ASSESSMENT OF ENVIRONMENTAL HAZARDS OF POSTHARVEST GRAPE DISEASES

BY

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THESIS

Submitted in Partial Fulfillment of the
Requirements for the Degree
of

DOCTOR OF PHILOSOPHY

In

ENVIRONMENTAL SCIENCES
(AGRICULTURAL SCIENCE - PLANT PATHOLOGY)

Department of Agricultural Sciences
Institute of Environmental Studies and Research
Ain Shams University

1992

APPROVAL SHEET

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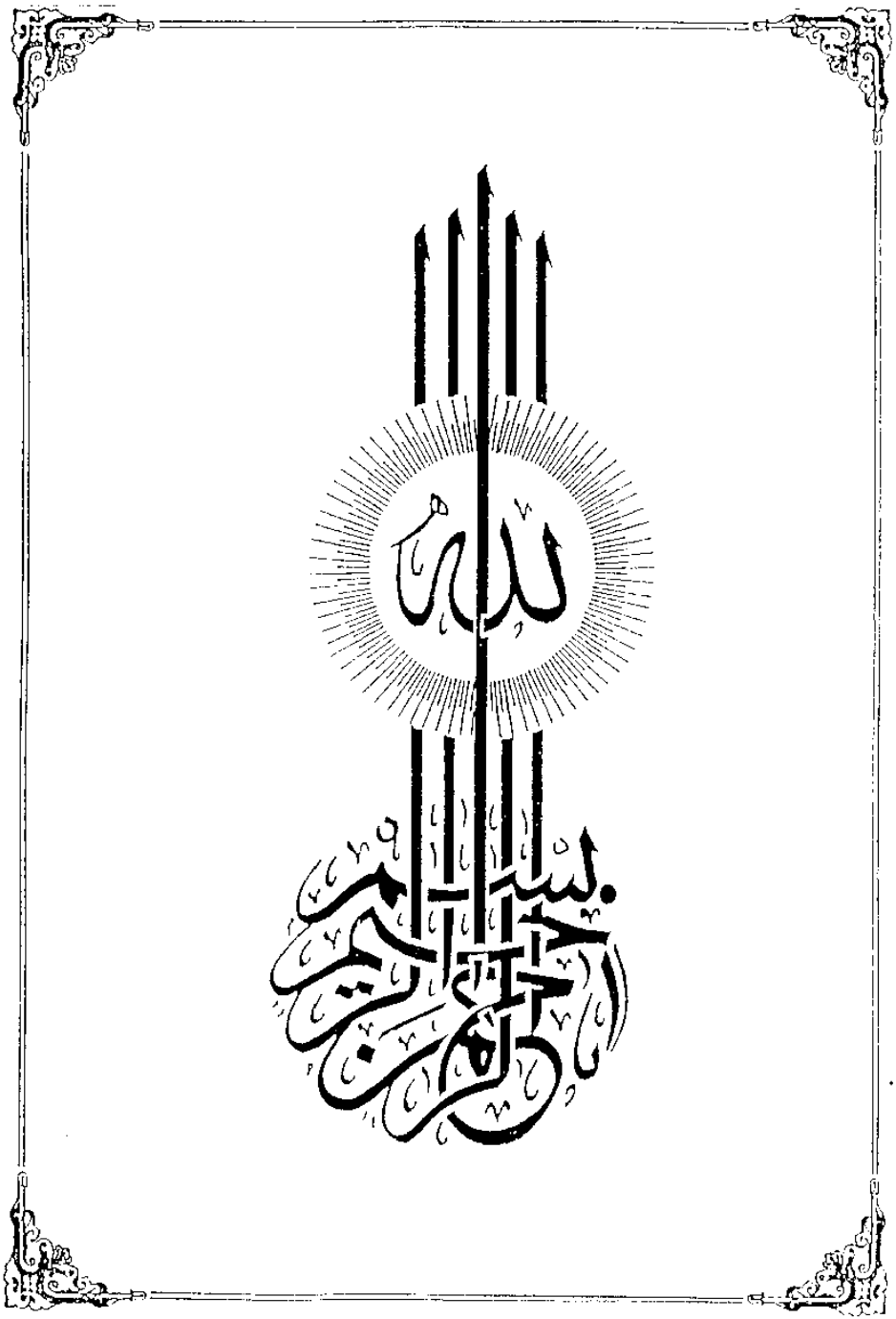

