

FEASIBILITY STUDY OF MEDFLY (*Ceratitis capitata* Wied.) CONTROL BY STERILE INSECT TECHNIQUE IN NERETVA RIVER VALLEY

Mario BJELIŠ

¹Institute for Plant Protection in Agriculture and Forestry of Republic of Croatia, Solin

ABSTRACT

The medfly – *Ceratitis capitata* Wied. (Tephritidae) invaded Neretva river valley 25 years ago. Today the is pest spread everywhere and cause seriously fruit damage. The most attacked fruit types are: fig– *Ficus carica*, peach - *Prunus persicae*, plum – *Prunus domestica*, apricot – *Prunus armeniaca*, mandarine tree – *Citrus reticulata* and kaki – *Dyopirus lotus*. The Neretva river Valley is a relatively isolated ecosystem and this advantage provides high chance of succes for a future project, since such isolation by mountines would strongly limit the "import" of wild medfly adults into the valley. The Neretva Valley is devided into part of Republic of Croatia (mostly characterized by soft climat and citrus (mostly mandarines) production, and part of Bosnia and Herzegovina (mostly characterised by continental climate with stone fruits production). It has been noted that highest damage caused by medfly is along the border area and can cause up to 30 % damage on mandarins – *C. reticulata* B. The Neretva Valley is at the northernmost limit of the geographic distribution of the medfly. This means that the pest is not in the most suitable conditions for its development. Should a programme be launched, it would largely benefit from the limitation of wild medfly population during the cold season. The Croatian team leaded by Ministry of Agriculture, Forestry and Watter Management will start two years program as a part of IAEA TC project during the 2007.-2008. years. A feasibility studdy of medfly suppression in Neretva valley is basic point for further activities. The medfly control by using of SIT tehniqe would economically benefit all local stakeholders including growers and the public at large in view more access to fresh fruits. Should such a program be launched and given the economic importance of the production in the region, it would benefit from the support of the local authorities as well as of the growers and exporters.

Key words: *Ceratitis capitata*, feasibility study, medfly, Neretva valley, SIT

IZVLEČEK

RAZISKAVA MOŽNOSTI ZATIRANJA BRESKOVE MUHE (*Ceratitis capitata* Wied.) S TEHNIKO STERILIZIRANJA ŽUŽELK V DOLINI NERETVE

Breskova muha (*Ceratitis capitata* Wied.) je prodrla v dolino Neretve pred četrto stoletje. Zdaj je škodljivka razširjena povsod in povzroča resne poškodbe na sadju. Najbolj napadeni so plodovi smokve – *Ficus carica*, breskve – *Prunus persica*, slive oz. češplje – *Prunus domestica*, marelice – *Prunus armeniaca*, mandarine – *Citrus reticulata* in kakija – *Dyospyros lotus*. Dolina Neretve je sorazmerno izoliran ekosistem in njegova prednost za nadaljnje projekte je v tem, da okolna gorovja z izolacijo močno omejujejo vnos divjih odraslih osebkov obravnavane škodljivke v to dolino. Dolina Neretve je razdeljena v del, ki pripada Republiki Hrvaški (ki se odlikuje z blagim podnebjem in pridelavo agrumov, večinoma mandarin) in del, ki pripada Republiki Bosni in Hercegovini (in je značilen z bolj

¹M. Sc., Zvonimirova 14 A, 21210 Solin, Croatia

celinskim podnebjem, ustreznim za pridelovanje koščičarjev). Ugotovljeno je, da breskova muha povzroča največje škode ob robu tega območja in da lahko na mandarini povzroči škodo tudi do 30%. Dolina Neretve je z njenim severnim delom meja za geografsko razširjenost te škodljivke. To pomeni, da vrsta *C. capitata* na tem območju nima najboljših razmer za razvoj. Če bi začeli z ustreznim programom zatiranja, bi imel ta velike prednosti od omejitev divjih populacij škodljivke v hladnem obdobju leta. Hrvaška skupina, ki jo vodi Ministrstvo za kmetijstvo, gozdarstvo in upravljanje z vodami, namerava začeti z dvoletnim programom kot delom IAEA projekta med letoma 2007 in 2008. Raziskava možnosti zatiranja breskove muhe v dolini Neretve je osnovno izhodišče za nadaljnje aktivnosti. Zatiranje omenjene škodljivke s tehniko SIT bi pomenila ekonomske koristi za vse krajevne zasebne pridelovalce, vključno z večjimi pridelovalci in z javnostjo, ki bi dobila več možnosti za nakup svežega sadja. Če bo ta program izveden in bo dosegel gospodarski pomen pri pridelavi, bo to prispevek v prid lokalnih oblasti, kot tudi pridelovalcem in izvoznikom.

