

Etiology and Epidemiology of Phytoplasma diseases of Stone Fruit and Grape Vine in Jordan



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In Jordan, stone fruits (i.e. almond, peach, apricot, nectarin) & Grape vine are major economic crops;

- **various value chain stakeholders (rural areas, investors, exporters, transporters,..),**
- **livelihoods and improve the food security.**

- **Almond (green fruit are consuming) in several rural areas and family farming instead of olive trees (14 JOD= €18/kg).**
- **The prices ranging from 1-3.5/ Kg. for the other crops of stone fruit and grape vines**



Stakeholders; farmers, exporters, transports, packaging & food bodies, mediators, vendors, retailers, wholesales market, etc



Fruit tree	Cultivated area/D.	Production /ton	Remark
Almond	8645.4	8477.5	
Peach	69670.6	63390.5	Rain-fed and irrigated areas
Prunus	23579	18080.8	
Apricot	18461	29479.8	Produced area
Cherries	5799	7421.5	
Grape	138807	13224	





Economic importance of Stone fruits & Grape



Pests & Diseases associated with stone fruits and grape in Jordan

Several pests & Diseases are attacking stone fruits and grape in the whole country ;

Stone Fruit:

- *Monilinia fructicola*,
- *Taphrina deformans*,
- *T.amygdali*,
- *Pruni xanthomonas Bacte*,
- **Powdery Mildew** ,
- *Capnodis tenebrionis*,
- *Ceratitis capitata*,
- *Myzu persicae* ,
- *Hoplocampa flava*.

Grapevine:

- *Botrytis cinereal*,
- **Dead arms- Eutypa**,
- **Powdery& Downey mildew**,
- *Verticillium wilt*, *Leafroll virus*,
- **Grape Mealybug**,
- *Lobesia botrana*,
- **Grape Mite**,
- **Root-Knot Nematodes**.



Phytoplasmas diseases

- **Phytoplasmas, a large group of plant-pathogenic, phloem-inhabiting bacteria that are transmitted by phloem insect vectors Associated with more than 1,000 plant species (Namba, 2019).**
- **In the case of severe epidemic outbreaks, they can induce losses up to 70-100%.**
- **Based on 16S rDNA sequences and biological features; 44 species within 'Candidatus Phytoplasma (Miyazaki et al., 2018).**
- **Many phytoplasma diseases affecting important crops are already epidemic in Europe and can represent a key threat in some regions, where new outbreaks occurred recently (Janse et al., 2012).**
- **European Euro-Mediterranean countries include some of the largest producers of stone fruit and grape vines reported many destructive Phytoplasma diseases;**
 - **Bois Noir (BN), Flavescence Dorée (FD)**
 - **'Candidatus Phytoplasma phoenicium' AlmWB: 200,000 Almond Trees in Last 20 years , peach and nectarine in Iran (Abou-Jawdah et al., 2009, Saleehi, 2006).**



Bio-ecological indicators

Bio-ecological indicators;

The more recent rapid spread of phytoplasma, identification of efficient insect vectors, increased the alarm about the risk it poses for stone fruit & grape production in the Middle East & Mediterranean basin (Abou-Jawdah et al., 2003).

Due to the similar environmental, climate condition& potential vectors;

- **CaPphoe & related strains as well as other phytoplasmas could be considered emerging pathogens able to enter and adapt to Jordan conditions.**
- **Plant diseases associated with 'Ca. Phytoplasma solani' (infecting tomato and grapevine),**
- **'Ca. Phytoplasma aurantifolia' (infecting potato) and**
- **'Ca. Phytoplasma asteris' (infecting grapevine and peach)**

- **have been recently reported in Jordan. However, the phytoplasma/host plant(s)/insect vector(s)**



Phytoplasma in Jordan

Disease Notes



First Report of '*Candidatus* Phytoplasma solani' Strains Associated with Grapevine Bois Noir in Jordan

N. M. Salem, F. Quaglino, A. Abdeen, P. Casati, D. Bulgari, A. Alma, and P. A. Bianco

Affiliations 

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Faculty of Agricultural Technology, Al-Balqa' Applied University, Al-Salt, Jordan

Detection and Identification of Aster Yellows (16SrI) Phytoplasma in Peach Trees in Jordan by RFLP Analysis of PCR-Amplified Products (16S rDNAs)

G. H. ANFOKA and I. FATTASH



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Detection and Molecular Characterization of a Phytoplasma Associated with Big Bud Disease of Tomatoes in Jordan

GHANDI H. ANFOKA, AMJAD B. KHALIL and ISAM FATTASH

DISEASE NOTES



First Report of '*Candidatus* Phytoplasma aurantifolia'-Related Strains Infecting Potato (*Solanum tuberosum*) in Jordan