ACKNOWLEDGMENT

The author wishes to express his grateful gratitude and sincere appreciation to Prof. ***Hamed M. El-Antably*** *Professor of Plant Physiology, Dept. of Agricultural Botany, Fac. of Agric., Ain Shams Univ. for his supervision and continuous encouragement and extremely support throughout this investigation. Many thanks are also extended to Prof. Dr.* ***Zeinab M. El-Tobshy****, Plant Pathology Research Institute, Agric. Res. Center, and Dr.* ***El-Said A.M. El-Basiouny****, Agric. Economic Dept., Fac. of Agric., Ain Shams Univ. for their supervision, criticism facilities and kind help.*

Sincere thanks are due to Prof. Dr. ***Mohamed M. El-Zayat****, Plant Pathology Dept., Fac. of Agric., and Agricultural Science Dept., Institute of Environmental Studies and Research, Ain Shams Univ. for his continuous kind help and generous support.*

Thanks are also due to Mr. ***Ali A. Abo Gazia****, Union of Production and Exporter for Horticultural Crops, Ministry of Agriculture and Land Reclamation, Mr,* ***Samir A. Mohamed****, Mr.* ***Hassan H. Nassar*** *and Dr.* ***Saneya M. El-Neshawy****, Agric. Res. Center for their kind assistance and facilities.*

Deep thanks and grateful gratitudes are due to the author's family for their continuous support and encouragement.

Thanks also due to all whom their kind help made this work possible.

The author

CONTENT

INTRODUCTION

Grape is one of the most widely planted fruit crops in the world, covering an area of approximately 25 million feddan (**Pearson and Goheen, 1990**). In Egypt, it is also considered one of the major fruit crops (the second in order) where its cultivated area in the season 1989 was 109,058 feddan yielded 620,583 ton of fruits (90,212 feddan only at production stage, as stated by **Anon. (1989)**.

The grape is a crop plant of many uses. The fruits are eaten fresh, canning, through the use of cold storage, and dried into raisins. In some countries, the concentrated frozen juice is common use for the fruit. The fruit of wine grapes is also fermented to wines and brandy which is forbidden in the Islam. So, we care only with the fruits and raisins.

Grapes are subjected to be infected severely with several fungi resulting in substantial losses in production. Producers apply many treatments of fungicides to control the fungal pathogens, but these fungicides may have harmful residues inside the fruits. The fungal pathogen also may produce deleterious metabolites in the fruits which are called phytotoxins and mycotoxins. The environmental conditions influence

the disease severity and sometimes, they are the limiting factors for the disease occurrence.

Thus the present study aimed to:

- estimate the losses of production incited by the postharvest fungal pathogens.
- determine the model of the correlation between the environmental conditions and the disease incidence.
- control the postharvest fungal pathogens and prolong the storage of grapes berries through:
  * preharvest treatments with salts, fungicides or their combination.
  * biological control.
  * modified atmosphere during storage individually or after the preharvest applications of fungicides.
  * using SO_2-releasing guards.
- analysis the residues of the most efficient fungicides adopted as preharvest.
- analyze the pesticide residues in grape berries sampled from markets of different governorates.
- study the environmental effects of the plant growth regulators used in the vineyards.
- determine the mycotoxin contamination of grape berries and raisins.

REVIEW OF LITERATURE

I. Economic Losses of Postharvest Grape Diseases:

Grape berry is the object of several genera of fungal pathogens causing different types of diseases, regarded as postharvest diseases. These postharvest disease have a negative economic effect on the grape yield.

