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Plant Protection Society of Slovenia

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## UVODNI REFERATI

## **Zakonodaja in tehnične rešitve za zmanjševanje pojavov zanašanja (drifta) pri nanosu pripravkov v sadovnjakih in vinogradih**

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V številnih severnoevropskih državah so uvedli zakonodajne ukrepe da bi preprečili negativne učinke zanašanja pripravkov za varstvo rastlin na okolje. Razvili so sistem varovalnih pasov s katerim so omogočili nadaljevanje uporabe nekaterih za okolje manj prijaznih pripravkov. Širina varovalnih pasov je prilagojena vrsti opreme za nanos pripravkov, odmerku in lastnostim posameznega pripravka ter lastnostim biotopov v neposredni bližini s pripravki tretiranih zemljišč (vodni viri, naselja, občutljivi biotopi, ...). Razvili so tudi klasifikacijo opreme za nanašanje glede na stopnjo tveganja za pojave zanašanja pripravkov izven območja nanosa. V mediteranskih deželah so do sedaj v zvezi s to tematiko opravili malo raziskav. Naraščajoča skrb glede varovanja okolja in potreba po usklajevanju zakonodaje znotraj Evropske unije je privedla do razvoja skupnih usmeritev na tem področju. Z namenom ovrednotenja problema zanašanja pripravkov v italijanskih vinogradih in sadovnjakih so izvedli študijo, ki je potekala skladno s standardom (ISO DIS 22866). Rezultati raziskave kažejo, da ima na obseg zanašanja pripravkov v okolico sadovnjakov in vinogradov zelo velik vpliv gojitvena oblika – struktura krošnje dreves in oblika listne stene vinograda. Pri vinogradih z ožjimi medvrstnimi razdaljami in gostejšo listno steno so bile izmerjene vrednosti količine v okolico zanesenih pripravkov manjše, kot v vinogradih z večjimi medvrstnimi razdaljami in ožjimi listnimi stenami. Velike vrednosti depozitov pripravkov zanesenih izven območja tretiranja so bile izmerjene v nasadih, kjer so škropljenja opravljali s pršilniki z veliko kapaciteto za izmenjavo zraka in kjer so uporabljali šobe, ki oblikujejo drobne kapljice. Z uporabo antidriftnih šob so dosegli značilno zmanjšanje zanašanja.

**Ključne besede:** zanašanje pripravkov, vinogradi, sadovnjaki, antidriftne šobe, pršilniki

*ABSTRACT*

### **Legislative measures and technical solution able to reduce spray drift in arboreal crop**

In several Northern European countries legislative measures have been introduced to prevent the negative effects of spray drift on the environment. The use of buffer zones has been introduced to enable the continued use of some environmentally sensitive pesticides. The width of these is dependant the type of equipment used, the applied pesticide dosage and the features of the area adjacent to the treated field (i.e. presence of surface water, urban sites, etc.) (Gilbert, 2000). Also, a classification of spraying equipment, according to drift risk, has been defined (Herbst and Ganzelmeier, 2000; Walklate *et al.*, 2000). In Mediterranean countries, relatively little research has been carried out on this subject. Nevertheless, the rising concerns about environmental safety and the need to harmonise legislative measures for the mitigation of drift risks is a European Union directive. With the purpose of quantifying the problem of spray drift in Italian vineyards and orchards, a specific study has

been carried out following the International guidelines (ISO DIS 22866). The results indicate a considerable influence of the canopy characteristics on the amount of drift deposit assessed on the ground in the area adjacent to the vineyard orchard sprayed. The vineyard featured by a narrower spacing and compact vegetation gave lower drift than the vineyard featured by wider spacing and thinner canopy. Higher values of drift were always observed when fine droplets and high air flow rates were used, while adopting air inclusion nozzles gave considerable drift reductions.

**Key words:** application drift, vineyards, orchards, drift reducing nozzles, sprayers



### **Postopek testiranja pršilnikov za pridobitev deklaracije z oznako "oprema za zmanjševanje pojava zanašanja" v Nemčiji**

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Zmanjševanje zanašanja (drifta) pri nanosu pripravkov za varstvo rastlin je eno glavnih orodij za zmanjševanje tveganja za okolje pri njihovi uporabi. Zato je potrebno določanje varnostnih pasov in uporaba opreme, ki zmanjšuje obseg aplikacijskega zanašanja in s tem izpostavljenost ne ciljnih organizmov in površinskih voda. V Nemčiji je podeljevanje dovoljenj (registracij) za dajanje fitofarmaceutskih sredstev na trg tesno povezano s predhodnim določanjem velikosti varovalnih pasov za aplikacijo ob vodnih virih in tudi z lastnostmi opreme za nanos, povezanimi s potencialom za povzročanje zanašanja. Leta 1993 so pričeli oblikovati register opreme, ki je deklarirana, kot oprema za zmanjševanje zanašanja (Drift reducing equipment DRE; Verzeichnis Verlustmindernde (Abdriftmindernde) Geräte). Trenutni register vsebuje podatke za 250 vrst naprav, ki uradno izpolnjujejo s standardi deklarirane lastnosti. Proizvajalci opreme (pršilnikov, škropilnic, šob, ...) so dolžni pred dajanjem novih naprav na trg ustanovi BBA (Biologische Bundesanstalt für Land- und Forstwirtschaft) podati vlogo za uvrstitev njihovih naprav v register DRE. Ustanova BBA najprej ugotovi ustreznost opreme za namene, za katere je deklarirana uporaba. Ko je zaključen prvi ciklus pregleda tehnične skladnosti z namenom uporabe, dobi naprava prvo deklaracijo v obliki BBA nalepke in šele potem pristopijo k testiranju lastnosti glede zmanjševanja zanašanja. Pri testiranju nove naprave glede značilnosti zanašanja, vrednosti ugotovljene pri meritvah zanašanja v standardnih protokolih, primerjajo z vrednostmi referenčne standardne opreme značilne za nemško tržišče, ki so podane v registru podatkov imenovanem "basic drift values". Novo napravo potem uvrstijo v ustrezen razred glede zmanjševanja zanašanja (Drift reducing class, Abdriftminderungsklasse). Osnovni razredi v registru so 50%, 75% in 95% razred zmanjšanja zanašanja. Za uvrstitev naprave v posamezen razred morajo izvesti poskuse v naravi in poskuse v nadzorovanih razmerah vetrovnega tunela. Register naprav in podatke o njihovi uvrstitvi v posamezne razrede glede zmanjševanja zanašanja potem predstavijo v zveznem uradnem listu (Bundesanzeiger). Podatke iz tega registra uporabljajo tudi pri postopkih registracije novih fitofarmaceutskih pripravkov na način, da določijo odstopanja od predpisanih razdalj za varnostne pasove. Velikost razdalj varnostnih pasov določijo glede



na stopnjo zmanjšanja zanašanja, ki jo ima oprema s katero želimo nanašati nek pripravek. To pomeni, da lahko enak pripravek nanašamo na različnih razdaljah od vodnega vira, odvisno od tipa opreme za nanašanje. V nekaterih primerih novih pripravkov za varstvo rastlin sploh ni mogoče registrirati, če niso predvideni za nanašanje z opremo, ki ima deklarirano natančno določeno stopnjo zmanjševanja zanašanja. Takšen pristop k reguliranju pojavov zanašanja pripravkov za varstvo rastlin omogoča pridelovalcem uporabo pripravkov, ki jih sicer, po strogih okoljevarstvenih določilih, z zastarelimi stroji, sploh nebi mogli več uporabljati.

**Ključne besede:** zanašanje, drift, pripravki za varstvo rastlin, stroji za nanos pripravkov, testiranje, zakonodaja

#### *ABSTRACT*

#### **The test procedure for drift reducing sprayers in Germany**

Drift reduction is a main tool in risk mitigation. Therefore buffer zones and drift reducing sprayers are needed to minimise the exposition of non-target organisms and surface waters during the application of plant protection products. In Germany often the authorization of plant protection products can only be granted in combination with buffer zones to surface waters and the use of drift reducing sprayers. An official list of drift reducing sprayers has been introduced in 1993. Today this list comprises nearly 250 entries. Manufacturers have to apply for an entry in the list and their sprayers will then be tested by the federal biological research centre (BBA) concerning its suitability for the intended purpose. As a result the sprayers gets the BBA-approval sticker which is a prerequisite for the test procedure on drift reduction. In comparison to the basic drift values which have been determined with common spray techniques the so called "loss reducing equipment" must reduce spray drift fallout significantly. Three drift reduction classes have been established, 50 %, 75 % and 90 % reduction. In field tests or in wind tunnel tests the drift reduction class of the candidate sprayer has to be determined. Each successfully tested equipment will then be listed in the official list of which is published in the federal gazette ("Bundesanzeiger"). If buffer zones are specified in the label of the plant protection product a reduced buffer zone width can be specified for applications with listed sprayers. In some cases a plant protection product cannot be registered when applied with common spray techniques. Drift reducing sprayers therefore enable farmers to use plant protection products which otherwise could not be authorized. In some cases plant protection would no longer be possible without these risk mitigation measures.

**Key words:** drift, plant protection products, application equipment, testing, legislation



## **Stanje obvladovanja pojavov zanašanja (drifta) fitofarmaceutskih sredstev v Sloveniji**

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V prispevku je prikazana ocena stanja tehničnega in organizacijskega obvladovanja pojavov neposrednega aplikacijskega zanašanja (drifta) fitofarmaceutskih sredstev (FFS) v Sloveniji. Zaradi specifične strukture in prostorske razporeditve pridelovalnih zemljišč (majhne parcele, tesna prostorska prepletenost pridelovalnih zemljišč in infrastrukturnih ter bivanjskih objektov, velika pogostost pojavljanja pridelovalnih zemljišč ob vodnih virih), obstoječe tehnologije varstva rastlin in obstoječe dokaj zastarele opereme za nanos FFS potrebuje Slovenija pri obvladovanju pojavov zanašanja FFS moderne, vendar njenim razmeram prilagojene rešive. Glede na obstoječe razemre je potrebno posodobiti naprave za nanos FFS in nekatere določbe obstoječe zakonodaje ter povečati koordinacijo vseh vpletenih pri izvajanju načrtovanja rabe prostora na območjih, kjer se agrarno okolje zliva z urbanim. Rešitve morajo biti prilagojene lokalni rabi prostora, intenzivnosti in vrsti kmetijske pridelave. Nekateri predlogi za usklajevanje interesov pridelovalcev živeža in drugih uporabnikov ruralnega prostora so predstavljeni v tem prispevku.

**Ključne besede:** zanašanje, drift, fitofarmaceutska sredstva, Slovenija, regulacija, preprečevanje

*ABSTRACT*

### **Plant protection product drift regulation and prevention in Slovenia**

Slovenian technical and organizing aspects of regulation and prevention of drift of plant protection products (PPP) are presented. Due to specific structure, spatial distribution and characteristics of agricultural allotments (small, very diverse, scattered within public and residential area infrastructure and premises, frequently close to surface water bodies), existing agricultural production technology and relatively old machinery for PPP application, Slovenian society needs new and modern, but specific locally adjusted solutions for regulation and prevention of drift of PPPs. According to the existing situation some improvements (modernisation) in the field of PPP application devices and techniques, and also some revisions of existing legislation and significant improvements in coordination among all parties involved in land use planning are needed, especially in intensive agricultural production areas near urban areas. Solutions for drift regulation have to be adapted to specific local land use schemes and types of agricultural production. Some proposals for future reconciliation of interests of agricultural producers and other users of rural land areas are presented.

**Key words:** drift, plant protection products, Slovenia, regulation, prevention



## Vodovarstvena območja – ukrepi in omejitve v zvezi z ravnanjem z zemljišči

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V letu 2004 so bili na Ministrstvu za okolje in prostor v skladu z zakonom o vodah sprejeti trije podzakonski predpisi, s katerimi bo v bodoče zagotovljen enoten način določanja vodovarstvenih območij ter ukrepov in omejitev na teh območjih: Pravilnik o kriterijih za določitev vodovarstvenega območja, Pravilnik o gradnjah na vodovarstvenih območjih, ki se lahko izvedejo samo na podlagi vodnega soglasja, in o dokumentaciji, ki je potrebna za pridobitev vodnega soglasja in Pravilnik o kriterijih za označevanje vodovarstvenega območja in območja kopalnih voda. Na podlagi navedeni predpisov je Vlada RS v oktobru 2004 sprejela Uredbo o vodovarstvenem območju za vodno telo vodonosnika Ljubljanskega polja, na Ministrstvu za okolje in prostor pa v tem trenutku poteka z zadevnimi občinami usklajevanje osnutka uredbe o vodovarstvenem območju za vodno telo vodonosnikov Selniške dobrove, Ruš, Vrbanskega platoja, Limbuške dobrove in dela Dravskega polja. Z namenom, da se zavaruje podzemna voda, ki se že uporablja ali je namenjena za oskrbo prebivalstva s pitno vodo v bodoče, je treba v čim večji meri preprečiti in omejiti točkovne in razpršene vire onesnaževanja, ki lahko pomenijo tveganje za onesnaženje vodnega telesa. Zato morajo biti v uredbi navedeni zaščitni ukrepi, prepovedi in omejitve ter roki, v katerih morajo lastniki ali drugi posestniki nepremičnin na obravnavanih območjih svoje delovanje prilagoditi določbam uredbe. Zaščitni ukrepi, prepovedi in omejitve se nanašajo tako na gradnjo objektov kot tudi na ravnanje s kmetijskimi in drugimi nepozidanimi zemljišči in so različno strogi na posameznem notranjem vodovarstvenem območju. Zato bodo določbe uredb pripravljene tako, da se bo potencial tveganja za onesnaženje vodnega telesa na obravnavanih območjih čim bolj omejil in preprečil, gradnja objektov ter ravnanje s kmetijskimi in drugimi nepozidanimi zemljišči na tovrstnih območjih pa bo mogoče uspešno nadzirati. Uveljavitev vodovarstvenih režimov pomeni določene spremembe in prilagoditve tako pri načrtovanju razvoja na obravnavanih območjih kot tudi pri obstoječi rabi prostora in opravljanju obstoječih dejavnosti. Nekatere spremembe in prilagoditve je možno uveljaviti takoj ob uveljavitvi pravnega akta, za nekatere pa so v uredbi predvidena prehodna obdobja, saj je takojšnja prilagoditev zaradi specifičnosti nekaterih dejavnosti nemogoča.

**Ključne besede:** ekologija, varstvo voda, vodovarstvena območja, zakonodaja

Angleški povzetek ni bil predložen.



## Umerjanje vinogradniških pršilnikov - pristopi v Italiji

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Pri postopkih umerjanja pršilnikov za nanos pripravkov v vinogradih je potrebno poznati osnovne parametre umerjanja, kot so: količina porabljene škropilne brozge, količina izmenjanega zraka z ventilatorjem pršilnika in vozna hitrost. Ustrezno umerjen pršilnik naj omogoča oblikovanje največje možne količine obloge (depozita) pripravkov na ciljnih površinah (listje in plodovi). Hkrati naj omogoča zmanjševanje zanašanja (drifta) pripravkov izven ciljnega območja nanosa ter oblikovanje po vseh ciljnih površinah izenačenega površinskega depozita aktivnih snovi pripravkov. Postopek umerjanja je sestavljen iz nastavitve delovnih parametrov pršilnika, to je določitve potrebnega števila aktivnih šob, njihove prostorske usmeritve, pretoka šob, določitve kapacitete ventilatorja in izstopne hitrosti zraka in vozne hitrosti pršilnega agregata. V prispevku so predstavljeni rezultati združenega raziskovalnega programa italijanskih univerz, ki je pod naslovom »Improving calibration methods for vineyard spray application equipment, as a tool to reduce pesticide amounts and environmental effects« potekal v obdobju od leta 1999 do 2003. Ugotovitve pridobljene med raziskovalnim programom so bile naslednje:

- uporaba pokončnih paternatorjev (lovilna stena za določanje prostorske distribucije pršilnega oblaka) je priporočljiva za splošno umerjanje vinogradniških pršilnikov, vendar je kljub temu še naprej potrebno izvajati tudi terensko umerjanje in določanje distribucije v nasadih, posebej pred škropljenji v začetku rastne dobe;
- izmenjalno kapaciteto ventilatorja pršilnika, ki se pogosto uporablja v praksi (6 do 11 m<sup>3</sup>/s) je možno značilno zmanjšati in pri tem zagotoviti enakomerno pokrovnost z oblogo (depozitom) škropiva in prodiranje v notranjost listne stene trte;
- povprečno hitrost vožnje je mogoče še povečati na 8 do 10 km/h in povečati storilnost, brez tveganja za zmanjšanje kakovosti nanosa in poslabšanja enakomernosti distribucije depozita.

**Ključne besede:** vinska trta, umerjanje pršilnikov, zanašanje fitofarmaceutskih sredstev

*ABSTRACT*

### **Calibration of vineyard sprayers. An Italian approach**

Calibration of air-assisted sprayers for applications in vineyards requires the definition of such operating parameters as the spray application rate, the air flow rate and the forward speed. Proper calibration should maximise the amount of spray deposited on the target (foliage and/or fruits), thus reducing off-target drift and environmental pollution, and provide a uniform deposition of the active ingredient over the target area. This involves the adjustment of such operating parameters as the number and orientation of active nozzles, the spray volume, the air volumetric flow rate and speed, and the travel speed. The paper reports

the results from a research program, involving several Italian Universities between 1999 and 2003 in the task of "improving calibration methods for vineyard spray application equipment, as a tool to reduce pesticide amounts and environmental effects". The program led to following indications:

- vertical spray patternators may be recommended for a general sprayer calibration, but sprayer adjustment in the field is necessary during the earlier growth stages of the vines;
- airflow rate levels commonly used in the practice ( $6 \text{ m}^3/\text{s}$  to  $11 \text{ m}^3/\text{s}$ ) may be reduced substantially, thus improving both overall deposition and penetration into the canopy;
- the increase of the forward speed up to 8-10 km/h may be recommended to increase work capacity and timeliness of operation, without impairing the distribution quality.

**Key words:** vineyard, sprayer calibration methods, spray drift



## **Lastnosti vetra v Sloveniji**

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V prispevku je prikaz razčlenitev vetrnih razmer v Sloveniji glede na hitrost in prevladujočo smer vetra. Slovenija zaradi svoje geografske lege v zavetrju Alp in reliefne razgibanosti ni zelo prevetrena dežela. Na majhno vetrovnost kažejo tudi podatki meteoroloških postaj, ki merijo smer in hitrost vetra na kmetijsko zanimivih območjih. Analizo smo naredili na osnovi polurnih podatkov avtomatskih meteoroloških postaj. Povprečna letna hitrost je pod  $3 \text{ m/s}$  (na letališču v Mariboru  $2,2 \text{ m/s}$ , v Dobljčah v Beli krajini pa samo  $1,0 \text{ m/s}$ ). Veter je močno spremenljiv, hitrost se s časom močno spreminja, tudi med dnevom. Hitrost je v povprečju najmanjša ponoči, ko je zrak zaradi ohlajanja zemeljske površine stabilen. Zjutraj se začne površina ogrevati, ozračje postane nestabilno in veter se okrepi. Najvišjo hitrost doseže veter med 14. in 15. uro, ta je ponavadi dva - večkrat višja od nočne. Povprečna hitrost se spreminja tudi med letom. Najvišje povprečne hitrosti veter doseže ravno v rastni dobi (ponavadi marca ali aprila), najnižje povprečne mesečne hitrosti pa nimajo opaznega pravila, v Murski Soboti nastopijo oktobra, v Beli krajini februarja, na Goriškem septembra. Tudi letna povprečja kažejo spremenljivost, čeprav manjšo kot mesečna. Še bolj spremenljiva kot hitrost je smer vetra. Ponavadi jo prikažemo z vetrnimi rožami, ki kažejo, kako pogosto piha veter iz določene smeri. Vetrne rože so zelo močno odvisne od kraja. Na smer vetra vplivajo namreč relief, vetrne ovire (drevesa, zgradbe...), splošna vremenska situacija... Zaradi razgibanega površja nastajajo lokalni vetrovi, ki imajo značilni dnevni hod. Najbolj enakomerna je porazdelitev po smereh v Murski Soboti, kjer je približno enako verjetno, da bo veter zapihal iz katerekoli smeri. Najmočnejši veter pa piha z jugozahoda. V Vipavski dolini, na Krasu in ob Obali se močno pozna pogosta burja, drugod pa so najpogostejši vetrovi z jugozahoda. Čeprav je v povprečju Slovenija slabo prevetrena, pa imamo občasno tudi močan veter, ki včasih doseže celo rušilno moč. Najvišje hitrosti doseže veter na Primorskem (burja) in pod Karavankami (severni fen), povsod po Sloveniji pa velikokrat močni sunki vetra spremljajo nevihte.