N. M. Salem , R. Tahzima, A. O. Abdeen, P. A. Bianco, S. Massart, T. Goedefroit, and K. De Jonghe

Affiliations 

Published Online: 2 Apr 2019 | <https://doi.org/10.1094/PDIS-04-18-0705-PDN>





Cacopsylla pyricola



Cacopsylla bidens Sulc, 1907

Psylloidea (Hemiptera) of Jordan

by Mashhour Al-Khawaldeh, Ahmad Katbeh-Bader and Daniel Burckhardt

1997

Further studies will investigate the role of ***Hyalesthes obsoletus*** Signoret, a polyphagous **Cixiidae** responsible for the **BN phytoplasma transmission** in Europe, and other possible insect **vector(s)** in the BN spread in **Jordan**. (Salem et al., 2013)



Phytoplasma in Jordan

In conclusion; two studies before 15 years & 2 reports (Selected areas, Vectors????).

- AlmWB & other that related with almond, stone fruit, not reported !!!!
- Reported species and other crops (global confirmation).



The aim and objectives of current study

- (i) survey the presence of phytoplasma diseases affecting stone fruits and grapevine in Jordan by symptoms observation and molecular identification;
- (ii) identify putative insect vector(s) and non-crop plant host(s) of phytoplasmas and provide a map of their distribution;
- (iii) identify genetic markers useful for taxonomic distinction and typing of phytoplasmas,&

Increase the expertise and awareness about the Phytoplasmas diseases.



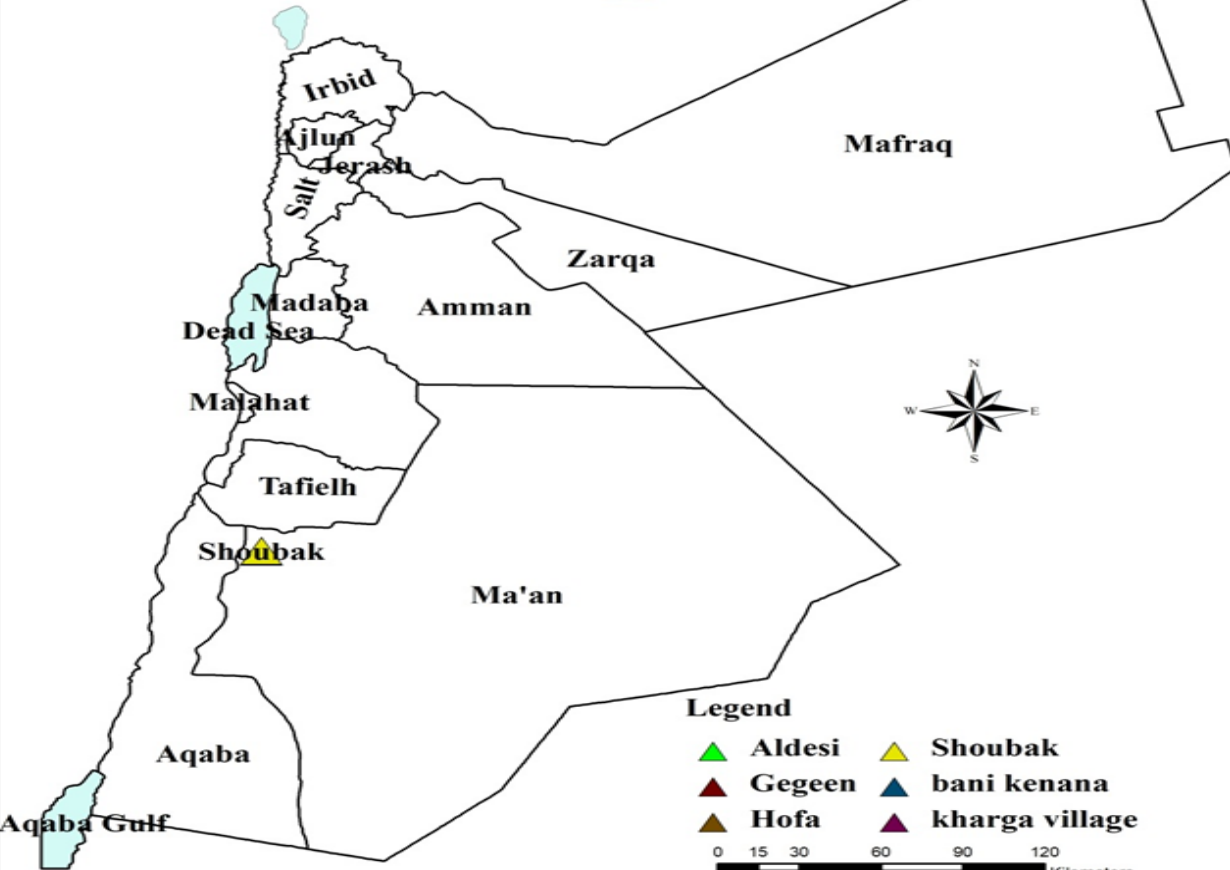
Methodology

1st year;