I.a. Survey of the Fungal Pathogens of Postharvest Grape Diseases:

Berro Aguilera (1926) reported that the grape cluster was infected by parasitic fungi before packing of these fungi, *Penicillium glaucum* is undoubtedly the most active, followed by *B. cinerea*, *A. niger*, *Alternaria*, *Monilia*, *Candida*, *Cladosporium* and *Mucor* spp. **Fish (1927)** also reported that *Botrytis cinerea*, *Penicillium* sp. and *Rhizopus nigricans* were the predominant fungi found on the berries. He mentioned that *Penicillium* usually attacks the berries after *Botrytis* has damaged them. It was also stated that *Rhizopus* has been found attacking berries in cold store, whereas *A. niger* and *Alternaria vitis* occurred on the berries occasionally.

Du Plessis (1948) attributed the rotting and spoilage of dessert grapes to various causes, e.g. gray mold (*B. cinerea*), blue-green molds (*Penicillium* spp.), black molds (*Aspergillus* spp.) cobweb mold (*Rhizopus nigricans* and velvet mold (*Cladosporium baccae*).

In Egypt, **El-Helaly et al., (1965)** isolated *A. niger*, *Alternaria geophila*, *Cladosporium* sp., *Rhizopus nigricans* and *Botrytis cinerea* from non-sterilized grapes.

Marshina et al., (1979) isolated *Penicillium expansum*, *P. matensii*, *P. claviforme*, *Aspergillus niger*, *A. flavus*, *Alternaria alternata* and *Cladosporium herbarum* from grapevine fruits.

In 1981, **El-Tobshy et al.** reported that *Aspergillus niger*, *Alternaria spp.*, *Cladosporium herbarum*, *Stemphylium sp.*, *Penicillium italicum* and *Rhizopus nigricans* were the most organisms causing berries rot of grape samples from Roumi Red and Banati seedless cultivars.

Raisins are also subjected to be infected with several fungi. **Follstad (1966)** studied the microflora of non-processed raisins. Several *Aspergillus* spp. including *A. flavus*, were isolated from surface sterilized raisins from drying-trays in the field. Species of *Alternaria*, *Botrytis*, *Candida*, *Cladosporium*, *Helminthosporium*, *Mucor*, *Nigrospora*, *Penicillium*, *Pullularia*, *Rhizopus*, *Sclerotinia* and *Stemphylium* were also isolated.

Hewitt (1990) mentioned that *Alternaria*, *Aspergillus*, *Botrytis*, *Chaetomium*, *Cladosporium*, *Helminthosporium*,

Hormiscium, *Hormodendrum*, *Penicillium*, *Rhizopus* and *Stemphylium* are common raisin mold and rot fungi.

I.b. Pathogenic Propensity of the Fungi Associate Berry Molds and Rots:

Although *Botrytis cinerea* is the most prevalent fungus causing berry molds and rots, **Du Plessis (1934)** mentioned that infection by *Botrytis* was generally slight in the vineyards. **Bulit and Dubas (1990)** reported that *Botrytis* bunch rot or gray mold exists in all vineyards in the world, while it was considered a secondary disease for a long time but became increasingly important in Europe after the phylloxera epidemic and the reconstitution of vineyards by grafting.

Du Plessis (1937) stated that the susceptibility of uninjured Henab Turki grapes to variety of *B. cinerea*, i.e., B12C, increased with maturity and that injured berries were slightly susceptibility even when they had been green.

Wilhelm (1944) showed that the germinated conidia of *B. cinerea* in water were unable to infect unwounded vine leaves and grapes, but those in a nutrient medium penetrated the uninjured tissues. It was stated that wounded leaves and grapes were infected without the aid of nutrient. Therefore, *B. cinerea* is a wound parasite, not a facultative one.

Nelson (1951 and 1958) stated that grapes were infected with *B. cinerea* through the intact skin, openings or injuries. *B. cinerea* requires 6-18 hrs. of saturated moisture conditions at 20°C to infect mature grapes.

Bessio (1972) illustrated that there were 2 paths of penetration of *B. cinerea* into the grape, in the grapevine. The first was through cracks which developed with approaching maturity in tissues inside the peristomatic aureole and occasionally, the second was through ostioles of the stomata.

