STUDIES ON EARLY BLIGHT DISEASE OF TOMATO

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2

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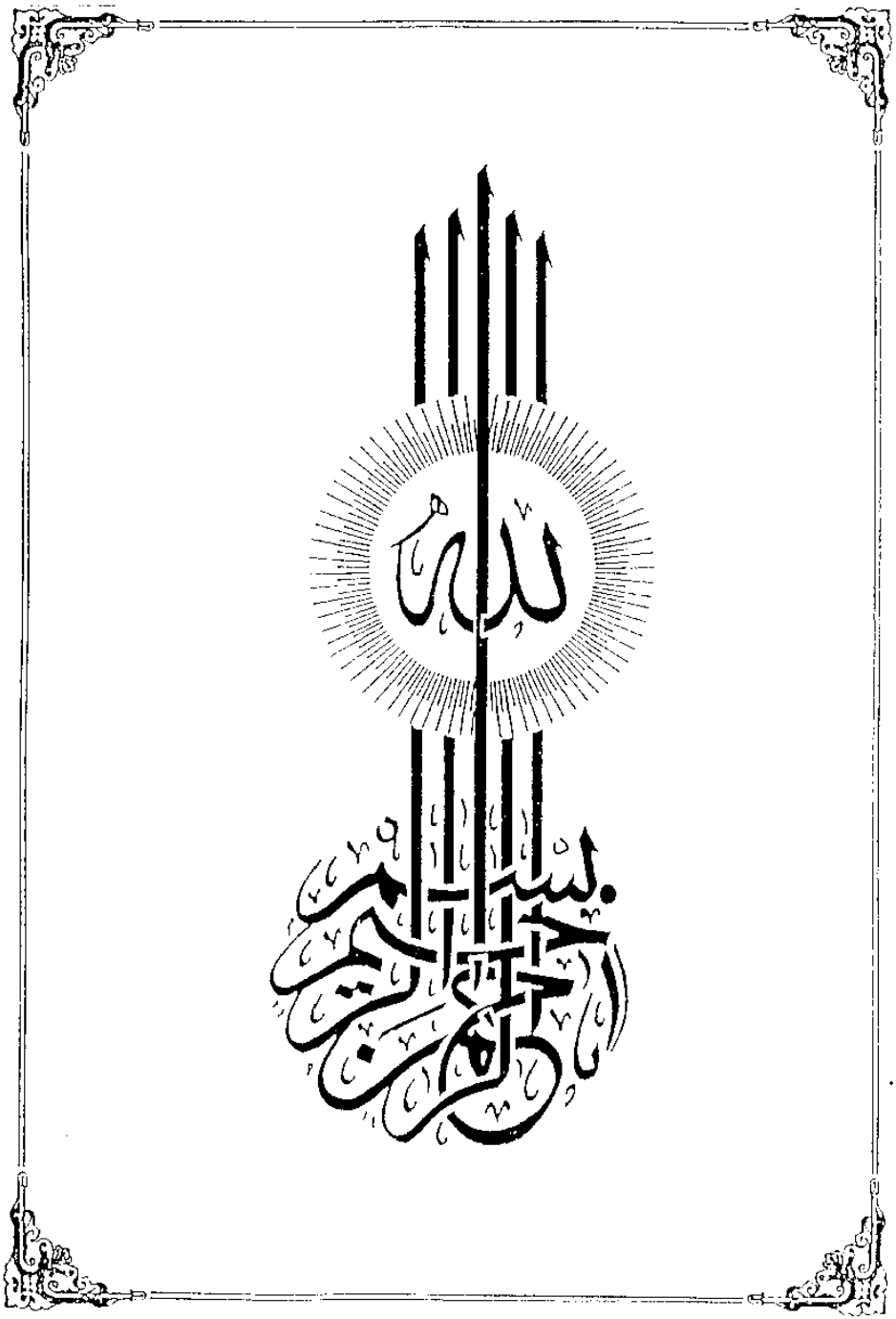

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INTRODUCTION

Tomato (Lycopersicon esculentum Mill.) is a well known lopular vegetable crop grown in Egypt as well as in many parts of the world. In (1984) the Cultivated area in Egypt reached 321085 Feddans that produced 2992796 Tons.

