

## Diseases of Garlic: *Various Pests*

### Introduction

Garlic can be a very easy-to-grow herb in the garden, however it is also prone to several diseases. These include but are not limited to: Basal Rot (*Fusarium culmorum*), White Rot (*Sclerotium cepivorum*), Downy Mildew (*Peronospora destructor*), Botrytis Rot (*Botrytis porri*), and Penicillium Decay (*Penicillium hirsutum*). Most of the major garlic diseases are soil-born, so proper site assessment and yearly rotations are crucial in maintaining a healthy garden of garlic. In addition to these diseases, garlic is also subject to damage by several genera of nematodes.

There are a few physiological disorders of garlic that may alarm the homeowner but are of generally little consequence to the ability to grow or store garlic. These include: genetic abnormalities and waxy breakdown.

### Symptoms and Signs

**Basal Rot:** The symptoms of basal rot are slow to develop. Often, they are seen as yellowing and eventual dieback of the leaves. Sometimes one can also see white fungal growth at the bulb base, which will lead to both pre- and post-harvest rotting. Post-harvest rotting can include single, several, or all of the cloves in the garlic bulb.

**White Rot:** The symptoms of white rot may look almost identical to basal rot, with the exception that the process of disease initiation to plant death is more rapid. Early symptoms include white, fluffy fungal growth on the stem that extends around the bulb base. Small, dark, over-

wintering structures called sclerotia form in the decayed tissue (Fig.1).



Figure 1: Microsclerotia of the White Rot fungus *Sclerotium cepivorum* developing on an infected garlic bulb, provided by S. Jensen, Cornell University.

**Downy Mildew:** The symptoms of downy mildew are quite distinct: a whitish, furry growth will appear on the leaves, along with yellow discoloration. It can kill younger plants and stunt the growth of older ones. Diseased leaf tips and other tissues will eventually collapse. Bulbs in storage will have a blackened neck, be shriveled, and outer scales will become water-soaked. Some bulbs may sprout prematurely.

**Botrytis Rot:** The symptoms of Botrytis Rot include water-soaked stems and gray fuzzy fungal growth. This disease is also called “neckrot.”

**Penicillium Decay:** Seed clove decay often results in stunted, wilted, and yellowing plants. It can also reduce growth. The fungus may sporulate on diseased cloves, appearing as a bluish-green mass.

**Nematodes:** Many symptoms are associated with specific nematode types. Common symptoms, however, include an erratic plant stand developing in the field, stunting of plants, yellowing, deformed bulbs, and stem swelling.

The bloat nematode (*Ditylenchus dipsaci*) was found in 2010 and 2011 in both commercial and home garden plantings of garlic in some northeastern states. In subsequent years it seemed to be spreading, and requests for analysis for this pest rose. As analysis for the presence of this pest is best performed by selecting symptomatic bulbs for examination, we are including some photos (Figs. 2 & 3) that may help in selecting the most suitable tissue for analysis.



Figure 2: Root loss and roughened cracked and/or swollen tissue at the basal plate, provided by S. Jensen, Cornell University



Figure 3: Although other symptoms may be less evident, yellowing of skins may be indicative of infestation or other issues, provided by S. Jensen, Cornell University.

**Physiological Disorders:** Genetic abnormalities in garlic can resemble disease symptoms. A common abnormality is variegation of a leaf or entire plant, which can result in reduced photosynthesis or bulb deformation. Waxy breakdown is the degradation of the outer cloves of garlic. Here, sunken tissue will turn a dark yellow color, and then become translucent and sticky. Individual cloves will become soft. Unaffected outer scales can obscure these symptoms.

## Disease Cycle

**Basal Rot:** The fungus that causes basal rot prefers high temperatures. It is often considered a weak pathogen, as it will attack plants already damaged by other diseases or insects. Initial infection often occurs through the basal plate, but not all infected bulbs show disease symptoms. The pathogen is often spread through fields by infected seed or through movement of soil and other debris, transfer from tools or equipment, and in irrigation water.

**White Rot:** The fungus that causes white rot prefers temperatures below 75°F. In northern climates, it attacks plants in the spring. The sclerotia can survive in soil for indefinite periods in the absence of garlic or other hosts. Sclerotia are stimulated to germinate in the presence of organic sulfur compounds produced by the plants. Once the plants become infected, disease and rot rapidly ensue, either killing the plant outright or causing rot of bulbs later in storage.

**Downy Mildew:** The downy mildew pathogen can survive for many years in the soil as oospores. In order to spread and infect plants, they need to have moist conditions. One spore stage of the pathogen is motile (it can swim) so free water is necessary for infection and spread. Additionally, spores may also be spread under windy rainy conditions.

**Botrytis Rot:** The fungus will attack garlic plants and bulbs after warm, wet weather. During cooler growing seasons, the disease may not be present in the garden but may develop on stored bulbs.



