Bulb Mites

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Bulb mites in the Genus *Rhizoglyphus* are mostly unseen creatures that spend most of their lives in the soil or potting mix. Although reported as pests on many crops, including onions, garlic, Gladiolus, Freesia and lily, there has not been a major research effort to investigate the biology, pest status and control of bulb mites. This is, of course, because the mites are generally below ground feeding on and in bulbs and other things. Soil-dwelling creatures are much more difficult to study than those that are visible above ground. Information in this article is from a number of sources, but the most recent review of bulb mites is the major source. This review, "Biology, ecology, and management of the bulb mites of the genus *Rhizoglyphus* (Acari: Acaridae)" by Díaz et al. was published in 2000 in Experimental and Applied Acarology, Volume 24: 85-113.

The two most important and widespread bulb mite species are *Rhizoglyphus echinopus* and *R. robini*. Both species apparently are distributed virtually worldwide. One of the reasons that the mites are so widespread is that they can survive on numerous food sources and are often shipped long distances on bulbs, corms and tubers.

Biology

Bulb mites usually occur in groups or colonies. All developmental stages are present throughout the year. The developmental stages are egg (0.12 mm long), larva (0.15 to 0.25 mm long), protonymph (0.4 mm long), hypopus or heteromorphic deutonymph (more information below), tritonymph (0.5 mm long) and adult (0.5 to 0.9 mm long). Figure 1 is a drawing of these stages illustrating their size and shape differences.

Hypopi (plural of hypopus), also called heteromorphic deutonymphs, form when there is overcrowding or the area in which they are feeding deteriorates. This is a non-feeding stage that can attach itself to a visiting insect and be carried elsewhere to begin life anew. This is called phoresy, and contributes to more widespread distribution.

The number of eggs produced by female bulb mites varies widely with the host plant, host plant quality and temperature. *R. robini* seems to produce more eggs than *R. echinopus*, but females of either species can lay more than 400 eggs, with an upper limit nearing 700 eggs for *R. robini* at favorable temperatures (24-27º C; 75-81º F). The low temperature threshold for development (not survival, which is lower) is 11.8º C (53º F). As with egg deposition, development time from egg to adult also varies with temperature, with some effects of host plant. On garlic at 16º

C (61º F), development from egg to adult takes about 40 days, and 12 days at 27º C (81º F). Adult bulb mites are shiny white and smooth. Legs and other appendages are reddish brown. Figure 2 is an enlarged photo of an adult - probably *R. robini*. Figure 3 is part of a bulb mite colony on an Easter lily bulb with different development stages.

As mentioned, bulb mites are usually found below the surface in rich organic soils, leaf litter, decaying vegetation, etc. One of the reasons why *R. robini* and *R. echinopus* are so successful and widespread is that they can survive on almost anything - including seeds, dead plants, live plants, dead insects and other arthropods, nematodes and fungi. In laboratory studies, bulb mites have even survived on filter paper! Detecting bulb mite infestations before they reach damaging levels is not easy. The usual detection method is to look at bulbs, etc., before planting. For a crop such as Easter lily, unless the infestation is already well established there is not much chance of detecting it. Lily growers who are concerned about bulb mites will usually try some kind of preventive control method.

Most bulb mite injury is on plant parts beneath the soil surface, but mites have sometimes been collected from lily stems and leaves. In severe infestations bulb mites may even work their way up into the stem. Figure 4 shows severe injury to Easter lily caused by bulb mites (as well as plant pathogens). Bulb mite infestations can stunt, distort or even stop plant growth. Mites will injure apparently healthy plant tissue, but infestations develop faster when bulbs are also infected with Fusarium or other fungi. In fact, there may be a chemical attraction between bulb mites and bulbs infected by fungi. It is not yet known how important fungi are as food, but mites are definitely attracted to bulbs, corms and tubers infected with fungi. This relationship complicates trying to estimate how many bulb mites it takes to injure a plant. However, if there are over 100 bulb mites per bulb one can assume that there will be some injury visible on leaves and/or stems.

Management

This is the difficult part. The usual management method on potted greenhouse crops is to apply an insecticide/miticide or combination of an insecticide/miticide and fungicide. We are in deep trouble with bulb mite control using pesticides. Bulb mites are resistant to pesticides in several chemical classes. Most products registered specifically for mite control are ineffective. Pyrethroid insecticides are not effective. Most of the effective pesticides are in pesticide classes now under scrutiny by the Environmental Protection Agency: the organophosphates and carbamates.