Tomato Plants usualy suffer from a number of diseases during the growing season depending on the prevailing environmental conditions.

One of the most common diseases is the early blight caused by Alternaria Solani (Ell. & G. Martin) Jones & Grout. The infection with the early blight disease could cause a great reduction in yield of tomato fruits as well as in their quality.

This investigation is dealing with the early blight disease of tomatoes and planned to study the different following points:

1- Isolation of the causal organism from different localities in Egypt, i.e. Alexandria, Ismailia, Kalubia, Fayoum and Beheira Governotates.

2- Studying the cultivar resistance against the early blight disease.

3- Susceptibility to early blight in relation to some chemical components of tomato plants.

   a- Total free amino acids contents.
   b- Sugar content (reducing-non reducing and total Sugars)
   c- Phenol contents (free conjugated and total phenols)

4- Studies On *Alternaria solani* Toxin (s)

a- Effect of culture filtrate on tomato and other plants

b- Effect of streptomycin sulfate, penicillin and ∝-tomatine on pigment production

c- Fractions of toxin (s) like substance (TLS) from culture filtrate

d- Studying of TLS of *A. solani* on protoplast viability of different tomato cultivars

5- Chemical Control of Early Blight Disease

a- Effect of different fungicides on the growth and sporulation of *A. solani*

b- Field experiment for disease control

REVIEW OF LITTERATURE

The Causal Organism And Disease Symptoms:

Early blight is one of the most common foliage diseases of tomato and it is much less limited by climatic conditions than the other diseases (Walker, 1957). The Causal Pathogen was first described by Ellis and Martin in (1882) from dying leaves of potato collected from New Jersey. The distinction of this disease from other foliage diseases began about 1891. The most critical early work was that of Jones 1896, 1897 at Vermont. Rands (1917) was the first to prove that the same pathogen Macrosporium solani Ell. & J. Martin 1882 that was changed to Alternaria solani (Ell. & G.Martin) L. R. Jones & Grout, 1896, incited the leaf and stem disease on both Tomato and Potato. Tuber rot was overlooked until 1925, when it was described by Folsom and Bonde.

However, different names were reported concerning this pathogen. These were reported by Walker (1957) as the following synonyms:

Macrosporium solani Ell. & Mart., 1882

Macrosporium solani CKe. (in part), 1883

Macrosporium Cooke Sacc. (in part), 1896

Alternaria Solani Sorauer (in part), 1896

Sporidesmium solani Var. Varians Vanha, 1904

Alternaria Porri (Ell.) Neerg. f sp. Solani (Ell. & G.Martin) Neerg., 1945.

The mycelium is septate and branched and becomes dark-colored with age. Conidiophores, rising from the older disease host tissue, are relatively short and dark-colored. Conidia (12 to 20 by 120 to 296μ) are beaked, muriform, dark-coloured, borne singly or in chains of two (in pure culture) .

They form from a bud which arises from the terminal cell of the conidiophore. The fungus grows readily on artificial media, usually producing an abundance of yellowish to reddish pigment which diffuses throught the substrate. It sporulates very sparsely in pure culture, as a rule, but abundant sporulation is stimulated by wounding the mycelium or by exposing the culture to ultraviolet rays. Considerable Variations between isolates has been observed with reference to virulence and to growth and sporulation in pure culture.

The disease appears first as spots on the leaflets of tomato. These are dark brown to black, and in the leathery-appearing necrotic Tissue concentric ridges often form to produce a characteristic target-board effect.

