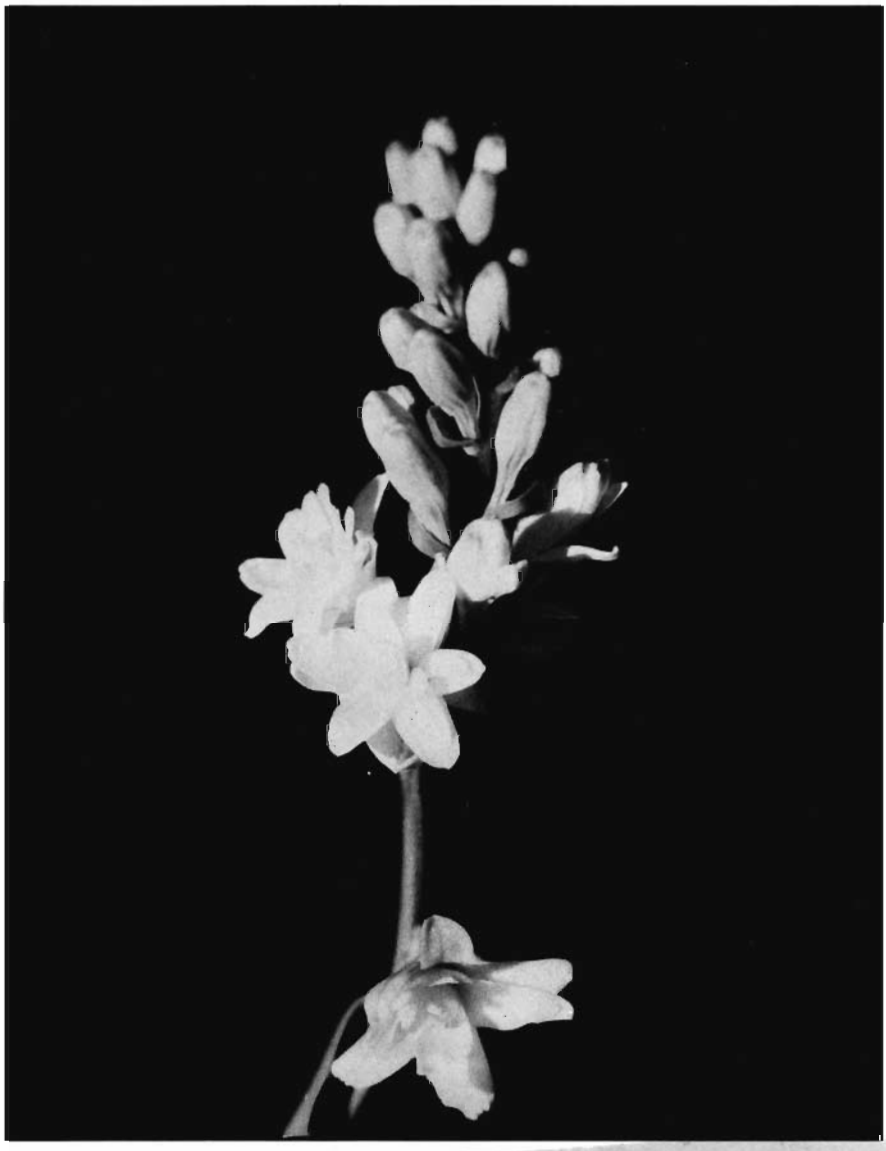
University of Hawaii
Cooperative Extension Service
Circular 427

DISEASES OF TUBEROSE IN HAWAII



DISEASES OF TUBEROSE IN HAWAII

E. E. TRUJILLO

Tuberose, *Polianthes tuberosa* L. of Mexican origin, is cultivated in Hawaii for its fragrant, white, waxy flowers used to make leis. The plant is propagated by transplanting daughter tubers from older plants. This form of vegetative propagation favors the spread of many diseases. A number of fungus, bacteria, virus, and nematode diseases are spread in and on tubers, bulbs, or rhizomes of vegetatively propagated ornamentals (*2, 6, 7, 8*).

While many growers of tuberose in Hawaii fumigate the soil with 450 pounds of methyl bromide (MC-2) per acre, this practice by itself has little or no effect in the control of diseases which are tuber-borne. Usually the beneficial effects of soil fumigation are lost when a grower plants diseased tubers or tubers contaminated with disease-causing microorganisms in clean soil.

Because little is known of tuberose, investigations were initiated at the Hawaii Agricultural Experiment Station to study the problems of the crop. Of the three serious diseases of tuberose found in Hawaii, two are caused by parasitic nematodes and one by a fungus. Of the two minor diseases, one is caused by an insect and bacterium and one by insects alone.