The best bulb mite control seems to be obtained with the organochlorine miticide dicofol (Kelthane) - generally by soaking bulbs in a suspension of the pesticide for 30 minutes before planting. Drenches of Kelthane after planting are not as effective, but do help. Kelthane is still registered on greenhouse ornamentals, but the treatments mentioned above are not on the current product label. Experiments at the University of Minnesota showed that Avid applied as a drench or bulb soak and Vendex drenches provided some bulb mite control. Neither of these products is registered for use as a drench or soak. DuraGuard, Avid, Hexygon and Kelthane were the best treatments in a drench experiment on Easter lilies at Ohio State University's OARDC.

The relationship between bulb mites and fungi complicates control of plant

pathogens as well. Research done at the University of Minnesota found that controlling plant pathogens with fungicides was only possible when bulb mite infestations are low. Therefore, the bottom line is that bulb mites and plant pathogens must be managed together. The question is, how?

Alternative controls include hot water treatments (soaks and vapor) and biological control. Hot water treatments have been successful at mite control, but unfortunately have also injured bulbs. Perhaps someone ought to try a drench of a pesticide in water that is just below the temperature for bulb injury.

Predatory mites in the genus *Hypoaspis* feed on all stages of bulb mites. *Hypoaspis* mites also are effective predators of fungus gnats and thrips transformation stages, so introducing these mites at the beginning of a crop, or as soon as pots are brought into the greenhouse from the cool storage facility could help keep bulb mites below damaging levels. Fungicide drench applications for plant pathogen control could still be applied. If further research shows that Hypoaspis mites can control bulb mites, this would be the preferred management method.

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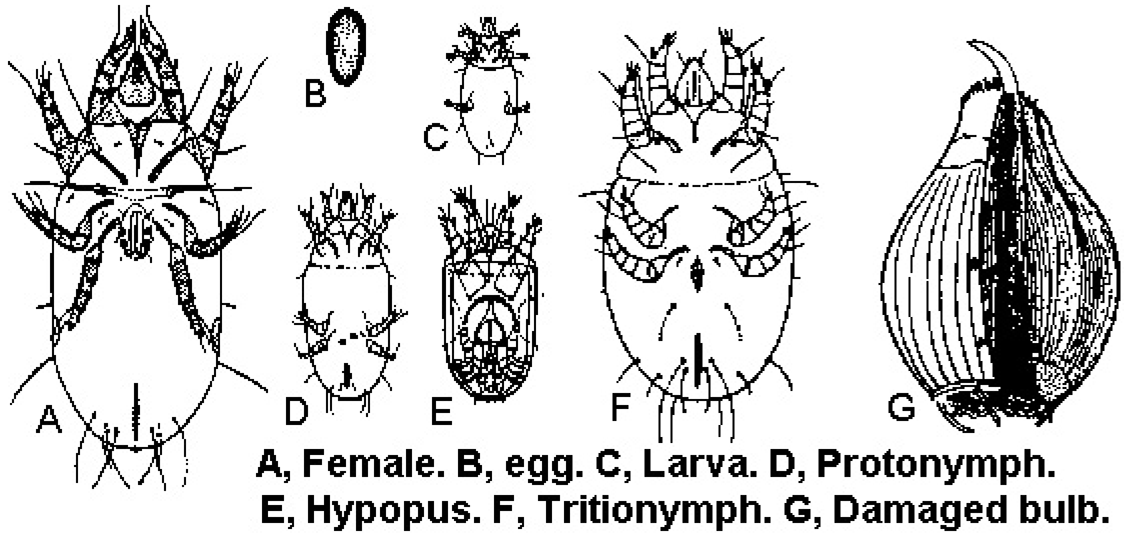

Fig. 1. Drawing of bulb mite development stages, from North Carolina State University. Further information can be found at http://ipmwww.ncsu.edu/INSECT_ID.

Fig. 2. Enlarged photo of a Rhizoglyphus robini adult. It is not likely that you will ever see one this close, but note the shiny white body and reddish brown appendages. Photo: Mark Ascerno, University of Minnesota.

Fig. 3. A colony of bulb mites on an Easter lily bulb, with adults and immature stages. This is the view you would get using a binocular microscope. There is decaying plant tissue in the photo as well.

Fig. 4. Bulb mite injury, and associated plant pathogen injury, on an Easter lily stem. If infestations are heavy, plant growth can stop. Photo: Mark Ascerno, University of Minnesota.