- **Field inspection - of stone fruit and grape in 3 cultivated areas (Irrigated and rainfed farms);Irbid, Ajloun and Al-Mafraq (all in North).**
- **Leaf samples of stone fruit (Almond, Prunus, Peach & Apricot), Table and wine grape were surveyed. Samples collection lasted from May to Mid- Sep.,**
- **Small and commercial farms were surveyed.**
- **Symptomatic leafs and twigs from stone fruit trees and grape were collected, labeled and mapped,**
- **Orchards and nurseries were demonstrated.**
- **Additionally, the symptomless leaf's were collected based on the fact latent period of phytoplasma, Sampled of wild plants (bindweed- Convolvulus arvensis L.) have been taken,**
- **The covered locations and their coordinates (altitude) were determined via digital GIS (I phone 6S plus).**



The proposed surveyed areas that will be covered during the study (2 seasons).

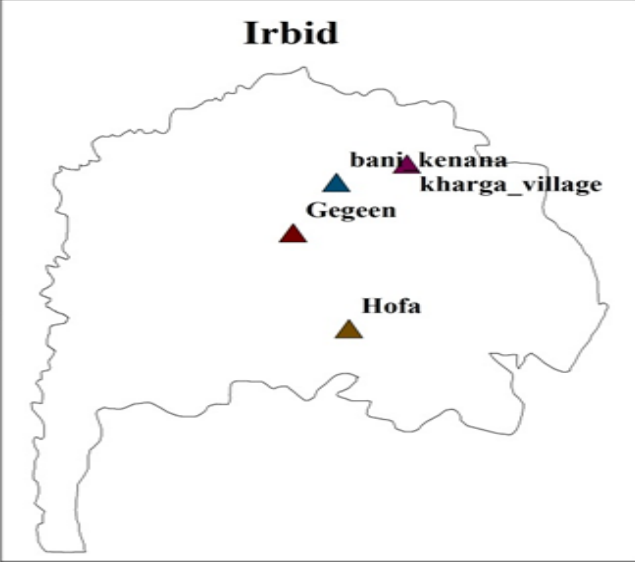


Legend

	Aldesi		Shoubak
	Gegeen		bani kenana
	Hofa		kharga village

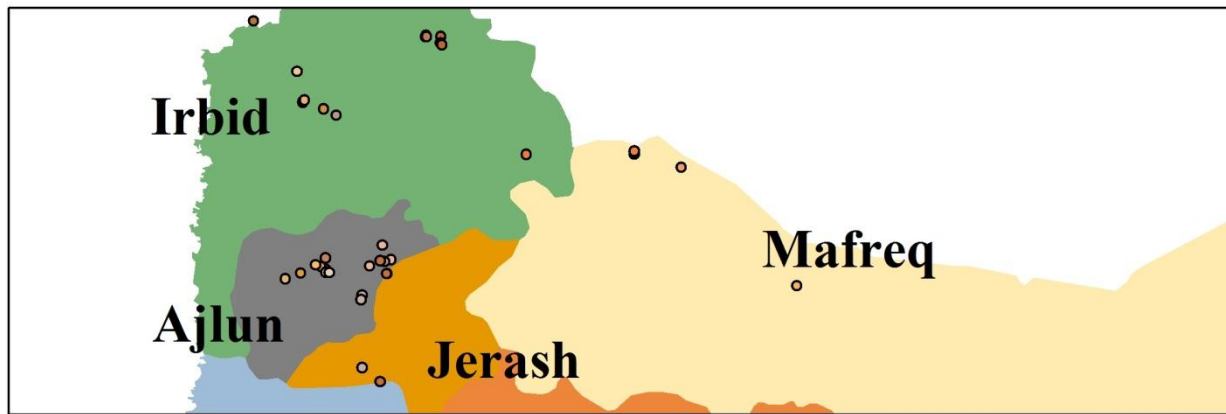
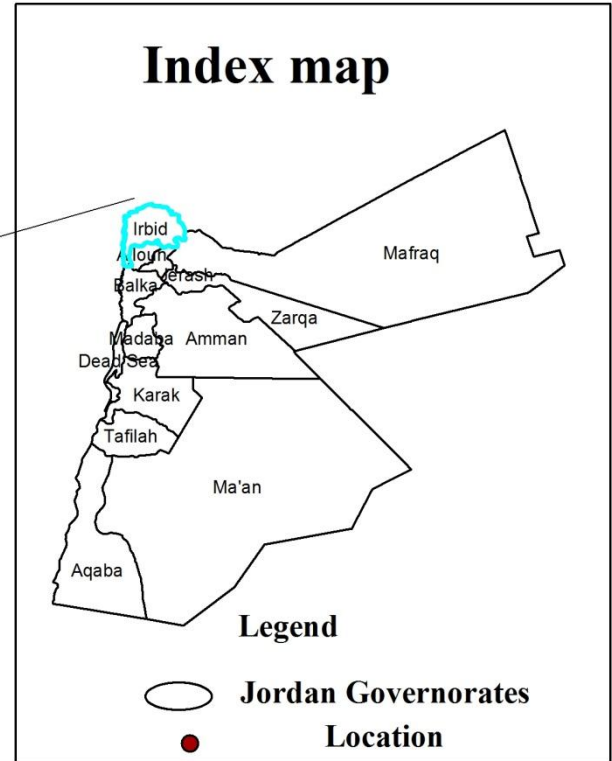
0 15 30 60 90 120 Kilometers

