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in

D'Onghia A.M. (ed.), Brunel S. (ed.), Valentini F. (ed.).
Xylella fastidiosa & the Olive Quick Decline Syndrome (OQDS). A serious worldwide challenge for the safeguard of olive trees

Bari : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 121

2017
pages 93-96

Pest risk analysis on *Xylella fastidiosa* in Palestine

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Agriculture is considered as one of the main components of the national identity, history, heritage, society and economy of Palestine. About 11.5% of the workforce in Palestine is in agriculture. The total agricultural area is about 120 706 hectares, about 21% of the total area of the West Bank and Gaza strip. About 81% of the agricultural area is rain-fed, while the other 19% is irrigated. Palestine has a semi–arid Mediterranean climate and a wide topographical variation, which permit a high biodiversity and natural resources. The main crops are divided into 3 groups: field crops represent about 27%, vegetables 11% and fruit trees 62%. Olive orchards account for more than 80% of the total fruit tree area and about 50% of the cultivated area . Olive production relies on natural precipitation and constitutes 2.15% of the Palestinian national income.

Given the major importance of agriculture in Palestine and the threat posed by *Xylella fastidiosa* in the Mediterranean area after the first outbreak in 2013 in Italy on olive orchards, the National Plant Protection Organization (NPPO) is going to apply different actions to prevent entrance, establishment, spread and the destructive effect of this disease.

Pest Risk Analysis

Xylella fastidiosa is a destructive disease which attacks a wide range of plant species including economically important crops (citrus, stone fruits, grapevine and olive), in addition to wild forest trees, shrubs and landscape plants. From the literature, *Xf* is a gram-negative bacterium (family *Xanthomonadaceae*) that has evolved with plants to exist as a xylem-limited endophyte. It is known to have a remarkably broad host range, with 359 plant species, from 204 genera and 75 different botanical families recorded. *Xf* is transmitted by xylem-feeding insects, which are limited to the order Hemiptera, sub-order Auchenorrhyncha (Cicadellidae, Aphrophoridae and Cercopidae).

The geography of Palestine, in particular the broad range of climatic and environmental conditions and the wide range of host plants present, could favour the establishment and spread of *Xf*. More research and surveys need to be conducted to determine the presence of the many xylem-feeding insects from the previous mentioned order, which could be widely distributed. The lack of accurate information about the vectors and their associated hosts means that it is difficult to evaluate the likelihood of introduction, and requires more in-depth research and monitoring.

Pest Risk Assessment

Regulatory status. The Borders of Palestine (West Bank & Gaza Strip) are not under Palestinian control. All trade is indirect, through Israeli ports where checks occur and strict import regulations are applied. NPPO follows two legal mandates in addition to Israeli Regulations: the up-dated national law of Agriculture No. 2 of 2003 and its amendments No.11 of 2005; and 3 relevant bylaws - Agricultural Nurseries bylaw, Agricultural Quarantine bylaw and the Production of Seeds and Plant Propagation Material bylaw.

Current situation of the disease. To date, *Xf* has never been reported in Palestine. Suitable conditions and availability of host plants mean that it is of high importance to conduct a

comprehensive survey for the disease and for insect vector(s) detection. The former should be based mostly on symptom observation and testing of suspected plants. The possibility of entrance of *Xf* by trade of plant material is rated to be low. Entry via passengers carrying plant material and by insect vector is rated to be moderate to low.

Host plants and vectors. A wide range of plants, which are known as hosts of *Xf*, are present in Palestine, including cultivated fruit trees, weeds, ornamentals and forests species. In addition, a wide range of xylem-feeding insects are present and may be potential vectors of the pathogen.

A thorough survey is needed to be sure whether the pest is present (or absent). Laboratory analyses, infrastructures and financial support are needed. There are no abiotic factors that could limit *Xf* establishment. Study and survey programs to determine the status of the potential vectors of *Xf* in Palestine are essential, leading to consider more appropriate management options with the possible risk.

Pest entrance by plant material. Importing fruit tree planting material is prohibited according to the law. All types and quantities of imported commodities are subjected to Israeli authorities checks at the borders (Paris economic agreement). Agricultural commodities should have a phytosanitary certificate from the country of origin. Moving plants or plant seedlings between Palestine and Israel is possible with an internal arrangement. Therefore, the possibility of entrance by plant material appears to be unlikely. In the case of fruits, there is no evidence that fruit can transmit *Xf*.

Pest entrance by insect vectors. Insect vectors are unable to move from country to country by themselves. Movement of vehicles into Palestine is not possible, except trade vehicles which are obliged to remain on the borders or ports for a long time. It is moderately likely to unlikely that *Xf* can be introduced by insect vectors.