1 INTRODUCTION

The medfly, *Ceratitis capitata* Wied. is a pest of great economic importance in the area of Dalmacija region. It has been present in the littoral regions for over 50 years (Tominić 1959, Kovačević, 1960). In some areas, such as southern part surrounding the city of Dubrovnik, the presence of the medfly precludes fresh fruit production, even when chemical control measures are applied (Bjeliš and Pelicarić, 2002). To date, the medfly is present in the whole Dalmacija and in northern part of Istria (Pelicarić and Bjeliš, 2001). As it is often the case worldwide, optimum conditions for medfly are found in backyards where several host plants are grown, allowing the medfly to be present from late spring until the winter. Althow medfly was not managed in the past, some observations on possibilities for control by using attractant were done (Šimunić 1960, Tominić, Brnetić 1960, Brnetić 1968)

The medfly has invaded the Neretva river valley, the most important mandarins, *Citrus reticulata* production area of Croatia. Depending on the area considered, the main hosts of the medfly in Croatia during the fruiting season are loquat, early fig varieties, stone fruits, late fig varieties, mandarin and kaki.

Benefits of using SIT for the area-wide suppression of the medfly have been investigated. The Neretva river valley (Curić, 1994), as well as some islands (Vis, Hvar, Brač and Elaphyte archipelago), are geographically isolated or have some isolated areas of interest and as such are highly convenient for the use of SIT (Bjeliš and Pelicarić, 2003).

The Neretva river valley seems to be to date, the best candidate for an area-wide medfly suppression programme using the SIT. The whole valley represents 80 % of the national citrus production. The valley has been classified as «international aquatic reserve», where more than 300 birds types has been recorded (Rucner, 1993) and due to the presence of some other endangered aquatic species, and it is divided between Croatia and Bosnia & Herzegovina. For these reasons, the area-wide and transboundary use of SIT seems to be the most suitable solution for medfly suppression. Neretva Delta region is an area with the largest and most valuable part of old Mediterranean wet-lands in Croatia (Markovčić, 2001) and also one of few such areas preserved in Europe. This is a natural unit covering approximately total of 20.000 ha of land, from the area of the Hutovo Blato Nature Park (7.411 ha) in Bosnia and Herzegovina to spacious Neretva estuary (12.000 ha) in Croatia. Croatian part of the lower Neretva valley contains 7 protected localities covering 1,624 ha. The possibilities for organic farming practice exist in small areas near the mountines that surround the valley, where water is not yet contaminated, such as Desne and Pojezerje areas in Croatia, as well as areas bordering Hutovo Blato Nature Park in Bosnia and

Herzegovina. The cultures that can be cultivated by using principles of ecological agriculture in both parts are traditionally grown mediterranean and sub-mediterranean cultures such as citrus, japanese apple, kiwi, artichoke, figs, peaches, almost all represent host plants for medfly.

Since the medfly infestation still raise, the number of insecticide sprayings will increase and only environmental friendly methods such well developed SIT technique should be used together with other organic methods which would not disrupt the present natural balance (Bjeliš and Pelicarić, 2003). Baseline data collection on medfly biology is currently undergoing, and a study is planned with the support of the IAEA TC project for the period 2007-2008. year, to assess the technical and economic feasibility of an area-wide SIT-based medfly suppression program in the Neretva Valley.

2 MATERIALS AND METHODS

All tasks were chosen in the direction of collection main elementary data about medfly biology, behavior, host preferable, seasonal occurrence etc. All this data are necessary for further observations which will be used for the preparing the study of the sterile insect program by using sterile males to control medfly in the selected area, the Neretva river valley, as the most important economic citrus and environment endangered area.