DESCRIPTION OF THE DISEASES

Greasy Streak

The foliar nematode, *Aphelenchoides besseyi* Christie, causes a greasy leaf streak that rapidly rots the foliage in wet, warm weather (*5*). Early symptoms are rather restricted to small water-soaked spots near the midrib. These spots enlarge along the midrib, causing elongated, black, greasy spots measuring from 2 to 6 inches long (Fig. 1). Spots this size or larger cause the leaf to bend, wilt, and dry (Fig. 2). Nematodes are usually found in great abundance at the margin of the spots.

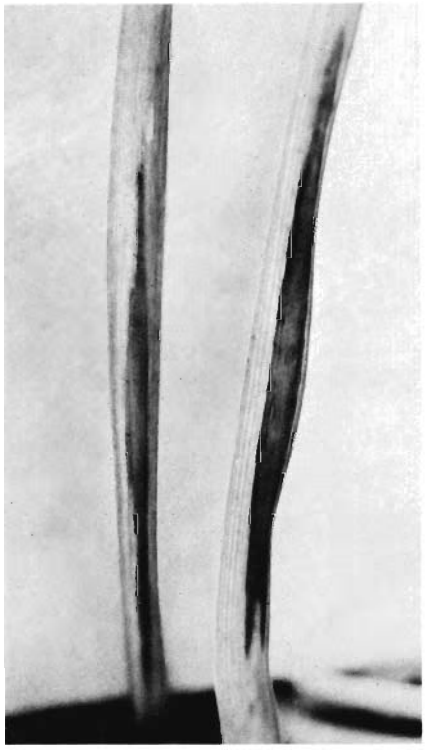


Figure 1. Tuberose leaves showing typical symptoms of black greasy streak caused by *A. besseyi.*

Figure 2. Leaf bending, wilting, and black greasy rotting caused by severe infestation of *A. besseyi.*

Root-knot Nematode

Symptoms of root swelling and galling are similar to those described for other host plants infected with the root-knot nematode. Affected plants are usually stunted and leaves become yellow at the tip when the root system is heavily galled (Fig. 3, 4). The nematode, *Meloidogyne* sp., that causes this disease can be carried in galled tubers or contaminated soil from infested beds.

Figure 3. Symptoms of root swelling and galling caused by the root-knot nematode.

Figure 4. Severe stunting of tuberose plant at left, caused by high infectation of *Meloidogyne* species on the root system.

Stem Rot

Stem rot caused by *Sclerotium rolfsii* Sacc. can be a serious problem on tuberose during warm, wet weather. This is a new disease (*1*) characterized by sudden wilting and collapsing of the crown leaves at the soil level and rotting of the flower stalk (Fig. 5). The fungus that causes this disease produces abundant cottony growth on the collapsed leaves, forming a large number of sclerotia which resemble cabbage seeds. These round bodies are first white, turn brown, and serve as a rapid means of identification (Fig. 6). These sclerotia persist during unfavorable periods, allowing the fungus to survive and also providing the means by which the organism can be spread.

Figure 5. Plant at right. Sudden wilting and collapsing of the leaves at the crown level are typical symptoms of stem rot.

Figure 6. Basal portion of tuberose stalk covered with the minute sclerotia of *S. rolfsii*, cause of stem rot.

Flower Bud Rot

Erwinia sp. is involved in a bacterial rot of flower buds that occurs during warm, wet periods. This bacterial blight is associated with an unidentified insect vector that lays eggs on the flowers at the bud stage (Fig. 7). Usually, as the eggs hatch, the soft rot bacteria become active and rot the tissues while the insect larvae develop.

Figure 7. Tuberose flowers showing symptoms of bud rot.

Rusty Flower

During warm, wet weather populations of the Hawaiian thrips, *Thrips hawaiianses* Morgan, build up to extremely large numbers on tuberose flowers, causing injury to the petals. Beginning symptoms are yellow-brown spots on a white background, and when damage is severe the whole flower shrivels and turns rusty brown (Fig. 8).

Figure 8. Rusty flower symptoms caused by feeding of the Hawaiian thrip.

CONTROL

Hot-water treatment has been used effectively to eradicate parasitic nematodes from vegetatively propagated ornamentals (*3*, *4*, *6*). Preliminary tests with dormant tuberose tubers showed that tuberose can withstand temperatures above 50°C for more than 10 minutes. Temperatures of 46 to 50°C are necessary to kill root-knot nematodes (*2*, *9*), and foliar nematodes (*3*) that are present in diseased planting material. Nematode-infested dormant tuberose tubers were hot-water treated at 50 and 55°C for 10 to 20 minutes. These tubers were planted in beds fumigated with methyl bromide at 450 pounds per acre. For control infected, untreated tubers were used. Six months after planting the root systems of the surviving plants were examined. All tubers treated at 50 and 55°C survived; the root system showed no root-knot nematode and the plants were free of foliar nematode damage (Fig. 9).

