INSECT AND MITE PESTS OF NARCISSUS

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The statement that the *Narcissus* has fewer insect and mite pests than many of our well-known ornamentals would seem to be in keeping with the facts. This does not mean, however, that these pests of *Narcissus* are any the less important considering the damage they do. Perhaps it means that those of us who are concerned with controlling the insect and mite pests of *Narcissus* can concentrate our attention more fully on a smaller number of subjects. It might be of interest to note that these pests of *Narcissus* are limited to a few species of flies and two species of mites. However, one of these flies, the *Narcissus* bulb fly, probably does more damage than all the others put together.

THE NARCISSUS BULB FLY

The adult of the *Narcissus* bulb fly resembles a small bumblebee somewhat in appearance. It is a shiny yellow-and-black fly whose body is covered with rather long and coarse hairs. The adults are active fliers and prefer sunny locations. Flight among the plants is somewhat zigzagged and usually about eight to ten inches above the ground. Their flight is also characterized by a peculiar high pitched hum when they are most active during warm sunny weather. They apparently dislike the wind for they usually are found in sheltered spots. The adult flies feed on pollen and nectar and will leave the host plants in search of this food.

The *Narcissus* bulb fly is thought to have been a native of southern Europe. It appeared in the bulb producing areas of northern Europe early in the nineteenth century. The insect was reported as present in the United States as early as 1879 and in Canada as early as 1903. This fly is now definitely established in the major narcissus producing areas of the United States.

Damage to the *Narcissus* results from the feeding of the maggots or larvae in the bulbs. Infested growing bulbs produce fewer leaves than normal. That is, if the bulb is not too seriously damaged, it may produce a few leaves. These are usually rather small and grassy in appearance. Infestation in bulbs to be planted may be detected by examining the bases. Cleaning away the soil and old roots with a knife will aid in this examination. A brown colored sunken portion of the root ring which surrounds the base indicates the presence of a maggot. This deep brown discoloration often extends upwards on the side of the bulb above the point of attack. If the bulbs fail to grow, it is probably because the maggots have injured them severely enough to have killed them. Such bulbs are soft, discolored and often in an advanced state of decay. An examination of such bulbs will disclose a large whitish or yellowish-white maggot inside the bulb feeding on the plant tissue.

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The *Narcissus* bulb fly is known to attack *Narcissus*, hyacinths, *Amaryllis*, *Galtonia* and several others. In addition, the writer has also reared the *Narcissus* bulb fly from infested bulbs of the following species: *Cooperia pedunculata*, *Hymenocallis amancaes*, *Chlidanthus fragans*, *Sprekelia formosissima* and *Pancratium maritimum*.

Adult flies begin to appear in late April and are present into June. The peak of adult activity is in mid May. The eggs are laid singly on the bulb leaves at approximately ground level and occasionally in the soil close to the host plants. The newly hatched maggot moves downward between the soil and the surface of the bulb to the base of the bulb where it enters and starts feeding. The larvae are well developed with the approach of winter and remain in an inactive condition in the bulb throughout the winter months. The normal life cycle is completed in one year.

The mature larva has a length of five-eighths to three-fourths of an inch. On reaching maturity the larva leaves the bulb in the spring and moves upward through the soil to the surface where it pupates. The pupa is the transitional stage in which the insect changes from the larva to the adult fly. The skin of the mature larva hardens to form the covering or puparium within which the transformation occurs.

Control

The only satisfactory method for controlling the narcissus bulb fly is to lift the bulbs as soon as they are mature, clean them, and fumigate them, after which they should be returned to the soil promptly. Unfortunately, no sprays have yet been devised that will give reliable protection. Both cyanide and methyl bromide are used in the fumigation of narcissus bulbs. Successful fumigation requires adequate equipment. This means first of all that the grower must have access to a fumigating chamber that has been constructed for the purpose. Most commercial growers have this equipment and use it in a routine procedure. The problem confronting the gardener or the estate owner is quite different. The present methods of control do not lend themselves to the protection of narcissus that have been naturalized in a woodland glade. No really satisfactory field treatment for bulb flies has been developed. Poison bait sprays have been recommended in England, but these appear to be ineffective under conditions in the United States. It is hoped that some of the newer insecticides may prove effective once we learn how to use them.

