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INTENSITY OF ATTACK OF RASPBERRY GALL MIDGE *LASIOPTERA RUBI* SCHRANK (DIPTERA, CECIDOMYIIDAE) ON SOME RASPBERRY GENOTYPES

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Abstract

The pressure of gall midge *Lasioptera rubi* Schrank (Diptera, Cecidomyiidae) was monitored over a two-year period in the raspberry collection planting of the Fruit Research Institute Čačak at the 'Zdravljak' site. The galls were in evidence during the research period only on raspberry cv Latham, whereas on cvs Tullamen, Willamette and hybrid K 81-6 they were observed only during the 2006 growing season. The galls were not in evidence on cv Meeker. A different number of galls, from 1 to 5, were found on canes along with a different number of larvae, the latter ranging from 1 to 51 per cane. Cv Latham hosted the largest number of larvae, i.e. up to 51.

KEY WORDS: *Lasioptera rubi*, galls, raspberry, pressure, genotypes

Introduction

Of about 80 damaging pest organisms which have been found in raspberry plantings worldwide, 25 are from different insect species (STAMENKOVIĆ *et al.*, IVANOVIĆ *et al.*, 1999). Among the damaging insects in Serbian raspberry growing regions, the big raspberry aphid (*Amphorophora idaei* Born.), small raspberry aphid (*Aphis idaei* van der Goot), raspberry beetle (*Byturus tomentosus* F.), raspberry blossom weevil (*Antonomus rubi* Hbst.) and raspberry stem girdler (*Agrilus aurichalceus* Retd.) are, in economic terms, the most serious pest insects. The pressure of midges, namely the raspberry cane midge Resseliella theobaldi Barnes (MASTEN,

1958; MILENKOVIĆ *et al*., 2006), and the raspberry gall midge Lasioptera rubi Schrank. (Heeger.) (SIMOVA & DOBRIVOJEVIĆ, 1966; DOBRIVOJEVIĆ, 1968; MILENKOVIĆ & RANKOVIĆ, 2001; GORDON *et al*., 2003; MILENKOVIĆ, 2005) has been on the rise lately.

R. theobaldi and *L. rubi* from the Cecidomyiidae (Diptera) family are, economically speaking, extremely serious pests spread throughout Europe. Within the certification schemes OEEP/EPPO (1993) for the *Rubus* genus and hybrids PM 4/10(1), these two pest insects are deemed damaging organisms which require preventive measures of monitoring (compulsory visual monitoring) aimed at their elimination from the growing field (for all categories of reproductive planting material utilized for the propagation of certified planting material). Compulsory chemical control measures are envisaged within good agricultural practice (GAP 2/26(1)) of OEEP/EPPO (2002) schemes.

L. rubi develops one generation annually. In May or June, females lay eggs in groups on the surface of primocanes, very close to the developing flower buds (SIMOVA-TOŠIĆ, 1970), laying on average 15 eggs laterally at the base of the flowering buds (ANONYMOUS, 2007). The development of the embryo takes from eight to ten days. Immediately upon hatching, white larvae tunnel into the canes, forming globules underneath the epidermis. The gall is visible three to six weeks later, in July or August. Orange-ish yellow to red larvae are housed inside the galls where they winter (Fig. 1). Most commonly, an orange cocoon is formed during April in the following year and the development of the imago takes two to three weeks. The adult insect is dark in colour, 1.5-3 mm long, with a small head, black eyes, and glassy, closely overlapping wings. The thorax is brown, with sliver stripes in the front. The abdomen is dark brownish, with silvery gray stripes of transverse volumes.

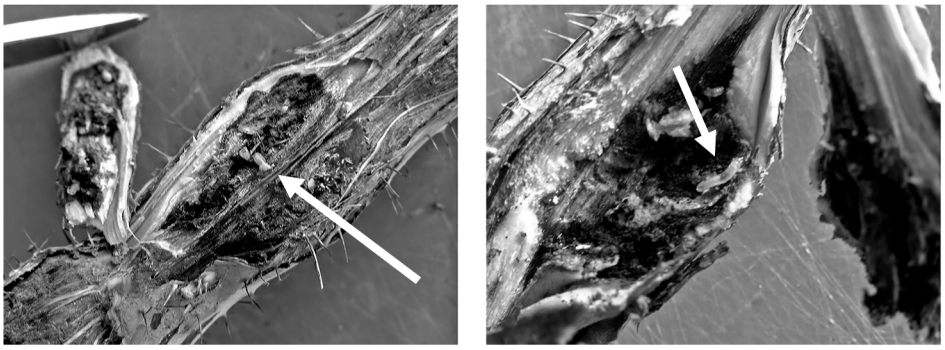

Figure 1. Galls – diameter (Original) (arrows indicate position of larvae).