**Ključne besede:** veter, meteorologija, kmetijstvo, Slovenija

*ABSTRACT*

### **Characteristics of wind in Slovenia**

This article presents characteristics of wind in Slovenia considering its speed and direction. Slovenia is not a very windy country because of its geographical position on the lee of Alps and its complex relief. Data from meteorological stations with wind speed and direction measurements in agricultural regions show low windiness too. The analysis was made on data from automatic meteorological stations. Everywhere yearly average speed is under 3.0 m/s (in airport Maribor 2.2 m/s, in Dobljče in Bela Krajina 1.0 m/s only). Wind changes very rapidly, its speed changes with time, also during a period of a day. Wind speed is the lowest at night, when the air is stable, due to the surface cooling. In the morning surface begins to warm up, the air in the atmosphere becomes unstable and wind strengthens. It reaches the highest speed between 2 and 3 PM. The highest daily speed is two to three time larger than the speed at night. Average wind speed changes also during a year. Average speed reaches its maximum in vegetation period (usually in March or April). Minimum average speed doesn't obey similar rule, in Murska Sobota minimum is reached in October, in Bela krajina in February and in Goriško in September. There is also a year-to-year variability in the wind speed, but it is not as large as month-to-month variability. Direction of the wind changes even more rapidly than the wind speed. Usually it is graphically presented by wind roses. The wind rose shows how frequent are the winds from selected direction. Wind roses change very much from place to place. Wind is strongly influenced by relief, wind obstacles (trees, buildings...), general weather situation... Complex terrain causes local winds with characteristic daily pattern. Distribution of wind direction is the most uniform in Murska Sobota. For the wind it is approximately equally probable to blow from any direction, even if the strongest wind comes from southwest. For Vipavska dolina, Karst and Obala the typical and frequent wind is bora. Elsewhere the most frequent wind blows from southwest. On the average winds in Slovenia are weak, but sometimes they develop hurricane strength. The strongest winds are bora in Primorska and foehn under Karavanke mountains. Very strong wind gusts are common everywhere in Slovenia during storms.

**Key words:** wind, meteorology, agriculture, Slovenia



## **Napovedi za kmetijstvo zanimivih vremenskih dogodkov, še posebej napovedi vetra in njihova zanesljivost**

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Vremenske dogodke je potrebno obravnavati selektivno, odvisno od njihovih vplivov na posamezno področje človekove dejavnosti. Kmetijstvo spada z vidika napovedovanja vremena med bolj zahtevne, saj obstaja le malo vremenskih dogajanj, za katere lahko rečemo, da so brez posledic za to gospodarsko dejavnost. Spoznali bomo postopke, ki v sektorju meteorološke prognoze vodijo do priprave vremenske napovedi, uporabne v kmetijske namene. Videli bomo, kako tanka črta včasih loči točno od netočne vremenske napovedi. Še posebej pozorno si bomo ogledali napovedovanje vetra in lokalnih vetrovnih razmer s pomočjo numeričnih modelov ozračja.

**Ključne besede:** veter, meteorologija, kmetijstvo, Slovenija

*ABSTRACT*

### **Forecasting weather phenomena of interest for the agriculture, especially the wind, and the forecasts' confidence**

Different weather phenomena affect the human activities each in its own way and should therefore be treated selectively. Of all the industries the agriculture is the one that is probably the most sensitive to the meteorological conditions since there really are few weather phenomena that do not have a noteworthy affect to the agriculture. Here we demonstrate how a weather prediction with application in the agriculture is designed and constructed. Theoretical and practical background is explained and some technical procedures, resulting in a disseminated weather bulletin will be described. Along the way, it hopefully becomes more clear why sometimes such a thin line separates a good weather forecast from a bad one. A substantial portion of the presentation focuses on diagnosing and predicting of the local wind conditions, using numerical modelling techniques.

**Key words:** wind, meteorology, agriculture, Slovenia

## **Aplikacija fitofarmaceutskih sredstev in zanašanje FFS**



## **Pregled in analiza stanja na področju naprav za nanašanje fitofarmaceutskih sredstev v republiki Sloveniji**

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V Sloveniji potekajo redni pregledi naprav za nanos fitofarmaceutskih sredstev (FFS) s prekinitvami že od leta 1975 dalje, vendar niso bili zakonsko obvezni. Leta 1994 je bil sprejet Zakon o zdravstvenem varstvu rastlin (Uradni list RS, št.82/94), ki je uredil in poenotil postopke pri testiranju naprav za nanos FFS, ter zakonsko določil, da se morajo redni pregledi izvajati vsake tri leta oziroma vsako leto za organizacije in osebe, ki izvajajo ukrepe varstva rastlin drugim osebam. Leta 2001 je začel veljati nov zakon, Zakon o fitofarmaceutskih sredstvih (Uradni list RS, št.11/01), ki v 47. členu določa, da morajo imetniki naprav pridobiti znak o rednem pregledu vsaki dve leti. V Sloveniji je registriranih 86 324 družinskih kmetij, v uporabi pa je 32 606 naprav za nanašanje FFS. V času neobveznega testiranja naprav za nanašanje FFS je bil delež neustreznih naprav med 70 % in 85 %, skoraj nespremenjen je ostal do leta 1997. Po letu 2001 beležimo v povprečju 2591 naprav pregledanih na leto odstotek neustreznih naprav se je zmanjšal in je znašal med 35 % in 50 %. Največ napak med 50 in 65 % je bilo na krmilno razvodnem sklopu, sledijo šobe s protikapnimi mehanizmi kjer je bil delež napak med 20 % in 30 %. V letu 2004 je od 11606 pregledanih naprav bilo neustreznih le med 10 % in 15 %, kar nam kaže, da se je stanje naprav bistveno izboljšalo.

**Ključne besede:** varstvo rastlin, škropilnice, redni pregledi

*ABSTRACT*

### **An overview of the situation in the field of devices used for the application of plant protection products in Slovenia**

In Slovenia, regular inspections of devices used for application of plant protection products (PPP) have been carried out with certain interruptions since 1975, however they were not enforced by law. In 1994 a Law on Sanitary Protection of Plants (Official Gazette of the Republic of Slovenia, No. 82/94) was passed regulating and unifying the procedures used at testing PPP application devices which also governed that regular inspections had to be performed every third year, or every year by the organisations and persons engaged in plant protection business and performing plant protection activities in the name and for other subjects. In 2001, a new Law on Plant Protection Products (Official Gazette of the Republic of Slovenia, No. 11/01) was passed. Its Paragraph No. 47 states that the owners of devices have to acquire a symbol for regular inspection every two years. There are 86324 registered family farms in Slovenia and 32606 devices for PPP application in use. In the time of not obligatory testing of these devices, it was established that the share of unsuitable devices was between 70 to 85%, which remained almost unchanged by 1997. After 2001 a recorded

number of inspected devices a year was 2,591 and the percentage of unsuitable devices decreased and was between 35% and 50%. Most flaws, between 50% and 65%, were on the steering divide joint, followed by nozzles with anti-drip mechanisms, where the share was between 20% and 30%. Out of 11604 of inspected devices in 2004 the percentage of unsuitable ones was only between 10% and 15%, which is a proof that the state of devices has improved significantly.

**Key words:** plant protection, sprayers, regular inspections



### **Primerjava uspešnosti zatiranja nekaterih škodljivcev in bolezní jablan pri nanosu pripravkov s standardnimi ali z antidriftnimi šobami**

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V letu 2004 smo izvedli poskuse, v katerih smo preučevali vpliv tipa šobe (standardne primerjalno z antidriftnimi) na biotično učinkovitost fungicidov in insekticidov uporabljenih za zatiranje bolezní in škodljivcev jablan. Opravili smo primerjavo med standardnima šobama Lechler TR in Albus ATR ter antidriftnima šobama Lechler ITR and Albus AVI. Fungicide in insekticide smo skozi vso rastno dobo nanašali s klasičnim sadjarskim pršilnikom pri porabi vode 350 l/ha na ločene parcelice (vsaka velika 200 m<sup>2</sup>) razporejene po poskusni zasnovi naključnih blokov. Pri zatiranju jablanovega škrlupa (*Venturia inaequalis*) in jablanove pepelaste plesni (*Podosphaera leucotricha*) glede biotične učinkovitosti fungicidov nismo ugotovili statistično značilnih razlik med preučevanimi tipi šob. Pri zatiranju jablanove zelene uši (*Aphis pomi*) in jabolčnega zavijača (*Cydia pomonella*) smo ugotovili, da je bila biotična učinkovitost insekticidov nanesenih z različnimi tipi šob zelo podobna in izenačena. Le pri štirih ocenah učinkovitosti proti škodljivcem so se pojavile manjše, vendar statistično značilne razlike. Dvakrat smo ugotovili večjo učinkovitost pri standardnih šobah in dvakrat obratno, večjo učinkovitost pri antidriftnih šobah. Dobljeni rezultati kažejo, da je pred podajanjem zaključnih sklepov o vplivu preučevanih antidriftnih šob na biotično delovanje preučevanih insekticidov proti preučevanim škodljivcem, potrebno opraviti še dodatne poskuse.

**Ključne besede:** jablana, škropljenje, antidriftne šobe, biotična učinkovitost, insekticidi, fungicidi, *Aphis pomi*, *Cydia pomonella*, *Podosphaera leucotricha*, *Venturia inaequalis*

## ABSTRACT

### Comparison of efficiency of apple pest and disease control with plant protection products applied with standard or drift-reducing nozzles

Field trials were carried out in 2004 to study the influence of nozzle type (standard vs. drift-reducing) on biotical efficacy of fungicides and insecticides applied against diseases and pest of apple trees. Standard nozzles Lechler TR and Albus ATR were compared to drift-reducing nozzles Lechler ITR and Albus AVI. Fungicides and insecticides were applied throughout the season with axial fan sprayer at 350 l/ha spray volume on separate trial plots (200 m<sup>2</sup> each) arranged in a random block design. No significant differences in fungicide efficacy between the types of nozzles could be observed when controlling apple scab (*Venturia inaequalis*) and powdery mildew (*Podosphaera leucotricha*). In the case of insecticides applied against green apple aphid (*Aphis pomi*) and codling moth (*Cydia pomonella*), the obtained results were very similar for both groups of nozzles. Only in the case of four efficacy assessments against pests statistically significant differences were observed: twice standard nozzles showed higher efficacy and twice the result was the opposite. This leads to the assumption that influence of nozzle type on insecticide efficacy has to be further studied before reaching a final conclusion about the biotical performance of studied nozzles.

**Key words:** apple, spraying, drift-reducing nozzles, biotical efficacy, insecticides, fungicides, *Aphis pomi*, *Cydia pomonella*, *Podosphaera leucotricha*, *Venturia inaequalis*



### Vpliv antidriftnih šob na učinkovitost delovanja fungicidov in insekticidov proti nekaterim škodljivcem in boleznim hrušk ter breskev

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V poskusih v nasadih hrušk in breskev smo preučevali vpliv uporabe antidriftnih šob na uspešnost zatiranja hruševega škrlupa (*Venturia pyrina* Aderh.) in breskove kodravosti (*Taphrina deformans* (Berk.) Tul.) ter škodljivcev: ameriškega kaparja (*Quadraspidiotus perniciosus* Comst.), murvovega kaparja (*Pseudaulacaspis pentagona* Targ.), jabolčnega zavijača (*Cydia pomonella* L.), navadne hruševe bolšice (*Cacopsylla pyri* L.), hruševe hrčice (*Contarinia pyrivora* Ril. in *Dasyneura pyri* Bouché.), ušem (*Dysaphis pyri* B.d.F. in *Aphis pomi* de Geer) ter pršicama (*Eriophyes pyri* Pagst. in *Epitrimerus pyri* Nal). Skozi vso rastno dobo smo pripravke nanašali z antidriftnimi šobami (Lechler ITR 90-015 in Albus AVI 80-015) ali standardnimi šobami (Lechler TR 80-015 in Albus ATR 212) vgrajenimi v aksialni pršilnik Agromehanika AGP 400 ENU pri porabi vode 400 litrov na hektar. Škropilni program je bil sestavljen iz kontaktno in sistemsko delujočih pripravkov. Dosežena biotična učinkovitost uporabljenih fungicidov za zatiranje škrlupa in breskove kodravosti je bila pri obeh tipih šob skoraj popolnoma enaka. Razlike v učinkovitosti delovanja insekticidov med obema vrstama šob prav tako niso bile značilne pri zatiranju

uši, jabolčnega zavijača in obeh vrst hrčic. Manjše, sicer statistično značilne razlike, smo opazili pri zatiranju obeh vrst kaparjev in navadne hrušve bolšice, kjer smo z uporabo standardnih šob dosegli za 5 do 8% večjo učinkovitost, kot pri antidriftnih šobah. Pri uporabi akaricidov proti hruševima pršicama smo pri uporabi antidriftnih šob dosegli večjo učinkovitost, kot pri standardnih šobah.

**Ključne besede:** standardne in antidriftne šobe, hruška, breskev, zatiranje bolezni in škodljivcev, insekticidi, fungicidi, biotična učinkovitost

#### ABSTRACT

#### **The influence of drift-reducing nozzles on fungicide and insecticide efficacy for control of some diseases and pests of pears and peaches**

In field trials the influence of use of drift reducing nozzles on biotical performance of fungicides and insecticides applied against diseases and pests of pears and peaches was studied. Studied diseases were pear scab (*Venturia pyrina* Aderh.) and peach leaf curl (*Taphrina deformans* [Berk.] Tul.). Studied pests were: San Jose scale (*Quadraspidiotus perniciosus* Comst.), white mulberry scale (*Pseudaulacaspis pentagona* Targ.), codling moth (*Cydia pomonella* L.), pear sucker (*Cacopsylla pyri* L.), pear midges (*Contarinia pyrivora* Ril. and *Dasyneura pyri* Bouché.), aphids (*Dysaphis pyri* B.d.F. and *Aphis pomi* de Geer) and two eriophidae mite species (*Eriophyes pyri* Pagst. and *Epirimerus pyri* Nal). Contact and systemic acting insecticides and fungicides were included in spray program. Pesticides were applied through the whole season by Agromehanika AGP 400 ENU axial fan sprayer in which drift reducing (Lechler ITR 90-015 in Albus AVI 80-015) or standard (Lechler TR 80-015 in Albus ATR 212) nozzles were mounted to deliver 400 l of spray volume per hectare area. Fungicide efficacy obtained by control of pear scab and peach leaf curl disease was almost identical by both groups of nozzles. Also by controlling insect pests i.e. aphids, codling moth and both pear midge species the difference in insecticide efficacy between both types of nozzles was not statistically significant. Differences in insecticide efficacy were noticed at scale insect and pear sucker control. Efficacy of insecticides applied with standard nozzles was 5 to 8% higher than efficacy obtained by means of drift reducing nozzles. In the case of performance of acaricides against both mite species (*Eriophyes* sp.), higher efficacy was achieved at drift reducing nozzles.

**Key words:** standard and drift-reducing nozzles, pear, peach, disease control, pest control, fungicides, insecticides, biotical efficacy



## Ocena uporabnosti antidriftnih šob za nanos pripravkov za zatiranje nekaterih škodljivcev in bolezni jablane

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V poskusih v nasadih jablan smo preučevali uporabnost antidriftnih šob za nanos pripravkov za zatiranje škodljivcev in bolezni jablan. Pripravke smo vse leto nanašali s pršilnikom v katerega so bile vgrajene standardne (Lechler TR, Albus ATR) ali antidriftne šobe (Albus AVI, Lechler ITR). Škropilni programi so bili sestavljeni iz sistemsko in kontaktno delujočih pripravkov. Razlike v učinkovitosti delovanja fungicidov za zatiranje škrlupa in pepelaste plesni, nanesenih s standardnimi ali antidriftnimi šobami, so bile zelo majhne. Pri zatiranju omenjenih bolezni lahko standardne šobe brez zadržkov zamenjamo z antidriftnimi šobami. Pri zatiranju škodljivcev, kot so zelena jablanova uš (*Aphis pomi*), jabolčni zavijač (*Cydia pomonella*) in jablanov cvetožer (*Anthonomus pomorum*) so poskusi pokazali, da se v specifičnih razmerah (vreme, struktura krošnje dreves, ...), pri uporabi preučevanih antidriftnih šob, učinkovitost kontaktno delujočih insekticidov lahko nekoliko zmanjša. Pri zmernih populacijah omenjenih škodljivcev v poskusih ugotovljeno zmanjšanje učinkovitosti delovanja insekticidov (za 3–10%) ne vpliva značilno na velikost in kakovost pridelka jabolka, v primeru velikih populacij škodljivcev, pa je zaradi uporabe antidriftnih šob možen pojav tolikšnih izgub pridelka, da ekonomsko niso več sprejemljive.

**Ključne besede:** jablana, bolezni, škodljivci, zatiranje, antidriftne šobe, biotična učinkovitost pripravkov

*ABSTRACT*

### Evaluation of usefulness of drift-reducing nozzles for application of plant protection products against some diseases and pests of apple

The usefulness of drift-reducing (DR) nozzles for application of plant protection products (PPP) against major diseases and pests of apple (*Malus domestica* Borkh.) was studied in field trials carried out in experimental apple plantations. Contact and systemic acting PPPs were applied throughout whole growing season with standard axial fan sprayer in which standard nozzles (Lechler TR, Albus ATR) or DR nozzles (Albus AVI, Lechler ITR) were mounted. Differences in biological efficacy of fungicides applied for control of apple scab (*Venturia inaequalis*) and apple powdery mildew (*Podosphaera leucotricha*), between standard or DR nozzles, were very small. In case of control of two mentioned diseases standard nozzles can therefore be replaced with DR nozzles without any hindrance related to efficacy of PPPs. Results of trials demonstrate that by controlling pests like green aphid (*Aphis pomi*), codling moth (*Cydia pomonella*) and apple bud weevil (*Anthonomus pomorum*) the slight reduction of efficacy of contact acting insecticides can appear in specific conditions (weather, tree crown structure, ...) if studied DR nozzles are used. In case

of moderate populations of mentioned pests the established reduction of insecticide efficacy (3- 10%) due to use of drift-reducing nozzles does not influence a lot the yield amount and fruit quality, however in case of large populations of mentioned pests, reduction of insecticide efficacy caused by use of DR nozzles can lead to such yield losses, which are not tolerable according to economic aspects.

**Key words:** apple, diseases, pests, control, drift-reducing nozzles, biotical efficacy of plant protection products



### **Vpliv tipa šobe (standardne, antidriftne) na biotično učinkovitost treh herbicidov uporabljenih za zatiranje plezajoče pirnice (*Elymus repens* L.)**

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V poljskem poskusu smo preučevali vpliv tipa šobe (standardne, antidriftne) na biotično učinkovitost herbicidov uporabljenih za zatiranje plezajoče pirnice (*Elymus repens* L.). Poskus je bil zasnovan v faktorski bločni zasnovi. Preučevali smo tri dejavnike; tip šobe (Lechler LU, Lechler IDK, Albus ADI, Albus AVI), količino porabljene vode za nanos (175 ali 350 l/ha) in vrsto herbicida (sulfosat, fluazifop-p-butil in tepraloksidim). Herbicide smo nanесли s standardno traktorsko škropilnico 15. aprila na gosto populacijo pirnice (450 bili na m<sup>2</sup>, 10 do 15 cm visoke rastline), ki se je nemoteno razvijala leto dni na pšeničnem strnišču. Tri tedne po aplikaciji herbicidov smo izvedli vizualno ocenjevanje učinkovitosti delovanja herbicidov, nato smo njivo preorali in posejali koruzo. V koruzi smo dvakrat aplicirali herbicide proti širokolistnim plevelom, ki niso imeli nikakršnega zatiralnega učinka na pirnico. Z njihovo uporabo smo popolnoma zatrli širokolistne plevela in ti zato niso vplivali na pridelek koruze. V juniju in v avgustu smo izvedli štetje števila bili pirnice v sestoji koruze in kvantificirali stopnjo regeneracije. Jeseni smo določili pridelek svežih storžev. Vsi preučevani dejavniki so imeli značilen učinek na biotično učinkovitost herbicidov in na pridelek koruze. Učinkovitost vseh treh preučevanih herbicidov je bila najvišja pri porabi vode 175 l/ha. Najvišjo stopnjo biotične učinkovitosti smo ugotovili pri aktivni snovi sulfosat, pri nanosu s šobo Lechler LU. Povprečno je bila najvišja učinkovitost pri vseh treh herbicidih dosežena pri uporabi šobe Lechler LU. Interakcija med tipom šobe in količino porabljene vode ni bila značilna, interakcija med tipom šobe in vrsto herbicida pa je bila značilna. Pri uporabi anidriftnih šob in večji porabi vode (350 l/ha) je bil pridelek koruze za 5 do 10% manjši, kot pri uporabi standardne šobe tipa LU pri porabi vode 175 l/ha.