Pest entrance by human movement. Very few citizens from Palestine can travel to EU countries, North and South America and other *Xf* infected countries. However, many Israeli citizens are residents in all mentioned countries and travel back to Israel. These passengers may be moderately likely to transfer host plants for plantings or the vector to the country. It is important to establish bilateral discussions and professional meetings and establish efficient measures to raise the public awareness about the dangers of importing plant material.

Pest establishment. Under the current situation - availability of wide range of host plants, suitable weather conditions for the bacterium and insect vector - the possibility for *Xf* to become established in Palestine is considered to be very likely. The availability of the insect vectors would play a major role in the establishment and spread of the pathogen. However, further studies are needed to define the status of xylem-fluid feeding insects in Palestine. If these potential vectors are present then the establishment of the pathogen will be rated as very likely based on the wide host range of cultivated crops, in addition to the possible wild and asymptomatic host plants, the confidence will be high. The lack of efficient cultural practices to limit this pest or control measures also increases the probability of establishment.

Economic, environmental and social impact. The establishment and spread of *Xf* would have major negative impacts on the agriculture sector and national income. Trade in horticultural goods would slow and *Xf* would reduce the production quality and quantity and cause host deterioration, negatively affecting the international and national markets, food security and safety, in addition to farmers' incomes. Intervention against the pest or its vector/s will incur additional costs, taking into consideration the budget for eradication or treatment.

Olive and other fruit trees such as Citrus, grapevine and stone fruits would be negatively affected. More than 100 thousand Palestinian families, the majority living in rural areas (14% of total population), rely on the olive sector either directly or indirectly (labour, transportation, industry, nurseries and traders). The value of olive production at the farm gate consists of 3.5% of the total value of agricultural production. The olive sector comprises 13.2% of total agricultural exports.

Many plant species have a positive environmental impact, limiting soil erosion and runoff, desertification, carbon dioxide uptake and contributing to biodiversity, in addition to being beneficial to tourism. Control measures against *Xf,* mainly pesticide use against the vectors, may have side effects on beneficial insects, wild life, biodiversity and the environment.

Area endangered by the pest. Cultivated areas with olives, citrus, grapes, almond, ornamental plants, and forest are the main endangered areas in the country.

Pest Risk management

Prevention. Importation of agricultural commodities from countries where the pest is present should be prevented (plant material of pathogen host species). Each country should carry out surveys and establish if the pest and its possible vector/s are present. Other commodities should be checked to ensure that they do not harbour any insect vectors before shipping. Further inspection should be done at the borders before entrance either for passengers' baggage and/or commodities. For Palestine, import of planting material especially of fruit trees is prevented, and *Xf* is considered a quarantine pest.

Eradication. Once the bacterium has established or spread, eradication is very difficult and unlikely, because of the huge range of host plants (symptomatic and asymptomatic) and potential vectors. In addition, latent infections, which could act as an inoculum source, are hard to detect.

Public awareness on the disease, focusing on symptoms on different plant species, is required. Stakeholders should look for symptoms of *Xf* and report any suspected plant to the NPPO for assessing the presence of the bacterium through laboratory testing.

The implementation of the legislation provision to contain the spread of the disease will involve the following actions:

- premoval and burning of infected host plants taking into consideration the latent infections and the buffer zone; tools should be disinfected after use in infected orchards or when moving from one orchard to another; for nurseries, all plants should be destroyed if *Xf* is detected;
- isolation of the infected area, establishment of clear borders and prevention of movement of any host plant out of the infected area;
- control measures against the vector(s) within the contaminated area and the surrounding buffer zone using pesticides, trapping and/or any method to decrease vector population;
- survey in the orchards to identify infected plants (inspection and sampling for laboratory tests); eradication or containment measures improve with early detection within a region.

Exclusion. No treatments are efficient for eradicating the bacterium once it is introduced or established. Insufficient relevant information about the bacterium, its host plant range and insect vectors could increase uncertainty. Procedures are beaded to improve management for this disease and to reduce its negative effect. The followings should be considered:

- phytosanitary certificate, indicating that the seedlings, commodities and any agriculture products come from a pest-free area. Issue of strict regulation to prevent importation of any possible host plant/part of plant from infested area;
- information exchange between countries, organizations and stakeholders about the pest, host plants, vector/s and contaminated area;
- survey and inspection for the nurseries, mother plants, orchards and natural or wild areas, for the presence of symptoms, infected plants or insect vector/s;

– additional intervention such as treatment of imported consignments and packaging material (either at origin or at borders before entrance) to eliminate any possibility of any infestation by vectors;

– public awareness for farmers and citizens, using posters and local media, etc.

A contingency plan should be soon prepared by the NPPO with the support of all relevant organizations in order to identify and train the responsible for the different actions (e.g. surveillance and monitoring, surveys, sampling, laboratory analyses).