Map Prepared By Eng.Wafa'a Abu Hammour

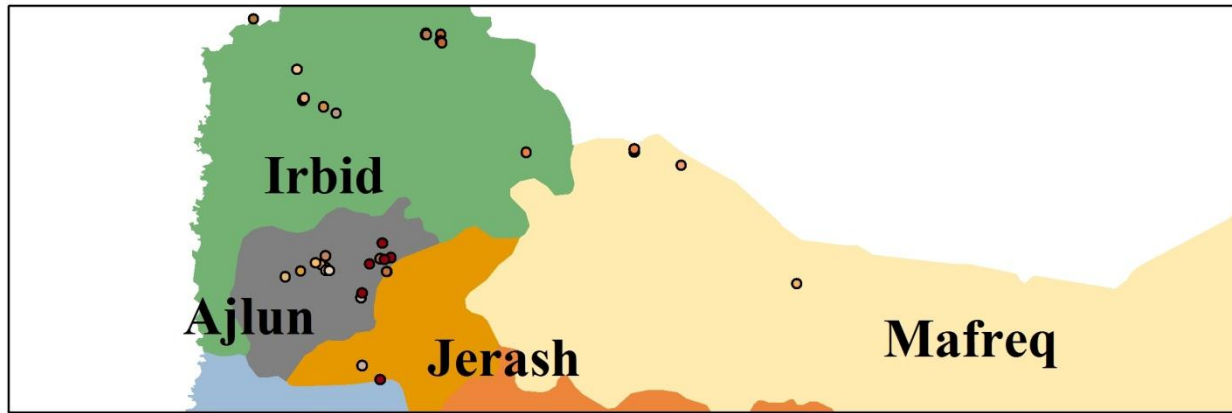
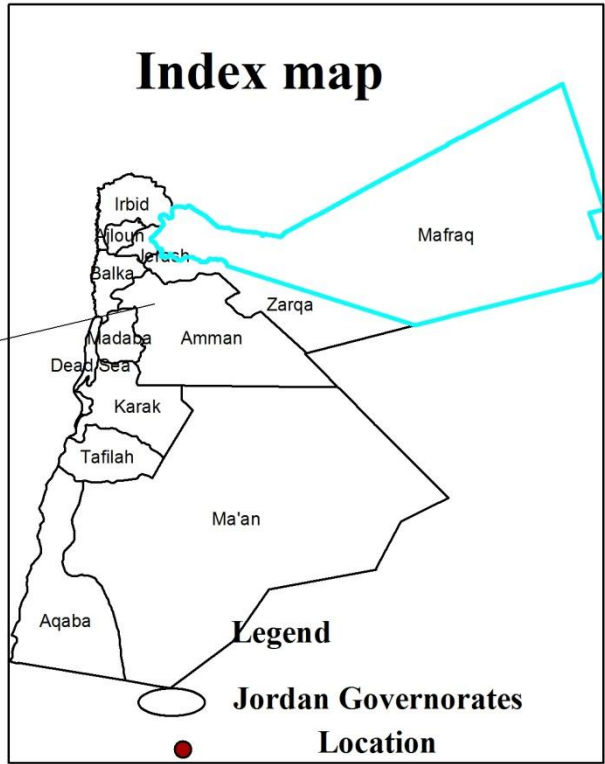
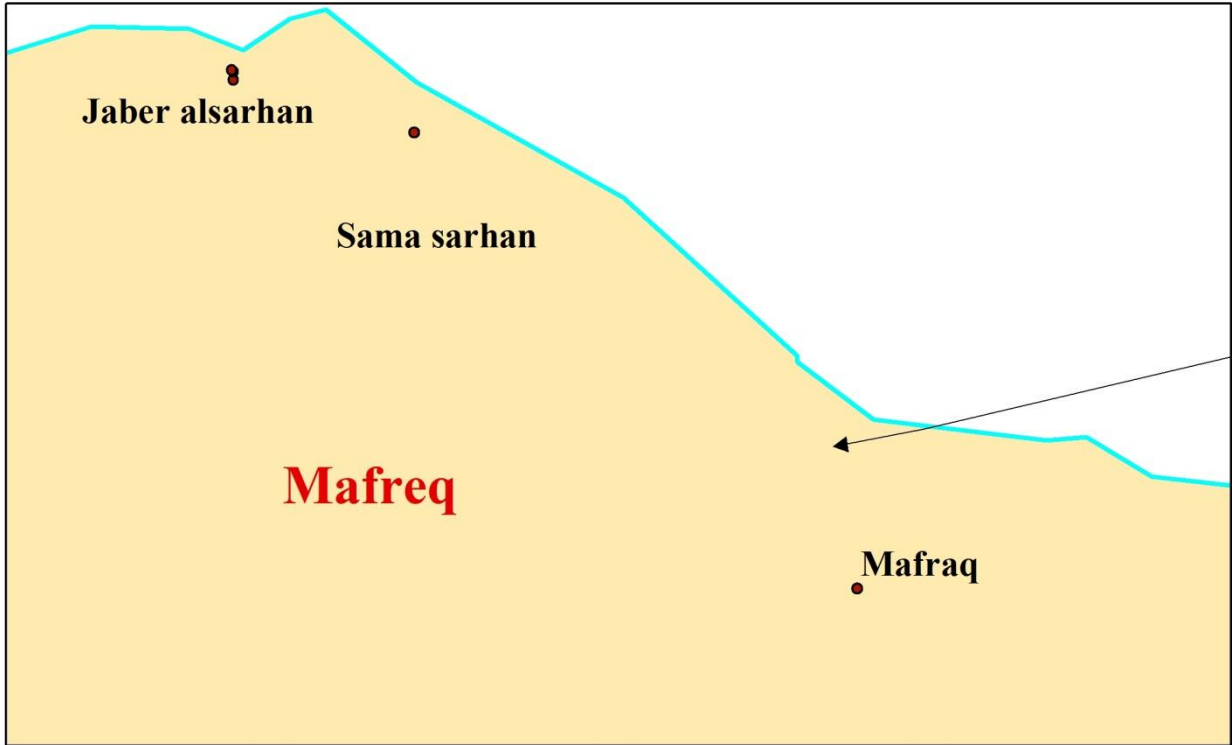