FUMIGATION

Fumigation with hydrocyanic acid gas is effective in killing the bulb fly larvae within the bulb. The hydrocyanic gas can be generated from either sodium cyanide or calcium cyanide. Calcium cyanide is the most convenient form to use and should be used at the rate of 16 ounces to each 100 cubic feet of fumigator space. The bulbs should be left in the fumigator for four hours at a temperature of 70 degrees F. The fumigating chamber should be gas tight. It should be provided with a heater

and automatic temperature controls and should be equipped with a fan for circulating the gases during fumigation. CAUTION! *Sodium cyanide and calcium cyanide and the hydrocyanic acid gas evolved from them are deadly poison.* Adequate precaution should be observed in using the gas and the materials from which it is generated. Only experienced and dependable persons should attempt to use these materials. The fumigation chamber should be cleared of all residual gas after fumigation before anyone is allowed to enter it. It is not advisable to handle fumigated bulbs until at least 24 hours after they have been removed from the fumigation chamber.

A reaction of the calcium cyanide with atmospheric moisture evolves the gas. This reaction is rather slow and the chemical must be spread out thinly to permit the air to reach all of it. It is advisable to apply the material by spreading it on paper on shallow pans or trays which are placed on the floor of the fumigation chamber. At the end of the fumigation excess material may be rolled up with the paper and disposed of.

Methyl bromide can also be used for fumigation. It should be used at the rate of three pounds to 1000 cubic feet of fumigating space. The bulbs should be given an exposure of four hours at 70 degrees F. Methyl bromide will also kill Tarsonemus mites if they happen to be present, something that cyanide will not do.

HOT-WATER-FORMALIN TREATMENT

Bulb fly larvae in *Narcissus* bulbs can also be killed by immersing the bulbs in water that has been heated to a temperature of 110 to 111 degrees F. for a period of four hours. Commercial formaldehyde solution should be added to the water at the rate of one pint to 25 gallons. This is done to prevent the spread of fungus diseases in the treating bath. The tank should be insulated against the rapid loss of heat and the bath should be circulated through the bulbs during the operation. Some means should be provided for automatically adding heat to the bath as it is lost through radiation or otherwise dissipated.

THE LESSER BULB FLY

Narcissus bulbs are occasionally found in a more or less rotted condition, the decayed tissue containing numbers of maggots. These are the larvae of one of the lesser bulb flies and almost without exception are found in numbers, whereas the larvae of the *Narcissus* bulb fly, with the same regularity, occur alone or singly. There are three species of these flies occurring in *Narcissus* bulbs and all belong to the genus *Eumerus*. *Eumerus tuberculatus* Rond. is the most common of the three species. *Eumerus strigatus* Fallen is occasionally found and *Eumerus narcissi* Smith is present in limited numbers, apparently in certain localities only. These three species are very similar in appearance and habits, so all three can be discussed as a group.

Opinions differ as to the importance of these three species as insect enemies of the *Narcissus*. There are those who claim the larvae are not able to attack normal sound *Narcissus* bulbs, that they are able to enter

only bulbs in which decay or rot has already affected the tissue. It is known that the larvae of the lesser bulb flies can not develop in the absence of certain decay organisms. No doubt many bulbs in which decay or injury may have been only incipient could have been saved if larvae of the lesser bulb flies had been prevented from attacking them. Moreover, the writer has examined many bulbs that have been injured by the larvae of these species which bore unmistakable evidence that the injury was due primarily to the activities of the maggots.

The adult flies are quite different in appearance from those of the narcissus bulb fly. They appear black at a distance but closer examination reveals the color to be a dark blue with profuse iridescence. The body bears three pairs of grayish white marks on the upper side of the abdomen. Both ends of the fly are bluntly rounded giving the body a plump appearance. The adults are somewhat variable in size ranging in length from one-fourth to one-third of an inch.

The lesser bulb flies are known to attack *Narcissus*, hyacinths, *Amaryllis*, onions, *Iris*, shallot and several other plants. The writer has also reared them from larvae infesting bulbs of *Lilium specosium*.