**Ključne besede:** koruza, zatiranje plevelov, herbicidi, anidriftne šobe, *Elymus repens*, sulfosat, fluazifop-p-butil, tepraloksidim

## ABSTRACT

### **The impact of nozzle types (standard vs. drift-reducing) on biotical efficacy of three herbicides applied for control of quack grass (*Elymus repens* L.)**

In a field trial the impact of nozzle types (standard vs. drift-reducing) on biotical efficacy of herbicides applied for control of quack grass (*Elymus repens* L.) was studied. The trial was arranged in factorial randomised block design. Three factors and their interactions were investigated, the first being the nozzle type (Lechler LU, Lechler IDK, Albuz ADI, Albuz AVI), the second was the spray volume (350 l/ha or 175 l/ha) and the third was herbicide active substance (sulphosate, fluazifop-p-butyl in tepraloksidim). Herbicides were applied on April 15th with standard tractor mounted field boom sprayer. At the time of herbicide application, quack grass plants were 10 – 15 cm high and formed very dense population (450 stalks per m<sup>2</sup>) since they had been developing for one year on wheat stubble. Three weeks later visual estimation of herbicide efficacy was done. Afterwards field was ploughed under and prepared for sowing of maize. In May and beginning of June, two herbicide applications in maize crop followed. Herbicides only acting against broad leaved weeds were used. They did not affect quack grass development, but they completely eliminated broad leaved weeds. At the end of June and August counting of number of quack grass stalks per m<sup>2</sup> was carried out to quantify regeneration rate. In the autumn, the yield of fresh cobs was assessed. All studied factors had significant effect on herbicide efficacy and maize yield. Also some interactions among them were significant. The herbicide efficacy was significantly higher in case of lower spray volume. The highest level of efficacy was achieved with the sulphosate applied with the Lechler LU nozzle (standard nozzle). On average, the efficacy of all three herbicides was higher when they were applied with the Lechler LU nozzle than when they were applied with other nozzle types. There was no significant interaction between the type of nozzle and the spray volume, whereas the interaction between herbicide type and nozzle type was significant. In case of the application of herbicides with drift-reducing nozzles at high spray volume the maize cob yield was, on average, by 5 – 10% lower than in the case of the application with the standard LU type nozzle and 175 l/ha spray volume.

**Key words:** standard and drift-reducing nozzles, maize, weed control, yield, *Elymus repens*, sulphosate, fluazifop-p-butyl, tepraloksidim



## Vpliv tipa šobe (standardne, antidriftne) na biotično učinkovitost herbicidov uporabljenih za zatiranje plevelov v koruzi

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V poljskem poskusu smo preučevali vpliv tipa šobe (standardne, antidriftne) na biotično učinkovitost herbicidov uporabljenih za zatiranje plevelov v koruzi. Največji delež v plevelni populaciji poskusnih parcelic so zavzemali naslednji pleveli: bela metlika (*Chenopodium album*), srhkodlakavi ščir (*Amaranthus retroflexus*), bradati mrkač (*Bidens tripartitus*), drobnocvetni in vejcati rogovilček (*Galinsoga parviflora* in *G. ciliata*), navadna kostreba (*Echinochloa crus-galii*) in njivski slak (*Convolvulus arvensis*). Poskus je bil zasnovan kot poskus z več dejavniki v bločni zasnovi. Preučevali smo tri dejavnike; tip šobe (Lechler LU, Lechler ID, Albus ADI, Albus AVI), količino porabljene vode za nanos (150 ali 300 l/ha) in vrsto herbicida oziroma herbicidne kombinacije (aktivne snovi: dimetenamid + izoksafutol, pendimetalin + 2,4-D, pendimetalin + izoksafutol, izoksafutol, 2,4-D, mezotrion, foramsulfuron). Herbicide smo nanegli s standardno traktorsko škropilnico. Tri tedne po aplikaciji herbicidov smo izvedli vizualno ocenjevanje biotične učinkovitosti herbicidov. Jeseni smo ugotovili pridelek storžev. Vpliv preučevanih dejavnikov na biotično učinkovitost herbicidov je bil pri različnih plevelih različen. Pri nobenem plevelu nismo ugotovili značilnega vpliva tipa šobe na biotično učinkovitost katerega koli od preučevanih herbicidov. Interakcija med tipom šobe in tipom herbicida ali tipom šobe in količino porabljene vode, glede vpliva na biotično učinkovitost herbicidov ni bila značilna pri nobenem herbicidu. Pri vseh plevelih so bile značilne razlike med učinkovitostjo preučevanih herbicidov, pri nekaterih (kostreba, slak in mrkač) so bile značilne tudi razlike glede porabe vode za nanos. Tip herbicida in količina porabljene vode za nanos sta imela značilen vpliv na oblikovanje pridelka, tip šobe pa ne. Razlike v pridelku storžev med parcelicami s 56 različnimi kombinacijami preučevanih dejavnikov so bile zelo majhne in redko značilne, kar kaže na to, da so glede uporabnosti za zatiranje plevelov, kot so bili zastopani v tem poskusu, preučevane standardne in antidriftne šobe popolnoma enakovredne.

**Ključne besede:** koruza, kemično zatiranje, pleveli, standardne in antidriftne šobe, *Chenopodium* sp., *Amaranthus* sp., *Bidens* sp., *Convolvulus* sp., *Echinochloa* sp., *Galinsoga* sp., dimetenamid, izoksafutol, pendimetalin, mezotrion, 2,4-D, foramsulfuron



## ABSTRACT

### **The impact of nozzle types (standard vs. drift-reducing) on biotical efficacy of herbicides applied for control of weeds in maize**

In a field trial the impact of nozzle types (standard vs. drift-reducing) on biotical efficacy of herbicides applied for control of weeds in maize was studied. The trial was arranged in factorial randomised block design. Predominant weed species developing on plots of experimental field were: common lambsquarters (*Chenodium album*), redroot pigweed (*Amaranthus retroflexus*), burmargold (*Bidens tripartitus*), field bindweed (*Convolvulus arvensis*), smallflower galinsoga (*Galinsoga parviflora* in *G. ciliata*) and barnyardgrass (*Echinochloa crus-galii*). Three factors and their interactions were investigated, the first being the nozzle type (Lechler LU, Lechler ID, Albuz ADI, Albuz AVI), the second was the spray volume (150 or 300 l/ha) and the third was herbicide active substance or substance combinations (dimetenamid + izoksaflutol, pendimetalin + 2,4-D, pendimetalin + izoksaflutol, izoksaflutol, 2,4-D, meotrion, foramsulfuron). Herbicides were applied with standard tractor-mounted field boom sprayer. Three weeks after herbicide application visual estimation of herbicide biotical efficacy was done. The yield of fresh cobs was assessed in the autumn. The impact of studied factors on herbicide efficacy was different in different weeds species. The influence of nozzle type on biotical efficacy was not statistically significant at none of combinations of studied weed species and herbicides. Also the interaction between nozzle type and herbicide combinations or nozzle type and amount of water for application of herbicides on the efficacy of herbicides was not significant at none of studied weed species. Differences in biotical efficacy between herbicide combinations were significant in all weeds, but in case of some (chenopodium, amarant and bidens) the amount of water for herbicide application influenced efficacy of herbicides significantly. Herbicide types and amount of water for herbicide application had significant influence on yield of maize cobs, whereas the type of nozzle did not significantly influence the maize cob yield. Differences between cob yields on plots with different combinations of studied factors (together 56 combinations) were small (only few were significant), what leads us to the conclusion that there are no significant differences in usefulness between studied nozzle types (standard vs. drift-reducing) used for the control of studied weeds with studied herbicides.

**Key words:** standard and drift-reducing nozzles, maize, weed control, *Chenopodium* sp., *Amaranthus* sp., *Bidens* sp., *Convolvulus* sp., *Galinsoga* sp., *Echinochloa* sp., dimetenamid, izoksaflutol, pendimetalin, meotrion, 2,4-D, foramsulfuron

## **Ekologija fitofarmaceutskih sredstev in zakonodaja**

## Opredelitev fizikalno kemijskih lastnosti tal in FFS za oceno tveganja onesnaževanja podtalnice

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V raziskavi smo izdelali kriterije in podlage za strokovno rabo fitofarmaceutskih sredstev (FFS) na izbranih območjih v Sloveniji. Kriterije in podlage smo opredelili za herbicide, ki pomenijo največje tveganje za okolje in za talne tipe treh izbranih območij v Sloveniji. Herbicide smo na podlagi različnih kemijskih lastnosti razvrstili v štiri skupine. Odločujoče lastnosti za razvrščanje posamezne aktivne snovi so razpolovni čas razgradnje ( $DT_{50}$ ), moč vezanja na organsko snov v tleh (Koc), topnost v vodi in nekateri drugi dejavniki kot je obseg rabe pesticidov. V prvo skupino smo uvrstili herbicide, pri katerih je tveganje za onesnaževanje podtalnice in pitne vode minimalno. V drugo in tretjo skupino so uvrščeni pripravki, pri katerih so zelo pomembne lastnosti tal in je njihova uporaba v veliki meri odvisna od le-teh. V zadnji, četrti skupini pa so herbicidi, katerih fizikalno kemijske lastnosti so neugodne in jih na vodovarstvenih območjih ne glede na lastnosti tal ne priporočamo. Razvrstitev v Sloveniji registriranih herbicidov leta 2002 je pokazala, da je večina od 121 herbicidov razvrščena v skupini tveganja 2 in 3 (71 %). Med registriranimi pripravki je bilo 21 % takšnih, katerih uporabo bi na najbolj občutljivejših območjih odsvetovali. Vendar ima dovoljenje za uporabo le še 8 % oziroma 10 pripravkov med katerimi sta aktivni snovi simazin s tremi pripravki in prometrin s štirimi pripravki. Kriterije talnih lastnosti pomembnih za vezavo oziroma izpiranje FFS iz tal smo opredelili s točkami izračunanimi iz atributnih podatkov digitalne pedološke karte. Pri razvoju algoritma smo uporabili delež organske snovi v tleh (v prvem in drugem zgornjem horizontu tal) in podatek o povprečni globini tal. Podatke o teksturi tal smo uporabili pri testiranju algoritma z modelom PELMO, ki je eden od uradnih modelov EU pri registraciji FFS. Pedosistematske enote smo glede na izračunane točke razvrstili v pet kategorij glede na tveganje izpiranja FFS iz tal. Rezultati razvrščanja na izbranih območjih Ljubljane, Celja in Murska Sobota so pokazali, da največji delež (37,3 %) predstavljajo talne enote, kjer je tveganje izpiranja FFS srednje veliko, z 29,6 % sledijo talne enote z zelo velikim tveganjem za izpiranje, talnih enot z velikim tveganjem za izpiranje FFS je 22,9 %, talnih enot kjer je tveganje za izpiranje FFS majhno oziroma zanemarljivo pa je le 7,6 % oziroma 2,5 %. Za omenjena tri območja smo izrisali tematske karte zemljišč kmetijske rabe.

**Ključne besede:** tla, pripravki za varstvo rastlin, fizikalno kemične lastnosti, podtalnica, onesnaževanje, varstvo pred onesnaževanjem

## *ABSTRACT*

### **Determination of physical and chemical properties of soils and pesticides for the estimation of groundwater pollution risk**

In the current research the criteria and bases for a professional use of pesticides in the selected areas of Slovenia were made. The criteria and bases were defined for herbicides which represent the highest risk for environment and soil types of three selected areas of Slovenia. Herbicides were classified into four groups based on different chemical properties. The crucial properties utilised for the classification of individual active substances are the following: half life of degradation ( $DT_{50}$ ), the ability of binding to organic matter in soil ( $K_{oc}$ ), solubility in water and some other factors such as the extent of pesticide use. The first group includes herbicides with the minimum groundwater and drinking water pollution risk. The second and the third group contain products for which the properties of soil are very important and their use depends very much on these properties. In the last, the fourth group there are herbicides whose physical-chemical properties are unfavourable and they are not recommended for the use in water protection areas irrespective of soil properties. The classification of herbicides registered in Slovenia in 2002 has shown that most of 121 herbicides are classified in the risk groups 2 and 3 (71 %). Among the products registered there were only 21 % of those which use in the most susceptible areas would be warned against. However, the official registration for use at the time have only 8 % of them or 10 products among which are the active substances simazine with three products and prometryne with four products. Soil organic matter content of the first two soil horizons and soil depth were attribute data from digital soil map of Slovenia that was used to calculate the risk of pesticide leaching through the soil profile. Soil texture data was used during the validation of algorithm with PELMO model, which is one of the official models used during the registration process of pesticides in EU. According to the risk of pesticide leaching through the soil profile soil mapping units (SSU) were classified into 5 categories. The majority of SSU (37.3 %) from selected test areas of Ljubljana, Celje and Murska Sobota were classified into the group with possible risk, the next most frequent group was the very high risk group with 29.6 % of SSU; the group with the high risk of pesticide leaching through soil profile was the next group with 22.9 % of SSU; in the last two groups with minor and negligible risk of pesticide leaching there were only 7.6 % and 2.5 % of SSU from tested areas. Thematic maps with five risk categories of soils with agricultural land use on tested areas were printed out.

**Key words:** soil, pesticides, physical and chemical properties, groundwater pollution risk, pollution prevention



## **Fitofarmacevtska sredstva v prometu**

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Slovenija je, tako kot vse druge države članice, prenesla skupno evropsko zakonodajo v nacionalno. Zakon o fitofarmacevtskih sredstvih povzema vse elemente Direktive Sveta 91/414/EGS o dajanju fitofarmacevtskih sredstev v promet. Aktivne snovi v fitofarmacevtskih sredstvih se ocenjujejo centralizirano v delovnih telesih EFSA in Evropske komisije, v katerih sodelujejo tudi države članice. Ko je aktivna snov pozitivno ocenjena, se vključi na Prilogo I k direktivi, nato države članice registrirajo pripravke na osnovi teh aktivnih snovi na nacionalni ravni. Z direktivo 91/414/EGS je skladen tudi nacionalni sistem registracije v Republiki Sloveniji. Sredstvo, ki ni registrirano, se ne sme dati v promet in uporabo. Vnos in uporaba fitofarmacevtskih sredstev iz sosednjih držav, ki niso registrirana v Republiki Sloveniji, nista dovoljena in sta protizakonita. Ocenjevanje pripravkov pred dajanjem v promet je potrebno zaradi varovanja zdravja ljudi in okolja. Glede na oceno in specifične pogoje uporabe se pri registracijskem postopku določijo navedbe na etiketi, ki jih je treba dosledno upoštevati. V Republiki Sloveniji je v prometu okrog 350 pripravkov na podlagi 210 aktivnih snovi (število se neprestano spreminja).

**Ključne besede:** fitofarmacevtski pripravki, promet, zakonodaja, Slovenija

*ABSTRACT*

### **Plant protection products on the market**

Slovenia has implemented the common European legislation into national legislation as every other Member state has. With Plant protection product act the Council Directive 91/414/EEC concerning the placing of plant protection products on the market is implemented. The evaluation and authorization procedure of active substances for use in plant protection products is centralized on EU level and it is done within the working bodies of EFSA and European Commission. In this process also Member States are involved. When the active substance is included into Annex I of Directive 91/414/EEC, the authorization of plant protection products for placing on the market and use is done on Member State level. Slovene national authorization process is in line with Directive 91/414/EEC. Only authorized plant protection product can be placed on the market and use. The import and use of unauthorized products on the territory of Slovenia is illegal. The evaluation of plant protection products prior to their placing on the market and use is essential due to protection of human health and environment. Statements on the label resulting from evaluation and authorization procedure should be considered. There are about 350 products (on 210 active substances) on the market of the Republic of Slovenia (these numbers constantly vary).

**Key words:** plant protection products, placing on the market, legislation, Slovenia



## **Izpostavljenost ljudi ostankom fitofarmaceutskih sredstev**

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Sodobna kmetijska pridelava sloni na uporabi fitofarmaceutskih sredstev, ki ob pravilni uporabi predstavljajo najpomembnejši način pridelave zadostne količine kakovostne hrane. Napačna ali nenadzorovana uporaba teh sredstev lahko hkrati povzroči negativne vplive na ljudi, živali in okolje. Z uporabo sredstev za varstvo rastlin je dobršen del človeške populacije stalno izpostavljen ostankom pesticidov, zlasti prek živil rastlinskega in živalskega izvora in vode. Vnos pa je odvisen od količine ostankov v živilih in količine zaužitih živil, ki ostanke vsebujejo. Pri registraciji fitofarmaceutskih sredstev se za ugotavljanje tveganja ostankov pesticidov aktivnih snovi, njihovih metabolitov ter razgraditvenih produktov izdelava kronična in akutna ocena tveganja za zdravje ljudi, ki predstavlja enega od ključnih kriterijev pri odločanju o registraciji. Ocena tveganja se izračuna z modeli, ki na eni strani upoštevajo izpostavljenost ljudi ostankom fitofarmaceutskih sredstev prek prehrane, določi se maksimalna količina ostankov, ki jih ljudje zaužijejo, ta vrednost se primerja s toksikološkimi lastnostmi ostankov. Pri kronični oceni tveganja se količina ostankov primerja s sprejemljivim dnevnim vnosom (ADI, acceptable daily intake), pri akutni oceni tveganja pa z akutnim referenčnim vnosom (ARfD, acute reference dose). Zagotavljanje in nadzor nad sprejemljivo izpostavljenostjo ljudi ostankom fitofarmaceutskih sredstev je eden od ključnih elementov problematike varne hrane v sodobni družbi. S tem prispevkom želimo prikazati in približati ocenjevanje tveganja za zdravje ljudi pri postopku registracije, in v primeru prekoračitev mejnih vrednosti ostankov tako pridelovalcem, kot tudi potrošnikom.

**Ključne besede:** Fitofarmaceutska sredstva, maksimalne vrednosti ostankov, kronična ocena tveganja, akutna ocena tveganja, sprejemljiv dnevni vnos in akutna referenčna doza

### *ABSTRACT*

#### **Human exposure to pesticide residues**

Modern agricultural production is based on the use of plant protection products which, if properly used, represents the most important method for the production of sufficient quantities of foodstuffs. The improper or uncontrolled use of these products may result in negative effects on human health, animals and the environment. Because of the use of plant protection products a substantial share of human population is constantly exposed to pesticide residues, mainly through the foodstuffs of plant and animal origin and water. However the input depends on the quantity of residues in foodstuffs and on the quantity of the consumed foodstuffs, which contain the residues. In order to establish the risk for residues of the pesticides, their metabolites, and breakdown products, a chronic and acute risk assessment for human health is carried out upon registration of plant protection products,

which is one of the main criteria in deciding on the registration. The risk assessment is calculated by the means of models, which consider the exposure of humans to pesticide residues through foodstuffs, the maximum quantity of the consumed residues is determined and the value is compared with toxicological properties of residues. When carrying out chronic risk assessment the quantity of residues is compared with acceptable daily intake (ADI), and at acute risk assessment with acute reference dose (ARfD). To ensure and supervise the acceptable exposure of humans to pesticide residues is one of the key elements of the problematic of food safety in the modern society. The aim of this article is to represent to and get producers as well as consumers familiar with the risk assessment for human health in the registration procedure and in the event of exceeded maximum levels for pesticide residues.

**Key words:** Plant protection products, maximum levels for pesticide residues, chronic risk assessment, acute risk assessment, acceptable daily intake, acute reference dose



### **Vloga urada RS za kemikalije v postopkih izdaje dovoljenj za fitofarmacevtska sredstva**

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Zakon o fitofarmacevtskih sredstvih (Uradni list RS, št. 98/04-UPB1) v 13. členu določa, da odločitev o registraciji FFS sprejme pristojni organ (Fitosanitarna uprava RS) v soglasju z organom, pristojnim za kemikalije (Urad RS za kemikalije) in sicer na podlagi ocene FFS, ki jo izdelajo usposobljeni strokovni delavci ustrezne javne službe in na podlagi mnenja komisije. Pravilnik o enotnih načelih ocenjevanja in registracije FFS (Uradni list RS, št. 31/02) v prilogah 1 in 2 določa, da morajo ocenjevalci pri ocenjevanju FFS upoštevati splošna in posebna načela za ocenjevanje, prav tako mora pristojni organ pri odločanju o registraciji upoštevati splošna in posebna načela za registracijo. Člen 23. a pa določa ravnanje v primerih, ko ni mogoče upoštevati zahteve proizvajalca, da se registrira FFS, ki vsebuje aktivno snov, uvrščeno na seznam, na podlagi registracije v drugih državah članicah EU. Če ni izpolnjen pogoj, da so pri predlagani uporabi FFS na ozemlju Republike Slovenije razmere v kmetijski pridelavi, varstvu rastlin ter okolju, vključno s klimatskimi razmerami, primerljive z razmerami v drugih državah članicah, se lahko določi dodatne pogoje uporabe, dodatne teste in analize, v postopku ocenjevanja in registracije pa je potrebno upoštevati posebne ekološke občutljivosti okolja in drugačne prehranske navade prebivalstva. Člen 49. a Zakona o kemikalijah (Uradni list RS, št. 110/03-prečiščeno besedilo in 47/04) določa kot podlago za soglasje urada k odločbi o registraciji FFS oceno vplivov na zdravje ljudi in okolje, pri tem pa nujno upoštevanje geografskih, okoljskih in zdravstvenih značilnosti slovenskega prostora ter namena in načina uporabe FFS. Te nacionalne značilnosti je potrebno upoštevati v primerih, ko bi se aktivna snov v FFS uporabljala v drugačnih razmerah, kot v državah članicah EU, kjer je uporaba že dovoljena in bi lahko pri predvideni uporabi predstavljala v našem prostoru večje tveganje za zdravje ljudi in okolje. Za določitev in opredelitev značilnosti ter posebnosti slovenskega prostora za potrebe izvajanja člena 49. a

Zakona o kemikalijah, je minister za zdravje februarja 2004 pri Uradu RS za kemikalije imenoval posebno strokovno komisijo. Za opredelitev tveganja, ki bi ga neka aktivna snov, oziroma FFS lahko predstavljala v našem prostoru, naj bi v sodelovanju s pristojnim organom pripravili smernice in kriterije za podporo pri ocenjevanju in odločanju o registraciji FFS, oziroma izdaji soglasja, v vseh fazah postopka registracije. V referatu je predstavljena vloga urada v postopku registracije FFS in sklepi dela komisije.