**Penicillium Decay:** Planting infected bulbs spreads *Penicillium* decay. Infection in the field, however, can occur through the basal plate. Average summer high temperatures in upstate New York are ideal for the growth of this fungus.

**Nematodes:** Nematodes are soil-borne and are often introduced to an area from soil movement due to human activity. Once in the soil, they can usually persist there until there is no longer suitable host tissue for feeding. *Ditylenchus dipsaci*, *Pratylenchus penetrans* (lesion), and *Meloidogyne* (root knot) species are most associated with *Allium* crops.

**Physiological Disorders:** While physiological disorders do not have disease cycles, some common climatic conditions exacerbate them. For example, while the occurrence of genetic abnormalities cannot be clearly defined, it has been noted that waxy breakdown is often the result of high temperatures occurring near harvest.

## Management Strategies

If possible, work in clean fields prior to working in fields where infections or infestations have been found. Clean equipment between fields to avoid moving infested soil from one field to another. Additionally, as with any crop, it is important to plant clean healthy seeds. For most of the mentioned diseases (Basal Rot, White Rot, Downy Mildew, and Nematode infestation), once the pathogen is established in a field, rotation away from *Allium* spp. for several years is an essential management tool.

**Basal Rot:** Removing infected plants as soon as they are noticed and planting disease-free seed helps manage the disease. In addition, it has been shown that hot water treatment of the garlic cloves can reduce infection by up to 50%.

**White Rot:** It is advisable to not re-plant in infested fields, application of some iprodione products (agricultural products---not to be used on residential sites) at planting may help reduce disease incidence. Also, avoid planting infested cloves. Pre-treating garlic cloves before planting

can help reduce white rot. Hot water pre-treatment includes dipping cloves in hot water before planting, though the water should not be above boiling as this will kill or destroy the cloves.



Figs. 4,5,6: Top: One clove of this bulb is exhibiting severe *Botrytis* rot; Center: Small lesions on an individual clove; this milder damage is easy to miss; Bottom: Dark sclerotia, the resting stage, may survive in soil for years, provided by S. Jensen, Cornell University.

**Downy Mildew:** Good air circulation and wide row spacing are important in reducing the occurrence of downy mildew in the field. Several pesticides may be registered to manage or suppress *Peronospora* spp. on garlic. Some products may be suitable for use in the home garden. Please see our vegetable fungicide table for more information.

**Botrytis Rot:** Promoting rapid drying at harvest and good aeration in storage is best for managing Botrytis on bulbs. Additionally, cooler storage temperatures may help control the disease. To manage Botrytis Rot in the garden, allowing adequate row spacing and using disease-free bulbs is crucial.

Some Serenade formulations are also registered to manage or suppress Botrytis spp. on garlic. Monitor plants for symptoms and begin treatment at the first sign of disease. Removing infected leaves prior to beginning treatment may also help remove inoculum. If plants are severely infected, rogue plants. Do not leave plant debris in the field or compost it.

**Penicillium Decay:** Planting cloves as soon as they are cracked and minimizing wounding of

bulbs are the best ways to manage *Penicillium* decay. Quick drying before storage will also help manage the disease.

**Nematodes:** Preventing an infestation is the best approach. Soil can be tested for the presence of nematodes at a diagnostic facility, but as only a few nematodes in a large quantity of soil can quickly develop into a damaging population, testing of bulbs taken from a suspect field may be a better method for determining if that field may be infected. A portion of newly purchased bulbs can also be tested for nematodes before planting. A hot water treatment may help to kill nematodes in bulbs. Once a field is infested, rotation away from garlic is possibly the only way to effectively reduce nematode populations, although this may not be helpful with genera having broad host ranges.

**Physiological Disorders:** The physiological disorders caused by genetic abnormalities, in addition to waxy breakdown, cannot be managed in the field. It is important, however, to make sure affected bulbs hold their integrity and provide optimal storage conditions

## References

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2010 Bloat Nematode Problem on Garlic: Symptoms, Distribution, and Management Guidelines by George S. Abawi and Kundan Mokton at: <http://www.hort.cornell.edu/expo/proceedings/Onions%20&%20Garlic/Abawi%20bloatSum.pdf>.

The Department of Agriculture and Markets Nov. 10, 2011 press release regarding this pest at: <http://www.agriculture.ny.gov/AD/release.asp?ReleaseID=1984>.

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**READ THE LABEL BEFORE APPLYING ANY PESTICIDE!** Changes in pesticide regulations occur constantly. All pesticides distributed, sold, and/or applied in New York State must be registered with the New York State Department of Environmental Conservation (DEC). Questions concerning the legality

and/or registration status for pesticide use in New York State should be directed to the appropriate Cornell Cooperative Extension Specialist or your regional DEC office.

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