



Izvečki referatov / *Abstract volume*

12. SLOVENSKO POSVETOVANJE O VARSTVU RASTLIN Z MEDNARODNO UDELEŽBO

12TH SLOVENIAN CONFERENCE ON PLANT PROTECTION WITH
INTERNATIONAL PARTICIPATION

3.–4. marec 2015, Ptuj, SLOVENIJA

**Društvo za varstvo rastlin Slovenije
Plant Protection Society of Slovenia**

Izvečki referatov 12. Slovenskega posvetovanja o varstvu rastlin z mednarodno udeležbo, Ptuj 2015

Izdajatelj Društvo za varstvo rastlin Slovenije

Urednik prof. dr. Stanislav TRDAN

Tehnični urednik in oblikovalec prof. dr. Stanislav TRDAN

Tisk Cicero, Begunje, d.o.o.

Naklada 300 izvodov

Ljubljana, 2015

CIP - Kataložni zapis o publikaciji
Narodna in univerzitetna knjižnica, Ljubljana

632(082)

SLOVENSKO posvetovanje o varstvu rastlin z mednarodno udeležbo (12 ; 2015 ; Ptuj)

Izvečki referatov = Abstract volume / 12. slovensko posvetovanje o varstvu rastlin z mednarodno udeležbo = 12th Slovenian Conference on Plant Protection with International Participation, 3.-4. marec 2015, Ptuj, Slovenija ; [urednik Stanislav Trdan]. - Ljubljana : Društvo za varstvo rastlin Slovenije = Plant Protection Society of Slovenia, 2015

ISBN 978-961-93447-2-9

1. Trdan, Stanislav

278057216

Pokrovitelj:

Uprava Republike Slovenije za varno hrano, veterinarstvo in varstvo rastlin

Sponzorji:

Karsia d.o.o. in DOW AgroSciences
Metrob d.o.o.
BASF Slovenija d.o.o.

Posvetovanje so podprli:

Syngenta Agro d.o.o.
Mediline d.o.o.
EFOS informacijske rešitve d.o.o.
AS AN d.o.o.
Bayer d.o.o.
Pioneer Semena Holding GmbH, Podružnica Murska Sobota
Omega d.o.o.
Zadružna zveza Slovenije in Deželna banka Slovenije d.d.

Donatorji:

Agriphar Crop Solutions
D-Net d.o.o.
Kambič laboratorijska oprema d.o.o., Semič
Agroruše d.o.o.
Nered d.o.o.
LT d.o.o.
Panvita d.d.
Hmezad exim d.d.
Kmetijska zadruga Šaleška dolina, z.o.o.
Mlekarna Celeia d.o.o.
Zavarovalnica Tilia, d.d.
Jata Emona d.o.o., Ljubljana

Predsednik Organizacijskega odbora / President of the Organizing Committee

prof. dr. Stanislav TRDAN, univ. dipl. inž. agr.

Organizacijski odbor / Organizing Committee

doc. dr. Matej VIDRIH, univ. dipl. inž. agr.

doc. dr. Žiga LAZNIK, univ. dipl. inž. agr.

dr. Tanja BOHINC, univ. dipl. inž. agr.

Jaka RUPNIK, inž. les.

dr. Ivan ŽEŽLINA, univ. dipl. inž. agr.

mag. Iris ŠKERBOT, univ. dipl. inž. agr.

Andrej REBERNIŠEK, univ. dipl. inž. kmet.

Ivan BRODNJAK, inž. kmet.

mag. Katarina GROZNIK, univ. dipl. inž. agr.

Programski odbor / Scientific Committee

prof. dr. Stanislav TRDAN, univ. dipl. inž. agr.

dr. Gregor UREK, univ. dipl. inž. agr.

prof. dr. Maja RAVNIKAR, univ. dipl. biol.

akad. zasl. prof. ddr. Jože MAČEK, univ. dipl. inž. agr., univ. dipl. oec.

mag. Gabrijel SELJAK, univ. dipl. inž. agr.

Organizator / Organizer

Društvo za varstvo rastlin Slovenije / Plant Protection Society of Slovenia

Jamnikarjeva 101, SI-1111 Ljubljana

<http://dvrs.bf.uni-lj.si/>

Naslov Organizacijskega odbora / Organizing Committee address

Biotehniška fakulteta, Oddelek za agronomijo

Katedra za fitomedicino, kmetijsko tehniko,

poljedelstvo, pašništvo in travništvo

Jamnikarjeva 101, SI-1000 Ljubljana

Telefon: 01 320 32 25

El. pošta: stanislav.trdan@bf.uni-lj.si

Biotechnical Faculty, Department of Agronomy

Chair of Phytomedicine, Agricultural Engineering,

Crop Production, Pasture and Grassland Management

Jamnikarjeva 101, SI-1000 Ljubljana

Telephone: ++386 1 320 32 25

E-mail: stanislav.trdan@bf.uni-lj.si

KAZALO

Uvodni referati	6
Varstvo sadnega drevja in jagodičevja	13
Fitofarmaceutvska sredstva in splošno	28
Varstvo vrtnin	36
Varstvo poljščin in krmnih rastlin	43
Varstvo gozdnega drevja in drugih lesnatih rastlin	65
Varstvo vinske trte	74
Posterji	82
Kazalo avtorjev	114

Uvodni referati

What is Environmentally Acceptable Plant Protection?

Anthony M. SHELTON

Cornell University, Department of Entomology, 630 W. North St., Geneva, NY 14456,
USA (ams5@cornell.edu)

Agricultural researchers strive to develop cropping systems that produce abundant, nutritious and safe food for consumers, as well as systems that are profitable to the business of farming and have the least amount of negative impact on the environment. To achieve these goals requires understanding the biology and ecology of the crops and their pests, the environment in which they interact, and scientific innovation. In her 1962 seminal book, *Silent Spring*, Rachel Carson described to the general public and the scientific community the problems caused by excessive use of broad-spectrum pesticides in agriculture. Before publication of *Silent Spring*, Vern Stern and colleagues in California developed and published in 1959 the concept of integrated pest management (IPM). They defined IPM as a series of multiple tactics to avoid or reduce pest outbreaks and the use of pesticides only when needed. This philosophy of IPM guides crop protection practices in many countries today. A cornerstone of IPM is the use of pest-resistant plants, whether developed through natural selection, mutation breeding or genetic engineering (GE). However the use of GE plants has engendered controversy and, in many cases, taken useful tools out of the toolbox growers need.

IZVLEČEK

Kaj je okoljsko sprejemljivo varstvo rastlin?

Raziskovalci v kmetijstvu strmiijo k razvoju sistemov rastlinske pridelave, s katerimi bi bilo mogoče pridelati večjo količino hranljive in za potrošnika varne hrane, obenem pa bi bili takšni sistemi donosni in bi imeli čim manj negativnih vplivov na okolje. Da bi dosegli te cilje, moramo poznati biologijo in ekologijo gojenih rastlinskih vrst in njihovih škodljivih organizmov, okolja, v katerem sobivajo, in novosti v znanosti. Rachel Carson je leta 1962 v knjigi *Nema pomlad* seznanila javnost in znanstveno srenjo o negativnih okoljskih vplivih, ki jih lahko povzroči prekomerna uporaba fitofarmaceutskih sredstev v kmetijstvu. Pred izdajo knjige *Nema pomlad* so Vern Stern in sodelavci leta 1959 v Kaliforniji razvil in objavil koncept integriranega varstva rastlin (IVR). IVR so definirali kot skupek različnih strategij, s katerimi se je mogoče izogniti močnemu pojavu škodljivih organizmov ali pa je mogoče njihovo številčnost zmanjšati, FFS pa uporabimo le tedaj, ko je to potrebno. Še dandanes se omenjena filozofija IVR uporablja v številnih državah. Temelj IVR je uporaba rastlin, odpornih na škodljive organizme, ki jih bodisi vzgojimo prek naravne selekcije, žlahtnjenja mutantov ali genskega inženiringa. Kakorkoli že, uporaba gensko spremenjenih rastlin vzbuja polemike in v številnih primerih pridelovalcem otežuje njihovo uporabo.



Environmental benefits and risks of biological control: evaluation of natural enemies as a basis for releasing BCAs in the Netherlands

Antoon J.M. LOOMANS

National Plant Protection Organization, Netherlands Food and Consumer Product Safety Authority, Geertjesweg 15, 6706 EA, Wageningen, The Netherlands
(a.j.m.loomans@nvwa.nl)

The release of biological control agents (BCA) is an important means as to control pest insects worldwide. In Europe, application in greenhouses has reached a high level of implementation and success. Most agents that are released have a positive track record, both in efficacy as in safety. There is, however, growing awareness that potential side effects should be considered prior to that a release is made. In the Netherlands, the release of animal species into the wild is prohibited by the Flora and Fauna Act since 2005. This act forbids the release of animals or their eggs into nature, including biological control agents. Based on the information available until 2005, a short risk-assessment (quick-scan) was made by the Dutch NPPO for each BCA which was already in use. As a result, 135 BCAs were considered to be 'safe' and thereby to continue their release. These species were exempted from being licensed ("vrijstellingslijst 2005") and thus free to release. BCA species that were not exempted or new, from then on could only be released when licensed ("onthefing"). This includes species supporting biological control practices such as factitious host or prey. To be eligible for licensing, each stakeholder (e.g. research institute, commercial stakeholder) has to submit an application, including a dossier. In the Netherlands, procedures and criteria for regulation, authorization and preparation of a dossier are used in accordance with international legislation, using harmonized methodologies for regulation and data requirements, adopted as standard PM 6/2(2) by EPPO (2010). Based on the dossier information the NPPO performs an Environmental Risk Analysis. This ERA is based on the information requirements and criteria as described by e.g. Van Lenteren *et al.* (2006) and assesses whether release of a specific BCA or other beneficial is considered 'safe for the native flora and fauna', or not. Taxonomic identity, impact on human and animal health and ecological impact are the main criteria. Efficacy data are optional, but are not required. Establishment and dispersal potential, host specificity and direct / indirect non-target effects of the BCA are assessed to determine ecological impact. Each ERA has a step-wise approach: information requirements needed may vary, based on the type of biological control program (classical, inundative), origin of the organism (native, non-native), ecological factors (known or unknown), 1st or 2nd application, etc. A permit to release can be issued to a single applicant only and is species-based and not product-based: each applicant has to apply for a permit to release a single species. A permit is issued for a maximum period of 5 years and can be mandated by the applicant to end-users to release their organism already under permit. When a release of a BCA is assessed as safe for the native flora and fauna, a licence is issued. From 2004 - 2013, 55 permits for 27 BCA species have been issued, from native as well as non-native origins. In the presentation the benefits, recent developments, limitations and bottlenecks will be addressed.

IZVLEČEK

Okoljske koristi in tveganja zaradi biotičnega varstva rastlin: ocena naravnih sovražnikov kot podlaga za izpust biotičnih agensov na Nizozemskem

Izpust biotičnih agensov je podlaga za zatiranje škodljivih organizmov po vsem svetu. V Evropi je uporaba biotičnih agensov v rastlinjakih dosegla visoko stopnjo implementacije in uspeha. Večina izpuščenih agensov ima dokazano učinkovitost in varnost uporabe. Kljub temu pa se ljudje vse bolj zavedajo potrebnosti preučitve morebitnih stranskih učinkov uporabe biotičnih agensov pred njihovim izpustom. Od leta 2005 je na

Nizozemskem na podlagi zakona (Fauna and Flora Act) prepovedan vnos živalskih vrst v naravo. Omenjeni zakon prepoveduje vnos živali ali njihovih jajčec v naravo, vključno z biotičnimi agensi. Na podlagi informacij nizozemske nacionalne organizacije za varstvo rastlin (Dutch NPPO), ki so na voljo od leta 2005, je bila narejena kratka ocena tveganja za vsak koristni organizem, ki je bil pred tem že v uporabi. Rezultati so pokazali, da je 135 vrst koristnih organizmov dobilo pozitivno oceno in se je zaradi tega njihova uporaba za namene varstva rastlin pred škodljivimi organizmi nadaljevala. Omenjeni organizmi so bili izvzeti iz licenciranja (t.i. vrijstellingslijst 2005) in se lahko uporabljajo v biotičnem varstvu rastlin. Koristni organizmi, ki niso bili izvzeti iz licenciranja oz. so novi, morajo biti od takrat naprej pred izpustom obvezno ocenjeni (t.i. ontheffing). Za pridobitev dovoljenja mora vsak uporabnik (raziskovalni inštitut, komercialni ponudnik) priložiti obrazec, ki vključuje tudi dokumentacijo. Na Nizozemskem so postopki in kriteriji za registracijo, avtorizacijo in pripravo dokumentacije v skladu z mednarodno zakonodajo, ki uporablja skladno metodologijo in podatke, privzete po standardih varstva rastlin organizacije EPPO (PM 6/2 [2] EPPO [2010]). Na podlagi dokumentacije NPPO naredi oceno okoljskega tveganja. Ocena okoljskega tveganja temelji na informacijah in kriterijih, ki so opisana v delu Van Lenteren *et al.* (2006) in določa, ali je izpust določenega koristnega organizma 'varna za domorodno živalstvo in rastlinstvo' ali ne. Glavni kriteriji so taksonomska identiteta, vpliv na zdravje ljudi in živali ter vpliv na okolje. Podatki o njihovi učinkovitosti so opcijski, a neobvezni. Lastnosti, kot so zmožnost širjenja biotičnih agensov, njihov posredni in neposredni vpliv na neciljne organizme, so ključnega pomena pri ocenitvi morebitnega vpliva na okolje. Vsaka ocena tveganja ima t.i. fazni pristop: informacije o organizmu lahko variirajo, odvisno od načina njihove rabe v programih biotičnega varstva rastlin (klasično, preplavno), njihovega izvora (domorodni, tujerodni), vplivov na okolje (znanih, neznanih), enkratne ali večkratne aplikacije, itd. Dovoljenje za uporabo lahko pridobi le en prosilec in temelji na vrsti organizma in ne na pripravku: vsak prosilec mora priložiti vlogo za dovoljenje izpusta za vsako vrsto koristnega organizma posebej. Dovoljenje velja za obdobje petih let. Ko je izpust koristnega organizma ocenjen kot varen za naravno okolje, pridobi dovoljenje. V obdobju 2004-2013 je bilo izdanih 55 dovoljenj za 27 vrst koristnih organizmov, tako domorodnih kot tudi tujerodnih. V prispevku bodo predstavljene prednosti in slabosti uporabe koristnih organizmov.



The long jump from chemical to non-chemical control in stored product protection: which are the viable alternatives to neurotoxic insecticides in this meta-pesticide era?

Christos G. ATHANASSIOU

Laboratory of Entomology and Agricultural Zoology, Department of Agriculture, Crop Production and Rural Environment, University of Thessaly, Phytokou str., 38446, N. Ionia, Magnesia, Greece (athanassiou@agr.uth.gr)

Currently, stored product protection is based chiefly on the use of chemicals which are, in majority, neurotoxic to insects. However, the continuous use of these substances meets with several drawbacks, such as the high mammalian toxicity of some active ingredients, the detection of residues in the final product, and the development of resistance by several major stored product insect species. At the same time, the increased consumers' demand for residue-free food, the strict requirements of organic food production, and environmental concerns, constitute the future of many active ingredients uncertain. In this context, several alternatives have been evaluated and proposed, based on the use of bio-rational approaches, which do not contain conventional insecticides. On the other hand,

despite the fact that there are numerous alternatives to pesticides in stored product protection, there is still inadequate information on their viability for wide scale applications. Nevertheless, there are methods that can be used with success for this purpose, and can, either in part or completely, replace chemicals. Modified and controlled atmospheres are classified among the most promising alternatives to chemical control, since they can be applied in various commodities and at various environmental conditions. Both methods are based on the reduction of oxygen around the treated commodity, to a level that is usually lower than 3 %, causing hypoxia or anoxia. Other techniques are based on the use of macro- or micro-biological control: these include predators, parasitoids and insect pathogens, which are introduced in the facility. Extreme temperatures, known as "heat treatment" or "cold treatment" are also good viable alternatives to aerial insecticides and aerosols in storage and food processing facilities. In the case of heat, ideally, the temperature has to be raised at 50 °C in all locations of a given facility, while in the case of cold, all insects usually die in 1-2 days at -17.8 °C (0 °F). Other methods include the application of natural resource-based inert materials, such as diatomaceous earths, the use of mating disruption and the utilization of mechanical methods in buildings and commodities that have to do with "insect proof food packaging" or "insect proof buildings". All these techniques are now used in large-scale applications, clearly suggesting that the meta-pesticide era in stored product protection is feasible. This feasibility, apart from the insecticidal efficacy, is also related to the fact that the cost of most of these approaches and techniques is directly comparable with the cost of conventional methods that are currently in use.

IZVLEČEK

Dolg skok od kemičnega do nekemičnega zatiranja skladiščnih škodljivcev: katere so učinkovite alternative nevrotoksičnim insekticidom v obdobju po intenzivni uporabi fitofarmaceutskih sredstev?

Varstvo uskladiščenih pridelkov pred škodljivci je večinoma vezano na uporabo kemičnih snovi, ki na škodljive žuželke (te predstavljajo najpomembnejšo skupino skladiščnih škodljivcev) delujejo predvsem kot živčni strupi. Slaba stran dolgotrajne rabe takšnih snovi je visoka strupenost za sesalce pri nekaterih aktivnih snoveh, pojavljanje ostankov v skladiščnem materialu in njegovih proizvodih ter pojav odpornosti na insecticide pri nekaterih najpomembnejših vrstah skladiščnih škodljivcev. Hkrati pa naraščajoče zahteve potrošnikov po hrani brez ostankov fitofarmaceutskih sredstev, stroge zahteve ekološke pridelave in splošna skrb za okolje vplivajo na to, da je prihodnja uporaba številnih aktivnih snovi precej negotova. V tej zvezi je bilo doslej preučevanih veliko okoljsko sprejemljivih načinov, ki ne vsebujejo sintetičnih insekticidov in nekateri med njimi se danes že uporabljajo v praksi. Na drugi strani pa se, kljub dejstvu, da je znanih veliko alternativnih načinov za zatiranje skladiščnih škodljivcev, še vedno srečujemo z njihovo nezadostno uporabo v velikih skladiščnih prostorih. Vseeno so že znani alternativni načini, ki se z uspehom uporabljajo v širši praksi in ki že delno ali v popolnosti nadomeščajo kemične snovi. Spremenjena ali nadzorovana atmosfera se uvršča med najbolj obetajoče alternative kemičnim pripravkom, saj se lahko uporablja v različnih skladiščnih materialih in v različnih okoljih. Obe metodi temeljita na zmanjšanju koncentracije kisika v skladišču na manj kot 3 %, s čimer pri žuželkah pride do hipoksije (pomanjkanje kisika v tkivih) ali anoksije (odsotnost ali hudo pomanjkanje kisika v tkivih). Ostali načini temeljijo na uporabi makro- in mikrobiotičnih agensov, in sicer plenilcev, parazitoidov in žuželčnih patogenov, ki se znašajo v skladišča. Tudi uporaba ekstremne temperature, znana kot "vroče tretiranje" ali "hladno tretiranje", predstavlja dobro alternativo kemičnim fumigantom v skladiščih in živilskih obratih. V primeru vročine, je najbolj učinkovito, da temperaturo v celotnem skladišču povišamo na 50 °C, pri mrazu pa je znano, da žuželke pri -17,8 °C navadno

poginejo po enem do dveh dneh. Druge alternativne načine predstavljajo naravni inertni materiali, kakršen je na primer diatomejska zemlja, metoda zbejanja in mehanični načini zatiranja skladiščnih škodljivcev, s katerimi se škodljivcem fizično prepreči dostop v prostor ali v pakirno enoto. Omenjeni načini se danes že uporabljajo v široki praksi, kar nakazuje na to, da je mogoče skladiščne škodljivce učinkovito zatirati tudi brez kemičnih sredstev za varstvo rastlin. To dejstvo potrjuje tudi cena omenjenih alternativnih načinov, ki je primerljiva s ceno klasičnih (kemičnih) načinov zatiranja skladiščnih škodljivcev.



The future of plant protection products on the European market; even tougher restrictions for the marketing authorisations.

Aurélie DHAUSSY

European Crop Protection Association, 6 Avenue E Van Nieuwenhuysse, 1160 Brussels, Belgium (aurelie.dhaussy@ecpa.eu)

The tools available to European farmers for the protection of their crops are decreasing. Under Directive 91/414 on the placing of plant protection products on the market, a review programme decreased the number of available active substances from around 1,000 to around 300. Further losses are expected due to the provisions introduced by Regulation 1107/2009 replacing Directive 91/414 since 14 June 2011, but their impact is difficult to predict considering the lack of clear definition for some criteria. The Regulation incorporates hazard-based criteria which do not take into account the actual risks associated with the use of plant protection products, and will result in banning products that were judged safe for use through the recent review programme. An unworkable and not scientifically based implementation of the cut-off criteria, of the zonal worksharing or the comparative assessment could particularly make it unviable to continue the production of many key crops in the European Union, especially minor crops, seriously disadvantaging EU farmers with increased food imports. ECPA's main aim is to ensure a workable and sustainable regulation of plant protection products authorisations, which is science-based, aims at protecting health and the environment, and which ensures that consumers have access to affordable, quality fresh foods.

IZVLEČEK

Prihodnost fitofarmaceutskih sredstev na evropskem trgu ; celo strožje omejitve za pridobitev dovoljenja za promet

Orodja, ki so na voljo evropskim kmetom za varstvo rastlin, se zmanjšujejo. V skladu z Direktivo 91/414 o dajanju fitofarmaceutskih sredstev v promet se je število razpoložljivih aktivnih snovi od prvotnih 1000 zmanjšalo na okoli 300. Dodatno zmanjšanje pričakujemo zaradi določb iz Uredbe 1107/2009, ki nadomešča Direktivo 91/414 in velja od 14. junija 2011. Vpliv teh določil je zaradi pomanjkanja jasnih opredelitev za nekatera merila težko napovedati. Uredba 1107/2009 vključuje merila, ki temeljijo na nevarnosti, vendar pa ne upošteva dejanskih tveganj povezanih z uporabo fitofarmaceutskih sredstev. To bo privedlo do prepovedi sredstev, ki so bila v prejšnjem programu revizije ocenjena kot varna za uporabo. Neizvedljivo in znanstveno neutemeljeno je uvajanje tako imenovanih "cut-off" meril, medsebojno sodelovanje v conah in uvajanje primerjalnih ocen. Vse to bo v prihodnje vplivalo na pridelavo glavnih poljščin v Evropski uniji, pa tudi t.i. malih rab, resno bo ogrozilo konkurenčnost evropskih kmetij in vplivalo na povečan uvoz hrane.

Glavni cilj ECPA je zagotoviti izvedljiv in trajnostno urejen način izdajanja dovoljenj za fitofarmacevtska sredstva – način, ki temelji na znanosti in je namen varovanju zdravja ljudi in okolja in ki zagotavlja, da imajo potrošniki dostop do cenovno dostopnih ter kakovostnih živil.

Varstvo sadnega drevja in jagodičevja

Sejana nizka podrast – sistem pridelave jabolk brez uporabe herbicidov

Biserka DONIK PURGAJ¹, Matjaž BEBER¹, Mario LEŠNIK², Stanislav TOJNKO²

¹KGZS – Zavod Maribor, Sadjarski center Maribor, ²Fakulteta za kmetijstvo in biosistemske vede Maribor (sadjarski.center.mb@gmail.com)

V sadjarskem centru Maribor smo v poskusu v sadovnjaku (Pinova/M9; vitki vretenast grm) raziskovali vpliv načina vzdrževanja podrasti pod drevesi na rodnost jablan in kakovost jabolk. V poskusu smo imeli naslednja obravnavanja: 1) obdelava tal v pasu 80 cm pod drevesi (brez podrasti), 2) obdelava tal v pasovih v kombinaciji z nizko podrastjo (sendvič sistem SS) in 3) trajna nizka podrasti s setvijo zeli in trav, ki imajo majhno tekmovalno sposobnost do dreves. Obdelava tal v pasovih do globine 6 cm je bila izvedena z prekopalnikom Pelentz. Obdelava tal po sistemu SS, kot ga izvajajo v Švici je bila izvedena tako, da smo podrast pustili nemoteno rasti neposredno pod drevesno krošnjo, z obeh strani pasu podrasti pa smo izvajali plitvo obdelavo s prekopalnikom v pasu širokem 30 cm. Načini vzdrževanja podrasti so imeli značilen vpliv na količino in kakovost pridelka primerjano na kontrolo, kjer smo gola tla pod drevesi zagotovili z uporabo herbicidov. Razlike glede učinka na pridelek med preučevanimi sistemi so bile statistično značilne.

ABSTRACT

Seeded orchard understory stripes - an apple production system without herbicide use

The impact of three understory management systems on the yielding potential and fruit quality of apples was studied in a trial carried out at the Pinova (M9, super spindle) orchard at the Maribor fruit research station. The tested understory management systems were the following: 1) cultivation of soil under trees (80 cm wide stripe without any vegetation), 2) limited soil cultivation combined with intact understory composed of seeded herbs and grasses ("sandwich" system; SS) and 3) undisturbed understory vegetation composed of herbs and grasses which have a very low competitive capacity with apple trees. The under tree soil cultivation (6 cm deep) was carried out with a Pelentz cultivator. The SS management system, commonly practiced in Switzerland, was applied by leaving a central stripe (30 cm) of understory, positioned directly under the trees, intact and by cultivating 30 cm wide stripes along both sides of the central green stripe. All three systems had a significant effect on the amount and quality of the apple yield when compared to control plots with bear soil (vegetation controlled by herbicides). The differences in the effects on the yield among 3 tested systems were statistically significant.



Bakterijski ožig oljk – nova grožnja slovenskemu oljkarstvu

Erika OREŠEK¹, Gabrijel SELJAK²

¹Uprava za varno hrano, veterinarstvo in varstvo rastlin, Dunajska 22, SI-1000 Ljubljana (erika.oresek@gov.si)

²KGZS, Kmetijsko gozdarski zavod Nova Gorica, Pri hrastu 18, SI-5000 Nova Gorica

Karantenska bakterija *Xylella fastidiosa*, povzročiteljica bakterijskega ožiga oljk, je v EU uvrščena v prilogo I.A.I direktive Sveta 2000/29/ES. V Evropi je bila prvič ugotovljena leta 2013 na območju province Lecce v pokrajini Apulija v Italiji, kjer je v povezavi z drugimi škodljivimi organizmi povzročila obsežno propadanje oljčnikov. Bakterija lahko okuži več kot 100 vrst gostiteljskih rastlin, med katerimi so številne gospodarsko pomembne gojene rastline, kot so trta, agrumi in oljke, ter okrasne in prosto rastoče rastline. Doslej so znane štiri podvrste *X. fastidiosa* in sicer *X. fastidiosa* ssp. *fastidiosa*, *X. fastidiosa* ssp. *sandyi* in *X. fastidiosa* ssp. *multiplex* in *X. fastidiosa* ssp. *pauca*, posamezne podvrste imajo različne spektre gostiteljskih rastlin. Različek bakterije, ki je bil ugotovljen v provinci Lecce, je najbližji *X. fastidiosa* ssp. *pauca*. Poleg oljk (*Olea europaea*) so bili tam okuženi tudi mandljevci (*Prunus dulcis*), češnje (*Prunus avium*), oleandri (*Nerium oleander*), navadna žuka (*Spartium junceum*) ter okrasne vrste *Polygala myrtifolia*, *Westringia fruticosa* in *Acacia saligna*. Okužena navadni zimzelen (*Vinca* spp.) in madagaskarski zimzelen (*Catharanthus roseus*) nista kazala bolezenskih znamenj. Raziskave v zvezi z gostiteljskimi rastlinami *X. fastidiosa* v pokrajini Lecce še potekajo. Do sedaj je znani prenašalec v Italiji škržatek navadna slinarica (*Philaenus spumarius*, Hemiptera: Aphrophoridae), možni prenašalci pa so tudi druge žuželke, ki se hranijo v ksilemu. Na večje razdalje se bolezen prenaša z okuženim sadilnim in razmnoževalnim materialom gostiteljskih rastlin in z okuženimi vektorji. *X. fastidiosa* do sedaj v Sloveniji ni bila ugotovljena. Obstaja tveganje, da bi bila vnesena v Slovenijo in bi se zaradi ugodnih vremenskih razmer razširila na območju pridelave oljk. Zaradi nevarnosti vnosa te nevarne bakterije ob uvozu gostiteljskih rastlin iz tretjih držav, kjer je navzoča *X. fastidiosa*, in širjenja z okuženih območij v Italiji so bili leta 2014 v EU sprejeti nujni ukrepi za preprečevanje vnosa in širjenja te nevarne bolezni.

ABSTRACT

***Xylella fastidiosa* – new threat for Slovenian olive growing**

Xylella fastidiosa is a quarantine bacterium listed in the EU in the Annex I.A.I of the Council Directive 2000/29/EC. In Europe it was confirmed for the first time in 2013 in Italy where it has caused extensive dying of olive orchards in connection with some other harmful organisms in the province Lecce in the region Apulia. The bacterium is able to infect more than 100 host species including numerous economically important crops like vine, citrus and olives as well as ornamental and wild plants. Until now four strains have been known: *X. fastidiosa* ssp. *fastidiosa*, *X. fastidiosa* ssp. *sandyi*, *X. fastidiosa* ssp. *multiplex* and *X. fastidiosa* ssp. *pauca* with different host range. The strain confirmed in the province Lecce is similar to *X. fastidiosa* ssp. *pauca*. In Lecce, beside *Olea europaea* also *Prunus dulcis*, *Prunus avium*, *Nerium oleander* and *Spartium junceum* and the ornamentals *Polygala myrtifolia*, *Westringia fruticosa* in *Acacia saligna* were infected, while *Vinca* spp. and *Catharanthus roseus* did not show symptoms. The research related to host plants of *X. fastidiosa* in Italy is being carried out. In Italy until now, *Philaenus spumarius* (Hemiptera: Aphrophoridae) has been confirmed as the vector of *X. fastidiosa*. Potential vectors are also other xylem-feeding insects. On long distances, the disease can be transmitted by infected planting and reproductive material of host plants and by infected vectors. Until now, *X. fastidiosa* has not been found in Slovenia. Due to the favourable climate conditions there is a risk for the establishment of the pest in the olive growing areas in Slovenia. Due to the risk of introduction of *X. fastidiosa* with host plants from third countries and the spread from infected areas in Italy emergency measures for prevention of introduction and spread were adopted in the EU in 2014.



Določanje novega škodljivega organizma v Evropi, bakterije *Xylella fastidiosa*, z molekularnimi metodami

Tanja DREO¹, Manca PIRC¹, Tjaša JAKOMIN¹, Maria SAPONARI², Maja RAVNIKAR¹

¹Nacionalni inštitut za biologijo, Oddelek za biotehnologijo in sistemsko biologijo, Večna pot 111, SI-1000 Ljubljana (tanja.dreo@nib.si)

²CNR - Institute for Sustainable Plant Protection, Via Amendola 165/A, 70126 Bari, Italija

Bakterija *Xylella fastidiosa* povzroča pomembne bolezni v Ameriki npr. Pierceovo bolezen vinske trte in šarasto bledico agrumov. V Evropi je bila karantenska bakterija (uvrščena v prilogu I.A.I Direktive Sveta 2000/29/ES) prvič potrjena leta 2013 v Italiji, kjer povzroča »hitro propadanje oljk« oljk in okužuje mnoge druge rastline. Določanje temelji na molekularnih metodah, bolezenskih znamenjih in izolaciji na gojiščih. Bolezenska znamenja so neznačilna in se pogosto izrazijo ko so rastline v stresu zaradi pomanjkanja vode, hranil ali zaradi prisotnosti drugih škodljivih organizmov. Izolacija na gojiščih je časovno zahtevna in ni primerna za analizo večjega števila vzorcev. Molekularne metode nam tako omogočajo ugotavljanje okužbe tudi v rastlinah, ki bolezenskih znamenj ne kažejo, vendar so pomembne za vnos bolezni na nova področja in kot rezervoar bakterije ter za določanje v žuželčjih prenašalcih. Za določanje *X. fastidiosa* smo preverjali metodi PCR v realnem času, ki ju uporabljamo za vinsko trto (Schaad *et al.*, *Phytopath* (2002) 92: 721–728; Francis *et al.*, *EJPP* (2006) 115(2): 203-213) ter metodo izotermalnega pomnoževanja DNA (metoda LAMP; Harper *et al.*, *Phytopath* (2010) 100: 1282–1288), ki smo jo prilagodili fluorescentni detekciji primerni za uporabo na terenu. Z metodo LAMP smo zaznali do 80 tarčnih kopij čiste DNA na reakcijo kar ustreza 10^5 celic na mL začetnega vzorca, v 11-30 minutah, medtem ko smo s PCR v realnem času zaznali nižje koncentracije tarče (do 10^4 celic/mL vzorca) vendar smo za to potrebovali daljši čas. V domnevno pozitivnih vzorcih z okuženega območja v Italiji smo z metodo LAMP potrdili okužbo v 8/10 vzorcih analiziranih v redčitvah 1:10 in 1:100, medtem ko so bili vsi rezultati domnevno negativnih vzorcev ustrezni. Medtem ko je qPCR občutljiva in natančna metoda določanja *X. fastidiosa* v rangu koncentracij, je metoda LAMP zaradi hitrosti obetaven presejalni test za analizo večjega števila vzorcev z izraženimi bolezenskimi znamenji in višjimi koncentracijami bakterije.

ABSTRACT

Detection of *Xylella fastidiosa*, a novel pathogen in Europe, with molecular methods

Xylella fastidiosa is the causal agent of several economically important diseases in the Americas e.g. Pierce's disease on grapevine and citrus variegated chlorosis. This bacterium, listed as a quarantine pest (Annex I.A.I. of the Council Directive 2000/29/EC), was confirmed in Europe for the first time in 2013 associated to a novel disease of olive »quick decline syndrome« in Italy but also infecting other plants. Accurate detection of the bacterium relies mainly on PCR-based molecular approaches, symptoms and isolation on culture media. Visual inspections for symptoms could support the diagnosis however they could be related to other factors (i.e. water stress, nutrient deficiency or other pathogens). Isolation is a laborious process and not suitable for massive samples processing. Tests based on laboratory diagnosis are thus necessary for the detection of *X. fastidiosa* in

asymptomatic plants that are important as a source of infection, as well to detect the bacteria in the insect vectors. In this work, we compare the real-time PCR assay, which are used for grapevines (Schaad *et al.*, *Phytopath* (2002) 92: 721-728; Francis *et al.*, *EJPP* (2006) 115 (2): 203 -213), and the isothermal amplification of DNA (LAMP method; Harper *et al.*, *Phytopath* (2010) 100: 1282-1288), adjusted to a field deployable platform. The LAMP assay detected as low as 80 copies of purified target DNA in the reaction, corresponding to 10^5 CFU/ml, within 11-30 minutes. Real-time PCR was more sensitive (down to 10^4 copies/mL) but needed longer running times. In total, 8 out of 10 of the presumed positive samples from the Italian outbreak were confirmed by LAMP assay. All presumed negative samples from the same area tested negative with LAMP. While qPCR is accurate and sensitive over a range of concentrations, LAMP could represent a promising method for rapid screening of large number of samples.



Hrušev ožig po obdobju 2001-2014 še vedno omejeno navzoč v Sloveniji

Primož PAJK¹, Vlasta KNAPIČ¹, Erika OREŠEK¹, Joži JERMAN CVELBAR²

¹Ministrstvo za kmetijstvo, gozdarstvo in prehrano, Uprava RS za varno hrano, veterinarstvo in varstvo rastlin, Dunajska 22, SI-1000 Ljubljana (primoz.pajk@gov.si)

²Ministrstvo za kmetijstvo, gozdarstvo in prehrano, Direktorat za kmetijstvo, Ljubljana

Hrušev ožig, ki ga povzroča bakterija *Erwinia amylovora* (Burr.) Winsl. *et al.*, je škodljivi organizem, nadzorovan na jablanah, hruškah in kutinah ter ostalih gospodarsko pomembnih gostiteljskih rastlinah po celem svetu. Kot karantenski organizem (status A1) je uvrščen na sezname v Južni Afriki, Kitajski, vzhodni Aziji in Rusiji. V Evropi še vedno ni navzoč v Moldaviji, Estoniji, Finski in Malti. Neokuženi status Slovenije je bil določen na podlagi znanstvenega in strokovnega dela ter zlasti na podlagi rezultatov vsakoletnih posebnih nadzorov od leta 1998 dalje. V Sloveniji bakterija ni bila navzoča vse do leta 2001, ko je bilo po uradnih pregledih gostiteljskih rastlin na 791 nadzorovanih točkah na eni izmed njih ugotovljeno prvo žarišče okužbe (Naklo). Rezultati sistematičnih posebnih nadzorov in izvedba uradnih ukrepov eradikacije so v letu 2004 omogočili priznanje statusa Slovenije kot varovanega območja za hrušev ožig pri Evropski komisiji. V Evropski uniji je hrušev ožig že splošno razširjen. Pridelava sadik, podlag in cepičev je mogoča v drevesnicah in matičnih nasadih v t. i. nevtralnih območjih, kjer je v tistih državah članicah, kjer je tak status tudi priznan, mogoče vzpostaviti razmere za izdajanje rastlinskih potnih listov za varovana območja. Ekološke in vremenske razmere v Sloveniji so zelo ugodne za pojavnost hruševega ožiga, zato je pričakovati njegovo nadaljnje širjenje, še zlasti v jugovzhodni in severovzhodni Sloveniji na območjih, kjer je večina intenzivnih nasadov jablan in hrušk. V zadnjih petnajstih letih so bile zelo ugodne vremenske razmere za pojavnost hruševega ožiga v letu 2003 (prvi večji izbruh) in v letu 2007 (drugi večji izbruh), ko se je bakterija v severnem in osrednjem delu Slovenije tako močno razširila, da eradikacija ni bila več mogoča. Zato so iz varovanega območja izključena naslednja območja ustalitve hruševega ožiga: Gorenjska, Koroška, Notranjska, Maribor in občini Lendava in Renče-Vogrsko (južno od hitre ceste H4). Stalni nadzor bakterije na razmejenih območjih je potreben zaradi nenadnih izbruhov bakterije in temelji na preventivi in odstranjevanju okuženih gostiteljskih rastlin. Okužene podlage, cepiči, sadike in čebelji panji so najpogostejše poti prenosa bakterije z okuženih območij. V prispevku je predstavljena izvedba posebnega in uradnega nadzora, vključno z

razmejitvami žarišč okužbe, vzpostavitevijo neokuženega (varovanega) območja in nevtralnih območij v obdobju 2001-2014.

ABSTRACT

Fireblight after period 2001-2014 still at low prevalence in Slovenia

Fireblight, caused by the bacterium *Erwinia amylovora* (Burr.) Winsl. *et al.* is regulated as harmful organism all over the world, where the apple, pear, quince and other economically important host plants are grown. It is still listed as an A1 quarantine organism in South America, China and East Asia, East-south Africa and Russia. In Europe it is still absent from Moldova, Estonia, Finland and Malta. The pest-free status of Slovenia has been declared on the basis of scientific and expert work and in particular on the basis of official annual systematic surveys, which have been conducted as from 1998. In Slovenia it had been absent until 2001, when a single focus was officially delimited at 1 (near Naklo) out of 791 monitoring points. Survey results and official measures deployed with the aim of eradication justified the Slovenian status as the European Union (EU) protected zone for *Erwinia amylovora* (Burr.) Winsl. *et al.* in 2004. Fireblight is considered as widespread within the EU, except in the officially controlled buffer zones, where nurseries and mother plantations could be maintained for suitable conditions to issuing plant passport, especially those for protected zones. Ecological and climatic conditions in Slovenia are most suitable for fireblight, which will in infection matching conditions most probably spread and establish itself in new areas, where the majority of apple and pear intensive orchards are grown (in particular southeast and northeast of Slovenia). In the past 15 years there were the most favourable climatic conditions for fireblight in 2003 (first outbreak) and in 2007 (second outbreak), where fireblight spread in the northern and central Slovenia, rendering the eradication measures impracticable. Areas with low fireblight prevalence were therefore excluded from the protected zone territory: the regions of Gorenjska, Koroška, Notranjska, Maribor, and the communes of Lendava and Renče-Vogrsko (south from the highway H4). As fireblight causes destructive outbreaks and as the control measures are mainly based on prevention and exclusion, the further regulation of *Erwinia amylovora* (Burr.) Winsl. *et al.* is necessary. Contaminated rootstocks, cuttings and grafted plants for planting, as well as transport of beehives from infected areas, constitute the main regulated pathways. Survey and official control results are presented, including the development of regulated areas with foci of infection, buffer and protected zones in the period 2001-2014.



Comparison of *Botrytis cinerea* populations from horticultural crops

Brankica TANOVIĆ¹, Jovana HRUSTIĆ¹, Milica MIHAJLOVIĆ¹, Goran DELIBASIĆ²

¹Institute of Pesticides and Environmental Protection, Banatska 31 b, 11080 Belgrade - Zemun, Serbia (brankica.tanovic@pestring.org.rs)

³University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade - Zemun, Serbia

Botrytis cinerea is a necrotrophic poliphagous plant pathogen well-known for its great phenotypic and genetic variability. Phenotypic diversity of the pathogen is usually explained by multinucleate and heterocaryotic nature of hyphae or conidia and aneuploid state of nuclei. However, initial molecular investigation of French and Chilean populations of *B. cinerea* in different host-plants had shown that the species is composed of two

sympatric species, *transposa* and *vacuma*, characterized by the presence of two transposable elements, *Boty* and *Flipper*, or by absence of both of them. Afterwards, isolates with only one transposon were found, suggesting more complex population structure. Based on additional molecular studies, *B. cinerea* population is grouped in two genetic entities – Group I, containing fenhexamid-resistant isolates of *vacuma* type, and Group II, containing fenhexamid-sensitive *transposa*, *vacuma*, *boty*, and *flipper* isolates. Although the absence of host-specialization in *B. cinerea* is widely accepted, some authors hypothesized that a certain degree of host specialization existed in *B. cinerea* population. Furthermore, significant differences regarding the frequency of *vacuma* and *transposa* isolates on various host plants, as well as the difference in the prevalence of morphological types of isolates were detected. In order to characterize the population structure of *B. cinerea* in some horticultural crops including berries and ornamentals, the following features of 57 *B. cinerea* isolates were studied: colony morphology, growth rate, sporulation, virulence, and the presence of the transposable elements. Significant differences among studied populations of *B. cinerea* were detected. The isolates from berries are mostly of sclerotial type, they do not sporulate or sporulation is sparse and detected in less than 50% of the isolates, while the isolates from ornamentals are mostly of mycelial type and with abundant sporulation. Transposons were present in 75-90% of the isolates from berries and in all the isolates from ornamentals. Project III 46008.



