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Surveys on *Xylella fastidiosa* and its vectors in Montenegro

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INTRODUCTION

Xylella fastidiosa (Xf), a gram-negative bacteria with a very wide range of host plants, causes various diseases on important crops such as olives, grapevines, citrus fruits, almonds, but also forest trees, ornamental plants and plants of spontaneous flora. Since the olive is the most widespread fruit species in Montenegro, possible presence of the Xf bacterium would cause great economic losses. Therefore, an efficient prevention system was established, based on continuous monitoring of susceptible plant species and observations of the life cycles and behaviour of vectors. The paper presents the results of a three-year survey of olive trees and other host plants carried out in olive groves, nurseries, home and public gardens.

MATERIAL AND METHODS

The surveys were cariried out in period from 2020 to 2022, on olive trees and other host plants in olive groves, nurseries, home and public gardens. With visual inspections a special attention was paid to the presence of typical and atypical symptoms, i.e. marginal leaf chlorosis, leaf wilting and necrosis, twig dieback. Phytosanitary inspectors collected a total of 120 samples dominantly from Montenegrin coast. The samples were analysed in the laboratory of the Center for Subtropical Cultures in Bar, Biotechnical Faculty, using the LAMP method (Yaseen et al., 2015).

Bearing in mind the importance of vectors in the transmission of Xf from infected host plants to healthy ones the presence of insect vectors (Cicadomorpha species) in olive groves on the Montenegrin coast was monitored as well. Insects were collected on weeds, using sweep-net sampling at three locations in the area of Valdanos (41° 56′ 28″ N, 19° 10′ 56″ E; 41° 56′ 26″N, 19° 10′ 58″ E; 41° 56′ 21″ N, 19° 11′ 15″ E) and two locations in Radanovići (42° 21′ 35″ N, 18° 45′ 32″ E; 42° 21′ 08″ N, 18° 45′ 52″ E). Sampling was carried out three times in the area of Valdanos and one in the area of Radanovići each year. The collected insects were preserved in 96% alcohol till determination. Insects identification was performed on the basis of the morphological characteristics of the species.

RESULTS AND DISCUSSION

In three-year period dominantly colected were samples of *Olea europaea* (39.2%), followed by *Citrus sp*., *Prunus sp.*, *Nerium oleander*, *Laurus nobilis*, *Magnolia grandiflora*, *Rosmarinum officinalis* and other host plant (Tab. 1).
In the analyzed plant material phytopathogenic bacteria Xf was not detected.

Monitoring of potential Xf vectors show that the insect population in the area of Valdanos compared to population in Radanovići was richer in number of species and more abundant in number of individuals (table 2, 3, 4). *Philaenus spumarius* L. was the most prevalent vector in the area of Valdanos in all three location, with the highest abundance in 2020 and the lowest in 2021. In locations of Radanovići in the first year of monitoring *Exitianus capicola* Stål was the most prevalent species. In subsequent years *Euscelis sp.* were dominantly presented.

Table 1. List of analyzed plant species

No.	Plant species	Number of samples			Sum
		2020	2021	2022	(%)
1.	*Olea europaea*	16	19	12	39.2
2.	*Citrus sp.*	9	10	1	17.0
3.	*Prunus sp.*	2	2	6	12.5
4.	*Laurus nobilis*	2	2	4	6.6
5.	*Nerium oleander*	2	1	6	5.8
6.	*Magnolia grandiflora*	3	1	-	3.3
8.	*Rosmarinus officinalis*	2	2	-	3.3
9.	*Lavandula sp*	1		3	3.3
10.	*Acacia dealbata*	-	2	-	1.6
11.	*Platanum sp.*	2	-	-	1.6
12.	*Vitis vinifera*	-	-	2	1.6
13.	*Polygala myrtifolia*	-	1	-	0.8
14.	*Quercus robur*	-	-	1	0.8

Table 2. List of determinated species (2020)

