



## **Occurrence of Grape Phylloxera *Daktulosphaira vitifoliae* Fitch (Hemiptera: Phylloxeridae) in the State of Espírito Santo, Brazil**

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### **Authors' contributions**

*This work was carried out in collaboration with all authors. Authors FZM and VLSL designed the study and managed the writing of the manuscript. Author CMM conducted the experiment in the field. Author JRC performed the statistical analysis. Authors DP and MZ managed the writing of the manuscript. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/JEAI/2018/39074

#### Editor(s):

(1) Dalong Guo, Professor, College of Forestry, Henan University of Science and Technology, Luoyang, People's Republic of China.

#### Reviewers:

(1) Manoel Fernando Demétrio, Universidade Federal da Grande Dourados, Brazil.

(2) Iris Beatriz Scatoni, Agronomy College, University of Republic, Uruguay.

Complete Peer review History: <http://www.sciencedomain.org/review-history/23055>

**Short Research Article**

**Received 18<sup>th</sup> November 2017**

**Accepted 29<sup>th</sup> January 2018**

**Published 6<sup>th</sup> February 2018**

### **ABSTRACT**

The phylloxera *Daktulosphaira vitifoliae* (Fitch 1856) (Hemiptera: Phylloxeridae) is one of the most important pests in grapevine cultivation. This specie is distributed in all continents and can attack the plant aerial part and the vine root system. In Brazil, phylloxera has been causing losses in most municipalities from the southern region that produce grape, and there is no evidence of *D. vitifoliae* in the State of Espírito Santo. The objective of this study was to monitor the occurrence of *D. vitifoliae* in the grapevine crop in the State of Espírito Santo. Between February and December of 2016, leaves and roots with typical pest lesions were collected from grapevines crops cultivars 'Niagara Rosada' and 'Isabel' in different production regions of the state. After analyzing the materials and taxonomic identification, the presence of phylloxera in grapevines was confirmed in Espírito Santo.

**Keywords:** Grape leaf galls; 'Isabel'; 'Niagara Rosada'; vine; viticulture.

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## 1. INTRODUCTION

The grape phylloxera *Daktulosphaira vitifoliae* (Fitch 1856) (Hemiptera: Phylloxeridae) originates in North America and feeds on leaves and vine roots (*Vitis vinifera* L.) [1]. Due to its worldwide spread through plant material in the 19<sup>th</sup> and early 20<sup>th</sup> centuries, phylloxera has become one of the most devastating pests of viticulture, causing worldwide losses [2]. In Brazil, phylloxera has been found in practically all grape producing regions in the south of the country [3] and has been monitored since the first cultivated edgrapevine crop [4].

Phylloxera has a complex plant life cycle, where part of its life is in the soil infesting roots, and another part is to form leaf galls under the vine leaves, depending if the species are European or American [5]. The leaves of the vine are relatively tolerant to feed on phylloxera, but its fine and structural roots are highly susceptible [6]. Feeding on the tip of young roots by phylloxera causes nodosities while feeding on mature roots causes large tuberosities, which eventually will deform and crack [7]. Both forms of root damage allow soil fungi and bacteria, resulting in severe damage to the root, loss of yield and grapevine [8]. In addition, this metabolism behavior induces changes in the uptake and transport of water, minerals and photoassimilates [9].

The Brazilian viticulture occupies an area of approximately 79,000 hectares, with an annual production of 1,500 tons [10]. In the state of Espírito Santo, viticulture is distributed in 200 hectares mostly with the cultivars 'Niagara rosada', 'Isabel', 'Isabel precoce', 'Vitoria', 'Violeta' and 'Bordo' ungrafted and grafted with rootstocks 'IAC 572 Jales' and IAC 766 Campinas' (11). However, the culture presents a high incidence of pests and diseases. Although viticulture has become increasingly important in relation to the sustainability of rural properties in the state of Espírito Santo, few studies have been carried out regarding the occurrence of pests that may affect its production. Being aware of the great damages, phylloxera can occur in grapevines, and its records are important, in order to obtain information that allows the efficient control of the pest. In this sense, the objective of this study was to report the occurrence of phylloxera in grapevine crops in the state of Espírito Santo, Brazil.

## 2. MATERIALS AND METHODS

Grape samples were collected from three growing regions in the state of Espírito Santo in the following municipalities: Santa Teresa (district of Caldeirão do São José, 19° 55'20" S, 40° 44'48.69" W), Santa Maria de Jetiba (19° 59' 25.47" S, 40° 42'16.58" W) and Mantenedópolis (18° 51'6.89"S, 41° 7'55.354" W) (Fig. 1).

