

AGRICULTURAL AND ECONOMICAL ASPECTS OF OLIVE'S SENSITIVITY TO OLIVE FLY (*Bactrocera oleae*)

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ABSTRACT

Olives beside vine grapes are the most important long term agricultural culture in Istra, Croatia. In 2006. it was estimated that Istra had 750.000 olive trees, a share of 18.78 % of total number in Croatia. The olive tree fly *Bactrocera oleae* Gmel. is one of the most important pest on olive's in general. Depending from year to year, it makes minor or larger damages on olives. The damaged olives for table use (fresh olive's) are not suitable for consummation, while in olive's for oil production, the olives contained with olive's larvae are lower in quality and affect the oil quality. In 2006. we researched the damage on olives from olive tree fly on 100 olives randomly picked. Olives were taken in mature state of technological ripeness, from 26th October till 10th November on six localities (Rovinj, Vodnjan, Kaštelir, Poreč, and two locations near Livade). We examined ten cultivars (Rosigniola, Buža, Ascolana, Leccino, Carbonazza, Pendolino, Frantoio, Bjelica, Črnica and Picholine). We used two types of protection against olive oil fly, with and without chemicals. On untreated olives the most damage was spotted on variety Buža from Rovinj, while the least damage was on pendolino from Kaštelir and Črnica from Livade (with 1 % of damaged olives). On treated olives the highest percentage of damage had cultivar Leccino from Poreč (21 % damaged olives) while Pendolino from Poreč and Leccino from Livade had only 1 % of damage.

Key words: *Bactrocera oleae*, Croatia, damage, Istra, olive, olive fly.

IZVLEČEK

AGRONOMSKI IN EKONOMSKI ASPEKTI OBČUTLJIVOSTI OLJK NA OLJČNO MUHO (*Bactrocera oleae*)

Oljka je ob vinski trti najpomembnejša trajna kultura v hrvaški Istri. Ocenjuje se, da je bilo v letu 2006 na tem področju 750.000 oljčnih dreves, kar predstavlja 18,75 % oljčnih nasadov v Republiki Hrvaški. Oljčna muha (*Bactrocera oleae* Gmel.), ki sodi med najpomembnejše škodljivce na oljki, povzroča poškodbe na plodovih v odvisnosti od sezone in kultivarja. Posledice poškodb, ki jih povzročajo ličinke oljčne muhe na plodovih namiznih kultivarjev, se kažejo v tem, da te olive niso ustrezne za predelavo. Olje iz oljnih kultivarjev ima slabšo kakovost. Slabša kvaliteta plodov in olja pa se odraža tudi v gospodarski škodi, ki jo utrpi proizvajalec. V letu 2006 smo v nekaterih oljčnih nasadih v Istri vzorčili 100 naključno izbranih plodov in spremljali stopnjo napadenosti plodov z ličinkami oljčne muhe. Plodove smo pobirali med 26. oktobrom in 10. novembrom na šestih lokacijah (Rovinj, Vodnjan, Kaštelir, Poreč in dve v Livadi). V opazovanje je bilo vključenih 10 kultivarjev (Rosigniola, Buža, Ascolana, Leccino, Carbonazza, Pendolino, Frantoio, Bjelica, Črnica in Picholine), od katerih je bilo polovica tretiranih z insekticidom,

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druga polovica pa ne. V netretiranih nasadih je imel največji odstotek napadenih plodov cv. Buža v Rovinju (91 %), medtem ko so bili najmanj napadeni plodovi cv. Pendolino v Kašteliru in plodovi cv. Črnica v Livadah (1 %). Na tretiranih olivah je imel največji odstotek napadenih plodov cv. Leccino v Poreču (21 %), medtem ko so cv. Pendolino v Poreča in Leccino v Livadah imali le 1 % napadenih plodov.