**Ključne besede:** fitofarmacevtska sredstva, registracija, ocenjevanje tveganja, smernice, odločanje

*ABSTRACT*

### **The role of national chemicals bureau in authorisation procedures of plant protection products**

The Act on Plant Protection Products (O.J. No. 98/04-UPB1) determines in the article 13, that the decision on registration of PPP is taken by the phytosanitary national authority (Phytosanitary Administration) in agreement with the chemicals national authority (National Chemicals Bureau - NCB) based on the evaluation of the PPPs, made by qualified experts from adequate public service and based on the opinion of the committee. Rules on uniform principles for evaluation and registration of PPPs (O.J. No. 31/02) determines in the annexes 1 and 2 that the evaluators should take into consideration general and special principles for the evaluation of PPPs and in the same manner should the national authorities take the decision about the registration. The article 23 determines dealing with cases, when the producer demand for the registration of PPPs, which contains an active substance included in list of annex 1, based on registrations in other EU Member States can not be taken into consideration. When the conditions of proposed use of PPPs on the territory of the Republic of Slovenia in agricultural production, plant protection and environment, including climatic conditions, are not comparable to those in other Member States, could determine additional conditions for the use, additional testing and analysis, and in the process of evaluation and registration the special vulnerabilities of environment and different nutritional habits of inhabitants ought to be taken into consideration. Article 49.a of The Chemicals Act (O.J. No. 110/03) determines as a basis of the agreement on the registration decision the evaluation of impacts on health and environment with contemporary consideration of geographical, environmental and health characteristics of the Republic of Slovenia and the purpose and manner of use. This national characteristics are inevitably to be considered in cases, when the active substance in PPP could be used under different conditions as are those in other Member States, where the use is permitted and at proposed use could present higher risk for health and environment when used in Republic of Slovenia. For determination and stipulation of the characteristics and peculiarities of Republic of Slovenia for the implementation of the 49.a article of Chemicals Act nominated Minister of Health in february 2004 special expert Committee at the NCB. For determination of the risk, that an active substance or PPP could represent in the area of our country, the guidelines and the criteria to support the evaluation and decision-making process in registration of PPPs at all stages of the registration process should be prepared in cooperation with national authority. In this report the role of NCB in the procedure of registration of PPPs and conclusions of work of the Committee are represented.



**Key words:** plant protection products, registration, risk assessment, guidelines, decision-making



### **Vpliv imidakloprida na rast, prehrano ter aktivnost encimov AChE in GST pri kopenskih enakonožnih rakih**

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Neonikotinoidi so relativno novi sistemični insekticidi, ki so kemično podobni nikotinu - toksinu, ki ga vsebuje tobak. Podobno kot nikotin, tudi neonikotinoidi delujejo na živčni sistem. Zaradi močno elektronprivlačnih skupin imajo delno pozitivni naboj in se tako vežejo na nikotinske acetilholinske receptorje, oziroma jih irreverzibilno blokirajo. Pri insektih je afiniteta za vezavo na nikotinske acetilholinske receptorje bistveno bolj izražena kot pri sesalcih. Glede na dejstvo, da so neonikotinoidi relativno novi insekticidi, je na področju raziskav razgradnje in sorbcije v tleh, metod sledenja v okolju ter strupenostnih testov na različnih vodnih in kopenskih organizmih, bilo opravljenih malo raziskav. Namen študije je bil ugotoviti, v kolikšnem obsegu so neonikotinoidi ustrezna zamenjava za organske fosforne estre ter kakšne posledice ima lahko uporaba omenjenih spojin za neciljne organizme in neživo naravo ter posledično za človeka. V ta namen smo v prvem eksperimentu ugotavljali spremembe aktivnosti encimov AChE (acetilholinesteraze) pri kopenskih enakonožnih rakih (*Porcellio scaber*) po dveh tednih izpostavitve imidaklopridu v koncentracijah 1, 2.5, 5 in 10 µg imidakloprida na g suhe hrane. Rezultati poskusa so pokazali, da se aktivnost omenjenega encima ne spreminja glede na koncentracijo imidakloprida, dodanega v hrano. V drugi študiji, v kateri so bili odrasli osebki izpostavljeni koncentracijam 0, 10 in 25 µg imidakloprida/g suhe hrane, smo merili spreminjanje aktivnosti encima glutation-S-transferaze (GST) kot posledico izpostavitve imidaklopridu. Rezultati so pokazali povečano aktivnost encima GST pri koncentraciji 10 µg/g suhe hrane ter zmanjšano aktivnost GST pri koncentraciji 25 µg/g suhe hrane. Po dveh tednih izpostavitve imidaklopridu v hrani, smo opazili tudi učinke na izračunane parametre prehrane (privzem in asimilacijska učinkovitost) pri koncentracijah 10 in 25 µg imidakloprida/g suhe hrane. Na rast živali ter vsebnost proteinov in lipidov pa izpostavitve imidaklopridu ni imela učinka pri nobeni od izbranih koncentracij.

**Ključne besede:** imidaklopid, toksikologija, encimi, AChE in GST, *Porcellio scaber*

## ABSTRACT

### **Effect of imidacloprid on growth, feeding rate and activity of AChE and GST enzymes in the terrestrial isopods *Porcellio scaber* (Isopoda, Crustacea)**

Neonicotinoids are relatively new systemic insecticides, which are chemically alike nicotine – toxin, present in tobacco. Similarly as nicotine, neonicotinoids act on the nerve system. Neonicotinoids have because of highly electron acceptor group's partially positive charge and they can bind nicotinic acetylcholine receptors. So they irreversibly block acetylcholine receptors. The affinity for the binding is expressed much stronger at insects as it is expressed in mammals. For neonicotinoids as relatively new insecticides, there are not many of scientific papers dealing with their degradation and sorption in the environment, methods for the monitoring in different environmental matrices, toxicity testing on different testing organisms, aquatic and terrestrial. We want to find out, if the replacement of organophosphates with neonicotinoids is suitable and what kind of consequences it brings for non-target organisms and lifeless nature and also for the mankind. In the first experiment we wanted to assess the activity of acetylcholinesterase (AChE) after two weeks of exposure of terrestrial isopods *Porcellio scaber* to imidacloprid, added in food in concentrations of 1, 2.5, 5 and 10 µg imidacloprid/g dry food. No changes in the AChE activity were observed after the exposure to imidacloprid. In the second study glutathion-S-transferase (GST) activity was determined in the experiment with adults at concentrations 0, 10 and 25 µg imidacloprid/g dry food as the consequence of exposure to imidacloprid. The results have shown that after 2 weeks of exposure the GST activity was increased in animals, exposed to 10 µg imidacloprid/g dry food and decreased in animals, exposed to 25 µg imidacloprid/g dry food. After two weeks of exposure to imidacloprid, added in food there were observable effects on feeding parameters (consumption rate, assimilation efficiency) at concentrations 10 and 25 µg imidacloprid/g dry food. No effect on growth rate, proteins and lipids content was observed.

**Key words:** imidacloprid, toxicology, enzymes, AChE in GST, *Porcellio scaber*



### **Vpliv talnih dejavnikov na usodo herbicida izoproturona**

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Usoda herbicidov v tleh je odvisna od talnih dejavnikov, lastnosti pripravka ter dejavnikov okolja: rastne dobe in podnebni razmer ter njihovih sezonskih gibanj. Izoproturon [N-(4-izopropilfenil)-N',N'-dimetilurea], izbrani modelni herbicid v naši študiji, spada v skupino fenil-sečninskih herbicidov in se široko uporablja za zatiranje travnega in širokolistnega plevela v ozimni pšenici, ječmenu in rži. Izoproturon je količinsko med najbolj uporabljanimi pesticidi konvencionalnega kmetijstva Zahodne Evrope. Posledično ga

zasledimo kot enega izmed onesnažil podtalnice in površinskih voda. Njegova usoda v okolju, posebno razgraditev, je zato predmet številnih študij. V prispevku bomo na osnovi literaturnega pregleda in izsledkov lastnih raziskav ovrednotili možne usode izoproturona v odvisnosti od talnih lastnosti. Usodo izoproturona smo preučevali v kontroliranih razmerah laboratorijskih razgradnih testov in mikrokozem talnih kolon ter v zunanjih lizimetrovskih poizkusih, v vseh primerih s  $^{14}\text{C}$  tehniko. Ugotovili smo, da je razpon mineralizacije izoproturona 2-3 mesece po uporabi lahko od 5% do 60 % uporabljene količine herbicida v odvisnosti od talnih dejavnikov (sposobnosti mikrobnih združb za razgraditev, vsebnosti vode v tleh, pH, vsebnosti organske snovi in glin, vsebnosti biotično dostopnih težkih kovin). Na osnovi analiziranih razgradnih produktov sklepamo, da je glavna pot razgradnje izoproturona demetilacija, ki vodi do metabolitov MDIPU [3-(4-izopropilfenil)-1,1-metilsečnine] in DDIPU [3-(4-izopropilfenil)-sečnine], ter kasneje do anilina. Pomemben proces v usodi izoproturona je nastanek vezanih ostankov (*bound residues*), saj smo v talnih vzorcih analizirali tudi več kot 50% uporabljene količine izoproturona v tej obliki. Izhlapenje in izpiranje izoproturona je bilo v naših poizkusih v preučevanem obdobju 2-3 mesecev po uporabi minimalno.

**Ključne besede:** tla, izoproturon, razgradnja

*ABSTRACT*

### **Effects of soil parameters on the fate of the herbicide isoproturon**

The fate and behaviour of herbicides in soil is governed by many different factors including soil characteristics, compound properties and environmental factors: vegetation, climate conditions and any seasonal fluctuations. Isoproturon [3-(4-isopropylphenyl)-1',1'-dimethylurea], the chosen model compound in our study, is an herbicide belonging to the class of phenyl-urea derivatives, widely used in agriculture for the pre- and post-emergence control of annual grasses and broad-leaved weeds in cereals. It is among the most used herbicide in conventional agriculture in Western Europe, resulting in contamination of ground and surface waters. Its fate in the environment, specifically degradation, has been intensively studied. In the article, effects of soil parameters on the fate and behaviour of isoproturon will be evaluated considering literature overview and results of own research work. The fate of isoproturon was examined in laboratory degradation tests and in microcosm soil columns, as well as in outdoor lysimeter experiments, in all cases using  $^{14}\text{C}$  technique. The results of our study have shown that the total mineralisation over a period of 2-3 months can range from 5% to 60% regarding to the soil parameters (microbial community capability to degrade isoproturon, soil water content, pH, organic matter and clay content, bioavailable heavy metal content). The degradation products analyses of soil samples indicated that the main metabolic pathway involves an initial N-demethylation of isoproturon to MDIPU [3-(4-isopropylphenyl)-1,1-metilurea], followed by another N-demethylation to DDIPU [3-(4-izopropilfenil)-urea] and cleavage of the urea side chain to anilin. Formation of bound residues is an important process in the fate of isoproturon as more than 50% of applied amount can be found in this form. Volatilisation and leaching of isoproturon over a period of 2-3 months have been in our experiments negligible.

**Key words:** soil, isoproturon, degradation, environmental fate

## **Agrometeorologija in napovedovanje pojava bolezni**

## **Državna meteorološka mreža in operativne merilne mreže; namen, razlike in dopolnjevanje**

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Predstavili bomo kriterije za razporeditev merilnih postaj v državni meteorološki mreži in stroge zahteve po kakovosti podatkov, ki jih morajo ta merilna mesta izpolnjevati. Postopek zagotavljanja kakovosti podatkov, ki tvorijo državni meteorološki arhiv, je pomemben sestavni del procesa meritev. Pojasnili bomo, zakaj je potrebno redno umerjanje instrumentov, zakaj so tako pomembni podatki o kraju in načinu meritve ter o postopku zagotavljanja kakovosti. Za nekatere namene se je potrebno pri analizah naslanjati zgolj na podatke državne meteorološke mreže, je pa veliko posebnih potreb po meteoroloških podatkih, ki jih ta mreža ne zmore pokriti. Zato poleg državne meteorološke merilne mreže obstaja tudi vrsta merilnih mrež, ki so postavljene in prilagojene posebnim namenom in potrebam. Te mreže so običajno bolj goste, neredko so opremljene s posebnimi merilniki, ki jih državna meteorološka mreža ne vključuje. Pogosto so opremljene tudi s programsko opremo, ki uporabniku neposredno računa izvedene količine ali določa stopnjo glede na izbrane mejne vrednosti. Tudi te posebne merilne mreže morajo izpolnjevati vrsto pogojev, pri njihovem vzdrževanju pa se srečujemo s podobnimi težavami kot v državni meteorološki mreži. Za podporo dejavnostim, kot je tudi kmetijstvo, sta nujno potrebni tako državna kot tudi posebna merilna mreža. Podatki obeh se med seboj dopolnjujejo in nudijo celovit nabor podatkov za različne vidike uporabe v kmetijstvu. Na osnovi primerjave podatkov državne merilne mreže s podatki iz kmetijske merilne mreže bomo predstavili nekaj opažanj, ugotovitev in priporočil.

**Ključne besede:** državna meteorološka mreža, Slovenija

*ABSTRACT*

### **National meteorological network and operational monitoring systems; purpose, differences, and how they complement**

Criteria how the meteorological stations within a national meteorological network are distributed in space and which tough quality assurance criteria data shall meet will be presented. Quality assurance procedure performed on data on their way onto national meteorological archive is an important part of monitoring process. We'll answer why it is so important to calibrate instruments regularly, why metadata are needed and why a description of a quality check process should always be integrated in data archive. For some purposes it is strictly necessary to use only data obtained in the national meteorological network, but there are many special needs that cannot be sufficiently taken care of only by using those data. That's why beside the national meteorological network also a number of operational monitoring systems coexist. They are designed on purpose to fulfil the requirements of special users with quite peculiar needs. Usually they are much denser, often equipped with special sensors, which are not integrated in the national meteorological network on the

regular base. Many times they incorporate software, which in real time calculates derived values, or perform an alert system based on the thresholds set in advance. Also these operational networks should meet a number of requirements, maintaining such a network one is expected to face quite similar problems as the national meteorological network operators. To support economic branches with special requirements, like agriculture, there is a need for both networks: the national and the operational one. Data from both networks are complimentary, and provide the end users with integral set of information. Comparing and analysing data from national meteorological network and data from agro-meteorological measuring system some conclusions have been drawn and they will be presented together with some suggestions for future cooperation.

**Key words:** National meteorological network, Slovenia



### **Problematika določevanja trajanja omočenosti lista**

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Med vremenskimi spremenljivkami, ki najbolj vplivajo na pojav in razvoj rastlinskih bolezni in škodljivcev ter tudi na učinkovitost sredstev za varstvo rastlin, je trajanje omočenosti lista (TOL), ki je posledica padavin, rose ali megle. Vse več fitopatoloških modelov upošteva TOL v kombinaciji z drugimi pomembnimi dejavniki pri napovedi za splošno nevarnost pojava rastlinskih bolezni in škodljivcev. TOL lahko neposredno merimo ali pa jo računamo z simulacijskimi modeli. Obstaja več tehnik merjenja, kjer uporabljamo elektronske senzorje, ki po obliki in dimenzijah posnemajo liste rastlin. Za daljinsko zaznavanje TOL uporabljajo tudi meteorološke radarje oz. urne vrednosti izmerjenih padavin. Elektronska merjenja TOL so osnova za razvoj in kalibracijo simulacijskih modelov za računanje TOL. Osnovni fizikalni princip teh modelov sloni na izračunu energijske bilance lista. Računa se tudi vodna bilanca lista, ki upošteva padavine, roso ter izhlapevanje vode z lista. Modele za TOL delimo glede na tip rastlin v dve skupini. Pri nizkih rastlinah upoštevamo tudi vlažnost tal in intercepcijo padavin, medtem ko pri višjih rastlinah modeliramo le procese na vrhu rastlinske odeje. Vhodni podatki za simulacijske modele so različne meteorološke spremenljivke, najpogosteje v urni časovni skali in sicer: dolgovalovno in globalno sevanje, relativna vlaga, količina padavin, temperatura zraka, hitrost vetra in oblačnost. V modele za TOL lahko vnesemo tudi vrednosti omenjenih spremenljivk, ki jih daje vremenska napoved za nekaj dni vnaprej.

**Ključne besede:** meteorologija, omočenost listja, napovedovanje bolezni

## ABSTRACT

### Assessment of leaf wetness duration

Weather plays a key role in plant epidemiology. In particular, leaf wetness duration (LWD) produced by dew, fog or precipitation is one of the most significant meteorological pest-promoting factors that trigger fungal and bacterial plant diseases and activities of insects, and that influence the effectiveness of pesticides and the uptake mechanism for gases deposited onto vegetation. Many phytopathological models use the LW parameter in combination with other factors to assess the infection risk and pest severity, and to manage disease control activities in an efficient way. A great number of measuring principles and construction techniques are available for the monitoring of LWD. Some techniques use artificial surfaces that are representative of the shape or dimension of the leaves. Other techniques use electronic grid elements which can be mounted directly on the leaf surface. In order to obtain higher spatial resolution LW can be estimated also by using hourly radar measurements of rainfall. LWD is also assessed by microclimate models calibrated by electronic LW measurements in or above canopies. Calculation is based on physical principles of the energy balance and energy transfer. Models act as a water budget for a plant surface, where water is added by precipitation or condensation from dew and lost by evaporation. A surface energy balance model can describe these physical processes as a balance of energies. During a dew event radiant energy is lost from the plant surface and is converted into latent and sensible heat. LW models distinguish between low crops and canopies with foliage-free bottom. In low crops LWD is modelled by taking the soil moisture, canopy interception and the crop-dependent radiative transfer into consideration. For orchards it is assumed that the soil has no effect on the LWD and the calculation is restricted on the top leaf of an orchard. The leaf can form and evaporate dew according to its energy balance and the flow state. LWD caused by rain is given by the duration of the rain period itself and, during the following rainless hours, by the lifetime of a water drop settled on the top leaf. LW models need as an input predominantly meteorological data such as longwave and global radiation, relative humidity, precipitation amount, air temperature, windspeed and cloud cover. Weather forecast data can be included in most models, as well.

**Key words:** meteorology, assessment, leaf wetness duration, disease prognose



### Meritve in modeliranje trajanja omočenosti lista

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Trajanje omočenosti lista (TOL) je ena od pomembnejših agrometeoroloških spremenljivk, ki vpliva na razvoj rastlinskih bolezní. Kljub pomembnosti spremenljivke je presenetljivo, da ne obstajajo enotna merila za operativni monitoring TOL v sklopu nacionalnih meteoroloških mrež. Težava je v tem, da TOL ni klasična meteorološka spremenljivka, meritve so

indirektne in s pomočjo merilne tehnike težko simuliramo lastnosti lista, zato tudi meritve dajejo različne rezultate in potrebujejo umerjanje za posamezno rastlino. Modeliranje, ki temelji na znanih fizikalnih principih in parametrih lista, vsekakor predstavlja dobro alternativo pogosto nedoslednim meritvam in neumerjenim senzorjem. V članku smo analizirali meritve merilnikov Adcon Combo 730 SU in izvedli primerjavo z nemškim modelom LEAFWET, ki smo ga dobili v izmenjavo v sklopu aktivnosti programa Evropske skupnosti COST 718 (Meteorološke aplikacije za kmetijstvo). Model je sestavni del fitopatoloških modelov znotraj kompleksnega agrometeorološkega informacijskega sistema Nemške meteorološke službe. Model je bil razvit v sklopu napovedovanja škrlupa v sadjarstvu (model ASCHORF), nova verzija je prilagojena za vinogradništvo kot del modela za napoved peronospore na vinski trti (model PERO). Fizikalna osnova modela je energijska bilanca in vhodne spremenljivke so temperatura zraka, relativna vlaga zraka, hitrost vetra, kratkovalovno in dolgovalovno sevanje ter višina padavin. Primerjavo smo izvedli na izbranih meteoroloških postajah Agencije RS za okolje, meritve trajanja omočenosti lista smo pridobili iz mreže Fitosanitarne uprave RS Ministrstva za kmetijstvo, gozdarstvo in prehrano v letih 1999-2003. Rezultati kažejo na nekonsistentnost meritev TOL, kar vsekakor nakazuje potrebo po rednem umerjanju senzorjev in možnost uporabe modelov pri preverjanju kvalitete meritev.