In the period between February and December 2016, monthly sampling was carried out during different stages of grapevine plant and product development. The grape cultivar evaluated was 'Niagara Rosada', which is the result of a somatic mutation in "Niagara Branca" (*Vitis labrusca* L. x *Vitis vinifera* L.) and 'Isabel', an American grape cultivar [11]. Both cultivars were evaluated in grafted and ungrafted plantations with rootstocks 'IAC 572 Jales' and IAC 766 Campinas' [11]. The samples were randomly collected between the planting lines, in order to find leaves with a possible symptom typical of phylloxera galls. Twenty plants per hectare were sampled and each sample was composed of ten leaves with symptoms of phylloxera per plant and four roots (one root per direction, North, South, East, and West).

The collected plant materials were packed in hermetically sealed thermal boxes (44x25x37 cm) and transported to the Entomology Sector of the Nucleus of Scientific and Technological Development in Phytosanitary Management of Pests and Diseases of the Center of Agrarian Sciences and Engineering of the Federal University of Espírito Santo. In the laboratory, the leaves and vine roots were cut using a scalpel to remove the insects, which were placed in glass tubes containing alcohol (70% v/v). The insects were identified by the researcher Marcos Botton in the Brazilian Agriculture Research Corporation (EMBRAPA) Grape and Wine, Bento Gonçalves, RS, Brazil.

## 3. RESULTS AND DISCUSSION

The materials analyzed were collected in the three different municipalities and it was verified that all the samples presented phylloxera in the leaves and in most samples of roots of grafted and ungrafted plants. In regions where the farmers did not use rootstocks, nodosities in the roots of the plants were verified. The nodosities are characterized by increased root tissue, a typical symptom of phylloxera attack on susceptible materials [12]. In all the collected

material, leaf galls were the predominant symptom (Fig. 2), allowing to note the occurrence of phylloxera, *D. vitifoliae*, for the first time in the state of Espírito Santo, Brazil.

The occurrence of phylloxera in grape producing regions in the state of Espírito Santo may be related to the contaminated vegetative material and climatic conditions favorable for the development of phylloxera. Generally, the common location of oviposition, nutrition and mating of phylloxera are the roots, therefore not all forms or phases of the life cycle occur in certain regions since the cycle stages are associated with the climate conditions and host susceptibility [13]. Insects induce a feeding location within the meristematic zone of the root tip, where they remain attached to the root, feeding inter and intracellularly [14]. Overall, the pest found on the leaves and roots can paralyze the development of the plant and may cause its

death [13]. The control of phylloxera in grape plantations is indispensable to guarantee the vigor of the plants, ensuring a good production.

One of the control techniques of phylloxera is grafting technique of the cultivars of economic interest on rootstocks of American cultivars (*Vitis cordifolia*, *V. rupestris*, *V. berlandieri*, *V. riparia*) or hybrid, resistant or tolerant to phylloxera [15]. The use of resistant rootstocks is the most common form of phylloxera management, worldwide, since the late 19<sup>th</sup> century [16]. Another way to manage this pest is to prevent it since phylloxera can easily disperse next to the seedlings. Certified and suitable nurseries and avoiding the purchase of ungrafted *V. vinifera* plants [17] is preferred. Biological control methods for phylloxera have been tested with arthropods, nematodes and entomopathogenic fungi, but few types of research have been successful and used in the field [18,19].