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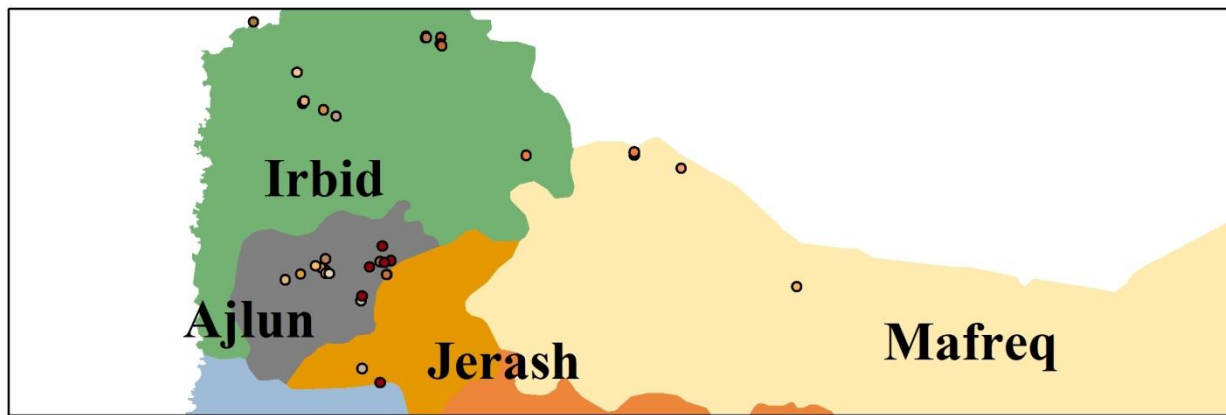
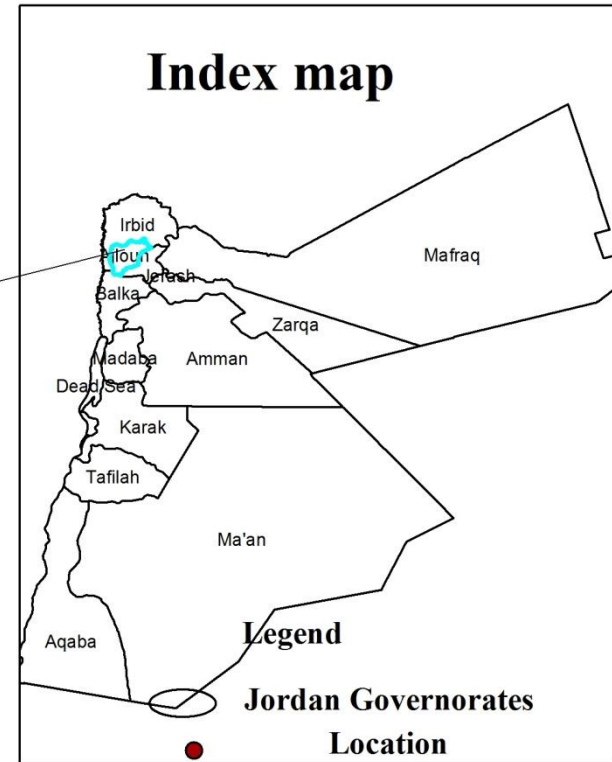




