

## Reaction of organically grown walnut cultivars to walnut blight (*Xanthomonas campestris p.v. juglandis*) and anthracnose (*Gnomonia leptostyla*)

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### Abstract

After field monitoring has been studied the reaction to anthracnose and walnut blight of 3 local and 5 recently introduced in Bulgaria walnut varieties. Incidence of anthracnose in leaves was as follows – 100% in Turkish, 60-80% in Bulgarian varieties and 30-60% in cultivars from USA. There were no symptoms from this disease in cv. Fernor from France. Regarding the incidence of walnut blight in leaves - American varieties were the most strongly affected – 40-100%, Bulgarian and Turkish varieties had low infection – 0-3%, french Ferno – 10%. In fruits the disease incidence of anthracnose was almost 100% in all varieties with the exception of Bulgarian cv. Perustinski (55%) and American representatives Chandler and Pedro (1%). The spread of walnut blight in fruits was about 70% in the American varieties and it was not registered in the Bulgarian genotypes. Recommendations about organic production of walnut are discussed.

**Keywords:** Walnut, cultivars, *Gnomonia leptostyla*, *Xanthomonas campestris p.v. juglandis*.

### Introduction

Walnut (*Juglans regia*) is traditionally grown in many South and Central European countries, Americas, Asia due to its highly nutritional and health beneficial qualities. In the recent years this crop has increased its area, because of unlimited global markets demand and improved technology. Organically grown walnuts became also important, this raised many questions about the diseases control under such more complicated conditions. Recently on the Balkans along with local varieties new mostly Californian and French varieties were introduced. So far they grow adapted well, but prove to react differently to the two major diseases - walnut blight (*Xanthomonas campestris p.v. juglandis*) and anthracnose (*Gnomonia leptostyla*). Which are actually the most important disease in the different cultivars under field conditions and organic technology of growing was the subject of the present study.

### Material and Methods

The monitored walnut orchards were organically grown with measures for diseases control based mainly on copper application, leaves incorporation into the soil, sanitation pruning of infected branches. Cultivars were Bulgarian or introduced and new for the country foreign genotypes. Size of plantations was 0.5-5 ha. Data collection was done in August during two consequential seasons, which allowed symptoms to develop and more complete information to be obtained. In each plot 20 randomly chosen trees and 100 complex leaves or fruits per tree were evaluated for disease incidence and severity (%). In two consequential years the same 16 orchards have been visited. The region was Central North Bulgaria near the river of Danube. In the first year of the observations (2016) winter was mild and spring rainy during blooming time, then weather became relatively dry. In 2017 winter was extremely

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cold and snowy, spring was rainy before and after the critical stages for walnut blight infections.

## Results

Bulgarian and Turkish varieties as well as cv. Pedro show high susceptibility to anthracnose in leaves (table 1), moderate reaction of Chandler and tolerance of cv. Fernor. Interestingly incidence of the walnut blight was much higher in the sensitive to anthracnose cultivars. Only cv. Fernor was tolerant to both diseases. Results about leaves severity follow similar trend (table 2). In 2017 no bacterial blight infections were detected in all the orchards.

Table 1: Diseases incidence in leaves. %.

Variety	Origin of selection	Year 2016		Year 2017	
		Anthracnose	Walnut blight	Anthracnose	Walnut blight
Fernor	France	0	10	7	0
Chandler	USA	32	100	47	0
Pedro	USA	61	40	76	0
Perustenski	Bulgaria	72	2	93	0
Izvor 10	Bulgaria	81	3	100	0
Sheynovo	Bulgaria	80	3	98	0
Chebin	Turkey	100	0	100	0
Bilecik	Turkey	100	0	100	0

Table 2: Diseases severity in leaves, %.

Variety	Origin selection	Year 2016		Year 2017	
		Anthracn.	Waln. blight	Anthracnose	Waln. blight
Fernor	France	0.0	2.9	7	0
Chandler	USA	8.8	6.2	12	2
Pedro	USA	23.1	5.8	34	3
Perustenski	Bulgaria	9.5	0.2	12	0
Izvor 10	Bulgaria	20.5	0.5	21	0
Sheynovo	Bulgaria	20.5	0.5	24	0
Shebin	Turkey	43.1	0.0	32	0
Bilecik	Turkey	54.2	0.0	38	0

In fruits results are available only for some varieties from 2016 (table 3), because of spring frost damage. About anthracnose the results show again higher susceptibility in Bulgarian varieties, though one of them (Perustenski) is relatively better in this aspect to the others. As to walnut blight it is impressive that local selection is practically immune in fruit compared to approx. 70% infected and not marketable fruits in Chandler and Pedro.

Table. 3. Diseases incidence in fruits, %.

Variety	Anthracnose, %		Walnut blight, %	
	Incidence	Severity	Incidence	Severity
Izvor 10	100.0	43.0	0	0
Pedro	100.0	1.3	75	49
Perustenski	55.0	26.5	0	0
Sheynovo	100.0	49	0	0
Chandler	83.3	0.9	67.9	50.3

The shown above results illustrate substantial difference between infections of walnut varieties grown in Bulgaria under organic conditions. The main reason about this should be their inborn reaction to the two major diseases, which we should consider before planting walnuts. In regions with higher air humidity or long rainfalls, especially during the blooming time, cultivars like Chandler and Pedro should be avoided or planted on smaller area.

Infections by anthracnose take place usually later in the season when leaves are open and overwintering fruiting bodies become mature. They could happen during the whole summer and anthracnose usually needs multiple cycles of infections to become more dangerous. So this could also be taken into mind when the highly sensitive Bulgarian or Turkish varieties are to be planted.

Sanitary measures are possible mainly for anthracnose, where main infection overwinters in the leaves litter. So it could be shredded or removed from the orchard. Pruning has less impact to both diseases. Chemical control is for both diseases according to organic legislation is possible only with copper, but so far local results are not very positive. The reasons could be bad timing, improper application technique and low efficacy of the product. Walnut blight is usually controlled through phenology based sprays from the "praying stage" (Strand, L., 2003, Ramos, D. 1998). In anthracnose forecasting is more applicable and substantial reduction in dry seasons is possible. Such reduction of sprays could be crucial, because due to the large canopy volume the dose of copper should be increased too. This could be problematic about organic regulations. In addition to this resistance to copper has been reported in France (Gardan et al., 1993) and USA (Olson W. et al., 1997).

Cultivar Chandler is first choice in new plantations all around the world due to excellent marketing and yield characteristics, but it could be very problematic organically grown under suitable for walnut blight regions and seasons. Chemical sprays should be as precise as possible timed and used in combination with other methods. Since most Bulgarian varieties demonstrate very high resistance to this disease they could be used as well as a buffer in the large plantations.

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