**Ključne besede:** trajanje omočenosti lista, energijska bilanca lista, modeliranje rastlinskih bolezni

#### *ABSTRACT*

#### **Measurements and modelling of leaf wetness duration**

Leaf wetness duration (LWD) is very important agrometeorological parameter in the spreading of plant diseases. Since LWD is not a true meteorological variable, as is temperature or precipitation, its measurement has not been routinely made as a part of a general observation program by most national meteorological agencies. The main problem is that most sensors measure LWD indirectly and have different physical properties from leaves, so they require calibration to represent particular crop. Hence, attempts have been made to build models in order to simulate LWD based on physical principles and plant leaf properties using standard meteorological data. The simulation of LWD is a well-known alternative to uncalibrated sensors and inconsistent measurements. In our study, comparison between Adcon Combo 730 SU sensor and LEAFWET model was performed. LEAFWET model was developed by German Weather Service (DWD) and it was distributed to the members of European Cooperation in the field of Scientific and Technical Research - COST 718 (Meteorological Applications for Agriculture). The objectives of the research in the frame of action is focused on the evaluation of the models resulting in improving of the models and in establishment of recommendations for the end users. The model is a part of complex advisory agrometeorological system of DWD. The model was formerly developed for apple-scab forecast in orchards (model ASCHORF); new version was updated for vineyards in the frame of advisory for disease development of downy mildew (model PERO). The physical principle of the model is based on the energy-balance equation and input parameters are air temperature, relative humidity, wind speed, short- and long- wave



radiation and precipitation. The comparison was performed on the meteorological stations of the Environmental Agency of the Republic of Slovenia; the LWD measurements were obtained from the network of Slovenian office for protection and registration of plant varieties in the years 1999-2003. The results pointed out that there is strong inconsistency of LWD measurements, need for regular calibration of sensors and stressed usefulness of LWD model for regular calibration of sensors.

**Key words:** leaf wetness duration, leaf energy balance, plant diseases modeling



### **Izkušnje z različnimi metodami spremljanja izbruhov askospor pri prognozi jablanovega škrlupa**

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V letih 2003 in 2004 smo v Mariboru in v Žalcu primerjali tri metode spremljanja izleta askospor jablanovega škrlupa (*Venturia inaequalis*); z lovilec spor Mycotrap in Buchard ter z vazelinskimi objektnimi stekelci. Rezultate obeh metod smo primerjali s stopnjami okužbe po Millsu, ki jih izračunal računalniški program Addvantage. Ugotovili smo, da se izbruhi askospor jablanovega škrlupa, ki jih je zabeležil lovilec spor Mycotrap, nadaljujejo tudi več ur po dežju in da so se posamezni izbruhi askospor dogajali tudi v nočnem času.

**Ključne besede:** *Venturia inaequalis*, metode napovedovanja

#### *ABSTRACT*

In the years 2003 and 2004 we compared in Maribor region three methods of release primary apple scab ascospore (*Venturia inaequalis*): with ascospore catcher Mycotrap and Buchard and with microscope vaseline slides. Both methods we compared with Apple scab infections which calculated computer software Addvantage according to Mills. We establish that primary apple scab ascospore fly out many hours after the end of rain and nighttime release can occur as well.

**Key words:** *Venturia inaequalis*, plant disease prognose



## **Izkušnje z modelom Maryblyt pri prognoziranju hruševega ožiga (*Erwinia amylovora*) v Sloveniji**

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Slovenska Opazovalno napovedovalna služba za varstvo rastlin spremlja razvoj hruševega ožiga (*Erwinia amylovora*) s prognostičnim modelom Maryblyt, ki služi kot pripomoček pri ugotavljanju kritičnih obdobji za razvoj in širjenje bakterije. V nasadih na območju petih opazovalnih centrov spremljamo vremenske razmere, razvoj jablan in hrušk ter opravljamo opazovanja bolezenskih znamenj. V prispevku je predstavljeno delovanje modela v nekaterih jablanovih in hruševih nasadih v posameznih regijah v zadnjih dveh letih, s poudarkom na analizi dogajanj med cvetenjem, ko je nevarnost za širjenje bakterije največja.

**Ključne besede:** *Erwinia amylovora*, hrušev ožig, Maryblyt, Slovenija

ABSTRACT

### **Experience with maryblyt forecasting model for predicting fire blight (*Erwinia amylovora*) in Slovenia**

The Slovene Forecasting and Warning Service for Plant Protection observes the development of fire blight (*Erwinia amylovora*) using the forecasting model Maryblyt which serves as an instrument for the determination of periods critical for the development and spreading of the bacterium. Weather conditions, development of apples and pears and disease signs were monitored in orchards situated in the area of five regions. The paper presents the functioning of Maryblyt model applied in some apple and pear orchards situated in different regions over the last two years, emphasising the analysis of the situation during the bloom time when the danger of spreading of the bacterium is the greatest.

**Key words:** *Erwinia amylovora*, fire blight, Maryblyt, Slovenia



## Prvi rezultati uporabnosti prognostičnega modela Simphyt za varstvo krompirja pred krompirjevo plesnijo (*Phytophthora infestans*) v Sloveniji

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Uspešno varstvo pred krompirjevo plesnijo temelji na pravočasnem začetku škropljenja krompirišč s fungicidi, v času, ko bolezen prehaja iz skrite v epifitotično fazo. Za ugotavljanje začetka epifitocije krompirjeve plesni smo v naših rastnih razmerah testirali nemški model Simphyt I, ki na podlagi vremenskih podatkov ter podatkov o vzniku, sortni občutljivosti in lastnostih rastišča napoveduje pojav bolezni za dva občutljivostna razreda in različne termine vznikanja krompirja. Model napove pojav bolezni za osem dni vnaprej, kar zadošča za pravočasno izvedbo škropljenj. Prvi rezultati preizkušanja modela na dveh lokacijah v Sloveniji so dobri, saj je model v vseh primerih pravočasno napovedal pojav bolezni.

**Ključne besede:** *Phytophthora infestans*, prognostični model Simphyt, napovedovanje bolezni

*ABSTRACT*

### First results of the applicability of simphyt decision support system for the control of potato late blight [*Phytophthora infestans*] of potato in Slovenia

A successful protection against the potato late blight (*Phytophthora infestans*) is based on an accurate timing of the beginning of fungicide treatment, which is when the disease is proceeding from a latent stage to an epiphytotic level. To establish the beginning of potato late blight epiphytotics in growing conditions of Slovenia, a German model Simphyt I has been tested. The model is based on meteorological data and data on emergence, cultivar susceptibility and field characteristics and it prognoses the occurrence of the disease for two susceptibility categories and different terms of potato emergence. The occurrence of the disease is predicted eight days in advance, which is early enough for a proper timing of treatments. The first results of the model testing on two locations in Slovenia are satisfying, as the model in all cases predicted the disease in due course of time.

**Key words:** *Phytophthora infestans*, prognostic model Simphyt, plant disease prognose

## **Informacijski sistemi povezani z varstvom rastlin**

## Informacijski sistem na področju fitofarmaceutskih sredstev

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Informacijski sistem na področju fitofarmaceutskih sredstev (FFS) je vzpostavljen kot del širšega informacijskega sistema na fitosanitarnem področju. Namenjen je zbiranju podatkov o registraciji, prometu in uporabi FFS, zbiranju podatkov na področju usposabljanj iz fitomedicine in pregledov naprav za nanašanje FFS. Njegov glavni namen je podpora upravnim postopkom, preverjanje podatkov za izplačila denarnih nadomestil ter nadzor nad prometom in uporabo FFS. Aplikacija Fito-FFS vsebuje različne podatke o FFS, aktivnih snoveh, upravnih postopkih ter povezave do dokumentov EU. Register FFS, ki je del aplikacije vsebuje podatke o registriranih FFS v Republiki Sloveniji: ime, vsebnost, označevanje, proizvajalec, mesto prodaje, uporaba in način tretiranja, škodljivi organizmi, datum in vrsta izdane odločbe, veljavnost registracije, pogoji uporabe ipd. Aplikacija vsebuje tudi podatke o vseh registriranih domačih in tujih pravnih in fizičnih osebah, ki v Republiki Sloveniji opravljajo promet s FFS ter podatke o prometu FFS po letih. Na spletni strani [www.furs.si](http://www.furs.si) in [www.fito-info.bf.uni-lj.si](http://www.fito-info.bf.uni-lj.si) so javno dostopni sproti osnovni podatki o registriranih FFS. V prihodnosti bodo dostopni tudi podatki o dovoljenih ostankih v živilih, o registriranih uporabah in posebnih omejitvah uporabe FFS. Centralna evidenca o opravljenih usposabljanjih, preverjanjih znanja in izdanih potrdilih o znanju iz fitomedicine za predavatelje, odgovorne osebe, prodajalce FFS in izvajalce varstva rastlin povezuje podatkovne baze vseh izvajalcev usposabljanj na področju fitomedicine. Centralna evidenca na področju naprav za nanašanje FFS vsebuje podatke o vseh napravah, ki so vključene v sistem rednega pregledovanja, in povezuje podatke vseh izvajalcev, ki izvajajo preglede naprav. Aplikacija nudi tehnične podatke o napravah, podatke o lastniku naprave ter podatke o opravljenih pregledih. Slednji aplikaciji sta tudi izvorni evidenci za kontrolo izplačil denarnih nadomestil, služili pa bosta tudi nadzoru kupcev in uporabnikov FFS oziroma naprav.

**Ključne besede:** registri, evidence, informacijski sistem, fitofarmaceutska sredstva, Slovenija, potrdilo o znanju iz fitomedicine, naprave za nanašanje fitofarmaceutskih sredstev

### *ABSTRACT*

#### **Information system in the field of plant protection products**

Information system in the field of plant protection products (PPP) represents a part of a wider information system in the phytosanitary field. The purpose of the system is to collect information in relation to the registration, placing on the market and use of PPP, to collect information in the field of phytomedicine training and testing of the equipment for the application of PPP. The main purpose is to provide support for administrative procedures, check data in relation to the payment of monetary compensations and supervise the trade

and the use of PPP. The application Phyto-PPP includes various data on PPP, active substances, administrative procedures, as well as references to EU documents. The register of PPP as a part of the application includes data on the registered PPP in the Republic of Slovenia: name, content, labelling, producer, sales outlets, use and the manner of treatment, harmful organisms, date and the kind of the issued decision, validity of registration, conditions for use, etc. The applications include also the information on all registered domestic and foreign legal and natural persons, involved in the placing on the market of PPP in the Republic of Slovenia, and data on the trade in PPP by years. The websites [www.furs.si](http://www.furs.si) and [www.fito-info.bf.uni-lj.si](http://www.fito-info.bf.uni-lj.si) provide publicly available on-line basic information on the registered PPP. In future also the information in relation to the permitted residues in foodstuffs, registered uses and special restrictions on the use of PPP shall be made available. The central record on the performed trainings, the assessment of knowledge and the issued certificates of knowledge of phytomedicine for lecturers, responsible persons, sellers of PPP and the performers of plant health, represents connection between data bases of all performers of the training in the field of phytomedicine. The central record in relation to the equipment for the application of PPP includes information on all equipment, which is subjected to regular checking system, and connects information on all performers of the checking. The application provides technical data on the equipment, its owner and information in relation to the performed examinations. On the basis of the latter applications also the control of payment of monetary compensations is carried out, however they shall be used also for the control of buyers and users of PPP or equipment.

**Key words:** registers, records, information system, plant protection products, Slovenia, certificate of knowledge of phytomedicine, equipment for the application of plant protection products



### **Fitosanitarni informacijski sistem - vsebine in zahteve**

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Fitosanitarni informacijski sistem predstavljajo vsi informacijski sistemi s področja zdravstvenega varstva rastlin, fitofarmaceutskih sredstev, mineralnih gnojil, varstva in registracije sort rastlin ter kakovosti semenskega materiala kmetijskih rastlin, ki se razvijajo pod okriljem državnega organa, pristojnega za fitosanitarno področje. Njegovi zametki segajo v leto 1997, ko je začel delovati spletni portal Fito-info. Sledila mu je spletna aplikacija za podporo upravnih zadev Fito-register, ki vsebuje register izdajateljev rastlinskih potnih listov oziroma imetnikov določenih rastlin, rastlinskih proizvodov in nadzorovanih predmetov v skladu z Zakonom o zdravstvenem varstvu rastlin in s tem povezane evidence. V letu 2003 smo začeli z razvojem več aplikacij za podporo upravnim postopkom, registrom in evidencam:

- Fito-register je bil nadgrajen s Seme-registrom, ki vsebuje register dobaviteljev semenskega materiala kmetijskih rastlin in s tem povezanih evidenc.
- Fito-nadzor, ki vsebuje podatke o pojavljanju škodljivih organizmov, najdenih na območju RS, ki so jih v okviru načrtovanih posebnih nadzorov zabeležili fitosanitarni inšpektorji ter pooblaščen izvajalci fitosanitarnih pregledov. Vsebuje tudi evidenco opravljenih analiz pooblaščenih laboratorijev za zdravstveno varstvo rastlin.
- Fito-GIS je modul, ki je vgrajen v večino omenjenih aplikacij in omogoča zajem geografskih podatkov v registre in evidence in različne prostorske prikaze in analize geografsko povezanih podatkov.

V letu 2004 smo pričeli še z razvojem modulov, ki tudi geoinformacijsko beležijo preglede in dogodke povezane z varstvom rastlin in so podlaga za upravljanje fitosanitarnega področja v Republiki Sloveniji:

- Fito-pregled je pilotska aplikacija, ki vsebuje evidenco inšpekcijskih in fitosanitarnih pregledov fitosanitarne inšpekcije na področju zdravstvenega varstva rastlin, ki so jih opravili v notranjosti države. Vsebuje tudi evidenco uradno odvzetih vzorcev s sumom na karantenske ali gospodarsko pomembne organizme. V prihodnje bo to aplikacijo razširila aplikacija FSI-pregled, ki bo podpirala vodenje vseh postopkov in evidenc fitosanitarne inšpekcije.
- Fito-FFS je aplikacija, ki zajema register FFS, register prodajaln FFS, centralno evidenco izobraževanj na področju FFS in centralno evidenco opravljenih testiranj škropilnih naprav.
- Fito-sorta je aplikacija, ki zajema sortno listo kmetijskih rastlin, register prijav za varstvo sort rastlin in register zavarovanih sort rastlin v RS.
- Fito-prognoza je aplikacija v razvoju, zajema pa evidenco meteoroloških podatkov (online podatki meritev avtomatskih agrometeoroloških postaj v petih regijskih centrih opazovalno napovedovalne službe za varstvo rastlin), evidenco prognostičnih obvestil, vsebovala pa bo tudi prognostične modele za pomembnejše bolezni in škodljivce.
- Uradna spletna stran Fitosanitarne uprave RS ([www.furs.si](http://www.furs.si)) je zbirka informacij o predpisih, mednarodnih standardih in drugih informacijah javnega značaja.

Ker je večina registrov in evidenc povezanih z ostalimi uradnimi evidencami RS je standardizacija in skladnost podatkov v vseh sistemih ključnega pomena za točnost in preverljivost podatkov ter izmenljivost podatkov z ostalimi aplikacijami. Zelo pomembna je tudi varnost sistemov, ki vsebujejo osebne in zaupne podatke. Standardizacija, skladnost podatkov - izmenljivost, sledenje dostopov in izpolnjevanje vseh zahtev varnosti informacijskih sistemov po obsegu in stroških predstavljajo dve tretjini obsega razvoja informacijskega sistema.

**Ključne besede:** informacijski sistemi, registri, evidence, varstvo rastlin, fitofarmacevtska sredstva, sorte rastlin, semenski material, Slovenija

*ABSTRACT*

### **Phyto-sanitary information system – subjects and requirements**

The phyto-sanitary information system is represented by all information systems from the field of plant health, plant protection products, mineral fertilisers, protection and registration of varieties of plants and quality of agricultural seed material, which are developed under the

auspices of a state body responsible for the phytosanitary field. It was initiated in 1997 with the website portal Phyto-info. This was followed by a website application, the Phyto-register, which was created as a support for administrative matters and includes the register of persons authorised to issue plant passports or of holders of certain plants, plant products and regulated articles in accordance with the Plant health act and the related records. In 2003 a number of applications were initiated as to support administrative procedures, registers and records:

- Phyto-register was upgraded with the Seed-register, which includes register of suppliers of agricultural seed and propagating material and the related records.
- Phyto-surveillance, which includes information in relation to the occurrence of harmful organisms, found within the territory of the RS, recorded by phytosanitary inspectors and authorised persons of phytosanitary examinations within planned special surveillance. It includes also the record of analyses performed by authorised laboratories for plant health.
- Phyto-GIS is a module, incorporated in most of the above mentioned applications, enabling geographical information to be included in registers and records, as well as various spatial presentations and the analysis of the geographically related information.

In 2004 we started to develop also modules for the geoinformational recording of examinations and events, related to plant health, which are the basis for the management of the phytosanitary field in the Republic of Slovenia:

- Phyto-examination is a pilot application, which includes a record of inspections and phytosanitary examinations performed by phytosanitary inspection in the field of plant health within the country. It includes also a record of samples, officially taken on the basis of suspected quarantine or economically important organisms. This application shall be in the future extended by the application PSI-inspection, as to support the management of all procedures and records of phytosanitary inspection.
- Phyto-PPP is an application, which includes the register of PPP, the register of sales outlets for PPP, the central record of training courses in the field of PPP and the central record of the executed tests of spraying equipment.
- Phyto-varieties is an application, which includes common catalogue of agricultural varieties of plants, the register of applications for the protection of varieties of plants and the register of protected varieties in the RS.
- Phyto-prognosis is an application which is under development and includes record of meteorological data (on-line data of the measurement carried out by automatic agrometeorological stations in five regional centres of the observation prognostic plant health service), record of prognostic reports, and is planned to include also prognostic models in respect of more significant diseases and harmful organisms.
- The official website of the Phytosanitary Administration of RS ([www.furs.si](http://www.furs.si)) is a collection of information as to the regulations, international standards and other information of public character.

Since most registers and records are connected with other official records of RS, the standardisation and conformity of data in all systems is essential so as to ensure accuracy and ascertainability of data as well as exchangeability of data with other applications. The security of systems, which include personal and confidential data, is also of great importance. Standardisation, congruency of data – exchangeability, traceability of accesses and meeting all requirements in respect of the security of information system as regards the extent and costs, represent two thirds of the level of the information system's development.



**Key words:** information systems, registers, records, plant health, plant protection products, varieties of plants, seed material, Slovenia.



### **Informacijski sistem fitosanitarne inšpekcije**

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FSI-pregled je informacijski sistem Fitosanitarne inšpekcije, ki je bil razvit v letu 2004 in se je začel uporabljati v letošnjem letu. FSI-Pregled je ena izmed aplikacij celovitega informacijskega sistema na fitosanitarnem področju, ki ga izgrajuje Fitosanitarna uprava. Aplikacija FSI-pregled zagotavlja beleženje vseh dejavnosti Fitosanitarne inšpekcije in zapis podatkov, ki so potrebni za načrtovanje in analizo dela inšpekcije, zagotavlja zajem podatkov potrebnih za laboratorijske analize, zagotavlja zbiranje podatkov o ugotovljenih nepravilnostih in odkritih škodljivih organizmih in o odrejenih ukrepih za odpravo nepravilnosti in preprečevanje širjenja škodljivih organizmov, nudi možnost izrisa podatkov na različnih geografskih podlagah in omogoča elektronsko komunikacijo s strankami. Z izgradnjo celovitega informacijskega sistema na fitosanitarnem področju bo omogočena neposredna izmenjava podatkov z drugimi aplikacijami v sistemu.

**Ključne besede:** informacijski sistem, fitosanitarna inšpekcija, Slovenija

*ABSTRACT*

### **Phytosanitary inspection information system**

FSI-Control is an information system for the Phytosanitary Inspection that was developed in 2004 and launched this year. FSI-Control is one of the applications of a comprehensive information system in the phytosanitary area constructed by the Phytosanitary Administration. The application FSI-Control registers all activities of the Phytosanitary Inspection and records data required for the planning and analysis of inspection work, ensures the entry of data required for laboratory analyses, as well as the collection of data on irregularities and harmful organisms detected and the measures imposed to remove irregularities and to prevent the spread of harmful organisms; in addition, it provides the possibility of entering the data on different geographical bases and of communicating electronically with clients. The establishment of an integral information system in the phytosanitary area will make it possible to exchange data directly with other applications in the system.