Uporaba čebel za raznos biopesticida za varstvo jagod pred sivo plesnijo (*Botrytis cinerea*)

Danilo BEVK, Andrej ČOKL

Oddelek za entomologijo, Nacionalni inštitut za biologijo, Večna pot 111, 1000 Ljubljana
(danilo.bevk@nib.si)

Ekološka pridelava jagod se sooča s problemom učinkovitega zatiranja bolezni. V okviru evropskega projekta BICOPLL smo raziskovali zaščito jagod pred sivo plesnijo (*Botrytis cinerea*) z uporabo spor glive *Gliocladium catenulatum* v pripravku Prestop Mix (PM). *G. catenulatum*, ki deluje kot antagonist sive plesni, je bil na cvetove jagod nanosen s pomočjo čebel. Čebele se PM pobrale v posebnem razdelilniku nameščenem na izhodu panja in ga prenesle na cvetove. Raziskali smo učinkovitost metode in varnost za čebelo. Maja in junija 2013 in 2014 smo čebeljo družino postavili zraven nasada jagod velikega 0,5 ha. Na osmih vzorčnih ploskvah (4 tretirane in 4 kontrolne) smo spremljali pašno dejavnost čebel in pridelek. Čebele so cvetove jagod obiskovale kljub alternativnim pašnim virom v okolici. Najbolj številčne so bile v toplem vremenu in popoldne. Po končanem cvetenju smo na vzorčnih ploskvah pobrali zdrave in obolele jagode in jih stehali. Leta 2013 je uporaba PM povečala delež zdravega pridelka za polovico. V letu 2014 statistično značilnih razlik med tretiranimi in netretiranimi ploskvami ni bilo, domnevno zaradi hladnega in deževnega vremena v času cvetenja. Če so bile čebele izpostavljene večjim količinam PM, smo opazili nekaj negativnih vplivov na vedenje, vendar so takim količinam izpostavljene le posamezne čebele, zato je uporaba pri zdravih in močnih družinah varna in ne moti njihovega razvoja. Rezultati so pokazali, da je v ugodnih vremenskih razmerah čebela primerna za raznos organizma za biotično zatiranje na cvetove.

ABSTRACT

Using honeybees to deliver biopesticide for protection from grey mould (*Botrytis cinerea*)

Organic berry production suffers heavily from lack of effective disease control. BICO POLL was a European study on protection of strawberries from the grey mould (*Botrytis cinerea*), using spores of fungus *Gliocladium catenulatum* in Prestop Mix (PM). *G. catenulatum*, which acts as an antagonist of grey mould, was delivered to strawberry flowers using honeybees. Bees gathered PM in a dispenser placed at the exit of the hive and delivered it to the flowers. The efficacy of the method and safety for honey bees was studied. A honeybee colony was placed next to a 0.5 ha strawberry field during May and June of 2013 and 2014. Foraging activity and yield were monitored in eight experimental plots (4 treated and 4 controls). Bees visited the strawberry flowers despite alternative food sources close to the field. The visits were more frequent in warm weather and in the afternoons. At the end of the flowering season, the healthy and the mouldy berries were collected from each plot and weighed. In 2013, the use of PM resulted in a 50% increase of the ratio of healthy berries over the mouldy ones. In 2014, no statistically significant differences between treated and untreated plots were found, presumably due to cold and rainy weather in the flowering period. When bees were exposed to large amounts of PM some negative effects on behaviour were detected. In real situation only few bees are exposed to such amounts. Use of PM in healthy and strong colony is safe and do not disturb its development. The results showed that, in favourable weather conditions, entomovectoring is an effective method for delivering biocontrol agents to flowers.



Razširjenost plodove vinske mušice - *Drosophila suzukii* v Sloveniji in njena populacijska dinamika v obdobju od leta 2011 do 2014

Gabrijel SELJAK, Matjaž JANČAR, Mojca ROT

KGZS, Kmetijsko gozdarski zavod Nova Gorica, Oddelek za varstvo rastlin, Pri hrastu 18, SI-5000 Nova Gorica (gabrijel.seljak@go.kgzs.si)

Plodova vinska mušica (PVM) - *Drosophila suzukii* (Matsumura 1931) [Diptera: Drosophilidae] je ena najbolj invazivnih tujerodnih žuželk, ki so bile v zadnjem obdobju zanesene v Evropo. Po prvi najdbi te vrste v Sloveniji jeseni 2010 se na najbolj ogroženih območjih izvaja sistematični nadzor njenega pojavljanja. Ugotovljeno je, da je plodova vinska mušica že razširjena bolj ali manj povsod po Sloveniji vse od morja pa do nadmorske višine vsaj 1.400 m. Napada veliko število mehkih plodov gojenih in divjih rastlin v obdobju zorenja: češnje, višnje, marelice, breskev, borovnic, ameriških borovnic, na grozdju, maline, robidnice, kranjske kozje češnje, brogovite, črnega bezga. Velikost in gostota populacije se zelo spremenljiva in je odvisna od letnega časa, vremenskih razmer poleti in razpoložljivosti plodov gostiteljskih rastlin. V sušnem poletju 2012 je bila njena populacija povsod izjemno skromna. Nasprotno je bila v mokrem letu 2014 njena številčnost skoraj povsod izjemno velika že od zgodnjega poletja dalje in je povzročila veliko škode pri pridelavi češenj, breskev, jagod, ameriških borovnic in malin, ki je ponekod preseгла 50%. V prispevku bosta podrobneje obravnavana razširjenost in populacijska dinamika PVM v Sloveniji in oboje ponazorjeno tudi grafično.

ABSTRACT

Distribution of spotted wing drosophila - *Drosophila suzukii* in Slovenia and its population dynamics in the period between 2011 and 2014

The spotted wing drosophila (SWD) - *Drosophila suzukii* (Matsumura 1931) [Diptera: Drosophilidae] is among the most invasive alien species that have been introduced into Europe recently. After the first findings of the pest in Slovenia in autumn 2010, systematic monitoring has been carried out in the most endangered regions. The results show that *D. suzukii* is already commonly spread from the sea level up to 1400 m in the mountains in the almost whole territory of Slovenia. It attacks a vast number of small fruits and stone fruits of cultivated and wild plants at the ripening time: sweet and sour cherry, apricot, peach, bilberry, blueberry, grape, raspberry, blackberry, *Viburnum opulus*, *Rhamnus fallax*, black elder. The size and density of the population is highly variable and depends on the season, weather conditions during the summer months and the availability of suitable fruits. In dry summer 2012, the population was extremely low everywhere, whereas in the rainy season 2014 its abundance was extremely high from early summer onwards, and has caused considerable yield losses of cherries, peaches, strawberries, blueberries and raspberries exceeding 50% in some cases. In the paper, distribution data and population dynamics of SWD in Slovenia will be discussed more in detail and illustrated with diagrams.



Pregled stanja in vzrokov za množičen pojav oljčne muhe (*Bactrocera oleae* Rossi) v Slovenski Istri v letu 2014

Matjaž JANČAR¹, Viljanka VESEL¹, Irena VRHOVNIK¹

¹KGZS Zavod Nova Gorica, Pri Hrastu 18, SI-5000 Nova Gorica
(matjaz.jancar@go.kgzs.si)

Najpomembnejša škodljivka oljk, oljčna muha, se je v letu 2014 pojavila zelo zgodaj in zelo agresivno. Že ob prvem vzorčenju plodov v začetku julija smo zaznali do 60% aktivno poškodovanost oljčnih plodov. Tudi naslednja dva rodova škodljivke sta bila zelo številčna in povzročila veliko škodo. Močna poškodovanost plodov je bila pri večini oljkarjev vzrok za zelo zgodnje pobiranje pridelka, ki se je pričelo že konec septembra. Mnogo oljkarjev je zaradi aktivnosti oljčne muhe ostalo brez celotnega pridelka oljk. Skupna škoda na območju Slovenske Istre je presegla 75% povprečne letne količine pridelanega oljčnega olja. Vzroke za nastalo situacijo, kakršne v zadnjih 30 letih ne pomnimo, gre iskati predvsem v vremenskih razmerah ugodnih za razvoj oljčne muhe in neugodnih za njeno zatiranje. V prispevku so podani podatki o ulovu škodljivke, poškodovanosti plodov in korelaciji med poškodbami in kislostjo oljčnega olja. Podani so tudi vremenski podatki in analizirani vzroki za množičen pojav škodljivke in povzročeno škodo.

ABSTRACT

Overview of the situation and the reasons for the mass presence of olive fly (*Bactrocera oleae* Rossi) in Slovenian Istria in 2014

The most important pest of olive, the olive fly, appeared in the year 2014 very early and aggressively. At first sampling in early June the active damage that was observed was up

to 60%. Also the next two generations of the pest were numerous and caused big damage. Strong damage was the reason most olive-growers started the harvest very early, at the end of September. Many olive-growers due to the activities of the olive fly were left without any harvest. The total damage in the area of Slovenian Istria has exceeded 75% of the average annual quantity of produced olive oil. The reasons for this situation, as we do not recall in the last 30 years, are most likely the weather conditions, advantageous for development of the olive fly and disadvantageous for its suppression. In this paper there is data about catch of the pest, damage of the olives and correlation between damages and acidity of the olive oil. We also present weather data and the reasons for the mass appearance of the insect and caused damage are analysed.



Novo orodje za napovedovanje dinamike fluktuacij populacije oljčne muhe *Bactrocera oleae* (Rossi)

Branko KAVŠEK², Maja PODGORNIK^{1,2}, Damjan JURIČ², Dunja BANDELJ^{1,2}

¹Univerza na Primorskem, Znanstveno-raziskovalno središče Koper, Inštitut za oljkarstvo, Garibaldijska 1, SI-6000 Koper

²Univerza na Primorskem, Fakulteta za matematiko naravoslovje in informacijske tehnologije Koper, Glagoljaška 8, SI-6000 Koper (branko.kavsek@upr.si)

Zaradi dolgotrajnih, dragih in mestno specifičnih poljskih poskusov spremljanja škodljivih organizmov, ki so za kakovostno pridelavo hrane in za oceno negativnega vpliva kmetijstva na okolje na območju Sredozemlja nujno potrebni, so bile aktivnosti projekta SIGMA2 - Čezmejna mreža za sonaravno upravljanje okolja in biotske raznovrstnosti (Evropsko teritorialno sodelovanje, Program čezmejnega sodelovanja Slovenija – Italija 2007-2013) usmerjene v izdelavo napovednega modela za oljčno muho, ki lahko predstavlja učinkovito orodje za varstvo oljk. Kombinacija meritev na terenu in matematičnega modeliranja je učinkovita metoda za razumevanje naravnih procesov, ki lahko različnim vrstam uporabnikov (raziskovalci, pedagogi, tehniki, svetovalci, pridelovalci ...) nudi podporo pri prognozi prisotnosti oljčne muhe v oljčnikih in vnosu fitofarmaceutskih pripravkov v okolje. Izdelava prognostičnega modela za oljčno muho je temeljila na bazi podatkov pridobljenih v obdobju med leti 2005 in 2012 na območju Slovenske Istre, ki pa žal zaradi svoje omejenosti na lokalno območje in kratko obdobje ne zagotavlja dovršene in natančne napovedi. Z nadaljevanjem spremljanja oljčne muhe in testiranjem modela na ostalih območjih bo v prihodnje mogoče razviti inovativno orodje za natančne napovedi prisotnosti oljčne muhe.

ABSTRACT

The new tool for predicting the population fluctuation of the olive fruit fly *Bactrocera oleae* (Rossi)

The need for high quality food production together with the assessment of the negative impact of farming on the environment in the Mediterranean region led to various pest monitoring and control experiments. These experiments are time consuming, costly and locally specific. For these reasons the activities of the SIGMA2 project Cross-border network for the sustainable management and biodiversity (European Territorial Cooperation, CBC Programme Italy-Slovenia 2007-2013) were oriented towards the

development of a prediction model for the olive fruit fly that can represent an effective tool for the preservation of olive trees. The combination of on-site measurements and mathematical modeling is an effective technique for understanding natural processes that can help many end-users (e.g. researchers, teachers, technicians, consultants, growers, etc.) and support prognosis of olive fruit fly presence in olive tree plantations and emission of pesticide in the environment. Our mathematical prognostic model for predicting olive fruit fly presence is based on data gathered in the years 2005 to 2012 in the region of Slovenian Istria. Unfortunately, the limited timespan and a relatively small covered area limit the predictive power and the accuracy of our model. By extending both the timespan and the observed area of the experiment we will be able (in the future) to develop a powerful and innovative tool for accurately predicting the presence of olive fruit fly in olive tree plantations.



Učinkovitost in upravičenost vzpostavljene metode spremljanja oljčne muhe v okviru projekta SIGMA, Interreg IIIA

Maja PODGORNIK^{1,2}, Matjaž JANČAR³, Dunja BANDELJ^{1,2}, Bojan BUTINAR¹,
Milena BUČAR MIKLAVČIČ¹

¹Univerza na Primorskem, Znanstveno-raziskovalno središče Koper, Inštitut za oljkarstvo, Garibaldijska 1, SI-6000 Koper (Maja.Podgornik@zrs.upr.si)

²Univerza na Primorskem, Fakulteta za matematiko naravoslovje in informacijske tehnologije Koper, Glagoljaška 8, SI-6000 Koper

³Kmetijsko gozdarska zbornica Slovenije – Zavod GO, Kmetijsko svetovalna služba Koper, Ulica 15. maja 17, SI-6000 Koper

Dinamika leta oljčne muhe (*Bactrocera oleae* Rossi) se v Sloveniji v okviru strokovnega dela kmetijsko svetovalne službe Koper (KGZS – zavod Nova Gorica) spremlja že od leta 1983. V letu 2005 smo v okviru projekta SIGMA »Inovativni sistem za skupno upravljanje v kmetijskem sektorju in skupna uporaba čezmejne mreže za kmetijsko okoljsko monitoriranje« (Program pobude skupnosti INTERREG IIIA Slovenija-Italija) pristopili k novemu načinu spremljanja oljčne muhe, ki je bil prvotno vzpostavljen v Liguriji (Italija 1999-2001) in Toskani (Italija) v letih 2000 – 2001. Z namenom, da bi ocenili učinkovitost in ovrednotili upravičenost vzpostavljene metode smo za obdobje 2005 – 2014 izvedli analizo pridobljenih podatkov in preučili interakcijo med dinamiko leta oljčne muhe, abiotскими dejavniki okolja (temperatura, padavine, relativna zračna vlaga) ter strategijo zatiranja oljčne muhe določeno v tehnoloških navodilih za integrirano pridelavo sadja. Rezultati analize so potrdili znano dejstvo, da velikost populacije oljčne muhe iz leta v leto niha in je močno odvisna od vremenskih razmer. Zgoraj navedena dejstva in dinamika spreminjanja strategije zatiranja oljčne muhe skozi obravnavan čas kažejo, da je za zagotavljanje učinkovite zaščite pridelka, strategijo zatiranja oljčne muhe potrebno sezonsko prilagajati velikosti populacije in danim vremenski razmeram.

ABSTRACT

The effectiveness and viability of the established method of monitoring the olive fly in the project SIGMA, Interreg IIIA

The flight dynamics of the olive fly (*Bactrocera oleae* Rossi) in Slovenia in the context of professional work of the Koper agricultural advisory service (KGZS – Institute of Nova

Gorica) has been monitored since 1983. In terms of the project SIGMA - "Innovative system for the shared management of agri-environmental monitoring of networks" (Community Initiative Programme INTERREG IIIA Slovenia-Italia) we initiated a new method in 2005 for monitoring the olive fly, which was originally established in Liguria (Italy 1999-2001) and Tuscany (Italy) in 2000-2001. In order to assess the effectiveness and to evaluate the viability of the method, we conducted for the period 2005-2014 an analysis of the data obtained and examined the interaction between the flight dynamics of the olive fly, abiotic environmental factors (temperature, precipitation, and relative humidity) and the strategy of repressing olive fly determined in technological instructions for an integrated fruit production. The results of the analysis have confirmed the fact that the size of the olive fly population varies from year to year and is heavily dependant on weather conditions. The above facts and the dynamics of changing the olive fly repressing strategy through time suggest that in order to ensure the effective protection of crops, we have to adjust the strategy of repressing the olive fly to the size of the population and given weather conditions according to the seasons.



Kljunati oljkov rilčkar *Rhodocyrtus cribripennis* (Desbrochers des Loges, 1869) potrjen tudi v Sloveniji

Matjaž JANČAR

KGZS Zavod GO, Pri hrastu 18, SI-5000 Nova Gorica (matjaz.jancar@go.kgzs.si)

Kljunati oljkov rilčkar *Rhodocyrtus cribripennis* (Desbrochers des Loges, 1869) je v zadnjem desetletju postal zelo pomemben škodljivec oljk v sosednji Hrvaški. Velike škode zaradi škodljivca so bile opažene v letih 2011 in 2013. V letu 2013 se je škodljivec razširil iz južne in srednje Istre tudi v severno. V Sloveniji prisotnosti škodljivca nismo zaznali, na plodovih oljk pa smo opazili posamezne poškodbe, ki bi jih lahko pripisali rilčkarju. Zaradi prisotnosti škodljivca v neposredni bližini slovenske meje smo v letu 2014 pričeli s programom spremljanja navzočnosti škodljivca in v oljčniku v notranjosti Slovenske Istre potrdili prisotnost kljunatega oljkovega rilčkarja. V prispevku je predstavljen škodljivec, rezultati spremljanja, škoda, ki jo povzroča ter možnosti zatiranja.

ABSTRACT

The presence of olive fruit curculio *Rhodocyrtus cribripennis* (Desbrochers des Loges, 1869) confirmed in Slovenia

The olive fruit curculio *Rhodocyrtus cribripennis* (Des Rochers des Loges, 1869) in last decade became a very important pest of olives in neighboring Croatia. Great damage has been observed in 2011 and 2013. In 2013, the pest has spread from southern and central Istria to the north. In Slovenia the presence of the pest was not detected. On olive fruits were observed individual injuries that could be attributed to curculio. Due to the presence of the pest in the immediate vicinity of the Slovenian border in 2014 we began a program of monitoring. We confirmed the presence of olive fruit curculio in olive orchard in inland of Slovenian Istria. This paper presents pest monitoring results, caused damage and possible plant protection measures.



Razširjenost breskove muhe - *Ceratitis capitata* Wiedemann na območju Slovenske in Hrvaške Istre

Mojca ROT¹, Matjaž JANČAR², Mario BJELIŠ³

¹KGZS, Kmetijsko gozdarski zavod Nova Gorica, Goriška 23b, SI-5270 Ajdovščina
(mojca.rot@go.kgzs.si)

²KGZS, Kmetijsko gozdarski zavod Nova Gorica, Ulica 15. maja 17, SI-6000 Koper

³Institute for Plant Protection, Croatian Centre for Agriculture, Food and Rural Affairs, Solin, Croatia

Breskova muha - *C. capitata* Wiedemann (Diptera: *Tephritidae*) spada med svetovno razširjene in gospodarsko pomembne škodljivce. Je zelo polifagna vrsta, ki napada številne sadne vrste. V mediteranskih državah naredi največ škode na citrusih, breskvah, figah in kakiju. Izvira iz Podsaharske Afrike, od koder je bila sredi 19. stoletja zanesena v Evropo. Na območju Severnega Jadrana je prisotna že od sredine prejšnjega stoletja. V Sloveniji je bila najdena prvič leta 1959, v Kopru. Danes je prisotna v vseh mediteranskih in balkanskih državah, Slovenija pa še vedno predstavlja skrajni severni rob njenega pojava. Razširjenosti breskove muhe smo spremljali v letih 2013 in 2014 na različnih lokacijah na območju Slovenske in Hrvaške Istre. V prispevku bo prikazana sezonska dinamika in razširjenost breskove muhe ter seznam gostiteljskih rastlin, na katerih se pojavlja gospodarska škoda.

ABSTRACT

Distribution of Mediterranean fruit fly - *Ceratitis capitata* Wiedemann in the area of Slovenian and Croatian Istria

The Mediterranean fruit fly (Medfly) *Ceratitis capitata* Wiedemann (Diptera: *Tephritidae*) is widespread fruit pest of great economic importance. It is a highly polyphagous species with a wide host range. In Mediterranean countries it is particularly damaging on citrus, peach, fig and persimmon. *C. capitata* originated from Sub-Saharan Africa and it was introduced in Europe in the middle of the 19th century. It has been present in the Northern Adriatic area since the middle of the 20th century. In Slovenia was found for the first time in 1959 in Koper. Today is present in all Mediterranean and Balkan countries, Slovenia represents most northern area of its occurrence. Monitoring of medfly was carried out in years 2013 and 2014 on different locations in the area of Slovenian and Croatian Istria. Seasonal population dynamics and distribution of *C. capitata* are presented in the article. The list of host plants on which the economic damage appears is also included.



Predsezonska priprava pršilnikov v podjetju Sadjarstvo Blanca

Filip VUČAJNK¹, Martin MAVSAR², Gregor LESKOŠEK³, Janko REBERNIK¹, Rajko BERNIK¹

¹Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana
(filip.vucajnk@bf.uni-lj.si)

²KGZS – zavod Novo mesto, Šmihelska c. 14, SI-8000 Novo mesto

³Inštitut za hmeljarstvo in pivovarstvo Slovenije, Cesta Žalskega tabora 2, SI-3310 Žalec

Pred sezono je potrebno preveriti delovanje posameznih elementov na pršilniku, jih popraviti in po potrebi tudi zamenjati. Prav tako je potrebno preveriti obrabo šob in njihov nanos na ciljno površino. Tako bomo dosegli nemoteno delovanje med rastno dobo. V podjetju Sadjarstvo Blanca smo pred sezono pregledali pršilnike. Pri tem smo preverili natančnost delovanja manometra, izmerili hitrost vetra pri puhalu in pretoke šob. V sadovnjaku smo s pomočjo na vodo občutljivih lističev preverili nanos na drevesa jablan. Na ta način smo primerjali različne šobe glede kakovosti nanosa, pri različnih tlakih, hitrostih škropljenja in pri različnih medvrstnih razdaljah. Rezultati vseh preizkusov na pršilnikih bodo predstavljeni v prispevku.

ABSTRACT

Preseason preparation of orchard sprayers in the Sadjarstvo Blanca fruit cultivation undertaking

Each orchard sprayer element needs to be checked, repaired and, if necessary, replaced before the start of the season. In addition, it is necessary to verify nozzle wear and check the spray deposition on the target surface, as this will assure smooth functioning of orchard sprayers during the growth period. In the 'Sadjarstvo Blanca' fruit cultivation undertaking, all orchard sprayers were checked before the season. The checks involved verification of the pressure gauge accuracy, measurement of wind speed on the fan and verification of nozzle flow rate. On the apple trees in the orchard, spray deposition was checked using water sensitive paper. This allowed us to compare various nozzle types in terms of spray deposition quality according to different pressure, spraying speed and inter-row width. The results of all the tests performed on the orchard sprayers are presented in this article.



Laser 240 SC – biotični insekticid za zatiranje plodove vinske mušice (*Drosophila suzukii*)

Primož ŠTEPIC¹, Andrej KOS¹, Drago MAJČEN¹, Marjan KRAGL¹, Boris PARADŽIK²

¹KARSIA, Dutovlje, d.o.o., Poslovalnica Ljubljana, Tržaška 132, SI-1000 Ljubljana
(primoz.stepic@karsia.si)

²Dow AgroSciences WmbH

Plodova vinska mušica (*Drosophila suzukii*) je gospodarsko pomemben škodljivec, ki povzroča škodo na večini sadnih rastlin in tako zmanjšuje kakovost, pridelek in posledično tudi dohodke na kmetijskem gospodarstvu. Škodljivec izhaja iz jugovzhoda Azije in se v zadnjem času širi tudi po celotni Evropi. V Sloveniji so jo prvič opazili v letu 2010, največjo škodo pa je povzročila v letu 2014, predvsem na breskvah in češnjah. V primerjavi z ostalimi mušicami, ki se večinoma naselijo na že poškodovane plodove, pa plodova vinska mušica odlaga svoja jajčeca tudi v zdrave, nepoškodovane plodove. To ji omogoča njena nazobčana leglica, s katero je plodova vinska mušica sposobna predreti lupino plodov. Odlaganje jajčec je najbolj pogosto ravno v času dozorevanja plodov. Zaradi gospodarske škode, ki jo povzroča plodova vinska mušica, je zelo pomembno ustrezno varstvo pred tem škodljivcem. Ena od zelo učinkovitih metod je zatiranje

škodljivca z biotičnim insekticidom LASER 240SC, na osnovi učinkovine *spinosad*. Insekticid LASER 240 SC je naravno pridobljeno sredstvo na osnovi metabolitov, ki se pridobivajo iz fermentacije v naravi prisotnih mikroorganizmov. Sredstvo LASER 240 SC ima dovoljenje za uporabo v ekološki pridelavi, kar potrjuje, da ima zelo ugoden ekotoksikološki profil in je varen za uporabnika. V državah EU, kjer že imajo registracijo sredstva LASER 240SC za zatiranje plodove vinske mušice, se je sredstvo izkazalo za zanesljivo in visoko učinkovito. Prednost pri uporabi ima tudi zaradi kratkih karenčnih dob.

ABSTRACT

Laser 240 SC – biological insecticide for control of spotted wing drosophila (*Drosophila suzukii*)

Spotted wing drosophila (*Drosophila suzukii*), is an economically important pest, causing damage to the majority of fruit species and so reduces the quality, yield and consequently reduces the income on the farm. The pest is arising from Southeast Asia and recently also spreads throughout Europe. In Slovenia, was first observed in 2010, the greatest damage was caused in 2014, especially on peaches and cherries. Compared to other flies, which can lay eggs in already damaged fruits, spotted wing drosophila may lay their eggs in healthy and undamaged fruit. This enables it a serrated ovipositor with which the spotted wing drosophila penetrate the skin of the fruit. The oviposition is most often just in time of fruit ripening. Due to the economic damage caused by the spotted wing drosophila, it is very important adequate protection against this pest. One of the most effective method is the treatment with insecticide LASER 240SC, containing an active substance *spinosad*. Insecticide LASER 240SC is a naturally derived product based on metabolites produced by fermentation of a naturally occurring soil organism. Laser 240 SC is authorized for use in organic production, which confirms that it has a very favourable ecotoxicological profile, and it is safe for the user. In the EU countries that already have registration of LASER 240SC for controlling fruit flies, the product proved to be a reliable and highly efficient. The advantage for use is also very short pre-harvest interval.

Fitofarmaceutska sredstva in splošno

Aktualni izzivi EU registracijskih postopkov

Bojana ZGONEC

TSGE Svetovanje d.o.o., Špruha 19, SI-1236 Trzin (bojana.zgonec@tsgeslovenia.com)

21. oktobra 2009 je bila objavljena Uredba (ES) št. 1107/2009 o dajanju FFS v promet, ki je razveljavila Smernico št. 91/414/EEC. V veljavo je stopila 14.6.2011, v Sloveniji pa je bila objavljena Uredba o izvajanju Uredbe o dajanju FFS objavljena dne 27.10.2011 in je začela veljati naslednji dan po objavi v UL št. 86/2011. Najpomembnejše novosti uvedene s tem zakonodajnim aktom so uvedba kategorije snovi z nizkim tveganjem ter osnovnih snovi, ocenjevanje varoval in sinergistov, uvedba conskih registracij, podaljšanje registracij ob ponovni oceni vsake aktivne snovi v FFS, natančneje opredeljeni in krajši roki za registracijo FFS ter primerjalna ocena FFS, ki vsebujejo snovi kandidatke za zamenjavo. Hkrati je potrebno upoštevati še Uredbo (ES) št. 1272/2008 o razvrščanju, označevanju in pakiranju snovi ter zmesi objavljeno dne 16.12.2008, v skladu s katero je potrebno do 1.6.2015 ustrezno uskladiti in prilagoditi razvrščanje in označevanje FFS.

V sklopu vseh regulatornih zahtev ne smemo pozabiti tudi na ocenjevanje novih aktivnih snovi ter ponovno ocenjevanje obstoječih aktivnih snovi, ki se istočasno odvija na nivoju ES v 4 različnih sklopih t.i. AIR programih 1 do 4. Ali bo ob vseh zahtevah, s katerimi se sooča industrija kakor tudi upravni organi obseg dela v prihodnje še obvladljiv? Ali se bo zaradi zgoraj omenjenih dodatnih ukrepov in bremen za industrijo razvoj novih snovi in mehanizmov delovanja FFS preselil iz Evrope v druge dele sveta? Kakšen vpliv lahko posledično pričakujemo na kmetijstvo v Evropski skupnosti?

ABSTRACT

Current challenges of the EU registration procedures

On 21th October 2009 Regulation (EC) No. 1107/2009 concerning the placing of plant protection products on the market replacing Directive 91/414/EEC was published. Regulation entered into force on 14th June 2011, in Slovenia Regulation about placing plant protection products on the market was published on 27th October 2011 and entered into force next day after the publication in the OJ No. 86/2011. Most important new procedures introduced with this Regulation were low risk substances, evaluation of safeners and synergists, introduction of zonal registrations, prolongation of product registrations with each active substance evaluation, clearly defined and shorter registration deadlines and comparative assessment of formulations containing substances candidates for substitution. At the same time Regulation (EC) No. 1272/2008 on classification, labelling and packaging of substances and mixtures published on 16th December 2008 has to be taken into account. Following this Regulation all mixtures including plant protection products have to be reclassified and labelled until 1st June 2015. It should not be forgotten that at the same time evaluation of new and re-evaluation of existing active substances in 4 groups (AIR 1-4) is taking place. Will the workload that industry and competent authorities will be facing in the future remain manageable at all? Or will as a consequence of above mentioned additional regulatory measures and burdens the development of new subsistence move out of Europe? What consequences can we expect in such case for the EU agricultural sector?



Kemijski povzročitelji hormonskih motenj – kje smo in kam gremo?

Lucija PERHARIČ

Nacionalni inštitut za javno zdravje, Zaloška 29, Si-1000 Ljubljana
(lucija.perharic@nijz.si)

Med kemijske povzročitelje hormonskih motenj (KPHM) spadajo poleg nekaterih zdravil številne naravne in umetne kemikalije: bisfenol A, dioksini, etilni alkohol, fitoestrogeni, ftalati, furani, kofein, kovine, nonilfenoli, nekateri pesticidi, poliaromatski ogljikovodiki, polibromirani difenil etri, poliklorirani bifenili, perfluoro-oktanoična kislina, tributil stanati. KPHM so v zadnjih dveh desetletjih pomembno zaznamovali področje kemijske varnosti tako na strokovni in upravni ravni kot tudi v širši javnosti. Na našem inštitutu to področje spremljamo poldrugo desetletje. Od 2010 kot nacionalni predstavniki aktivno sodelujemo pri pripravi strategije Evropske skupnosti (ES) za KPHM. Na spletni strani Generalnega direktorata za zdravje in varstvo potrošnikov je v zvezi z določitvijo kriterijev za identifikacijo KPHM v kontekstu implementacije zakonodaje za fitofarmacevtska sredstva (FFS) in biocide do 16. 1. 2015 potekala javna razprava, kajti 23. člen Uredbe ES 1107/2009 o dajanju FFS v promet navaja, da osnovne snovi FFS, odobrene za uporabo v ES, same po sebi ne povzročajo motenj hormonskega ravnovesja. Menimo, da so za umestitev snovi med KPHM potrebni prepričljivi dokazi za vzročno povezanost in hormonski način delovanja, torej kjer škodljivi učinek na hormonski sistem ni posledica drugih procesov strupenosti. Relevantnost za človeka se privzame, če ni dokazov o nasprotnem, za bitja v okolju je ključni škodljivi učinek na ravni populacije. Obstoj praga učinka, ne-monotoni odnos med odmerkom in učinkom, morebitni učinki pri odmerkih nižjih od eksperimentalno določenih neškodljivih odmerkov, učinki mešanic in izpostavljenost v ključnih obdobjih občutljivosti so ključne negotovosti. Mednarodno sprejete testne metode so pomanjkljive za ugotavljanje izidov pri nizkih odmerkih oz. v ustreznem razvojnem obdobju ter za ugotavljanje učinkov na druga bitja v okolju. Naštete negotovosti in pomanjkljivosti niso ekskluzivne za KPHM, vendar se o njih najintenzivneje razpravlja ravno v zvezi s KPHM. Vzrok slednjega pripisujemo predvsem vplivom KPHM na plodnost in razvoj ter posledično strahu pred izumrtjem. Zato ostajajo KPHM pomemben naravoslovni in družboslovni izziv.

ABSTRACT

Endocrine disrupting chemicals – where are we and where are we heading?

Besides some medicines, endocrine disrupting chemicals (EDCs) include numerous natural and synthetic chemicals: bisphenol A, dioxins, ethyl alcohol, phytoestrogens, phthalates, furans, caffeine, some metals, nonylphenols, some pesticides, polyaromatic hydrocarbons, polybrominated diphenyl ethers, polychlorinated biphenyls, perfluorooctanoic acid, tributyl stanates. In the last two decades, chemical safety has been significantly marked by EDCs on the professional and the regulatory level, and amongst the general public. Our institute has surveyed the EDCs for 15 years. As national representatives, we have participated in the preparation of the European union (EU) strategy for the EDCs since 2010. In view of the article 23 of the Regulation 1107/2009 concerning the placing of plant protection products (PPP) on the market, which states that basic substances approved in the EU should not have an inherent capacity to cause endocrine disruption, a public consultation on defining criteria for identifying endocrine disruptors in the context of the implementation of the PPP and the biocidal products regulation was open on the website of the Directorate General for Health and Consumer

Protection until 16.1. 2015. We believe that for inclusion of a chemical to EDCs, convincing proofs on casual association and an endocrine mode of action are required; a harmful effect on endocrine system should not be due to other toxic processes. The relevance for humans is adopted if there are no proofs to the contrary; while for wildlife the effect on a population level is critical. The existence of the effect threshold, the non-monotonous dose-effect relationship, possible effects below the experimentally observed adverse effects, effects of mixtures, and exposure during the critical windows of susceptibility are key uncertainties. The internationally accepted testing methods are inadequate for the identification of outcomes at low doses and at the relevant developmental stages, as well as for the identification of effects in wildlife. While the listed uncertainties and inadequacies are not exclusive to the EDCs, the debate on these issues is most intense exactly with EDCs. We believe that this may be due to a fear of extinction in view of the effects on fertility and development. Therefore the EDCs remain an important challenge in the spheres of natural, as well sociological sciences.



Raziskave in ovrednotenje delovanja biopesticidov

Maja RAVNIKAR¹, Jana ERJAVEC¹, Manca PIRC¹, Špela ALIČ¹, Jože BRZIN², Jerica SABOTIČ², Tina NAGLIČ³, Magda TUŠEK ŽNIDARIČ¹, Matjaž PETERKA³, Tanja DREO¹

¹ Nacionalni inštitut za biologijo, Večna pot 111, SI-1000 Ljubljana
(maja.ravnikar@nib.si)

² Inštitut Jožef Stefan, Jamova cesta 39, SI-1000 Ljubljana

³ Center odličnosti za biosenzoriko, instrumentacijo in procesno kontrolo, Tovarniška 26, SI-5270 Ajdovščina

Na trgu je registriranih že kar nekaj biopesticidov, ki nadomeščajo ali dopolnjujejo konvencionalna sredstva. Razvoj naravnih sredstev za varstvo rastlin je še posebej pomemben v primeru, ko ne poznamo učinkovitega sredstva za zatiranje patogenih mikrobov ali škodljivcev ali pa se je razvila odpornost na že uporabljane učinkovine. Za bakterijske bolezni rastlin ni učinkovite kemijske zaščite, zato je razvoj alternativnih načinov zatiranja bolezni, ki bi v prihodnosti lahko bili sestavni del celostnega upravljanja z boleznimi, zelo pomemben. V naravi najdemo številne vire protimikrobnih snovi, kot so na primer rastline, glive in bakterije, zaščito pa lahko nudijo tudi mikroorganizmi sami ter s svojo prisotnostjo preprečujejo razvoj bolezni in celo spodbujajo rast rastlin. Ena od možnosti za zatiranje bakterij so bakteriofagi, virusi, ki specifično napadajo bakterije. Raziskali smo možnost njihove uporabe za zatiranje bakterij mehkih gnilob. Opisali bomo raziskave v katerih proučujemo vpliv ekstraktov višjih gliv (bazidiomicet) oziroma gob na bakterijo *Ralstonia solanacearum*, ki povzroča rjavo gnilobo krompirja in bolezen na številnih drugih gospodarsko pomembnih rastlinah. Prav tako je pomembno spremljanje učinkovitosti raznosa biopesticidov kot bomo opisali na primeru glive *Gliocladium catenulatum* (BCA), ki se uporablja za zatiranje sive plesni, ki jo povzroča gliva *Botrytis cinerea*. Metodo s katero lahko zasledujemo raznos preparata na cvetove jagod s pomočjo čebel, lahko s pridom uporabimo tudi za preverjanje prisotnosti morebitnih ostankov *G. catenulatum* v medu in cvetnem prahu.

ABSTRACT

Research and evaluation of biopesticides

Several biopesticides are already available on the market and complement existing chemical pesticides. Development of biopesticides is especially important in cases where there are no pesticides available or pests have developed resistance to the existing control agents. There is no effective chemical protection available against many bacterial diseases of plants making development of alternative control measures that could in the future represent a viable component of an integrated bacterial disease management all the more important. Natural sources of antimicrobial substances, such as plants, fungi, bacteria and bacteriophages, can prevent disease development and even promote plant growth. In our research we are testing extracts from higher fungi (mushrooms) against quarantine bacterium *Ralstonia solanacearum*, the causative agent of the brown rot disease of potatoes and other economically important plants. The mechanism of the biopesticide application is also important, since application has a direct effect on the efficiency of the protective agent.. We will explain the efficiency of the spread of biocontrol fungus *Gliocladium catenulatum*, which is used for the control of *Botrytis cinerea* on strawberries. Moreover, we have developed a sensitive method for monitoring *G. catenulatum* spread on the strawberry flowers and its residues in the honey and pollen.



Vpogled v uporabo prognostičnih obvestil javne službe za zdravstveno varstvo rastlin na KGZS - zavodu Novo mesto

Karmen RODIČ, Domen BAJEC, Andreja PETERLIN

KGZS – Zavod NM, Služba za varstvo rastlin, Šmihelska c. 14, SI- 8000 Novo mesto
(karmen.rodic@gov.si)

Služba za varstvo rastlin na KGZS – Zavodu Novo mesto posreduje prognostične informacije za varstvo rastlin do svojih uporabnikov prvenstveno preko spletne strani Fito-info. Prva obvestila smo začeli objavljati vzporedno z razvojem službe, leta 2000. Stranke so pridelovalci različnih kmetijskih kultur, od katerih prevladujejo sadjarji in vinogradniki, sledijo jim vrtnarji in poljedelci. Glavna tehnična poudarka sta ažurnost in periodičnost. Vsebinske prilagoditve so namenjene uporabnosti navodil za čim širšo skupino prejemnikov.. Na začetku smo obliko in deloma vsebino prilagajali tehničnim zahtevam ter osnovnim potrebam uporabnikov informacij, kasneje pa se je z vzporednim nadgrajevanjem sistema Fito-info in vzpostavitvijo novega agrometeorološkega spletnega prehoda, pokazala potreba po širši analizi želja uporabnikov. V letu 2014 smo pripravili in ovrednotili vprašalnike 163 pridelovalcev. V vsebini so nas zanimale informacije o obsegu in vrsti njihove pridelave, tehnični opremljenosti, ter dosedanjih praksah dostopa do informacij. Sledilo je poizvedovanje o potrebah, željah in pomanjkljivostih obstoječih obvestil ter priporočenih nadaljnjih usmeritvah.

ABSTRACT

Insight in use of forecasting notices of plant protection service on KGZS – zavod Novo mesto

Plant protection service on KGZS-Zavod Novo mesto provides prognostic information for plant protection to its users primarily through the website Fito-info. The publishing of first notices started in year 2000 when the development of plant protection service has begun. Producers of different agricultural cultures are the main users. Fruit growers and winegrowers are prevailing, followed by gardeners and farmers. The main technical focus is accuracy and periodicity. Conceptual adjustments are aimed to fulfil requirements of wider group of growers. In the beginning the form and content was adapted by the technical requirements and by the basic needs of users. With a parallel upgrading of the system Fito-info and the establishment of new agro-meteorological website showed the need for a wider analysis of the user's wishes. In year 2014 we prepared and evaluated the questionnaires of 163 growers. We were interested in information about the extent and type of their production, technical equipment and current practices of access to information. The survey about the needs, wishes and weaknesses of the existing notices and the recommended guidance were followed.



Zakonodaja na področju biotičnega varstva rastlin: seznamami koristnih organizmov

Simona MAVSAR¹, Stanislav TRDAN²

¹Ministrstvo za kmetijstvo, gozdarstvo in prehrano, Uprava za varno hrano, veterinarstvo in varstvo rastlin, Sektor za zdravje rastlin in rastlinski semenski material, Dunajska 22, SI-1000 Ljubljana (simona.mavsar@gov.si)

²Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI- 1000 Ljubljana

Koristni organizmi, ki se uporabljajo za namen biotičnega varstva rastlin, so lahko domorodne ali tujerodne vrste organizmov, ki jih za ta namen Evropska organizacija za varstvo rastlin (EPPO) uvrsti na t.i. pozitivni seznam. Omenjeni seznam je bil prvič odobren septembra 2001. O reviziji seznama vsako leto odloča Panel za biotično varstvo rastlin (Panel on Biological Control Agents). Koristni organizmi, katerih vnos, gojenje in uporaba je, v skladu s Pravilnikom o biotičnem varstvu rastlin (Uradni list št. 45/06), dovoljena v Republiki Sloveniji, so razvrščeni na Seznam domorodnih vrst organizmov za namen biotičnega varstva rastlin in na Seznam tujerodnih vrst organizmov za namen biotičnega varstva rastlin. Oba seznama (http://www.uvhvvr.gov.si/si/zakonodaja_in_dokumenti/zdravje_rastlin/slovenska_zakonodaja/nadzor_skodljivih_organizmov/bioticno_varstvo_rastlin/) vodi Uprava za varno hrano, veterinarstvo in varstvo rastlin (v nadaljnjem besedilu: Uprava) na podlagi rezultatov raziskav, strokovnih oziroma znanstvenih člankov ali drugih uradnih dokazov in seznama koristnih organizmov Evropske organizacije za varstvo rastlin, standarda za fitosanitarne ukrepe o varni uporabi koristnih organizmov za biotično varstvo rastlin. V prispevku bodo za obdobje 2009-2014 predstavljene nekatere aktivnosti Panela za biotično varstvo rastlin, s poudarkom na reviziji pozitivnega seznama (1 - Tržno dostopni biotični agensi; 2 – Biotični agensi, uspešno vneseni v okviru klasičnega biotičnega varstva, 3 - Biotični agensi, ki jih je EPPO včasih priporočala za uporabo [danes pa ne več]), in aktivnosti domačih raziskovalnih inštitucij (zlasti Oddelka za agronomijo Biotehniške fakultete), ki so s preučevanjem zastopanosti naravnih sovražnikov v Sloveniji omogočili večanje Seznama domorodnih vrst organizmov za namen biotičnega varstva rastlin in s tem možnosti za njihovo implementacijo v sisteme pridelave živeža v Sloveniji. V tej zvezi se je prvotni seznam s 16 vrstami domorodnih naravnih sovražnikov v letu 2008 povečal za dve vrsti entomopatogenih ogorčic (EPO) in enega parazitoida listnih uši, leta 2009 za dve

vrsti EPO, enega parazitoida listnih uši in enega parazitoida ščitkarjev, leta 2011 za parazitoida listnih zavrtalk in leta 2013 za enega plenilca fitofagnih pršic in enega plenilca resarjev.

