The Status of Fungal GTD, Pathogen Inventory and Current Research in TURKEY

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Turkey is an important country among the grape producing countries in the World.
## World Vineyard Area (ha) 2012

<table>
<thead>
<tr>
<th></th>
<th>Country</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spain</td>
<td>943.000</td>
</tr>
<tr>
<td>2</td>
<td>France</td>
<td>760.805</td>
</tr>
<tr>
<td>3</td>
<td>Italy</td>
<td>696.756</td>
</tr>
<tr>
<td>4</td>
<td>China</td>
<td>600.000</td>
</tr>
<tr>
<td>5</td>
<td>Turkey</td>
<td>462.296</td>
</tr>
<tr>
<td>6</td>
<td>United States</td>
<td>389.349</td>
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<tr>
<td>7</td>
<td>Argentina</td>
<td>220.000</td>
</tr>
<tr>
<td>8</td>
<td>Iran</td>
<td>215.000</td>
</tr>
<tr>
<td>9</td>
<td>Chili</td>
<td>204.000</td>
</tr>
<tr>
<td>10</td>
<td>Portugal</td>
<td>179.500</td>
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<tr>
<td></td>
<td>World Total</td>
<td>6,969,373</td>
</tr>
</tbody>
</table>

www.faostat.fao.org
## World Grape Production (Ton) 2012

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Production (Ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>9,600,000</td>
</tr>
<tr>
<td>2</td>
<td>United States</td>
<td>6,661,820</td>
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<tr>
<td>3</td>
<td>Italy</td>
<td>5,819,010</td>
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<tr>
<td>4</td>
<td>France</td>
<td>5,338,512</td>
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<tr>
<td>5</td>
<td>Spain</td>
<td>5,238,300</td>
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<td>6</td>
<td>Turkey</td>
<td>4,275,659</td>
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<tr>
<td>7</td>
<td>Chili</td>
<td>3,200,000</td>
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<tr>
<td>8</td>
<td>Argentina</td>
<td>2,800,000</td>
</tr>
<tr>
<td>9</td>
<td>Iran</td>
<td>2,150,000</td>
</tr>
<tr>
<td>10</td>
<td>South Africa R.</td>
<td>1,839,030</td>
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<tr>
<td></td>
<td>World Total</td>
<td>67,067,129</td>
</tr>
</tbody>
</table>

[www.faostat.fao.org](http://www.faostat.fao.org)
The Percentages of the Grapes produced in Turkey

- 52% Table Grapes
- 37% Raisin
- 7% Domestic Products
- 4% Wine
Grape Production Percentages in Geographical Regions of Turkey

- Aegean: 49.2%
- Mediterranean: 19.5%
- Marmara: 4.7%
- Central Anatolia: 14.2%
- East Anatolia: 2.4%
- Southeast: 9.7%
- Black Sea: 0.11%
The Status of GTD in Turkey
History of GTD in Turkey

• GTD symptoms were first observed in 1942 (İyriboz).
• Stereum (S. necator and S. hirsutum) and Phellinus species (necator and versicolor) were reported in 1947.
History of GTD in Turkey

- *P. chlamydospora* and *Phaeoacremonium aleophilum* were first detected in 1998 by Erkan Ari and Larignon in the Aegean Region.
GTD Field Surveys in Turkey
The first field study was conducted in the Marmara Region to determine rates of Esca Disease in 2000 (Köklü).
Field Survey in the Marmara Region in 2000

26 vineyards,
14 table and wine grape cultivars were inspected.

The whole Rate of vines showing Esca Syndrome:

- Tyger-striped leaves: 1.4%
- Apoplexy: 0.2%

1.6%
The status of GTD
In the Aegean Region
The status of GTD in the Aegean Region

• The study was conducted in 2013
• 97 vineyards were inspected
• The vines showing GTD symptoms were grouped in two categories, according to their appearance

• **Category 1:** Vines showing typical tyger striped leaves
• **Category 2:** Dead arm, local drying or apoplexy
Category 1

Tiger striped leaves
Category 2

Dead arm

Apoplexy
Symptomatic wood samples
The pathogens obtained from the Aegean Region

- *Botryosphaeria dothidea*
- *Diplodia seriata*
- *Lasiodiplodia theobromae*
- *Neofusicoccum parvum*

