain. The injury predisposes the host to secondary bacterial invasion of the inner ear.

The adult stage of the Rocky Mountain wood tick (Figure 31) is seen attached to sheep and other large mammals in the spring. The immature stages generally are not seen because they parasitize small mammals such as ground squirrels and rabbits.

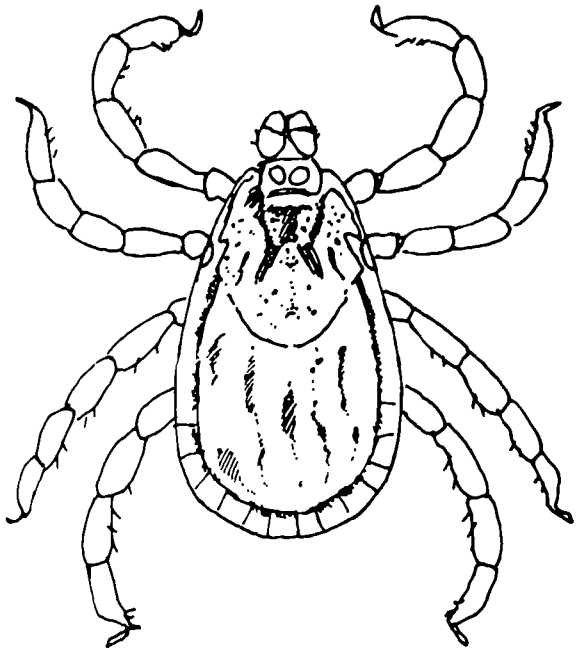


Figure 31. The Rocky Mountain wood tick. The unengorged female is about 5.0 mm.

The life cycle of the Rocky Mountain wood tick is fairly complex (Figure 32). In the spring adults come out of hibernation and attach to large mammals. Mating and feeding occur on the host, then the females drop to the ground in one to three weeks. Egg-laying takes place on the ground, and over 6,000 eggs can be produced by one female. The larval or seed ticks, which hatch in a month, attach to small wild mammal hosts where they feed for two to eight days, then drop off. Nymphs, which appear three weeks after the larvae drop, may either hibernate that winter as nymphs or find another small mammal host. If another host is found, the nymph feeds, drops off, molts, and spends the winter as an unfed adult. Overwintering nymphs seek small mammal hosts the following summer, feed for about a week, then drop off the host. After a quiescent period, these nymphs molt and overwinter as unfed adults.

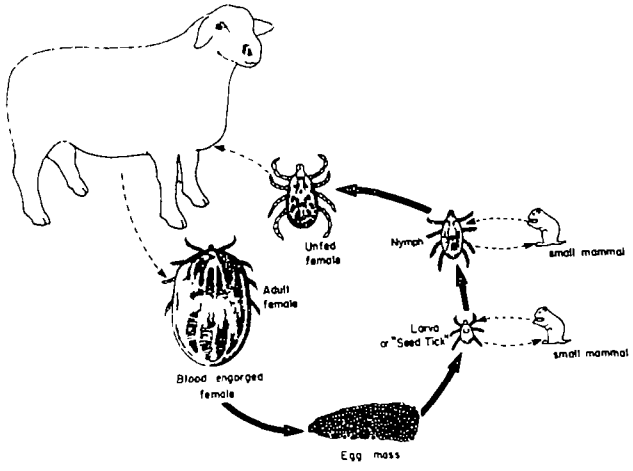


Figure 32. Life cycle of the Rocky Mountain wood tick.

The nymphs and larvae of the spinose ear tick (Figure 33) are the stages that are usually seen, and these are found in the ear, attached to the tender skin. Larval spinose ear ticks hatch from eggs that have been laid on the ground. The larvae climb onto the vegetation, feed troughs, etc., to contact passing host animals. After contacting the host, the larval tick moves to the ear where it attaches to the delicate lining of the ear and engorges. It molts in one to two weeks to the first nymphal stage, then the second. Nymphs may remain in the ear up to

six months. The nymphs then drop to the ground, molt to the adult stage, mate, and lay eggs.