Adults from overwintering larvae appear in April or May. Soon after emergence the females begin to deposit their eggs in clusters of three to ten or more in the soil close to or on the leaves at the neck of the bulb. Soon after hatching the larvae work downward to the bulb which they enter and in which they develop. As soon as mature they move to the soil surface where they pupate and the adults emerge late in June or in July. In the commercial bulb producing sections the bulbs are being harvested at this time and the bulbs in storage are exposed to the egg laying activities of the females of this second generation. Most of the larvae of this second generation pass the winter as immature larvae. A few develop into adults in August or early in September. A few of these may lay eggs from which larvae will develop that will also overwinter. Adults from both of these groups appear about the same time in the spring, thus there are two complete generations and a partial third annually, though they overlap to considerable extent.

Control

Control measures that have been found to be effective against the narcissus bulb fly are also effective against the lesser bulb flies. In addition the grower might keep in mind the advisability of protecting his bulbs against unnecessary bruises or injuries and of protecting planting stock while in storage.

BULB MITES

Any stock of *Narcissus* bulbs may contain bulb mites. These pests are usually associated with decayed tissue in some form and there is some difference of opinion as to whether or not the mites are primarily responsible for the decayed tissue. In many instances the evidence available points to the mites as being primarily responsible for the decayed

tissue. Plants grown from bulbs infested with these mites turn yellow and present a sickly appearance. The leaves are stunted and the plants will generally fail to produce flowers, or will produce only misshapen ones. Bulbs injured by mechanical means, rough handling, heating or weakened by disease are subject to attack by mites, and it is in such bulbs that the mites are usually found.

The Bulb Mite

The bulb mite, *Rhizoglyphus hyacinthi* Bdz. is the most widely distributed species and is the one most commonly encountered by the bulb grower. This mite will attack nearly all classes of bulbs including *Narcissus*, hyacinths, *Amaryllis*, lily, *Crocus*, and *Gladiolus*. The adult mites are almost as large as the head of a common pin. Their bodies are rounded, glistening white and sometimes there are dark spots on the back. The eight legs are reddish brown and the beak or mouthparts region has a similar brown color. The immature stages resemble the adults in appearance but are smaller and the first stage has only six legs.

The life of the adult mite varies in length from one to two months. Each female may deposit from fifty to one hundred eggs. The eggs are quite large and can be seen with the aid of a low-powered lens. Newly hatched nymphs resemble the more common insects in that they have six legs, all other stages having eight legs. Under certain conditions, probably unfavorable to the species, a heavily chitinized, non-feeding but very active stage known as the *hypopus*, may develop from the six-legged nymph. This stage may last from one to two weeks. *Hypopi* readily attach themselves to insects or other creatures and may in this way be distributed to new and more favorable environments. The mites apparently prefer rather healthy bulbs and are known to migrate through the soil from bulbs in an advanced state of decay to the more attractive ones.

CONTROL

Methyl bromide fumigation will kill the bulb mite. It is doubtful if it will kill all the eggs and it may be that the *hypopi* will be able to stand the methyl bromide fumigation. It has been demonstrated however that the methyl bromide fumigation is very much worthwhile, particularly where the grower is not equipped to use the hot-water formalin treatment. The standard control for the bulb mite is the hot-water-formalin treatment. If this treatment is used for the control of mites in lily bulbs, the time should be reduced to one hour. Iris bulbs will tolerate three hours, provided the bulbs are treated at the right stage of maturity. Inexperienced growers contemplating using this treatment should consult their local authorities. The bulb mite is known to spread rapidly among bulbs in storage. Precautions against this spread should be a part of the routine procedure of every grower.

The Bulb Scale Mite

Recently a very small mite has been found infesting *Narcissus* bulbs, and because of its habit of working between the bulb scales, it has been called the bulb scale mite. The species is *Tarsonemus laticeps* Halbert. Numerous articles in the literature refer to this mite as *Tarsonemus approximatus narcissi* Ewing. These mites are very small, so small in fact that they are not discernible without the aid of a microscope or a strong hand lens. When present in considerable numbers on the bulb tissue, they have the appearance of fine grains of light colored sand. This mite, like the bulb mite, spreads rather slowly in the field, but also like the bulb mite it spreads rapidly among bulbs in storage. Plants from infested bulbs are discolored and there are scarlike yellowish-brown longitudinal streaks on the leaves and the flower stems.

CONTROL

The same methods that are effective in controlling the bulb mites will also control the bulb scale mites. Growers should take precautions against the spread of these mites in storage and whenever possible, should avoid replanting on infested land.