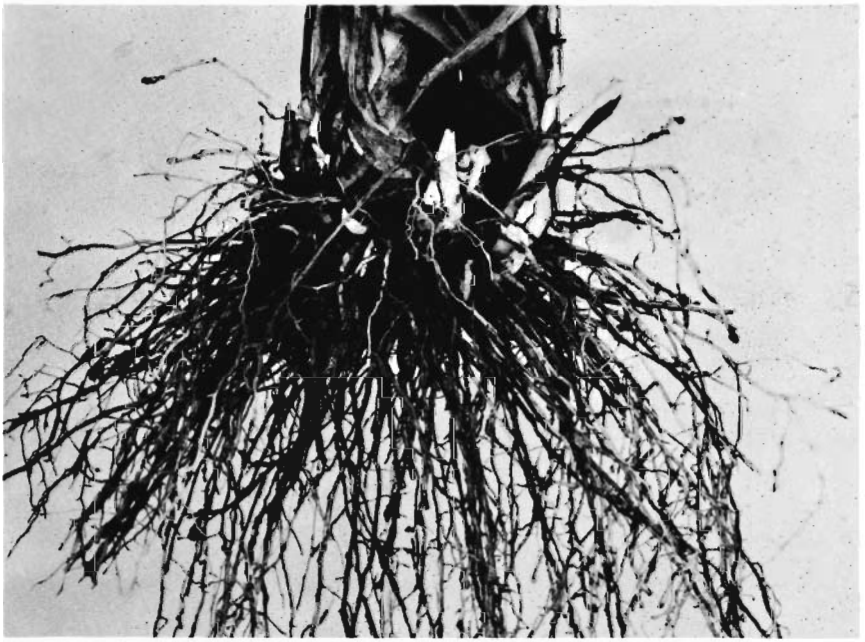


Figure 9. Tuberose plant grown from hot-water treated tubers six months after planting in MC-2 fumigated soil, showing a vigorous and healthy root system and foliar growth.

The control plants showed 100 percent root-knot nematode infection and 30 percent of the plants had foliar nematode (Fig. 10). The flower production on treated plants increased fourfold as compared with the controls (Table 1). Tubers showing severe root-knot nematode infection were also hot-water treated after trimming all infected areas. Severely trimmed tubers survived the hot-water treatment; however, root production was delayed and growth was not resumed in more than 50 percent of them.

Table 1 Effects of hot-water treatment on the control of root-knot nematodes affecting tuberose planting six months after planting in fumigated beds

Treatment Time	Temperature in °C	Tuber Survival	Nematode Survival	No. of Flower Stalks/Hill
10	50	100%	0%	4
10	55	100%	0%	4
20	50	100%	0%	4
Control		100%	100%	1

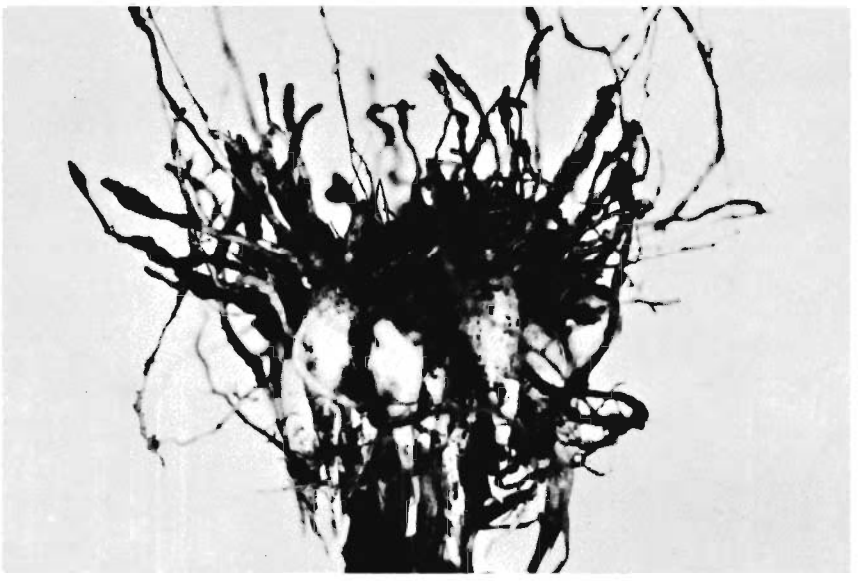


Figure 10. Tuberose plant grown from tubers not treated with hot water six months after planting in MC-2 fumigated soil, showing severe root-knot nematode damage of the root system and dried, bent, black leaves, typical damage of the foliar nematode.