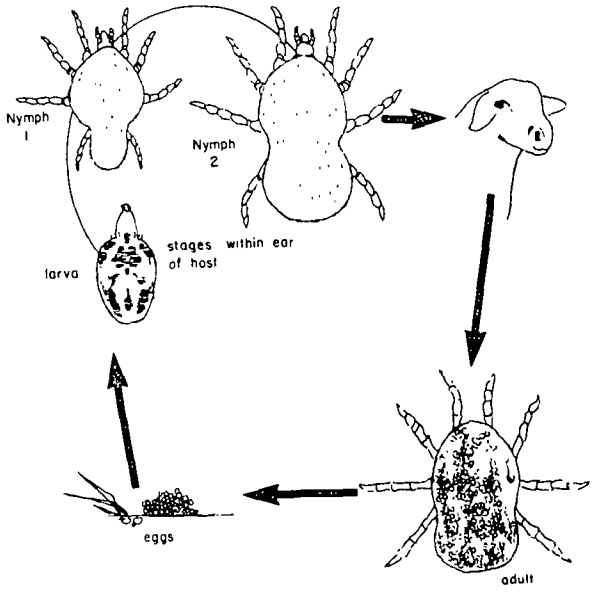


Figure 33. Life cycle of the spinose ear tick. The engorged larva and nymph, which occur in the ear, are approximately 3.5 and 7.5 mm, respectively.

Control of Rocky Mountain wood tick is best accomplished by means of an approved insecticide applied as a high pressure spray or by a dip vat. Spinose ear ticks may be controlled by application of a dust or oil solution directly into the ear.

Mange Mites

Several different mite species produce a contagious disease of the skin of domestic animals known as mange. The type of mange is named after the mite causing it, e.g. sarcoptic mange, psoroptic mange, and chorioptic mange which are caused by Sarcoptes, Psoroptes, and Chorioptes mites, respectively. For diagnosis, mites are scraped from an infected area of the host animal. Microscopic examination is necessary for positive identification of the type of mange present because mites are barely visible to the naked eye.

All of these mites have developmental stages similar to those of ticks, i.e. eggs, larvae, nymphs, and adults (Figure 34). All stages live only on the host animal and are spread by contact between animals or with contaminated equipment.

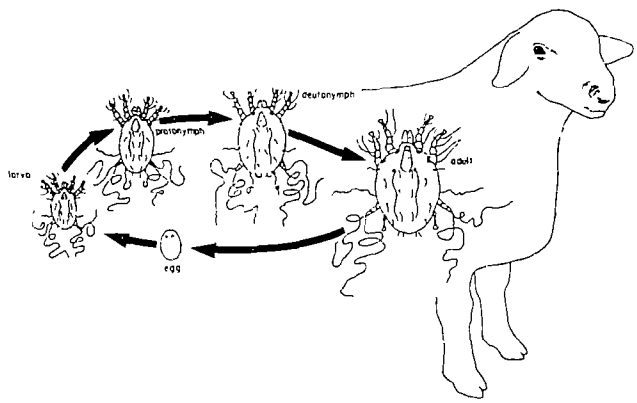


Figure 34. The life stages of a mange mite.

Sarcoptic Mange

Sarcoptic mange is rare in sheep. Adult sarcoptic mites (Figure 35), burrow within the skin of the host and cause severe irritation. Eggs are laid within the burrows. Development of the mite from egg to reproductive adult takes approximately two weeks. This form of mange occurs only on the nonwooly skin. Lesions usually first appear on the head and face.

Psoroptic Mange

Psoroptic mange of sheep is also called sheep scab. It is caused by Psoroptes ovis (Figure 35). It is a notifiable and quarantinable disease, and when suspected should be reported immediately to regulatory officials.