Only the damage caused by the galls is visible. Globules, 3 - 4 cm long and 1.5 - 2 cm wide (ANONYMOUS, 2007), can be observed on canes, lateral canes, petioles and stalks. Initially, the galls are green but take on a light brownish colour and grow wooden later in the season. The gall surface cracks and a chamber inside house a different number of orange-red larvae. Growth of the infested canes and fruit formation is inhibited. Canes commonly break just beneath the galls. The most efficient control measure is the removal of the infested canes immediately after harvesting and all through the following April, prior to the emergence of the new generation imago. The pest pressure is increased if there are mechanical injuries to the canes (tools or hail): in 1999, when it hailed in the region of Čačak in Western Serbia, it became apparent that about 30% of raspberry plantings there were infested with galls of *L. rubi* (IVANOVIĆ *et al.*, 1999).

Material and Methods

The trial was set up in the raspberry planting of the Fruit Research Institute Čačak at the 'Zdravljak' site, the GPS coordinates being USR 7444859 and 4855139; the altitude, 649 m; the orientation, southern. The planting was established in 2002. It included five genotypes planted randomly in 11 north-east facing rows with three to four replications per genotype and 50 plants per replication. The intrarow and interrow planting distance was 0.33m and 2.5m respectively. During the 2006 growing period, four years after planting, six floricanes per meter were recorded on average. The sampling was performed on cvs Willamette, Tullameen, Latham and the hybrid K 81-6.

At the site, the planting arrangement by rows was as follows: row 1: K 81-6 and Tullameen; row 2: Latham and Meeker; row 3: Willamette and Latham; row 4: Tullameen and Meeker; row 5: Latham and Willamette; row 6: K 81-6 and Tullameen; row 7: Willamette and K 81-6; row 8: Tullameen and Meeker; row 9: K 81-6 and Latham; row 10: Meeker and Latham; row 11: Latham and K 81-6 (Fig. 2).

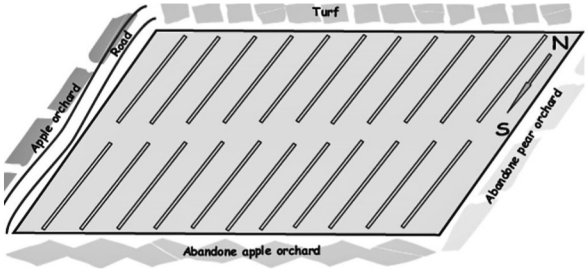

Figure 2. Trial scheme.

Rows and row sections intended for sampling were determined by the random choice method. The sampling was performed on 2 m of four genotypes per row in four replications. All canes with symptoms of morphological changes in the form of galls were collected from the designated sections in the rows.

Sampling was performed on August 2nd, 2006 and July 6th, 2007. Likely because of high air temperatures and a low humidity rate, as shown in Fig. 3, the incidence of galls in 2007 was observed about three weeks earlier than in the previous growing season.

Collected canes were brought to a laboratory where the diameter, length and width of the canes was measured (Fig. 4), and the diameter of the galls and the number of larvae in the galls were recorded. The features were measured by the ″Inox″calliper, precision ± 0.05 mm.

Results and Discussion

During the research period, galls made by the raspberry gall midge in cv Latham were found over both growing seasons, whereas in cvs Tullameen and Willamette, and hybrid K 81-6 the globules were found only in the 2006 growing season (Tabs. I & II). During the first research year, the galls covered the entire length of primocanes, and were sporadically observed on fruiting canes and petioles (Fig. 5), whereas in the following

vegetation these were found only on primocanes at a height not exceeding 70 cm. The most vigorous canes were observed in hybrid K 81-6.