These tests demonstrated that cleaning and selection of tubers coupled with hot-water treatment could significantly reduce nematode infestation and increase flower production. Therefore, the following recommendations are made for control of the three major diseases of tuberose:

Soil preparation

1. Till and allow all plant residue to rot before fumigation.
2. Fumigate beds with methyl bromide at 450 pounds per acre under plastic tarpaulin. Moist soils in seed-bed condition produce best results.
3. Remove plastic tarpaulins 48 to 72 hours later.
4. Broadcast, fumigate the planting fields by overlapping the tarpaulin.
5. Plant selected hot-water treated tubers.

Hot-water treatment

1. A constant temperature hot-water bath manufactured to specifications is recommended. A model similar to the Blue M. Magrin-Whirl constant temperature with a 17.0-gallon capacity supplied by various scientific supply houses is adequate for the commercial grower. Otherwise, water can be heated on the kitchen stove. When desired temperature is obtained, by constant stirring of the water and alternate heating, the temperature can be maintained at the desired level. Always check water temperature at 1-minute intervals with a reliable thermometer.
2. Select large tubers with minimum basal rot and other disease symptoms.
3. Treat dormant tubers at 55°C (122°F) for 10 to 15 minutes in a constant temperature hot-water bath containing ¼ ounce of Panogen (2.2 percent methylmercury dicyandiamide) to 5 gallons of water.
4. Dust tubers with PCNB (Pentachloronitrobenzene), Terraclor, dust after treatment to control *Sclerotium rolfsii.*

Post-plant treatment

Stem-rot blight may occur in new plantings in spite of fumigation and hot-water treatment. Whenever symptoms of this disease become apparent, drench soil around plants with ¼ pound of PCNB in water for every 1,000 square feet of bed.

For the control of foliar nematodes in growing plants apply two or three sprays with parathion 25 percent wettable powder at 2½

pounds per 100 gallons of water every 7 days, or Systox at a rate of 1 quart of 42 percent Systox to 100 gallons of water every 10 to 12 days.

Insect control

Control of the insect vector with Malathion or Dibrom at 1 pound per 100 gallons of water provides effective control of the flower rot caused by *Erwinia* sp. Weekly sprays with Malathion or Dibrom control also the Hawaiian thrips, cause of the rusty flower.

FOUR KEYS TO PESTICIDE SAFETY

Before using any pesticide STOP, read the precautions.

1. READ THE LABEL ON EACH PESTICIDE CONTAINER BEFORE EACH USE. Heed all cautions and warnings.
2. STORE PESTICIDES IN THEIR ORIGINAL LABELED CONTAINERS. Keep them out of the reach of children and irresponsible people.
3. APPLY PESTICIDES ONLY AS DIRECTED.
4. DISPOSE OF EMPTY CONTAINERS SAFELY.

LITERATURE CITED

1. AYCOCK, ROBERT. 1966. Stem rot and other diseases caused by *Sclerotium rolfsii*. University of North Carolina Agricultural Experiment Station Technical Bulletin 174: 202 pp.
2. CHRISTIE, R. J. 1959. Plant nematodes their bionomics and control. University of Florida Agricultural Experiment Station. 256 pp.
3. FEDER, W. A. 1951. Yellow bud blight, a disease of *Vanda Joaquim* in Hawaii. University of Hawaii Agricultural Experiment Station, Progress Note 62, 5 pp. (mimeographed).
4. GUBA, E. F., and C. J. GILGOUT. 1938. Control of the begonia leaf-blight nematode. Massachusetts Agricultural Experiment Station. Bulletin 348.
5. HOLTZMANN, O. V. 1968. A foliar disease of tuberose caused by *Aphelenchoides besseyi*. Plant Disease Reporter 52: 56.
6. JENSEN, H. J., and E. E. CAVENESS. 1954. Hot-water treatment and Systox for control of foliar nematodes in Bellingham hybrid lilies. Plant Disease Reporter 38: 181-184.
7. ROISTACHER, C. N., K. F. Baker, and J. G. Bald. 1957. Hot-water treatment of gladiolus cormels for the eradication of *Fusarium oxysporum* f. *gladioli*. Hilgardia 26: 659-684.
8. TRUJILLO, EDUARDO E. 1964. Diseases of ginger *(Zingiber officinale)* in Hawaii. University of Hawaii Agricultural Experiment Station Circular 62: 14.
9. TRUJILLO, EDUARDO E. 1964. Clean banana rhizome certification. Hawaii Farm Science 16: 8-9.

NOTE

Cooperative Extension Work in Agriculture and Home Economics
College of Tropical Agriculture, University of Hawaii, Honolulu, Hawaii 96822
United States Department of Agriculture Cooperating
C. Peairs Wilson, Director, Hawaii Cooperative Extension Service
Distributed in Furtherance of the Acts of Congress of May 8 and June 30, 1914

CIRCULAR 427—NOVEMBER 1968