Ključne besede: *Bactrocera oleae*, Istra, Hrvaška, oljka, oljčna muha, škoda

1 INTRODUCTION

Olive growing in Croatia has a milenium long history and knowledge about it is spreaded from generation to generation. During the last ten years olive growing has become more attractive because of State subventions for planting (about 2.800-3.700 euro/ha) and funds for production (annual stimulation). According to Operative plan, Croatia will plant 5.500 ha olives in 2004-2007 (Ilak Peršurić, 2006). Istra has 750 000 olive tree's, respectively, 18.75 % comparing to the total number in Croatia (16.000 ha). It is an economically important culture, and olive oil prices justify the production and revenues, but which need better marketing strategy and promotion (Ilak Peršurić and Juraković, 2002., 2006; Mili, 2006, Pribetić, 2006). Olives are attacked by over 250 pests, but only a small number makes larger damages on the fruits, creating significant economical effects (Žužić and Raguž, 2001.). In this paper we will discuss about the olive fly (*Bactrocera /Dacus/ oleae* Gmel. Diptera: Tephritidae), which is nowadays broadened all around the Mediterranean coastal areas. In certain years this pest can create significant economical expendables, which occur through yields, fruit quality and oil quality. Losses depend on several factors, for example if no pest protection is used damages on fruits can range from 50- 80 % (Bjeliš *et. al.*, 2003, Mavrotas *et. al.*, 2003, Servis *et. al.*, 2003). Some olive varieties show much more sensitiveness on olive fly attacks, especially table varieties, because of fruit size (Ciglar, 1998., Rice, 2000.). Istra's autochthonous varieties which are sensitive to olive fly attacks are the following: Buža, Buža minuda, Buža punroža, Istarska bjelica, Oblica, while introduced varieties are: Ascolana tenera, Grossa di spagna, Itrana, Leccino, Picholine (Bjeliš *et al.*, 2003; Pribetić, 2006).

2 MATERIALS AND METHODS

This paper explains the attack of fly's third generation, during technological fruit ripeness in 2006., therefore data from September till end November were taken into consideration. We used statistical data from the meteorology station (figure 1). In order to confirm olive fly activity we used data on air temperature and precipitation.

Climate conditions as a factor from September till December in 2006. had effects on olive fly's through temperatures (ranged from 10,1- 20,5 °C) and precipitation (very low, 126,8 mm). These conditions were favorable for olive fly attacks.

Determination of fly attack was done from September till November according to information from farmers and identification of attacks in field during fruit picking. Significant damages were spotted only during harvest time from 26. October till 18. November, 2006.

Baggiolini's visual observation method was used. Samples contained 100 randomly picked olive's on six localities in Istra (one location from Rovinj, Vodnjan, Kaštelir, Poreč and two from Livade) (figure 2). On these locations we had 10 varieties (Rosigniola, Buža, Ascolana tenera, Leccino, Carbonazza, Pendolino, Frantoio, Istarska bjelica, Črnica and Picholine). For pest treatment we used two methods of protection, with treatment and without treatment (table 1). The sample's in Poreč were treated with Succes bait (spinosad 0,24 g/l + atraktant solulys 264 g/l; 1,3 l/ha), sample's from Livade were treated with Chromgor 40 EC (dimetoat 400 g/l, concentration 0,1 %). Treatments were done on

the whole tree because of great attack (sometimes because of ecological reason only some parts of the tree are treated). Samples were checked visually and determination of fly's was done according to total number of fly pricks. Also presence of larvae's in olives was checked.

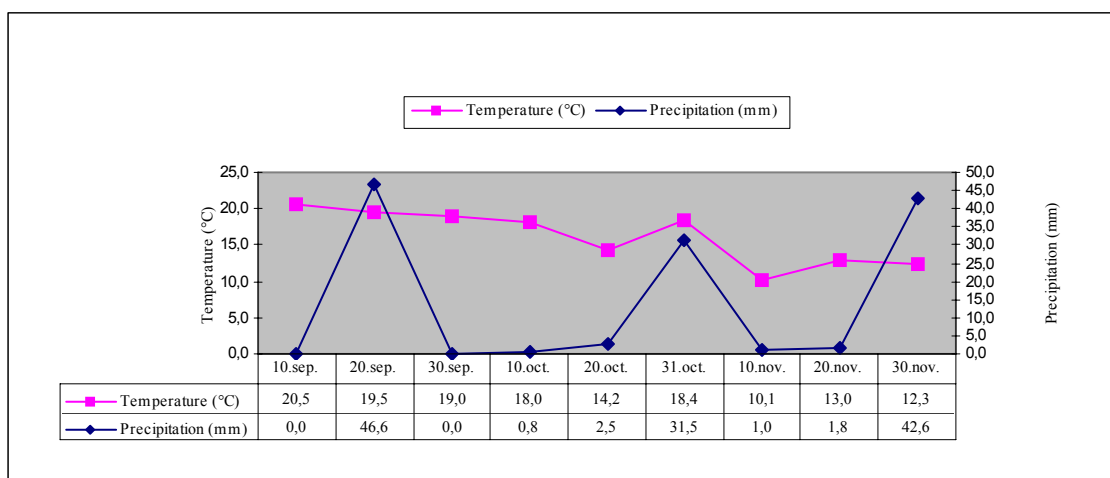


Figure 1: Climate diagram (Source: Meteorology station, Poreč; monthly measurements, 2006)