The spots are oval or angular in shape and on leaflets are mostly up 3 or 4 mm. in diameter. There is usually a narrow chlorotic zone around the spot, which fades into the normal green. While the spots are quite delimited, there is ample evidence of pathological effects beyond the necrotic Tissue. When Spots are numerous, the general effect on the leaflet is such as to make it go into a senescent condition (Walker, 1957; Sharma et al, 1966) Lowest Leaves are affected first, as a rule, and the disease progresses upward.

Tomato fruits are penetrated in the green or ripe stage usually at the stem end but also through growth cracks and other wounds. Lesions start as black or brown, usually sunken. Spots which may bear a velvety black mass of spores over the surface. Sometimes a small Lesion at the surface is only part of an extensive internal region of decayed tissue Waraitch et al., (1975) reported that early blight of tomato caused by A. solani starts appearing from the seedling stage till the last harvest of the fruit. The diseases on leaves, stem and fruits under favourable conditions results in defoliation, drying off of twigs and premature fruit drop, depending upon its severity. The fungal pathogen was isolated from leaves and stems of tomato (Marcinkowska, 1982).

This disease was firstly reported in Egypt by Britton Jones (1920-22) and by Melchers (1931).

Factors Affecting Fungal Growth

Several investigators have studied the invitro effect of temperature on the linear growth as well as on the disease severity in the field.

Roth (1936), Klaus (1940), Zacha (1948), Tweedy and Powell (1960) found that the optimum temperature for the growth of A. solani was 28°c while Arya and Prasade (1953), Kapoor and Hingorani (1960) reported that the optimum temperature for the growth of the fungus was 29°c.

Pound (1950) Studies four isolates of A. solani were studies comparatively in the laboratory. All isolates grew well on laboratory media over a wide range of temperature, with an optimum growth at 24-28°c .

Assal (1967) found that optimum temperature for mycelial growth on Richard's solution was 30°c. for A. solani and ranged from 25-30°c for A. solani on PDA medium.

Hodosy (1968) recorded that dry warm summer with prolonged dews at night are particulary favourable for infection of tomato with A. solani.

Tsupkova (1980) showed that optimum temprature for the development of Macrosporium (Alternaria)solani is between 25 and 30°c. This pathogen attacks tomato in Northern area in the UK and Moldavia.

Fungal Sporulation

Some isolates of A. solani do not produce spores readily under laboratory conditons. Several workers attempted to increase sporulation by various techniques.

Rands (1917) used method of spore production of A. solani involving the laceration and desiccation of agar cultures by growing the fungus on Petri-dishes of hard potato agar, and after 10-12 days they shredded to bits and evenly distributed over the surface of the dishes. The moisture was controlled around it for 24 to 48 h. and the dishes were exposed to sulight in a sterilized moist chamber.

Charlton (1953) found that A. solani strain CBPG7 was induced to sporulate by exposing 6 to 8 cm in diameter colonies, grown on a modified Czapek-Dox agar plus sucrose at 24°c, to ultra-violet light for 20 miniutes and reincubating dishies for 18 to 24 h. at 24°c, he also found that oxidizing agents such as hydrogen peroxide and ozone induced sporulation but to a lesser degree than ultra-violet light.

Miller (1955) found that A. solani sporulated on 20% V-8 juice agar media without UV-irradiation.

Lukens (1960) induced sporulation of A. solani in shaking liquid nutrient medium, when the mycelium was fragmented, centrifuged, resuspended in phosphate buffer

(PH 6.4) and distributed in 2- ml protions of filter paper in Petri-dishes, after 24 hr. under fluorescent light, the fungus produced conidiophores and conidia developed after a further 24 hr. in darkness or day light.

Gupta and Pushkarnath (1962) indicated that sporulation of A. solani on PDA culture was obtained by exposure to sunlight for 40 minutes followed by 60 minutes exposure to intra-red rays. They added that the amount of sporulation was inversely proportional to the concentration of dextrose.