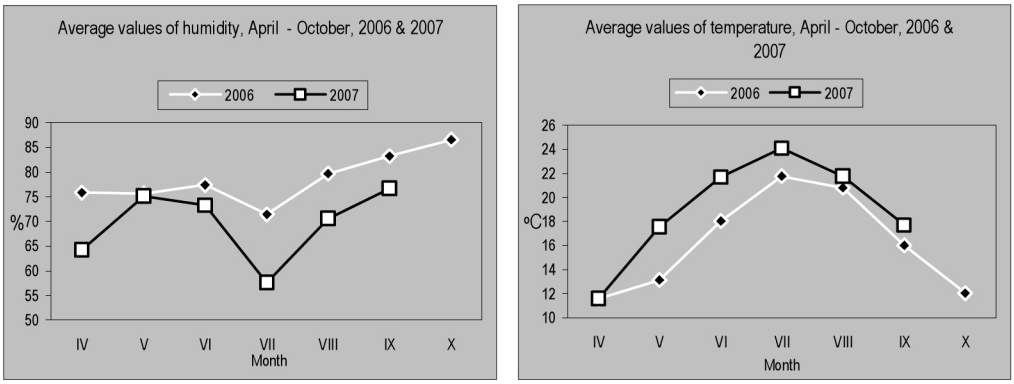

Figure 3. Average values of humidity and temperature over 2006 – 2007.

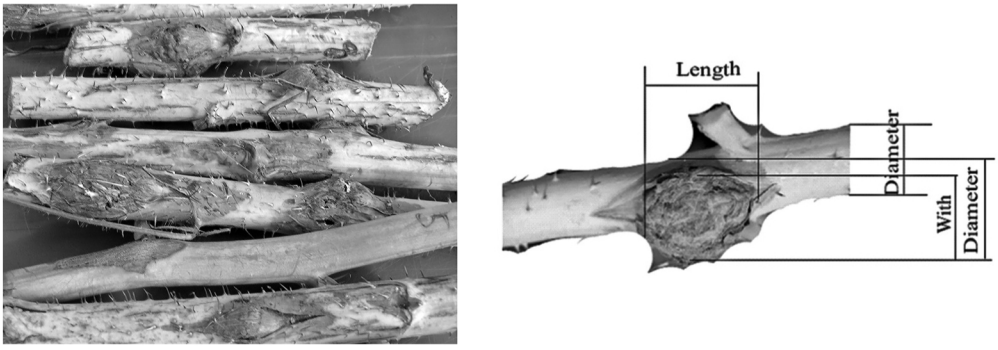

Figure 4. Collected canes and the measuring method.

Figure 5. Galls on raspberry petioles and colour change (Original).

With eight infested canes (the average number in four replications with 12 plants per replication), hybrid K 81-6 had the largest number, followed by cvs Latham, Willamette and Tullamen with five, four and one cane infested respectively. The highest larvae pressure was recorded in a gall in cv Latham (51), while in hybrid K 81-6 some parasitic larvae were found. Investigations conducted in this region (SIMOVA & DOBRIVOJEVIĆ, 1966) also registered the highest number of galls and larvae per gall (106) on the cultivar Latham.

The collection planting included cv Meeker as well; however, no galls were in evidence during the research period.

In order to monitor the pest pressure by cultivars, we have calculated the average values by cultivar over individual seasons (Tab. II).

Table I. Average results of laboratory measuring in four replications

Genotype	No. of galls		Cane diameter (cm)		Gall						No. of larvae per gall	
					length (cm)		width (cm)		diameter (cm)			
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Tullameen	1		0.62		2.7		1.5		1.7		7	
Latham	2	5	0.63	1.0	2.4	1.41	1.4	6.2	1.2	1.32	51	7
					1.4	1.62	0.9	9.4	1.0	1.20	7	5
	1		0.93		1.4	1.03	1.2	6.4	1.1	1.11	/	5
	1		0.92		2.7	1.64	1.28	9.4	1.36	1.22	9	10
	1		0.72		1.21	1.02	0.74	5.6	1.05	1.10	5	3
	1	1	0.22	1.2	1.72	2.40	1.17	14	1.8	1.42	31	6
		1		0.8		2.02		20.0		1.28		6
		1		1.4		2.42		12.0		1.80		1
		1		0.9		2.22		9.0		1.22		3
		2		0.7		2.24		12.2		1.04		8
Willamette	1		0.46		1.31		1.11		0.94		3	
	1		0.84		2.89		1.24		1.28		4	
	1		0.67		2.28		1.14		1.26		9	
	2		1.01		2.32		1.16		1.52		29	
					1.08		0.61		1.22		2	
K 81-6	3		1.09		1.61		1.53		1.46		37	
					1.66		1.54		1.89		26	
					1.46		0.68		0.68		7	
	1		1.09		1.82		1.2		1.42		5	
	2		1.02		1.52		1.19		1.59		7	
					0.46		0.86		1.14		1	
	1		1.24		1.12		0.84		1.41		0	
	1		0.84		1.01		1.01		0.94		0	
	2		0.96		1.74		1.31		1.34		23	
					2.34		1.24		1.39		10	
	1		1.09		1.62		1.03		1.39		9	
	1		1.05		1.89		1.67		1.69		6	