**Key words:** information systems, phytosanitary inspection service, Slovenia



## **Javno dostopne vsebine fitosanitarnega področja v Sloveniji – [www.furs.si](http://www.furs.si)**

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Fitosanitarna uprava RS je osrednji organ na fitosanitarnem področju, ki vključuje zdravstveno varstvo rastlin, fitofarmacevtska sredstva, mineralna gnojila, varstvo in registracijo sort rastlin ter kakovost semenskega materiala kmetijskih rastlin. Skrbi za področje varstva rastlin pred škodljivimi organizmi, za varstvo rastlinskih pridelkov in rastlinskih proizvodov na način, da se zagotovi pravilna raba fitofarmacevtskih sredstev. Skrbi za izvajanje drugih ukrepov varstva rastlin, pomembnih za zdravje ljudi in živali ter za okolje, zlasti pa še za varstvo potrošnikov ter zagotavljanje varnosti hrane rastlinskega izvora ter zdravja in kakovosti kmetijskih rastlin, optimalne rastlinske pridelave, reguliranje trgovanja z rastlinami in rastlinskimi proizvodi na nacionalnem in mednarodnem nivoju ter v skladu z mednarodnimi standardi in zahtevami (FAO-IPPC, EPPPO, WTO – SPS) uvaja mednarodno priznane standarde v slovensko zakonodajo. Uprava skrbi za reguliranje prometa in uporabe fitofarmacevtskih sredstev in spremljanje njihovih ostankov (reziduoov), ugotavljanje in diagnosticiranje škodljivih organizmov in izvajanje ukrepov za preprečevanje vnosa in širjenja ter zatiranje škodljivih organizmov, zagotavljanje kakovosti semena in razmnoževalnega materiala kmetijskih rastlin ter za izobraževanje in osveščanje prebivalstva o fitosanitarnih vsebinah. Vsebine fitosanitarnega področja, vključno s prečiščenimi besedili nacionalnih predpisov in predpisov Evropske Skupnosti, mednarodnimi standardi, informacijami javnega značaja, kontaktnimi točkami, publikacijami, konferencami in delavnicami ter povezavami na sorodne spletne strani so dostopne na uradni spletni strani Fitosanitarnе uprave Republike Slovenije - <http://www.furs.si>.

**Ključne besede:** Fitosanitarna uprava Republike Slovenije, predpisi, standardi, javno dostopne informacije, Slovenija

ABSTRACT

### **Publicly available phytosanitary information in Slovenia - [www.furs.si](http://www.furs.si)**

The Phytosanitary Administration of the Republic of Slovenia is the central authority in the phytosanitary field, which comprises plant health, plant protection products, mineral fertilisers, protection and registration of plant varieties and the quality of agricultural seeds and propagating material. It is responsible for the field of protection of plants against harmful organisms, for the protection of crop products and plant products in such a manner as to ensure proper use of plant protection products. It furtheron ensures the carrying out of other plant protection measures, which are important for the public and animal health and the

environment, and in particular for the protection of the consumer and for the ensuring safety of food of plant origin and health and quality of agricultural plants, optimal plant production, the regulation of trade in plants and plant products at national and international level, and implements internationally recognised standards in Slovene legislation in accordance with international standards and requirements (FAO-IPPC, EPPO, STO – SPS). The task of the Administration is to provide for the placing plant protection products on the market and their use, and monitoring the residues, establishing and diagnosing of harmful organisms, and for the carrying out of measures for the prevention of introduction, spread and suppression of harmful organisms, ensuring the quality of agricultural seeds and propagating material, and for the training and public awareness in relation to phytosanitary matters. The matters related to the phytosanitary field, including consolidated texts of national regulations and the regulations of the European Community, international standards, information of public character, contact points, publications, conferences and workshops, as well as links to other related sites, are available at the official site of the Phytosanitary Administration of the Republic of Slovenia - <http://www.furs.si>.

**Key words:** the Phytosanitary Administration of the Republic of Slovenia, regulations, standards, publicly available information, Slovenia



### **Prenovljene vsebine na spletnih straneh slovenskega sistema za varstvo rastlin fito-info**

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Slovenski informacijski sistem za varstvo rastlin (FITO-INFO) je v obdobju od svojih začetkov, v letu 1997, do danes doživel kar nekaj vsebinskih, strukturnih, in oblikovnih sprememb. Prvotne strani informacijskega sistema smo preselili na novo lokacijo <http://www.fito-info.bf.uni-lj.si>. Da bi uporabnikom sistema zagotovili čim več aktualnih informacij s področja varstva rastlin, smo obstoječe module deloma spremenili, dopolnili in nadomestili z novimi. Prenovljeni moduli so zasnovani kot relacijske podatkovne baze na SQL strežniku, kar omogoča hitrejši in kompleksnejši dostop do podatkov in njihovo ažuriranje, in internet aplikacije na osnovi dinamičnih ASP strani. Predstavljeni so naslednji prenovljeni moduli sistema in njihove možnosti uporabe: fitofarmacevtska sredstva, agrometeorološke informacije, fenofaze gojenih rastlin, šifrant organizmov z opisi organizmov, zbirka gospodarsko škodljivih organizmov in sortna lista. Razvoj sistema finančno in strokovno podpira Fitosanitarna Uprava RS, razvoj modulov pa poteka v sodelovanju z več raziskovalnimi inštitucijami.

**Ključne besede:** informacijski sistem, relacijska podatkovna baza, varstvo rastlin, fitofarmacevtska sredstva, prognoza, organizmi.

## ABSTRACT

### Renovated contents of the Information System for Plant Protection (FITO-INFO) on the web – site

The Information System for Plant Protection (named FITO-INFO) has reached in the period from its first beginning, in year 1997, until today, many changes regarding its contents, structure and design. Existent pages of information system have been moved to the new location <http://www.fito-info.bf.uni-lj.si>. To assure users as many as possible most current information about plant protection, the existing modules were partly changed, completed and substituted with new ones. Renovated modules are designed as relational databases on SQL server, which enables faster and complex access to data and their update, and as internet interfaces based on dynamic active server pages (ASP). Presented are the following renovated system modules and possibilities of their use: plant protection products, agrometeorological information, phenology, species list with descriptions, collection of harmful pests and list of varieties. Development of the system is financially and professionally supported by the Slovenian Office for Protection and Registration of Plant Varieties, development of the modules is conducted in cooperation with several research institutions.

**Key words:** information system, relational database, plant protection, plant protection products, forecasting, organisms



### Agrometeorološki informacijski sistem v okviru delovanja opazovalno napovedovalne službe zdravstvenega varstva rastlin

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Slovenski in angleški povzetek nista bila predložena.

**Varstvo sadnih rastlin in vinske trte**

## **Vpliv tehnoloških ukrepov na pojav in širjenje trsnih rumenic**

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V obdobju med leti 2002 in 2004 smo preizkušali vpliv 6 tehnoloških ukrepov za zmanjšanje pojava trsnih rumenic. Primerjali smo 2 tehnologiji mehanske obdelave tal s standardno uporabo insekticidov proti grozdnim sukačem, 4 različne tehnologije uporabe herbicidov proti širokolistnim vrstam plevelov z dodatno rabo insekticidov v primerjavi z integrirano pridelavo. Rezultati v letu 2004 so pokazali, da so tehnologije uporabe herbicidov proti širokolistnim plevelom z uporabo insekticidov zaustavile širjenje trsnih rumenic. Odstotek okuženih trsov je v primerjavi z letom 2002 ostal nespremenjen v standardni integrirani pridelavi se je povečal iz 11,5% na 17,1%. Prav tako je bil odstotek na novo okuženih trsov v letu 2004 največji v tehnologiji integrirane pridelave (3,8%).

**Ključne besede:** trta, fitoplazme, epidemiologija, tehnologija pridelovanja

*ABSTRACT*

### **Influence of different technologies on appearance and spreading of Bois noir phythoplasma**

In period between the years 2002 and 2004 we testing the influence of 6 different technologies for reduction of appearance Bois noir phythoplasma. We compared standard integrated pests control technology (IPM) with 2 different technologies of soil cultivation and 4 different technologies of using herbicides against broad leaf weeds with additional using of insecticides against grape moths. The results in the year 2004 showed, that in all 4 different technologies of using herbicides against broad leaf weeds with additional using of insecticides against grape moths the percent of infected wine grapes stay the same in comparison with IPM technology, where the percent of infected wine grapes increased from 11,5% to 17,1%. The percent of new infected wine grapes was also the highest in IPM technology (3,8%).

**Key words:** grapevine, phytoplasma Bois noir, epidemiology, production technology



**Preizkušanje nekaterih fungicidov za zatiranje sive plesni (*Botryotinia fuckeliana* [de Bary] Whetzel) na vinski trti (*Vitis vinifera* L.) in vpliv njihovih ostankov na potek spontane vinske fermentacije**

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V triletnem obdobju (2002-2004) smo izvajali poljske poskuse za preverjanje učinkovitosti iprodiona (Kidan<sup>®</sup>), vinklozolina (Ronilan<sup>®</sup>), pirimetanila (Mythos<sup>®</sup>), ciprodinila + fludioksonila (Switch<sup>®</sup>) in fenheksamida (Teldor<sup>®</sup>) za zatiranje sive plesni na grozdju na populaciji štirih elit sorte Rebula (B3, B5, B12 in B22) na lokaciji Hruševlje v Goriških Brdih v letih 2002 do 2004 ter v letu 2004 tudi na dodatni lokaciji na Slapu pri Vipavi. Po dveh aplikacijah sredstev (ob zapiranju grozdov in v začetku zorenja jagod) smo pred trgatvijo okužbo grozdov s sivo plesnijo ocenili po Unterstehöfferjevi lestvici in izračunali stopnjo okužbe po Thownsend-Heubergerjevi enačbi. V vseh treh letih smo ob trgatvi določili tudi količino ostankov aktivnih snovi na grozdju (razen za fenheksamid) s pomočjo plinskega kromatografa z masno selektivnim detektorjem. V triletnem obdobju smo izvedli spontane vinske fermentacije za vsako obravnavanje (razen za fenheksamid) v treh ponovitvah in spremljali njihovo dinamiko (merjenje količine sproščenega CO<sub>2</sub>, log cfu/ml, koncentracijo glukoze, fruktoze, etanola in glicerola, čas trajanja fermentacije) ter sledili deleže posameznih vrst kvasovk. Zaradi prevetrene lege na lokaciji Hruševlje in zelo uravnovešene rasti ter opravljenih zelenih del na lokaciji Slap je bila okužba s sivo plesnijo v vseh letih dokaj majhna. Učinkovitost uporabljenih sredstev je bila različna med populacijami elit posajenimi v vinogradu in odvisna od položaja poskusnega bloka v vinogradu in s tem povezane bujnosti rasti trt na lokaciji Hruševlje. Kljub temu lahko uporabljena sredstva razvrstimo po vrstnem redu glede na učinkovitost: ciprodinil + fludioksonil in fenheksamid, ki jima sledi pirimetanil, slabšo učinkovitost pa sta pokazala iprodion in vinklozolin iz skupine dikarboksimidov. Količine aktivnih snovi na grozdju v mg/kg niso presegle dovoljenih vrednosti v nobenem letu in so bile nižje v letih z višjimi poletnimi temperaturami zraka in manj padavinami (2003) kot pa v letih z nižjimi temperaturami zraka in večjo količino padavin (2002 in 2004), kar nakazuje, da je zmanjševanje količine preiskovanih aktivnih snovi na grozdju od zadnje aplikacije do trgatve bolj odvisno od temperature zraka kot pa od količine padavin. Ostanki aktivnih snovi na grozdju, so kljub temu, da so bili pod dovoljenimi vrednostmi, vplivali na rast in razvoj populacije ne-*Saccharomyces* vrst v začetnih fazah fermentacije in s tem na dolžino spontane fermentacije in kinetiko pojavljanja posameznih vrst kvasovk med procesom.

Zahvala: Raziskavo sta finančno podprla Ministrstvo za visoko šolstvo, znanost in tehnologijo ter Ministrstvo za kmetijstvo, gozdarstvo in prehrano (Projekt z oznako V4-0591-01).

**Ključne besede:** Rebula, *Botrytis cinerea*, ostanki fungicidov, kvasovke, vino

*ABSTRACT*

**Testing of some fungicides against grey mould (*Botryotinia fuckeliana* [de Bary] Whetzel) on grapevine (*Vitis vinifera* L.) and impact of their residues on course of spontaneous wine fermentation**

In the three-year period (2002-2004) efficiency of iprodione (Kidan<sup>®</sup>), vinclozolin (Ronilan<sup>®</sup>), pyrimethanil (Mythos<sup>®</sup>), cyprodinil plus fludioxonil (Switch<sup>®</sup>) and fenhexamide (Teldor<sup>®</sup>) against the grey mould on grapes were estimated. The field trial on the progenies of four elite grapevines of variety Rebula (B3, B5, B12 in B22) were done in Hruševlje (2002-2004) and Slap near Vipava (2004). After the two applications of the fungicides (at the closure of the berries and at the beginning of the grape ripening) the infection of grapes with the grey mould was evaluated according to the Unterstehöffer scale. The level of the susceptibility for each grapevine was further calculated with the Townsend-Heuberger formula. Each year of the experiment the amounts of fungicide residues were determined (except of fenhexamide) with the combination of GC and MS detector and also the spontaneous wine fermentation were carried out in the three replications for the each treatment (except of fenhexamide). Their dynamics were followed by the measurements of the different processing parameters: amount of exhausted CO<sub>2</sub>, duration of fermentation, log cfu/ml and concentration of glucose, fructose, ethanol and glycerol and determination of the yeast species in the different phases of the process. The infection of grapes with the grey mould was very low due to the very good micro location in Hruševlje and balanced growth of the grapevines and proper canopy management in Slap. The effectiveness of used fungicides differs among the inspected progenies of elite grapevines and it was depended on the location of experimental block in the vineyard that influenced the grapevine vigour. Nevertheless, the fungicides could be ranged in the following order according to their efficiency: cyprodinil plus fludioxonil and fenhexamide, followed by pyrimethanil; lower efficiency was recorded for iprodione and vinclozolin that belong to the group of dicarboximidic fungicides. In the experimental years the fungicide residues detected on the grapes did not overcome the permitted levels for grapes and were higher in the year with higher summer day temperatures and lower precipitation (2003) in comparison to the years with lower summer day temperatures and higher precipitation (2002 and 2004). Therefore the summer day temperatures played more important role in the decay rate of the investigated fungicides on grapes than the precipitation. In spite of the low level of fungicide residues found on grapes, they influenced the duration of the spontaneous fermentation and also on the shares of the yeast species during the process owing to their impact on the growth of non-*Saccharomyces* yeasts in the early stages of the fermentation.

**Acknowledgment:** This research was supported by the Ministry of higher Education, Science and Technology and by the Ministry of Agriculture, Forestry and Nutrition (Project no. V4-0591-01).

**Keywords:** Rebula, *Botrytis cinerea*, fungicide residues, yeasts, wine





## Izkušnje z metodo zbeganja v nasadih jablane in breskve

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Sodobno varstvo rastlin, zaradi številnih zahtev do varovanja okolja, išče in uporablja tudi različne nekemične načine varstva. Med te uvrščamo biotehnične pripravke, ki so v intenzivnem razvoju. Okolju in pridelovalcem prijazna je metoda zbeganja. To metodo smo preizkusili pri preprečevanju gospodarske škode najpomembnejših škodljivcev jablane, jabolčnega zavijača (*Cydia pomonella* L.) in breskve, breskovega zavijača (*Cydia molesta* Busck.) ter breskovega molja (*Anarsia lineatella* Zell.). Metodo konfuzije smo preizkušali v intenzivnih nasadih jablan in breskev z integrirano pridelavo ter v nasadu jablan z ekološko pridelavo v dveh zaporednih letih 2003 – 2004. Velikost poskusnih nasadov je bila od 0,70 – 2 ha. Dvoletna raziskovanja so pokazala, da je metodo zbeganja mogoče uspešno uporabiti tudi v manjših sadovnjakih. Za dopolnitev uspešnosti metode smo uporabili insekticide na podlagi diazinona, klorpirifos-metila ter virusa granuloze. Prav tako so rezultati v drugem letu pokazali izrazito zmanjšanje populacije škodljivcev, zato se je zmanjšala uporaba insekticidov, na nekaterih parcelah pa jih sploh ni bilo potrebno uporabiti.

**Ključne besede:** feromoni, biotehnični pripravki, integrirana pridelava, jabolčni zavijač, breskov zavijač, breskov molj

### ABSTRACT

### Experience with confusion method in apple and peach orchards

Contemporary phytomedicine, because of many environmental demands and its protection, is looking for and uses different ways of plant protection. Here also belongs the use of biotechnical substances which are in intensive development. Environmental and user friendly is the method of confusion, which we tested in protection of economic damage because of one of the most important pests in apple (*Cydia pomonella* L.) and peach (*Cydia molesta* Busck.) and (*Anarsia lineatella* Zell.). We tested the method of confusion in integrated and organic pest management apple and peach orchards in two following years 2003 – 2004. The trial areas were between 0,70 – 2 ha. In some cases we additionally applied insecticide based on diazinon, klorpirifos-metil and granulose virus. Our two years research proved that this method can be successfully used also in smaller areas. The results in the second year indicated lower population of pests. Consequences are less use of insecticide; some areas required no use of insecticide.

**Keywords:** pheromones, biotechnical substances, integrated fruit production, Codling moth, Oriental fruit moth, Peach twig borer



### **Zatiranje breskovega zavijača (*Cydia molesta* L.) z metodo zbeganja**

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V letu 2004 smo v nasadu breskev v Potočah v Vipavski dolini preizkušali učinkovitost metode zbeganja oz. konfuzije za zatiranje breskovega zavijača. V poskusu so bili uporabljeni dispenzorji Ecodian CM z nizko vsebnostjo sintetičnega feromona, ki privlači samce breskovega zavijača in jih zadrži v bližini dispenzorja ter na ta način prepreči uspešno oploditev samic. V poskusu smo primerjali metodo zbeganja, kombinacijo uporabe insekticida in metode zbeganja ter klasično zatiranje z insekticidi. Delež črvivih plodov v nasadu, ki je bil trikrat tretiran z insekticidi, je bil 4%, v delu nasada, ki je bil skozi vse obdobje leta metuljčkov pokrit z dispenzorji Ecodian CM je bil delež črvivih plodov 1,46 %, najboljše rezultate pa smo dobili v delu nasada, v katerem je bil proti I. rodu zavijača uporabljen insekticid lufenuron (v odmerku 1, 42 l/ha), proti II. in nadaljnjim rodovom pa dispenzorji Ecodian CM, delež črvivih plodov je bil nižji od 1 % (0,98%).

**Ključne besede:** *Cydia molesta*, breskev, zatiranje, metoda zbeganja

#### *ABSTRACT*

### **Control of oriental fruit moth (*Cydia molesta* L.) by mating disruption method**

The mating disruption method for the control of *Cydia molesta* L. has been evaluated in the peach orchard in Potoče, Vipava valley in the year 2004. In the trial were used dispensers Ecodian CM with low synthetic pheromone rate that attracts males of *Cydia molesta*, keeps them close to the dispenser and in this way prevents the copulation with females. Three different protocols were compared in the trial: mating disruption method alone, chemical control and mating disruption method combined and classical chemical control. The part of damaged fruits in plot with classical chemical control (three applications of insecticides) was 4%. In the plot which was through whole period of the flight of *Cydia molesta* controlled by dispensers Ecodian CM the part of damaged fruits was 1, 46 %. Best results were achieved in the plot with insecticide application (lufenuron 1, 42 l/ha) at the start of first generation of *Cydia molesta* and Ecodian CM application for the control of second and further generations. The part of damaged fruits in this plot was lower than 1 % (0.98 %).

**Key words:** *Cydia molesta*, peach, insect control, insect mating disruption



## **Spremljanje zastopanosti češpljevega zavijača (*Grapholita funebrana* [Treitschke], Lepidoptera, Tortricidae) v ekstenzivnih sadovnjakih v Sloveniji**

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V letu 2004 smo na šestih lokacijah v Sloveniji (Gabernik, Latkova vas, Dol pri Hrastniku, Rakitnica, Želimplje, Kromberk pri Novi Gorici) spremljali zastopanost češpljevega zavijača (*Grapholita funebrana*). Feromonske vabe smo od sredine aprila do konca oktobra nastavljali v ekstenzivnih sadovnjakih. Namen raziskave je bil ugotoviti, koliko rodov razvije ta škodljivec na podnebno in geografsko različnih območjih. Rezultati monitoringa so pokazali, da ima češpljev zavijač v Sloveniji tri rodove na leto le na Primorskem (Kromberk), medtem ko ima v celinskem delu države dva rodova na leto. V prispevku je predstavljena bionomija škodljivca, tipi poškodb in škodljivost vrste.