Screening of the host plants in the area was done during the season, starting from spring till autumn. Inspections of the surrounding area were repeated every month and hosts plants were notice. Traps and attractants: Chromotrap-type traps were used (Isagro, Italy). These traps are yellow three-side glue-covered traps with parapheremone trimedlure added in tampon form in the amount of 1 ml per trap. Beside this, food attractant amonium-bycarbonate was added in capsula form (Isagro, Italy). Traps were changed twice during the season while the both attractants were changed once a month. Traps were put in the southern part of the tree canopy, about 2 meters above the ground. Traps density was about 5 per hectar. Data collection were repeated weekly.

3 RESULTS

3.1 Area description

Generally, two main areas can be defined. The lower part of the valley with mostly mandarin crop and low medfly capture and higher part of the valley with numerous host plants and very high capture datas. In total, the treatment area in SIT suppression program could be estimated to up to 25-30.000 ha of join Croatian and BiH sides. The hypsometric map of the Croatian part of the river Neretva valley, shows great geographic isolation of whole area. It should be expressed that very limited vegetation of non-host plants has been recorded over 200-250 meter high. In lower parts, special in first 100-150 meter following medfly host plants was recorded: wild fig – *Ficus carica* var. *caprificus*, wild berry – *Prunus mahaleb* and wild brier (dog-rose berry) – *Punica* spp. Also some weeds such as *Solanum nigrum* were recorded. Higher areas of surrounding hills are almost only stone. However, hilly areas should be taken into calculation of SIT releasing treatment. The temperature data collected for Neretva and surrounding areas were collected from different sources, but still represent average monthly temperature as an minimum one decade data.

Numerous medfly host plants witch grows in whole region of Dalmacija shows possibilities that medfly can easily reproduce from May when first possible hosts are having fruits like loquats – *Eryobotria japonica* and apricots – *Prunus armeniaca*. Later, more preferable hosts are available, such as peaches – *Prunus persicae*, nectarine – *P.p. var nectarine* and special important and area wide present numerous fig – *Ficus carica* and wild fig – *Ficus carica* var *caprificus*. The period starting from September gives more

preferable hosts such as Japanese apple – *Dyospiros kaki*, mandarins – *Citrus reticulata* etc.

3.2 Pest trapping data

Trapping data shows that the period of captures varies from earliest beginning of July until end of December. Trapping data from the Neretva river valley are shown in figure 1.