No roj	family	species	abundance ♂♂,♀♀	locality	data
1.	Aphrophoridae	*Philaenus spumarius* L	1♀♀	Valdanos 1	11.06.20.
2.		*Neophilaenus campestris* Fallén	1♂♂	Valdanos 1	11.06.20.
3.	Cicadellidae	*Euscelis ohausi* Wagner	1♂♂, 5♀♀	Valdanos 1	11.06.20.
4.		*Jassargus obtusivalvis* Kirschbaum	2♂♂, 2♀♀	Valdanos 1	11.06.20.
5.		*Euscelis sp*.	1♀♀	Valdanos 1	11.06.20.
6.	cixidae	*Pentastiridius sp*	9♂♂, 6♀♀	Valdanos 1	11.06.20.
7.	Cicadellidae	*Exitianus capicola*	1♀♀	Valdanos 2	11.06.20.
8.		*Euscelis ohausi* Wagner	6♂♂, 9♀♀	Valdanos 2	11.06.20.
9.		*Jassargus obtusivalvis* Kirschbaum	1♂♂, 1♀♀	Valdanos 2	11.06.20.
10.	Aphrophoridae	*Neophilaenus campestris* Fallén	1♂♂	Valdanos 2	11.06.20.
11.	cixidae	*Pentastiridius sp*	39♂♂, 15♀♀	Valdanos 2	11.06.20.
12.	Aphrophoridae	*Philaenus spumarius* L	2♀♀	Valdanos 3	11.06.20.
	Cicadellidae	*Euscelis sp.*	1♀♀	Valdanos 3	11.06.20.
13.		*Euscelis ohausi* Wagner	9♂♂, 7♀♀	Valdanos 3	11.06.20.
14.	cixidae	*Pentastiridius sp*	6♂♂, 3♀♀	Valdanos 3	11.06.20.
15.	Aphrophoridae	*Neophilaenus campestris* Fallén	1♀♀	Valdanos 1	02.11.20.
16.		*Philaenus spumarius* L	30♂♂, 42♀♀	Valdanos 1	02.11.20.
17.	Cicadellidae	*Euscelis ohausi* Wagner	1♀♀	Valdanos 1	02.11.20.
18.	Aphrophoridae	*Philaenus spumarius* L	17♂♂, 27♀♀	Valdanos 2	02.11.20.
19.	Cicadellidae	*Exitianus capicola* Stål	7♂♂, 22♀♀	Valdanos 2	02.11.20.
20.	Aphrophoridae	*Philaenus spumarius* L	5♂♂, 8♀♀	Valdanos 3	02.11.20.
21.		*Neophilaenus campestris* Fallén	1♂♂, 2♀♀	Valdanos 3	02.11.20.
22.	Cicadellidae	*Euscelis ohausi* Wagner	1♀♀	Valdanos 3	02.11.20
23.	Aphrophoridae	*Philaenus spumarius* L	3♂♂, 6♀♀	Radanovići 1	05.11.20.
24.	Cicadellidae	*Exitianus capicola* Stål	20♂♂, 29♀♀	Radanovići 1	05.11.20.
25.	Aphrophoridae	*Neophilaenus campestris* Fallén	2♂♂, 2♀♀	Radanovići 1	05.11.20.
26.	Aphrophoridae	*Neophilaenus campestris* Fallén	2♂♂, 3♀♀	Radanovići 2	05.11.20.
27.		*Philaenus spumarius* L	1♀♀	Radanovići 2	05.11.20.
28.	Cicadellidae	*Exitianus capicola* Stål	1♂♂, 1♀♀	Radanovići 2	05.11.20.

Table 3. List of determinated species (2021)

No oj	family	species	abundance ♂♂,♀♀	locality	data
1	Aphrophoridae	*Philaenus spumarius L*	2♀♀	Valdanos 1	30. 9.21.
2		*Neophilaenus campestris* Fallén	1♀♀	Valdanos 1	30. 9.21.
3	Cicadellidae	Euscelis sp.	2♀♀	Valdanos 1	30. 9.21.
4		*Psammotettix alienus* Dahlbom	1♂♂	Valdanos 1	30. 9.21.
5	Cicadellidae	*Euscelis lineolatus* Brullé	1♂♂, 2♀♀	Valdanos 2	30. 9.21.
6		Euscelis sp.	1♀♀	Valdanos 2	30. 9.21.
7		*Exitianus capicola* Stål	1♀♀	Valdanos 2	30. 9.21.
8	Aphrophoridae	*Philaenus spumarius* L	10♂♂, 24♀♀	Valdanos 1	10.11.21.
9		*Neophilaenus campestris* Fallén	8♂♂, 7♀♀	Valdanos 1	10.11.21.
10	Cicadellidae	*Euscelis lineolatus* Brullé	2♂♂, 2♀♀	Valdanos 1	10.11.21.
11		*Euscelis ohausi* Wagner	1♀♀	Valdanos 1	10.11.21.
12		*Euscelis lineolatus* Brullé	1♂♂, 1♀♀	Valdanos 2	10.11.21.
13		*Euscelis ohausi* Wagner	2♂♂, 4♀♀	Valdanos 2	10.11.21.
14		*Exitianus capicola* Stål	1♀♀	Valdanos 2	10.11.21.
15	Aphrophoridae	*Philaenus spumarius* L	18♂♂, 20♀♀	Valdanos 2	10.11.21.
16		*Neophilaenus campestris* Fallén	1♂♂	Valdanos 2	10.11.21.
17	Cicadellidae	*Euscelis ohausi* Wagner	2♂♂, 1♀♀	Radanovići	25.11.21.
18		*Euscelis lineolatus* Brullé	7♂♂, 2♀♀	Radanovići	25.11.21.
19		Euscelis sp.	2♀♀	Radanovići	25.11.21.
20	Cicadellidae	*Exitianus capicola* Stål	2♂♂	Vranovići	25.11.21.
21		*Euscelis ohausi* Wagner	3♂♂, 9♀♀	Vranovići	25.11.21.
22		*Euscelis lineolatus* Brullé	5♂♂, 2♀♀	Vranovići	25.11.21.
23	Aphrophoridae	*Philaenus spumarius* L	1♂♂	Vranovići	25.11.21.

Table 4. List of determinated species (2022)

No oj	family	species	abundance ♂♂,♀♀	locality	Data
1.	Cicadellidae	*Euscelis lineolatus* Brullé	2♂♂, 1♀♀	Valdanos 1	05. 7.22.
2.		*Euscelis ohausi* Wagner	2♀♀	Valdanos 1	05. 7.22.
3.	Cicadellidae	*Euscelis lineolatus* Brullé	2♂♂, 6♀♀	Valdanos 3	05. 7.22.
4.		*Euscelis ohausi* Wagner	1♂♂, 1♀♀	Valdanos 3	05.7.22.
5.	Aphrophoridae	*Philaenus spumarius* L	18♂♂, 25♀♀	Valdanos 1	02.11.22.
6.	Aphrophoridae	*Philaenus spumarius* L	10♂♂, 16♀♀	Valdanos 2	02.11.22.
7.	Cicadellidae	*Euscelis lineolatus* Brullé	2♂♂, 1♀♀	Valdanos 2	02.11.22.
8.	Aphrophoridae	*Philaenus spumarius* L	5♂♂, 9♀♀	Valdanos 3	02.11.22.
9.	Aphrophoridae	*Neophilaenus campestris* Fallén	1♂♂, 2♀♀	Valdanos 3	02.11.22.
10.	Cicadellidae	*Euscelis sp.*	2♀♀	Radanovići	03.11.22.
11.	Aphrophoridae	*Philaenus spumarius* L	2♀♀	Valdanos 1	21.12.22.
12.	Cicadellidae	*Euscelis ohausi* Wagner	3♀♀	Valdanos 1	21.12.22.
13.	Cicadellidae	*Euscelis lineolatus* Brullé	2♂♂, 2♀♀	Valdanos 2	21.12.22.
14.		*Euscelis ohausi* Wagner	2♂♂, 5♀♀	Valdanos 2	21.12.22.
15.		*Exitianus capicola* Stål	1♀♀	Valdanos 2	21.12.22.
16.	Cicadellidae	*Euscelis lineolatus* Brullé	6♂♂, 7♀♀	Valdanos 3	21.12.22.
17.	Cicadellidae	*Euscelis ohausi* Wagner	4♂♂, 7♀♀	Valdanos 3	21.12.22.

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