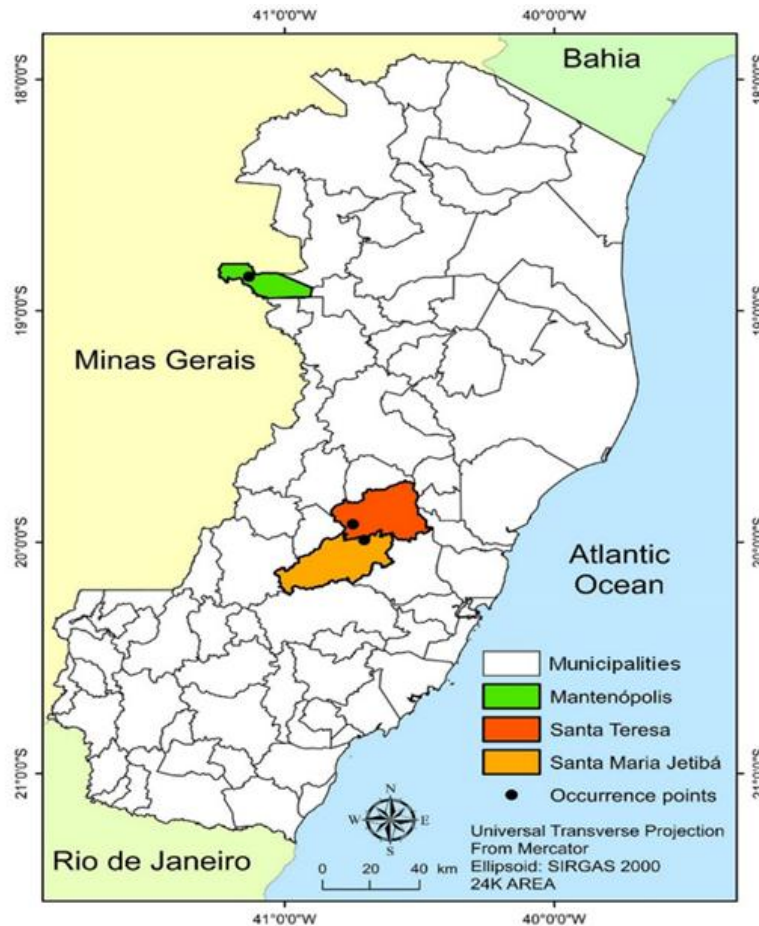
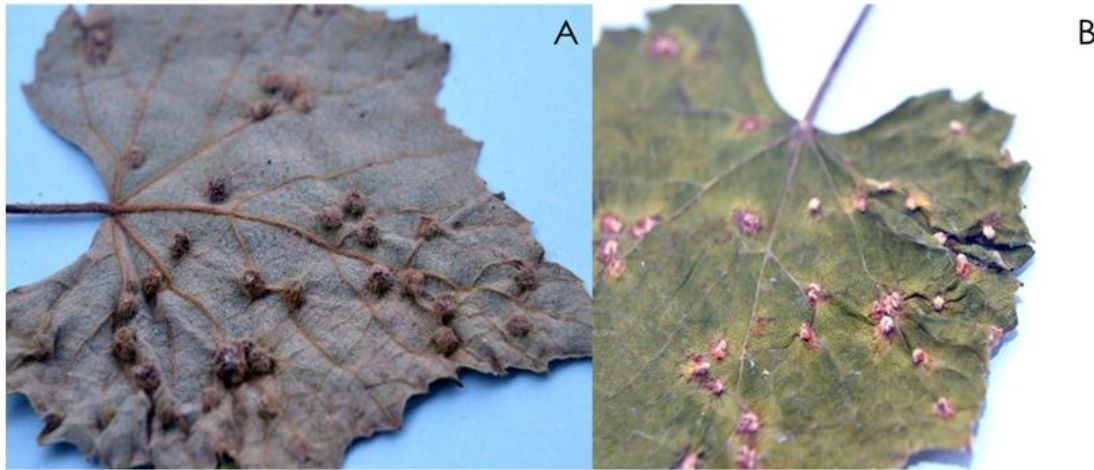


Fig. 1. Location of collection of *Daktulosphaira vitifoliae* in municipalities of Espírito Santo, Brazil



**Fig. 2. Lesions (galls) on a vine leaf var. 'Niagara rosada' caused by *Daktulosphaira vitifoliae* in Espírito Santo, Brazil. Surface view of the leaf, abaxial (A) and adaxial (B)**

Regarding insecticides, several of them have been reported for suppression of phylloxera populations. Therefore their use as a control agent is limited worldwide [20]. In addition, the use of insecticides to control phylloxera in the roots has not been recommended because of the cost of treatment and the need for annual applications, as well as the high toxicity of the active ingredients used in the soil [21]. In Brazil, there are no products registered in the Ministry of Agriculture, Livestock and Supply for the control of phylloxera in grapevine plantations [22].

It is noteworthy that the early detection of phylloxera in the vineyard is more important than the control method. Developing detection techniques capable of evaluating the suspected infiltration of phylloxera is crucial to obtain a successful implementation of phytosanitary treatments [20], and consequently, the economic damages will be as minimum as possible.

The occurrence of phylloxera in grapevine plantations in the state of Espírito Santo is worrisome since the areas of grapevine crops are growing and there is a possibility of dispersion of phylloxera through infected seedlings. Consequently, significant economic losses could occur in grape producing regions, affecting viticulture and vintners. Therefore, it is of fundamental importance to monitor phylloxera in grapevine plantations and nurseries and to inform the farmers about the risks, and showing them ways to control and manage this recent pest of vines in the state of Espírito Santo, Brazil.

#### 4. CONCLUSION

It was identified the occurrence of phylloxera in vine plantations in the state of Espírito Santo. The occurrence of phylloxera in vineyards in the state of Espírito Santo can lead to economic losses.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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