ABSTRACT

Legislation in the field of biological control: lists of beneficial organisms

Beneficial organisms, which can be used for the purpose of biological control of plant pests, may be indigenous and exotic species of organisms, which the European Plant Protection Organisation include on the positive list. First approved in September 2001. Revisions of the list are each year decided by the Panel on Safe Use of Biological Control. Beneficial organisms, the introduction, rearing and use of which is permitted in the Republic of Slovenia pursuant to Rules on biological control of plant pests (Official Gazette RS No 45/06), shall be classified in the list of indigenous and in the list of exotic species of organisms. The list of indigenous and in the list of exotic species of organisms shall be maintained by the Administration of the Republic of Slovenia for food safety, veterinary sector and plant protection (hereinafter as: the Administration) on the basis of the results of researches, professional or scientific articles or other official evidences, as well as the list of useful organisms of the European plant health organisation, the standard for phytosanitary measures on the safe use of useful biological control agents. The list of indigenous and in the list of exotic species of organisms shall be available at the Administration and on its website:

http://www.uvhvvr.gov.si/si/zakonodaja_in_dokumenti/zdravje_rastlin/slovenska_zakonodaja/nadzor_skodljivih_organizmov/bioticno_varstvo_rastlin/



Pristop k obvladovanju prereznožitve golih polžev iz rodu *Arion*

Vlasta KNAPIČ¹, Marjan VAUPOTIČ²

¹Ministrstvo za kmetijstvo, gozdarstvo in prehrano, Uprava RS za varno hrano, veterinarstvo in varstvo rastlin, SI-1000 Ljubljana (vlasta.knapic@gov.si)

²Ulica generala Maistra 5, SI-9000 Murska Sobota

Nekateri invazivni polži so globalno prepoznani kot pomembni okoljsko in gospodarsko škodljivi organizmi. *Arion vulgaris* Moquin-Tandon, 1855; sin. *Arion lusitanicus* auct. Non-Mabille (Mollusca, Gastropoda, Arionidae) se omenja kot vzorčni primer v dokumentih nove politike Evropske unije (EU) na področju invazivnih tujerodnih vrst (Uredba EU št. 1143/2014), ki ima med drugim namen dopolnjevati fitosanitarno in veterinarsko politiko. Fitosanitarna zakonodaja EU (Direktiva 2000/29/ES), vključuje določbe o organizmih, ki so škodljivi za rastline ali rastlinske proizvode. Prve vrste polžev, ki so regulirani na področju zdravja rastlin, so iz rodu *Pomacea* (Perry). Tropski sladkovodni polž *Pomacea caniculata*, ki izvira iz Južne Amerike, je bil prvič vnesen v Azijo kot potencialni vir proteinske hrane, a je namesto tega postal resen škodljivec v pridelavi riža. Po poročilu Španije o ugotovitvi novega škodljivega organizma *Pomacea insularum*, ki ogroža vodne rastline, je bil na fitosanitarnem področju sprejet prvi nujni ukrep 2012/697/EU proti polžem s prepovedjo vnosa in širjenja polžev iz rodu *Pomacea* (Perry). Tveganje vnosa novih vrst se je zelo povečalo v zadnjih desetletjih zaradi povečanega obsega svetovne trgovine, prometa, turizma in podnebnih sprememb. Oba

sektorja politike pri reguliranju izključujeta naravno širjenje in urejata le tujerodne vrste, vnesene v Unijo kot posledico človekove dejavnosti. Kot podlaga za zakonsko ureditev tujerodnih organizmov je na obeh sektorjih potrebna trdna znanstvena in strokovna podpora, ki lahko oceni tveganje in poda ustrezne predloge ukrepov. V tem prispevku želimo prikazati pomen znanstvene podpore za pravilno uradno ukrepanje na primeru vrste *Arion vulgaris*, ki je bila v srednji, vzhodni in južni Evropi napačno identificirana kot tujerodna vrsta in poimenovana *Arion lusitanicus* Mabille, 1868 (endemična vrsta na Portugalskem). Vrsta, ki smo jo podobno kot drugod po Evropi tudi v Sloveniji opisovali predvsem z imenom španski lazar, je na tem območju – kot kažejo novejša dognanja – avtohtona. Ta vrsta se je v zadnjih desetletjih v Evropi močno namnožila in ponekod predstavlja znatno grožnjo kmetijski pridelavi in hortikulturi. V prispevku so nakazane možnosti pristopa k obvladovanju prerazmnoženih populacij španskih lazarjev na podlagi novo ugotovljene biologije in ekologije ter možnosti za razvoj prognostičnega modela za podporo integriranemu varstvu rastlin.

ABSTRACT

Management approach to abundance of *Arion* slugs

Some invasive molluscs are recognised as the world's important ecological and economic pests. *Arion vulgaris* Moquin-Tandon, 1855; sin. *Arion lusitanicus* auct. Non-Mabille (Mollusca, Gastropoda, Arionidae) is mentioned as a case example in the new EU policy documents on invasive alien species (Regulation 1143/2014/EU), which *inter alia* tends to be complementary to phytosanitary and veterinary policies. EU phytosanitary legislation (Directive 2000/29/EC) includes provisions on organisms which are harmful to plants or plant products. The first mollusc species, regulated in respect to plant health, were from the genus *Pomacea* (Perry). Tropical sweet water snail *Pomacea caniculata*, native to South America, was first introduced to Asia as protein food source but became a serious pest in rice cultivation. After the Spanish report on finding a new harmful organism of *Pomacea insularum* that endangered aquatic plants, a new decision on emergency measures (Decision 2012/697/EU) against genus *Pomacea* (Perry) was adopted by the EU phytosanitary sector, whereby the introduction into and the spread within the Union of the *Pomacea* snails were prohibited. The risk of introduction of new species had intensified through the past decades by the increased global trade, transport, tourism and climate change. Both the policy sectors exclude the natural spread and regulate only species introduced into the Union as a consequence of human activity. As a basis for regulation, both the sectors need sound scientific and technical support for risk evaluation and identification of risk reduction measures. In this paper we are showing the importance of scientific support for proper official action in case of *Arion vulgaris*, which had been misidentified in Central, Eastern and Southern Europe as an alien species and named *Arion lusitanicus* Mabille, 1868 (an endemic species in Portugal). This species, in Slovenia prevalingly presented as the Spanish slug, like in the rest of Europe, is indigenous to this area as proven by recent findings. In the recent decades, Spanish slugs have been locally abundant in Europe, at times posing a significant threat to horticulture and agricultural production. Some management options based on new life history traits of *A. vulgaris*, and the possible prognostic model in support of the integrated pest management are presented.

Varstvo vrtnin

Zatiranje ogorčic koreninskih šišk (*Meloidogyne* spp.) pri pridelavi zelenjave

Polona STRAJNAR, Saša ŠIRCA, Barbara GERIČ STARE, Hans-Josef SCHROERS,
Gregor UREK

Kmetijski inštitut Slovenije, Oddelek za varstvo rastlin, Hacquetova ulica 17, SI-1000
Ljubljana (polona.strajnar@kis.si)

Ogorčice koreninskih šišk (*Meloidogyne* spp., RKN) uvrščamo med ekonomsko najpomembnejše škodljivce med rastlinsko parazitskimi ogorčicami. Napadajo veliko število različnih rastlinskih vrst, eno- in dvokaličnic, zelnate in lesnate rastline. RKN se hranijo in razmnožujejo v rastlinskih koreninah, na katerih posledično povzročajo šiške oz. zadebelitve. Napadene rastline slabše sprejemajo hranila, kar se odraža na kakovosti in količini pridelka. V Sloveniji največ škode povzročajo ogorčice vrste *Meloidogyne incognita* v rastlinjakih, saj za svoj razvoj potrebujejo toplo okolje. Zatiranje ogorčic koreninskih šišk je težavno, še posebno, če je pridelovalec vključen v integrirano ali ekološko pridelavo zelenjave. Ti pridelovalci ne smejo uporabljati nematocidov, ampak samo okolju prijazne strategije varstva rastlin, med katere prištevamo parjenje rastlinjaka, solarizacijo tal, kolobarjenje, sajenje proti ogorčicam odpornih sort zelenjave ter sajenje za ogorčico slabih gostiteljskih oz. negostiteljskih rastlin. S temi metodami ogorčic koreninskih šišk praviloma ne izkoreninimo, ampak samo zmanjšamo njihovo število na raven, ki ne povzroča ekonomske škode. Za razvoj alternativnih metod obvladovanja teh škodljivcev na Kmetijskem inštitutu Slovenije potekajo raziskave mikroorganizmov, ki izkazujejo sposobnost zaščite gostiteljskih rastlin pred ogorčicami koreninskih šišk, določanja novih rastlinskih odpornostnih genov ter preučevanja populacijske dinamike ogorčic koreninskih šišk.

ABSTRACT

Management of root-knot nematodes (*Meloidogyne* spp.) in vegetable production

Root knot nematodes (RKN) are a group of plant parasitic nematodes of major economic importance. They can parasitize numerous higher plant species including monocotyledons, dicotyledons, herbaceous and woody plants. RKN feed and reproduce inside the plant roots which leads to formation of root galls. RKN infested plants absorb less nutrients which results in lower yield quality and quantity. In Slovenia RKN *M. incognita* causes the highest damage in the greenhouses, because of warm conditions that are needed for its reproduction. Eradication of the RKN is very difficult, especially if the grower is included in integrated or organic production of vegetables. These producers may not use nematocides, but may use only environmentally friendly strategies for plant protection, such as steaming of the greenhouses, soil solarization, crop rotation, growing vegetable varieties resistant against nematodes, growing vegetables, which are poor or non-host for nematodes. With these strategies the RKNs are not eradicated completely, but their population is reduced to levels that do not cause economic damage. To develop alternative strategies of protection against RKN investigations the Agricultural Institute of Slovenia are focused on microorganisms, exhibiting the ability of protecting host plants against RNK, on detection of plant resistance genes and determination of RKNs population dynamics.



Preučevanje sočasne uporabe herbicidov z entomopatogenimi ogorčicami (Nematoda: Rhabditida)

Žiga LAZNIK, Stanislav TRDAN

Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana
(ziga.laznik@bf.uni-lj.si)

V laboratorijskem poskusu smo preučili združljivost štirih vrst entomopatogenih ogorčic (*Steinernema* in *Heterorhabditis*) z 8 izbranimi pripravki s herbicidnim delovanjem. Vpliv direktnega izpostavljanja infektivnih ličink (IL) herbicidom smo preverjali po 1, 6 in 24 urah v petrijevkah pri 15, 20 in 25 °C. Rezultati naše raziskave so pokazali, da je bila izmed preučevanih vrst vrsta *S. kraussei* najbolj tolerantna na izbrane herbicide. Vrsta *S. carpocapsae* je bila najbolj občutljiva na delovanje herbicidov v našem poskusu. Odstotek preživelih IL je bil v poskusu največji pri 15 °C (81 %). Največ IL je umrlo v aktivni snovi oksifluorfen (53 %). Aktivna snov 2,4-D na preživetje vrste *S. feltiae* pri 25 °C ni imela vpliva v našem poskusu. Statistična analiza je pokazala, da aktivna snov dikvat dibromid nima vpliva na vrsto *S. kraussei* pri 15 °C. Rezultati naše raziskave so potrdili, da je skladnost EPO s herbicidi vrstno specifična lastnost, na katero vpliva temperatura kot tudi čas izpostavljenosti aktivnemu sredstvu. Sočasna uporaba herbicida in EPO bi lahko predstavljala časovno kot tudi cenovno ugodno rešitev v varstvu rastlin.

ABSTRACT

Testing the simultaneous use of different herbicides and entomopathogenic nematodes (Nematoda: Rhabditida)

In a laboratory experiment we studied the compatibility of four entomopathogenic nematodes (*Steinernema* and *Heterorhabditis*) species with 8 selected plant protection products with herbicidal activity. The influence of direct exposure of infective juveniles (IJs) to herbicides was tested after 1, 6, and 24 hours in Petri dishes at 15, 20 and 25 °C. The study showed that *S. kraussei* proved to be the most tolerant among tested EPN species. The specie *S. carpocapsae* was the most sensitive to all tested herbicides. The percentage of IJs that survived was statistically the highest after 15 °C (81 %). The largest percentage of IJs died in active ingredient oxyfluorfen (53 %). An active ingredient 2,4-D proved to have no effect on *S. feltiae* survival at 25 °C at all times of exposure tested in our investigation. Statistical analyses showed that active ingredient diquat dibromide have no effect on *S. kraussei* survival at 15 °C at all times of exposure. The results confirmed the fact that the compatibility is species specific characteristic, influenced with temperature and time of the exposure to active ingredient. The combination could offer a cost-effective and time saving alternative to pest-weed control.



Pomen glukozinolatov v varstvu križnic (Brassicaceae) pred škodljivci: predstavitev rezultatov domačih raziskav

Tanja BOHINC¹, Stanislav TRDAN²

¹Zgornja Lipnica 9a, SI-4246 Kamna Gorica (tanja.bohinc@gmail.com)

²Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana

Dveletni poljski poskus (2009-2010), v katerem smo preučevali obseg poškodb kapusovih bolhačev (*Phyllotreta* spp.) in kapusovih stenic (*Eurydema* spp.), v odvisnosti od vsebnosti glukozinolatov, smo izvedli na dveh različnih lokacijah. Vsebnost in vpliv glukozinolatov na preučevane žuželke smo analizirali v dveh različnih genotipih zelja, zgodnjem in srednje-poznem, ter v treh vrstah gojenih križnic (oljni redkvi, beli gorjušici in krmni ogrščici). Ugotovili smo, da se je v rastni dobi vsebnost glukozinolatov spreminjala med posameznimi križnicami, kot tudi med posameznimi genotipi iste rastlinske vrste. Med dejavnike, ki vplivajo na vsebnost glukozinolatov v križnicah, uvrščamo tudi okoljske dejavnike ter razvojni stadij rastlin. V prispevku bomo predstavili povezave med obsegom poškodb preučevanih skupin škodljivcev in vsebnostjo glukozinolatov v različnih križnicah, kot tudi med posameznimi genotipi. Izpostavljene bodo razlike v vsebnosti glukozinolatov med posameznimi rastlinskimi deli. Predstavili bomo tudi vpliv okoljskih dejavnikov na vsebnost teh rastlinskih substanc.

ABSTRACT

The role of glucosinolates in protection of brassicas (Brassicaceae) against the pests: presentation of research results from Slovenia

Two-year field experiment (2009-2010), in which we investigated the level of injuries caused by cabbage flea beetles (*Phyllotreta* spp.) and cabbage stink bugs (*Eurydema* spp.) in correlation to glucosinolate content was conducted at two locations in Slovenia. Content and impact of glucosinolates were analysed in two different cabbage genotypes, early and mid-late, and in three different brassicas (oil radish, white mustard and oil rape). We discovered that glucosinolate content differs between different brassicas, as well as between different plant organs. Content of glucosinolates is also influenced by environmental factors and plant's developmental stage. In the presentation we will correlate level of injuries caused by two different cabbage insect groups and glucosinolate content in different brassicas, as well in different genotypes. We will establish differences related to different glucosinolate content in different plant organs. Impact of environmental factors on glucosinolate content will be also presented.



Iskanje inovativnih rešitev za integrirano varstvo pred kapusovo muho (*Delia radicum*) v okviru projekta PURE

Meta URBANČIČ ZEMLJIČ, Kristina UGRINOVIĆ, Špela MODIČ, Jaka RAZINGER, Mojca ŠKOF, Metka ŽERJAV

Kmetijski inštitut Slovenije, Hacquetova ulica 17, SI-1000 Ljubljana (Marjeta.Zemljic-Urbancic@kis.si)

Kapusova muha (*Delia radicum*) spada med nevarne škodljivce kapusnic. Njeno zatiranje je zaradi pomanjkanja učinkovitih insekticidov precej omejeno. V prispevku predstavljamo rezultate poskusov zatiranja kapusove muhe, ki smo jih izvajali v letih 2012 do 2014 v nasadih brokolija in cvetače. Poskusi so potekali v dveh sklopih. V mikro poskusih na raziskovalnem polju v Jabljah smo na majhnih parcelah primerjali insekticidne učinke izbranih ukrepov: zalivanje sadik pred presajanjem s pripravkom na osnovi glive *Beauveria bassiana*, zalivanje s pripravkom Laser 240 SC (a.s. spinosad) in izbranim

izolatom glive *Metarhizium anisopliae*, trosenje apnenega dušika, uporaba slame za zastirko. Postopke, ki so se v mikro poskusih pokazali za bolj obetavne in izvedljive na večjih površinah, smo preizkusili še v tržni pridelavi kapusnic. Učinkovitost posameznih ukrepov na kapusovo muho smo ugotavljali z metodo spiranja korenin in štetja bub ter ocenjevanja poškodb na koreninah po pobiranju pridelka. V vseh poskusih smo najboljše delovanje na kapusovo muho ugotovili pri postopku, kjer smo sadike pred presajanjem zalivali z insekticidom spinosad.

ABSTRACT

Research on innovative solutions for integrated control of cabbage root fly (*Delia radicum*) in the frame of PURE project

Cabbage root fly (*Delia radicum*) is one of the most destructive pests of Brassica crops. Possibilities for its control are limited because of the lack of efficient insecticides. The field trials for cabbage root fly control in broccoli and cauliflower were held in years 2012 to 2014. The trials were carried out in two steps. The insecticide efficacy of different measures was compared in the small scaled field trials, which were held on research station in Jablje. Different treatments were tested: drenching of transplants with insecticide based on fungus *Beauveria bassiana*, drenching of transplants with insecticide Laser 240 SC (a.i. spinosad) and drenching of transplants with selected isolate of fungus *Metarhizium anisopliae*, fertilisation with the lime nitrogen and applying the straw mulch. The most promising measures were also tested on cauliflower production farm. The efficacy of measures applied against cabbage root fly was evaluated by root washing method, counting the numbers of pupae and observing the root damage after harvesting. The most effective measure in all trials was treatment of the transplants with the insecticide spinosad.



Vpliv parametrov aplikacije na oblikovanje depozita škropilne brozge na listju čebule

Marjan SIRK, Mario LEŠNIK, Brigita BRAČKO, Stanislav VAJS

Fakulteta za kmetijstvo in biosistemske vede Maribor, Pivola 10, SI-2311 Hoče
(marjan.sirk@um.si)

Izveden je bil poljski poskus v katerem smo preučevali vpliv parametrov aplikacije in dodajanja močila Break Thru (kopolimer tri-siloksana) na oblikovanje depozita škropilne brozge na površini listja čebule. Značilnosti depozita smo prikazali z uporabo testnih lističev občutljivih za vodo (angl. WSP) in z meritvami koncentracije barvila tartrazin (E102) izluženega s površine listov čebule. Aplikacija škropilne brozge je bila izvedena s standardno poljedelsko škropilnico umerjeno na porabo vode 200 ali 400 l/ha. Testirali smo šobe TeeJet XR 11002, 11004; TeeJet Twin 60 11002, 60 11004 in TeeJet Turbo Twin 60 11002, 60 11004. Statistična analiza je pokazala značilne razlike med depoziti barvila tartrazin, ki so jih različne šobe oblikovale na različnih delih zelenja čebule. Šoba TeeJet Twin je deponirala značilno več barvila na listju čebule, kot druge dve testirani šobi. Povečanje porabe vode iz 200 l/ha na 400 l/ha ni značilno povečalo depozita barvila. Učinek dodajanja močila Break Thru je bil pri različnih šobah različen in je povzročil povečanje depozita na različnih delih listov čebule.

ABSTRACT

Effects of parameters of spray application on spray deposit formation on onion leaves

Field trial was carried out to test the effects of parameters of spray application and of addition of Break Thru trisiloksane based adjuvant on formation and retention of spray deposits on leaf surfaces of onion. Characteristics of spray deposits were visualized by use of water sensitive papers (WSP) and by measurements of concentration of tartrazine dye (E102) extracted from onion leaves. Application of spray was carried out by standard field boom sprayer set to deliver 200 or 400 l of spray per hectare. Nozzles TeeJet XR 11002, 11004, TeeJet Twin 60 11002, 60 11004 and TeeJet Turbo Twin 60 11002 or 60 11004 were tested. Statistical analysis revealed a significant difference between nozzles in terms of the tartrazine deposited at different positions of onion canopy. The TeeJet Twin nozzle deposited significantly more compared to other two tested nozzles. The increase of spray volume from 200 to 400 l/ha did not increase tartrazine deposit significantly. The effect of adding of adjuvant was different at each of tested nozzles. It caused increase of tartrazine deposits at different positions of onion leaves.



Problematika določanja virusov in viroidov v semenih paradižnika

Nataša MEHLE, Ion GUTIERREZ-AGUIRRE, Jure PAPLER, Nejc RAČKI, Maja RAVNIKAR

¹Nacionalni inštitut za biologijo, Oddelek za biotehnologijo in sistemsko biologijo, Večna pot SI-111, SI-1000 Ljubljana (natasa.mehle@nib.si)

Semena paradižnika so lahko vir za številne ekonomsko pomembne povzročitelje bolezni, kot sta na primer virus mozaika pepina (PepMV) in viroid vretenatosti gomoljev krompirja (PSTVd). PepMV in PSTVd sta zelo obstojna in se izredno hitro širita z dotikom ali z okuženim orodjem, zato se lahko okužba ene same rastline, zrasle iz okuženega semena, hitro razširi na druge rastline. Prisotnost PepMV v vzorcu semen ugotavljamo z RT-qPCR (obratno prepisovanje in verižna reakcija s polimerazo v realnem času), s katerim lahko zaznamo eno naravno okuženo seme v vzorcu 5.000 semen (Gutierrez-Aguirre in sod., J. of Virol. Methods, 2009: 46-55). Kot presejalni test uporabljamo RT-qPCR, ki omogoča detekcijo vseh znanih genotipov PepMV. Za potrditev morebitnega odkritja PepMV, pa smo razvili specifične RT-qPCR, ki pomnožujejo druge dele virusnega genoma in s katerimi ločujemo različne genotipe PepMV. V primeru okužbe semen s PSTVd smo s poskusi ugotovili, da lahko z RT-qPCR po Boonham in sod. (J. of Virol. Methods 2004: 139-146) zaznamo eno umetno okuženo seme v vzorcu 3.000 semen. RT-qPCR ni specifičen za PSTVd, zaradi velike podobnosti nukleotidne sekvence PSTVd z drugimi pospiviroidi, ki za razliko od PSTVd niso uvrščeni na evropski karantenski seznam rastlinam škodljivih organizmov. Zato je za nedvoumno potrditev prisotnosti PSTVd potrebno sekvencirati produkt klasične RT-PCR reakcije. Slednja se je v naših poskusih izkazala za manj občutljivo v primerjavi z RT-qPCR. Opisali bomo preizkušanje različnih možnosti koncentriranja RNA iz ekstrakta semen in različne načine ekstrakcije RNA, da bi povečali RNA viroida v vzorcu in s tem omogočili uspešno sekvenciranje in s tem potrjevanje PSTVd.

ABSTRACT

The challenges of detection of viruses and viroids in tomato seeds

Tomato seeds may be a source for the introduction of several plant pathogens that constitute a serious threat for tomato production, e.g. *Pepino mosaic virus* (PepMV) and Potato spindle tuber viroid (PSTVd). PepMV and PSTVd are very stable and easily transmissible either mechanically or by contaminated tools, therefore even a single infected plant, grown from a single infected seed, can rapidly spread the infection to neighboring plants. To assess the presence of PepMV in tomato seeds we use reverse transcription real-time PCR (RT-qPCR) assay that detects as low as one naturally PepMV infected seed among 5000 uninfected seeds (Gutierrez-Aguirre et al., J. of Virol. Methods, 2009: 46-55). To screen for all PepMV genotypes we use a 'universal' RT-qPCR combined with confirmatory RT-qPCR assays that target other genes of PepMV, and simultaneously allow genotype characterization. In the case of PSTVd infected seeds we experimentally confirmed that the RT-qPCR assay by Boonham et al. (J. of of Virol. Methods 2004: 139-146) can detect one artificially infected seed among 3000 uninfected. This assay is not specific for PSTVd, because of the high similarity of PSTVd nucleotide sequence with sequences of other pospiviroids that, unlike PSTVd, are not listed in the European quarantine list of plant pathogens. Therefore, for reliable confirmation of PSTVd in the sample, a sequence of conventional RT-PCR product is required. In our experiments, conventional RT-PCR has been shown to be much less sensitive compared to RT-qPCR. We will describe different efforts to obtain higher concentration of viroid RNA from seed extracts (either by RNA concentration or by using different extraction procedures) which is needed for confirmation of PSTVd by sequencing.



Avtomatsko spremljanje škodljivcev - kje smo in kam gremo

Matej ŠTEFANČIČ

Efos d.o.o., Razdrto 47B, SI-6225 Hruševje (matej.stefancic@efos.si)

Moderni načini obvladovanja škodljivcev v kmetijstvu so učinkoviti le če so primerno uporabljeni. Pri tem pravočasnost igra zelo pomembno vlogo. Zaradi tega je potrebno sprotno in natančno spremljanje populacije škodljivcev kjer nam sistemi za avtomatsko spremljanje škodljivcev lahko bistveno pomagajo. V predstavitvi bomo pokazali trenutno stanje tehnologije, pregledali kako je tako spremljanje uporabljeno pri nekaterih ključnih škodljivcih ter izpostavili nekaj izzivov za tovrstno spremljanje v prihodnosti.

ABSTRACT

Automated pest monitoring - current state and future challenges

Modern pest control measures are efficient only if they are properly applied and right timing is crucial. This require constant and accurate monitoring of pest population and automated insect monitoring systems can provide significant help. Presentation will focus on current state of technology, overview of some of key pests which are being monitored with the help of automation and will highlight some of key challenges which could be addressed in near future.

Varstvo poljščin in krmnih rastlin

Vpliv paše jelenjadi (*Cervus elaphus* L.) na zmanjšanje pridelka in spremembe hranilne vrednosti krme trajnega travinja: izkušnje iz treh ekoloških govedorejskih kmetij na Kočevskem

Stanislav TRDAN¹, Žiga LAZNIK¹, Tomaž SINKOVIČ¹, Breda JAKOVAC STRAJN²,
Gabrijela TAVČAR KALCHER², Andrej UDOVČ¹, Matej VIDRIH¹

¹Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1111 Ljubljana
(stanislav.trdan@bf.uni-lj.si)

²Veterinarska fakulteta, Inštitut za patologijo prehrane, Cesta v Mestni log 47, SI-1000
Ljubljana

Z več kot 60 % prekritostjo z gozdovi je Slovenija tretja najbolj gozdnata evropska država. Posledica tega dejstva je, da velik delež kmetijskih zemljišč meji na gozdove, v gozdu živeče živali pa najdejo na njivah, travnikih, pašnikih in kmetijskih gospodarstvih (silažne bale idr.) kakovostnejšo krmo kot v njihovem osnovnem bivalnem okolju. Pri iskanju hrane in s samim hranjenjem pa lahko divjad povzroči precejšnjo škodo. V Sloveniji sta z naskokom najbolj škodljivi vrsti divjadi na kmetijskih zemljiščih divji prašič (*Sus scrofa*) in navadni jelen (*Cervus elaphus*), pri čemer naš prispevek obravnava izpad pridelka zaradi paše jelenjadi na naravnem travinju na treh ekoloških kmetijskih gospodarstvih. Na omenjeni pojav smo kot prvi na območju južne in srednje Evrope opozorili že v začetku tisočletja, v letu 2002 pa smo na travinju v konvencionalni pridelavi z uporabo železnih kletk dokazali, da na Kočevskem (JV Slovenije) v pasu nekaj 100 m od gozdnega roba jelenjad v povprečju popase do 50 % zelinja, na najbolj izpostavljenih legah pa celo do 80 %. Poljske poskuse, katerih rezultate predstavljamo v pričujočem prispevku, smo v obdobju 2013-2014 izvedli na treh lokacijah (Novi Lazi, Kačji Potok, Stari Breg) na Kočevskem. V obeh letih je poljski poskus potekal od konca prve dekade maja, ko smo na vseh lokacijah prvič nastavili kletke, do 14. oktobra 2013 oz. 3. oktobra 2014, ko smo izvedli zadnjo (tretjo) košnjo. Upoštevač rezultate vseh treh košenj na vseh treh lokacijah ugotavljamo, da je bil povprečni optimalni skupni pridelek zračno suhega travinja na Kočevskem 8,1-8,2 t/ha, skupni izpad pridelka zaradi paše jelenjadi pa je znašal 48-52 % oz. 3,9-4,3 t/ha. Med tremi lokacijami smo potrdili razlike v optimalni produktivnosti naravnega travinja in izpadu pridelka zaradi paše jelenjadi. Signifikantno najmanjši skupni optimalni pridelek zračno suhega travinja (6,7-7,2 t/ha) smo ugotovili v Starem Bregu, kjer smo sicer potrdili največji izpad pridelka zračno suhega zelinja (56-75 % oz. 4-5 t/ha). V Novih Lazih smo ugotovili skupni optimalni pridelek 8,3-9,3 t/ha in 33-40 % (2,7-3,7 t/ha) izpad pridelka, v Kačjem potoku pa skupni optimalni pridelek 7,7-9,6 t/ha in 47-53 % (3,6-5,1 t/ha). Ugotavljamo, da se jelenjad na naravnem travinju na Kočevskem pase prek celega koledarskega leta, a se posledični količinski izpad pridelka med rastno dobo razlikuje; največjo konzumacijsko sposobnost ima jelenjad spomladi (pri prvi košnji smo ugotovili izpad pridelka 1,7-1,9 t zračno suhega zelinja/ha), proti koncu rastne dobe pa se ta zmanjšuje (pri tretji košnji smo ugotovili izpad 0,9 t/ha). Zaradi intenzivnejše rasti rastlin v travni ruši naravnih travnikov v spomladanskem času je bil sicer izpad pridelka prve košnje 38-40 %, pri tretji košnji pa kar 75 %. S florističnim popisom trajnega travinja na vseh treh lokacijah neposredno pred vsako od treh košenj nismo ugotovili pomembnejših razlik med pojavnostjo trav, metuljnic in zeli, njihovimi deleži pokrovnosti in obilnosti, ki so bili sicer zelo variabilni, pa nakazujejo na vrstno in proizvodno siromašnost trajnega travinja na ekoloških govedorejskih kmetijah an Kočevskem. S kemično analizo zelinja v poskusu smo ugotovili, da je bila vsebnost surovih beljakovin na nezavarovanih parcelah v večini primerov večja kot na zavarovanih delih zemljišč, kar

pripisujemo paši jelenjadi, ki z zaporednim odtrgavanjem in odstranjevanjem zelinja pomlajuje travno rušo in posledično sili trave v oblikovanje novih listov. Zaradi velikega izpada pridelka pa je bil pridelek surovih beljakovin in neto energije za laktacijo na delih zemljišč, ki so bili izpostavljeni paši jelenjadi, na vseh lokacijah pri vseh košnjah precej manjši kot na zavarovanih delih. Hranilna vrednost krme je bila na vseh lokacijah slaba in tudi pri prvi košnji ni preseгла 5 MJ/kg sušine, kar pripisujemo predvsem slabi floristični sestavi travinja. V ekonomski analizi smo na podlagi modelnih ocen stroškov ugotovili, da je strošek kmetije za krmo travinja, ob predpostavki, da na kmetiji redijo živino v obsegu kot bi jim to omogočala pridelana krma, zaradi škodbe, ki jo povzroča divjad, višji tako zaradi stroškov pridelave, kot tudi zaradi nakupa potreben krme, ki jim omogoča ohranitev zelenega staleža živali. Ugotavljamo, da se povprečni dodatni strošek na enoto površine giblje med 182 in 344 EUR/ha, razlike pa so posledica različne intenzivnosti paše divjadi na posameznih lokacijah in različne proizvodne sposobnosti travinja. Na podlagi naših večletnih raziskovalnih izkušenj in poznavanja prednosti in slabosti kmetovanja na Kočevskem ugotavljamo, da imamo srečo, da so trajni travniki na Kočevskem, na katerih se od zgodnje pomladi pase jelenjad, pozneje tudi pokošeni. Ob nasprotnem, se bodo zemljišča v prihodnje zelo hitro zarasla.

ABSTRACT

Influence of red deer (*Cervus elaphus* L.) grazing on yield reduction and changes in the chemical composition of grassland forage: experiences from three organic cattle farms in the Kočevje Region

With more than 60 % of forest cover, Slovenia is the third most forest abundant European country. The consequence of this fact is that a large portion of agricultural land borders to forests and animals living in the forest search for feed on arable land, meadows, pastures and farm facilities (round bale silage, flat silage silo) of better quality more intensive as they are doing in their native living environment. When looking for feed and after that also consuming that forage, game can cause considerable damage. In Slovenia far most harmful species of game are wild boar (*Sus scrofa*) and red deer (*Cervus elaphus*) and our paper deals with the yield loss due to red deer grazing on permanent grassland at three organic farms. We were the first group of experts in the area of south and central Europe who draw attention to above mention situation already in the beginning of the millennium and in 2002 we also confirmed on grassland in conventional production with the usage of iron cages that in the Kočevje region (SE of Slovenia) in the belt of some 100 m from the forest edge red deer graze in average up till 50 % of available herbage and at most exposed sites also up to 80 %. Grassland experiments, which results we deliver in a present paper, were conducted in 2013 and 2014 on three locations (Novi Lazi, Kačji Potok, Stari Breg) in Kočevje region. In both years the grassland experiments lasted from the end of the first decade of May, when we on all three locations mounted iron cages for the first time, till October 14 in 2013 and October 3 in 2014, when we carried out the last (third) cut. Considering the results of all three cuts on all three locations we determined that an average optimal yield of dry matter on grassland in Kočevje region was 8.1 to 8.2 t/ha and total yield loss due to red deer grazing accounted from 48 to 52 % or 3.9 to 4.3 t/ha. Between all three locations we also confirmed differences in optimal productivity on permanent grassland and yield loss due to red deer grazing. Significantly the lowest optimal total yield of forage dry matter (6.7-7.2 t/ha) we established in Stari Breg, where we also confirmed the largest yield loss of herbage dry matter (56-75 % or 4-5 t/ha). In Novi Lazi the total optimal yield was 8.3 to 9.3 t/ha and 33-40 % (2.7-3.7 t/ha) was the yield loss and in Kačji Potok we measured 7.7 to 9.6 t/ha of forage dry matter and 47-53 % (3.6-5.1 t/ha) for yield loss. We ascertain that red deer graze on permanent grassland in Kočevje region through the whole calendar year but consequently the yield loss varies

during the growing season with highest forage consumption in spring time (at first cut we determined the yield loss of 1.7 to 1.9 t/ha of dry matter) with its decrease to the end of the growing season (at the third cut we assessed yield loss of 0.9 t/ha of dry matter). But due to the intensive growth of grass sward on permanent grassland in spring period the yield loss at the first cut was 38 to 40 % and at the third cut as far as 75 %. When conducting floristic mapping on sward of experimental plots on permanent grassland at all three locations beforehand each cut we did not established any important differences in abundance and foliage cover of grasses, legumes and herbs. The major output of such surveys was namely indication of species poor grassland on organic cattle farms in Kočevje region. With chemical analysis of sampled herbage in an experiment we determined that the content of crude protein in treatment control was always higher than in treatment protected. This is due to red deer grazing which rejuvenate grass sward with progressive defoliation and removal of herbage and force grasses to form new leaves which also hold the most important part of fodder quality. On the contrary happened to crude fibre, which content was the highest in herbage in treatment protected. Nutritional value of conserved feed at all locations was low as it not reached 5 MJ/kg dry matter even at the first cut. This we attribute to poor floristical composition of studied grassland. In economical analysis which was done on the basis of model price costs we adjudge that costs for feed on farm by presumption that farm breeds livestock in extent which is allowed by the inputs and considering the damage done by wildlife are higher because of primary production costs and feed purchases outside the farm which both lead to the current farm existence. We ascertain that average additional cost per unit of land ranges from 182 to 344 EUR/ha and that differences are consequence of different level of intensity in red deer grazing on individual locations and different production capacity, of grassland. On the grounding of our several years of research experiences and knowing the benefits and weakness of farming in Kočevje region we discovered that as a society we have luck that permanent meadows in Kočevje are, despite the heavy red deer grazing from early spring, later on still cut. On the contrary the land will get abandoned and overgrown by bush vegetation.



Učinkovitost talnih insekticidov za zatiranje ogrcev poljskega majskega hrošča (*Melolontha melolontha* L.)

Anka POŽENEL¹, Mojca ROT², Ivan ŽEŽLINA², Jana ČUK³, Branko CARLEVARIS²

¹KGZS, Kmetijsko gozdarski zavod Nova Gorica, Goriška 23b, SI-5270 Ajdovščina
(anka.pozenel@go.kgzs.si)

²KGZS, Kmetijsko gozdarski zavod Nova Gorica, Pri hrastu 18, SI-5000 Nova Gorica

³KGZS, Kmetijsko gozdarski zavod Nova Gorica, Rutarjeva 35, SI- 5220 Tolmin

Preizkušanje učinkovitosti insekticidov za zatiranje ogrcev majskega hrošča smo izvajali v letih 2012-2014 v Črnem vrhu nad Idrijo. Na tem območju so bile v zadnjih 10 letih 3 prerazmnožitve poljskega majskega hrošča *M. melolontha* L.. Ogrci majskega hrošča so ponekod popolnoma uničili travno rušo in povzročili veliko gospodarsko škodo. Tri zaporedna leta smo v poljskih poskusih preverjali učinkovitost talnih insekticide v granulirani obliki na osnovi aktivnih snovi klorpirifos in teflutrin. Rezultati so pokazali, da imajo talni insekticidi statistično značilen vpliv na zmanjšanje populacije ogrcev v tleh. Število ogrcev se je najbolj zmanjšalo po aplikaciji teflutrina (za 81%). Učinkovitost insekticidov je bila zelo odvisna od vremenskih razmer po aplikacije in razvojnega stadija ogrcev med aplikacijo. Najboljše rezultate smo dobili v zadnjem letu preizkušanj, v letu

2014, ko so bili ogrci v L2 razvojnem stadiju in je po aplikaciji insekticidov padla zmerna količina padavin. Teflutrin v odmerku 13 kg/ha je imel 80 % učinkovitost, klorpirifos v odmerku 15 kg/ha pa 68% učinkovitost.

ABSTRACT

The efficacy of soil insecticides in the control of Common Cockchafer (*Melolontha melolontha* L.) grubs

Testing the efficacy of insecticides was carried out in the years 2012-2014 in Črni Vrh nad Idrijo. Three outbreaks of the Common Cockchafer (*M. melolontha* L.) occurred in last ten years in this region. A great number of grubs completely destroyed the turfgrass in some locations and caused significant economic damage. Granular soil insecticides based on active substances teflutrin and chlorpyrifos were tested in the field trials in three consecutive years. The results showed a statistically significant impact of soil insecticides in reduction of *M. melolontha* population. The number of grubs in the soil decreased the most after teflutrin application (up to 81%). The results of the trails also showed that the efficacy of soil insecticides depends on weather conditions after the application and on grub development stage during the application. The best results were obtained in the last year, in 2014, when the grubs were in L2 stage and after the application a moderate rainfall has dropped. The efficacy of teflutrin applied at dose rate 13 kg/ha was 80%, and the efficacy of chlorpyrifos at dose rate 15 kg /ha was 68%.



Spremljanje razširjenosti pokalic (Elateridae) v Sloveniji s feromonskimi vabami

Iris ŠKERBOT¹, Magda RAK CIZEJ², Igor ŠKERBOT¹, Silva KUHARIČ GRABOVAC³, Simon ARNŠEK³

¹KGZS-Zavod CE, Trnoveljska cesta 1, SI-3000 Celje (iris.skerbot@ce.kgzs.si)

²Inštitut za hmeljarstvo in pivovarstvo Slovenije Žalec, Cesta Žalskega tabora 2, SI-3310 Žalec

³Syngenta Agro d.o.o., Kržičeva 3, SI-1000 Ljubljana

Strune, ličinke hroščev pokalic, so nevarni škodljivci številnih kmetijskih rastlin. V letih od 2009 do 2014 smo s pomočjo feromonskih vab spremljali pojavljanje hroščev pokalic na območju Slovenije. Spremljanja poljske pokalice (*Agriotes lineatus*), motne pokalice (*Agriotes obscurus*), solatne pokalice (*Agriotes sputator*), žitne poklice (*Agriotes ustulatus*) ter vrst *Agriotes brevis* in *Agriotes rufipalpis* so potekala v posevkih koruze, krompirja, hmelja in vrtnin. V prispevku bodo predstavljeni rezultati spremljanja in podane nadaljnje usmeritve.

ABSTRACT

Monitoring of click-beetles (Elateridae) distribution in Slovenia using pheromone traps

Wireworms, larvae of click-beetles, are the most dangerous pests on many field crops. In the years between 2009 and 2014 we monitored the click-beetles with the pheromon traps in Slovenia. Monitoring of click-beetles *Agriotes lineatus*, *Agriotes obscurus*, *Agriotes sputator*, *Agriotes ustulatus*, *Agriotes brevis* and *Agriotes rufipalpis* were done in the

maize, potatoe, hop and vegetable field. The article presents results of the implementations measures and indicates further guidelines.



Uporabnost prognostičnega modela za napovedovanje koruznega hrošča (*Diabrotica v. virgifera*) in vpliv kolobarja na naraščanje njegove populacije v Sloveniji

Špela MODIC, Jaka RAZINGER, Matej KNAPIČ, Gregor UREK

Kmetijski inštitut Slovenije, Oddelek za varstvo rastlin, Hacquetova 17, SI-1000 Ljubljana
(spela.modic@kis.si)

Koruzni hrošč *Diabrotica v. virgifera* LeConte (Coleoptera, Chrysomelidae) izvira iz Srednje Amerike in ga uvrščamo med najbolj nevarne škodljivce koruze. V Sloveniji smo ga prvič ugotovili leta 2003 na območju Prekmurja in Podravja kot tudi na Goriškem. Od takrat dalje se škodljivec nezadržno širi in v letu 2009 je bil hrošč ugotovljen večinoma na vseh nadzorovanih lokacijah po državi. Velikost in širjenje populacije koruznega hrošča v posameznem letu sta v največji meri odvisna od okoljskih dejavnikov, med katerimi je, poleg vremenskih razmer (temperatura, padavine, suša), še posebno v ospredju delež površin, kjer se koruza prideluje kot monokultura oziroma v neustreznem kolobarju. Na osnovi večletnih podatkov o ulovu koruznega hrošča smo preverili prognostični model za napovedovanje začetka izleganja hroščev v štirih različnih pridelovalnih območjih koruze v Sloveniji (Gorenjska, Štajerska, Prekmurje in Primorska). Pomen uporabe takšnih modelov se kaže v določanju optimalnih rokov rabe insekticidov, ki omogoča njihovo racionalno rabo. Poleg prognostičnega modela smo preverili vpliv pridelovanja koruze v neprimernem kolobarju na obseg naraščanja populacije koruznega hrošča.