**Ključne besede:** češpljev zavijač, *Grapholita funebrana*, monitoring, Slovenija

*ABSTRACT*

### **Monitoring of plum fruit moth (*Grapholita funebrana* [Treitschke], Lepidoptera, Tortricidae) in extensive Slovenian orchards**

The main purpose of this paper was to study the occurrence of the plum fruit moth (*Grapholita funebrana*) in Slovenia. In 2004, on six locations in Slovenia (Gabernik, Latkova vas, Dol near Hrastnik, Rakitnica, Želimplje, Kromberk near Nova Gorica) pheromone traps were placed in extensive orchards. The aim of the research was to determine the number of generations it develops per year in climatically and geographically different regions. Based upon this monitoring (from the middle of April till the end of October) it can be concluded that the plum fruit moth has 3 generations per year only in the littoral part of Slovenia (Kromberk), while on the other hand, in the continental part of the country it has 2 generation per year. In addition, bionomics of the pest, types of damage it causes and harmfulness of the moth on the hosts are presented.

**Key words:** plum fruit moth, *Grapholita funebrana*, monitoring, Slovenia



## Škorec (*Sturnus vulgaris*) čedalje pomembnejši škodljivec oljčnikov Slovenske Istre

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Oljka je s 1300 ha zasajenih zemljišč najpomembnejša sadna vrsta na območju Slovenske Istre in druga sadna vrsta v Sloveniji. Zaradi večje intenzivnosti pridelave oljk se povečuje število do sedaj znanih škodljivcev oljčnikov, pojavljajo pa se tudi novi. Kot pomembnejši škodljivec se je v zadnjih letih pojavil tudi škorec (*Sturnus vulgaris*). Velike jate škorcev, ki se zbirajo v jeseni, tik pred obiranjem oljk, so občutnejšo škodo v oljčnikih povzročile v letu 2002. V prispevku so podani: opis škodljivca, škoda, ki jo povzroča in možnosti varstva oljk pred tem škodljivcem.

**Ključne besede:** škorec (*Sturnus vulgaris*), oljka, škoda, varstvo

*ABSTRACT*

### **Starling (*Sturnus vulgaris*), an increasingly important pest in olive orchards of Slovenian Istria**

With 1300 ha of olive orchards, olive is the most important fruit species in region of Slovenian Istria and second in Slovenia. The intensification of the olive oil production resulted recently in an increase of number of well-known olive pests. Increasing starling (*Sturnus vulgaris*) populations have become an unexpected consequence of increased olive tree cultivation. For the past few years, large flocks of starlings have been observed in the orchards where the birds cause significant damage to the trees and crops, particularly in the year 2002. Descriptions of a starling, the damage and some possibilities for its mitigation are presented in this paper.

**Key words:** starling (*Sturnus vulgaris*), olive, damage, protection

**Fitofarmaceutska sredstva (sadjarstvo, vinogradništvo)**

## **Nove možnosti zatiranja navadne hruševе bolšice (*Cacopsylla pyri* L., Homoptera Psyllidae) v obdobju začetka rasti**

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Gojenje hrušk v sodobnih plantažah je povzročilo značilne spremembe v tehnologiji pridelovanja in omogočilo razmah škodljivcev, ki v preteklosti niso bili tako pomembni in ki lahko značilno vplivajo na kakovost pridelka. Eden od škodljivcev, ki so v sodobnih pridelovalnih razmerah pridobili na pomenu je navadna hruševa bolšica (*Cacopsylla pyri* L., Homoptera, Psyllidae). Osnovna škoda, ki jo ta škodljivec povzroča, nastane zaradi izsesavanja poganjkov, drugotna pa nastane zaradi obilnega izločanja medene rose (izločki in slabo prebavljen rastlinski sok), s katero so obdane ličinke. Medena rosa je ugodno gojišče za glivice sajavosti, ki se razvijajo na njej in skazijo videz plodov, dodatno pa so ti izločki obrambno sredstvo ličink pred negativni vplivi iz okolja, tudi pred delovanjem insekticidov, ki jih uporabimo proti njim. Zatiranje bolšice otežuje majhen izbor močno učinkovitih pripravkov in njena sposobnost hitrega pridobivanja odpornosti proti insekticidom, ki jih pogosto uporabljamo. Cilj raziskave je bil preučiti možnosti zatiranja bolšice v spomladanskem obdobju z uporabo novih dodatkov pripravkom, v primerjavi s standardnimi pripravki. Poskus na lokaciji Ljutovo (severna Srbija) je bil zasnovan v skladu s standardom EPPO (No. 4 / 1982). Pred začetkom škropljenj smo na drevesih označili štirikrat po 10 enoletnih poganjkov (dolžina približno 20 cm) na katerih smo prešteli vse nimfe, ločeno stadije L<sub>1-3</sub> in ločeno stadije L<sub>4-5</sub>. Razmerje med stadiji L<sub>1-3</sub> in L<sub>4-5</sub> je bilo 84,51% proti 15,49 %. Aplikacijo insekticidov smo opravili 7. maja 2003. Oceno učinkovitost pripravkov smo naredili 10. in 17. maja. Pri ocenjevanju smo prešteli žive in mrtve ličinke različnih stadijev. Preučevali smo naslednje pripravke: Dimilin SC-48 (0,024%) + omočilo Silwet L-77 (0,05%), Mitac-20 (0,3%, primerjalni standard) in Dimilin SC-48 (0,024%) + omočilo Belol (0,25%, primerjalni standard). Izračun stopnje učinkovitosti pripravkov smo opravili po metodi Henderson-Tilton in z uporabo analize probit vrednosti. Pri kombinaciji pripravka Dimilin in omočila Silwet smo ugotovili zelo visoko učinkovitost za zatiranje ličink L<sub>1-3</sub> že po treh dneh. Pri pripravku Mitac in pri kombinaciji pripravka Dimilin z oljem Belol smo ugotovili značilno manjšo učinkovitost (pod 80%). Vse tri kombinacije so imele v času 10 dni po aplikaciji visoko učinkovitost (95%) tudi proti ličinkam višjih stadijev. Glede na ugotovljeno stopnjo učinkovitosti lahko vse tri pripravke še vedno priporočamo za uporabo, pri tem, da jih je potrebno uporabiti proti najmlajšim stadijem nimf.

**Ključne besede:** hruška, zatiranje, *Cacopsylla pyri*, insekticidi, diflubenzuron, amitraz

*ABSTRACT*

### **Recent possibilities of *Cacopsylla pyri* L. (Homoptera, Psyllidae) control at the beginning of vegetation**

Rising of commercial pear orchards caused significant changes in producing technology and enabled development of the pests significant for fruit quality. One of the expressed pests in

such ecological conditions is *Cacopsylla pyri* L. - pear psyllid. Primary damage is caused by sucking the juices from youngest plant parts, which cause leaf drop and reduced yield and secondary ones in the production of the great quantities of honeydew in which live larvae. Along with being good medium for fungi development that colors black all colonized fruit organs, it protects larvae from exterior conditions (including insecticides as well). Control of larvae is also made difficult by small number of efficient active ingredients, as well as rapid development of resistance to long used ones. The aim of the study was to determine favorable moment for *C. pyri* control at early spring based upon bionomy of the pest and to estimate efficiency of new insecticides by their comparison with untreated control and standard. The trial was set up in the locality of Ljutovo (northern Serbia), according to EPPO No. 44 (1982) methodology for the control of *C. pyri*. Before setting up of the trial 10 branches, 20 cm in length, were marked and counted for the presence of larvae L<sub>1-3</sub> and L<sub>4-5</sub>, in four replications. Larvae L<sub>1-3</sub> were represented by 84.51% and L<sub>4-5</sub> by 15.49%. Treatment was performed on 7 May 2003. Efficacy evaluation of the pesticide was done on 10 and 17 May 2003, when alive and dead larvae were counted per categories. In the control of *C. pyri* were applied following insecticides: Dimilin SC-48 in concentration of 0.024% and in the combination with wetting agent Silwet L-77 (0.05%). Mitac-20 (0.3%) and Dimilin S-48 + Belol (0.024%+0.25%) were used as standard. Efficacy of the studied insecticides was evaluated according to Henderson-Tilton formula (cit. Wetzel, 1984) and in probit values. Obtained results in the control of larvae L<sub>1-3</sub> suggest that combinations Dimilin SC-48 + Silwet L77 showed high efficacy that was visible three days after treatment. Very high efficacy of over 80%, three days after treatment Dimilin SC-48 + Belol (0.024%+0.25%), Mitac-20 (0.3%) in reducing young larvae was below 80%. Results of the studies in reducing populations of L<sub>4-5</sub> larvae suggest that three days after treatment the most efficient were Dimilin S-48 + Silwet L-77 (0.024+0.05) and Mitac -20 (0.3). Insecticide Dimilin S-48 + Belol (0.024+0.25) showed the lowest efficacy. Ten days after treatment all of the studied insecticides showed very high efficacy of over 95% in the control of pear psyllid larvae (all stages). Based upon studies we can recommend all the studied insecticides and combinations for use. However, they should be applied when dominance of younger larvae L<sub>1-3</sub> in an orchard is obvious.

**Key words:** pear, control, *Cacopsylla pyri*, insecticides, diflubezuron, amitraz



### **Ridomil gold MZ Pepite – Nova formulacijska tehnologija za boljšo učinkovitost in okoljske lastnosti ter lažje rokovanje**

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Formulacija novih ridomilov se imenuje "Pepite". Zaščiteno trgovsko ime „Pepite“ Syngenta se uporablja za formulacijo, ki temelji na proizvodnem procesu „fluid bed“. Ta proces omogoča proizvodnjo posebnih močljivih zrn (WG), ki imajo več prednosti v primerjavi z drugimi WG formulacijami. Nekateri WG pripravki se dobro dispergirajo, a slabo omočijo, ali nasprotno; v tem smislu je „Pepite“ formulacija nedvomno najboljši standard. Nova

tehnologija omogoča, da so delci z aktivno snovjo v pripravku veliko manjši. To je ključnega pomena predvsem za kontaktne aktivne snovi, kot je mancozeb, kjer je pri isti količini aktivne snovi na voljo najmanj dvakrat več kontaktnega površja kot pri standardnih formulacijah, to pa je glavni razlog za v številnih poskusih ugotovljeno boljšo učinkovitost Ridomila Gold MZ Pepite v primerjavi z Ridomilom Gold MZ WP. „Pepite“ zrnca so izredno kompaktna, brez zraka v notranjosti, zato se aktivna snov v zrnih praktično ne razgrajuje, kot npr. pri WP formulacijah ali nekoliko manj pri drugih WG formulacijah. „Pepite“ zrnca so zelo trda in čvrsta, zato pri rokovanju ne prihaja do prašenja, v izpraznjeni embalaži pa praktično ni ostankov pripravka. V letu 2004, ko so bile razmere za razvoj bolezni gliv plesnivk zelo ugodne, so programi na podlagi Ridomila Pepite v poskusih inštitutov v Sloveniji pokazali najboljšo učinkovitost med vsemi preizkušanimi programi pri vinski trti in krompirju.

**Ključne besede:** metalaksil, mancozeb, formulacije pripravkov, fungicidi

#### *ABSTRACT*

#### **Ridomil Gold MZ Pepite – New formulation technology for better efficacy, environment profile and for optimum ease of handling**

New Ridomils are formulated as a “Pepite”. The brand name „Pepite“ has been given by Syngenta to a type of formulation using the „fluid bed“ manufacturing process. This method produces special water-dispersible granules (WGs) that have positive characteristics compared to other types of WG formulations. Some WGs are dispersible with poor wettability, others have a good wettability with poor dispersion; Pepite formulation is clearly the best standard in this respect. Due to this innovative technology the particle size of the a. i. is very small. This is a key benefit for contact products as mancozeb where for the same weight minimum two times more a. i. surface is available compared to standard formulations, which is the major reason for better efficacy observed in trials with Ridomil Gold MZ Pepite formulation compared to the Ridomil Gold MZ WP formulation. „Pepite“ granule is very compact, with no air inside which means less degradation of a. i. by air which is a problem of main WPs and to less extent with other WGs. Due to the hardness of the granules there is no dust while handling and no remaining product in the emptied package ready for disposal. In extremely favourable conditions for *Oomyces* development in 2004, spraying programmes based on Ridomile Pepite expressed the best performance vs. all other programmes tested in grapes and potatoes by institutes in Slovenia.

**Key words:** metalaksil, mancozeb, pesticide formulations, fungicides





## **Envidor –akaricid, nov in drugačen**

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Rdeča sadna pršica (*Panonychus ulmi*) je reden škodljivec na sadnem drevju in na vinski trti, ki ob prerazmnožitvi povzroči veliko škodo. Učinkovina spirodiklofen prihaja iz nove kemične skupine in ima drugačen način delovanja v primerjavi z ostalimi akaricidi. Deluje tako, da prepreči sintezo maščobnih kislin. Spirodiklofen deluje na rdečo sadno pršico (*Panonychus ulmi*) in na navadno pršico (*Tetranychus urticae*), ima pa delno delovanje tudi na navadno hruševo bolšico (*Psylla piri*) in na vejčastega kaparja (*Lepidosaphes ulmi*). Envidor deluje na vse stadije pršic, tudi na jajčeca. Najboljši čas uporabe je pred prerazmnožitvijo pršice, nazadnje pa lahko sredstvo uporabimo 14 dni pred obiranjem. Envidor se lahko uporabi samo enkrat v rastni dobi, zaradi tega, da se ne pojavi rezistenca. Je neškodljiv za naravne sovražnike pršic (črna polonica, plenilske pršice, plenilske stenice...) in ima izredno dolgo delovanje, saj ga dež težko izpere.

**Ključne besede:** akaricid, rdeča sadna pršica, navadna pršica, sadno drevje, vinska trta

### *ABSTRACT*

#### **ENVIDOR – new acaricide based on spirodiclofen**

European red mites (*Panonychus ulmi*) are regular pests in orchards and in vineyards where they make a lot of damage when they overmultiply. The active ingredient spirodiclofen belongs to new chemical group and it has a new mode of action. Spirodiclofen inhibits lipid synthesis. Spirodiclofen shows good efficacy against spidermites - *Panonychus ulmi* and *Tetranychus urticae* and also controls some insect pests - *Psylla piri* and *Lepidosaphes ulmi*. Envidor is active against all developmental stages of mites, including eggs. The optimal time for use is at the beginning or at a low level of mite infestation, at last you can use it 14 days before picking the fruits. Envidor can be used only once in one season – to prevent the development of mite resistance. It does not harm beneficials (*Stethorus punctillum*, Phytoseiidae, Anthocoridae...) and it has a long duration of action, because the rain can not wash it off

**Key words:** acaricide, European red mite, twospotted spidermite, fruits, **grapevine**



**Ecodian Star in Ecodian CM - nove možnosti zatiranja jabolčnega zavijača (*Cydia pomonella*) in breskovega zavijača (*Cydia molesta*) z dezorientacijo; za biotično in integrirano varstvo nasadov.**

Andrej KOS

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Jabolčni in breskov zavijač na jablanah ter breskov zavijač na breskvah, povzročata v zadnjih letih, v slovenskih sadovnjakih, precej škode. Vzroke za močnejši pojav lahko iščemo v klimatskih spremembah, upoštevanju načel integriranega varstva, ki je močno zmanjšal število dovoljenih insekticidov in delno neupoštevanje lastnosti, oziroma načina delovanja določenih insekticidov v danih razmerah. ECODIAN® je nov pripravek na podlagi feromonov, za zatiranje škodljivih metuljkov iz rodu *Lepodoptera*, z dezorientacijo. Metodo in pripravek je razvilo podjetje ISAGRO S.p.A. iz Italije. Dispensorji, ki so prepojeni z ustrezno količino feromona, so izdelani iz koruznih amidov (MATER-BI®), ki so biotično razgradljivi in ne obremenjujejo okolja. Količina feromona v dispensorjih je le tolikšna, da samce ne zmede, ampak jih le dezorientira ter preusmeri na dispensorje. Na ta način samec ne najde samice in je ne more oploditi. Dispensorji, odvisno od tipa, sproščajo feromon enakomerno in kontinuirano, do 60 dni v okolico, ne glede na temperaturo in nagnjenost terena ter v tem obdobju zagotavljajo zelo učinkovito varstvo. ISAGRO S.p.A. je razvil več različnih tipov dispensorjev ECODIAN®, za zatiranje različnih škodljivcev iz vrste *Lepidoptera*, v delu pa sta predstavljena ECODIAN STAR za zatiranje jabolčnega in breskovega zavijača na jablanah in ECODIAN CM za zatiranje breskovega zavijača na breskvah in nektarinah. Dobra učinkovitost te metode je bila potrjena tudi v biotičnih poskusih, tako v tujini in tudi Sloveniji, kar kaže, da bomo lahko to metodo uspešno uporabljali v integriranem varstvu kot dopolnilo kemičnim pripravkom in biotični pridelavi.

**Ključne besede:** *Cydia pomonella*, *Cydia molesta*, zatiranje, metoda zbejanja

*ABSTRACT*

**Ecodian Star and Ecodian CM - new chance against *Cydia pomonella* and *Cydia molesta* by the method of »disorientation«; for biotical and integrated control of orchards**

In the last few years we have in Slovenia a lot of problems with *Cydia pomonella* and *Cydia molesta* in apple orchards and with *Cydia molesta* in peach orchards. We can say that the reason for higher appear of *Cydia pomonella* and *Cydia molesta* are:

- in change of weather conditions;

- and in principle of integrated control which reduced the number of permitted insecticides.

ECODIAN® is a new preparation based on pheromone against butterflies of Lepidoptera species by the method of false-trail following, or »disorientation«. The method and preparation were development by ISAGRO S.p.A., Italija. Isagro's Ecodian dispensers are made of Mater-Bi (amid of corn) , that is a mixture of biodegradable materials so this have

result of new plant protection guidelines granting a future premium on the adoption of innovative methodologies that are respectful of the environment and consumers health.

The low pheromone dosage in dispenser is able to compete with those of the female insect and thus disorientate males in their search of partners. Because of that the male couldn't fecundate the female. Pheromone dispenser, depend on type, have an average equiable duration of 60 days. It has very high efficacy without depend of temperature and inclination of ground. ISAGRO S.p.A. developed many different type of dispensers ECODIAN<sup>®</sup>, against different pest of *Lepidoptera species*, but here we are presenting only ECODIAN STAR against *Cydia pomonella* and *Cydia molesta* on apple tree and ECODIAN<sup>®</sup> CM against *Cydia molesta* on peach. In biotical trials the methode of confusion with diffusors ECODIAN STAR showed excellent results as in Slovenia as in other country. So we can say that we could usefull use this method in integrated control as complement to other chemical products and in biotical produce.

**Key words:** *Cydia pomonella*, *Cydia molesta*, insect control, insect mating disruption



### **Madex, granulozni virus *Cydia pomonella* – alternativna rešitev v boju proti jabolčnemu zavijaču**

Metka TROBIŠ in sodelavci<sup>1</sup>, Gustav MATIS in sodelavci<sup>2</sup>

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Odkritje virusa granuloze jabolčnega zavijača (CpGV) sega v leto 1963 (Mehika). Vsi tržni pripravki so še danes izvorno iz primarnega soja, čeprav je bila latentna navzočnost virusa granuloze v naravnih populacijah jabolčnega zavijača do danes potrjena tudi v Italiji, Rusiji, Poljski, Kanadi in Angliji. Iz navedenega lahko sklepamo, da je okužba tudi v slovenski populaciji, zato tretiranje ne pomeni vnosa novih organizmov, temveč večanje navzočnosti obstoječih. Od petih pripravkov sta v prometu v EU samo Madex in Carpovirusin, od katerih je Madex, proizvajalca Biocontrol AG, Švica, od leta 2004 registriran v R Sloveniji. Okužba ličink jabolčnega zavijača je izključno oralna. Ob upoštevanju mesta izleganja jajčec in prehranjevalnih specifičnosti škodljivca daje uporaba v času prvega rodu najboljši rezultat. Madex sodi v skupino ekološko najbolj sprejemljivih pripravkov. V prispevku prikazujemo rezultate dvoletnih slovenskih preizkušanj pripravka v različnih modelnih postopkih. Tudi slovenske izkušnje potrjujejo učinkovitost, predhodno dokazano v najvidnejših sadjarskih okoliših Evrope.

**Ključne besede:** *Cydia pomonella*, zatiranje, entomopatogeni virusi, virus granuloze CpGV

## ZUSAMMENFASSUNG

### **Madex, Granulose Virus *Cydia pomonella* – die alternative Lösung gegen den Apfelwickler**

Granulose Virus des Apfelwicklers (CpGV) wurde im Jahr 1963 in Mexico entdeckt. Obwohl die latente Verseuchung der natürlichen Apfelwicklerpopulationen mit den Granulose Viren bis heute in Italien, Russland, Polen, Kanada und England bestätigt wurde, stammen nach wie vor alle Handelsprodukte aus dem primären Stamm. Deshalb können wir mit hoher Wahrscheinlichkeit annehmen, dass auch die slowenische Population des Schädlings damit latent verseucht ist. Die Produktausbringung bedeutet dadurch keine Einfuhr von neuen Organismen, sondern die Erhöhung der bereits Vorhandenen. Von den fünf derzeit vermarkteten Produkten sind innerhalb des EU-Raumes nur zwei (Madex und Carpovirusin) amtlich zugelassen; davon Madex, hergestellt von Biocontrol AG, Schweiz seit 2004 in Slowenien. Die Infektion der Apfelwickler-Larven erfolgt ausschliesslich oral. Unter Berücksichtigung der Ei-Ablagestelle, wie auch der Ernährungsspezifika ist am Erfolgreichsten die Produktapplikation in der ersten Population des Schädlings. Madex zählt in die Gruppe der umweltfreundlichsten Produkte. Im nachstehenden Beitrag berichten wir über zweijährige Ergebnisse aus Slowenien in verschiedenen Versuchsmodellen. Die angegebenen Daten bestätigen die Wirksamkeit, die bereits in den wichtigsten Obstbauregionen Europas festgestellt wurde.