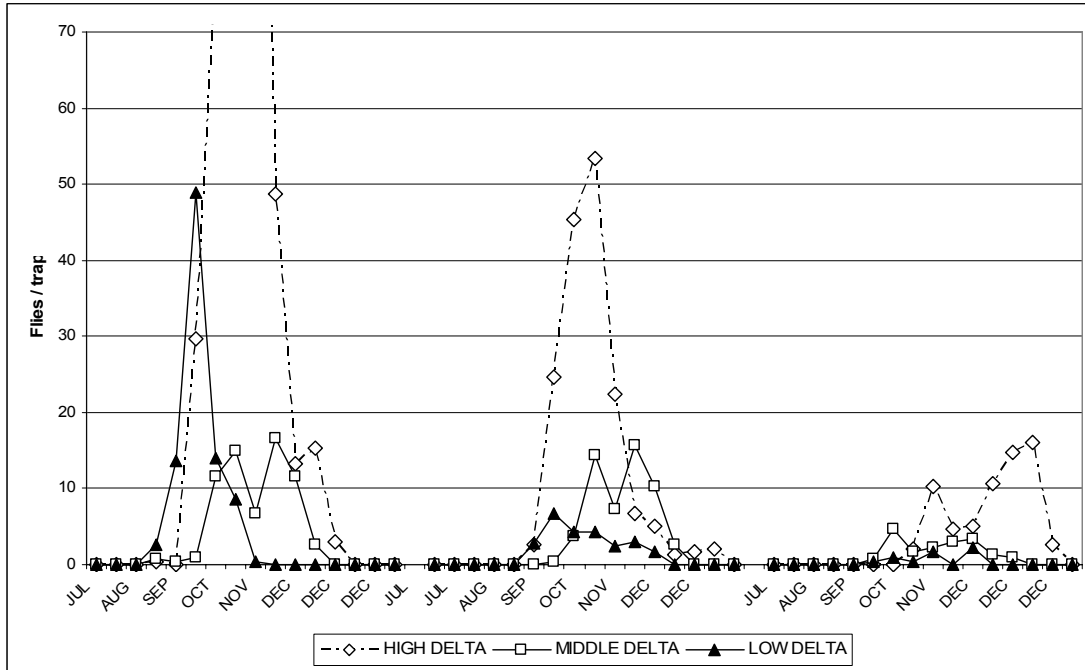


Figure 1: Population dynamic of *Ceratitis capitata* in different parts of delta Neretva valley during 2002-2004. years.

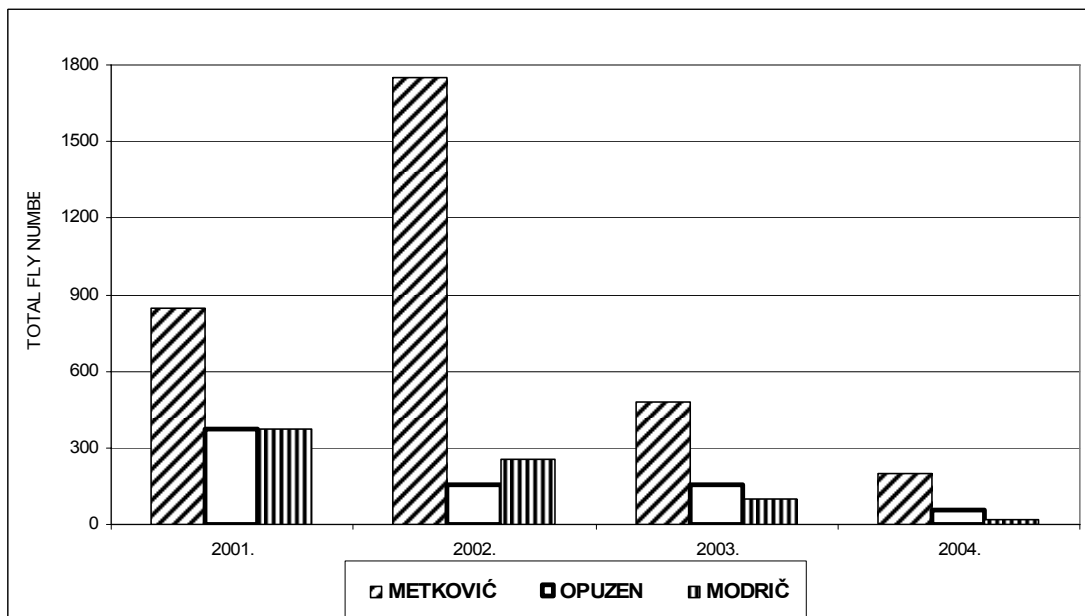


Figure 2: Medfly captures on selected locations with different hosts availability in Neretva river valley during September and October

On this area first captures can start from half August like it was in 2002. , or in the first decade of September like it was in 2003. The location in Metković shows the highest captures during both years of observations and maximum of 269 flies per trap were recorded in end of September / beginning of October. Much lower captures were recorded both at Opuzen and Modrič locations.

The results shown in figure 2 shows that during four years of observation, the highest capture were recorded at the Metković location, while much lower captures were recorded at Opuzen and Modrič locations.

The hottest area has been defined around city of Metković, which is located on the border with Bosnia and Herzegovina, with numerous cultivated and ornamental host plants, with accent on loquats – *E. japonica* at almost all city streets and all kind of cultivated stone fruit trees. It should be expressed that across the state border in Bosnia and Hercegovina there are hundreds of ha of peaches – *P. persica*, nectarines – *P. p. var nectarine* and plums – *P. domestica*.

At some very infested orchards almost 250 flies per trap were captured weekly. The lowest captures, less than 10 flies per trap weekly, were recorded at the lower part of the valley, where mostly mandarin orchards are placed. Small urban areas with higher number of host plants around shows higher captures.

3.3 Activities

On the base of the work plan for 2007.-2008. year as a part of IAEA TC 2006001, the following outputs are defined: Feasibility study of Medfly Suppression by SIT in the Neretva Valley, Preparation of an economic feasibility study including the following scenarios: full production on site, shipping of eggs and shipping of sterile pupae.