- *Phaeomoniella chlamydospora*
- *Togninia minima*

- *Diaporthe ampelina*
- *D. neoviticola*
- *Phomopsis viticola*

- *Fomitiporia mediterranea*
Average diseases prevalence was 82.5% in the Aegean Region.
The Percentages of two GTD symptom categories in the Aegean Region, Turkey

- Tiger striped leaves: 6.9%
- Local dead arm or apoplexy: 2.5%
Average Isolation frequency of GTD fungi in the Aegean Region, Turkey

- **Botryosphaeriaceae spp.**: 8.1%
- **Diaporthe, Phomopsis spp.**: 15.4%
- **F. mediterranea**: 2.1%
- **P. chlamydospora**: 5.1%
- **T. minima**: 1.7%
The status of GTD in the Aegean Region

• We think that *Diaporthe* and *Phomopsis* species are more common than the other GTD fungi.

• So we have to pay more attention on these species for GTD research in this region.
Fungal trunk pathogens of Sultana Seedless vineyards in Aegean region of Turkey

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2 Viticulture Research Station, Ministry of Agriculture, 45125, Horozkoy, Manisa / Turkey
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Summary. In recent years, grapevine trunk diseases have become a problem in Sultana Seedless vineyards of Manisa and Izmir provinces (Aegean Region, Turkey). A field survey was conducted in 2013 in these provinces (in 8 cities and 80 vineyards) to determine disease incidence, fungal species associated with grapevine trunk diseases and pathogenicity. Symptomatic vines were grouped by two different grapevine trunk disease symptoms: (1) typical tiger-striped leaves, (2) dead arm, shoot decline or apoplexy. Over 80% of vineyards in these areas were positive for at least one characteristic trunk disease symptom. Incidence of tiger-stripe symptom ranged from 2.9-15% and incidence of apoplexy ranged from 0-4.2%. Eight fungal species in five fungal families were identified from declining grapevines based on morphological and molecular (ITS, β-tubulin and EF1-α) studies including, Botryosphaeria dothidea, Diplodia seriata, Lasiodiplodia theobromae, Neofusicoccum parvum, Diaporthe ampelina, Phaeomoniella chlamydospora, Togninia minima and Fomitiporia mediterranea. Overall, D. ampelina was the most frequently recovered fungus from symptomatic grapevine tissues followed by botryosphaeriaceous fungi, P. chlamydospora, F. mediterranea and T. minima. Pathogenicity tests confirmed all eight fungi as pathogens of grapevine in these regions with N. parvum being the most virulent among the fungi tested.

Key words: Botryosphaeriaceae, esca, Diaporthe ampelina, Togninia minima, Vitis vinifera
In the Mediterranean Region
The status of GTD in the Mediterranean Region

• The study was conducted in 2015
• 57 vineyards were inspected
• The vines showing GTD symptoms were grouped in three categories, according to their appearance

• **Category 1**: Apoplexy
• **Category 2**: Tiger striped leaves
• **Category 3**: Dead arm or local drying
Average diseases prevalence was **63.2%** in the **Mediterranean Region** in 2015.
The Percentages of three GTD symptom categories in the Mediterranean Region, Turkey

- Apoplexy: 0.83%
- Tiger Striped Leaves: 1.38%
- Dead arm: 3.15%
The pathogens obtained from the Mediterranean Region

- *Botryosphaeria dothidea*
- *Diplodia seriata*
- *Lasiodiplodia theobromae*
- *Neofusicoccum parvum*
- *N. vitiusiforme*

- *Phaeomoniella chlamydospora*
- *Phaeoacremonium parasiticum*

- *Diaporthe ampelina*
- *Phomopsis taxon 2*

- *Eutypa leptoplaca*
- *E. lata*
The percentages of main pathogen groups in the Mediterranean Region, Turkey:

- **7.9%** *Phaeocremonium parasiticum*
  - *Phaeomoniella chlamydospora*
- **7.9%** *Diaporthe ampelina*
  - *Phomopsis taxon 2*
- **4.9%** *Eutypa lata*
  - *E. leptolaca*
- **79.3%** Botryosphaeriaceous fungi
The percentages of Botryosphaericeous isolates in the Mediterranean Region (2015 survey)

- **N. parvum**: 20.7%
- **D. seriata**: 65.4%
- **L. theobromae**: 6.9%
- **N. vitiusiforme**: 3.5%
- **B. dothidea**: 3.5%
In the Central Anatolia Region
Mrs. Süreyya ÖZBEN et al. have been doing a survey study for 1.5 years.