ABSTRACT

Applicability of the prognostic model to predict the western corn rootworm (*Diabrotica v. virgifera*) and influence of crop rotation to increase of WCR population in Slovenia

The western corn rootworm (WCR), *Diabrotica v. virgifera* LeConte (Coleoptera, Chrysomelidae) is a pest which originates in Central America and causes considerable economic damage to maize *Zea mays* (L.). Its presence in Slovenia was first reported in 2003 in the northeast (Prekmurje, Pomurje) and west of Slovenia (Gorica). In 2009 the entire territory of Slovenia was officially declared an infested area. The size and the spread of the WCR population in individual year depends on environmental factors, among which, in addition to weather conditions (temperature, precipitation, drought), worth mentioning is a share of areas where maize is grown as a monoculture or in an improper crop rotation. Based on several years of data on catches of WCR, we have checked a prognostic model for predicting the beginning of the hatching of adults of WCR in four different regions where maize is grown in Slovenia (Gorenjska, Štajerska, Prekmurje in Primorska). The importance of the use of such models is reflected in the determination of the optimal time limits of the use of insecticides, which allows for their rational use. In addition to the prognostic model, we have examined the impact of growing maize in an improper rotation on the increase in the WCR population.



Ocena škodljivosti nekaterih še ne razširjenih vrst rodu *Ambrosia* za kmetijsko pridelavo Slovenije

Mario LEŠNIK, Stanislav VAJS

Fakulteta za kmetijstvo in biosistemske vede Maribor, Pivola 10, SI-2311 Hoče
(mario.lesnik@um.si)

Na podlagi pregleda literature, nadzorovanega gojenja rastlin v posodah in izvajanja herbicidnih poskusov je bila opravljena ocena škodljivosti nekaterih novih vrst invazivnih plevelov iz rodu *Ambrosia*. V delu so obravnavane naslednje vrste: *A. acanthicarpa* Hook, *A. grayi* (A. Nels.) Shinnars, *A. maritima* L., *A. psyllostachya* D.C. = *A. coronopifolia* Torr. & A. Gray, *A. confertiflora* DC., *A. tenuifolia* Spreng., *A. tomentosa* Nutt. in *A. trifida* L. Zelo verjetno se vse preučevane vrste, glede na lokalne klimatske značilnosti in splošno tehniko pridelovanja kmetijskih rastlin, lahko trajno ohranjajo na ozemlju Slovenije. Kot najbolj škodljiva za kmetijsko pridelavo se kaže vrsta *A. trifida*, kot vrsta z največjim ekosistemskim vplivom pa vrsta *A. confertiflora*. Vse vrste omenjene v raziskavi je potrebno uvrstiti na listo karantenskih vrst za Republiko Slovenijo.

ABSTRACT

Noxiousness evaluation of some not yet widespread species of the genus *Ambrosia* for the agricultural production in Slovenia

The noxiousness status of some new invasive species from the *Ambrosia* genus in Slovene agricultural production was established based on an analysis of literature sources, plant cultivation in containers under controlled conditions and the performance of herbicide trials. The following species were studied: *A. acanthicarpa* Hook, *A. grayi* (A. Nels.) Shinnars, *A. maritima* L., *A. psyllostachya* D.C. = *A. coronopifolia* Torr. & A. Gray, *A. confertiflora* DC., *A. tenuifolia* Spreng., *A. tomentosa* Nutt. in *A. trifida* L. It is very likely, depending on the characteristics of local climate and the general techniques of cultivation in agricultural crops, that all studied species have the potential for permanently developing on the territory of Slovenia. *A. trifida* was recognised as the species with the highest level of noxious effects in agricultural production systems and *A. confertiflora* as the species with the highest level of ecosystem threat. All studied species need to be put on the list of quarantine noxious weeds in Slovenia.



Virusi rumene pritikavosti žit in virus rumene pritikavosti pšenice na žitih v Sloveniji

Mojca VIRŠČEK MARN, Irena MAVRIČ PLEŠKO, Meta ZEMLJIČ URBANČIČ

Kmetijski inštitut Slovenije, Oddelek za varstvo rastlin, Hacquetova 17, SI-1000 Ljubljana (Mojca.Marn@kis.si)

Virusi, ki povzročajo rumeno pritlikavost žit (yellow dwarf viruses, YDVs), in virus rumene pritlikavosti pšenice (*Wheat dwarf virus*, WDV) lahko povzročijo občutne izgube pridelka vseh vrst žit. V letu 2012 so v sosednji Avstriji potrdili okužbe žit z virusom rumene pritlikavosti pšenice na 10.000 hektarih. Ocenili so, da so ob zgodnjih spomladanskih okužbah izgube pridelka znašale do 50%. V letu 2014 smo zato v okviru strokovnih nalog analizirali 40 vzorcev pšenice in 20 vzorcev ječmena iz skupno 16 lokacij na navzočnost WDV in treh virusov, ki povzročajo rumeno pritlikavost žit: *Barley yellow dwarf virus-PAV* (BYDV-PAV), *Barley yellow dwarf virus-MAV* (BYDV-MAV) in *Cereal yellow dwarf virus-RPV* (CYDV-RPV). Navzočnost slednjih smo v vzorcih ječmena, pšenice in ovs testirali že v letu 2007, Kus in sodelavci pa v ozimnem ječmenu v drugi polovici 90. let. Rezultati kažejo, da so v Sloveniji navzoči virusi, ki povzročajo rumeno pritlikavost žit, WDV pa v Sloveniji za sedaj še nismo potrdili. V prispevku predstavljamo posamezne viruse, rezultate testiranja in možnosti za omejevanje širjenja teh virusov in škod zaradi okužb.

ABSTRACT

Wheat dwarf virus and yellow dwarf viruses in cereals in Slovenia

Yellow dwarf viruses (YDVs) and *Wheat dwarf virus* (WDV) can cause severe losses in cereals. In neighbouring Austria WDV infections were confirmed on 10.000 hectares in 2012. When infections occurred in early spring estimated yield losses were up to 50 %. A small scale survey was therefore initiated in Slovenia in 2014. 40 samples of wheat and 20 samples of barley were collected on 16 locations. The samples were tested for the presence of *Wheat dwarf virus* and three YDVs: *Barley yellow dwarf virus-PAV* (BYDV-PAV), *Barley yellow dwarf virus-MAV* (BYDV-MAV) and *Cereal yellow dwarf virus-RPV* (CYDV-RPV). The presence of the last three viruses in Slovenia was already tested for in 2007 in wheat, barley and oats and in the late nineties in winter barley. Results show that YDVs are present in Slovenia, whereas the presence of WDV was not confirmed. Viruses, results of testing and possibilities for control of their spread and losses caused in Slovenia will be shown in the presentation.



Project CornProtect

Herfried NEUMEISTER

Agria GmbH, Europark 1, 412 Allerheiligen, Austria (h.neumeister@agria.com)

CornProtect is a biological plant protection product against the pest *Diabrotica virgifera virgifera*, based on the mating disruption method. Pheromones of the female *Diabrotica* are added on a special mineral as carrier and sprayed over the whole maize field. The pheromones are emitted continuously over 8-10 weeks, preventing the mating of the beetles and the development of larvae in the next year. The advantages are the easy application, the high effectiveness, the long efficiency period and the prevention of negative effects on the environment. By application of CornProtect every year and a crop rotation of 75 % maize, economic harvest losses can be prevented.

IZVLEČEK

Projekt CornProtect

CornProtect je naravni pripravek za varstvo rastlin, namenjen zatiranju koruznega hrošča (*Diabrotica virgifera virgifera*), ki temelji na metodi zbeganja. V pripravku je feromon samice koruznega hrošča nanosen na posebni mineralni nosilec. Pripravek se na njivo s koruzo nanaša kot škropivo. Iz pripravka se kontinuirano izloča feromon 8-10 tednov in na ta način preprečuje parjenje odraslih osebkov, s tem pa tudi pojav ličink v prihodnjem letu. Prednosti pripravka CornProtect so enostaven nanos, visoka in dolgotrajna učinkovitost ter dejstvo, da nima negativnih vplivov na okolje. Z vsakoletnim nanosom pripravka CorProtect in s kolobarjem, ki vsebuje 75 % koruze, je mogoče preprečiti izpad pridelka zaradi ličink koruznega hrošča.



Ocena škodljivosti nekaterih še ne razširjenih vrst rodu *Solanum* za kmetijsko pridelavo Slovenije

Mario LEŠNIK, Stanislav VAJS

Fakulteta za kmetijstvo in biosistemske vede Maribor, Pivola 10, SI-2311 Hoče
(mario.lesnik@um.si)

Na podlagi pregleda literature, nadzorovanega gojenja rastlin v posodah in izvajanja herbicidnih poskusov je bila opravljena ocena škodljivosti nekaterih novih vrst invazivnih plevelov iz rodu *Solanum*. V delu so obravnavane naslednje vrste: *S. carolinense* L., *S. chenopodioides* Lamarck, *S. furcatum* Dunal, *S. elaeagnifolium* Cav., *S. rostratum* Dunal, *S. sarrachoides* Sendtn. = *S. physalifolium* Rusby, *S. viarum* Dunal, *S. sisymbriifolium* Lam. in *S. triflorum* Nuttall. Zelo verjetno se večina preučevanih vrst, glede na lokalne klimatske značilnosti in splošno tehniko pridelovanja kmetijskih rastlin, lahko trajno ohranjajo na ozemlju Slovenije. Kot najbolj škodljivi za kmetijsko pridelavo se kažeta vrsti *S. carolinense* in *S. rostratum*. Preučevane vrste so vmesni gostitelji gospodarsko pomembnih virusov in bakterij, ki povzročajo velike izgube pridelka pri gojenih razhudnikovkah. Vse je potrebno uvrstiti na listo karantenskih plevelnih vrst za Republiko Slovenijo.

ABSTRACT

Noxiousness evaluation of some not yet widespread species of the genus *Solanum* for the agricultural production in Slovenia

The noxiousness status of some new invasive species from the *Solanum* genus in Slovene agricultural production was established based on an analysis of literature sources, plant cultivation in containers under controlled conditions and the performance of herbicide trials. The following species were studied: *S. carolinense* L., *S. chenopodioides* Lamarck, *S. furcatum* Dunal, *S. elaeagnifolium* Cav., *S. rostratum* Dunal, *S. sarrachoides* Sendtn. = *S. physalifolium* Rusby, *S. viarum* Dunal, *S. sisymbriifolium* Lam. in *S. triflorum* Nuttall. It is very likely, depending on the characteristics of local climate and the general techniques of cultivation in agricultural crops, that all studied species have the potential for permanently developing on the territory of Slovenia. *S. carolinense* and *S. rostratum* were recognised as the species with the highest level of noxious effects in agricultural production systems. All studied species are important hosts of viruses and bacteria that cause significant losses of solanaceous crop yields. All studied species need to be put on the list of quarantine noxious weeds in Slovenia.



Ciljno zatiranje plevela s pomočjo Sistema za podporo pri odločanju – dvoletne izkušnje z zatiranjem plevela v koruzi

Robert LESKOVŠEK, Igor ZIDARIČ, Gregor UREK

Kmetijski inštitut Slovenije, Hacquetova ulica 17, SI-1000 Ljubljana
(robert.leskovsek@kis.si)

Učinkovita raba fitofarmaceutskih sredstev na podlagi preseženih pragov gospodarske škodljivosti je temelj trajnostnega varstva rastlin. Tudi smernice uravnavanja plevelne vegetacije po načelih integriranega zatiranja plevelov se razvijajo v smeri ciljnega zatiranja plevelnih populacij, saj se vrste razlikujejo po občutljivosti na določene vrste herbicidov, kakor tudi škodi, ki jo povzročajo v gojenih rastlinah. Eno izmed orodij, razvitih v okviru projekta PURE, je generični model za podporo pri odločitvah kemičnega zatiranja plevela. Sistem kvantificira dejanske količine herbicidov potrebnih za učinkovito zatiranje plevelnih vrst ob hkratnem ohranjanju višine pridelka. Slovenska verzija sistema je sestavljena iz štirih prototipov, v podatkovno bazo pa je vključenje 19 herbicidov in 17 plevelnih vrst v koruzi. V letih med 2013 in 2014 smo na površinah Kmetijskega inštituta v Jabljah pri Mengšu izvajali poljska testiranja izbranih prototipov. Poskus je bil zasnovan po metodi naključnih blokov in je bil vsako leto izveden na dveh lokacijah. Pri tem smo na podlagi ocenjevanja gostote in razvojne faze plevelov na poskusnem polju s pomočjo sistema za podporo pri odločanju v obravnavanju vključili štiri najučinkovitejše in najcenejše kombinacije herbicidov in njihovih kombinacij. Na podlagi dvoletnega preizkušanja smo ugotovili, da sta dva izmed štirih prototipov pokazala visoko stopnjo učinkovitosti ocenjeno 7-8 tednov po aplikaciji, kakor tudi rezidualnega delovanja, kjer smo ocenjevali pokrovnost plevelov ob koncu rastle sezone v koruzi. Kljub nekoliko nižji učinkovitosti dveh testiranih prototipov, le-ta ni bistveno vplivala na višino pridelka. Dobre rezultate učinkovitosti delovanja smo ugotovili tudi v obravnavanjih z najcenejšimi pripravki, vendar je bila ugotovljena višja variabilnost v stopnji učinkovitosti. Pri večini obravnavanj smo ugotovili za 20-40 % nižje vrednosti kvocienta med uporabljenimi in registriranimi odmerki v eni rastni sezoni (treatment frequency index-TFI), kar pomeni občutno zmanjšanje obremenitve okolja v smislu zmanjšanja količin uporabljenih herbicidov. Naši preliminarni izsledki nakazujejo veliko uporabno vrednost sistema za podporo pri odločanju, vendar bo potrebna nadaljnja optimizacija in dodatna preizkušanja izbranih prototipov pred vpeljavo sistema v prakso.

ABSTRACT

Site specific weed management with Decision support system- two years experience with weed control in maize

Decreased inputs of plant protection products and its longterm sustainable use is often based on the economic threshold levels. In the integrated weed management approach site specific weed control measures should be considered, since weed species greatly differ in their susceptibility to herbicides and their ability to compete with the crop. Within the PURE project, a generic decision support system model for chemical weed control in maize was recently developed. The model quantifies the actual herbicide rate needed to

sufficiently control the weed species without causing any yield losses. In the slovenian version of the model 19 herbicides and 17 weed species were included. In the years 2013-2014 field validation of selected prototypes was carried out at the experimental station of Agricultural institute of Slovenia in Jablje, Mengeš. Field experiments were arranged in the random block design and conducted at two sites in each year. In the first step, the actual need for weed control was assessed with generic decision support system. Secondly, specific herbicide treatments and their rates were calculated on the basis of field scouting, where weed densities and their growth stages were identified. Two years of validation trials showed that two out of four tested prototypes displayed very high level of weed control at 7-8 weeks after treatment as well as residual efficacy, where final weed cover was assessed at the end of the growing season. Decreased efficacy was observed in two tested prototypes, however no significant yield losses in maize were determined. Some of the cheapest herbicide treatments displayed adequate level of weed control, however very high variability in their performance was observed. Significant 20-40 % reduction in terms of TFI (treatment frequency index) was observed in all of the treatments, indicating large reduction in herbicide inputs. Our preliminary testing indicate, that decision support system displayed high potential to reduce herbicide inputs but further optimisation and validation of selected prototypes will be needed before its implementation into practice.



Vpliv termina aplikacije in znižanih odmerkov na učinkovitost izbranega herbicida v koruzi

Igor ZIDARIČ, Robert LESKOVŠEK

Kmetijski inštitut Slovenije, Hacquetova ulica 17, SI-1000 Ljubljana (igor.zidaric@kis.si)

Sodobne smernice varstva rastlin temeljijo na ciljni in strokovno upravičeni rabi fitofarmaceutskih sredstev, kjer so v ospredju prizadevanja za zmanjšanje njihovega vnosa in s tem manjše obremenitve okolja in z njim povezanega tveganja za zdravje ljudi. Obstajajo dvomi ali lahko z znižanimi odmerki herbicidov dovolj učinkovito vplivamo na razvoj in zmanjšanje populacije plevelov brez izgub pridelka. V okviru integriranega pristopa pri zatiranju plevelov v koruzi smo preučevali možnosti uporabe znižanih odmerkov izbranega herbicida uporabljenega v dveh različnih terminih. V ta namen smo v letih 2013 in 2014 na poskusnem polju v Jabljah pri Mengšu zasnovali poskus po EPPO smernicah in proučevali učinkovitost delovanja herbicida Adengo (izoksaf lutol 225 g/l in tienkarbazon metil 90 g/l) pri zatiranju naravne plevelne populacije v posevku koruze. Poljski poskus se je obe leti izvajal na dveh njivah. Vsi poskusi so vključevali 3 odmerke (100 %, 75 % in 50 % polnega odmerka) herbicida, ki smo ga uporabili pred vznikom (BBCH 00 – 11) in zgodaj po vzniku (BBCH 12 – 13) koruze. Učinkovitost delovanja herbicida je bila ocenjena dvakrat po vizualni metodi. Prvo ocenjevanje smo opravili 3-4 tedne, drugo pa 6-8 tednov po aplikaciji. V obeh letih preizkušanja smo ugotovili visoke skupne učinkovitosti zatiranja plevelov, saj so bile ocenjene vrednosti pri večini postopkov nad 95 %. Na obravnavanjih, kjer smo herbicid uporabili zgodaj po vzniku koruze, se učinkovitost delovanja ni zmanjšala v primerjavi z uporabo pred vznikom koruze. Primerjava postopkov z različnimi odmerki je pokazala, da ni bilo signifikantnih razlik v učinkovitosti pri 100 % in 75 % odmerku, smo pa ugotovili nekoliko slabše delovanje, kadar smo uporabili le polovični odmerek. Na podlagi rezultatov pridobljenih s poljskimi

poskusi lahko trdimo, da lahko v razmerah zmerne zapleveljenosti učinkovito uravnavamo plevelno vegetacijo tudi z znižanimi odmerki testiranega herbicida.

ABSTRACT

The effect of reduced doses and application timing on efficacy of selected herbicide in maize

Current plant protection guidelines are based on targeted use of pesticides with the objective to reduce pesticide inputs and related risks to the environment and human health deriving from their use. There are doubts whether with reduced doses of herbicides weed can be sufficiently suppressed without loss of the crop. According to the principles of integrated weed management, efficacy of reduced doses of selected herbicide used at two different application timing was studied in maize. Two field trials on two sites were conducted in years 2013 and 2014 at the experimental located in Jablje, Mengeš. Standard herbicide Adengo (isoxaflutole 225 g/l in tienkarbazon methyl 90 g/l) was selected for suppression of natural weed population in maize. Three different doses (100%, 75% and 50% of full dose) of tested herbicide were used in two different timing of application. One application was before emergence (BBCH 00 – 11) and other early after emergence (BBCH 12-13) of the maize. Efficacy of herbicide has been assessed by a visual method; the first evaluation was done 3-4 weeks after application, and the second 6-8 weeks after application. In general all treatments displayed high level of weed control with total efficacies in most of the treatments exceeded 95 % in both years. In the early post treatments, level of weed control in maize was not reduced compared to the pre-emergence treatments. There was also no significant difference in efficacy between the registered dose (100%), compared to the reduced, 75% dose. Further decrease in herbicide rate resulted in a decreased efficacy in treatments where only 50 % of the registered dose was applied. Results of the two years field study indicate that in a moderate weed pressure conditions, reduced doses of selected herbicide can be recommended and will provide sufficient level of weed control.



Učinkovitost herbicidov za zatiranje novih invazivnih plevelov v posevkih soje

Stanislav VAJS¹, Mario LEŠNIK¹, Jože MIKLAVC², Boštjan MATKO², Miroslav MEŠL²

¹Fakulteta za kmetijstvo in biosistemske vede Maribor, Pivola 10, SI-2311 Hoče
(stanislav.vajs@um.si)

²Kmetijsko gozdarska zbornica Slovenije, Kmetijsko gozdarski zavod Maribor, Vinarska 14, SI-2000 Maribor

V poljskem poskusu smo v letu 2014 v posevku soje preučevali biotično učinkovitost herbicidov za zatiranje tujerodnih invazivnih plevelov. Poskus je bil zasnovan v bločni zasnovi z 9 obravnavanji (herbicidnimi programi) v štirih ponovitvah. Aplikacija herbicidov je bila izvedena z nahrbtno škropilnico na stisnjen zrak v dveh različnih terminih. Poraba škropilne brozge je znašala 350 l ha⁻¹. Izvedeni sta bili dve ocenjevanji biotične učinkovitosti izbranih herbicidnih kombinacij na invazivne plevele iz rodov *Ambrosia*, *Amaranthus*, *Iva*, *Datura*, *Sida*, *Bidens*, *Solanum* in *Ipomea*. Prikazani so podatki o učinkovitosti posameznih mešanic herbicidov za zatiranje posameznih plevelov. S herbicidi, ki jih imamo v Sloveniji registrirane za uporabo v posevkih soje ni možno zagotoviti učinkovitega zatiranja preučevanih invazivnih vrst plevelov.

ABSTRACT

The efficacy of herbicides in controlling new invasive weeds in soybean crops

The biological efficacy of herbicides to control new non-native invasive weeds in soybean crops was studied in a field trial carried out during the 2014 season. The trial was designed as a randomized block design with 9 treatments (herbicide programmes) in four replications. The herbicides were applied in a spray volume of 350 l ha⁻¹ by a knapsack sprayer powered by compressed air during two different soybean growth periods. Evaluations of herbicide efficacy for controlling weeds belonging to the genera *Ambrosia*, *Amaranthus*, *Iva*, *Datura*, *Sida*, *Bidens*, *Solanum* and *Ipomea* were done twice within a season. The efficacy data of individual herbicide mixtures for the control of individual weed species are presented. Herbicides registered for weed control in soybean crops in Slovenia do not provide reliable control of the studied invasive weeds.



Pojavnost rženega rožička (*Claviceps purpurea*) v Sloveniji na vrstah iz družine trav (Poaceae) v letu 2014

Franci Aco CELAR, Klemen ELER, Katarina KOS

Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana
(franc.celar@bf.uni-lj.si)

Rženi rožiček je rastlinska bolezen, katere povzročiteljica je gliva *Claviceps purpurea*, ki okužuje plodnice žit in trav. Med gojenimi žiti je rženi rožiček bolj pogost na rži in tritikali kot pa na pšenici, ječmenu in ovsu. Tujeprašne rastline, kot sta rž in tritikala ter nekatere trave so bolj občutljive zato, ker spore patogena lažje dospejo v cvetoč klas. Okužba pšenice in ječmena je manj verjetna, ker sta samoprašni vrsti. Številne samonikle in gojene trave so tudi dovzetne za okužbo. Najbolj občutljive gostiteljske rastline so tiste, ki dolgo časa in bolj odprto cvetijo. Hladno in vlažno vreme med cvetenjem pospešuje okužbe z askosporami in konidiji. Pogosto so samonikle trave glavni vir spor, ki potem okužujejo žita. Sklerociji rženega rožička vsebujejo strupene spojine, poznane kot ergot alkaloidi. Ti alkaloidi so strupeni za ljudi in živali. Namen naše raziskave je bil ugotoviti razširjenost rženega rožička na žitih in travah v Sloveniji. Leta 2014 smo na 33 različnih lokacijah z žit in trav pobrali 116 vzorcev rženega rožička. Prisoten je bil na 18 samoniklih vrstah trav iz 13 rodov (*Agropyron*, *Agrostis*, *Alopecurus*, *Arrhenatherum*, *Brachypodium*, *Bromus*, *Calamagrostis*, *Dactylis*, *Festuca*, *Holcus*, *Lolium*, *Phalaris* in *Phleum*). V vzorcih zrnja krmnih žit pa smo našli rožičke tudi na rži, tritikali, pšenici in piri.

ABSTRACT

The incidence of ergot (*Claviceps purpurea*) in the species of the grass family (Poaceae) in Slovenia 2014

Ergot is a plant disease caused by the fungus *Claviceps purpurea*, which infects the ovaries of cereals and grasses. Among the cultivated cereals, ergot is more common in rye and triticale than in wheat, barley, and oat. Open-pollinated plants such as rye, triticale and some grasses are more susceptible because of the easy access of pathogen spores into the flowering head. Wheat and barley are less likely to become infected because they

are self-pollinated. Many wild and cultivated grasses are also susceptible. The most susceptible hosts are those with prolonged flowering periods and more open florets. Cool, wet weather during flowering favors infection by ascospores and conidia. Often, indigenous grasses are the main source of spores that infect small grain cereals. The ergot sclerotia contain poisonous compounds known as ergot-alkaloids. These alkaloids are toxic to humans and animals. The aim of our research was to assess the prevalence of ergot in cereals and grasses in Slovenia. In year 2014, at 33 different locations, 116 samples of ergot sclerotia were collected in cereals and grasses. Ergot was present in 18 wild species from 13 genera of grasses (*Agropyron*, *Agrostis*, *Alopecurus*, *Arrhenatherum*, *Brachypodium*, *Bromus*, *Calamagrostis*, *Dactylis*, *Festuca*, *Holcus*, *Lolium*, *Phalaris*, and *Phleum*). In samples of feed grain, we find ergot in rye, triticale, wheat and spelt.



Gondor® – močilo za zmanjšanje zanosa kapljic z vetrom (drift) in Sticman® - edinstveno lepilo in super močilo

Primož ŠTEPIC¹, Andrej KOS¹, Drago MAJČEN¹, Marjan KRAGL¹, Antoine PORTE¹

¹KARSIA, Dutovlje, d.o.o., Poslovalnica Ljubljana, Tržaška 132, SI-1000 Ljubljana
(primoz.stepic@karsia.si)

²De Sangosse, Francija

Na slovenskem trgu je registriranih mnogo močil, vendar trenutno samo GONDOR® vpliva na zmanjšan učinek zanašanja kapljic z vetrom (drift). GONDOR® je proizveden na osnovi sojinega lecitina, ki je formuliran skupaj z metil estri rastlinskih olj. Ta sestava ga uvršča med ekološko zelo sprejemljiva sredstva. Močilo GONDOR® omogoča hitrejši vstop (penetracijo) škropilne brozge v rastlino, kajti lecitin začasno razrahlja vezi v kutikuli na listni površini, vendar pa je ne poškoduje, kot ostala močila. Hitrejša je tudi translokacija oz. prenos učinkovin po rastlini. Zaradi hitrega vstopa smo tudi manj odvisni od vremenskih vplivov. Lecitin, kot zelo zmogljiv emulgator, pomembno prispeva k izboljšanju fizične združljivosti (mešanju) različnih fitofarmaceutskih sredstev in foliarnih gnojil tako v škropilnici kot na rastlini. Število zelo drobnih kapljic (megla) se zelo zmanjša, s tem zelo omejimo zanos škropiva na neciljne površine oz. rastline, s tem pa je tudi izguba škropilne brozge manjša in učinkovitost boljša. Ob tem močilo GONDOR® zelo izenači velikost kapljic, kar pomembno prispeva k enakomernemu nanosu škropiva na rastlino. GONDOR® močno zmanjša površinsko napetost na listu, kar bistveno zmanjša odtekanje škropilne brozge iz zelenih delov rastlin. Zaradi manjših izgub je lahko tudi poraba vode manjša. Priporočena je uporaba poleg herbicidov, fungicidov, Insekticidov in ob uporabi foliarnih gnojil. Če povzamemo: boljša učinkovitost fitofarmaceutskih sredstev, manjši zanos (drift) in manjše obremenjevanje okolja. STICMAN® je visokokvalitetno omočilo oziroma lepilo na osnovi latexa. Izboljša nanos in obstojnost fitofarmaceutskih sredstev. Predvsem se močilo STICMAN® priporoča ob kontaktnih in preventivnih fungicidih in z kontaktnimi oz. želodčnimi insekticidi. STICMAN® izboljša oprijemljivost kapljic na listni površini in s tem zaščiti škropivo pred izpiranjem zaradi dežja ali namakanja z razpršilci. STICMAN® tudi upočasni proces razpadanja škropiva in s tem podaljša njegovo delovanje. Izkazal se je z dobrim delovanjem proti fuzariozam (*Fusarium* spp.) in pri zniževanju mikotoksinov v žitih. Glavne prednosti močila STICMAN®: izboljša pokrovnost, obdrži in zaščiti škropivo na rastlini, izboljša in podaljša delovanje preventivnim fungicidom in kontaktnim insekticidom.

ABSTRACT

Gondor® - adjuvant for drift reduction and Sticman® - an unique sticker and super-wetter adjuvant

On the Slovenian market are registered many adjuvants but currently only GONDOR® impact on the reduced effect of drift. GONDOR® is produced on the basis of soya lecithin, which is formulated together with the methyl esters of vegetable oils. This composition is ecologically very acceptable. Adjuvant GONDOR® allows faster entry (penetration) of the spray mixture in the plant, because lecithin temporarily loosens the bonds in the cuticle on the leaf surface, but it does not hurt leaf surface as other adjuvants. Faster is also a spray translocation in the plant. Due to the faster penetration we are less exposed to weather conditions. Lecithin as a powerful emulsifier, is an important contributor to improving the physical compatibility (mixing) of different agrochemicals and foliar fertilizers in the sprayer and on the plant. The number of very fine droplets (mist) is very reduced, this means very limited drift to non-target areas or crops, consequent loss of spray and better efficacy. Also adjuvant GONDOR® is very equating the droplet size, which contributes significantly to the uniform application of the spray on the plant. GONDOR® greatly reduce the surface tension on the leaf/plant surface, which greatly reduces run-off spray from the leaf/plant. Due to the small losses we can also use less water. It is recommended to use together with herbicides, fungicides, insecticides and foliar fertilizers. To summarize: improved efficiency of agrochemicals, reduced drift and lower environmental pollution. STICMAN® the high quality adjuvant and sticker based on latex. Improves application and persistence of plant protection products. In particular wetting agent STICMAN® is recommended with contact and preventive fungicides, and with contact and ingested insecticides. STICMAN® improves the adhesion of droplets on the leaf surface and it protects spray against wash-off by rain or sprinkler irrigation. STICMAN® also slows the degradation process and thereby extend its function. It has good activity against fusariosis (*Fusarium* spp.) and in the reduction of mycotoxins in cereals The main advantages of STICMAN®: improving the cover, retain and protect spray on the plant, improves the performance and life of protectant fungicides and contact insecticides.



Razširjenost trdih pšeničnih sneti (*Tilletia* spp.) v Sloveniji

Metka ŽERJAV, Mateja PERVANJE, Marjeta ZEMLJIČ URBANČIČ

Kmetijski inštitut Slovenije, Oddelek za varstvo rastlin, Hacquetova ulica 17, SI-1000 Ljubljana (metka.zerjav@kis.si)

Trde pšenične sneti (*T. caries*, *T. laevis*, *T. controversa*) se v zadnjih dveh desetletjih v Evropi spet pogosteje pojavljajo, kar povezujejo predvsem z opuščanjem nekaterih preventivnih ukrepov varstva ter naraščanjem površin žit v ekološki pridelavi. V Sloveniji je njihov porast opazen po letu 2010. Za preprečevanje širjenja bolezni je ključna uporaba semena, ki ni kontaminirano s sporami oziroma je tretirano z učinkovitim fungicidom. V letu 2014 smo neposredno po žetvi zbrali 104 vzorce zrnja: 63 vzorcev navadne pšenice iz integrirane pridelave, 28 iz certificirane semenske pridelave ter 13 vzorcev zrnja žit iz ekološke pridelave. Vzorce smo analizirali s filtracijsko metodo in določili število spor/zrno. Prevladovali so vzorci iz Prekmurja in Štajerske, preiskali pa smo tudi vzorce z Dolenjske, Bele Krajine, Primorske in Gorenjske. Trde sneti so bile najdene v vseh pridelovalnih območjih. Spore sneti smo našli pri 59 % vzorcev zrnja pšenice iz integrirane

pridelave in pri 39% zrnja iz certificirane semenske pridelave. Prevladovali so vzorci z nizko okužbo (ena spora/ zrno ali manj). V integrirani pridelavi je bilo med kontaminiranimi vzorci 27 % takih, ki so imeli več kot eno/sporo na zrno. Med vzorci iz certificirane semenske pridelave sta bila takšna le dva. Ekološko pridelano zrnje je bilo močnejše kontaminirano; med 13 vzorci je bilo 10 vzorcev s snetjo, od tega štirje z več kot 500 sporami/zrno. Vsi pozitivni vzorci so imeli spore z mrežasto površino, značilno za vrsti *T. caries* in *T. controversa*. V nobenem nismo našli spor sneti *T. laevis*. Morfološko smo podrobneje analizirali 20 močnejše kontaminiranih vzorcev. V šestih smo ugotovili navzočnost spor z višjimi pregradami in debelejšim želatinastim slojem, kar je morfološka značilnost glive *T. controversa*.

ABSTRACT

Distribution of wheat smut fungi (*Tilletia spp*) in Slovenia

Common bunt (*T. caries*, *T. laevis*) and dwarf bunt (*T. controversa*) have re-emerged in Europe during the last two decades. Low-input farming systems and increase of organic production are mentioned as possible reasons. The increase of wheat contamination with bunt spores has been observed in Slovenia since 2010. The control of disease is based on healthy seeds free of bunt spores or seeds treated with efficient fungicides. Analysis of teliospore number per grain was done by filtration method for 104 samples of non-processes wheat grains collected in 2014. There were samples of grains from integrated wheat production (63), from certified seed production (28) and samples of organically produced cereals (13). Samples were taken in different regions of Slovenia, most of them in Štajerska region and Prekmurje. Spores of *Tilletia* were found on samples in all regions. Analysis revealed that 59 % of wheat samples from integrated production and 39 % from certified seed production were contaminated with teliospores. The samples with low contamination levels (one spore per grain or less) prevailed. Among contaminated samples of grain taken from fields with integrated wheat production there were 27 % with more than one spore per grain. Only two samples from certified seed production had more than one spore per grain. The samples of organically produced cereals were more contaminated: 10 samples out of 13 contained spores and four of them had over 500 spores /grain. Reticulated spores, characteristic for species *T. caries* and *T. controversa* were found in all contaminated samples. No spores of *T. laevis* were observed. Morphology of spores was studied in 20 samples with higher level of contamination. Teliospores with deeper reticulation and thicker gelatinous sheath, which is a morphological feature of *T. controversa*, were detected in 6 samples.



Povezava med stopnjo okuženosti klasov in zrn pšenice s fuzariozami ter vsebnostjo mikotoksina DON

Franci Aco CELAR¹, Igor ŠANTAVEC¹, Gabrijela Tavčar KALCHLER², Katarina KOS¹

¹Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana
(franc.celar@bf.uni-lj.si)

²Veterinarska fakulteta, Inštitut za patologijo prehrane, Gerbičeva 60, SI-1000 Ljubljana

Fuzarioza klasa (FK) je pomembna bolezen pšenice, predvsem v okoljih z dolgotrajnimi vlažnimi vremenskimi razmerami med cvetenjem in mehko voščeno zrelostjo zrnja. FK povzroča kompleks *Fusarium* vrst, med katerimi so najpogostejše *F. graminearum*, *F.*

culmorum in *F. avenaceum*. Te glive tvorijo nevarne mikotoksine, katerih kopičenje je škodljivo za zdravje živali in ljudi. Namen te raziskave je bil oceniti pojavnost *Fusarium* vrst na 19 sortah pšenice na dveh različnih lokacijah (Jable, Rakičan) v dveh zaporednih rastnih dobah (2012-2013). Poleg tega smo hoteli ugotoviti ali obstaja kakšna povezava med ocenjeno stopnjo okuženosti klasov na polju, laboratorijsko ugotovljeno okuženostjo zrnja z glivami *Fusarium* spp. in vsebnostjo mikotoksina DON. Za ocenjevanje poljske okuženosti klasov je bila uporabljena ocenjevalna skala z 10 kategorijami. Vrste gliv rodu *Fusarium* so bile po metodi agar nih plošč, ki jo priporoča ISTA, determinirane v laboratoriju s pomočjo mikroskopa. Koncentracija mikotoksina DON je bila ovrednotena z metodo ELISA. Iz pšeničnih zrn pobranih na različnih lokacijah smo izolirali glive *F. graminearum*, *F. culmorum*, *F. poae*, *F. avenaceum* in *F. tricinctum*. Potrjena je bila močna pozitivna linearna povezava med pogostnostjo gliv *F. graminearum* in *F. culmorum* na zrnih pšenice ter koncentracijo mikotoksina DON ($r = 0,71$). Med okuženostjo klasov in vsebnostjo mikotoksina DON v zrnju pšenice ni bilo ugotovljene signifikantne povezave.

ABSTRACT

The relationship between level of wheat head and kernel infection with fusariosis and mycotoxin DON content

Fusarium head blight (FBH) is an important disease of wheat in environment with prolonged wet climatic conditions from flowering through the soft-dough stage of kernel development. FHB is caused by a complex of *Fusarium* species, of which *F. graminearum*, *F. culmorum* and *F. avenaceum* are most frequently involved. These fungi produce dangerous mycotoxins, which accumulation is harmful for health of animals and humans. The aim of this work was evaluation of incidence of *Fusarium* species on 19 wheat varieties at two different locations (Jable, Rakičan) in two consecutive growing seasons (2012-2013). In addition, we wanted to find out if there is a correlation between the field estimated severity of *Fusarium* head blight, the laboratory detected kernel infection by *Fusarium* spp. and the content of the mycotoxin DON. The head blight severity was estimated under field conditions using a visual scale with 10 categories of infection. Species composition of the genus *Fusarium* was microscopically determined in laboratory using agar plate method recommended by ISTA. The concentration of mycotoxin DON in kernels was evaluated by ELISA method. *Fusarium* species isolated from wheat kernels collected at different locations were following: *F. graminearum*, *F. culmorum*, *F. poae*, *F. avenaceum* and *F. tricinctum*. A strong positive linear correlation between incidence of *Fusarium graminearum* and *F. culmorum* on wheat kernels and concentration of mycotoxin DON was confirmed ($r = 0.71$). No significant correlation between head infection and DON mycotoxin content in grains was found.



Bakterije iz rodu *Xanthomonas* na semenu fižola

Manca PIRC, Maja RAVNIKAR, Tanja DREO

Nacionalni inštitut za biologijo, Oddelek za biotehnologijo in sistemsko biologijo, Večna pot 111, SI-1000 Ljubljana (manca.pirc@nib.si)

Navadna bakterijska pegavost fižola, ki jo povzroča bakterija *Xanthomonas axonopodis* pv. *phaseoli*, je ena glavnih bolezní v pridelavi fižola. Okuženo seme je najpomembnejši vir teh bakterij, zato je testiranje semena izrednega pomena. Metode določanja so povzete po

protokolu 7-021 International Seed Testing Association (ISTA). Pri testiranju semen opazamo, da se na semenih pojavljajo sevi bakterij iz rodu *Xanthomonas*, ki jih na podlagi predpisanih metod ne moremo razlikovati od sevov *X. axonopodis* pv. *phaseoli*. Morfologija na umetnih gojiščih je zelo podobna, povzročajo hipersenzitivno reakcijo na rastlinah paradižnika ter pozitivno reagirajo na testu imunofluorescence s specifičnimi protitelesi. Na rastlinah fižola ob umetni okužbi povzročajo milejša bolezenska znamenja kot sevi *X. axonopodis* pv. *phaseoli*. Za razlikovanje izolatov smo vpeljali metodo določanja DNA črtnih kod dveh genov in sicer *gyrB* in *avrBs2*. Na podlagi uvedene metode smo ugotovili, da se pri semenu fižola pogosto pojavljajo sevi, ki sodijo v vrsto *Xanthomonas arboricola* in nekateri v vrsto *Xanthomonas campestris*. Analiza določanja DNA črtnih kod je nepogrešljiva za določanje *Xanthomonas axonopodis* pv. *phaseoli* in razlikovanje teh bakterij od drugih bakterij rodu *Xanthomonas* katerih biološki pomen v semenu fižola ni poznan.

ABSTRACT

Bacteria of the genus *Xanthomonas* on bean seeds

Common bacterial blight caused by *Xanthomonas axonopodis* pv. *phaseoli*, is one of the major diseases in bean production with infected seeds representing the major source of infection. Methods for detection of seed contamination are described in the International Seed Testing Association (ISTA) 7-021 protocol. During seed testing we have commonly observed the occurrence of strains of *Xanthomonas* genus, which on the basis of the prescribed methods cannot be distinguished from the *X. axonopodis* pv. *phaseoli*. They have similar morphology on artificial media, cause positive hypersensitivity reaction on tomato plants, react positively to the test immunofluorescence with specific antibodies however, they cause milder symptoms on bean plants. The newly introduced DNA barcoding of two genes, namely *gyrB* and *avrBs2*, is the only method able to distinguish these strains from *X. axonopodis* pv. *phaseoli*, identifying them as *Xanthomonas arboricola* and *Xanthomonas campestris*. DNA barcoding is therefore a necessary method for accurate detection of *Xanthomonas axonopodis* pv. *phaseoli*, also enabling their differentiation from other strains of the genus *Xanthomonas* for which the biological significance is not yet known.



Možnosti varstva visokega navadnega fižola (*Phaseolus vulgaris* L.) pred boleznimi in škodljivci pri pridelavi na hmeljiščih v premeni

Darja KOCJAN AČKO

Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana
(darja.kocjan.acko@bf.uni-lj.si)

V Sloveniji smo v letu 2014 pridelovali hmelj (*Humulus lupulus* L.) na 1296 ha, ki so zvečine v Spodnji Savinjski dolini, 489 ha hmeljišč pa je bilo v premeni. Vsa hmeljišča so vključena v integrirano pridelavo poljščin. Zaradi monokulturne pridelave hmelja je predpisana dveletna premena, ki je bila v zadnjih nekaj letih tudi daljša zaradi slabe prodaje hmelja na svetovnem trgu. Pod vzdrževanimi žičnicami na hmeljiščih v premeni, kmetje pridelujejo krmne poljščine, zlasti koruzo in ječmen, glede izkoriščenosti žičnice pa ima prednost pridelava visokega navadnega fižola (*Phaseolus vulgaris* L.). Pridelovalci

visokega fižola sadijo lokalno uveljavljeno sorto 'Semenarna 22', ki je potrošnikom bolj znana pod imenom »savinjski sivček«. Pri anketiranju 30-ih pridelovalcev »sivčka« v letu 2013 smo dobili podatke o posebnostih pridelave visokega fižola v žičnicah na hmeljiščih v premeni s poudarkom na varstvu pred povzročitelji bolezni in škodljivci. Pridelovalci so v anketni vprašalnik zapisali bolezni in škodljivce, ki so jih identificirali na fižolu. Ugotovili smo, da sta bili najbolj razširjeni bolezni fižolova rja (*Uromyces appendiculatus*) in fižolov ožig (*Colletotrichum lindemuthianum*), proti katerima je večina pridelovalcev uporabila enega od dovoljenih fungicidov. Tudi črno fižolovo uš (*Aphis fabae*) in navadno fižolovo pršico (*Tetranychus urticae*) so zvečine škropili z insekticidi. Ker smo z anketo ugotovili, da vse bolj ozaveščene kupce visokega fižola zanima način pridelave (odklonilni so zlasti proti pesticidom), bodo morali pridelovalci v prihodnje izbirati tudi med drugimi okoljsko bolj sprejemljivi načini varstva visokega fižola. V skladu z načeli trajnostne pridelave in varne hrane so na razpolago nekatera biotična in biotehnična sredstva, ki se sicer uporabljajo v ekološki pridelavi. Kot precejšnja neznanka vstopajo k nam agrohomoopatska sredstva za krepitev imunskega sistema rastlin in odvrčanje škodljivcev. Vključitev inovativnih rešitev pri pridelavi živil s čim manj ali brez pesticidov je cilj ne le trajnostne pridelave visokega fižola v žičnicah na hmeljiščih v premeni, ampak tudi drugih kmetijskih rastlin na njivah in gredicah.

ABSTRACT

Possibilities of protection of high common bean (*Phaseolus vulgaris* L.) against diseases and pests at cultivation on hop gardens in strands

In 2014 was hop (*Humulus lupulus* L.) produced on 1294 ha in Slovenia, most of production was in Spodnja Savinjska dolina, 489 ha of hop gardens was in strands. All hop gardens are included in the integrated crop production. Due to monoculture is in hop production prescribed two-years strand, which has been in the last few years longer due to poor sales of hop on the world market. Farmers are producing fodder crops, particularly corn and barley, under the maintained cableways on the hop gardens in strand. In respect to utilization of the cableway has production of high common bean (*Phaseolus vulgaris* L.) the advantage. High bean producers are planting locally established variety 'Semenarna 22', to consumers better known under the name »savinjski sivček«. At interviewing in 2013 of 30 »sivček« growers we get data about the specificities of high beans production in cableways on the hop gardens in strands with an emphasis on protection against pathogens and pests. Producers wrote in the questionnaire all diseases and pests, which they identified on beans. We found out that the most widespread diseases were bean rust (*Uromyces appendiculatus*) and bean anthracnose (*Colletotrichum lindemuthianum*), against which the majority of growers use one of the permitted fungicides for integrated production. Even the black bean aphid (*Aphis fabae*) and bean mite (*Tetranychus urticae*) are mostly sprayed with insecticides. As we found with survey that more and more aware buyers of high bean are interested in production method (they are mainly the against using of pesticides), producers should have to choose among other more environmentally acceptable ways of high beans protection in the future. In accordance with the principles of sustainable production and food safety are available some biotic and biotechnical products that are also used in organic production. As considerable unknown, is agrohomoopathic products entering to us to strengthen the plant immune system and deterring pests. The inclusion of innovative solutions for the food production with minimal or no pesticides is the aim not only at sustainable high bean production in the cableways on the hop gardens in the strands, but also at other agricultural crops on the fields and garden beds.



Razvoj diagnostične metode za hkratno detekcijo viroidov na hmelju

Tanja GUČEK¹, Sebastjan RADIŠEK¹, Jernej JAKŠE², Jaroslav MATOUŠEK³, Branka JAVORNIK²

¹Inštitut za hmeljarstvo in pivovarstvo Slovenije, Cesta Žalskega tabora 2, SI-3310 Žalec, (tanja.gucek@ihps.si)

²Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia

³Biology Centre of the ASCR, v.v.i., Branišovská 31, 370 05 České Budějovice, Czech Republic

Viroidi so najmanjši rastlinski patogeni, ki so sestavljeni iz krožne molekule RNA. Okužijo lahko tako kulturne kot okrasne rastline in v nekaterih primerih povzročajo visoko gospodarsko škodo. Viroidi, ki lahko okužijo hmelj (*Humulus lupulus*) so hmeljev latentni viroid (HLVd), viroid zaknelosti hmelja (HSVd), viroid razpokanosti skorje agrumov (CBCVd) in apple fruit crinkle viroid (AFCVd). Hmeljev latentni viroid je vsesplošno razširjen v vseh svetovnih pridelovalnih območjih hmelja in na večini sort ne povzroča vidnih bolezenskih znakov, vendar negativno vpliva na količino in kakovost pridelka. Mnogo agresivnejši viroidi hmelju so AFCVd, HSVd in CBCVd, ki na rastlinah povzročajo izrazita bolezenska znamenja in pridelovalce zaradi prizadetosti rastlin in hitrega širjenja prisilijo v krčenje nasadov. AFCVd je omejen le na Japonsko, medtem ko sta HSVd in CBCVd na hmelju bila nedavno prvič potrjena v Evropi in tudi v Sloveniji. Na hmelju lahko prihaja tudi do mešanih viroidnih okužb, ki so večinoma kombinacija HLVd in vsaj enega od ostalih viroidov. Za detekcijo viroidov se najpogosteje uporabljajo metode na osnovi nukleinskih kislin, kot sta molekularna hibridizacija in RT-PCR. V primeru hude oblike viroidne zaknelosti hmelja, ki je prisotna v Sloveniji, so v okuženih rastlinah lahko prisotni tudi trije viroidi hkrati, kar povečuje stroške detekcije, zato je smiselna uporaba metod, ki omogočajo hkratno detekcijo viroidov. S tem namenom smo razvili diagnostično metodo mRT-PCR za hkratno detekcijo vseh štirih hmeljevih viroidov. Z uporabo mRT-PCR se skrajša čas analize in zmanjša poraba reagentov in s tem cena analiz. Metoda se lahko uporablja tako za rutinska testiranja simptomatičnih rastlin iz polja, testiranja v okviru certifikacijskih shem sadilnega materiala, kot tudi za epidemiološke študije. Avtorji se zahvaljujemo za finančno podporo Javni agenciji za raziskovalno dejavnost RS (36371, P4-0077), Upravi RS za varno hrano, veterino in varstvo rastlin, Češkem ministrstvu za znanost (LH14255) in Evropski komisiji (FP7-REGPOT-2012-2013-1 MODBIOLIN No. 316304).

ABSTRACT

Development of a diagnostic method for the simultaneous detection of multiple viroids on hop

Viroids are the smallest plant pathogens; they consist of a circular RNA molecule. They can infect various cultivated and ornamental plants and, in some cases, can cause major economic losses. Viroids that can infect hop (*Humulus lupulus*) include *Hop latent viroid* (HLVd), *Hop stunt viroid* (HSVd), *Citrus bark cracking viroid* (CBCVd) and *Apple fruit crinkle viroid* (AFCVd). Hop latent viroid is generally present in all world hop production

areas and does not produce any visible symptoms on most varieties, although it has a negative impact on the quantity and quality of the crop. AFCVd, HSVd and CBCVd are much more aggressive on hops, causing pronounced disease symptoms, and growers are forced to reduce hop areas due to impairment of the plants and the disease's rapid spread. AFCVd is limited to Japan, while HSVd and CBCVd were recently confirmed on hops for the first time in Europe, including Slovenia. Hop can also be infected with multiple viroids; most infections are a combination of HLVd and at least one other viroid. The most commonly used methods for the detection of viroids, such as molecular hybridization and RT-PCR, are based on nucleic acids. In the case of aggressive hop stunt disease present in Slovenia, the presence of three different viroids on the diseased plants leads to higher costs of diagnosis and indicates the need for methods that allow simultaneous detection of all viroids. For this purpose, we have developed the diagnostic method mRT-PCR for detection of all four hop viroids. Use of mRT-PCR enables shorter analysis, reduces the use of reagents and, consequently, the cost of analysis. The method can be used for routine testing of symptomatic plants from a field, for testing in the context of a certification scheme for planting material, as well as for epidemiological studies. The authors acknowledge the financial support of the Slovenian Research agency (36371, P4-0077), the Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection, the Czech Ministry of Education (LH14255), and the European Commission (FP7-REGPOT-2012-2013-1 MODBIOLIN No. 316304).



Viroid razpokanosti skorje agrumov (CBCVd) nov nevaren patogen na hmelju

Jernej JAKŠE¹, Sebastjan RADIŠEK², Tanja GUČEK², Tine POKORN¹, Jaroslav MATOUŠEK⁴, Branka JAVORNIK¹

¹Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana
(sebastjan.radisek@ihps.si)

²Inštitut za hmeljarstvo in pivovarstvo Slovenije, Cesta Žalskega tabora 2, SI-3310 Žalec

³Biology Centre of the ASCR, v.v.i., Branišovská 31, 370 05 České Budějovice, Czech Republic

Leta 2007 smo na območju Savinjske doline in Koroške odkrili izbruh neznane agresivne bolezni, ki na hmelju povzroča zakrnelost in odmiranje rastlin z zelo hitro dinamiko širjenja. Po obsežni diagnostični analizi je bil v obolelih rastlinah potrjen Hop stunt viroid (HSVd), ki na hmelju povzroča nevarno obolenje »viroidno zakrnelost hmelja«. Zaradi specifičnih lastnosti bolezenske oblike viroidne zakrnelosti hmelja v Sloveniji, ki se izražajo v izrazito krajši inkubacijski dobi, višji stopnji agresivnosti, ter oteženi detekciji HSVd z omejitvijo le na tkiva storžkov, je bila opravljena dodatna diagnostična raziskava z novo tehniko v patologiji rastlin NGS (Next generation sequencing). NGS analiza je v simptomatičnih rastlinah presenetljivo potrdila prisotnost še enega viroida in sicer Citrus bark cracking viroida (CBCVd), ki je bil do sedaj opisan izključno kot viroid agrumov. Hkrati se je v okviru iste raziskave ugotovilo, da je glavni povzročitelj viroidne zakrnelosti hmelja v Sloveniji CBCVd, medtem, ko je HSVd najverjetneje zaradi antagonističnega odnosa s CBCVd v obolelih rastlinah neaktiven, občasno prisoten ali pa ga sploh ni več možno zaznati. Prisotnost CBCVd je bila z RT-PCR analizo potrjena na vseh žariščih viroidne zakrnelosti hmelja v Sloveniji, medtem ko je umetno okuževanje z biolistično metodo potrdilo visoko stopnjo agresivnosti in infektivnosti CBCVd na hmelju. Oba na novo odkrita viroida na hmelju predstavljata prvo najdbo v Evropi in v primeru CBCVd

celo prvo znano najdbo na hmelju. Z namenom ločevanja med obolenji, ki jih povzročata HSVd in CBCVd je bila nova oblika bolezni poimenovana »huda viroidna zakrnelost hmelja«. V prispevku predstavljamo tudi rezultate spremljanja pojava te bolezni v hmeljiščih, nove diagnostične pristope, izkušnje z ukrepi eradikacije in prve epidemiološke analize. Avtorji se zahvaljujemo za finančno podporo Javni agenciji za raziskovalno dejavnost RS (J4-4153, P4-0077), Upravi RS za varno hrano, veterino in varstvo rastlin, Češkem ministrstvu za znanost (LH14255) in Evropski komisiji (FP7-REGPOT-2012-2013-1 MODBIOLIN No. 316304).

ABSTRACT

Citrus bark cracking viroid (CBCVd) as a new aggressive hop pathogen

An unknown and aggressive disease was observed in 2007 in hop gardens in the Savinja valley and Koroška region in Slovenia. The disease spread extremely rapidly and caused severe stunting and the death of affected plants. Diagnostic analysis revealed the presence of hop stunt viroid (HSVd), known as the causal agent of hop stunt disease. The new disease in Slovenia corresponds to descriptions of HSVd infections, although some characteristics, such as a shorter incubation period, higher aggressiveness and unreliable RT-PCR detection limited to hop cones, were unusual and atypical for HSVd infections. Additional diagnostic research was therefore performed using NGS (next generation sequencing) analysis, which is a novel technique in plant pathology. NGS analysis of symptomatic plants surprisingly revealed the presence of citrus bark cracking viroid (CBCVd), which, until this finding, has been described as a pathogen of citrus plants. The research also showed that the main causal agent of the new hop disease is CBCVd, whereas HSVd, for still unknown reasons, is not active, is absent or present only in some plants. The presence of CBCVd was confirmed by RT-PCR on all outbreaks in Slovenia and infection tests using a biolistic inoculation technique proved the high aggressiveness and infectivity of CBCVd on hop. Both newly detected viroids represent the first finding on hop in Europe and, in the case of CBCVd, also the first finding on this host. In order to discriminate clearly between diseases caused by HSVd and CBCVd, we proposed naming the new disease »severe hop stunt disease«, since the characteristics resemble those of hop stunt disease. The presentation also presents the results of a monitoring survey, new diagnostics approaches, experiences with the eradication process and the first epidemiological analysis of this new disease in Slovenia. The authors acknowledge the financial support of the Slovenian Research agency (J4-4153, P4-0077), the Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection, the Czech Ministry of Education (LH14255), and the European Commission (FP7-REGPOT-2012-2013-1 MODBIOLIN No. 316304).

Varstvo gozdnega drevja in drugih lesnatih rastlin

Napoved rojenja prve generacije osmerozobega smrekovega lubadarja

Nikica OGRIS

Gozdarski inštitut Slovenije (nikica.ogris@gozdis.si)

Velikost populacije osmerozobega smrekovega lubadarja (*Ips typographus* Linnaeus, 1758) ugotavljamo s spremljanjem ulova v kontrolnih pasteh s specifičnimi feromonskimi pripravki kumulativno za spomladansko obdobje, ki traja od prvega rojenja do 15. junija. V primeru, ko ulov preseže 9.000 osebkov na kontrolno past se šteje, da je populacija podlubnikov na lokaciji pasti prenamnožena (Pravilnik o varstvu gozdov). Pravilnik datum rojenja prve generacije, tj. 15. junij, določa pavšalno za celo državo. Cilj raziskave je bil razviti metodo za določevanje natančnejšega datuma rojenja prve generacije za vsako kontrolno past. Uporabili smo metodo prostorske interpolacije točkovnih vrednosti povprečnih dnevni temperatur s pomočjo metode enostavnega kokriginga, kjer smo za pojasnjevalno spremenljivko vzeli digitalni model višin. Rezultat tega postopka so bile karte povprečne dnevne temperature za vsak dan posebej za območje Slovenije z ločljivostjo 1 km × 1 km. Datum rojenja prve generacije smo predvideli glede na dve dejstvi: spodnji temperaturni prag za razvoj osmerozobega smrekovega lubadarja je 8,3 °C in za popolni razvoj ene generacije je potrebna vsota efektivnih temperatur 365 stopinj dni. Za vsako kontrolno past smo datum rojenja prve generacije določili z dnem, ko je bila vsota efektivnih temperatur enaka ali večja kot 365 stopinj dni izračunano od datuma prvega ulova v letu v kontrolni pasti. Metodo smo preizkusili na podatkih spremljanja ulova osmerozobega smrekovega lubadarja v kontrolno-lovnih pasteh v letu 2014. Povprečen zaključek razvoja prve generacije se je dobro ujema s povprečnim začetkom prvega rojenja in se je zgodil med 10. in 29. junijem 2014. Iz rezultatov študije je razvidno, da je uradni datum 15. junij, do katerega se spremlja velikost populacije osmerozobega smrekovega lubadarja in je določen s Pravilnikom o varstvu gozdov, veljal le za 22,4 % obravnavanih kontrolno-lovnih pasti, ki so bile postavljene v nižjem višinskem pasu, tj. 328 m nad morjem povprečno. Razvita metoda bo pripomogla k bistveno natančnejšim določitvam datuma rojenja prve generacije in posledično k natančnejšim kratkoročnim napovedi o prenamnožitvah *I. typographus*.

ABSTRACT

Prediction of swarming of the first generation of eight-toothed spruce bark beetle

The size of the population of the eight-toothed spruce bark beetle (*Ips typographus* Linnaeus, 1758) is assessed by monitoring of catches in control traps with specific pheromone preparations. The catch is assessed cumulatively for the spring period, which lasts from the first swarming until 15th June. In the case, when catch exceed 9,000 individuals in the trap, it is considered that the population of *I. typographus* on the location of the trap will outbreak (Rules on the protection of forests). Date, June 15, has been set with the Rules approximately. The aim of this study was to develop a method for the determination of a more precise date of swarming of the first generation at each control trap. We used the method of spatial interpolation of point values of average daily temperatures (on daily basis) using simple co-kriging, where we took digital elevation model as an explanatory variable. The result of this process were maps of the average daily temperature for the territory of Slovenia with a resolution of 1 km × 1 km. Date of swarming of the first generation was predicted according to two facts: the lower temperature threshold for the development of the eight-toothed spruce bark beetle is 8.3 °C and for the full development of one generation is required 365 degrees days (sum of

effective temperatures). For each of the trap, swarming date of the first generation was determined by the date when the sum of effective temperatures were equal to or greater than 365 degree-days calculated from the date of first appearance. The method was tested on the data from monitoring of the eight-toothed spruce bark beetle in traps in 2014. The average swarming date of the first generation took place between 10th and 29th June 2014. The results of the study shows that the official date of June 15 applied only to 22.4% traps in 2014. The developed method will significantly rise the accuracy of determination of date of swarming of the first generation at each control trap. Consequently, the predictions of swarming will be more accurate and reliable.



Sekundarna škoda zaradi podlubnikov v gozdovih Slovenije po žledolomu februarja 2014

Marija KOLŠEK¹, Maarten DE GROOT²

¹Zavod za gozdove Slovenije, Večna pot 2, SI-1000 Ljubljana (Marija.Kolsek@zgs.si)

²Gozdarski inštitut Slovenije, Oddelek za varstvo gozdov, Večna pot 2, SI-1000 Ljubljana

Februarja 2014 je žled v Sloveniji povzročil poškodbe drevja na dobri polovici površine gozdov. Zaradi poškodb bo treba posekati 9 milijonov m³ drevja, od tega 3 milijone m³ iglavcev. Da bi preprečili večji obseg sekundarne škode v gozdovih zaradi namnožitve podlubnikov, bi morali do sredine maja posekati in izpeljati iz gozda v predelavo večino močno poškodovanih iglavcev, zlasti smreke. Ker sta posek drevja ter trgovina z lesom v Sloveniji prilagojena na letni posek okoli 4 milijonov m³ drevja in ju v kratkem času ni bilo mogoče zadostno povečati, je bilo do sredine maja 2014 saniranih samo četrtnina močno poškodovanih iglavcev. Zato pričakujemo, da bo namnožitev podlubnikov trajala več let s kulminacijo po letu 2014. Ker smo že v letu 2013 evidentirali povečanje števila smrekovih in jelovih podlubnikov, smo večjo sekundarno škodo zaradi podlubnikov pričakovali že v letu 2014. Zelo spremenljivo in deževno vreme brez daljših vročinskih valov je neugodno vplivalo na razvoj podlubnikov, zato se dodaten posek drevja zaradi podlubnikov v letu 2014 glede na posek zaradi podlubnikov v letu 2013 ni bistveno povečal. V prvi polovici leta 2014 so se na poškodovanem območju žarišča smrekovih podlubnikov pojavljala na v žledu močno poškodovanih smrekah, v drugi polovici leta tudi na manj poškodovanih ter tudi na navidezno zdravih in nepoškodovanih smrekah. Kontrolne feromonske pasti za podlubnike, s katerimi spremljamo številčnost in razvoj osmerozobih in šesterezobih smrekovih lubadarjev (*Ips typographus*, *Pityogenes chalcographus*), so na najbolj poškodovanem območju v letu 2014 služile le za spremljanje razvoja podlubnikov, Rezultati ulova bodo predstavljeni na posvetovanju.

ABSTRACT

Secondary damage of spruce bark beetles in the Slovenian forest after the ice storm in February 2014

In February the ice storm affected trees in more than half of the forests in Slovenia. Therefore there is a need to cut 9 million m³ from which were 3 million m³ of conifer trees. In order to avoid secondary damage by bark beetles, the damaged conifer trees should be cut and be transported out of the forests by the middle of May. Normally much lower amount of trees is cut annually (4 million m³ of trees) in Slovenia. Therefore there are not

enough work forces for cutting available in Slovenia. In combination with the short period till the middle May only around one fourth of the damaged conifer trees were logged till that time. Therefore we expect that there will be increasing attacks of bark beetles after 2014. In 2013 there was already an increase of spruce and fir bark beetles observed; therefore we expect even a higher number of bark beetles in 2014. However, there was not such an increase of bark beetles observed compared to 2013 as we expected. The reason for this is probably the rainy weather without longer heat wave, which affects the bark beetle populations negatively. In the first half of 2014, spruce bark beetle damage was mainly observed in the heavily damaged spruces, while in the second part of 2014 also seemingly healthy and not damaged spruces were attacked. Pheromone traps, which are used for monitoring the numbers and development of *Ips typographus* and *Pityogenes chalcographus* were set in the affected areas in 2014 mostly to investigate the development of the outbreaks of bark beetles. The results will be presented during the meeting.



Primerjava učinkovitosti feromonov Galloprotect 2D[®] in GalloprotectPack[®] na ulov žagovinarjev (Cerambycidae: Monochamus), vektorjev borove ogorčice (*Bursaphelenchus xylophilus*)

Gregor METERC, Maja JURC

Biotehniška fakulteta, Oddelek za gozdarstvo in obnovljive gozdne vire, Večna pot 83, SI-1000 Ljubljana (gregor.meterc@bf.uni-lj.si)

Vrste kozličkov iz rodu žagovinarjev (*Monochamus* Dejean, 1821) so najpomembnejši potrjeni vektorji borove ogorčice *Bursaphelenchus xylophilus* (Steiner & Buhner) Nickle. Borova ogorčica lahko v enem vegetacijskem obdobju povzroči odmiranje borov (*Pinus* spp.) vseh starostnih razredov, zato je v državah Evropske unije uvrščena na A1 listo karantenskih škodljivih organizmov. V Evropi je prisotnih le pet vrst iz rodu žagovinarjev, od katerih smo v Sloveniji našli štiri: *Monochamus galloprovincialis* (Olivier, 1795), *Monochamus saltuarius* (Gebler, 1830), *Monochamus sutor* (Linnaeus, 1758) in *Monochamus sartor* (Fabricius, 1787). V letu 2014 smo testirali učinkovitost feromonov Galloprotect 2D[®] in GalloprotectPack[®] (proizvajalec SEDQ Španija) na ulov žagovinarjev v gozdnih sestojih iglavcev z gozdnogojitvenim ukrepanjem in v sestojih brez ukrepanja. V ta namen smo na dveh lokacijah (Snežnik in Trnovski gozd) izbrali po osem ploskev z radijem 70 metrov. Štiri ploskve so bile izbrane v sestoju smreke (*Picea abies* (L) H. Karst.), štiri pa v sestoju jelke (*Abies alba* Mill.). Pri obeh drevesnih vrstah je bil na dveh ploskvah izveden 100 % posek dreves, na preostalih dveh pa ni bilo ukrepov. V sredino vsake ploskve smo postavili po eno križno past (proizvajalec Witasek Avstrija) s feronom Galloprotect 2D[®] oziroma GalloprotectPack[®]. Praznjenje pasti in menjava feromonov sta potekali 1x mesečno od meseca maja do meseca novembra. Determinacija ulova je bila opravljena na Biotehniški fakulteti, oddelku za gozdarstvo in obnovljive gozdne vire, v laboratoriju LEŠ – entomologija. Ulovili smo tri vrste žagovinarjev in sicer *M. sartor*, *M. sutor* in *M. galloprovincialis*, prevladovali pa sta vrsti *M. sutor* in *M. sartor*. Primerjava feromonov je pokazala večjo učinkovitost feromona znamke GalloprotectPack[®].

ABSTRACT

Comparison of the effectiveness of pheromones Galloprotect 2D[®] and GalloprotectPack[®] on the catch of *Monochamus* species (Cerambycidae), vectors of *Bursaphelenchus xylophilus*

Species from the genus *Monochamus* Dejean, 1821 are the most important confirmed vectors of *Bursaphelenchus xylophilus* (Steiner & Buhner) Nickle. Pine wood nematode (PWN) can cause the death of Pines (*Pinus* sp.) of all ages in only one vegetation period. In the countries of European Union the PWN is listed on the A1 list of quarantine pests. According to Bense (1995) only five species from genus *Monochamus* are present in Europe. In Slovenia we found four species, namely: *Monochamus galloprovincialis* (Olivier, 1795), *Monochamus saltuarius* (Gebler, 1830), *Monochamus sutor* (Linnaeus, 1758) and *Monochamus sartor* (Fabricius, 1787). In the year 2014, we tested the impact of two pheromones, Galloprotect 2D[®] and GalloprotectPack[®] (manufacturer SEDQ Spain), on the catch of *Monochamus* species. On two locations (Snežnik and Trnovski gozd) we choose eight plots with a radius of 70 meters. Four plots were chosen in the forest stand of Norway spruce (*Picea abies* (L) H. Karst), while other four were chosen in the stand of fir (*Abies alba* Mill, 1768). In both stands, 100 % of trees were cut on two plots, while on other two plots no action was taken. In the middle of each plot we put one Cross vane trap (manufacturer Witasek Austria) with a pheromone Galloprotect 2D[®] or GalloprotectPack[®]. Emptying of the traps and changing of pheromones were done once per month, from May to November. Determination of the catch was done on the Biotechnical faculty, Department of forestry and renewable forest resources, laboratory LEŠ – entomology. We caught three species from genus *Monochamus*, namely: *M. sartor*, *M. sutor* and *M. galloprovincialis*. The dominant species were *M. sartor* and *M. sutor*. Comparison of pheromones has showh greatest efficiency of pheromone GalloprotectPack[®].



Trends in outbreaks of forest pests in the last seven years in Slovenia

Maarten DE GROOT

Gozdarski inštitut Slovenije, Oddelek za varstvo gozdov, Večna pot 2, SI-1000 Ljubljana
(maarten.degroot@gozdis.si)

We analysed outbreaks of all forest pests, except for *I. typographus* and *P. chalcographus* in Slovenia for the period of 2008 till 2014. For this analysis, the data of ZGS was used. The trends were investigated for two different periods: 2008 till 2012 and 2013 till 2014. This division was because in 2013 a new information system was introduced which made reporting the data of outbreaks much easier. Therefore there was significant difference in records between before and after the introduction of the information system. In total 562 records of 56 species were made for 14 GGOs over the last 7 years. The most affected trees were beech (*Fagus sylvatica*), sweet chestnut (*Castanea sativa*) and Austrian pine (*Pinus nigra*). The austrian pine and beech were affected by different species, while sweet chestnut was only affected by one species (*Dryocosmus kuriphilus*). The most damage causing insect species were *Rhynchaenus fagi* and *Dryocosmus kuriphilus*. The attacked surface varied from 0.2 to 60000 ha with a mean around 2681 ha. The results about the trends are presented for the best investigated GGOs for the two periods.

IZVLEČEK

Trendi izbruhov škodljivcev gozdnega drevja v zadnjih sedmih letih v Sloveniji

Analizirali smo podatke Zavoda za gozdove Slovenije o izbruhih škodljivcev gozdnega drevja, z izjemo velikega in malega smrekovega lubadarja, v obdobju od 2008 do 2014 v Sloveniji. Trendi pojavljanja so bili analizirani za dve različni obdobji, in sicer od 2008 do 2012 in od 2013 do 2014. Za to delitev smo se odločili, ker je bil leta 2013 uveden nov sistem informiranja, ki je poročanje o pojavu škodljivih organizmov zelo poenostavil. Prav zato obstajajo značilne razlike v številu zapisov med obdobjem pred uvedbo novega sistema in obdobjem po uvedbi. V zadnjih sedmih letih je bilo v 14 gozdno gospodarskih območjih skupaj zabeleženih 562 zapisov oziroma 56 različnih vrst škodljivcev. Najbolj pogosto napadene vrste so bile bukev (*Fagus sylvatica*), domači kostanj (*Castanea sativa*) in črni bor (*Pinus nigra*). Črni bor in bukev so napadle različne vrste škodljivcev, medtem ko je bila na domačem kostanju zabeležena le kostanjeva šiškarica (*Dryocosmus kuriphilus*). Napadena površina je variirala med 0,2 in 6000 ha, povprečna prizadeta površina pa je znašala 2681 ha. Rezultati trendov so prikazani za najbolj raziskana gozdno gospodarska območja obeh period.



Kostanjeva šiškarica – kakšni so obeti za reševanje problematike v Sloveniji?

Katarina KOS¹, George MELIKA²

¹Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana
(katarina.kos@bf.uni-lj.si)

²Plant Health and Molecular Biology Laboratory, National Food Chain Safety Office, Budapest, Hungary

Kostanjeva šiškarica, *Dryocosmus kuriphilus* Yasumatsu, predstavlja resno grožnjo sestojem pravega kostanja po celem svetu. Ta invazivna vrsta se je v Sloveniji pojavila že leta 2005 in se je kljub strogim fitosanitarnim ukrepom in programa eradikacije, do leta 2014 razširila že po celotnem ozemlju Slovenije z naravnimi sestoji kostanja in v nasadih. Številne metode varstva pred tem škodljivcem (kemično varstvo, izrezovanje, žlahtnjenje in odbira odpornih sort) so se izkazale kot neučinkovite. Poleg tega so domorodni parazitoidi, ki so uspeli sprejeti kostanjevo šiškarico kot ustreznega gostitelja, z manj kot 2 % parazitiranostjo neuspešni. V 4-letnih raziskavah smo tudi v Sloveniji našli 27 vrst domorodnih parazitoidov. Kot edino uspešno se je pokazalo biotično varstvo s parazitoidom *Torymus sinensis*, ki se je po vnosu že ustalil v Italiji, vnesen pa je bil prav tako v Franciji in Madžarski, ter tudi na Hrvaškem. Čeprav so bili vnosi izvršeni v bližini slovenske meje, pa v Sloveniji v letu 2014 še vedno nismo dobili odobritve za vnos parazitoida, prav tako pa tudi nimamo podatka, da bi se parazitoid po naravni poti razširil znotraj meja Slovenije.

ABSTRACT

Chestnut gall wasp – the management options in Slovenia

Chestnut gall wasp, *Dryocosmus kuriphilus* Yasumatsu, is a global pest of chestnut. This invasive pest was first recorded in Slovenia in 2005 and, despite strict phytosanitary measures and an eradication program, in 2014 it has expanded nearly throughout the

Slovenian area with native chestnut stands. Various measures to control *D. kuriphilus* populations have proven to be unsuccessful (use of chemical pesticides, pruning, mechanical protection, selection of resistant varieties) and the attack rates of indigenous parasitoid species are usually less than 2%. So introduction of alien species of parasitoid *Torymus sinensis* has proven to be the only viable management option to save chestnut stands in Slovenia. Over a 4-year period a total of 27 species of native parasitoids emerged from overwintered and newly-formed *D. kuriphilus* galls in Slovenia. Parasitoid *T. sinensis* is yet established in Italy and has been also introduced in France, Croatia and Hungary, but in Slovenia the permission to introduce this successful and specific parasitoid is still not granted and till 2014 there are no reports that it passed the border via natural spread.



Novo pri nas: masarijsko odmiranje platane in platanova pepelovka

Dušan JURC¹, Lena MARION²

¹Gozdarski inštitut Slovenije, Večna pot 2, SI-1000 Ljubljana (dusan.jurc@gozdis.si)

²Tisa d.o.o, Cesta v Prod 84, SI-1000 Ljubljana

Javorolistna platana (*Platanus x hispanica*) je pomembna alohtona drevnina v urbanem okolju, ki ji pri nas ogrožata zdravje predvsem platanova listna sušica (*Apiognomonina veneta*) in platanova čipkarica (*Corythuca ciliata*). V zadnjih letih pa smo opazili povečevanje poškodb zaradi dveh novih bolezni, o katerih doslej pri nas niso poročali. Nevarna bolezen, ki ima velike ekonomske posledice, je masarijsko odmiranje platane, ki jo povzroča gliva *Splanchnonema platani* (*Macrodiploidiopsis desmazieresii*). Značilnost bolezni je odmiranje skorje platanovih vej na zgornji strani, redkeje odmiranje celih vej in nagla razgradnja lesa v okuženih vejah. Zaradi tega se veje pogosto nepričakovano zlomijo in ogrožajo ljudi in premoženje v urbanih predelih. Masarijsko odmiranje platane je postalo velik ekonomski problem v vseh okoljih, kjer se je bolezen pojavila, saj so stroški kontrole varnosti dreves in odstranjevanja nevarnih okuženih vej v urbanih nasadih izjemno narasli. Druga bolezen je tujerodna platanova pepelovka (*Erysiphe platani*), ki je pri nas prisotna že več let, vendar se jakost okužb v zadnjih letih povečuje. Okuženi listi so deformirani in manjši kot zdravi. Bolezen ni pomembna spomladi, ampak resno prizadene mlade, intenzivno rastoče poganjke poleti in jeseni. Močno so prizadeta drevesa, ki jim redno obžagujejo veje in intenzivno rastejo tudi kasno v rastni dobi. V prispevku so predstavljene značilnosti gliv povzročiteljic obeh bolezni, njuno širjenje drugod in ukrepi proti njima.

ABSTRACT

New in Slovenia: massaria disease of plane and powdery mildew of plane

London plane (*Platanus x hispanica*) is an important allochthonous tree species in urban environments. Its health in Slovenia is endangered mostly by anthracnose of London plane (*Apiognomonina veneta*) and sycamore lace bug (*Corythuca ciliata*). Recently we noticed increasing damages of this tree species caused by two new diseases, which were not detected in the past. One of these diseases, which also has a considerable economic impact is massaria disease of plane, caused by the fungus *Splanchnonema platani* (*Macrodiploidiopsis desmazieresii*). It is characterised by the dieback of bark on the upper parts or rarely of the whole branches, and rather rapid degradation of the infected wood.

Infected branches often break off unexpectedly and threaten people and property in urban environment. Massaria disease of plane became serious economic problem in all areas of its appearance because the costs of tree safety control and removing of infected and weakened branches increased significantly. Second disease, powdery mildew, is caused by the alien fungus *Erysiphe platani*. This fungus is already present in our country for some years, but the intensity of infections is increasing. Infected leaves are distorted and smaller than healthy leaves. The disease is not important in spring, but seriously affects young, vigorously growing shoots in summer and autumn. Most damages appear on trees that are regularly pruned and are growing intensively even late in growing season. In the paper the characteristics of both pathogens and the diseases, their spread and possibilities for their management are presented.



Nove najdbe karantenske glive *Lecanosticta acicola* v Sloveniji

Tine HAUPTMAN, Dušan SADIKOVIĆ

Gozdarski inštitut Slovenije, Oddelek za varstvo gozdov, Večna pot 2, SI-1000 Ljubljana
(tine.hauptman@gozdis.si)

Lecanosticta acicola (teleomorf *Mycosphaerella dearnessii*, sinonim *Scirrhia acicola*) je karantenska gliva, ki povzroča rjavenje borovih iglic. Gliva, ki domnevno ogroža vse vrste bora (*Pinus* spp.), je uvrščena v Prilogo II.A1 Direktive Sveta št. 2000/29/ES. *L. acicola* najverjetneje izvira iz Severne Amerike, vse bolj pogosto pa je ugotovljena tudi v Evropi. V Sloveniji je bila prvič odkrila leta 2008 na Bledu, in sicer na rušju (*P. mugo*) in rdečem boru (*P. sylvestris*), leto kasneje pa je bila bolezen odkrita tudi na rušju (*P. mugo*) v ljubljanskem parku Tivoli. Na obeh lokacijah so bili vsi okuženi osebki posekani in uničeni s sežigom. V Tivoliju izvedeni ukrepi niso zadostovali za izkoreninjenje glive *L. acicola*, saj smo leta 2013 na grmih rušja v parku odkrili nove okužbe. Tej drugi najdbi je posledično sledil strožji ukrep, to je posek in uničenje vseh grmov rušja v parku Tivoli, ki je bil izveden jeseni leta 2013. V letu 2014 smo v sklopu posebnega nadzora za glivi *Mycosphaerella dearnessii* in *M. pini* v parku redno spremljali zdravstveno stanje drugih vrst bora (*Pinus* sp.), vendar novih okužb z glivo *L. acicola* nismo odkrili. Nova žarišča bolezni pa smo odkrili na štirih drugih lokacijah v Sloveniji. Tri žarišča se nahajajo v urbanem okolju (Čatež ob Savi, Kostanjevica na Krki, Celje), odkritje bolezni v Trenti pa predstavlja prvo najdbo glive *L. acicola* v naravnem okolju pri nas. Na vseh štirih lokacijah so bile okužbe odkrite na rušju (*P. mugo*), na drugih vrstah bora v okolici žarišč pa simptomov rjavenja borovih iglic nismo odkrili. V prispevku predstavljamo tudi problematiko odkrivanja okužb, domnevne poti vnosa in širjenja glive ter možne vplive bolezni na bore (*Pinus* spp.) v Sloveniji.

ABSTRACT

New findings of quarantine fungus *Lecanosticta acicola* in Slovenia

Quarantine fungus *Lecanosticta acicola* (teleomorph *Mycosphaerella dearnessii*, synonym *Scirrhia acicola*) is the causal agent of the brown spot needle blight disease. The fungus, which presumably threatens all pine species (*Pinus* spp.), is listed on the Annex II.A1 of the Council Directive 2000/29/EC. *L. acicola* appears to be of North American origin, but it is more and more often found also in Europe. In Slovenia, the fungus was first discovered

in 2008 on *Pinus mugo* and *P. sylvestris* in Bled. The year after, the disease was also discovered on *P. mugo* in the park Tivoli in Ljubljana. At both locations, all infected specimens were felled and burned. In Tivoli, implemented measures were not sufficient to eradicate *L. acicola*, as new infections of *P. mugo* were found in 2013. After this second finding, felling and destruction of all *P. mugo* specimens in the park Tivoli was carried out in autumn 2013. During official surveillance of the fungi *Mycosphaerella dearnessii* nad *M. pini*, health status of other pine species (*Pinus* spp.) in the park Tivoli was regularly checked in 2014, but no new *L. acicola* infections were found. However, the disease was in 2014 discovered at the four other locations in Slovenia. Three infected sites are located in the urban environment (Čatež ob Savi, Kostanjevica na Krki, Celje), while infected site in Trenta represents first discovery of fungus *L. acicola* in the natural environment in Slovenia. At all four locations, infections were found on *P. mugo*, but on the other pine species in the vicinity, no disease symptoms were found. The issue of detection of infections, presumed pathways of the fungus and the potential impacts of the disease on pine species in Slovenia are also discussed in this article.

Varstvo vinske trte

Katere viruse vinske trte prenaša smokvin volnati kapar (*Planococcus ficus*) v Sloveniji?

Melita ŠTRUKELJ, Irena MAVRIČ PLEŠKO, Gregor UREK

Kmetijski inštitut Slovenije, Hacquetova ulica 17, SI-1000 Ljubljana

(melita.strukelj@kis.si)

Kaparji so znani prenašalci z zvijanjem listov vinske trte povezanih virusov (*Grapevine leafroll-associated viruses* - GLRaVs), ki povzročajo eno najpomembnejših in najbolj razširjenih virusnih bolezni vinske trte. Kaparji predstavljajo tudi velik delež tujerodnih organizmov, ki so se v zadnjih letih močno razširili predvsem v vinogradih na Primorskem, kjer povzročajo precejšnjo gospodarsko škodo. Smokvin volnati kapar (*Planococcus ficus*) je eden od možnih prenašalcev dveh najpomembnejših virusov v slovenskih vinogradih, GLRaV-1 in GLRaV-3. Ta kapar ima več rodov letno, kar še pospeši njegovo širjenje in ob tem tudi širjenje virusne okužbe v vinogradih. Posledica tega je lahko velika gospodarska škoda, tako zaradi vpliva virusov, kot tudi zaradi samih kaparjev. V izbranem vinogradu v bližini Ajdovščine, kjer so opazili hitro širjenje bolezni zvijanja listov vinske trte, smo našli kaparje vrste *P. ficus*. S testiranjem smo ugotovili močno okuženost vinograda z GLRaV-3. Okužb z GLRaV-1 je bilo bistveno manj. V delu vinograda, kjer je bila okuženost z GLRaV-3 pogostejša, so bili tudi kaparji zelo razširjeni, kar je kazalo na možno vpletenost kaparjev v širjenje bolezni. Z izbrano populacijo *P. ficus* iz tega vinograda smo dve leti zapored preučevali možnost prenosa GLRaV-1 in GLRaV-3 s tremi različnimi skupinami razvojnih stopenj kaparja. Uspešnost prenosa virusov na neokužene trte smo preverili z DAS-ELISA testom. Rezultati testa so pokazali, da prvi nimfalni stadij izbrane populacije *P. ficus* uspešno prenaša izbrani izolat GLRaV-3, medtem ko ostali stadiji kaparja niso prenesli nobenega od virusov.

ABSTRACT

Which grapevine viruses are transmitted by the Vine mealybug (*Planococcus ficus*) in Slovenia?

Scale insects are known vectors of grapevine leafroll-associated viruses (GLRaVs), which cause one of the most important and widespread viral diseases of grapevine. Scale insects represent great amount of non-native organisms, which have greatly expanded mainly in vineyards of Primorska region and cause considerable economic losses. Vine mealybug (*Planococcus ficus*) is one of the possible vectors of the two most important viruses in Slovenian vineyards, GLRaV-1 and GLRaV-3. Vine mealybug has several generations per year, which accelerate its spread and the spread of viral infections in the vineyards. This can result in enormous economic damage as a result of the impact of viruses, as well as the mealybugs themselves. *P. ficus* was found in a vineyard near Ajdovščina where the rapid spread of the grapevine leafroll disease was observed. The vineyard was heavily infected with GLRaV-3 while infections with GLRaV-1 were considerably lower. In the part of the vineyard with heavy GLRaV-3 infection, vine mealybugs were also widespread suggesting a possible role of mealybugs in the spread of the disease. Transmission experiments of GLRaV-1 and GLRaV-3 were made with three different groups of developmental stages of selected population of *P. ficus* from the same vineyard. The recipient plants were tested by DAS-ELISA. The results showed that only the first instars nymphs of this population of *P. ficus* successfully transmit the selected isolate of GLRaV-3.



Grapevine Pinot gris virus, trenutno stanje pri nas in v svetu

Irena MAVRIČ PLEŠKO¹, Mojca VIRŠČEK MARN¹, Ivan ŽEŽLINA², Boris KORUZA¹

¹Kmetijski inštitut Slovenije, Hacquetova ulica 17, SI-1000 Ljubljana
(Irena.MavricPlesko@kis.si)

²KGZS – zavod Nova Gorica, Pri hrastu 18, SI-5000 Nova Gorica

Že od leta 2001 smo na Primorskem na vinski trti opazili nenavadna bolezenska znamenja, ki bi lahko bila posledica virusnih obolenj ali posledica napada pršice šiškarice (pršica trsne kodravosti – *Calipitrimerus vitis*). Povzročitelja bolezenskih znamenj nismo uspeli ugotoviti. V letu 2012 so v Italiji kot možnega povzročitelja te bolezni identificirali nov virus, imenovan *Grapevine Pinot gris virus* (GPGV). V istem letu smo na simptomatičnih trsah v Sloveniji potrdili okužbo s tem virusom. Po najdbi GPGV v Italiji so virus našli tudi na Češkem in Slovaškem in v Grčiji. V letu 2014 pa je na Primorskem bolezen izbruhnila nepričakovano in v večjem obsegu. V povezavi s tem izbruhom smo v tem letu posebno pozornost pri vzorčenju in testiranju namenili prav Primorski, hkrati pa smo bili tudi pri pregledih objektov za pridelavo sadilnega materiala še posebej pozorni na bolezenska znamenja. Virus smo detektirali v večini simptomatičnih vzorcev, vendar tudi v nekaterih vzorcih brez bolezenskih znamenj. Z raziskavami virusa in spremljanjem bolezni bomo nadaljevali tudi v prihodnje, saj je za uspešno obvladovanje bolezni nujno potrebno poznati njene vzroke in epidemiologijo.

ABSTRACT

Grapevine Pinot gris virus, the situation in Slovenia and in the world

Unusual virus-like symptoms were observed on grapevine in Primorska since 2001 but the causal agent could not be identified for a long time. The observed symptoms resembled the ones caused by eriopyid mite *Calipitrimerus vitis*, but they could not be detected on symptomatic plants. *Grapevine Pinot gris virus* (GPGV), a new trichovirus was identified in grapevine in Italy in 2012 as a possible cause of the disease. In the same year the infection with GPGV was confirmed in symptomatic grapevine also in Slovenia. After the first finding in Italy the virus was found also in Slovakia, Czech Republic and Greece. In 2014 the disease caused a lot of problems in grapevine production in Primorska therefore sampling and testing for GPGV was focused on this part of the country. The places of production of planting material were also carefully screened for disease symptoms in whole country. GPGV was detected in almost all symptomatic samples from the field but also in some samples without visible symptoms. The studies of the virus and epidemiology of the disease are continued to provide additional information which would help us managing the disease.



Uporaba toplotne terapije za zatiranje fitoplazemske povzročiteljice zlate trsne rumenice in jajčec njenega prenašalca (ameriškega škržatka)

Jaka RAZINGER¹, Vojko ŠKERLAVAJ¹, Nataša MEHLE², Marina DERMASTIA²

¹ Kmetijski inštitut Slovenije, Oddelek za varstvo rastlin, Hacquetova 17, SI-1000 Ljubljana (jaka.razinger@kis.si)

² Nacionalni inštitut za biologijo, Oddelek za biotehnologijo in sistemsko biologijo, Večna pot 111, SI-1000 Ljubljana

Povzročiteljica zlate trsne rumenice (Flavescence dorée) - fitoplazma FDp, je v Evropi ena najpomembnejših fitoplazem, ki povzroča propadanje trsov vinske trte. FDp je bila prvič ugotovljena v Franciji, od koder se je razširila v Italijo. Ugotovljena je bila tudi Španiji, na Portugalskem, v Srbiji, Švici, na Hrvaškem, Madžarskem in v Sloveniji. FDp je uvrščena na II.A.II evropski karantenski seznam rastlinam škodljivih organizmov (Council Directive 2000/29/EC). Trenutno je edini učinkovit in predpisan ukrep za preprečevanje širjenja bolezni v vinogradih odstranjevanje okuženih rastlin ter zatiranje prenašalca FDp ameriškega škržatka (*Scaphoideus titanus*). Ker pa so lahko že trsne cepljenke okužene s FDp, smo v okviru CRP projekta V4-1103 'Trsne rumenice: metode zgodnjega odkrivanja in obvladovanja' na slovenskih cepljenkah in cepilnemu materialu testirali metodo toplotne terapije (TT) za obvladovanje FDp in njenega prenašalca. Preskusili smo kako uspešno TT uničuje FDp, ali se FDp prenaša s cepljenjem, kako TT vpliva na živost in vitalnost rastlinskega materiala namenjenega cepljenju ali neposrednemu sajenju, in kako TT vpliva na preživetje jajčec ameriškega škržatka. TT je uspešno uničila FDp v rastlinskem materialu in jajčeca ameriškega škržatka, hkrati pa ni negativno vplivala na živost razkuženega rastlinskega materiala. TT se je izkazala kot učinkovito orodje, s katerim bi trsničarska panoga lahko zagotovila višjo kakovost trsov, ob natančnem upoštevanju protokola TT.

ABSTRACT

The use of thermotherapy to control phytoplasma that causes grapevine yellows and the eggs of its vector (American grapevine leafhopper)

Phytoplasma FDp is the causal agent of Flavescence dorée and is associated with the main grapevine destruction in Europe. FDp was first reported in France, from where it spread to Italy. It was also discovered in Spain, Portugal, Serbia, Switzerland, Croatia, Hungary and Slovenia. FDp is listed in Annex II, Part A.II of Council Directive 2000/29/EC. The destruction of diseased plants and control of its vector American grapevine leafhopper (*Scaphoideus titanus*) is mandatory in vineyards. However, FDp can already be present in plant propagating material and young vines ready to be transplanted. Therefore, within a CRP project V4-1103 'Grapevine yellows: methods for their early detection and control' we evaluated thermotherapy (TT) as a method that could be used to control FDp as well as eggs of its vector. We evaluated how successfully TT destroys FDp, whether or not FDp can be transmitted by grafting, does TT decrease the viability of the planting or grafting plant material, and if TT destroys the eggs of American grapevine leafhopper. TT successfully removed FDp from plant material as well as destroyed the eggs of American grapevine leafhopper, without significant adverse effects to the disinfected plant material. It is a useful tool which could be used by Slovene vine nurseries to ensure a higher quality of grape transplants, provided the protocol is followed precisely.



Populacija ameriškega škržatka (*Scaphoideus titanus* Ball) po izvedbi ukrepov preprečevanja širjenja zlate trsne rumenice na območju Celjske regije

Magda RAK CIZEJ¹, Alenke FERLEŽ RUS¹, Iris ŠKERBOT²

¹Inštitut za hmeljarstvo in pivovarstvo Slovenije, Oddelek za varstvo rastlin, Cesta Žalskega tabora 2, SI-3310 Žalec (magda.rak-cizej@ihps.si)

²Kmetijsko gozdarska zbornica Slovenije, Kmetijsko gozdarski zavod Celje, Trnoveljska cesta 1, SI-3000 Celje

Ameriški škržatek (*Scaphoideus titanus*) je glavni naravni prenašalec zlate trsne rumenice, bolezni vinske trte, ki jo povzroča karantenska fitoplazma Grapevine Flavescence dorée (GFD). Eden izmed pomembnih ukrepov za uspešno preprečevanje širjenja GFD v vinogradih je zatiranje ameriškega škržatka z insekticidi, katerega smo na območju Celjske regije izvajali zadnja 3 leta. V prispevku bodo predstavljeni rezultati izvajanja ukrepov in podane nadaljnje usmeritve.

ABSTRACT

The population of the American leafhopper (*Scaphoideus titanus* Ball) after the implementation of measures to prevent the spread of Grapevine Flavescence dorée in the area of the Celje region

Scaphoideus titanus is a leafhopper natural vector of the quarantine phytoplasma that causes Grapevine Flavescence dorée (GFD). The most important measure for successful prevention spread of GFD in vineyards is management of *Scaphoideus titanus* with insecticides, which carried out last 3 years in the area of the Celje region. The article presents results of implementations measures and indicates guidelines for future.



Prognoza peronospore vinske trte *Plasmopora viticola* z modelom USCS

Maja PODGORNIK^{1,2}

¹Univerza na Primorskem, Znanstveno-raziskovalno središče Koper, Inštitut za oljkarstvo, Garibaldijeva 1, SI-6000 Koper (Maja.Podgornik@zrs.upr.si)

²Univerza na Primorskem, Fakulteta za matematiko naravoslovje in informacijske tehnologije Koper, Glagoljaška 8, SI-6000 Koper

Peronospora vinske trte (*Plasmopora viticola*) je poleg pepelovke oz. oidija (*Uncinula necator*) ena najpogostejših glivičnih bolezni v vinogradih Obalno-kraške in Goriške regije, ki lahko ob ugodnih vremenskih razmerah in ob neustreznem varstvu rastlin povzroči tudi celoten izpad pridelka. Z namenom, da bi zagotovili natančnejšo prognozo omenjene bolezni in s tem zmanjšali porabo fitofarmaceutskih sredstev na območju Obalno-kraške in Goriške regije smo v letu 2012 v okviru projekta SIGMA2 - Čezmejna mreža za sonaravno upravljanje okolja in biotske raznovrstnosti (Evropsko teritorialno sodelovanje, Program čezmejnega sodelovanja Slovenija – Italija 2007-2013) testirali novo metodo prognoze bolezni peronospore vinske trte (modle USCS - DowGraPri-Downy Mildew Grape Primary Infection), ki jo je leta 2008 razvilo italijansko Spin off podjetje HORTA S.r.l. katoliške univerze v Piacenzi (Università Cattolica del Sacro Cuore,

Piacenza). Nova metoda oziroma Model USCS, ki smo ga v letu 2012 testirali na območju 6 lokacijah Slovenske Istre, Vipavske doline in Goriških Brd, na podlagi urnih podatkov temperature zraka, relativne vlažnosti zraka, padavin in omočenosti lista simulira kalitev oospor v tleh, razvoj in kalitev zoospor na listni površini (prodrejo v notranjost rastline preko listnih rež) ter procese okužbe (primarne in sekundarne okužbe) in inkubacije.

Ob zaključku testiranja nove metode oz. modela USCS, ugotavljamo, da je testirani model primerno orodje s katerim bi lahko nadgradili prognozo peronospore vinske trte na območju Slovenske Istre. Žal pa zaradi neprilagojenosti modela USCS na klimatske razmere v Vipavski dolini in Goriških Brdih menimo, da je za dejansko uporabnost modela na območju Obalno-kraške in Goriške regije, model potrebno testirati v daljšem časovnem obdobju in na večjemu številu lokaciji.

ABSTRACT

Prognosis of grapevine downy mildew *Plasmopara viticola* with the USCS model

Beside the powdery mildew or oidium (*Uncinula nectar*) the grapevine downy mildew (*Plasmopora viticola*) is one of the most common fungal diseases of vineyards in the Coastal-Karst region and Goriška region, which can in favourable weather conditions and with inadequate protection of plants causes also the loss of an entire crop. In order to ensure a more accurate prognosis of these diseases and thereby reduce the consumption of pesticides in the area of the Coastal-Karst region and Goriška region, we tested a new method in 2012, which was developed in 2008 by the Italian company HORTA S.r.l. – a Spin Off company of the Catholic University of Piacenza ('Università Cattolica del Sacro Cuore, Piacenza), for the prognosis of the grapevine downy mildew disease (USCS model - DowGraPri-Downy Mildew Grape Primary Infection), under the project SIGMA2 – Cross-border network for the sustainable management and biodiversity (European Territorial Cooperation, Slovenia - Italy Cross-border Cooperation Operational Programme 2007-2013). The new method or the USCS model, which was tested in 2012 in the area of 6 location of the Slovenian Istria, Vipava Valley and Goriška Brda, on the basis of hourly data on the air temperature, relative humidity, precipitation and leaf wetness, simulates the germination of oospore in the soil, the development and germination of zoospore on the leaf surface (penetrate into the interior of plants through leaf stomata) and the process of infection (primary and secondary infections) and incubation. Upon the completion of testing of the new method or the USCS model, we find that the tested model is an appropriate tool that could upgrade the prognosis of the grapevine downy mildew in the area of Slovenian Istria. Unfortunately, due to poor adaptability of the USCS model to the climatic conditions in the Vipava valley and Goriška Brda, we believe that for the actual usefulness of the model in the area of Coastal-Karst and Goriška region, the model should be tested over a longer period of time and on a large number of locations.



Preizkus uporabnosti multispektralnih satelitskih posnetkov za zgodnje odkrivanje žarišč zlate trsne rumenice

Uroš ŽIBRAT, Matej KNAPIČ

Kmetijski inštitut Slovenije, Hacquetova 17, SI-1000 Ljubljana (uros.zibrat@kis.si)

Preizkusili smo uporabo multispektralnih satelitskih posnetkov za zgodnje odkrivanje žarišč zlate trsne rumenice, ki jo povzroča Grapevine flavescence dorée fitoplazma. Z

uporabo 27 spektralnih indeksov in štirih različnih algoritmov strojnega učenja smo dosegli razmeroma zanesljivo identifikacijo trt z izraženimi znaki okužbe. Rezultate slikovne analize satelitskih posnetkov je potrebno dopolniti s tarčno usmerjenimi terenskimi pregledi. Prednost te metode je, da lahko s slikovno analizo hitro pregledamo večje površine vinogradov in terenske preglede izvajamo usmerjeno, kar zmanjšuje obseg terenskega dela. Zgodnja identifikacija žarišč s pomočjo multispektralnih posnetkov lahko pripomore k učinkovitemu obvladovanju in preprečevanju širjenja zlate trsne rumenice. Ključne besede: Zaznavanje na daljavo, trsne rumenice, WorldView-2, zgodnje zaznavanje okužb.

ABSTRACT

Testing the applicability of multispectral satellite imaging for early detection of grapevine yellows foci

We tested the applicability of multispectral satellite images for early detection of grapevine yellows foci, caused by Grapevine flavescence dorée phytoplasma. Using 27 spectral indexes and four machine learning algorithms we achieved a comparatively reliable identification of grapevines with expressed signs of infection. Results of the image analysis need to be supplemented with field inspections. This new method enables early detection of foci with fewer visual inspections. With this method only suspect grapevines need to be visually checked, allowing for targeted field inspections. Early detection of foci using multispectral imaging could contribute to effective management and limiting the spread of grapevine yellows.



Molekulska raznolikost fitoplazme '*Candidatus Phytoplasma solani*' v Sloveniji

Nataša MEHLE, S. KAVČIČ, Marina DERMASTIA

Nacionalni inštitut za biologijo, Oddelek za biotehnologijo in sistemsko biologijo, Večna pot 111, 1000 Ljubljana (marina.dermastia@nib.si)

'*Candidatus Phytoplasma solani*' (BNp) iz skupine 16SrXII-A je povzročiteljica najbolj razširjene fitoplazemske bolezni vinske trte v Evropi – navadne trsne rumenice ali počrnelosti lesa (BN). V vseh slovenskih vinorodnih deželah je prisotna že dolgo časa. Ohranja se v naravnih epidemičnih ciklih, ki jih sestavljajo različne zelnote rastline in njen glavni žuželčji prenašalec *Hyalesthes obsoletus*. BNp ima dve genski gruči, *tuf-a* in *tuf-b*, ki naj bi bili povezani z različnimi naravnimi epidemičnimi cikli. Medtem ko je tip *tuf-a* prevladujoče povezan z veliko koprivo (*Urtica dioica*), so tip *tuf-b* našli v številnih plevelnih rastlinah, med katerimi je njivski slak (*Convolvulus arvensis*) prevladujoči rezervoar te fitoplazme v večini Evrope. Epidemiologija BN je povezana le s temi rezervoarnimi rastlinami, saj je vinska trta končni gostitelj za BNp. BNp tip *tuf-a* je najpogostejši v severozahodnih območjih pojavljanja BN (Nemčija, Francija, Švica), tip *tuf-b* pa je bolj razširjen, a vseeno prevladuje v jugovzhodnih in vzhodnih območjih pojavljanja bolezni. Da bi raziskali genetsko variabilnost sevov BNp v Sloveniji, smo analizirali vzorce iz vseh vinorodnih dežel, ki so jih nabrali med uradnim fitosanitarnim nadzorom v letih 2007 in 2013. Restriksijska analiza amplikonov gena *tuf* je pokazala prisotnost obeh tipov *tuf* v vseh vinorodnih deželah, pri čemer je *tuf-b* tip prevladoval. Tipizacija gena *vmp1* je odkrila 15 *vmp1* profilov. Pokazala je, da je profil *vmp1-1* v

vzhodni Sloveniji prevladujoče povezan s tipom tuf-b, medtem ko je na Primorskem variabilnost *vmp1* večja. Zanimiva je bila povezava tipa tuf-a s profilom *vmp1-9* v vseh, z izjemo enega primera. Na osnovi vseh rezultatov raziskave lahko zaključimo, da v Sloveniji v petih letih ni prišlo do signifikantnih sprememb v epidemiologiji BN.

ABSTRACT

Molecular diversity of 'Candidatus Phytoplasma solani' strains in Slovenia

'Candidatus Phytoplasma solani' (BNp) from 16SrXII-A group is a causal agent of the most widespread European grapevine phytoplasma disease Bois noir (BN) and has been existing in all Slovenian vine growing region for a long time. It is maintained in natural epidemic cycles consisting of different herbaceous plant hosts and its main insect vector *Hyalesthes obsoletus*. BNp has two main genetic clusters, *tuf-a* and *tuf-b*, which are presumably linked to different natural epidemic cycles in the field. While type *tuf-a* has been predominately associated with stinging nettle (*Urtica dioica*), the *tuf-b* type is found in a range of other weedy plants, field bindweed (*Convolvulus arvensis*) being the dominant reservoir plant throughout most of Europe. The epidemiology of BN is associated only with these reservoir plants, because grapevine is regarded to be a dead-end host for BNp. The *tuf-a* type is most common in northwestern area of disease occurrences (Germany, France, Switzerland) and the *tuf-b* type is more widespread but prevalent in the southeastern and eastern disease range. In order to investigate the genetic variability of BNp strains in Slovenia we analyzed samples from all vine growing regions collected during the official survey by the Slovenian phytoadministration in years 2007 and 2013. Restriction analysis of *tuf* gene amplicons showed the presence of both *tuf*-types in all vine growing regions, with *tuf-b* being prevalent. However, the *vmp1* typing revealed 15 *vmp1* profiles. It additionally demonstrated that in eastern Slovenia a profile *vmp1-1* was predominately linked to the type *tuf-b*, while in the Primorska region a genetic variability of *vmp1* was considerable. Interestingly, a type *tuf-a* was in all but one cases linked to profile *vmp1-9*. Based on overall results of this study we could conclude that there was no significant change in the epidemiology of BN within five years in Slovenia.

Posterji

Alien whiteflies (Hemiptera: Aleyrodidae) of Europe recorded in Croatia

Mladen ŠIMALA¹, Tatjana MASTEN MILEK², Maja PINTAR¹

¹ Croatian Centre for Agriculture, Food and Rural Affairs – Institute for Plant Protection, Zagreb, Republic of Croatia (mladen.simala@hcphs.hr)

² Croatian Centre for Agriculture, Food and Rural Affairs, Zagreb, Republic of Croatia

Whiteflies belong to the order Hemiptera and comprise a single superfamily, Aleyrodoidea, within the suborder Sternorrhyncha. They are all placed in a single family, Aleyrodidae with 1556 described species accommodated in 161 genera. The whitefly fauna of Europe and the Mediterranean Basin comprises 56 species that are considered to be native or naturalized, accommodated within 25 genera. Alien species are defined as species living outside of their natural range and outside of their natural dispersal potential. At present, the alien species represent 39 % of the total whitefly fauna occurring in Europe. Whiteflies are distributed throughout the major zoogeographical regions of the World, with their greatest diversity in tropical and south temperate regions. The trade of exotic trees and ornamentals is responsible for many accidental introductions of insects to countries far away from their native area. Most alien species of whiteflies were accidentally introduced with their host plant. The starting point for compiling the list of alien whitefly species in Croatia was a book “Alien Terrestrial Arthropods of Europe” and database DAISIE. A list of alien whiteflies in Croatia was made by searching of agricultural, forestry and taxonomic entomological peer-reviewed literature and the latest check list of whiteflies in Croatia. The check list of whiteflies in Croatia published in 2008, contains 31 species belonging to 18 genera. According to DAISIE list, seven of them are alien to Europe. These are the following species: *Aleurolobus olivinus* Silvestri, 1911, *Aleurothrixus floccosus* Maskell, 1896, *Bemisia afer* Priesner & Hosny, 1934, *Bemisia tabaci* Gennadius, 1889, *Dialeurodes citri* Ashmead, 1885, *Massilieurodes chittendeni* Laing, 1928 and *Trialeurodes vaporariorum* Westwood, 1856. Two alien whitefly species recorded for the first time in Croatia after 2008 and not presented in DAISIE (2009) are *Aleurocanthus spiniferus* Quaintance, 1903 detected in 2012 and *Aleuroclava aucubae* (Kuwana, 1911) found in 2013.



Bionomija rastlinjakovega ščitkarja (*Trialeurodes vaporariorum* [Westwood], Homoptera, Aleyrodidae) v zavarovanih prostorih

Iris ŠKERBOT¹, Lea MILEVOJ², Stanislav TRDAN³

¹KGZS-Zavod CE, Trnoveljska cesta 1, SI-3000 Celje (iris.skerbot@ce.kgzs.si)

²upokojena redna profesorica

³Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana

V letih 2007 in 2010 smo z vizualnimi pregledi rastlin in z rumenimi lepljivimi ploščami spremljali pojav rastlinjakovega ščitkarja (*Trialeurodes vaporariorum*) na papriki, paradižniku in kumarah ter bionomijo rastlinjakovega ščitkarja na paradižniku v zavarovanih prostorih na širšem celjskem območju. V letu 2007 smo pojav rastlinjakovega ščitkarja spremljali na 4 lokacijah. V letu 2009 smo v zavarovanem prostoru v Imenem

spremljali bionomijo rastlinjakovega ščitkarja. Prve odrasle osebke smo zabeležili konec prve dekade julija in odložena jajčeca konec druge dekade julija. V tretji dekadi julija smo zabeležili prve ličinke razvojne stopnje L1, L2 in L3 in v drugi dekadi avgusta še prve pupe. Od druge dekade avgusta smo na rastlinah zabeležili hkrati vse razvojne stadije škodljivca. Ugotovili smo, da rastlinjakov ščitkar prezimuje na plevelih v zavarovanih prostorih in na prostem ter preleta iz zavarovanega prostora na prosto in nazaj.

ABSTRACT

Bionomics of greenhouse whitefly (*Trialeurodes vaporariorum* [Westwood], Homoptera, Aleyrodidae) in greenhouses

In the years 2007 and 2010 we have been investigating the incidence greenhouse whitefly (*Trialeurodes vaporariorum*) on pepper, tomato and cucumber plants and the bionomics of greenhouse whitefly in the greenhouses around the Celje region. In 2007 we observed the presence of greenhouse whitefly on tomatoes on 4 locations. In 2009 we studied the bionomics of greenhouse whitefly at location Imeno. The first adults of the greenhouse whitefly were detected at the end of first decade of July, while deposited eggs were found at the end of the second decade of July. In the third decade of July we identified the first larvae in the L1, L2 and L3 stages, while in the second decade of August we detected the first pupae. From the second decade of August onwards all stages of the greenhouse whitefly were found on the plants at the same time. We established that greenhouse whiteflies overwinter on the weeds in glasshouses and in the open fields, and they also alternate between the greenhouses and the open fields.



Laboratorijski poskusi zatiranja smokvinega volnatega kaparja (*Planococcus ficus*) s slovenskimi sevi entomopatogenih gliv

Jaka RAZINGER, Melita ŠTRUKELJ, Gregor UREK

Kmetijski inštitut Slovenije, Oddelek za varstvo rastlin, Hacquetova 17, SI-1000 Ljubljana
(jaka.razinger@kis.si)

Kaparji so pomembni škodljivci vinske trte, ki se hranijo z rastlinskimi sokovi in povzročajo postopno propadanje rastlin. Na svoje gostitelje škodljivo vplivajo tudi posredno s prenosom z zvijanjem listov vinske trte povezanih virusov in izločanjem medene rose, na katero se lahko naselijo glive sajavosti. Kaparji predstavljajo precejšen problem v vinogradih, zato jih je potrebno zatirati z insekticidi in mehanskimi ukrepi, vse bolj pa prihaja v ospredje zavedanje o pomenu biotičnega varstva vinske trte. V seriji laboratorijskih *in-vitro* poskusov smo preskušali učinkovitost štirih entomopatogenih vrst gliv za zatiranje smokvinega volnatega kaparja (*Planococcus ficus*). Vse glive izvirajo iz Slovenije in so bile izolirane iz različnih substratov. Preskušali smo naslednje vrste gliv: *Metarhizium anisopliae*, *M. brunneum*, *M. robertsii* in *Beauveria brongniartii* (1 izolat na vrsto). Kaparji so bili izpostavljeni omenjenim biotičnim agensom posredno preko hranjenja s konidiji okuženimi kalčki krompirja. Kalčke smo okužili tako, da smo jih 15 minut namakali v suspenziji konidijev s koncentracijo 1×10^8 živih konidijev / ml ob konstantnem mešanju. V vsako petrijevko je bilo poleg okuženih kalčkov dodanih še po 5 nimf druge in tretje razvojne stopnje *P. ficus*. Po 21 dneh smo ocenili število mikotičnih nimf. Vsi testirani izolati so uspešno okuževali nimfe *P. ficus*. Delež mikotičnih nimf se je

gibal med $82,0 \pm 5,5$ % in $30,0 \pm 6,2$ % (0,0 pri negativni kontroli). Najvišji delež mikotičnih nimf je bil opažen pri tretiranju z *M. anisopliae*, izolat H. J. S. 1154. Rezultati naše raziskave nakazujejo, da bi lahko imela uporaba avtohtonih entomopatogenih gliv precejšen pomen v biotičnem varstvu trt pred gospodarsko škodljivimi kaparji.

ABSTRACT

Laboratory evaluation of entomopathogenic fungi against vine mealybug (*Planococcus ficus*)

Mealybugs are important pests of grapevine. They feed with plant juices thereby weakening the plant. They also cause indirect damage by vectoring grapevine leafroll-associated viruses and by secreting honeydew, which is a good medium for sooty mold growth. Mealybugs are mostly controlled with insecticides and mechanical means, but efforts have been made to find biological control alternatives. Activity of four entomopathogenic fungal species was tested against the vine mealybug (*Planococcus ficus*) in *in-vitro* laboratory bioassays. The fungi were isolated from various substrata in Slovenia. The following fungal species were tested: *Metarhizium anisopliae*, *M. brunneum*, *M. robertsii* and *Beauveria brongniartii* (1 isolate of each species). Mealybugs were exposed to fungal conidia indirectly by feeding on potato sprouts coated with conidia. Conidial coating was performed by immersing potato sprouts for 15 min in a conidial suspension with a concentration of 1×10^8 viable conidia / ml with constant mixing. Into each Petri dish 5 second and third instar nymphs of *P. ficus* were added and a 1.5 cm long piece of infected potato sprout. The experiment was observed after 21 days for nymph mycoses. All isolates tested were infective to *P. ficus*. The level of mycoses ranged from 82.0 ± 5.5 % to 30.0 ± 6.2 % (0.0 in the negative control treatment). The highest percentage of mycotic mealybugs was observed in treatment with *M. anisopliae*, strain H. J. S. 1154. The results of our experiments indicate that the use of indigenous entomopathogenic fungi could have a considerable importance in the biological control of mealybugs.



Razširjenost kaparjev na vinski trti v Sloveniji

Melita ŠTRUKELJ¹, Irena MAVRIČ PLEŠKO¹, Gabrijel SELJAK², Ivan ŽEŽLINA², Gregor UREK¹

¹Kmetijski inštitut Slovenije, Hacquetova ulica 17, SI-1000 Ljubljana (melita.strukelj@kis.si)

²KGZS – Kmetijsko gozdarski zavod Nova Gorica, Pri hrastu 18, SI-5000 Nova Gorica

Kaparji predstavljajo skoraj polovico vseh fitofagnih polkrilcev (Hemiptera), ki so bili v Slovenijo vneseni ali pa so se postopno razširili na to ozemlje. Te žuželke so splošno škodljive predvsem na sadnem drevju, grmičevju in rastlinah v zavarovanih prostorih, najdemo pa jih tudi na vinski trti. Hranijo se z rastlinskim sokom in s tem oslabijo rastlino, povzročijo razbarvanje in prezgodnje odpadanje listov, deformacije vej, velikokrat pa so tudi prenašalci rastlinskih virusov. Posredna škoda, ki jo povzročajo, je izločanje medene rose, kamor se naselijo glive sajavosti. V Sloveniji so bolj ali manj le občasni škodljivci vinske trte. V slovenskih vinogradih so bili do sedaj najdeni predstavniki dveh družin kaparjev: veliki trtni kapar (*Neopulvinaria innumerabilis* [Rathvon]), navadni trtni kapar (*Pulvinaria vitis* [Linnaeus]) in češpljev kapar (*Parthenolecanium corni* [Bouché]) iz

družine Coccidae ter smokvin volnati kapar (*Planococcus ficus* [Signoret]) iz družine Pseudococcidae. Kaparja *P. corni* in *P. vitis* sta domači vrsti in razširjeni na celotnem ozemlju Slovenije, medtem ko sta *N. innumerabilis* in *P. ficus* tujerodni vrsti in se za zdaj pojavljata le na Primorskem. *P. ficus* se je v preteklosti pojavljal na trti le v zavarovanih prostorih. Prva večja napada *P. ficus* na prostem sta bila zabeležena leta 2012 v vinogradu v Vipavski dolini in leta 2013 v dolini Drnice v okolici Kopra.

ABSTRACT

The distribution of scale insects on grapevine in Slovenia

Scale insects represent almost half of alien phytophagous Hemiptera, which have been introduced or spread to Slovenia. These insects are common pests on fruit trees, shrubs and on plants in protected cultivation but also on grapevine. Scale insects are sap-sucking pests and thereby weaken the plant; they may cause discolorations and premature fall of leaves, branches deformation and may also be vectors of harmful plant viruses. Indirect damage is also done due to honeydew secretion on which sooty mould growths. In Slovenia, they are considered as occasional pests on grapevine. In Slovenian vineyards representatives of two families have been recorded so far: cottony maple scale (*Neopulvinaria innumerabilis* [Rathvon]), cottony grape scale (*Pulvinaria vitis* [Linnaeus]) and European fruit lecanium (*Parthenolecanium corni* [Bouché]) of the family Coccidae and vine mealybug (*Planococcus ficus* [Signoret]) of the family Pseudococcidae. *P. vitis* and *P. corni* are indigenous species and occur throughout Slovenia, while *N. innumerabilis* and *P. ficus* are alien species occurring only in the Primorska region so far. In the past, *P. ficus* was recorded on the grapevine only in protected cultivation. The first heavier infestations in vineyards have been recorded recently, in 2012 in a vineyard in Vipava valley and in 2013 in Drnica valley near Koper.



Preučevanje učinkovitosti okoljsko sprejemljivih načinov zatiranja strun (*Agriotes* spp.) v krompirju

Tanja BOHINC¹, Jaka RUPNIK², Filip VUČAJNK², Stanislav TRDAN²

¹Zgornja Lipnica 9a, SI-4246 Kamna Gorica (tanja.bohinc@gmail.com)

²Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana

V letih 2013 in 2014 smo v poljskih poskusih preučevali učinkovitost različnih okoljsko sprejemljivih načinov zatiranja strun v krompirju. Poskus je bil izveden na Laboratorijskem polju Biotehniške fakultete v Ljubljani. Poskusno zemljišče smo razdelili na tri bloke, znotraj katerih smo naključno razporedili 5 obravnavanj. Proti strunam smo preučevali insekticidno delovanje apnenega dušika (500 kg/ha), peletov zmletih križnic (0,22 kg/m²) in melase (1 l/125 m²). Četrto obravnavanje je predstavljala netretirana površina, peto pa insekticid teflutrin (5 kg/ha). Vnos pripravkov v tla smo izvedli v medvrstnem prostoru neposredno pred osipanjem krompirja. Pridelek smo pri sortiranju razdelili v tri frakcije glede na debelino gomoljev. Iz posamezne frakcije posameznega obravnavanja smo naključno izbrali 3 gomolje, na katerih smo prešteli poškodbe (izvrtine), ki so nastale zaradi strun. V prispevku bo predstavljena učinkovitost preučevanih pripravkov – njihov vpliv na poškodbe strun in vpliv na končni pridelek krompirja.

ABSTRACT

Research on efficacy of different environmentally acceptable methods against wireworms (*Agriotes* spp.) in potato field

Between 2013 and 2014 we carried out field experiments in which we studied the effectiveness of different environmentally acceptable methods for controlling wireworms in potato field. Experiments were conducted at the Laboratory Field of Biotechnical Faculty in Ljubljana. Field was divided into three blocks, in each of them 5 treatments were randomly distributed. We have studied effectiveness of calcium cyanamide (500 kg/ha), brassica pellets (0.22 kg/m²), and molasses (1l/125 m²). Fourth treatment was non-treated area, and area on fifth treatment was treated with tefluthrin (5 kg/ha). All formulations were applied before shedding the rows. Classification of yield was established according potato tuber size into three fractions. From different fractions belonging to different treatments, we chose 3 tubers in which we counted the holes (injuries caused due to wireworms' feeding). In the presentation we will present the insecticidal efficacy of different methods – their impact on an extent of wireworms' injuries and on potato yield.



Possibilities of reducing wireworms' damages in maize field by trap crops

Antonela KOZINA¹, Darija LEMIĆ², Tomislav KOS²

¹Croatian Centre for Agriculture, Food and Rural Affairs – Institute for Plant Protection, Zagreb, Croatia (antonela.kozina@hcphs.hr)

²University of Zagreb, Faculty of Agriculture, Department for Agricultural Zoology, Zagreb, Croatia

Maize is economically the most important field crop in Croatia. Wireworms (Coleoptera: Elateridae), along with the western corn rootworm (*Diabrotica virgifera virgifera* LeConte), are the most significant maize pests. By feeding on seeds and roots wireworms cause reduction of crop density and yield losses. Wireworms can be controlled only preventively, but decision should be based on the results of soil examination. Due to numerous restrictions the number of permitted insecticides is decreasing. Therefore, it is necessary to investigate the possibilities of controlling wireworms, including non-pesticide measures and the rational pesticides application. Results of European and Canadian researchers suggest that sowing the trap crops along the main crop reduce pest attack and increase the yield. The aim of two-year investigation in Virovitica (Croatia) was to determine differences in crop density and yield between the maize sown as main crop and maize sown along with trap crops, wheat (*Triticum aestivum* L.) and peas (*Pisum sativum* L.). The field experiment consisted of two parts: one plot was sown with maize and trap crops while the other was sown only with maize. In each plot, three insecticides and non-treated control were included. Crop densities and maize yield were determined, and collected data were statistically compared using analysis of variance. The significant differences were observed between the non-treated controls of both plots. In plot with trap crops the crop density was 13.1 % higher in 2013 and 7.4 % in 2014, while the yield was higher by 69.58 % in 2013 and 7.4 % in 2014. The main reason of significant differences between the investigated years could be extremely unfavorable weather conditions (rainy and cold spring, frequent floods) during 2014. Nevertheless, it can be concluded that trap

crops positively affect the maize density and yield, which enhances the maize production in an environmentally friendly way.



Preučevanje učinkovitosti okoljsko sprejemljivih načinov zatiranja koloradskega hrošča (*Leptinotarsa decemlineata*) na krompirju: vpliv na pridelek

Tanja BOHINC¹, Jaka RUPNIK², Filip VUČAJNK², Stanislav TRDAN²

¹Zgornja Lipnica 9a, SI-4246 Kamna Gorica (tanja.bohinc@gmail.com)

²Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana

Dveletni poljski poskus (2013-2014), kjer smo preučevali vpliv alternativnih načinov zatiranja koloradskega hrošča (*Leptinotarsa decemlineata*) na pridelek krompirja, je potekal na Laboratorijskem polju Biotehniške fakultete v Ljubljani. Preučevali smo vpliv diatomejske zemlje, lesnega pepela in kombinacije obeh prašnatih pripravkov. Preučevane pripravke smo nanесли na rastline, ko so se na krompirju začele pojavljati ličinke stopenj L1 in L2. Odmerke prašiv smo prilagajali glede na razvojne stadije rastlin. V letu 2013 smo pripravke na rastline nanašali dvakrat, v letu 2014 pa trikrat. Pridelek gomoljev smo razdelili v tri različne frakcije. V prispevku bo predstavljena metodika nanašanja prašiv na listen krompirja in vpliv preizkušanih pripravkov na pridelek krompirja.

ABSTRACT

Testing the efficacy of environmentally acceptable methods against the Colorado potato beetle (*Leptinotarsa decemlineata*) on potato: an impact on the yield of potato

Two-year field experiment (2013-2014) was carried out at the Laboratory Field of Biotechnical Faculty in Ljubljana with the aim of studying an impact of alternative methods of controlling Colorado potato beetle on potato yield. We have studied the insecticidal properties of diatomaceous earth, wood ash and combination of both dusty formulations. Formulations were applied when Colorado potato beetle larvae belonging to L1 and L2 stages. Dose of formulations were adjusted according to plant's phenological stage. Formulations were applied two-times in 2013 and three-times in 2014. Potato yield was evaluated according to different fractions. In the paper we will present the methodology of application of formulations, as well as the impact of different dusts on potato yield.



Nove najdbe naravnih sovražnikov v Sloveniji v obdobju 2013-2014

Tanja BOHINC¹, Stanislav TRDAN²

¹Zgornja Lipnica 9a, SI-4246 Kamna Gorica (tanja.bohinc@gmail.com)

²Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana

V letih 2013 in 2014 smo v Sloveniji prvič potrdili zastopanost 11 vrst naravnih sovražnikov. V letu 2013 smo v treh travniških sadovnjakih na območju Gorenjske in Kočevske našli plenilsko pršico *Euseius finlandicus*. Plenilsko pršico *Phytoseius horridus* smo v letu 2014 ugotovili v različnih sadovnjakih na Kočevskem, plenilsko stenico *Macrolophus* cf. *rubi* pa v letu 2013 v rastlinjaku na območju Dragonje. V omenjenem rastlinjaku smo potrdili tudi parazitoidno osico iz rodu *Pnigalio*. V letu 2014 smo na različnih vrstah gojenih rastlin ugotovili zastopanost parazitoidnih os in plenilskih hroščev. Parazitoid *Diadegma semiclausum*, naravni sovražnik kapusovega molja (*Plutella xylostella*), je bil ugotovljen na različnih območjih v Sloveniji. Pojav parazitoidne vrste *Tersilochus heterocerus* smo prvič zabeležili na cvetoči oljni ogrščici v bližini Vodice. Med zanimivejšimi najdbami naravnih sovražnikov omenjamo tudi parazitoida *Trissolcus festivae*, ki je jačni parazitoid pisane stenice (*Eurydema ventrale*). Vrsta *Anisopteromalus calandrae* se je kot parazitoid žitnega kutarja (*Rhyzopertha dominica*) pojavljala v vedrih za namnoževanje skladiščnih škodljivcev za potrebe poskusov v Laboratoriju za entomologijo Oddelka za agronomijo. Na Laboratorijskem polju Biotehniške fakultete v Ljubljani smo v rastlinjaku, kjer smo zabeležili močan pojav navadne pršice, našli plenilskega hrošča *Holobus flavicornis*. Parazitoidna osa *Synopeas sosis* se je v sadovnjaku na Laboratorijskem polju pojavila v obdobju številčnega pojava ličink jabolne listne hrčice (*Dasineura mali*). Pojav nejezdnika *Encarsia inaron* smo na isti lokaciji zabeležili v začetku septembra na brstičnem ohrovtu, napadenem od kapusovega ščitkarja (*Aleyrodes proletella*). V prispevku bodo predstavljene tudi nekatere vrste biotičnih agensov, ki so bile v Sloveniji že ugotovljene, a jim doslej ni bilo namenjene dovolj pozornosti.

ABSTRACT

New records of biological control agents in Slovenia in the period 2013-2014

In 2013 and 2014, 11 biological control agents were recorded in Slovenia for the first time. In 2013, *Euseius finlandicus* was recorded in three meadow orchards in the Gorenjska and Kočevje region. In 2014, presence of *Phytoseius horridus* was detected in different orchards in Kočevje region. *Macrolophus* cf. *rubi* was confirmed in the greenhouse near Dragonja in 2013. Presence of parasitoid wasps belonging to *Pnigalio* spp. was also confirmed in the same greenhouse. In 2014, presence of parasitoid wasps and predatory beetles was recorded on different cultivated plants. Parasitoid wasp *Diadegma semiclausum*, parasitoid of diamondback moth (*Plutella xylostella*) was caught in different Slovenian regions. *Tersilochus heterocerus* was first recorded on the field near Vodice, that was covered with flowering oilseed rape. Among interesting records, we need to mention parasitoid wasp *Trissolcus festivae*, which is egg parasitoid of cabbage stink bug (*Eurydema ventrale*). *Anisopteromalus calandrae* was recorded as parasitoid of lesser grain borer (*Rhyzopertha dominica*) for the first time in buckets held in the Laboratory for entomology, where stored products pests are kept for the purpose of all kinds of research. In greenhouse at the Laboratory Field of Biotechnical Faculty in Ljubljana, predatory beetle *Holobus flavicornis* was first reported on eggplants, severely damaged by *Tetranychus urticae*. *Synopeas sosis* was first reported in orchard at the Laboratory Field of Biotechnical Faculty, at the time of massive occurrence of apple leaf curling midge (*Dasineura mali*). At the same location, presence of parasitoid *Encarsia inaron* was detected on Brussels sprouts attacked by cabbage whitefly (*Aleyrodes proletella*) in the beginning of September. Paper will also present names and more detailed presentation of biological control agents, that are already present in Slovenia, but they did not deserve enough attention.



Laboratorijski poskus biotičnega zatiranja kapusovih bolhačev (*Phyllotreta* spp.) in plodove vinske mušice (*Drosophila suzukii*) z entomopatogenimi glivami

Jaka RAZINGER, Špela MODIC, Hans-Josef SCHROERS

Kmetijski inštitut Slovenije, Oddelek za varstvo rastlin, Hacquetova 17, SI-1000 Ljubljana
(jaka.razinger@kis.si)

Kapusovi bolhači (KB, *Phyllotreta* spp.) in plodova vinska mušica (PVV, *Drosophila suzukii*) so pomembni škodljivci kmetijskih rastlin v Sloveniji. KB marsikje pri pridelavi kapusnic povzročajo celo večjo škodo kot kapusova muha. PVV pa se po vnosu v 2010 v Sloveniji še vedno širi in povzroča izjemno gospodarsko škodo pri pridelavi grozdja, borovnic, češenj in drugega sadja, a za njeno zatiranje v Sloveniji trenutno ni registriranega nobenega sredstva. S 1.1.2014 je stopila v veljavo nova zakonodaja, ki predpisuje nujnost izvajanja integriranega varstva rastlin. Posledično je aktualno iskanje alternativ kemičnemu zatiranju KB. Zato smo v nizu laboratorijskih *in vitro* poskusov preskusili možnost zatiranja KB in PVV z entomopatogenimi ali z žuželkami asociiranimi slovenskimi izolati gliv iz vrst: *Metarhizium anisopliae*, *M. brunneum*, *Clonostachys rosea* in *Trichoderma atroviride*. Vsi testirani izolati so uspešno okuževali KB. Preskušani izolati so že po 7 dneh značilno povišali smrtnost KB. Smrtnost KB po Abbottovemu popravku po 14 dneh je bila od $31,6 \pm 5,5$ do $84,7 \pm 6,8$ %. Najbolj virulentna izolata iz vrst *M. anisopliae* in *M. brunneum* sta značilno zmanjšala stopnjo prehranjevanja in povzročila najvišjo stopnjo mikoz KB. PVV se je, verjetno zaradi svojega izjemno kratkega razvojnega cikla, izkazala za trši oreh. Noben izolat ni značilno znižal celokupnega števila izleglih bub PVV. Sta pa izolata iz vrst *M. brunneum* in *T. atroviride* značilno upočasnili izleganje PVV bub in tako hitrost razvoja PVV. Izolati iz vrst *M. anisopliae*, *M. brunneum* in *T. atroviride* so se tako izkazali kot obetavni potencialni agensi biotičnega varstva pred KB in PVV in bodo v prihodnosti testirani v rastlinjaških in poljskih poskusih.