Barksdale (1969) recorded that sporulation of A.Solani was induced by scraping aerial mycelium of one week-old colonies on Lima been agar and exposuring to indirect sunlight + 200 ft.c cool white fluorscent light during the day and darkness at night.

Lukens and Horsfall (1973) found that the budding process involved in the production of conidiophores and spores of A. solani required 0_2 and inhibited by CO_2. Such conidiophores were also sensetive to azide, dinitrophenol and cyanide or thiols, but not to cyanide or fluoride. They also found that condiophore, but not spore, formation was inhibited by oligomycine, 8-azaguanine 2-thio-6-oxypurine.

Prasad et al., (1973) induced sporulation when fully grown A. solani cultures were dipped in or sprayed with distilled water and then kept partially covered at different temperatures. Cold water dips ($4^{o}c$ for 4 min,) or sprays followed by incubation at room temperature ($13-26^{o}c$) in diffuse sunlight produced the most spores within 60 hours.

Rath and Padhi (1973) found that sporulation of A. Solani was best in 3 days- old cultures on solid media exposed to direct sunlight for 10 minutes.

Prasad and Dult (1974) found that sunlight, but not incandescent electric light or infra-red light, was effective in producing sporulation in A. solani culture. They obtained maximum sporulation with 6- days - old cultures in which a sporulating zone was induced, within 24 h. after exposure to sunlight for 60 min.

Dorozhkin et al., (1976) found that when sterile cellophane disks were spread on the Petri dishs culture media, sporulation of most races of Macrosporium (Alternaria) solani was increased.

Tverskoi and Kvasnyuk (1979) found that, spraying of A. solani, grown on PDA, with water at $4^{o}c$, then kept in a moist chamber for 2 days, induced the maximum number of conidia.

Also sowing a cereal substrate with a mycelial suspension, conidia formed only after irradiation.

Madan and Thind (1979) studied the role of twenty trace elements on the growth and sporulation of A. solani. They found that Fe, Zn, Mn, Cu and Mo were essential for growth and sporulation.

Shahin and Shepard (1979) induced sporulation in pure culture without the concomitant production of aerial mycelium. Agar blocks from cultures on primary media were transferred to the surface of a slant (sporulation) medium of water agar plus Ca CO_3 and incubated in the dark at 18°c. Spores were harvested after 18-24h The addition of sucrose to the sporulation medium allowed repeated harvest of conidia at 24 h.

Gemwat and Ghosh (1981) found that temperature and growth regulators affected growth and sporulation of A. solani .

Vakalounakis (1982) showed large masses of sterile discs, from leaves of fresh solanaceous or cucurbitaceous plants placed on water agar plates and inoculated centrally with 5 mm plugs cut from the edge of 4 days old A. solani colonies, and incubated at 20°c under continious B I B irradiation, conidia were formeu after 6 days.

Kozolovskii, and Kvasnyuk (1984) grew A. solani on PDA in Petri-dishes at 22-25°c, and after 8-10 days the aerial mycelium was removed. Potato leaf extract was added to each dish and left for 1-2 min. Dishes were exposed to UV-rays for 1 min. and placed in polyethylene wet chamber for spore formation. Spores were harvested after 16 hours.

Honda and Nemoto (1984) exposed A. solani colonies to monochromatic radiation between 232 and 732 nm. following photoinduction of conidiophores by near UV-radiation

inhibitory exposures were made 3-7 h. into the dark period using monochromatic radiation. Radiation over 530 nm was not effective for inhibiting condium formation. The action spectrum had maxima at 486, 455 and 435 nm in the visible region, 381 nm in the near UV region, and 273 nm in the far UV region. The action spectrum is divided into 3 parts by Troughs at 303-316 nm and 391-415 nm. These characteristics of the action spectrum indicated that the photoinhibition of condidium formation is typical blue photoresponse with an increased in the far-UV region.