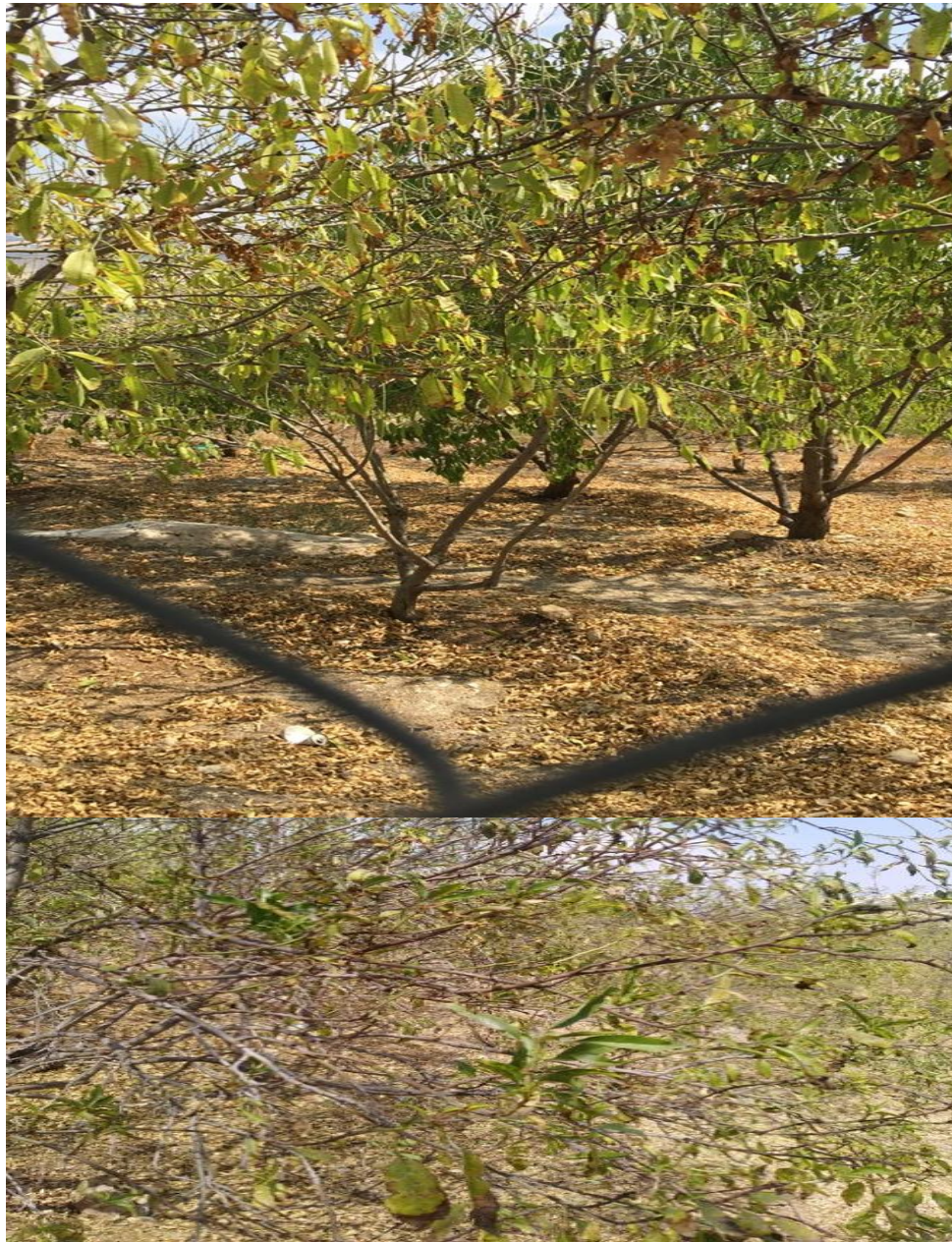
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Molecular identification of phytoplasmas