But conclusive results would be presented at 10th ICGTD next year.
Up to now, the reported GTD fungi in Turkey are:
Phaeomoniella chlamydospora   Phaeoacremonium aleophilum

Phaeoacremonium scolytii
Botryosphaeria dothidea

Diplodia seriata

Neofusicoccum parvum

Lasiodiplodia theobromae
Diaporthe neoviticola

Diaporthe ampelina

Phomopsis viticola
Campylocarpon fasciculare
Dactylonectria macrodidyma
Ilyonectria liriodendri
Fomitiporia Mediterranea
The pathogens, detected but not reported yet in Turkey
Cadophora luteo-olivacea
Lasiodiplodia citricola
Eutypa leptoplaca
Neofusicoccum vitiusiforme
Phaeoacremonium parasiticum
Current Research on GTD
Developing Molecular Markers for Turkish Botryosphaeriaceae Isolates by RFLP
Development of Molecular Markers for Turkish Botryosphaeriaceae Isolates by RFLP

Aims:

• To develop specific molecular markers for 6 different Botryosphaeriaceae species by RFLP
• To provide fast detection without DNA sequencing
Development of Molecular Markers for Turkish Botryosphaeriaceae Isolates by RFLP

At least four isolates of different species are used:

- *B. dothidea*
- *D. seriata*
- *L. theobromae*
- *L. citricola*
- *N. parvum*
- *N. vitiusiforme*
Curative Treatments on Grapevine Canes by Hot Water Treatments and Fungicide Applications for Eradication of Botryosphaeriaceae Fungi
Curative Treatments of Grapevine Canes by Hot Water Treatments and Fungicide Combinations for Eradication of Botryosphaeriaceae Fungi

Aims:

• To determine thermal death point of Turkish Botryosphaeriacea isolates with HWT in *in vitro*
• To determine most effective fungicide
• To cure latent BOT infections by hot water and fungicide treatments in grapevine canes
Curative Treatments of Grapevine Canes by Hot Water Treatments and Fungicide Combinations for Eradication of Botryosphaeriaceae Fungi

Three isolates of different species are used:

• B. dothidea
• D. seriata
• L. theobromae
• L. citricola
• N. parvum
• N. vitiusiforme

• Different temperature and time combinations

• 48 °C – 30 min, 45 min
• 49 °C – 30 min, 45 min
• 50 °C – 30 min, 45 min
• 51 °C – 30 min, 45 min
• 52 °C – 30 min, 45 min
• 53 °C – 30 min, 45 min
• 54 °C – 30 min, 45 min
Curative Treatments of Grapevine Canes by Hot Water Treatments and Fungicide Combinations for Eradication of Botryosphaeriaceae Fungi

Three isolates of different species are used:

- *B. dothidea*
- *D. seriata*
- *L. theobromae*
- *L. citricola*
- *N. parvum*
- *N. vitiusiforme*

- **Different fungicides**
  - Metrafenone
  - Azoxystrobin
  - Cyprodinil + fludioxonil
  - Boscalid
  - Triadimenol
Characterization of *Diaporthe* and *Phomopsis* Isolates, Their Pathogenicity and Sensitivity to HWT and Fungicides
Characterization of *Diaporthe* and *Phomopsis* Isolates, Their Pathogenicity and Sensitivity to HWT and Fungicides

**Aims:**

- To characterize Turkish *Diaporthe* and *Phomopsis* isolates by DNA sequencing and phylogenetic analysis
- To determine their pathogenicity
- To determine most effective fungicides and HWT in *in vitro* conditions
Characterization of *Diaporthe* and *Phomopsis* Isolates, Their Pathogenicity and Sensitivity to HWT and Fungicides

- ITS, Beta tubulin and Elongation Factor gene sequencing and phylogeny
- 48-54°C temperatures
- 30-45 min HWT

**Fungicides**
- Metrafenone
- Azoxystrobin
- Cyprodinil + fludioxonil
- Boscalid
- Triadimenol
Determination and Characterization of Fungal Trunk Pathogens in the Adana, Mersin Provinces (East Mediterranean Region, Turkey)
Determination and Characterization of Fungal Trunk Pathogens in the Adana, Mersin Provinces (East Mediterranean Region, Turkey)

**Aims:**

• To determine and characterize fungal GTD pathogens in this region
• To determine their pathogenicity
• To determine most effective fungicides and HWT in *in vitro* conditions
Thanks for attention...

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