McClellan and Hewitt (1973) indicated that a brown rot fruits, caused by *B. cinerea*, begins in midseason and may go on developing until harvest in the absence of rain. It was also stated that the disease may affect a few or most of the grapes in a bunch. Early infection may takes place during flowering and the fungus invades the stigma and style, becoming latent in the necrotic stigma and style tissue at the styler end of the grape.

El-Helaly et al., (1965) observed that infection in both sound and injured grapes was produced by *A. niger*, *Alternaria geophila*, *Rhizopus nigricans* and *B. cinerea*. *A. niger* and *B. cinerea* caused severe infection in ripe berries (pH 4.6) and slight infection in unripe ones (pH 2.5).

Delp et al., (1951) reported that both wounded and intact grapes contracted 100% infection when sprayed with a spore suspension and stored in a moist chamber.

Wangikar et al., (1970) stated that pathogenicity was shown by wound inoculation with a 3-day old culture of *Cladosporium oxysporum* on grapes.

I.c. Disease Syndrome:

Several reports demonstrated the symptoms on berries induced by the fungal infection. **Nagy and Glits (1964)** described the symptoms caused by *B. cinerea* as die back and browning of the vine shoots. **McClellan and Hewitt (1973)** stated that a brown rot of grapes starts in midseason and may continue to develop until harvest in the absence of rain. **Hewitt (1990)** showed that infected white grapes turn brown, and black grapes become reddish. During dry weather, infected berries dry out; in wet weather, they tend to burst and a brownish gray mold forms on the surface. Table grapes in cold storage after develop a wet rot of the rachis, which becomes covered by a mycelial mat, sometimes with sporulation. The infected berries develop circular brown lesions that gradually cover the whole fruit; this condition of epidermis is known as "slip-skin".

Ouchi *et al.*, (1976) renamed the black navel disease of the grapevine cv. Muscat of Alexandria caused by

Cladosporium cladosporoides and *C. herbarum* as brown spot at grapes. **Bulit and Dubos (1990)** stated that *Cladosporium* rot is a well-defined, black, soft, circular area ranging from 5-7 mm in diameter as much as two-thirds of a berry. The surface of the rotted area becomes a velvet olivaceous color due to sporulation under humid atmosphere at room temperature.

Barker (1928) stated that grapes were severally damaged, apparently by a species of *Penicillium* attacking the base of the grapes. Blue mold or *Penicillium* rot caused by *Penicillium* spp. producing large, dusty masses of colored spores (**Hewitt, 1990**).

Hewitt (1990) also mentioned that Aspergillus rot caused by *A. niger* is at first tan to brown, but the area is soon covered with a dusty mass of brown or black spores. These rot areas are initially soft but become firm and leathery. It was also stated that *Alternaria alternata* cause Alternaria rot as tan at first and becomes brown with age. Fluffy gray tufts of the fungus develop through cracks in the brown skin over rot lesions.

I.d. Yield Losses:

Akhmedov (1972) found that the untreated control of grapes had 28.4% infection by *B. cinerea* and the

treatment with some fungicides reduced it to 10.7-13.0%.

Kokovic (1972) concluded that treatment of grapes with fungicides reduced the fungal infection from 38% to 5%.

Pogosov (1979) used fungicides to control the gray mold at grapevine where the fungal incidence was reduced to 3.2% against 12.2% in the control.

Rose *et al.*, (1939) stated that black mold (*A. niger*) caused losses up to 20% of different grape cultivars.

The above mentioned is a type of losses where **Anon. (1978)** classified the postharvest losses in three categories.

- physical losses, measured by weight,
- losses of quality characters, i.e. presence of contaminants, changes in appearance, taste, or texture that may bring about rejection by potential buyers adding to these the contamination with mycotoxins, and
- losses of nutritional value which may be a combination of loss of quality.

Thus, screening of the contamination of grapes and raisin is of great value (**Follstad, 1966** and **El-Tobshy *et al.*, 1981**).