CROWN ROT AND WILT OF BABY'S BREATH (GYPSOPHILA PANICULATA L.) CAUSED BY THE SOIL FUNGUS PHYTOPHTHORA PARASITICA DAST.

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Abstract. Phytophthora parasitica Dast. incited a serious crown rot and wilt disease of baby's breath, Gypsophila paniculata L. Plant losses of 30% were recorded in the field under commercial conditions during the first month after transplanting. Early symptoms were a wilting of the foliage, followed by a soft, wet decay of stem tissue in the crown area. Potted plants began to wilt 4 days after inoculation in the greenhouse. The disease was most severe during the warmer part of the growing season from August through November and again in May. Maximum in vitro growth of the pathogen through the range 10 to 32 C (50-100 F) was at 32 C (90 F). The pathogen also killed the tomato cv. 'Tropic' (Lycopersicon esculentum) but was not pathogenic on chrysanthemum cvs. 'Hurricane', 'Iceberg', 'Puritan' and 'Torch' (Chrysanthemum morifolium), or the poinsettia cv. 'Annette Hegg' (Euphorbia pulcherrima).

Good disease control in pot experiments in the greenhouse was obtained with ethazol, intermediate control with captan, chloroneb and Experimental S-1805 (Dow Chemical Co., Midland, Mich.) and poor or no control with benomyl and zinc ion maneb.

Introduction

Baby's breath (*Gypsophila paniculata* L. 'Bristol Fairy') is one of the most important "minor" flower crops produced commercially in Florida. It is grown on at least 100 acres (40.5 hectares) annually and may produce a wholesale value of $10,000 per acre (5). Baby's breath is planted mainly in the southern half of the state during the period August through March. The plants are produced either from rooted cuttings or from crowns (roots and stems) harvested from the previous season's crop and held in cold storage.

Plant losses up to 30% of the crop have been recorded under commercial production during the first month after planting rooted cuttings in the field. Subsequent research revealed a crown rot caused by *Phytophthora parasitica* Dast. *P. parasitica* has a wide host range that includes members of 58 families (7). A review of the literature revealed no reports of a species of *Phytophthora* causing disease on *Gypsophila* spp. although Tucker (6). reported isolating an unidentified species of *Phytophthora* from *G. paniculata.* This paper reports aspects of the etiology, symptomatology and control of this disease.

Methods and Materials

Disease development and symptoms were studied on plants in commercial fields. In addition, disease development, symptoms, host range, and chemical control were studied on plants grown in pots in the greenhouse in Myakka fine sand. Two experiments (December 12, 1972 to March 1, 1973 and March 6 to April 19, 1973) were conducted on rooted cuttings planted in 15 cm (6 in) pots, and a third experiment (April 20 to May 30, 1973) was conducted on plants grown from crowns planted in 25 cm (10 in) pots. A fourth experiment (April 20 to May 30, 1973) was conducted in 10 cm (4 in) pots to survey potential host range of the pathogen. The mean night-day temperatures in the greenhouse for the four experiments were 19.5-31 C (67-88 F), 24-34 C (75-93 F), and for the last two 21-31 C (70-80 F), respectively. Five replications were used for each experiment. Plants in all four of the experiments were inoculated by scraping away the outer 1-2 mm (0.04-0.08 in) of tissue for a length of 10-20 mm (0.4-0.8 in) at the soil line and placing a 10 mm^2 block of Difco potato dextrose agar (PDA) on which the pathogen was growing against the wound. A block of sterile PDA was used in the control treatments.

In experiments to control the disease, plants were inoculated as above, after which a single application of 200 ml (6.8 fl oz) of chemical suspension was poured in each 15 cm pot (6 in) and

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500 ml (16.9 fl oz) in each 25 cm (10 in) pot. The following compounds were evaluated for disease control: benomyl 50 W (methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate), captan 50 W (N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide), chloroneb 65 W (1,4-dichloro-2,5-dimethoxybenzene), ethazol 30 W (5-ethoxy-3-(trichloromethyl)-1,2,4-thiadiazole), Experimental S-1805 (composition confidential, Dow Chemical Co., Midland, Michigan), and zinc ion maneb 80 W (coordination product of zinc ion and manganese ethylenebisdithiocarbamate).

Growth of the pathogen was determined in three experiments conducted in incubators equipped with fluorescent lights. Petri plates of PDA were seeded by placing one 5 mm disc of mycelial growth in PDA in the center of each plate. Five plates were incubated in constant light and five in constant darkness at 10, 15.5, 21, 26.5, 32 C and in one experiment also at 38 C (50, 60, 70, 80, 90, 100 F). The diameter of the colonies was measured as the index of growth. The light and dark phases of each experiment were conducted simultaneously by wrapping each of the petri plates to be grown in the dark in aluminum foil.

Results

The first outward manifestation of this disease in the field was a wilting of the leaves and small stems. Examination at this time revealed the early stages of a soft, wet decay in the crown area. Under favorable conditions of temperature and moisture decay developed so rapidly that within 2-3 days infected tissue encompassed the crown and the entire plant was in a severe state of wilt. Some of the leaves became chlorotic in the early stages of the disease while others simply wilted and died with little change in color. Infected stem tissue in the crown was initially white, but as the infection spread a tan coloration developed.

Potted plants produced either from rooted cuttings or crowns were inoculated in the greenhouse. Severe wilt developed 4 days after inoculation on plants 20 cm (8 in) in diameter. Seven days after inoculation the crown area was wet and soft, the cortex sloughed off easily for a distance of 4 cm (1.6 in) above and below the soil line, the diseased tissue had developed a tan color, and severely affected stem and root tissue could be crushed easily between the fingers.

In vitro growth tests demonstrated the optimal temperature for growth in light and in dark was 32 C (90 F) (Fig. 1).

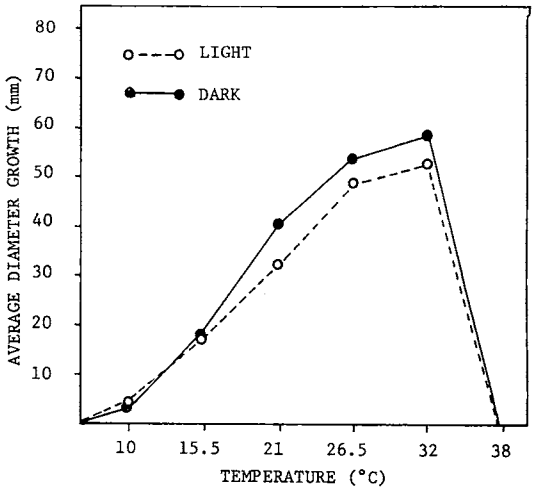

Fig. 1. Growth curve of Phytophthora parasitica Dast. in light and in dark in three experiments conducted at 10, 15.5, 21, 26.5, 32 and 38 C. Diameter of the mycelial mat was measured after 6, 9 and 12 days, respectively, in the three experiments.

Excellent disease control on potted plants in the greenhouse was obtained with drench applications of ethazol 30 W at 60 and 120 g/100 l (0.5 and 1.0 lb/100 gal), but not at 30 g/100 l (0.25 lb) (Table 1). Captan 50 W at 60 and 120 g/100 l (0.5 and 1.0 lb/100 gal), chloroneb 65 W at 120 g/100 l (1.0 lb/100 gal) and Experimental S-1805 (95% technical at 26.5 and 106 ml/100 l) (3.3 and 13.3 fluid oz/100 gal) were partially effective, whereas benomyl 50W and zinc ion maneb 80W were ineffective at all rates of application.

Tomato plants (*Lycopersicon esculentum* Mill. 'Tropic') inoculated with *P. parasitica* in the greenhouse developed basal stem cankers and died within 3 weeks. Baby's breath plants under similar conditions died within 2 weeks. However, 3-week old plants of chrysanthemum cvs., 'Hurricane,' 'Iceberg,' 'Puritan,' and 'Torch' (*Chrysanthemum morifolium* (Ramat.) Hemsl.) were not affected, nor was the poinsettia cv. 'Annette Hegg' (*Euphorbia pulcherrima* Willd.). The pathogen was reisolated or observed growing in or on representative inoculated and diseased host plants in the experiments.

Discussion

P. parasitica is an apparently ubiquitous soilborne pathogen in Florida. It causes the most frequently encountered disease of the roots and crowns of citrus trees (3) and causes diseases of certain vegetables on sandy (2) and calcarious soils (R. T.

Table 1. Control of Phytophthora crown rot and wilt (*Phytophthora parasitica* Dast.) of baby's breath (*Gypsophila paniculata* L. 'Bristol Fairy') in potted plants in the greenhouse[z].

Treatment	Rate lb/100 gal	Rate g/100 l	Experiment number	Percent[y] healthy plants
Control - Uninoculated	-	-	1,2,3	100
Control - Inoculated	-	-	1,2,3	0
Benomyl 50 W	0.25	30	2	0
"	0.5	60	2	0
"	1.0	120	2	0
Captan 50 W	0.5	60	2	40
"	1.0	120	2	60
Chloroneb 65 W	1.0	120	1	60
Ethazol 30 W	0.25	30	3	20
"	0.5	60	3	100
"	1.0	120	1	100
Maneb, zinc ion 80 W	0.5	60	3	20
"	1.0	120	3	0
S-1805 95% technical	3.3[x]	26 ml	3	80
"	13.3[x]	106 ml	3	60

[z]Summary of three experiments

[y]Each experiment replicated 5 times

[x]Fluid ounces

McMillan, personal communication). It also causes a root and stem rot of aloe (1) and a crown rot of petunia (4). Phytophthora wilt of baby's breath was observed on plants in the field one day after transplanting. Since greenhouse experiments indicated a minimum of 4 days is required for initial symptoms to appear, apparently the disease may be transmitted on planting material. The pathogen is reported to have a high optimal temperature of 30-32 C (86-90 F) (7). The isolate from baby's breath in these studies grew rapidly in the range of 27-32 C (81-90 F) (Fig. 1), corresponding with the published data. Disease development at warm temperatures in the greenhouse as well as observations made in commercial fields indicate the disease is active at warm temperatures common to the southern half of Florida where most of the *G. paniculata* is produced.

The presence of susceptible crops, a virulent and ubiquitous pathogen, optimal temperatures for pathogenesis, ample moisture, infested soils and the potential that the disease can be spread on plant material, all contribute to the probability that Phytophthora crown rot and wilt of *G. paniculata* may well continue to be a serious disease problem in the production of baby's breath under field production in Florida unless effective controls are used.

Excellent disease control was obtained in the greenhouse on potted plants with ethazol 30 W at 120 and 60 g/100 l. Under noncontrolled commercial conditions in the field, preliminary field drenching tests with ethazol 30 W at 120 g/100 l (1 lb/100 gal) provided good disease control. The experimental and commercial results suggest a high potential for control of Phytophthora crown rot in the field with ethazol but additional evaluation of rates of application are needed.

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TWO SPOTTED SPIDER MITE POPULATIONS ON OUTDOOR CHRYSANTHEMUM

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Abstract. **Development and spread of spider mite (Tetranychus urticae Koch) populations were studied in a chrysanthemum range to determine potential for a management program. Crops were grown under a natural saran cover of 25% shade in a range similar to those in commercial production. Plants were sprayed weekly until bud formation with a combination of acaricide, fungicide and insecticide. A specific acaricide, tricyclohexyltin hydroxide, was then applied at various rates in an effort to curtail mite populations.**

Spider mite infestations appeared first in local areas within the range, then spread rapidly from these loci to adjacent plants. Large populations were produced on maturing plants and 100 per cent of stems became infested in spite of a routine spray program. After three late season applications of tricyclohexyltin hydroxide, only the highest rate (0.5 lb ai/hg) reduced the number of mites on the blossoms.

Introduction

The two spotted spider mite (*Tetranychus urticae* Koch) on chrysanthemum and other floral crops has been the subject of much recent work (1, 2, 3, 4, 5). Populations attain high densities in late season near harvest and are cause for much concern for two reasons, 1) complete freedom from mites is desirable on cut flowers (5), and 2) the sensitivity of blossoms greatly restrict use of chemicals to control populations (3).

Two objectives of this study were to monitor, relative to crop growth, the population development and rate of increase on the plants and the subsequent dispersal of mites throughout the range, and to determine the efficiency of a spray program to manage populations by pre-harvest application of Plictran(R) (Tricyclohexyltin hydroxide), a promising new acaracide (6).

Materials and Methods

Subsurface irrigated saran house beds of Myakka fine sand were set with rooted cuttings of 'Show Off' chrysanthemums, Four plot replications of six treatments with 24 plants per plot were grown. Uninfested rooted chrysanthemum plants were set in the 6″ x 8″ spaces of standard wire mesh on 36″ wide raised beds during the week of February 9-16, 1972. Fertilizer (20-20-20) at 100 lb/A was applied weekly through April. A mixture of Captan + Imidan + Karathane was applied weekly as a cover spray to all 24 plots until the 9th week of growth. During week 10, after blossoms were present the first of three weekly applications of Plictran was made.

Random samples of 5 or 10 leaves per plot were taken initially and on the 5th, 7th, and 9th weeks of vegetative plant growth. Populations of mites and eggs were counted under 15X magnification. After blossoms appeared, random samples of 4 flower heads per plot were taken on the 11th and 13th weeks of growth, the 11th week sample was taken immediately after the first miticide application, and the 13th week sample less than one week after the third application.

The organisms were extracted from flowers in the following manner: whole flowers were col-

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