Table 1. Localities, varieties and dates of field research (2006) (Source: field research; *Treated olives)

VARIETY	Locality					
	KAŠTELIR	VODNJAN	POREČ	LIVADE 1	LIVADE 2	ROVINJ
LECCINO	27.10.	26.10.	3.11. *	7.11.	9.11.	-
BJELICA	27.10.	-	-	7.11.	9.11.	-
PENDOLINO	27.10.	-	3.11.	-	-	-
BUŽA	27.10.	02.11.	-	7.11.	9.11.	13.11.
CARONAZZA	-	26.10.	-	-	-	-
ASCOLANA TENERA	-	2.11.	-	-	-	18.11.
PISSOLONO	-	-	3.11.	-	-	-
FRANTOIO	-	-	-	7.11.	-	-
ČRNICA	-	-	-	7.11.	-	-
ROSIGNIOLA	-	-	-	-	-	10.11.

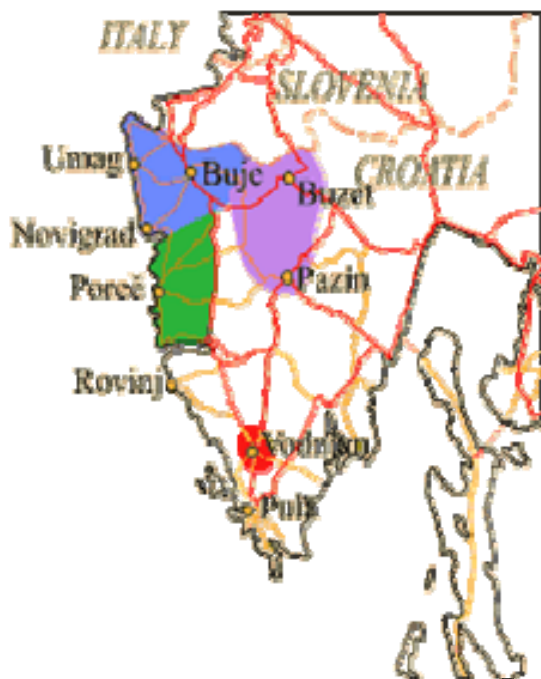


Figure 1. Research locations (Source: www.istra.com)

3 RESULTS AND DISCUSSION

According to literature, in southern Mediterranean areas 5- 6 generations of olive fly's can be observed annually, in northern parts it creates 1- 2 generation, while in Croatia we have 3- 4 generations annually (Žužić *et. al.*, 1987, 2001, Maceljki, 2002, Večernik, 2003, Pribetić 2006.). First generation of olive fly's is appearing by end June or early in July, but in August some generations can also appear. Most intense fly generations in Istra occur from September till December (Žužić *et. al.*, 1987; 2001, Tdc-olive, 2004.). In years with extreme dryness of air and soil. High summer temperatures ($> 33^{\circ}\text{C}$), along with low relative air moisture destroys eggs and other development stages (Žužić and Raguž, 2001, Maceljki, 2002, Tdc-olive, 2004). Olive fly is wintering as a cocoon. The female lies eggs in the olive. Daily it can lye 10-12 eggs, one egg in each olive. During her life cycle it can lye in total 200- 300 eggs. In one olive we can find also several larvae, which feeds on olive's, making wholes and corridors which could become infected by different bacteria and fungus which cause fruit deterioration and affect on fruit quality (oil destruction and free fatty acids). Olive fly attacks depend not only on the number of grown fly's, but also on fly mobility, presence of natural enemies, the olive variety, olive tree growth, olive yields and climate conditions (Spanedda *et. al.* 2006).

In our research the untreated olive fruits had more intense fly attack, as was expected. Up most attacks occurred on variety Istarska bjelica on location Kaštelir and rated 97 %, also high percentage of attack was spotted on variety Buža from Rovinj, 91 %. Lowest rates of attacks were spotted on Ascolana tenera variety in Vodnjan (7 %) in figure 5. High levels of damaged fruits mean significantly less oil quality, smelly oils, smell on larvae (Koprivnjak, 2006). Severe attacks like in Rovinj and Kaštelir, means table oil instead of possible extra virgin oil what means the production revenue is twice times less. For table olives severe attacks means total economic loss of production as damaged fruit cannot be conserved.