ABSTRACT

Biological control of cabbage flea beetles (*Phyllotreta* spp.) and spotted wing drosophila (*Drosophila suzukii*) with entomopathogenic fungi – laboratory evaluation

Cabbage flea beetles (CFB; *Phyllotreta* spp.) and spotted wing drosophila (SWD; *Drosophila suzukii*) are two particularly problematic agricultural pests in Slovenia. The CFB are an increasing problem in Slovene brassicaceous crops, which in some localities overshadows the problems caused by the cabbage root fly. The SWD is spreading in Slovenia, following its introduction in 2010, and causing alarming crop losses in grape, blueberry, cherry and other fruit production but no chemical insecticides are currently registered for its management in Slovenia. Due to new regulations, IPM is mandatory in the EU since 1st January 2014. Consequently, we have sought for novel alternative management strategies. Several entomopathogenic or insect associated fungal species, including *Metarhizium anisopliae*, *M. brunneum*, *Clonostachys rosea* and *Trichoderma atroviride*, were tested for their pathogenicity and virulence against CFB and SWD in *in vitro* laboratory bioassays. All isolates tested were infective to CFB imagos. The investigated fungi significantly increased the mortality rate of CFB already after 7 days.

Abbott's corrected mortality of CFB at day 14 ranged from 31.6 ± 5.5 to 84.7 ± 6.8 %. The most virulent *M. anisopliae* and *M. brunneum* significantly reduced the CFBs' feeding rate and caused highest rates of mycoses. Probably because of its very short life cycle, SWD proved to be a tougher nut to crack. No isolate caused a significant decrease of the total number of hatched SWD pupae. *M. brunneum* and *T. atroviride*, however, significantly decreased the pupal hatching rate and therefore the speed of imago development. The isolates *M. anisopliae*, *M. brunneum* and *T. atroviride* therefore show promise as potential biological control agents and will be further evaluated in glasshouse and field experiments.



Hrošči (Coleoptera), ki se pojavljajo v slovenskih kraških vinogradih in njihovi okolici

Špela MODIČ¹, Vojko ŠKERLAVAJ², Božidar DROVENIK³

^{1,2}Kmetijski inštitut Slovenije, Hacquetova 17, SI-1000 Ljubljana (spela.modic@kis.si)

³Biološki inštitut Jovana Hadžija – ZRC SAZU, Novi trg 2, SI-1000 Ljubljana

Pri obvladovanju škodljivcev vinske trte imajo lahko pomembno vlogo tudi predatorske vrste hroščev. Zastopanost in številčnost posameznih, predvsem koristnih vrst hroščev, v kraških vinogradih in njihovi okolici, v Sloveniji še ni bila raziskana. S tem namenom smo v letih od 2011 do 2014 v okviru projekta Agrotur spremljali dinamiko ulovov hroščev na štirih lokacijah. Hrošče smo spremljali v dvotedenskih razmikih v obdobju rasti vinske trte. Pasti za ulov hroščev (vinski kis kot vaba in fiksativ) smo nastavljali pri tleh ob trsih in tudi v območje rozg. V talne pasti smo najpogosteje ulovili vrste hroščev iz družine krešičev (Carabidae), kratkokrilcev (Staphylinidae) in govnačev (Geotrupidae). Rezultati ulovov so pokazali pestrost vrst krešičev (Carabidae): *Abax parallelepipedus* (Pill. & Mitt.), *Aptinus bombardia* (Ill.), *Brachinus explodens* Duft., *Calosoma sycophanta* L., *Carabus caelatus* L., *Carabus caelatus schreiberi* Kr., *Carabus catenulatus* S., *Carabus convexus* F., *Carabus coriaceus* L., *Carabus hortensis* L., *Carabus violaceus* L., *Harpalus* sp., *Leistus ferrugineus* (L.), *Myas chalybaeus* (Pall.), *Ophonus pubescens* (Müll.) in *Poecilus koyi* (G.). Na vseh proučevanih lokacijah so bile najštevilčnejše zastopane vrste: usnjati krešič *Carabus coriaceus* L., črni kratkokrilec *Ocypus olens* (O. Mull.) in spomladni govnač *Geotrupes vernalis* L.. Od domorodnih zaščitnih vrst smo na Krasu našli velikega moškatnika (*Calosoma sycophanta* L.), skopolijevega kozlička (*Cerambyx scopolii* F.) in kraškega poljskega kozlička (*Pedestredorcadion arenarium* S.).

ABSTRACT

Beetles (Coleoptera) occurring in Slovene Karst vineyards and their surroundings

Beneficial organisms in vineyards and their surroundings have an important role in the control of harmful organisms. Inventarization of predatory beetles in Slovene Karst vineyards and their surroundings hasn't been studied yet. In the frame of the Agrotur project we studied the beetle population dynamics at four locations in the years from 2011 to 2014. Beetles were sampled in two-week intervals during the vine growing season. The traps were placed in the soil at the bases of vine plants and in the canopies. Wine vinegar was used as an attractant and fixative. The most abundant beetle species caught in the pitfall traps belonged to the families of ground beetles (Carabidae), rove beetles (Staphylinidae) and dor beetles (Geotrupidae). The results revealed high biodiversity of

ground beetles (Carabidae): *Abax parallelepipedus* (Pill. & Mitt.), *Aptinus bombardarda* (Ill.), *Brachinus eximius* Duft., *Calosoma sycophanta* L., *Carabus caelatus* L., *Carabus caelatus schreiberi* Kr., *Carabus catenulatus* S., *Carabus convexus* F., *Carabus coriaceus* L., *Carabus hortensis* L., *Carabus violaceus* L., *Harpalus* sp., *Leistus ferrugineus* (L.), *Myas chalybaeus* (Pall.), *Ophonus pubescens* (Müll.), *Poecilus koyi* (G.). On all studied locations most abundant species were: *Carabus coriaceus* L., *Ocyopus olens* (O. Mull.) and *Geotrypes vernalis* L.. We also found *Calosoma sycophanta* Linne, *Cerambyx scopoli* Fuessly, and *Pedestredorcadion arenarium* Scopoli which are listed as protected species in Slovenia.



Implementation of the early detection survey of *Agrilus planipennis* and *A. anxius* in Slovenia

Maarten DE GROOT, Tine HAUPTMAN

Gozdarski inštitut Slovenije, Večna pot 2, SI-1000 Ljubljana (maarten.degroot@gozdis.si)

Since this year *Agrilus planipennis* and *A. anxius* (Coleoptera: Buprestidae) are listed on the Annex I.A1 of the Council Directive 2000/29/EC. The host plants of *A. planipennis* are many species of the genus *Fraxinus*. The native range of *A. planipennis* is in East Asia. In the beginning of this century it was found in North America and spread rapidly. Many *Fraxinus* species turned out to be very susceptible for this species. Since ten years it was also introduced in Moscow and has already dispersed towards the European countries. Also *Fraxinus excelsior* was found to be susceptible for this species. The native range of *A. anxius* is North America. The main host plants are the species in of the genus *Betula*. At the moment it is not yet found in other parts of the world. However, in experiments it was shown that the European birch species are very susceptible to this species. There is a strong trade in birch wood between America and the EU. Therefore there is a large chance that the species will be introduced in the EU. In 2015, the first early detection survey of *A. planipennis* and *A. anxius* will be started for Slovenia. For both species the host plants will be investigated for symptoms (drying and dying trees, 3 mm large d-shaped exit holes, mines of the larvae under the bark, etc) over whole Slovenia and especially in areas where the species are to be expected. In addition, specially-designed purple coloured “prism” traps will be used for the detection of *A. planipennis*.

IZVLEČEK

Uvedba posebnega nadzora jesenovega in brezovega krasnika v Sloveniji

Jesenov krasnik (*Agrilus planipennis*) in brezov krasnik (*A. anxius*) sta nova karantenska škodljivca, ki sta bila nedavno dodana v Prilogo I.A1 Direktive Sveta št. 2000/29/ES. Jesenov krasnik je naravno razširjen v Vzhodni Aziji, gostiteljske rastline pa so različne vrste jesena (*Fraxinus* spp.). V začetku stoletja se je pojavil v Severni Ameriki, kjer se je hitro razširil in povzročal veliko škodo. Pred desetimi leti je bil vnesen tudi v Moskvo, od tam pa se sedaj širi proti drugim evropskim državam. Za občutljivega se je izkazal tudi veliki jesen (*F. excelsior*). Brezov krasnik je razširjen v Severni Ameriki (ZDA in Kanada) in še ni bil prenesen na druge kontinente. Živi v vseh vrstah breze (*Betula* spp.). Raziskave so pokazale, da so evropske vrste brez bolj dovzetne za napad škodljivca kot severnoameriške vrste. Zaradi trgovanja z brezovim lesom med Evropo in Severno Ameriko, obstaja velika verjetnost vnosa škodljivca na ozemlje Evropske unije. Leta 2015 se v Sloveniji začne izvajati posebni nadzor nad obema omenjenima karantenskima

organizmoma. Po celotni Sloveniji, še posebej pa na mestih, ki predstavljajo večjo možnost vnosa, bomo izvajali preglede gostiteljskih rastlin, pri čemer bomo pozorni na značilne znake napada (sušenje in odmiranje dreves, serpentinasto zavite rove ličink pod skorjo dreves, izhodne odprtine v obliki črke D,...). Za namene nadzora jesenovega krasnika pa bomo na različnih lokacijah postavili posebno oblikovane vijolične prizmatične pasti.



Occurrence of noctuid species causing spring damage in vineyards

Domen BAJEC, Karmen RODIČ, Andreja PETERLIN

KGZS – Zavod NM, Služba za varstvo rastlin, Šmihelska c. 14, SI-8000 Novo mesto
(domen.bajec@gov.si)

Noctuid moth caterpillars are capable to produce severe damage of grapevine buds in spring. Bud loss caused mostly by Lesser Yellow Underwing (*Noctua comes* Hübner) and Broad-bordered Yellow Underwing (*Noctua fimbriata* Schreber) was significant in south eastern Slovenia in period 2000 to 2005. Before that, migratory noctuids were not noticed as pests and they appeared only sporadically. In 2014 severe damages appeared again, reaching 75-80% of damaged buds in the most exposed areas. Besides previously recorded, Large Yellow Underwing (*Noctua pronuba* L.) is recognized as additional pest species. Participation of other Noctuidae and Geometridae species is marginal. Every noctuid has specific life cycle, feeding or other habits, slightly differing one from another. Caterpillars of determined species are found in the spring on different terrains, but their abundance is greater on southern slopes of hills and knolls where females in autumn lay eggs in habitats with favourable host plants. As noted also on previous occurrences, their effect appears to be greater on ridges. Damages on grapevine buds are more likely after mild winter conditions with low rate hibernation mortality. In such circumstances greater number of noctuid caterpillars survives and in the spring they struggle for food. When phenological development of major herbaceous host plants progresses slowly, they prefer vine tree.

IZVLEČEK

Pojavnost metuljev sovk, povzročiteljev spomladanskih poškodb brstov v vinogradov

Gosenice metuljev sovk lahko spomladi na brstih vinske trte povzročijo obsežne poškodbe. Velike škode smo v jugovzhodni Sloveniji beležili med leti 2000 do 2005 in jih pripisali predvsem vrstam *Noctua comes* (Hübner) in *N. fimbriata* (Schreber). Pred tem so se migratorne sovke pojavljale le občasno in niso povzročale gospodarske škode. V letu 2014 je prišlo do ponovnega obsežnega pojava, ko so na najbolj izpostavljenih legah škode dosegle 75-80 % poškodovanih brstov. Kot dodatno škodljivo, smo prepoznali tudi vrsto *Noctua pronuba* (L.). Obseg poškodb zaradi drugih gosenic iz skupine sovk (Noctuidae) in pedicev (Geometridae) je zanemarljiv. Vsaka vrsta ledvičastih sovk ima specifičen razvojni krog, prehranske ali druge navade, po katerih se vsaj malenkostno ločujejo med seboj. Gosenice navedenih vrst najdemo spomladi na različnih terenih, a je njihova gostota največja prav na južnih pobočjih hribov in gričev, kjer na rastišča najugodnejših gostiteljskih rastlin v jeseni samičke odlagajo jajčeca. Večje škode se pojavljajo predvsem po milih zimah, saj je takrat stopnja umrljivosti med hibernacijo manjša. V takšnih okoliščinah preživi večje število ličink, ki se spomladi borijo za hrano.

Če je fenološki razvoj glavnih gostiteljskih zeli upočasnen, se najrajši usmerijo na vinsko trto.



Experiences with remote sensing of lepidopteran harmful species using different attractants

Domen BAJEC¹, Mateja ŠTEFANČIČ², Matej ŠTEFANČIČ², Karmen RODIČ¹, Peter ČEBOKLI², Dejan JERIČ², Andreja PETERLIN¹

¹KGZS – Zavod NM, Služba za varstvo rastlin, Šmihelska c. 14, SI-8000 Novo mesto
(domen.bajec@gov.si)

²EFOS d.o.o., Razdrto 47B, SI-6225 Hruševje

In 2012 we started testing Trapview devices, a new technology in agricultural forecasting services. The new approach offers rationalisation of current procedures considering monitoring of insect pests. Time and material consuming field visual inspections are replaced with viewing images through web or mobile application. The device takes snapshots of field situation on daily basis, thus farmer, producer or expert entomologist are informed of situation in the field on time. Primarily we focussed on remote sensing of polyphagous Lepidoptera harmful species which are complicated to attract and are also of significant economic importance. Starting with European corn borer (*Ostrinia nubilalis*) we expected low efficiency by pheromone luring due to phenotypic variation in attractant production and its perception. However the species morphological characteristics could allow faster recognition using computer vision techniques. At the beginning preliminary results showed some lack in luring performance, but were promising in general. Subjects of observation became also species whose presence is difficult to mark due to their migrability: cotton bollworm (*Helicoverpa armigera*), *Noctua fimbriata* and *Noctua comes*. These can be detected with Trapview AURA, specific wave length light emitter device. Also combinations of light and pheromone attractant were tried. In the same time we also routinely compared standard delta trap and Trapview on codling moth (*Cydia pomonella*) in the apple orchard using pheromone attractants.

IZVLEČEK

Izkušnje z daljinskim zaznavanjem škodljivih metuljev z uporabo različnih atraktantov

S preizkušanjem naprav Trapview, ki predstavljajo novo tehnologijo v prognozi v kmetijstvu, smo pričeli leta 2012. Nov pristop nudi racionalizacijo obstoječih postopkov nadzora škodljivih vrst žuželk. Terenske preglede, ki so časovno zahtevni in povzročajo materialne stroške tako zamenja pregledovanje posnetkov na spletu ali mobilnih aplikacijah. Trapview zajame posnetke na terenu v zelenem časovnem intervalu, medtem ko imajo kmet, pridelovalec ali entomolog informacijo stanja vedno pri roki. Primarno smo se osredotočili na daljinsko zaznavanje polifagnih škodljivih vrst metuljev, ki so težavne za privabljanje in so hkrati gospodarsko izredno pomembne. Pri preizkušanju na koruzni večji (*Ostrinia nubilalis*) smo pričakovali nizko učinkovitost privabljanja s feromoni, saj vrsta fenotipsko variira ravno na nivoju kemične komunikacije. Po drugi strani pa bi njene morfološke lastnosti omogočale hitrejše prepoznavanje s pomočjo računalniškega vida. Preliminarni rezultati so sprva kazali pomanjkljivosti privabilne tehnike, a so bili na splošno obetavni. Predmet opazovanj so postale še vrste, katerih spremljanje je oteženo zaradi

njihove migrabilnosti: južna plodovrtka (*Helicoverpa armigera*), *Noctua fimbriata* in *Noctua comes*. Te spremljamo z napravo Trapview AURA, ki privablja s pomočjo svetlobe specifične valovne dolžine. V tem okviru smo preizkušali tudi kombinacijo svetlobnih in feromonskih privabil. Hkrati smo na jabolčnem zavijaču (*Cydia pomonella*) v nasadu jablane rutinsko primerjali Trapview s standardno delta pastjo, kjer smo kot privabilo uporabili feromon.



Black fig fly - *Silba adipata* McAlpin (Diptera: Lonchaeidae), pest of growing importance in Croatian fig cultivation

Luka POPOVIĆ, Mario BJELIŠ

Institute for Plant Protection, Croatian Centre for Agriculture, Food and Rural Affairs,
Zvonimirova 14a, HR-21210 Solin (mario.bjelis@hcps.hr)

Black fig fly (BFF) is a pest of the fig fruits in the Mediterranean area. Significant local infestations were recorded in Croatia during the last decade. Symptoms of fruit infestation and size of larvae are similar to medfly, *Ceratitis capitata* Wied. (MFF) which attacks the fruits during ripening period. BFF larvae are white, very similar to MFF larvae that are coloured closer to yellow. The damages caused by BFF were often mistakenly attributed to MFF by the growers. During 2014, high intensity of infestation was recorded along the entire coastal region of Croatia. The first larvae (1.7-2.99 larvae/fruit) were detected in late April in the wider area of Dalmatia, especially in the Neretva valley, Solin and Kaštela. From April to June the infestation of fruits was recorded on cultivars Petrovača bijela and Bjelica. During August, a strong attack was recorded on wide area of Dalmatia and Istria. In Istria (Savudrija, Umag, Motovun) cultivars Crnica and Šaraguja were most strongly infested, and later the infection was detected on cultivar Petrovača crna, with fruit infestation of 50-80%. Cultivars Zamorčica and Petrovača showed half as much infestation. In Neretva Valley, during early September, samples of collected fallen fruits have recorded approximately 0.31 larvae/fruit, to a maximum of 11 larvae in a single fruit. In mid-September, sampling process determined 1.2 larvae/fruit, and in late September and early October 1.42 larvae/fruit. We can point out that figs which bearing fruits twice in one season, generally record a strong attack on the fruits from the first ripening period, with no major differences among cultivars. During second ripening period, more intense attacks are recorded on dark-coloured fruits. Based on our research, we can conclude that this pest in our climate conditions can achieve several generations during one season and can cause significant economic damage.



Biotično zatiranje ogrcev (Coleoptera: Scarabaeidae) na travinju: izkušnje iz Gotenice

Žiga LAZNIK, Stanislav TRDAN

Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana
(ziga.laznik@bf.uni-lj.si)

Ogrci - ličinke hroščev iz družine pahljačnikov (Scarabaeidae) so talni škodljivci, ki lahko ob prerazmnožitvi s svojim hranjenjem povzročijo veliko škodo na travnikih in pašnikih, tako kot tudi na gojenih rastlinah in v drevesnicah. V dvoletnem poljskem poskusu (2012-2013), ki je potekal na travniku v Gotenici, smo preučevali različne biotične agense za zatiranje ogrcev; entomopatogene glive (*Beauveria brongniartii*, *B. bassiana*), entomopatogene bakterije (*Bacillus thuringiensis* var. *kurstaki*, *B. thuringiensis* var. *tenebrionis*) in entomopatogene ogorčice (*Heterorhabditis bacteriophora*). Biotične agense smo nanесли dvakrat v sezoni (april in avgust). Rezultati naše raziskave so pokazali da številni biotični agensi uspešno zatirajo mlajše razvojne faze ličink (L₁ in L₂). Ko ogrci preidejo v tretjo larvalno stopnjo (L₃), večina biotičnih agensov ne učinkuje. Pri zatiranju ogrcev v tleh se je izkazala kot najbolj učinkovita kombinacija sočasne uporaba entomopatogenih gliv in entomopatogenih ogorčic za zatiranje prvega in drugega larvalnega stadija. Poletni nanos biotičnih agensov se je izkazal kot bolj učinkovit pri zatiranju ogrcev od spomladanskega.

ABSTRACT

Biological control of white grubs (Coleoptera: Scarabaeidae) in grassland: experiences from Gotenica

White grubs - the larvae of Scarabaeidae beetles are soil pests, which can cause damage of turfgrass, pastures and horticultural plants. A two-year field experiment (2012-2013) in grassland near Gotenica was conducted to test different biological control agents; entomopathogenic fungi (*Beauveria brongniartii*, *B. bassiana*), entomopathogenic bacteria (*Bacillus thuringiensis* var. *kurstaki*, *B. thuringiensis* var. *tenebrionis*), and entomopathogenic nematodes (*Heterorhabditis bacteriophora*) to control white grubs. The application of biological control agents was conducted twice (April and August). Our observations show that several biological control agents are capable of controlling the populations of the first and second instar larvae of different scarab grub species. The efficacy of most biological control agents, however, declines when larvae reach the third instar stage. The most promising combination tested in our study is that of entomopathogenic fungi and *H. bacteriophora* for controlling the first and second stage instar larvae. In addition, the summer application proved to be more suitable for control of the first stage instar larvae than the spring application.



Pojav pušpanove vešče (*Cydalima perspectalis*) na območju jugovzhodne Slovenije v letu 2014

Andreja PETERLIN, Karmen RODIČ

KGZS – Zavod NM, Služba za varstvo rastlin, Šmihelska c. 14, SI-8000 Novo mesto
(apeterlin@gov.si)

Na posameznih grmih pušpana (*Buxus* sp.), smo v zasebnih vrtovih v letu 2014 opazili množično škodo, ki so jih povzročile gosenice pušpanove vešče (*Cydalima perspectalis* Walker). Zaradi izrednih vremenskih pojavov v letu 2014 je na nekaterih območjih jugovzhodne Slovenije celo prišlo do njene prerazmnožitve. Vešča je na območju Evrope prisotna že od leta 2007. V Sloveniji pa smo jo prvič potrdili leta 2011 v Pomurju. Po podatkih navedenih v literaturi ima škodljivec 5 generacij na leto. Najbolj škodljiva faza je

faza gosenice. Prehranjuje se z objedanjem listov, ko le-teh zmanjka pa začne objedati les. Povzročena škoda lahko na koncu vodi tudi do propada rastlin. Najboljša zaščita pred škodljivcem je preventiva, rastline moramo redno pregledovati in po potrebi ukrepati. Naravni sovražniki tega škodljivca so ptice, drugače pa se lahko proti njimi borimo z uporabo različnih insekticidov, ki pa jih v Republiki Sloveniji nimamo registriranih. Pušpan v okrasnih vrtovih zaseda posebno mesto in ima dolgo tradicijo, zato bi bilo potrebno njihovem ohranjanju posvetiti večjo pozornost, predvsem z zaščito proti škodljivim organizmom.

ABSTRACT

The phenomenon of the Box tree's moth in the region of the South-east Slovenia in 2014

In 2014 we noticed severe damage on the box tree bushes that had been caused by the caterpillars of the box tree moth (*Cydalima perspectalis*). Phenomenon was found mostly in private gardens. Specific ecological conditions in 2014 led the appearance of caterpillars in abundance. The moth is present in Europe since 2007, while in Slovenia it was first noticed in Pomurje region in 2011. According to the data available in literature, the pest has 5 generations per year. The most damaging phase is the stage of the caterpillar. They feed on the box tree leaves, and when they run out they beguine to attack the trunk of the tree. Caused damage can lead to the collapse of the plant. The best protection against the pest is regular implementation of the prevention, such as systematic plant inspection and immediate reaction in case the box tree moth is observed. Natural enemies of this pest are birds, otherwise we can suppress them with the use of different insecticides, but they are not registered in Republic of Slovenia. Since box tree represents one of the most popular trees in the ornamental gardens, with a long tradition in Slovenia, it is very important to find a proper solution for its long-term preservation, especially with protection against harmful organisms, such is box tree moth.



First records of bougainvillea mealybug *Phenacoccus peruvianus* Granara de Willink, 2007 and madeira mealybug *Phenacoccus madeirensis* Green, 1923 (Hemiptera: Pseudococcidae) in Croatia

Tatjana MASTEN MILEK, Mladen ŠIMALA, Vjekoslav MARKOTIĆ

Croatian Centre for Agriculture, Food and Rural Affairs – Institute for Plant Protection, Zagreb, Republic of Croatia (tatjana.masten@hcphs.hr)

Bougainvillea mealybug (*Phenacoccus peruvianus*) and madeira mealybug (*Phenacoccus madeirensis*) are new scale insect species in Croatia. Bougainvillea mealybug was first recorded in Croatia in June 2014 on *Bougainvillea spectabilis* Willd. and *Lantana camara* L. on the island of Brač. Madeira mealybug was found for the first time in Croatia in October 2014 on *Lantana camara* L. in Dubrovnik. Both species cause damage on ornamentals via excretion of honeydew accompanied by sooty mould that decreases ornamental value of the plants. Bougainvillea mealybug originates from Southern America and was first described in 2007. Prior to being named, it had already been introduced to Europe and has spread throughout the Mediterranean. It is polyphagous, occurring on woody plants belonging to 9 families: Acanthaceae, Amaranthaceae, Asclepiadaceae,

Asteraceae, Aucubaceae, Myoporaceae, Nyctaginaceae, Scrophulariaceae and Solanaceae. It feeds most frequently on bougainvillea. The mealybug can be recognised by the lack of marginal wax filaments, which are usually present in other mealybugs. Madeira mealybug is a Neotropical species that originates from Southern America. It is a polyphagous species recorded on 154 plant species belonging to 42 plant families. Today it is spread throughout the world. In Europe it has been recorded in Italy, France, Portugal, Spain, Greece and Turkey. Further investigations are needed for both species, in order to establish their current distribution and possibilities of their domestication in Croatian climate.



First records of crape myrtle aphid *Sarucallis kahawaluokalani* (Kirkaldy 1906) and tulip-tree aphid *Illinoia liriodendri* (Monell 1879) (Hemiptera: Aphididae) in Croatia

Maja PINTAR¹, Tatjana MASTEN MILEK¹, Mladen ŠIMALA¹, Gabrijel SELJAK²

¹Croatian Centre for Agriculture, Food and Rural Affairs – Institute for Plant Protection, Zagreb, Republic of Croatia (maja.pintar@hcphs.hr)

²Agricultural and Forestry Institute of Nova Gorica, Department for Plant Protection, Slovenia

Crape myrtle aphid (*Sarucallis kahawaluokalani*) and tulip-tree aphid (*Illinoia liriodendri*) are newly discovered insect species in Croatia. Crape myrtle aphid originates from Southeast Asia but has spread throughout the world. It feeds on ornamental plants of the genera *Lagerstroemia* and *Lawsonia*. It causes damage on ornamentals via excretion of honeydew accompanied by sooty mould that decreases ornamental value of infested plants. The aphid is recognizable by black markings on the body and wings of an adult aphid and black tubercles on the back. Crape myrtle aphid was first found in Croatia in July 2014 on *Lagerstroemia indica* (L.) on the island Krk. Later investigation showed that it has spread throughout the entire Croatian coast and has since been found in Malinska, Poreč, Rovinj, Šibenik and Dubrovnik. Tulip-tree aphid is a Nearctic species that originates from North America. It is monoecious holocyclic species that feeds on *Liriodendron tulipifera* (L.). It has been spreading across Europe and Asia with its ornamental host plants and has so far been introduced in the UK, France, Germany, Luxembourg, Italy, Slovenia, Hungary and Greece. The aphid excretes considerable quantities of honeydew accompanied by sooty mould but heavy infestation can cause premature leaves' discoloration and defoliation. Tulip-tree aphid was first found in Croatia in August 2014 in Poreč. No further investigation on this aphid has been carried out so its real distribution in Croatia is still unknown. Since both species are alien to Europe, further investigations are needed in order to establish their current distribution, possibilities of spread and possibilities of their domestication in Croatian climate.



Odziv nekaterih škodljivcev kapusnic na sadike brokolija obogatene s selenatom

Kristina UGRINOVIĆ¹, Mojca ŠKOF¹, Špela MECHORA²

¹Kmetijski inštitut Slovenije, Hacquetova ulica 17, SI-1000 Ljubljana
(kristina.ugrinovic@kis.si)

²Univerza v Mariboru, Fakulteta za naravoslovje in matematiko, Oddelek za biologijo,
Maribor

Pri pridelavi kapusnic v naših ekoloških razmerah z vidika varstva rastlin največ težav povzročajo škodljivci. Zaradi vse manjšega izbora zaščitnih sredstev je potrebno poiskati alternativne možnosti varstva. Dosedanje raziskave na rastlinah s sposobnostjo kopičenja selena (Se) kažejo, da lahko nakopičeni Se rastlinam na različne načine služi kot obramba pred škodljivimi organizmi. V poskusih, ki jih predstavljamo v tem prispevku, smo preverjali, kako se dva pomembnejša škodljivca kapusnic, t.j. kapusova muha *Delia radicum* L. in kapusovi bolhači *Phyllotreta* spp., odzivata na rastline brokolija, ki smo jim dodali Se v obliki natrijevega selenata. Preliminarni lončni poskus smo izvedli v kontroliranih pogojih poskusnega rastlinjaka. Sadikam brokolija smo v substrat dodali 0, 25, 37,5 ali 50 µg Se, jih nato presadili v lonce in jim dodali ličinke kapusove muhe. Dva tedna kasneje so bile kontrolne rastline najnižje in so imele najmanj listov, najvišje pa so bile rastline, ki smo jim dodali 37,5 µg Se. Mesec dni po dodajanju Se, ko smo poskus zaključili, so bile rastline, ki smo jim dodali 37,5 µg Se, še vedno najvišje, imele pa so tudi najmanj poškodovane korenine. Pri ostalih parametrih (število listov, masa rastlin in število ličink) ob zaključku poskusa med postopki ni bilo značilnih razlik. V poljskem poskusu smo primerjali le sadike, ki smo jim dodali 25 µg Se in kontrolne sadike, ki jim Se nismo dodali. Pokazalo se je, da so samice kapusove muhe k sadikam, ki jim je bil dodan Se, odložile več jajčec kot h kontrolnim sadikam. Kljub temu smo ob spravlilu poskusa pri rastlinah, ki jim je bil dodan Se, našli manj bub kapusove muhe kot pri kontrolnih rastlinah. Tudi kapusove bolhače so mlade rastline, ki jim je bil dodan Se, privlačile bolj kot kontrolne rastline, saj so na listih prvih povzročili več poškodb.

ABSTRACT

Response of some Brassica pests to broccoli transplants enriched with selenate

In vegetable brassicas production the main problems in pest management in our ecological conditions are caused by insects. Due to reduced assortment of plant protection products alternative strategies of plant protection are needed. Earlier studies, performed on selenium (Se) accumulating plants, have shown that Se accumulated in plant tissue can act as defence against pests. The trials presented in this paper aimed to check the response of two major brassica pests, i.e. cabbage root fly *Delia radicum* L. and crucifer flea beetles *Phyllotreta* spp., on broccoli plants treated with Se in the form of sodium selenate. Preliminary pot trial was conducted under the controlled conditions in experimental glasshouse. The broccoli transplants were supplemented with 0, 25, 37.5 or 50 µg Se to the growing substrate. Afterwards the transplants were transplanted to bigger pots and the larvae of *D. radicum* were added. Two weeks later the control plants were the shortest and had the least number of leaves, while the plants treated with 37.5 µg Se were the highest. One month after the Se treatment when the experiment was terminated, the plants treated with 37.5 µg Se were still the highest and had the least damaged roots. For other parameters (number of leaves, plant weight and the number of larvae) also recorded at the end of trial, the differences between the treatments were not significant. Under the field conditions only transplants treated with 25 µg Se and control transplants

without Se treatment were compared. It turned out that females of cabbage root fly laid more eggs to transplants treated with Se than to control plants. Despite that, the number of pupae recovered at harvest was significantly less for Se treated plants than for untreated control. Young broccoli plants treated with Se also attracted more flea beetles which caused more damage on Se treated than on control plants.



Patogene glive iz rodu *Colletotrichum* na listih in plodovih jablan v Sloveniji

Alenka MUNDA¹, Vojko ŠKERLAVAJ¹, Domen BAJEC²

¹Kmetijski inštitut Slovenije, Oddelek za varstvo rastlin, Hacquetova 17, SI-1000 Ljubljana (alenka.munda@kis.si)

²KGZS – Zavod NM, Služba za varstvo rastlin, Šmihelska c. 14, SI-8000 Novo mesto

Glive iz rodu *Colletotrichum* povzročajo številne gospodarsko pomembne bolezni na sadnem drevju. Pri jablani je najpomembnejše gnitje plodov oziroma grenka sadna gniloba. Bolezen se lahko pojavi že v nasadu, v času zorenja in obiranja plodov, ali pa kasneje v skladišču. Na vlažnih rastiščih in v letih z obilnimi padavinami in zmernimi temperaturami, ki pospešujejo razvoj bolezni, lahko povzroči znaten izpad pridelka. Bolezenska znamenja se kažejo kot rjave, okrogle in rahlo uleknjene nekrotične pege na površini plodov. V vlažnem okolju se na njih razvijejo trosišča (acervuli) in oranžni skupki trosov. Glive iz rodu *Colletotrichum* prizadenejo tudi liste ter povzročijo nastanek nekroz, ob močni okužbi pa tudi defoliacijo. V letih 2013 do 2014 smo v različnih pridelovalnih območjih jablane v Sloveniji zbrali primerke plodov in listov z nekrotičnimi pegami in drugimi znamenji bolezni. V laboratoriju smo iz simptomatičnih rastlinskih delov izrezali tkivo z roba nekroze in ga prenesli na krompirjevo gojišče (PDA) z dodanim antibiotikom. Pridobili smo 24 izolatov gliv povzročiteljic bolezni, jih osamili v čisti kulturi ter identificirali na podlagi morfoloških značilnosti in podobnosti sekvenc dela gena za β -tubulin-2. Ugotovili smo, da bolezen povzročajo tri glive iz rodu *Colletotrichum*, dve pripadata kompleksu *C. acutatum*, ena pa kompleksu *C. gloeosporioides*.

ABSTRACT

Pathogenic *Colletotrichum* species on apple leaves and fruit in Slovenia

Species belonging to the genus *Colletotrichum* cause several economically important diseases on fruit trees. The most severe disease on apple is fruit rot, known as bitter rot. It affects fruits in the orchards and in the storage. The disease causes significant pre- and postharvest losses particularly in the years with wet and warm weather conditions. Symptoms of the disease include circular, brown and slightly sunken necrotic lesions on the fruit surface. In humid conditions acervuli with orange conidial masses develop on the lesions. *Colletotrichum* pathogens affect also leaves where they induce leaf spots, in severe cases also defoliation. In the years 2013 to 2014 we collected samples of fruits and leaves with necrotic lesions from different apple growing regions in Slovenia. 24 isolates were obtained from symptomatic plants by culturing pieces of necrotic tissue on potato dextrose agar (PDA) amended with antibiotics. Isolates were grown in pure culture and identified on the basis of morphological characteristics and sequence similarities of β -tubulin-2 gene. Two species, belonging to the *C. acutatum* species complex and one

species of *C. gloeosporioides* species complex were identified as the causative agents of the disease.



Pojavi nekroz na listju jablane v povezavi z glivami iz rodov *Marssonina*, *Colletotrichum* in *Alternaria* v Sloveniji

Alenka MUNDA¹, Vojko ŠKERLAVAJ¹, Domen BAJEC²

¹Kmetijski inštitut Slovenije, Oddelek za varstvo rastlin, Hacquetova 17, SI-1000 Ljubljana (alenka.munda@kis.si)

²KGZS – Zavod NM, Služba za varstvo rastlin, Šmihelska c. 14, SI-8000 Novo mesto

Nekroze na listih jablane, ki smo jih zadnja leta pri nas že večkrat zasledili, so se v letu 2014 pojavile v epifitotičnih razsežnostih v številnih nasadih jablan. Obolelo listje je rumenelo, rjavelo in prezgodaj odpadlo, močneje okužena drevesa pa so povsem ogolela že sredi avgusta. Najmočneje so bili prizadeti ekološki in travniški nasadi jablan, med sortami pa zlasti 'Topaz' in 'Zlati delišes'. Za raziskavo etiologije pojava smo zbrali 60 primerkov simptomatičnih listov različnih sort jablan. Pri vzorčenju smo zajeli nasade z različnimi načini pridelave in različna rastišča. Rastlinski material smo v laboratoriju inkubirali na vlagi, izolirali povzročitelje bolezni in jih identificirali s standardnimi mikroskopsko morfološki tehnikami. Ugotovili smo, da je poglavitna povzročiteljica nekroz na listih jablane gliva *Marssonina coronaria*. V Sloveniji je bila navzočnost te glive z ustreznimi diagnostičnimi postopki potrjena šele leta 2014, vendar je že od leta 2008 dalje zaslediti številna, čeprav pomanjkljivo dokumentirana opažanja o njenem pojavu. Druge glive, ki smo jih izolirali iz nekrotičnih listov jablane, so pripadale rodovoma *Alternaria* in *Colletotrichum*. V prispevku predstavljamo bolezenska znamenja, ki jih povzročajo ugotovljene glive, ter povzemamo dosedanja spoznanja o njihovi razširjenosti, ekologiji in razvojnem ciklu v naših pridelovalnih razmerah.

ABSTRACT

Necroses on apple leaves associated with *Marssonina*, *Colletotrichum* and *Alternaria* species in Slovenia

In 2014 the emergence of necrotic spots on apple leaves has been recorded in several orchards from our apple growing regions. Even though the disease has occasionally already been reported in the past few years, the epyphytotics of the disease have not been observed until now. The leaves of diseased trees were yellowing and browning and dropped prematurely. The damage was most severe in organic and meadow orchards where the entire crown of heavily affected trees could be defoliated already in the middle of August. The most affected cultivars were 'Topaz' and 'Golden Delicious'. 60 samples of symptomatic leaves were collected from different regions, productive systems and cultivars and sent for laboratory analysis. Leaves were incubated in wet chamber, the causative agents of the disease were isolated and identified on the basis of morphological characteristics using standard microscopic techniques. *Marssonina coronaria* was recognized as the main cause of leaf necroses. The fungus was officially reported from Slovenia only in 2014, however several unconfirmed reports exist already since 2008. *Alteranaria* and *Colletotrichum* species were also frequently encountered in the samples. In the paper we describe disease symptoms and present preliminary results of the distribution, ecology and disease cycle of each agent of the disease.



Proučevanje tolerantnosti starih slovenskih sort marelic na okužbo s fitoplazmo '*Candidatus Phytoplasma prunorum*'

Barbara AMBROŽIČ TURK¹, Mojca VIRŠČEK MARN¹, Irena MAVRIČ PLEŠKO¹,
Maja RAVNIKAR², Nataša MEHLE², Marina DERMASTIA², Valentina USENIK³,
Nikita FAJT⁴

¹Kmetijski inštitut Slovenije, Hacquetova ulica 17, SI-1000 Ljubljana (*Barbara.Ambrozic-Turk@kis.si*)

²Nacionalni inštitut za biologijo, Večna pot 111, SI-1000 Ljubljana

³Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana

⁴KGZS - zavod Nova Gorica, Pri hrastu 18, SI-5000 Nova Gorica

V naših pridelovalnih razmerah se pri gojenju marelice (*Prunus armeniaca* L.) pogosto soočamo s propadanjem dreves, ki se pojavi že v nekaj letih po sajenju. Na propadanje dreves pomembno vpliva občutljivost sort za okužbe s patogenimi organizmi, med katerimi predstavlja bolezen klorotičnega zvijanja listov koščičarjev (European stone fruit yellows - ESFY), ki jo povzroča fitoplazma '*Candidatus Phytoplasma prunorum*' ('*Ca. P. Prunorum*'), resno grožnjo pridelavi marelic. Fitoplazma '*Ca. P. Prunorum*' se na gostiteljske rastline iz rodu *Prunus* širi s pomočjo prenašalca češpljeve bolšice (*Cacopsylla pruni*) in z okuženim materialom pri vegetativnem razmnoževanju. V Sloveniji je infekcijski pritisk fitoplazme velik zaradi razširjenosti gostiteljskih rastlin in prenašalca. Kljub temu je na nekaterih območjih (Goriška Brda, Vipavska dolina, Posavje) še prisotnih nekaj starih dreves avtohtonih sort marelic s kakovostnimi plodovi. Pri ugotavljanju stanja okuženosti starih dreves avtohtonih sort marelic 'Debeli flokarji', 'Drobni flokarji', 'Budajska marelica', 'Catarji', 'Bela pašta' in 'Pišeška marelica' je bila z laboratorijskimi molekularnimi analizami potrjena prisotnost fitoplazme ESFY pri 26 od 27 testiranih dreves, pri čemer drevesa, nekatera stara nad 50 let, ne kažejo bolezenskih znamenj. V kolikor se bo izkazalo, da se tolerantnost prenaša na potomce, bi te sorte lahko bile zanimive za gojenje v razmerah visokega infekcijskega pritiska '*Ca. P. Prunorum*'. Z namenom spremljanja tolerantnosti navedenih sort so bili spomladi 2013 odvzeti cepiči od štirih okuženih dreves sort 'Debeli flokarji' in 'Catarji'. Cepljeni so bili na podlago Mirabolana 29 C. Vseh 12 sadik se je v prvi rastni dobi dobro razvilo. V letu 2014 je bilo pri štirih sadikah spomladi opaženo predčasno odganjanje listov, sicer je razvoj sadik v drugem letu po cepljenju potekal normalno. Po končani drugi rastni dobi so rezultati laboratorijskih analiz potrdili prisotnost fitoplazme ESFY pri desetih od dvanajstih sadik. Za pridobitev zanesljivih podatkov bo potrebno s spremljanjem nadaljevati tudi v naslednjih letih.

ABSTRACT

Assessment of tolerance to infection with '*Candidatus Phytoplasma prunorum*' in old Slovenian apricot cultivars

Tree decline is very common in apricot (*Prunus armeniaca* L.) production in Slovenia. Withering and apoplexy of apricot trees is caused by different non-parasitic and parasitic factors, among which the infection with phytoplasma '*Candidatus Phytoplasma prunorum*'

('Ca. P. Prunorum') that causes European stone fruit yellows (ESFY) disease is one of the most threatening in Slovenia, especially in sensitive cultivars. 'Ca. P. Prunorum' is transmitted to the host plants of genus *Prunus* by the vector *Cacopsylla pruni*. The pathogen is also transmitted through infected propagation material. In Slovenia the infection pressure of 'Ca. P. Prunorum' is high due to the abundance of host plants and the vector. Despite this, old trees of local apricot cultivars bearing fruits of good quality are still present in different areas in Slovenia (Goriška Brda, Vipavska dolina, Posavje). Old trees of local cultivars 'Debeli flokarji', 'Drobni flokarji', 'Budanjska marelica', 'Catarji', 'Bela pašta' and 'Pišeška marelica' have been tested for presence of phytoplasma using molecular diagnostic methods. 'Ca. P. Prunorum' was confirmed in 26 out of 27 apricot trees tested. Some of them are older than 50 years and although they are infected, none of the trees show symptoms of the disease. To study the tolerance of these cultivars buds were taken from four infected trees of 'Debeli flokarji' and 'Catarji' and grafted onto Myrobalan 29 C rootstock in the spring 2013. All 12 grafted plants developed well in the first year as well in the second year after budding, although four plants showed premature leaf development in the spring 2014. At the end of the second growth year the molecular analyses confirmed the presence of ESFY phytoplasma in 10 out of 12 plants. Further observations are needed to gain more information about tolerance to 'Ca. P. Prunorum' in old Slovenian apricot cultivars.



Prva najdba z zvijanjem listov vinske trte povezanega virusa 4 v Sloveniji

Melita ŠTRUKELJ¹, Irena MAVRIČ PLEŠKO¹, Ivan ŽEŽLINA², Gregor UREK¹

¹Kmetijski inštitut Slovenije, Hacquetova ulica 17, SI-1000 Ljubljana
(melita.strukelj@kis.si)

²KGZS – zavod Nova Gorica, Pri hrastu 18, SI-5000 Nova Gorica

Z zvijanjem listov vinske trte povezani virusi (GLRaV) so povzročitelji bolezni zvijanja listov vinske trte nahajajo predvsem v floemu okuženih rastlin. Virus povzroča zvijanje listov in nekatere druge morfološke spremembe (mozaik, kloroze) na listih vinske trte, kar vodi k zmanjšanju vrednosti neto fotosinteze, transpiracije, stomatalne prevodnosti in fluorescence klorofila. Zaradi naštetega uvrščamo GLRaV med najnevarnejše in gospodarsko najpomembnejše viruse vinske trte. Taksonomija GLRaV se v zadnjih letih močno spreminja. Do danes je bilo opisanih 11 z zvijanjem listov vinske trte povezanih virusov: GLRaV-1, -2, -3, -4, -5, -6, -7, -9, -Car in -Pr, vendar jih je bilo nedavno pet izmed njih združenih v eno vrsto, poimenovano GLRaV-4. Raziskave so pokazale, da so GLRaV-5, -6, -9, -Car in -Pr sorodni GLRaV-4, zato so to sedaj genetske različice GLRaV-4. Taksonomska uvrstitev omenjenih virusov temelji na podobnosti gena za stresni protein HSP70h (heat-shock related proteins from the HSP70 family) in podobnosti gena za plaščni protein (coat protein - CP). V Sloveniji je bil v preteklih letih poleg GLRaV-1, -2 in -3 najden tudi GLRaV-4, vendar ni bil podrobneje okarakteriziran. Iz rastlinskega materiala, kjer smo potrdili prisotnost GLRaV-3 in GLRaV-4, smo z metodo IC RT-PCR pomnožili 1336 nukleotidov dolg 3'-terminalni del slovenskega izolata GLRaV-4. Zaporedje vključuje del plaščnega proteina in celoten gen za protein p23 in na osnovi tega zaporedja smo preučili sorodnost slovenskega izolata z ostalimi izolati GLRaV-4.

ABSTRACT

First report of grapevine leafroll-associated viruses 4 in Slovenia

Grapevine leafroll-associated viruses (GLRaVs) cause grapevine leafroll disease and are mostly located in the phloem of infected plants. Viruses cause downward leaf rolling and other morphological changes (mosaic, chlorosis) in leaves which lead to a reduction of net photosynthesis, transpiration, stomatal conductance and chlorophyll fluorescence. Because of all these changes GLRaVs are economically the most important viruses of grapevines. Taxonomy of GLRaVs has changed greatly in recent years. Eleven GLRaVs have been described so far, GLRaV-1, -2, -3, -4, -5, -6, -7, -9, -Car and -Pr, but recently five of them have been comprised in one species, GLRaV-4. Researches have shown that GLRaV-5, -6, -9 -Car and -Pr are related to GLRaV-4, and they are now considered genetic variants of GLRaV-4. Among the criteria for taxonomic classification of these viruses is also the identity of the 70-kDa heat-shock protein homolog (HSP70h) and the coat protein gene (CP). GLRaV-1, -2 and -3 are known to occur in Slovenian vineyards. In addition GLRaV-4 was recently found on one location but has not been characterized so far. From infected plant, where the presence of GLRaV-3 and GLRaV-4 was confirmed by ELISA, the 1336 bp long 3'-terminal part of the Slovenian variant of GLRaV-4 was amplified using IC RT-PCR. The sequence included part of the coat protein gene and the entire p23 gene. On the basis of this sequence we examined the relationship of Slovenian variant with other variants of GLRaV-4.



Razvoj in uporaba metod za hitro določanje virusov na razhudnikovkah

Polona KOGOVŠEK, Tjaša JAKOMIN, Nataša MEHLE, Maja RAVNIKAR

Nacionalni inštitut za biologijo, Oddelek za biotehnologijo in sistemsko biologijo, Večna pot 111, SI-1000 Ljubljana (polona.kogovsek@nib.si)

Virus mozaika pepina (*Pepino mosaic virus*, PepMV) in krompirjev virus Y (*Potato virus Y*, PVY) sta razmeroma stabilna in lahko prenosljiva povzročitelja bolezni, ki povročata velike ekonomske izgube na rastlinah paradižnika oziroma krompirja. Oba virusa vključujeta različne skupine izolatov, ki se razlikujejo na molekularnem nivoju in na nivoju patogenosti. Za hitro in enostavno odkrivanje prisotnosti virusov PepMV in PVY, ki lahko olajša in pospeši odločitev o potrebnih ukrepih, smo uvedli izotermalno molekularno metodo LAMP (loop-mediated isothermal amplification). Metodo LAMP lahko izvedemo v laboratoriju kot hitro presejalno metodo ali na terenu, saj so rezultati lahko odčitani v že do 30 minutah (Kogovšek in sod., 2014, Plant Pathology). Že objavljene LAMP teste (Ling in sod., 2013, Virology Journal; Hasiow-Jaroszewska in Borodynko, 2013, Archives of Virology) smo prilagodili in uporabili v multiplex formatu in s tem zagotovili določanje vseh znanih PepMV izolatov hkrati. Za določanje PVY smo razvili metodo LAMP s katero lahko določamo vse znane izolate tega virusa. Metoda za določanje PepMV se je izkazala kot izredno hitra, specifična in občutljiva. V prispevku bomo prikazali prve rezultate razvoja in validacije metod, narejenih po smernicah Evropske organizacije za zaščito rastlin (EPPO). Delo je bilo narejeno v okviru projekta financiranega s strani ARRS (L4-5525, P4-0165).

ABSTRACT

Development and application of methods for fast detection of viruses on Solanaceae plants

Pepino mosaic virus (PepMV) and *Potato virus Y* (PVY) are relatively stable and easily transmitted plant pathogens, causing great losses in tomato and potato production, respectively. Both virus isolates are classified in several groups which differ on the molecular and pathological level. We developed a isothermal molecular method LAMP (loop-mediated isothermal amplification) for fast and simple detection of PepMV and PVY viruses, which offers easier detection and facilitates decision on the measures needed. LAMP method can be used in the laboratory as fast screening method or on-site, since the results can be obtained in less than 30 min (Kogovšek et al., 2014, Plant Pathology). Previously described LAMP methods for detection of PepMV (Ling et al., 2013, Virology Journal; Hasiow-Jaroszewska and Borodynko, 2013, Archives of Virology) were adopted and optimised to be used in multiplex format, to ensure detection of all known isolates simultaneously. We developed LAMP assay for detection of all known PVY isolates. Assay for PepMV isolates detection was shown to be extremely fast, specific and sensitive. Preliminary results of the development and validation, following the recommendations of European Plant Protection Organisation, will be shown and discussed. The work was done in the frame of the project supported by Slovenian Research Agency (L4-5525, P4-0165).



Delovne zbirke škodljivih, referenčnih in kontrolnih bakterij, virusov in viroidov na Nacionalnem inštitutu za biologijo

Manca Pirc¹, Špela Prijatelj-Novak¹, Nataša Mehle¹, Lidija Matičič¹, Maja Ravnikar¹ in Tanja Dreo¹ (tanja.dreo@nib.si)

¹Nacionalni inštitut za biologijo, Oddelek za biotehnologijo in sistemsko biologijo, Večna pot 111, SI-1000 Ljubljana, Slovenija

Referenčni in drugi kontrolni materiali so nepogrešljivi v diagnostiki in pri raziskovalnem delu. Na področju varstva rastlina za škodljive organizme ni na voljo certificiranih referenčnih materialov z znano sestavo, koncentracijo tarčnega organizma in drugimi poznanimi karakteristikami. Večino kontrol, ki jih uporabljamo pri našem delu npr. pozitivne kontrole izolacije DNA z znano koncentracijo škodljivih organizmov v rastlinskem materialu, zato pripravljamo sami. Z njimi med drugim preverjamo in potrjujemo ustrezno delovanje testov ali izvedbo eksperimentov (njihovo specifičnost, občutljivost in robustnost) ter jih uporabljamo pri razvoju in validaciji metod. V ta namen od leta 1990 z upoštevanjem navodil World Federation For Culture Collections vzdržujemo delovno zbirko bakterij shranjenih na sistemu Microbank (Pro-Lab diagnostics). Zbirko fitoplazem, ki jih ni mogoče gojiti na umetnih gojiščih, ter pomembnejše izolate virusov vzdržujemo v tkivnih kulturah ali na okuženih rastlinah v karantenskem rastlinjaku, medtem ko ostale viruse in viroide shranjujemo zamrznjene. V zbirki bakterij je več kot 2000 izolatov med katerimi so (i) tipski izolati vrst in patovarjev za rastline patogenih bakterij (referenčni izolati), (ii) bakterije, ki lahko navzkrižno reagirajo v testih detekcije škodljivih organizmov, (iii) izolati, ki predstavljajo mikrofloro gostiteljskih rastlin in (iv) izolati škodljivih organizmov, ki smo jih iz vzorcev osamili in določili na Nacionalnem inštitutu za biologijo. Zadnji so nepogrešljivi pri uvajanju in

razvoju novih metod saj se izolati pri nas lahko namreč razlikujejo od izolatov, ki so uporabljeni pri razvoju reagentov zaradi česar le-ti niso vedno primerni za analize domačih vzorcev. Izolate smo že uporabili za izboljšave obstoječih metod (Pirc *et al.*, Plant Pathology (2009) 58: 872-881) in razvoju metode sledenja in filogeografske analize bakterije *Erwinia amylovora*, povzročiteljice bakterijskega hruševega ožiga (Bühlmann *et al.*, Environmental Microbiology (2014) 16(7):2112-25).

ABSTRACT

Working culture collections of reference and control bacteria, viruses and viroid at the National Institute of Biology

Reference and other control materials are essential in diagnosis and in research work. In the field of plant pathology certified reference materials of known composition, the concentration of the target organism and other known characteristics are not available. Most of the controls that we use in our work we therefore prepare ourselves e.g. positive controls of DNA extraction that contain defined low concentration of the target organism in the background plant material. Controls are used to check and confirm the proper performance of the tests or the experiments (their specificity, sensitivity and robustness) and in the development and validation of methods. For this purpose we maintain a working collection of bacteria on the Microbank system (Pro-Lab Diagnostics) since 1990, following the World Federation for Culture Collections guidelines. The collection of phytoplasma that cannot be grown in culture media, and virus isolates most relevant to our work are maintained in tissue culture or in infected plants in the quarantine greenhouse, while other viruses and viroids are stored frozen. The collection of bacteria contains more than 2000 isolates including (i) the type isolates of plant pathogenic bacterial species and pathovars (reference isolates), (ii) bacteria, which can cross-react in the detection test, (iii) isolates, representing microflora of the host plants, and (iv) isolates harmful organisms, which were isolated from the samples and identified at National Institute of Biology. The last group is indispensable in the introduction and development of new methods. Isolates present in Slovenia may in fact differ from the isolates used in the development of reagents and consequently such tests are not always suitable for the analysis of the local samples. The Slovenian isolates were already used to improve existing methods (Pirc *et al.*, Plant Pathology (2009) 58: 872-881) and the development of methods of source-tracking and phylogenetic analysis of *Erwinia amylovora*, the cause of fire blight (Bühlmann *et al.*, Environmental Microbiology (2014), 16 (7): 2112-25).



Kateri talni parametri lahko vplivajo na poškodovanost travne ruše zaradi divjega prašiča (*Sus scrofa* [L.]) ?

Žiga LAZNIK, Stanislav TRDAN

Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana
(ziga.laznik@bf.uni-lj.si)

Poskus je potekal v letu 2013 na šestih lokacijah na območju občine Kočevje (Stari Log, Gotenica, Kačji Potok, Dolnja Briga, Stari Breg in Novi Lazi). Namen poskusa je bil ugotoviti, kateri talni parametri (zastopanost ogrcev in deževnikov, vsebnost P₂O₅, K₂O in organske mase v tleh, pH vrednost tal) vplivajo na delež poškodb travne ruše, ki jih napravi divji prašič (*Sus scrofa* [L.]). Signifikantno značilna pozitivna korelacija je bila ugotovljena med obsegom poškodb zaradi ritja divjih prašičev in številom ($r=0.73$) ter skupno maso ($r=0.69$) ogrcev v tleh, kot tudi vsebnostjo P₂O₅ ($r = 0.87$) v tleh. Na število

in maso ogrcev v tleh je vplivala vrednost pH tal ($r=0.71/0.72$), vsebnost P_2O_5 ($r = 0.90/0.91$), in delež organske mase ($r = 0.74/0.77$). Število in masa deževnikov kot tudi vsebnost K_2O v tleh ($r = 0.81/-0.84$) ni vplivalo na populacijo in maso ogrcev v tleh. Na podlagi naših rezultatov zaključujemo, da ogrci predstavljajo pomembnejši vir beljakovinske hrane za divje prašiče kot deževniki. Z zatiranjem ogrcev v tleh bi lahko zmanjšali delež poškodb na travinju, ki jih povzroči divji prašič s svojim ritjem.

ABSTRACT

Which soil parameters could effect on grassland-damage caused by wild boar (*Sus scrofa* [L.] ?

The experiment took place in 2013 at six different locations in Kočevje Region (Stari Log, Gotenica, Kačji Potok, Dolnja Briga, Stari Breg, and Novi Lazi). The aim of the experiment was to investigate which soil parameters (presence of grubs, earthworms, pH, content of P_2O_5 , K_2O and organic matter in soil) influenced the damage on grasslands caused with wild boar (*Sus scrofa* [L.]). A significant positive correlation was discovered between the extent of damage due to wild boar rooting in grasslands and the number of grubs ($r = 0.73$), the weight of grubs ($r = 0.69$) and the content of P_2O_5 ($r = 0.87$) in the soil. The quantity and weight of grubs in soil were significantly influenced by soil pH ($r = 0.71/0.72$), P_2O_5 ($r = 0.90/0.91$), and the content of organic matter ($r = 0.74/0.77$), while the quantity and weight of earthworms in soil were influenced by the content of K_2O ($r = 0.81/-0.84$). Grubs represent a more important source of protein for wild boars than earthworms; consequently, reducing the quantity of grubs in soil could minimize the extent of damage caused by boars.



Ograjevanje kmetijskih zemljišč z začasnimi elektroograjami z namenom preprečevanja škode zaradi divjadi

Matej VIDRIH, Žiga LAZNIK, Filip VUČAJNK, Stanislav TRDAN

Biotehniška fakulteta, Oddelek za agronomijo, Jamnikarjeva 101, SI-1000 Ljubljana
(matej.vidrih@bf.uni-lj.si)

V Sloveniji so bili v preteklosti deleži kulturne krajine, ter druge vmesne oblike negovanega vegetacijskega pokrova zastopani v večji meri. Zaradi sedanjega slabšanja okoljskih razmer in tudi uvajanja sodobnih postopkov kmetovanja je prisotno še večje opuščanje rabe kmetijskih zemljišč. V cilju soobstoja kmetijske dejavnosti, tako rastlinske kot živalske ter varstva in ohranjanje narave bo potrebno dati še več poudarka načinom, ki preprečujejo večjo škodo nekaterih prostoživečih živali (divji prašič, jelenjad, srnjad) na kmetijskih zemljiščih (njive, vrtovi, travinje) in posledično izbranih gojenih rastlinah. V ospredju vedno bolj stopa uporaba elektroograj, ki pa imajo svoje prednosti in tudi slabosti. V prispevku bo predstavljena skupina elektroograj, ki se jim pripisuje boljše učinkovitost delovanja in s tem preprečevanja škod zaradi divjadi in ne samo za namen nadzorovane paše domačih živali. Začasne elektroograje, ki so postavljene iz traku, vrvice, vrvi ali mreže so, kadar so pravilno postavljene in vzdrževane, dober način, da divjadi preprečimo dostop na varovano zemljišče in jih usmerimo tja, kjer bo njihova škoda manjša. Izbira vrste take ograje pri postavitvi okoli varovanega zemljišča prinaša največji delež k skupni učinkovitosti. Druga dva dejavnika sta čas in obdobje postavitve ter neprekinjeno in

zadovoljivo (dovolj visoka napetost in jakost) napajanje vodnikov elektroograje z pulzi pašnega aparata. Vrsto te elektroograje podajamo z višino ter ustreznim razmikom med elektro vodniki, dolžino in njeno globino. Pri tej vrsti ovire prav globina zaustavi živali, ki imajo drugače sposobnost, da skočijo tudi višje, da bi prečkala varovano zemljišče. Za začasno elektroograjo za namene odvratanja parkljaste divjadi naj velja, da jo je mogoče hitro postaviti, ali prestaviti in pospraviti. Te tri lastnosti namreč omogočijo da so območja, kjer take ograje uporabljamo, prehodna tudi za ljudi in manj moteča za uporabnike prostora izven vegetacijskega obdobja. Škodo, ki nastane med rastno sezono po divjadi, se ne da popolnoma preprečiti, vendar so postavljene in učinkovite začasne elektroograje najboljši način njihovega preprečevanja ali delnega zmanjšanja.

ABSTRACT

Fencing of agricultural land with temporary electric fences to prevent wildlife damage

In Slovenia the share of cultivated landscape and other intermediate forms of nursed vegetation cover were represented in the past in larger extent. Due to the present disintegrated environmental conditions and initiation of modern measures of farming even bigger effect of abandonment of agricultural land is present. With the aim of reaching the coexistence of farming activity with plant and animal production on one side and nature protection and conservation on the other side even more emphasis will be put on the search for the measures which prevent larger damage of some wildlife (wild boar, red deer, roe deer) on agricultural land (fields, gardens, grassland) and selected cultivated plants. The forefront position to solve such a problem is nowadays left to the usage of electric fences but which have their weaknesses and advantages. The present paper will be about the group of electric fences to which a better efficacy is assigned to when dealing with wildlife damage and not only for the purpose of controlled grazing of farm animals. Temporary electric fences, which are constructed from electric tape, polywire, electric rope or electric netting and correctly constructed and maintained are a good way to prevent wildlife to enter the protected fields and directing them towards the course where their damage will be smaller. The selection of such kind of electric fence to erect it around the protected land brings the biggest share to total efficiency. The other two factors are time and period of installation and uninterrupted and satisfying (high enough voltage and current) charging of conductors in electric fence with the pulses from the energizer. We feature this kind of electric fence with its height and corresponding spacings between conductors, length and depth. In this kind of barrier it is just depth which stops the animals, which on the other hand have a good capability of jumping higher just to enter and cross the protected area. The temporary electric fence needs to have three features, namely it must be quickly dismantled, moved and installed again. These three characteristics enable that areas, where such fences are used are still passable for people and less disturbing for site visitors outside the vegetation period. Damage which appears on agricultural land due to the wildlife activity is not possible to prevent entirely but temporary electric fences perform an outstanding measure of their prevention or partial reduction.



Effect of shoot residues of some perennial plants on the germination and development of common ragweed (*Ambrosia artemisiifolia* L.)

Gabriella KAZINCZI¹, R. HOFFMANN¹, Erzsébet NÁDASY², András TAKÁCS², Jozsef HORVÁTH²

¹Kaposvár University, Faculty of Agricultural and Environmental Sciences, Institute of Plant Science, Kaposvár, Hungary (kazinczi.gabriella@ke.hu)

²University of Pannonia, Georgikon Faculty, Plant Protection Institute, Keszthely, Hungary

Common ragweed (*Ambrosia artemisiifolia* L.) is considered to be the most dangerous invasive alien weed species in Europe. In Hungary, *A. artemisiifolia* infests many arable crops. Besides its harmful effects in agriculture it is believed to be the most important pollen-allergic plant. The aim of our investigations was to study the effect of shoot residues of some perennial species (*Ailanthus altissima*, *Juglans regia*, *Solidago gigantea*, *Robinia pseudo-acacia*) on the germination and aboveground biomass production of *A. artemisiifolia* in pot experiments under field conditions. It was stated that donor plants - known earlier about their inhibitory effects - rather promoted than retarded germination and early growth of *A. artemisiifolia*. Probably *A. artemisiifolia* could utilize shoot residues incorporated into the pot's soil, as nutrient sources via its roots, as it was already proved in earlier experiments. The observed stimulatory effects on common ragweed offer the possibility to help the dominance of this weed under field conditions.



Občutljivost populacij koruze (*Zea mays* L.) iz slovenske genske banke na herbicide z različnimi aktivnimi snovmi

Tina MODIC¹, Ludvik ROZMAN²

¹Bayer d.o.o., Bravničarjeva 13, SI-1000 Ljubljana (tina.modic@bayer.com)

²Biotehniška fakulteta, Jamnikarjeva 101, SI-1111 Ljubljana

Namen raziskave je bil proučiti občutljivost populacij koruze iz genske banke koruze na Biotehniški fakulteti Univerze v Ljubljani na herbicide z različnimi aktivnimi snovmi. V proučevanje je bilo vključenih 20 populacij koruze. Populacije smo tretirali z različnimi herbicidi; z dvema smo tretirali pred vznikom, H1 (izoksafutol), H2 (mezotrion, S–metolaklor, terbutilazin), s tremi pa po vzniku, H3 (foramsulfuron, jodosulfuron–metil natrij), H4 (nikosulfuron) in H5 (bentazon, dikamba). V skladu z EPPO smernicami smo poškodbe zaradi fitotoksičnosti ocenili vizualno v razvojni fazi 4-6 listov, beležili smo čas metličenja in svilanja ter ob spravilu izmerili višino storža in rastlin. Po spravilu smo izmerili še dolžino storža in storže stehali. Ocene poškodb smo iz vrednotili s Kruskal-Wallisovo enosmerno analizo variance ter jih prikazali s stolpci za moduse. Merjene parametre smo statistično obdelali z analizo variance po metodi split-plot. Rezultati so pokazali, da za vse proučevane lastnosti med populacijami obstajajo razlike v občutljivosti na posamezen herbicid in da različni herbicidi povzročajo različno jakost in različne poškodbe na isti populaciji. Prav tako smo opazili vpliv različnih herbicidov na merjene lastnosti koruze, kot so pridelek ali čas metličenja in svilanja.

ABSTRACT

Herbicide tolerance of maize populations (*Zea mays* L.) from slovenian gene bank to different herbicides

The aim of this study was to investigate tolerance of various maize populations from the gene bank of the Biotechnical Faculty, University of Ljubljana, to herbicides with different active ingredients. The investigation involved 20 maize populations, two pre-emergence herbicides – H1 (isoxaflutole), H2 (mesotrione, S-metolachlor, terbutilazine) and three postemergence herbicides – H3 (foramsulfuron, iodosulfuron-methy Na), H4 (nicosulfuron) and H5 (bentazon, dicamba). The phytotoxicity assessment was based on visual estimation of plant injuries and also involved certain metric parameters of maize plants (tasseling and silking date, uppermost ear height, plant height, ear length and ear weight), all according to EPPO guidelines. For non-parametric traits, Kruskal-Wallis one way analysis of variance was used, and simple chart with columns for the modes. The differences between treatments were analysed in order to find statistically significant impact of herbicides on a particular maize populations. The metric traits were tested by split-plot analyse of variance. The populations responded differently to herbicide treatments, and also individual genotypes exhibited different levels of tolerance and types of plant injuries. The differences were also expressed in other quantitative traits such as yield, silking and tasseling time.



Pregled ocene tveganja neposredno in posredno izpostavljenih oseb pri uporabi fitofarmaceutskih sredstev (FFS) v obdobju 2003-2014

Tanja FATUR, Mateja BOLČIČ TAVČAR, Mojca FUART GATNIK

Nacionalni inštitut za javno zdravje (NIJZ), Zaloška cesta 29, SI-1000 Ljubljana
(tan.fatur@nijz.si)

Za registracijo FFS mora vlagatelj pokazati, da sredstvo ne škoduje zdravju ljudi. Zato morajo vlagatelji, skladno s postopkom registracije (FFS), v Sloveniji in državah članicah Evropske Unije (EU), predložiti ocene izpostavljenosti in tveganja za posredno in neposredno izpostavljene osebe. Med izpostavljene osebe sodijo: uporabniki FFS, ki pripravljajo škropilno brozgo in nanašajo škropivo na rastline; delavci, ki izvajajo dela na s FFS-ji škropljenih rastlinah; naključne osebe, ki so v času škropljenja nahajajo v bližini; ter osebe, ki večino dneva preživijo v bližini kmetijskih površin (dom, služba, šola, idr) – v nadaljevanju prebivalci. V Sloveniji smo z ocenjevanjem tveganja za vse našete skupine z izjemo prebivalcev začeli leta 2003 na Nacionalnem inštitutu za javno zdravje (NIJZ), pri čemer sledimo smernicam EU. Za izračun izpostavljenosti uporabnikov uporabljamo nemški in angleški model. Modela upoštevata najpogostejše načine aplikacije FFS (npr. traktorsko nameščeno škropilnico/pršilnik, ročno oprtno škropilnico, škropljenje navzgor in navzdol). Način računanja izpostavljenosti delavca se je skozi čas spreminjal, od predvidene vrednosti za ostanke na listih, do faktorjev prenosa ostankov glede na stik s površino tretirane rastline in upoštevanja uporabe zaščitnih rokavic pri opravih na tretiranih kulturah. Prvotno smo za izpostavljenost naključno prisotnih oseb le predvideli, da je nižja od izpostavljenosti uporabnika. Kasneje pa smo izpostavljenost računali po angleškem modelu, ki upošteva izpostavljenost zaradi zanosa škropiva. Ocenjevanje tveganja za prebivalce smo uvedli leta 2012, pri čemer upoštevamo izpostavljenost preko kože in dihal, zaradi stika z ostanki, in vdihavanja hlapov, ki so posledica zanosa škropiv; pri izpostavljenosti otrok pa upoštevamo še vnos ostankov škropiva v usta s predmeti in rokami. Metodologija ocenjevanja tveganja za posamezne skupine se je zaradi želje po čim bolj natančni oceni izpostavljenosti spreminjala. Evropske agencija za varnost hrane (EFSA) je oktobra 2014 izdala nove smernice za oceno izpostavljenosti uporabnikov,

delavcev, rezidentov in naključno prisotnih oseb, katere priporočila naj bi vlagatelji in pristojni organi upoštevali.

ABSTRACT

Risk assessment for human health overview of direct and indirect exposure due to Plan Protection Products (PPPs) use from 2003-2014.

For the PPPs authorisation process the applicants have to demonstrate that respective PPPs pose an acceptable risk for human health. Therefore, applicants have to provide exposure and risk assessments for directly and indirectly exposed people, in accordance with the authorisation process of PPPs in Slovenia and the European Union (EU). Potentially exposed groups are: operators who prepare spray mixtures and apply it; workers who carry out tasks on treated plants; bystanders, being accidentally present in the vicinity of the spraying area and residents who spend most of the day near agricultural areas (home, work, school, etc.). Slovenia started performing risk assessment following the EU guidelines for all exposed groups, except for residents, in 2003 at the National Institute of Public Health (NIJZ). Operator exposure estimations are done using German and UK model. The models take into account the most common methods of application of PPP (eg. a tractor mounted/trailed boom/broadcast air-assisted sprayer, knapsack/hand-held sprayer for upwards and downwards spraying). Calculation of worker exposure has changed over time, regarding predicted values for dislodgeable foliar residues, transfer coefficients and taking into account the use of protective gloves when performing tasks on treated crops. In the beginning, the exposure of bystanders was predicted as being lower than the exposure of the operator. Later, the exposure has been estimated using an UK model, taking into account exposure from spray drifts. The risk assessment for residents was introduced in 2012, taking into consideration the exposure through skin and respiratory tract due to spray drift deposits; while the exposure of children additionally considers the object to mouth and hands to mouth exposure. The methodology of risk assessment for individual groups varied during years mostly because of more realistic exposure assessment. The European Food Safety Authority (EFSA) published new guidelines for estimating the exposure of operators, workers, residents and bystanders in October 2014 with recommendations that applicants and competent authorities shall take into account.



Uporaba nanotehnologije v povezavi s fitofarmacevtskimi sredstvi: analiza s Pajkom

Karmen STOPAR

Biotehniška fakulteta, Oddelek za agronomijo, INDOK, Jamnikarjeva 101, SI-1000 Ljubljana (karmen.stopar@bf.uni-lj.si)

Nanotehnologiji pripisujejo potencial neslutnih razsežnosti. Posebne lastnosti nanomaterialov skupaj z inovativni pristopi obetajo reševanje različnih aktualnih problemov, tudi takšnih, ki so povezani s povpraševanjem po zdravi in varni hrani. Na področju rastlinske proizvodnje se potenciali kažejo v preciznem kmetovanju, ki naj bi ob večjih pridelkih pripomoglo k zmanjšanju onesnaževanja. V našem delu smo za analizo omenjenega področja izbrali bibliometrični pristop. Ker se velik del agro-nano aplikacij nanaša na različna fitofarmacevtska sredstva, pa smo obravnavali predvsem ta vidik. Bibliometrično analizo smo pripravili s podatki iz splošne citatne zbirke WOS in

specializirane zbirke za širše področje kmetijstva CAB. Z vizualizacijo omrežij, ki smo jih pripravili s programskim orodjem Pajek, smo proučevali relacije med obravnavanimi elementi. Analiza vsebinskih področij (kategorije WOS) citirajočih in citiranih člankov v zbirki WOS je pokazala, da sega analizirano področje večinoma na področje analitske kemije, elektrokemije, biokemije, biofizike, biotehnologije, okoljskih znanosti in živilsko tehnologijo. Največja pojavnost člankov je iz revije *Biosensors & bioelectronics*. Biosenzorji, detekcija in fitofarmacevtska sredstva pa so tudi osrednje ključne besede v omrežju besed iz naslovov člankov in v omrežju WOS deskriptorjev KW+. Analiza kontroliranih ključnih besed iz zbirke CAB (CABI kod in deskriptorjev) izpostavi v povezavi z uporabo fitofarmacevtskih sredstev dve pomembni smeri raziskav; onesnaževanje oziroma okoljske študije ter vsebine, ki se nanašajo na zdravje človeka, poskusne živali in s tem povezane modele proučevanja. S CABI kodo *Biosensors and Biological Nanotechnology* imajo tudi v tem omrežju pomembno mesto senzorji.

ABSTRACT

Application of nanotechnology in relation with pesticides: analysis with Pajek

Nanotechnology shows potentials of unimaginable proportions. Specific properties of nanomaterials together with innovative approaches promise a solution to various current problems, including those, related to the demand for healthy and safe food. For example, in the field of plant production, precision farming shows the potentials to increase crop yields and reduce pollution. Bibliometric analysis was used to analyze the research patterns in this field. Since a large part of agro-nano applications relates to pesticides, we mainly focus on this aspect. Bibliometric data was derived from the general citation database WOS and also from CAB (specialized global database in the field of agriculture). With the software Pajek the network visualization was generated whereby we studied the relationships between the elements. Analysis of the thematic areas (categories WOS) of citing and cited articles in the database WOS show that the analyzed area extends mainly to the field of analytical chemistry, electrochemistry, biochemistry, biophysics, biotechnology, environmental sciences and food technology. The highest number of articles originates from the journal *Biosensors & bioelectronics*. *Biosensors*, *detection* and *pesticides* are also the main keywords in the network of words from the titles of the articles and the network of descriptors KW+ (WOS). Analysis of controlled keywords from the CAB database (CABI codes and descriptors) shows two important directions of research in the use of pesticides: pollution and environmental studies as well as research topics linking human health and experimental animals, and respective models of research. CABI code *Biosensors and Biological Nanotechnology* again assigns an important place to nanosensors in that network.



Učinkovitost mešanic pripravkov na podlagi glifosata, 2,4-D ter dikambe za zatiranje njivskega slaka (*Convolvulus arvensis* L.)

Aleš KOLMANIČ¹, Mario LEŠNIK²

¹Kmetijski inštitut Slovenije, Hacquetova ulica 17, SI-1000 Ljubljana
(ales.kolmanic@kis.si)

²Fakulteta za kmetijstvo in biosistemske vede, Pivola 10, SI-2311 Hoče Maribor

V lončnem poskusu smo preučevali učinkovitosti aktivnih snovi (a.s.) ter škropilnih brozg na podlagi glifosata (N-(fosfonometil) glicin), 2,4-D (2,4-diklorofenoksi-ocetna kislina) in dikambe (3,6-dikloro-o-anisinska kislina) za zatiranje njivskega slaka (*Convolvulus arvensis* L.). Glifosat smo uporabili v koncentracijah 2000 in 3000 g a.s. ha⁻¹, 2,4-D v 500, 1000 in 1500 g a.s. ha⁻¹ ter dikambo v 250, 500 in 750 g a.s. ha⁻¹. Učinkovitosti smo določili 3 in 6 tednov ter 8 mesecev po tretiranju z metodo vizualne ocene in s tehtanjem nadzemne ter podzemne mase rastlin. Opazili smo zmerne antagonizme med aktivnimi snovmi. Učinkovitost zatiranja koreninskega sistema (45-60% učinkovitost) se je bistveno razlikovala od učinkovitosti izraženi v zmanjšanju nadzemne mase (85-99% učinkovitost). 2,4-D, bodisi uporabljen samostojno (1500 g a.s. ha⁻¹; 94% učinkovitost) ali v mešanica z glifosatom (3000 g a.s. ha⁻¹ glifosat in 1500 g a.s. ha⁻¹ 2,4-D; 83,1% učinkovitost) je ena od najbolj učinkovitih aktivnih snovi za dolgoročno obvladovanje slaka. Glede na povečanje učinkovitosti uporabljenih škropilnih brozg ter iz stroškovnega vidika, mešanja 2,4-D (več kot 1000 g a.s. ha⁻¹) ali dikambe (več kot 500 g a.s. ha⁻¹) z glifosatom ne moremo priporočati.

ABSTRACT

Efficacies of glyphosate, 2,4-D, dicamba and their tank mixtures for long term control of field bindweed (*Convolvulus arvensis* L.)

The efficacies of active ingredients (a.i.) glyphosate (N-(phosphonomethyl)glycine), 2,4-D (2,4-dichlorophenoxy-acetic acid) and dicamba (3,6-dichloro-o-anisic acid) and tank mixtures for control of field bindweed (*Convolvulus arvensis* L.) grown in pots were studied. Glyphosate was applied at the rates of 2000 and 3000 g a.i. ha⁻¹, 2,4-D at the rates of 500, 1000 and 1500 g a.i. ha⁻¹ and dicamba at the rates 250, 500 and 750 g a.i. ha⁻¹. Efficacies were determined 3 and 6 weeks and 8 months after the application by methods of visual rating and by weighting of above-ground mass and rhizome weight. Moderate antagonism between glyphosate, 2,4-D and dicamba was observed. The rate of suppression of rhizome development (45-60% efficacy) differed significantly from the rate of suppression of development of above-ground mass (85-99% efficacy). 2,4-D applied alone (1500 g a.i. ha⁻¹, 94% efficacy) or in mixtures with glyphosate (3000 g a.i. ha⁻¹ glyphosate and 1500 g a.i. ha⁻¹ 2,4-D, 83.1% efficacy) is one of the most effective a.i. for long term control of field bindweed. However, considering the enhancement of efficacy and cost-benefit aspects of the control, increased rates of 2,4-D (more than 1000 g a.i. ha⁻¹) or dicamba (more than 500 g a.i. ha⁻¹) to glyphosate cannot be recommended.

KAZALO AVTORJEV / INDEX OF AUTHORS

ALIČ Špela	31
AMBROŽIČ TURK Barbara	102
ARNŠEK Simon	47
ATHANASSIOU Christos G.	9
BAJEC Domen	32, 93, 94 , 100, 101
BANDELJ Dunja	22, 23
BEBER Matjaž	14
BERNIK Rajko	25
BEVK Danilo	19
BJELIŠ Mario	25, 95
BOHINC Tanja	38, 86, 88(2)
BOLČIČ TAVČAR Mateja	110
BRAČKO Brigita	40
BRZIN Jože	31
BUČAR MIKLAVČIČ Milena	23
BUTINAR Bojan	23
CARLEVARIS Branko	46
ČEBOKLI Peter	94
CELAR Franci Aco	55, 58
ČOKL Andrej	19
ČUK Jana	46
DE GROOT Maarten	67, 69, 92
DELIBAŠIĆ Goran	18
DERMASTIA Marina	76, 80, 102
DHAUSSY Aurélie	11
DONIK PURGAJ Biserka	14

DREO Tanja	16, 31, 59, 105
DROVENIK Božidar	91
ELER Klemen	55
ERJAVEC Jana	31
FAJT Nikita	102
FATUR Tanja	110
FERLEŽ RUS Alenka	78
FUART GATNIK Mojca	110
GERIČ STARE Barbara	37
GUČEK Tanja	62, 63
GUTIÉRREZ-AGUIRRE Ion	41
HAUPTMAN Tine	72, 92
HOFFMANN R.	108
HORVÁTH József	108
HRUSTIĆ Jovana	18
JAKOMIN Tjaša	16, 104
JAKOVAC STRAJN Breda	44
JAKŠE Jernej	62, 63
JANČAR Matjaž	20, 21 , 23, 24 , 25
JAVORNIK Branka	62, 63
JERIČ Dejan	94
JERMAN CVELBAR Joži	17
JURC Dušan	71
JURC Maja	68
JURIČ Damjan	22
KAVČIČ S.	80
KAVŠEK Branko	22
KAZINCZI Gabriella	108

KNAPIČ Matej	48, 79
KNAPIČ Vlasta	17, 34
KOCJAN AČKO Darja	60
KOGOVSŠEK Polona	104
KOLMANIČ Aleš	112
KOLŠEK Marija	67
KORUZA Boris	76
KOS Andrej	26, 56
KOS Katarina	55, 58, 70
KOS Tomislav	78
KOZINA Antonela	87
KUHARIČ GRABOVAC Silva	47
LAZNIK Žiga	38, 44, 95, 106, 107
LEMIĆ Darija	87
LESKOŠEK Gregor	25
LESKOVŠEK Robert	52, 53
LEŠNIK Mario	14, 40, 49, 51, 54, 112
LOOMANS Antoon J. M.	7
MAJCEN Drago	26, 56
MARION Lena	71
MARKOTIĆ Vjekoslav	97
MASTEN MILEK Tatjana	83, 97, 98
MATKO Boštjan	54
MATOUŠEK Jaroslav	62, 63
MAVRIČ PLEŠKO Irena	49, 75, 76, 85, 102, 103
MAVSAR Martin	25
MAVSAR Simona	33
MECHORA Špela	99

MEHLE Nataša	41, 76, 80, 102, 104
MELIKA George	70
MEŠL Miro	54
METERC Gregor	68
MIHAJLOVIĆ Milica	18
MIKLAVC Jože	54
MILEVOJ Lea	83
MODIC Špela	39, 48, 90, 91
MODIC Tina	109
MUNDA Alenka	100, 101
NÁDASY Erzsébet	108
NAGLIČ Tina	31
NEUMEISTER Herfried	50
OGRIS Nikica	66
OREŠEK Erika	14, 17
PAJK Primož	17
PAPLER Jure	41
PARADŽIK Boris	26
PERHARIČ Lucija	30
PERVANJE Mateja	57
PETERKA Matjaž	31
PETERLIN Andreja	32, 93, 94, 96
PINTAR Maja	83, 98
PIRC Manca	16, 31, 59, 105
PODGORNIK Maja	22, 23, 78
POKORN Tine	63
POPOVIĆ Luka	95
PORTE Antoine	56

POŽENEL Anka	46
RAČKI Nejc	41
RADIŠEK Sebastjan	62, 63
RAK CIZEJ Magda	47, 78
RAVNIKAR Maja	16, 31 , 41, 59, 102, 104, 105
RAZINGER Jaka	39, 48, 76 , 84 , 90
REBERNIK Janko	25
RODIČ Karmen	32 , 93, 94, 96
ROT Mojca	20, 25 , 46
ROZMAN Ludvik	109
RUPNIK Jaka	86, 88
SABOTIČ Jerica	31
SADIKOVIĆ Dušan	72
ŠANTAVEC Igor	58
SAPONARI Maria	16
SCHROERS Hans-Josef	37, 90
SELJAK Gabrijel	14, 20 , 85, 98
SHELTON Anthony M.	7
ŠIMALA Mladen	83 , 97, 98
SINKOVIČ Tomaž	44
ŠIRCA Saša	37
SIRK Marjan	40
ŠKERBOT Igor	47
ŠKERBOT Iris	47 , 78, 83
ŠKERLAVAJ Vojko	76, 91, 100, 101
ŠKOF Mojca	39, 99
ŠTEFANČIČ Matej	42 , 94
ŠTEFANČIČ Mateja	94

ŠTEPIC Primož	26, 56
STOPAR Karmen	111
STRAJNAR Polona	37
ŠTRUKELJ Melita	75, 84, 85, 103
TAKÁCS András	108
TANOVIĆ Brankica	18
TAVČAR KALCHER Gabrijela	44, 58
TOJNKO Stanislav	14
TRDAN Stanislav	33, 38(2), 44 , 83, 86, 88(2), 95, 106, 107
TUŠEK ŽNIDARIČ Magda	31
UDOVČ Andrej	44
UGRINOVIĆ Kristina	39, 99
UREK Gregor	37, 48, 52, 75, 84, 85, 103
USENIK Valentina	102
VAJS Stanislav	40, 49, 51, 54
VAUPOTIČ Marjan	34
VESEL Viljanka	21
VIDRIH Matej	44, 107
VIRŠČEK MARN Mojca	49 , 76, 102
VRHOVNIK Irena	21
VUČAJNK Filip	25 , 86, 88, 107
ZEMLJIČ URBANČIČ Marjeta	39 , 49, 57
ŽERJAV Metka	39, 57
ŽEŽLINA Ivan	46, 76, 85, 103
ZGONEC Bojana	29
ŽIBRAT Uroš	79
ZIDARIČ Igor	52, 53

Sponzorji



Dow AgroSciences



150 years

 **BASF**

We create chemistry

Posvetovanje so podprli



Bayer CropScience



mediline

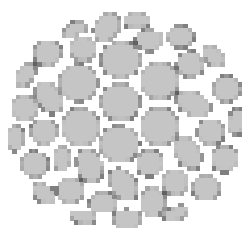
syngenta



trapview



PIONEER®
A DUPONT COMPANY



planet zdravja

Ω Omega d.o.o.



ZADRUŽNA ZVEZA
SLOVENIJE, z.o.o.



SEMENARNA
Ljubljana

 DEŽELNA BANKA SLOVENIJE

Donatorji



www.d-net.s