The calculated values for the 2006 vegetation show that the highest larvae pressure was found in cv Latham (17.2), which further implies that this cultivar is the most susceptible to raspberry gall midge under domestic growing conditions. The pest pressure decreases to 10.9 in hybrid K 81-6 and 9.4 in cv Willamette, and is the lowest in cv Tullameen (7 per gall). Regarding the average number of galls per cane, the number shows a

downward tendency, i.e. K 81-6 - 1.5 galls, Willamette - 1.25, Latham - 1.2 and Tullameen - 1 gall. As for the cane thickness, the highest values are found in cv Willamette, and K 81-6, Latham and Tullameen follow.
Galls are longest in cv Tullameen, followed by cvs Willamette, Latham and hybrid K 81-6. In terms of the width and diameter of the galls, the highest values were recorded in cv Tullameen, with a tendency to decrease further in K 81-6, Latham and Willamette. The results imply that the galls were largest in cv Tullameen and somewhat smaller in hybrid K 81-6, whereas cvs Latham and Willamette recorded similar values.

Table II. Mean values by cultivars and seasons

Cultivar	Average no. of galls		Average cane diameter (cm)		Galls, average values (cm)						Average no. of larvae per gall	
					length		Width		diameter			
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Tullameen	1		0.62		2.7		1.5		1.7		7	
Latham	1.2	1.83	0.68	1	1.8	1,64	1.11	0.95	1.25	1.15	17.2	5.18
Willamette	1.25		0.74		1.97		1.05		1.24		9.4	
K 81-6	1.5		1.05		1.52		1.17		1.36		10.9	

Compared to the 2006 growing season, the 2007 season was characterized by somewhat higher temperatures and a low humidity rate. Such conditions were best suited to cv Latham whose primocane diameter was 1 cm during this growing period and which on average recorded six infested canes with different numbers of galls in four replications (Tab. I). As compared to the previous growing season, galls were more elongated, and the average number of larvae almost three times lower (Tab. II).

Our results suggest that weather conditions cause the occurrence of gall midge on raspberry cultivars and different numbers of gall and larvae per gall. A new assessment should be done in different raspberry growing regions to confirm the findings of this study conducted under the conditions at Čačak (west Serbia).

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ИНТЕНЗИТЕТ НАПАДА *LASIOPTERA RUBI* SCHRANK (DIPTERA, CECIDOMYIIDAE) НА НЕКИМ ГЕНОТИПОВИМА МАЛИНЕ

СНЕЖАНА ТАНАСКОВИЋ, СЛОБОДАН МИЛЕНКОВИЋ и ДУШИЦА СРЕТЕНОВИЋ

Извод

Малинина мушица галица *Lasioptera rubi* Schrank (Diptera, Cecidomyiidae) представља економски значајну штеточину, посебно у малиногорјима где изостаје резидба двогодишњих изданака по завршеној берби. Циљ рада био је да се у нетретираном колекционом засаду малине Института за воћарство, утврди интензитет напада *L. rubi* на четири случајно одабрана генотипа малине.

У засаду малине, на објекту „Здрављак", са GPS координатама USR 7444859 i 4855139, на надморској висини 649 m и смер S, који је заснован 2002. године, прикупљени су изданци за преглед на присуство малинине мушице галице. У огледном засаду је пет генотипова засађених по случајном распореду у 10 редова правца север-југ, са четири понављања по генотипу и по 50 биљака у понављању. Растојање између биљака у реду, током садње је 0,33 m, а међуредно растојање износи 2,5 m. Током вегетационог периода 2006. године, у четвртој години по садњи, на 1м дужном је просечно шест двогодишњих изданака. Узорковање је извршено на сортама Willamette, Tullameen, Latham и хибриду K 81,6.

Редови и делови редова за узорковање обележени су методом случајног избора. Узорковање је обављено на 2 m дужна на четири генотипа, у четири понављања. На обележеним дужинама прикупљени су сви изданци са видљивим морфолошким променама у виду гала. Прикупљени изданци донети су у лабораторију где је извршено мерење пречника изданака, дужине, ширине и пречника гале, пребројавање гала на изданцима и ларви у галама.

На прикупљеним изданцима гале су се разликовале по облику (издужене, округласте или су у виду рак рана). Дуж изданака гале се налазе на различитим висинама, али и на лисним дршкама.

Током двогодишњег истраживања на наведеним генотиповима регистрован је различит интензитет напада малинине мушице галице.

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