Figure 3: Cocoon and fly
(Source: field research)

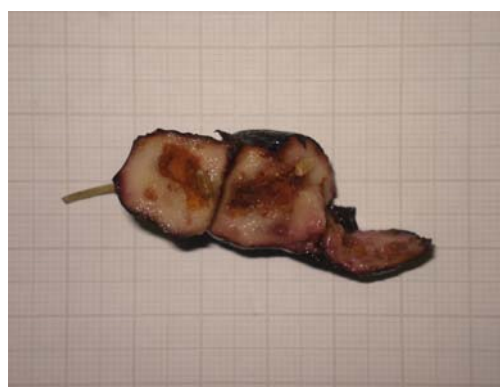


Figure 4: Damaged olive, Buža variety
(Source: field research)

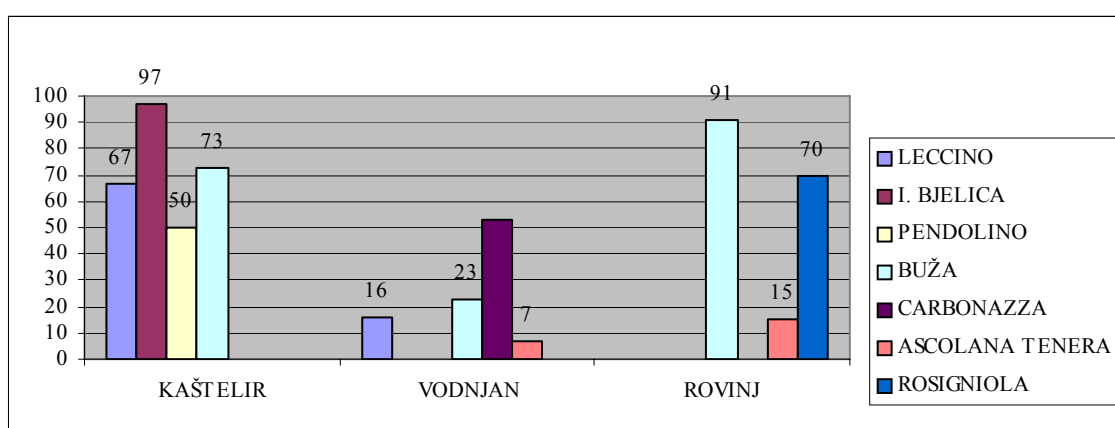


Figure 5: Percentage of attacked fruits on untreated olive varieties (Source: field research)

On sample's which were chemically treated the highest attack and damages occurred on variety Leccino on location Poreč (21 %), while the least attacks were observed on Pendolino (1 %) in Poreč, on Črnica from Livade 1, and Leccino from Livade location 2 (figure 6).

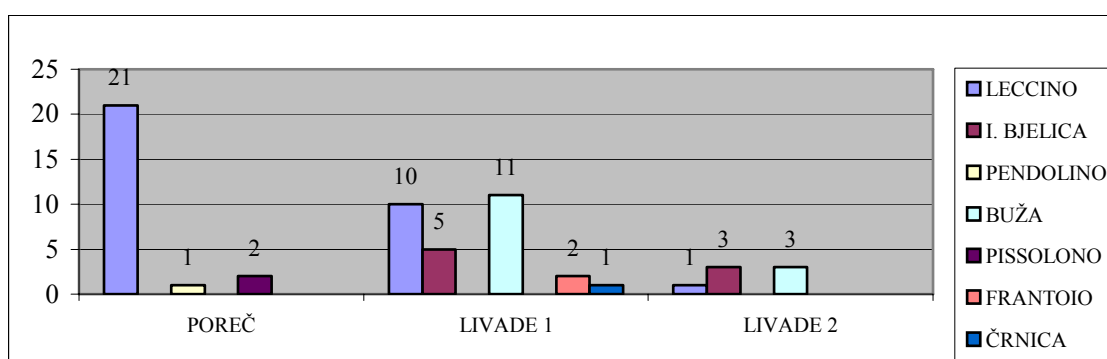


Figure 6: Percentage of attacked fruits on treated olive varieties (Source: field research)

Damaged or attacked olives stages of attack: fruits with one prick from egg lying and no larvae development; olive's with prick and larvae; olive's with larvae and imago; fruits with two larvae.

Damaged olives were evident on all samples (figs. 5 and 6). Untreated sample's had up to five pricks on Ascolana tenera. Three pricks were evident on Rosinjola (2 %) from Rovinj, and Istarska bjelica (6 %) and Leccino from Kaštelir. Two pricks were evident on all varieties in Kaštelir and Rovinj (figure 5) also on Carbonazza and Ascolana from Rovinj. Treated sample's had two pricks on Leccino (1 %) from Poreč, Istarska bjelica (1 %) and Buža from Livade 1.