Regarding training courses it has been planned to train regional group for SIT operations (mass rearing, preemergence operations, ground/aerial release etc.)

4 CONCLUSIONS

The results collected during the four years observation period shows that medfly can reproduce easily due to numerous host plants available in the Neretva valley. Also, there are no data about period when first adults emerge after winter period. Results show that the earliest capture were recorded in early July, what can be explained by very low medfly population before July. The results show that medfly reproduce very quickly and yearly peak of population is very similar in all areas observed, defined during September and October. Also, no catches were recorded after first decade of December. It seems that medfly can create high population through the late spring and early summer, and heavily attack citrus fruits.

This speculation can be supported through the observation data collected in Neretva river valley. The lower part, planted mostly with mandarin monoculture was observed and low medfly population was recorded. Also mandarin was not attacked heavily. In other side, the upper part of the valley with different consist of host plants give to medfly possibilities to create high population and create high damage on mandarins, witch represents small part of total crop in the area. The density of the medfly is the highest in the upper part, specially by the border with Bosnia and Herzegovina. This indicates to necessity of join action program of medfly suppression in this part of the valley.

The hypsometric data show possibility even to divide the valley to two separated sectors for treatment. It should be taken in considering that program of medfly control by SIT

technique could be feasible if only lower part, from the coastal line up to the city of Opuzen can be treated. However, the best solution is to treat whole area as geographic isolated system. It should be apostrophe that environment pollution aspect except only friendly area wide methods such as SIT technique and other environmental friendly supportive techniques.

The feasibility study of medfly suppression by means of sterile males released program is undergoing. Some information data however need to be observed.

Implementing of the SIT technique will specially benefits the Croatian County of the Dubrovačko neretvanska županija and BiH County of Hercegovvačko neretvanska županija, together with their farmers, stakeholders and local communities.

5 ACKNOWLEDGMENTS

This research is financially initiated and supported by Ministry of Agriculture and Forestry of Republic of Croatia and IAEA TC Project CRO 2006001.

6 REFERENCES

- Bjeliš, M., Pelicarić, V., 2002. Fruit fly pests in Croatia; an overview of economic importance and current control strategies. 6th International Symposium of Fruit Flies of Economic Significance, Stellenbosch, S. Africa: 325-329.
- Bjeliš, M., Pelicarić, V., 2003. Voćne muhe – Strategija i suzbijanje. Glasilo biljne zaštite 1.2003. 47th Croatian Plant Protection Society Annual Meeting.
- Brnetić, D., 1968. Prilog poznavanju atraktivnog djelovanja nekih suhih mamaca na mediteransku voćnu muhu, Agrohemija, str. 5-6.
- Čurić, Z., 1994. Donjoneretvanski kraj, Hrvatsko geografsko društvo, Zagreb, str.1-224.
- Kovačević, Ž., 1960. Voćna mušica *Ceratitis capitata* Wied. kao ekološki problem, Agronomski glasnik: 161-170.
- Markovčić, M., 2001. Identification of the relationship between hydrological dynamics and biodiversity values of Neretva River Delta, Workshop: Identifying priority activities for protection of the Neretva Delta, Mostar, Sept. 3-5, 2001.
- Pelicarić V., Bjeliš M., 2001. Rezultati detekcije i monitoringa sredozemne voćne muhe *Ceratitis capitata* Wied. (Diptera, Tephritidae) u 2001. godini. Glasilo biljne zaštite 1.2002. 46th Croatian Plant Protection Society Annual Meeting.
- Rucner, D., 1993. O životu ptica u dolini Neretve, Ogranak Matice Hrvatske, Metković.
- Šimunić, I., Usporedna ispitivanja privlačnih sredstava za voćnu muhu, Zaštita bilja, 62. 1960. Beograd.
- Tominić, A., 1959. Voćna muha novi štetni član naše entomofaune. Zaštita bilja, 55: 3-14.
- Tominić, A., Brnetić, D. 1960. Biološka ispitivanja voćne muhe (*Ceratitis capitata*) u 1959. godini. Biljna zaštita, godina IV: 59-65.