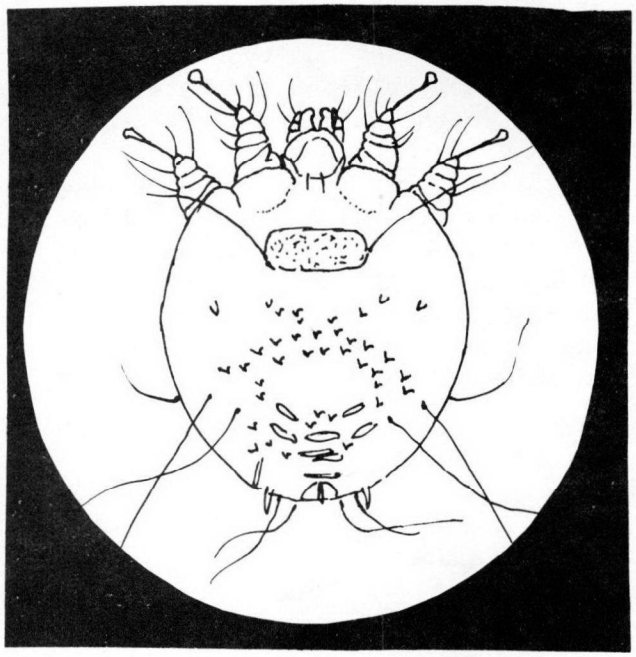


Figure 35. Sarcoptes scabiei, a mange mite. Microscopic in size.

Although it has not been reported from the United States in recent years, there is constant danger of its reestablishment.

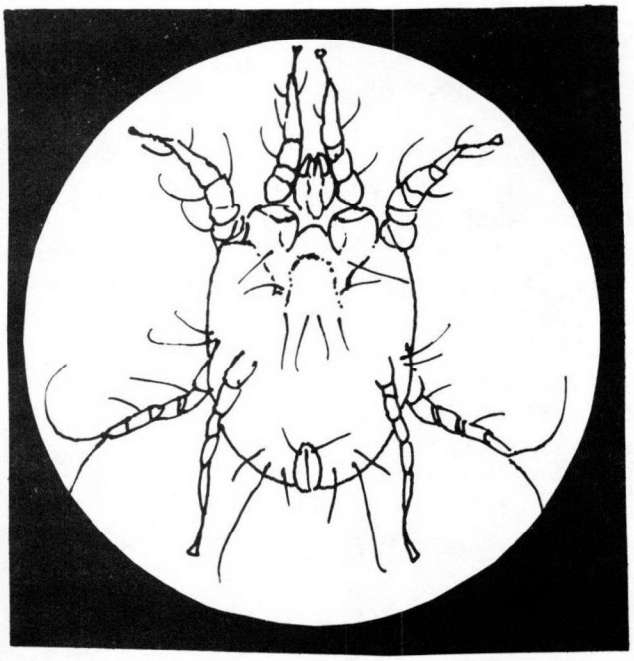


Figure 36. Psoroptes ovis, the causative agent of sheep scab. Microscopic in size.

Psoroptic mites do not burrow in the skin of the host. Instead, by pricking the skin to feed, they cause serum to ooze from the wounds. Accumulation of serum causes the formation of scabs. It occurs almost exclusively on the wooled parts of the body where it produces large, crusted lesions. Psoroptes infestations eventually may involve large skin areas. The coat of the sheep becomes ragged, and "tags" of wool are torn out or rubbed away by the sheep. Psoroptes ovis causes severe debility, extensive loss of wool, and in severe cases, deaths of animals are not uncommon.

The life cycle requires about two weeks and the infestation can build rapidly. Psoroptes mites occur abundantly under the scabs. Infested sheep rub and scratch because of the severe irritation, and this results in rapid spread of the disease to other animals.

Chorioptic Mange

This form of mange is probably the most widespread in sheep in the United States. Chorioptes mites (Figure 37) live on the surface of the skin and feed on scurf and skin secretions. Although it sometimes causes considerable irritation to the host, the only noticeable skin lesions occur on the scrotum of rams. Infested sheep may often be observed biting or licking their lower legs and feet.

The areas of the body on which this mite is found are those haired areas of the legs, face, and scrotum having no wool. Little damage results to the fleece and little weight is lost by fattening lambs.

Control of Mange Mites

Dipping is the preferred method of treatment for mange control in sheep.

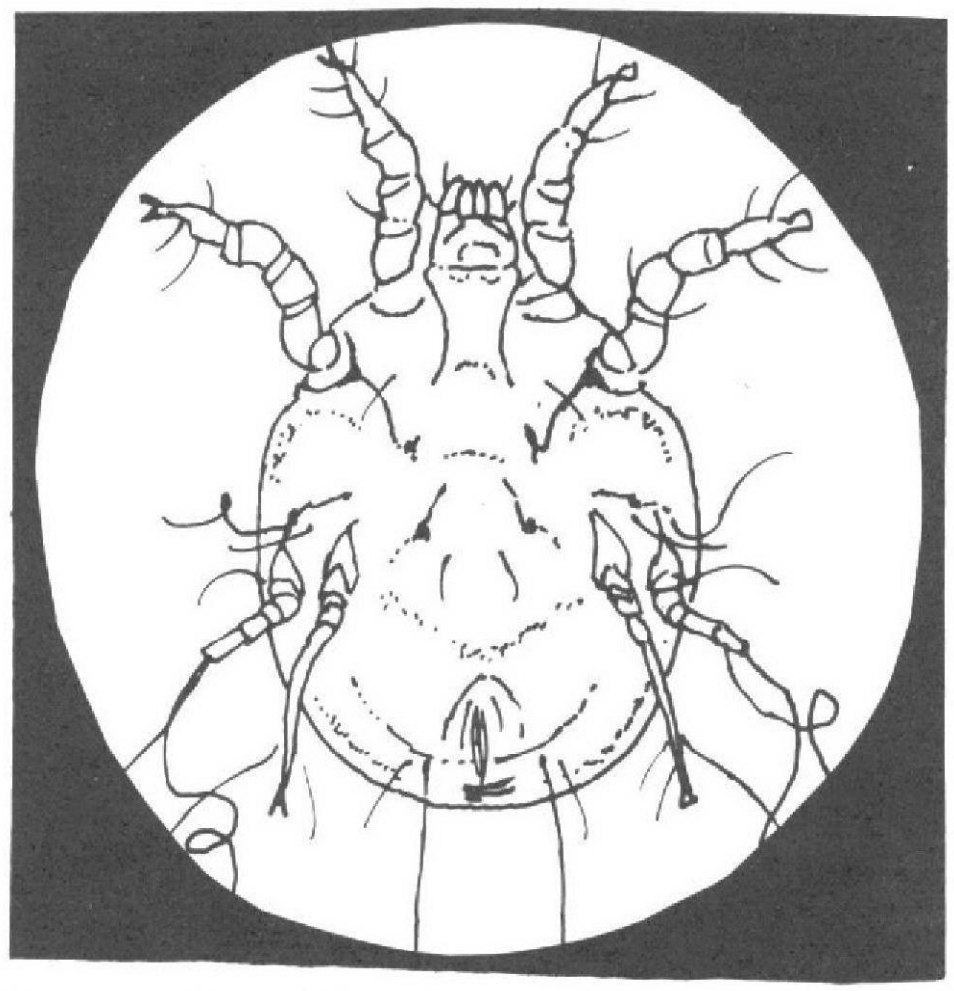


Figure 37. Chorioptes bovis, a mange mite. Microscopic in size.

Current state and federal regulations concerning treatment of sheep infected with or exposed to Psoroptes must be followed.

U.S. GOVERNMENT PRINTING OFFICE: 1981—680-146/73 Region No. 8