4 CONCLUSIONS

Based on our research we determined a significant attack of olive fly. Differences occurred by the number of population and locality. Significant differences were evident for variety Buža on locations Rovinj, Kaštelir, Vodnjan. Chemical treatment (chromgor) has proven more efficient than biological one (spinosad). Important economic losses were significant for table olive varieties which should be totally healthy and undamaged for conservation. Oil olives fly attack responds from damaged fruits to lower oil quality and economic losses. Severe attacks respond to smelly oils which cannot be declared as extra virgin, but as table oils, therefore production profit is twice or triple times less. Therefore in years of fly expectance we should identify fly appearance and inform farmers to treatments.

5 REFERENCES

- Bjeliš, M., Pelicarić V., Masten, T. 2003. Olive fruit fly-*Bactrocera oleae* Gmelin (Diptera, Tephritidae) in Croatia, Damage in new milenium an advanced methods of control. Collection of abstracts 1st European meeting of the IOBC/WPRS study group « Integrated Control in Olives. Crete, Greece, pp. 5
- Bjeliš, M., Pelicarić V., Radunić, D. 2003. Resistance of olive table cultivars to olive fruit fly-*Bactrocera oleae* Gmelin (Diptera, Tephritidae). Collection of abstracts 1st European meeting of the IOBC/WPRS study group « Integrated Control in Olives. Crete, Greece, pp. 28
- Ciglar, I. 1998. Integrirana zaštita voćnjaka i vinograda. Zrinski d.d., Čakovec.
- Group of authors 1983. Priručnik izvještajne i prognozne službe zaštite poljoprivrednih kultura. Savez društava za zaštitu bilja Jugoslavije, Beograd.
- Ilak Peršurić, A.S., Juraković, L. 2006. Maslinovo ulje – proizvodni i marketinški aspekti, Agronomski glasnik 68 (3): 237-254.
- Ilak Peršurić, A. S. 2002. Agribusiness chain management. Zbornik radova 21. Posvetovanje organizatorjev dela: 158-166, Portorož, Slovenija.
- Koprivnjak O. 2006. Djevičansko maslinovo ulje od masline do stola. MIH, Poreč
- Maceljki, M. 2002. Poljoprivredna entomologija. Zrinski d.d., Čakovec.
- Mavrotas, C., Alexandrakis, V., Prophetou, D., Kovaitos, D., Varikov, K., Vergoulas, P. 2003. GF-120* Natural insect control product field performance for the control of olive fruit fly (*Bactrocera oleae* Gmel.) on olive trees by bait application in the Mediterranean countries. Collection of abstracts 1st European meeting of the IOBC/WPRS study group « Integrated Control in Olives. Crete, Greece, pp. 15
- Mili, S. 2006. Olive oil markets on non-traditional markets: prospects and strategies, Medit.
- Pribetić, Đ. 2006. Štetnici i bolesti maslina. MIH, Poreč.
- Servis, D., Bozoglou, K., Klitsinaris A. 2003. The use of Fastac 10 SC (alphacypermethrin) in bait treatments for the control of olive fly (*Bactrocera oleae* Dipt. Tephritidae). A new highly effective programs and improvement of environmental parameters. Collection of abstracts 1st European meeting of the IOBC/WPRS study group « Integrated Control in Olives. Crete, Greece, pp. 16
- Spaneda, A.F. Pucci, C. 2006. Performance comparison between two forecasting models of infestation caused by olive fruit fly (*Bactrocera oleae* Rossi). *Pomologia croatica*, 12(1): 3- 14.
- Škarica, B., Žužić, I., Bonifačić, M. 1996. Maslina i maslinovo ulje visoke kakvoće. Tipograf d.d. Rijeka
- Rice, R. 2000. Bionomica of the olive fruit fly *Bactrocera* (*Dacus*) *oleae*. UC Plant protection quarter, 10 (3): 1- 5.

The olive fly - *Bactrocera (Dacus) oleae*. Site visited on 07.02.2007.
http://www.oliveoilsource.com/olive_fly.htm

TDC-OLIVE. 2004. Olive tree cultivation. TDC-OLIVE project (contract no. FOOD-CP-2004-505524). Sixth Framework Programme of the European Union, Priority 5, aimed to olive and olive oil SMEs.

Večernik, N. 2003. Čovjek i maslina. 3. dopunjeno izdanje, Grafex, Split.

www.istra.com Site visited 05.02.2007.

Žužić, I., Raguž, F. 2001. Priručnik za maslinare - Manuale per olivicoltori. Ened, Vodnjan.

Žužić, I., Ciglar, I. 1987. Usmjerena i integralna zaštita masline. A. G.. Matoš, Samobor.