**Key words:** *Cydia pomonella*, Granulose Virus (CpGV)



### **Euparen multi**

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V letu 2001 smo na mesto Euparena z aktivno učinkovino diklofluanid v Sloveniji pridobili registracijo za Euparen multi, proizvajalca Bayer CropScience, ki vsebuje 50 % tolilfluanid – a. Z novo učinkovino smo tako dobili pripravek, ki je prilagojen vsem zahtevam sodobnega varstva rastlin. Poleg fungicidnega učinka nam nova učinkovina tolilfluanid prinaša, še posebej v programih varstva sadnega drevja, veliko pozitivnih stranskih učinkov.

**Ključne besede:** Euparen multi, tolilfluanid, sodobno varstvo rastlin varstvo krompir, programi, fungicidi, Bayer CropScience

### *ABSTRACT*

### **Euparen multi**

In 2001 we obtained in Slovenia the marketing authorization for Euparen multi, manufactured by Bayer CropScience, which contains 50 % tolilfluanide, instead of Euparen,

which contains the active substance diclofluanide. Due to the new active substance we have thus obtained a preparation which meets all the requirements of the modern crop protection. In addition to its fungicidal effect, the new active substance tolilfluanide brings about many favourable side effects, in particular regarding the fruit-tree protection.

**Key words:** Euparen multi, tolilfluanide, modern crop protection, potato protection, programmes, fungicides, Bayer CropScience.



### **Pripravka družbe BASF na osnovi nove aktivne snovi boskalid, Cantus in Collis**

Damjan Finšgar

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Razvoj novih aktivnih snovi v fitofarmaceutskih pripravkih je usmerjen v iskanje takšnih, ki zatirajo večje število bolezní in se uporabljajo v številnih kulturah. To je pomembno predvsem pri t.i. malih kulturah kot je vinska trta, sadno drevje in zelenjava. V družbi BASF so razvili aktivno snov boskalid s specifičnim mehanizmom delovanja na patogene glive in možnostjo uporabe v številnih kulturah v sadjarstvu, vinski trti, poljedelstvu in zelenjadarstvu. Fungicidi, kombinacije aktivne snovi boskalid z drugimi aktivnimi snovmi družbe BASF, omogočajo razširitev in izboljšanje učinkovitosti delovanja takšnih pripravkov na bolezní rastlin. Pripravek Cantus je namenjen zatiranju sive grozdne plesni vinske trte (*Botrytis cinerea*) in čopičastih plesni (*Penicillium* spp.). Za zatiranje sive grozdne plesni je na voljo manjše število botriticidov. Vsak novi pripravek, ki ima drugačen mehanizem delovanja od poznanih pripravkov, takšen je Cantus, je pomemben za pridelovalce grozdja pri zatiranju sive grozdne plesni posebej pri načrtovanju antirezistenčne strategije zatiranja bolezní. Cantus, uporabljen za prvo škropljenje zatiranja sive grozdne plesni, zadovoljivo zatira tudi oidij vinske trte in sekundarne bolezní *Penicillium* spp.. Kombinirane pripravke, kot je Collis, zaradi antirezistenčne strategije, praviloma sestavljajo aktivne snovi z različnim mehanizmom delovanja. Aktivni snovi, ki jih vsebuje pripravek Collis, sestavljata boskalid in krezoxim metil. Imata različne mehanizme delovanja na patogene glive. Collis je v Sloveniji registriran za zatiranje oidija vinske trte (*Uncinula necator*). Uporaba je priporočena v obdobju največje nevarnosti pojava te bolezní.

**Ključne besede:** boskalid, fungicidi

*ABSTRACT*

### **New BASF fungicides Cantus and Collis based on boscalid active substance**

New plant protection products are most often developed for large crops rather than for crops with smaller application potential, such as the diverse fruits and vegetables. With boscalid, BASF has been successful in developing a new fungicide active ingredient with a new unique mode of action for use in a wide spectrum of crops for many fruits and vegetables,

grapes, turf and various agronomic crops, for example oilseed rape/canola. Through the combination of boscalid with other BASF fungicides, it is possible to broaden the activity spectrum and to thus round it off. The result is a family of products that offers an unusually wide spectrum of activity and one which meets the performance level of the most modern fungicides currently available. Boscalid inhibits the enzyme succinate ubiquinone reductase, also known as complex II, in the mitochondrial electron transport chain. Like the other complexes of the respiratory chain (I, III and IV), this enzyme is a component of the inner mitochondrial membrane. However, it does not function as a proton pump and its relatively simple structure consists of only four nucleus-encoded sub-units. Two of these polypeptides anchor the complex in the membrane whilst the others project into the mitochondrial matrix where they catalyse the oxidation of succinate to fumarate as part of the tricarboxylic acid (TCA) cycle. The electrons so released are channeled into the electron transport chain via the co-substrate ubiquinol (QH<sub>2</sub>). Efficacy of boscalid against *Botrytis cinerea* and *Penicillium* spp. in grapes, product CANTUS. To control *Botrytis cinerea*, grape growers have access to a limited number of effective active ingredients. With its new mode of action, boscalid is extraordinarily effective and also controls strains that have developed resistance to other products. With application of boscalid at the customary timings for Botrytis control, an additional powdery mildew treatment becomes unnecessary, because boscalid is also active against this fungus. Secondary diseases such as Penicillium rot, dreaded in wine grape culture, are also controlled. Boscalid provides the basis for a pure, healthy wine. Efficacy of boscalid plus kresoxim-methyl against *Uncinula necator* and *Botrytis cinerea* in grapes, product COLLIS. In the combination boscalid plus kresoxim-methyl, two different modes of action for the control of powdery mildew are united. The result is, that in addition to the extraordinary mildew activity in grapes, vegetables and ornamentals, an especially good residual activity has been observed. The combination boscalid and kresoxim-methyl is an important instrument for resistance management and is ideal for integrated pest management programmes.

**Key words:** boscalid, fungicides, disease control

## **Fitovirologija in fitobakteriologija**

## **Sistem zagotavljanja kakovosti laboratorijskih analiz na modelu določanja bakterij krompirja**

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Na Nacionalnem inštitutu za biologijo smo začeli z vzpostavljanjem sistema za zagotavljanje kakovosti laboratorijske diagnostike po letu 1997 z začetkom opravljanja analiz na obe karantenski bakteriji, ki okužujeta krompir: *Ralstonia solanacearum* (Smith) Yabuuchi *et al.*, ki povzroča rjavo gnilobo gomoljev krompirja in *Clavibacter michiganensis* (Smith) Davis *et al.* ssp. *sepedonicus* (Spieckermann and Kotthoff), Davis *et al.*, ki povzroča obročkasto gnilobo gomoljev krompirja. Pripravili smo prve postopke in navodila, ki so vključevala celotno shemo testiranja, ter opise posameznih testov, kakor tudi ustrezne obrazce. Celoten sistem smo stalno dograjevali ter sodelovali pri pripravi diagnostičnih protokolov v okviru EPPO (European Plant Protection Organization) Panela za bakteriologijo in v okviru Evropskega projekta Diagpro v ring testu v katerem se je preizkušala specifičnost in občutljivost posameznih metod, tudi najnovejših kot sta FISH (Fluorescent In Situ Hybridisation) in PCR v realnem času. Sodelovali smo tudi pri pripravi obeh EU direktiv. Na njuno implementacijo se je bilo potrebno dodatno pripraviti, saj sta uvedli dodatne teste (FISH in PCR) kot prve presejalne teste. Za njuno zanesljivo uporabo v presejalnih testih pa je potrebno zagotoviti primerno občutljivost in vključiti dodatne parametre, ki zagotavljajo nadzor inhibicije. V prispevku bodo opisani osnovni elementi zagotavljanja kakovosti na primeru laboratorijske diagnostike obeh karantenskih bakterij in rezultati testiranja vzorcev krompirja v letu 2003/2004. Opisali bomo tudi novosti ki jih prinašajo nove direktive in omogočajo skrajševanje časa analiz v primeru pozitivnega prvega presejalnega testa na podlagi uvedbe novih metod v diagnostiko omenjenih bakterij.

**Ključne besede:** *Ralstonia solanacearum*, *Clavibacter michiganensis*, detekcija, laboratorijske tehnike

### *ABSTRACT*

#### **Quality assurance for laboratory analysis shown on bacteria infecting potato as a model system**

National Institute of Biology started with introduction of quality assurance system in diagnostic laboratories after year 1997 when we began with diagnosis of quarantine potato bacteria *Ralstonia solanacearum* (Smith) Yabuuchi *et al.*, causative agent of potato brown rot and *Clavibacter michiganensis* (Smith) Davis *et al.* ssp. *sepedonicus* (Spieckermann and Kotthoff), Davis *et al.*, causative agent of potato ring rot. We elaborated standard operational procedures and schemes of testing, including different forms. The whole system has been continuously upgrading until now. We are active in EPPO (European Plant Protection Organization) Panel on bacteriology. We took part in preparation of EU Directives and in ring test in the frame of EU project DIAGPRO, where specificity and sensitivity of new



methods FISH (Fluorescent in Situ Hybridisation) and Real time PCR were tested. During year 2004 we were preparing ourselves to introduction of FISH and PCR as one of the first screening tests with required sensitivity. Additional parameters were added to assure quality of analysis. We will present basic elements of quality assurance system in the case of potato quarantine bacteria and results of testing in years 2003/2004, as well as novelties in new directives which will shorten time needed for analysis performance.

**Key words:** *Ralstonia solanacearum*, *Clavibacter michiganensis*, laboratory detection



### **Bakterijski ožig vinske trte (*Xylophilus ampelinus* [Panagopoulos] Willems *et al.*) - nova ali že stara bolezen v Sloveniji?**

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Bakterijski ožig vinske trte, ki ga povzroča bakterija *Xylophilus ampelinus* (Panagopoulos) Willems *et al.*, ima v EU karantenski status (seznam II.A.II) in je zato tudi v Sloveniji pod uradnim nadzorom. V Sloveniji je znana najbrž že iz konca petdesetih in začetka šestdesetih let, ko je bilo na območju zgornje Vipavske doline in okolice Štjaka na Krasu ugotovljeno množično odmiranje trt sorte 'rebula', 'pinela' in še nekaterih drugih sort. Bolezen se je v nekoliko večjem obsegu ponovno pojavila v sredini osemdesetih let v Vedrijanu in Višnjeviku v Goriških Brdih ter v zelo omejenem obsegu v okolici Dornberka in Šmarij v Vipavski dolini. V tistem obdobju je bilo zabeleženo tudi manjše žarišče te bolezni v Vidošičih v Beli Krajni. Trenutno so še vedno živa le manjša žarišča v Vedrijanu v Goriških Brdih, medtem ko so bila ostala žarišča sanirana z zamenjavo odpornih sort. Posledice pojava te bolezni so pri občutljivih sortah ponavadi zelo težka, saj okuženi trsi postopno hirajo in pogosto v nekaj letih propadejo. V okuženih vinogradih se bolezen navadno hitro širi, zlasti z rezjo in obdelovanjem tal. Med najbolj občutljive sorte vinske trte, ki se gojijo pri nas, spadajo 'rebula', 'barbera', 'pinela' in 'kraljevina'. Čeprav smo na podlagi značilnih bolezenskih znamenj in načinu širjenja bolezni od sredine osemdesetih let vseskozi pripisovali bakteriji *Xylophilus ampelinus*, pa je bilo to laboratorijsko potrjeno šele pred kratkim (Dreo in sod., 2004). Obvladovanje bolezni je na splošno zelo težavno in navadno uspešno le, če na okuženem območju povsem opustimo gojenje občutljivih sort. V prispevku bo predstavljena zgodovina pojavljanja in trenutno stanje razširjenosti te bolezni v Sloveniji, bolezenska znamenja, njen fitosanitarni položaj in gospodarski pomen ter možnosti za njeno obvladovanje.

**Ključne besede:** *Xylophilus ampelinus*, trta, Slovenija

## ABSTRACT

### **Bacterial blight of grapevine (*Xylophilus ampelinus*) - a new or an old disease in Slovenia?**

Bacterial blight of grapevine caused by the bacteria *Xylophilus ampelinus* (Panagopoulos) Willems *et al.* is a quarantine pest in EU (list II.A.II) and therefore under official control also in Slovenia. It is probably present in Slovenia since the late fifties or early sixties, when a mass decline of some grapevine varieties (e. g. 'Rebula', 'Pinela') in upper Vipava valley and in the area around Štjak in the Karst was observed. In the mid-eighties a new outbreak of the disease occurred in the surroundings of Vedrijan and Višnjevnik villages in Goriška Brda and again in a very limited proportion in some localities in Vipava valley (Dornberk, Šmarje). In that period a small focus of this disease near Vidošiči in Bela Krajna was also recorded. At present only focuses around the village Vedrijan in Goriška Brda still exist, while other known focuses were successfully eradicated through the elimination of sensitive varieties and planting of tolerant ones. For sensitive varieties the consequences of this disease are mostly very serious, because infected vine stocks weaken progressively and they often die after few years. Inside the infected vineyards the disease is spread in particularly by means of pruning and soil cultivation. The most sensitive grapevine varieties growing in this area are 'Rebula', 'Barbera', 'Pinela' and 'Kraljevina'. The causal organism *Xylophilus ampelinus* has been confirmed by laboratory means only very recently (Dreo *et al.*, 2004), although its identity based on characteristic symptoms and aetiology of the disease observed was quite certain also before. The control of the disease is particularly difficult and usually successful only if sensitive varieties are omitted in the infected area. In the present work the history, phytosanitary classification and the current distribution of the disease in Slovenia, as well as symptoms, its economic importance and measures for the control will be presented in more detailed.

**Key words:** *Xylophilus ampelinus*, grapevine, Slovenia



### **Laboratorijsko določanje počasi rastoče bakterije *Xylophilus ampelinus* na vinski trti**

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Bakterija *Xylophilus ampelinus* (Panagopoulos, 1969) *comb nov.* (Willems *et al.*, 1987) povzroča bakterijski ožig vinske trte. Bolezen lahko povzroči veliko škodo saj slabi rastline

ali celo uniči trse. Pogosta je tudi v prikriti obliki in takšna se uspešno širi s sadilnim materialom. Laboratorijsko določanje bakterij, ki skuša slediti Kochovim postulatam, je pri tej bolezni še posebej težavno. Bakterija živi v rastlinah najpogosteje neenakomerno v nizkih koncentracijah, na gojiščih izredno počasi raste, potrjevanje patogenosti izoliranih bakterij pa je nezanesljivo. Potem ko so v Sloveniji o njej po opažanjih znamenj bolezni prvič poročali v 60-tih letih, predvsem iz vinogradov na Primorskem, smo jo v vzorcu sorte Rebula iz enega takšnih vinogradov leta 2002 kljub težavni analizi tudi laboratorijsko potrdili. Znamenja bolezni v obliki madežev na listih so bila na tej sorti v tem letu še posebej izrazita, v takem primeru je koncentracija bakterij velika kar je olajšalo njihovo izolacijo na gojiščih. Dobljeni izolat smo potrdili kot *Xylophilus ampelinus* z uporabo različnih testov: z biokemijskimi, nutritivnimi, profilom maščobnih kislin, določanjem zaporedja nukleotidov dela gena za 16S rRNA, vgnezditveno PCR reakcijo, PCR v realnem času ter testom patogenosti. Iz drugih delov okužene rastline bakterije nismo mogli izolirati kljub pozitivnim rezultatom molekularnih metod, kar potrjuje omejitve klasičnih metod pri počasi rastočih bakterijah, za katere niso izdelana primerna selektivna gojišča. Pojavljanje znamenj bolezni ter učinkovitost diagnostičnih metod smo še nadaljnji dve leti spremljali v okviru posebnega nadzora bakterijskega ožiga vinske trte v koordinaciji Fitosanitarne uprave RS.

**Ključne besede:** *Xylophilus ampelinus*, laboratorijsko določanje, trta

#### ABSTRACT

#### **Laboratory detection of a slow-growing bacterium of grapevine, *Xylophilus ampelinus***

Bacteria *Xylophilus ampelinus* (Panagopoulos, 1969) *comb nov.* (Willems *et al.*, 1987) is a causal agent of bacterial blight of grapevine. Damage to the vineyards can be extensive as the affected vines weaken and decay. It is often present in latent form and as such is mainly spread via propagating material. Bacteria are usually present in low concentrations and unevenly distributed in plants. They grow only slowly on media. Reproduction of symptoms on host plants is unreliable. Based on visual observations the disease has been recorded in Slovenia, particularly in some vineyards of Primorska region during the 1960-ties. In 2002 presence of *X. ampelinus* was laboratory confirmed in a sample of Rebula cultivar from one such vineyard. Concentration of bacteria was high in characteristic lesions on leaves and that facilitated their isolation on media. The isolate has been identified and confirmed as *X. ampelinus* using biochemical and nutritional tests, fatty acids profile analysis, partial sequencing of 16S rRNA gene, nested-PCR, real-time PCR and pathogenicity test. Despite positive results of molecular tests on extracts from different parts of the same vine no further isolates could be obtained. This confirms limitations of classical methods in cases of slow-growing bacteria for which selective media are not available. The efficacy of diagnostic methods was further evaluated during subsequent two years in the frame of systematic survey of plant pests coordinated by Phytosanitary Administration of the Republic of Slovenia.

**Key words:** *Xylophilus ampelinus*, laboratory detection, grapevine



## **Problematika oljčnega raka (*Pseudomonas syringae* ssp. *savastanoi* pv. *Oleae*)**

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Oljčni rak je bakterijska bolezen, ki napada nekatere predstavnike iz družine Oleaceae. Gospodarsko škodo povzroča predvsem na oljkah (*Olea europaea*) in v drevesnicah, kjer okužuje gostiteljske rastline. V Sloveniji je približno 800 ha oljčnih nasadov, kar je ustrezen potencial za širjenje bolezni. V letu 2004 smo v nekaterih oljčnih nasadih, v Koprskem okolišu vzorčili nekaj dreves z bolezenskimi znamenji. Z laboratorijskimi analizami, smo potrdili bakterijo *Pseudomonas syringae* ssp. *savastanoi* pv. *oleae*. Varstveni ukrepi pred oljčnim rakom, so tako kot pri ostalih bakterijskih boleznih omejeni, zato je potrebno pravočasno odkrivanje bolezenskih znamenj in sanacija.

**KLjučne besede:** oljka, *Olea europaea*, gostiteljske rastline, oljčni rak, *Pseudomonas syringae* ssp. *savastanoi* pv. *Oleae*

### *ABSTRACT*

#### **Study of the olive tree knot disease (*Pseudomonas syringae* ssp. *savastanoi* pv. *Oleae*)**

Olive tree knot disease is bacterial disease harmful for some plants in *Oleaceae* family. Economically important damage causes particularly on olive tree and in nurseries, where infect host plants. In Slovenia is approximately 800 ha olive tree orchards, what represent spreading potential of bacterial disease. In 2004 we went in some olive tree orchards in Koper district and took some samples from trees with recognisable symptoms. With laboratory analysis we confirm presence of *Pseudomonas syringae* ssp. *savastanoi* pv. *oleae*. Because of limited disease control against olive tree knot disease and other bacterial diseases it is very important detection of symptoms and sanitation.

**Key words:** olive tree, *Olea europaea*, host plants, olive tree knot disease,



## **Pojav novega virusa na vinski trti**

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V letu 2001 in 2002 smo na trsnih cepljenkah sorte Laški Rizling opazili bolezenska znamenja, ki so nakazovala okužbo z virusom, ki ni običajen za vinsko trto. V letu 2002 smo zato začeli z natančnejšimi raziskavami povzročitelja in ugotovili vseh rastlinah, ki so kazale

bolezenska znamenja, '*Raspberry bushy dwarf idaeovirus*' (RBDV). Ta virus običajno okužuje maline in robide ter druge vrste iz rodu *Rubus*. Naša najdba je bila v svetu prva najdba naravne okužbe s tem virusom na rastlinah zunaj rodu *Rubus*. Pri teh je občutljivost na virus zelo različna. Pri občutljivih sortah povzroča zmanjšanje količine in kakovosti pridelka, pojavljanje različnih bolezenskih znamenj in vpliva na prirast in življenjsko dobo trsov. