

# Crown and Root Fungal Diseases of Alfalfa in Egypt

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## ABSTRACT

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A 3-yr survey was made of crown and root diseases of alfalfa in several regions of Egypt. Incidence of disease was highest in southern Egypt in the main production areas of New Valley and Esna. *Rhizoctonia solani* and *Fusarium* spp. were the most common fungi isolated. No pathogenic fungi were isolated from plants growing in the high soil salinity area of Siwa Oasis in the western desert. Root diseases increased with age of stand and rots were more common than wilts. The known alfalfa pathogens *R. solani*, *Sclerotium bataticola*, *F. oxysporum*, and *F. semitectum* were identified. *F. fusarioides* and *F. equiseti* were recorded for the first time on alfalfa anywhere and *F. acuminatum* for the first time in Egypt.

Additional key words: *Medicago sativa*, *Pythium*

Alfalfa (*Medicago sativa* L.) is attacked by more than 70 fungi in addition to bacteria, mycoplasmas, viruses, and nematodes (3). Diseases of alfalfa and their causal agents have been studied in-depth in Europe and North America, but in other parts of the world, they have received only occasional attention.

Alfalfa production in Egypt is rapidly expanding. Research on diseases, however, has been limited. *Sclerotium bataticola* Taub. and *S. trifoliorum* have been isolated from diseased alfalfa roots in Egypt (1,4). *Fusarium oxysporum* Schlecht. ex Fr., *F. solani*, *F. semitectum* Berk & Rav., *Rhizoctonia solani* Kühn, *Macrophomina phaseolina*, *Phytophthora* sp., and *Pythium* sp. were isolated from decayed seeds and damped-off seedlings and were shown to be pathogenic to alfalfa (2).

This paper reports the results of a survey and pathogenicity tests of fungi associated with crown and root diseases of alfalfa grown in the main production areas of Egypt. The surveys included New Valley in the southwest desert region, Esna in southern Egypt, Siwa Oasis in the middle west, and Tahrir in the desert west of the delta. The survey also included research plantings at El-Minya and Bani

Suef in southern Egypt, Giza in the central region, and Kafr El-Sheikh in the delta.

## MATERIALS AND METHODS

The incidence and severity of root and crown diseases were determined during the period 1978-1980. One thousand

plants, regardless of appearance, were collected randomly from each of the main production areas and 100-500 plants were collected from each of the research plantings. Each plant was evaluated for vascular discoloration and external and internal rot symptoms. When stands of different ages were available, samples were kept separate.

Fungal isolations were attempted from all plants that showed disease symptoms. Root or crown pieces were soaked for 2 min in 0.1% mercuric chloride, rinsed in sterile water, and plated on potato-dextrose agar at 27 C. Cultures were examined daily for 10 days and fungi usually identified on the plant tissue. Hyphal-tip and single-spore techniques on water agar were used to separate fungal mixtures.

The ability of several fungi isolated from field samples to cause damping-off was tested in the greenhouse. Inoculum was prepared by growing fungi on

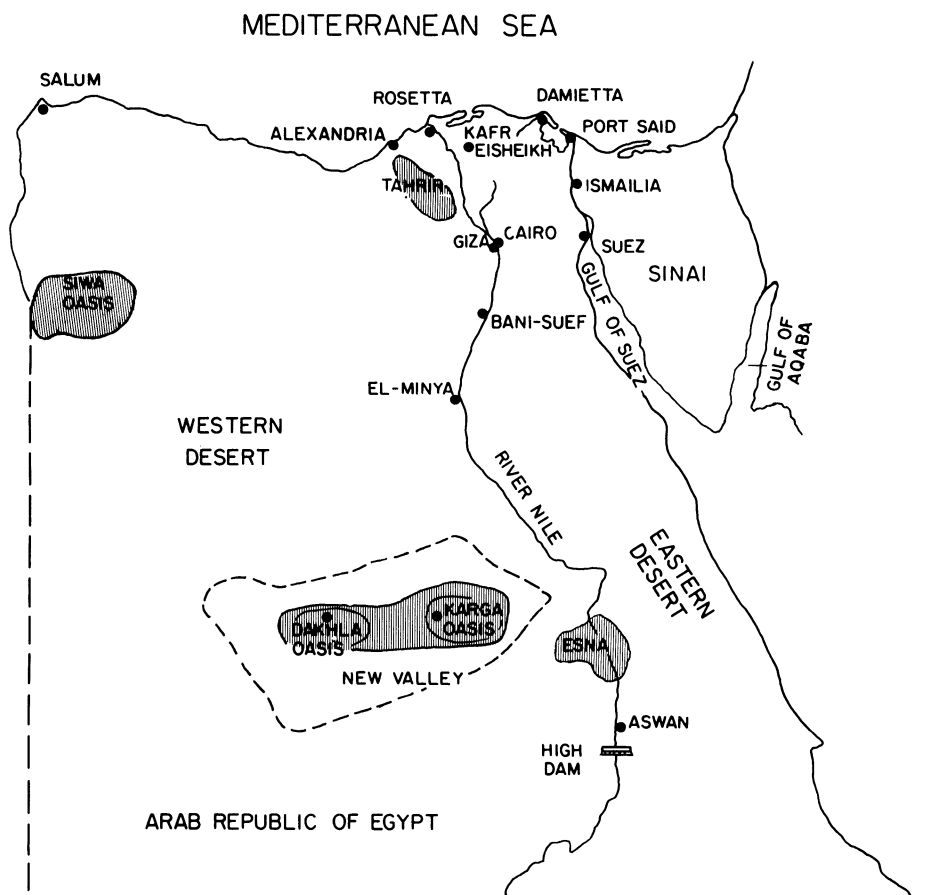


Fig. 1. Map of Egypt showing major sites of production (shaded) for alfalfa and sampling sites in the root and crown disease survey.

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**Table 1.** Incidence of root and crown diseases on alfalfa plants at different localities

Disease type	Plants diseased (%) <sup>a</sup>							
	New Valley <sup>b</sup>	Esna <sup>b</sup>	Tahrir <sup>b</sup>	Siwa Oasis <sup>b</sup>	El-Minya	Bani-Suef	Giza	Kafr El-Sheikh
Root and crown rot	48	41	10	0	15	43	14	24
Wilt	19	15	5	0	15	0	5	5

<sup>a</sup>Plants with symptoms of disease from randomly selected field samples.

<sup>b</sup>Main areas of alfalfa production in Egypt.

**Table 2.** Frequency of fungi isolated from alfalfa plants with root disease symptoms at different localities

Fungal isolate	Locality					Mean
	New Valley	Esna	El-Minya	Giza	Tahrir	
<i>Rhizoctonia solani</i>	28 <sup>a</sup>	61	60	17	26	38
<i>Fusarium</i> spp.	21	19	18	50	11	24
Phycomycete	10	20	10	0	3	9
<i>Sclerotium bataticola</i>	4	0	0	0	1	1
Sterile basidiomycete	0	0	0	11	0	2

<sup>a</sup>Expressed as percent isolations from approximately 100 plants with symptoms from each location.

**Table 3.** Identification and seedling pathogenicity of fungi isolated from roots and crowns of alfalfa at seven sampling locations in Egypt

Fungi	Damping-off (%) <sup>a</sup>	Location <sup>b</sup>
<i>Rhizoctonia solani</i> <sup>c</sup>	68	1,2,3,4,5,6
<i>Sclerotium bataticola</i> <sup>c</sup>	42	1,6
<i>Fusarium fusarioides</i>	89	6
<i>F. acuminatum</i>	76	1
<i>F. oxysporum</i> <sup>c</sup>	62	1,6
<i>F. equiseti</i>	58	5,6
<i>F. semitectum</i>	67	5,7
<i>Pythium</i> sp.	43	1,2,3,6
Sterile basidiomycete	56	5
Control (uninoculated)	15	...

<sup>a</sup>Combined preemergence and postemergence. All fungi significantly different from control (0.05).

<sup>b</sup>1 = New Valley, 2 = Esna, 3 = El-Minya, 4 = Bani Suef, 5 = Giza, 6 = Tahrir, and 7 = Kafr El-Sheikh.

<sup>c</sup>Average performance of several isolates.

moistened sterile barley seed for 15 days at 27 C. Sterilized soil in 0.3-m<sup>3</sup> pots was infested with colonized seed at a rate equal to 5% of the soil dry weight. Inoculum was distributed evenly throughout the uppermost 5–8 cm of soil, which was watered daily for 1 wk before sowing with alfalfa seed. Four replicates of each fungus were used; control pots received sterilized barley seed. Alfalfa seeds (New Valley open-pollinated variety) were treated with 0.1% mercuric chloride for 5 min, rinsed in sterile water, and sown 30/pot. Pathogenicity was evaluated by preemergence and postemergence damping-off after 15 and 30 days, respectively. Fungi were isolated from damped-off seedlings and compared with original cultures. The weight of 100 seeds produced on surviving plants from damping-off tests was also used to rate disease effects on plant performance. Additional pathogenicity tests were made with six fungi on mature roots of plants grown in the slant-board culture system (5).

## RESULTS

Locations of sampling sites are shown in Figure 1. Root and crown rots occurred more frequently in New Valley and Esna in southern Egypt than in Tahrir in the

north (Table 1). A similar pattern existed for these diseases in the research plantings; however, incidence at Kafr El-Sheikh was higher than that at El-Minya. No root or crown rot was detected in plants from Siwa Oasis in the western desert.

Root disease symptoms included cortical necrosis, stelar necrosis, and vascular browning. In severely diseased plants, the cortex and stele were dark brown. In 3- and 4-yr-old stands, crowns were often in advanced stages of decay. Incidence of root diseases increased with the age of the plants, and root and crown rots were more common than wilts.

Incidence and distribution of fungi associated with root diseases are given in Table 2. *R. solani* was isolated most often, with *Fusarium* spp. next in frequency. *S. bataticola* was isolated only from New Valley and Tahrir samples, and a sterile basidiomycete was isolated from a few plants from the Giza sample. Attempts to isolate fungi from the discolored steles of plants from Siwa Oasis were negative. *F. oxysporum* was commonly isolated from plants with vascular necrosis.

The fungi associated with diseased alfalfa roots and crowns and their pathogenicity in damping-off tests and

geographic occurrence are given in Table 3. Several isolates each of *Rhizoctonia*, *Sclerotium*, and *F. oxysporum* were used in the damping-off tests. A range of activity was observed, and the averages of the isolates are presented in Table 3. Many isolates caused severe damping-off of alfalfa seedlings. *Fusarium* spp. and *R. solani* were the most virulent.

The mean weight of seed produced by plants that survived the damping-off test was: control 261, *S. bataticola* 253, *R. solani* 201, and *Fusarium* spp. 102 mg/100 seed. Several isolates of each fungus were used, and the seed weights represent the average of combined weights of all isolates in a given genus.

Roots of alfalfa plants grown in slant-board culture were rotted 7 days after localized inoculation at the root tip or 4 cm above the root tip with *F. acuminatum* Ell. & Ev., *F. fusarioides* (Frag. & Cif.) Booth, *F. semitectum*, *R. solani*, *S. bataticola* or the sterile basidiomycete. *F. oxysporum*, *F. equiseti* (Corda) Sacc., and *Pythium* sp. Pringsh. were not available for these tests.

## DISCUSSION

Disease incidence varied with locality, the highest incidences occurring in southern Egypt. At New Valley and Esna, where alfalfa is the main forage crop, root and crown rots were very common. *R. solani* and *Fusarium* spp. were the most important pathogens where summer temperatures exceeded 41 C.

*R. solani* was the most common pathogen isolated. The unidentified sterile basidiomycete first found in the Giza area (6) was not found at any other site. The absence of fungi from plants grown at Siwa Oasis may be related to high soil salinity. In general, root rots and wilts became more common as stands increased in age.

Results of the damping-off pathogenicity tests implicated several fungi not previously reported as seedling pathogens of alfalfa. *F. fusarioides* and *F. equiseti* were recorded on alfalfa for the first time anywhere and *F. acuminatum* for the first time in Egypt.

This report of pathogenic fungi associated with alfalfa in the major production areas of Egypt points out the potential in these areas for major disease problems. Alfalfa is of increasing agricultural importance to Egypt and future varieties will need adequate types and levels of disease resistance to continue to flourish. *R. solani* may pose a

major threat to alfalfa establishment and sustained production in southern Egypt. Diseases caused by *Fusarium* spp. should be monitored carefully in the future.

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