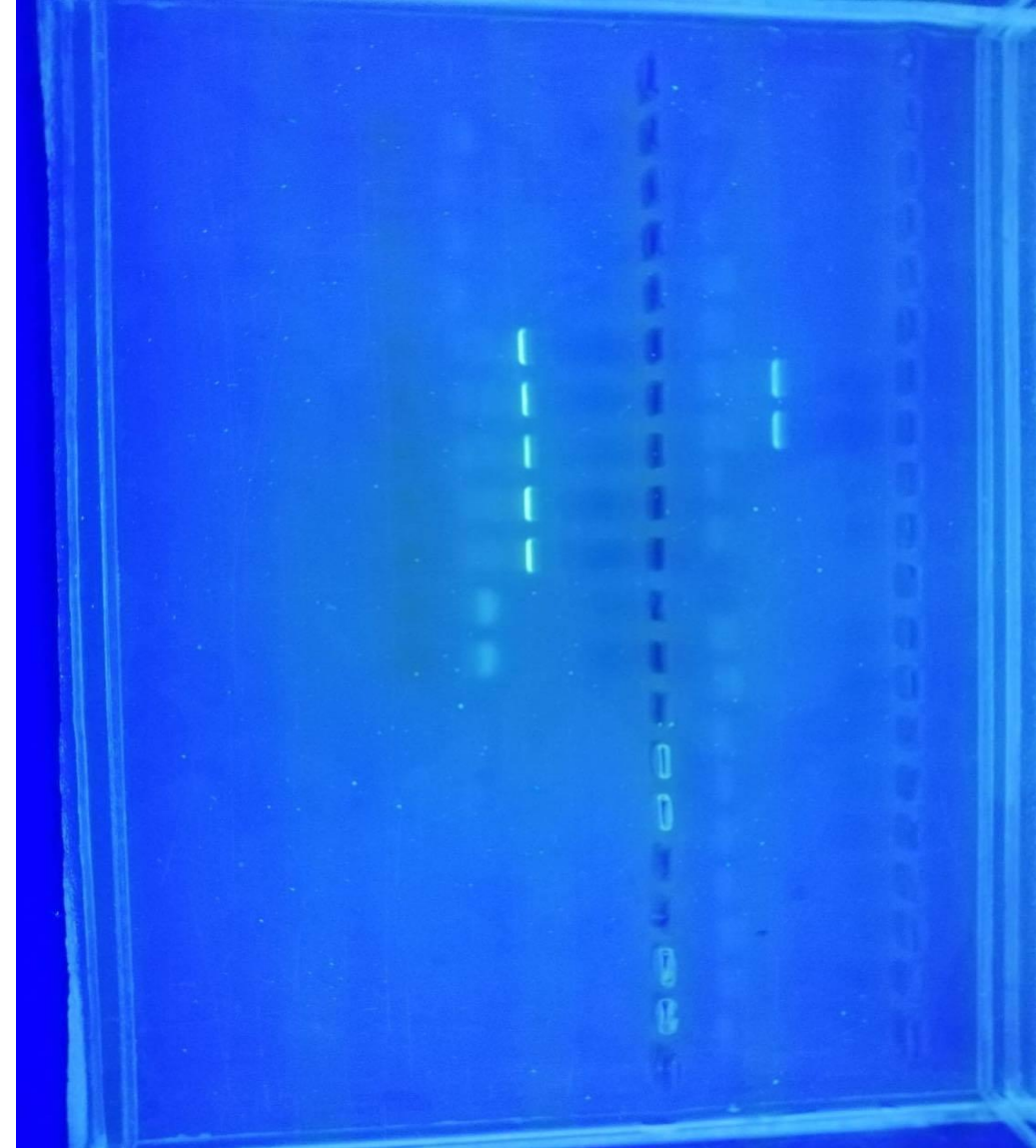
- Molecular identification of phytoplasmas
- Total nucleic acids (DNA) from collected samples were extracted at the laboratories of NARC, Jordan, protocols Angelini et al. (2001) and Marzachi *et al.* (2008), with some modifications (leaf veins and green phleom).
- Extracted DNAs' Have been stored at (-80 ° C) until they used.
- All stored DNAs' have been shipped to the biotechnology labs., at the faculty of Agriculture, environment and bioenergy- Phytopathology Dept. (DISAA) at University of Milan.
- Direct and Nested PCR were conducted to detect the Phytoplasma.
 - The universal Primers P1\P7 were used in Direct PCR and F1\F7 in the Nested PCR.
 - Direct PCR using StampF/StampR0 primer pair followed by nested PCR with the StampF1/StampR1 primer pair.



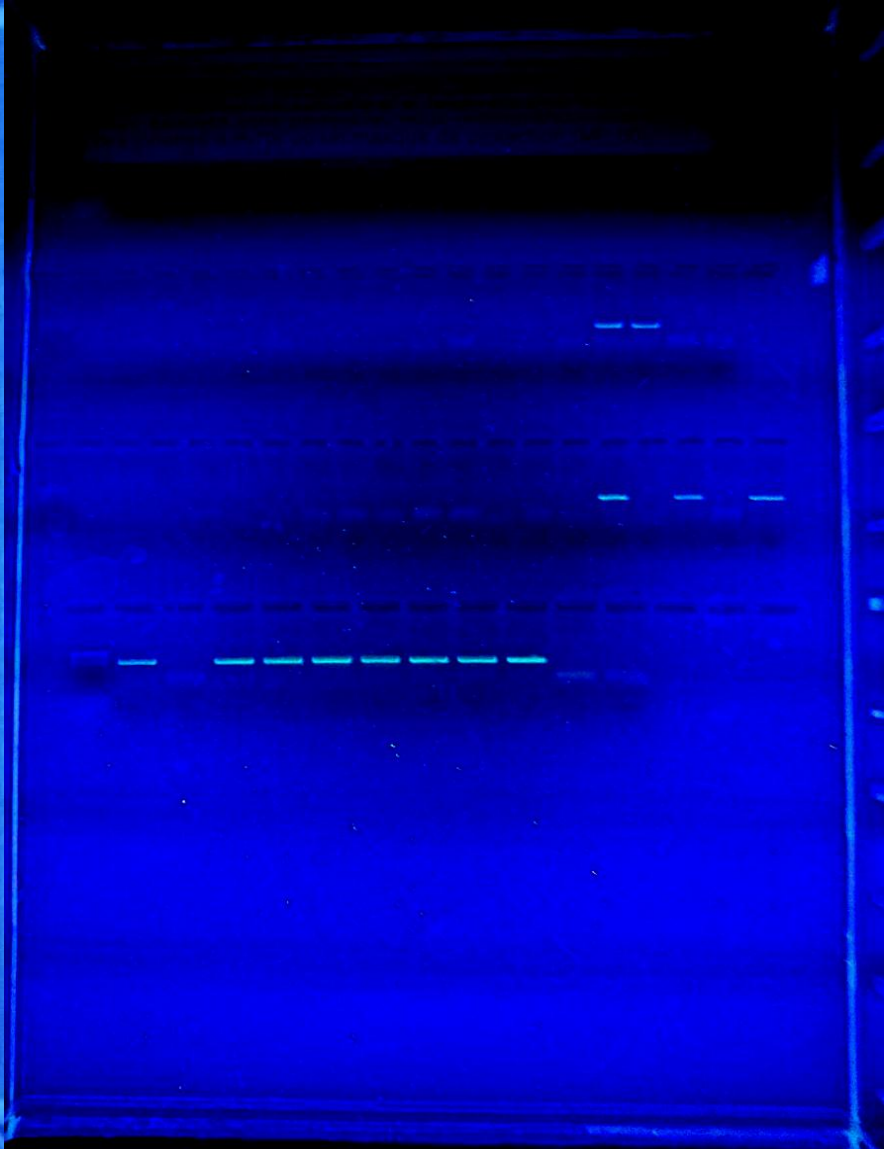
Findings

Primers	Crops	Positive Samples	Remarks
Universal Primers	Stone fruit	0	
Universal Primers	Grape	0	
Stamp Gene	Stone fruit	9	Almond, Apricot Rainfed and irrigated areas.
Stamp Gene	Grape	5	Rainfed and irrigated area. Table and wine vars.
Total		14	





Gel electrophoresis of the Nested PCR product by stamp gene - Grape vine



Gel electrophoresis of the Nested PCR product by stamp gene- Stone fruit



Perspectives

1st year:

PCR products will be sequenced and analyzed. The findings that will be obtained to be communicated via peered review journals.

2nd year:

Investigation on the epidemiology of the phytoplasma associated diseases described during the first year:

(i) Survey on the diseases in different geographic regions in Jordan (putative vectors to be collected, survey on non-crop plant hosts).

(ii) transmission trials of putative insect vectors.

(iii) Pomegranate will be included.



Conclusion

- In Jordan, few studies have been demonstrated the phytoplasmas diseases and their vectors.
- The obtained results up to now indicating that the phytoplasmas are spread in the country, and new strains related to the geographical zones, potential vectors, crops and wild hosting plants could be reported.
- The Obtained information will be very fruitful for Jordan and will provide profound insight about Phytoplasma and its vectors in ME, and help to prevent the farmers and their crops, and thereby keep the livelihoods and food security of various stakeholders who are really engaging the value chain of target crops. .

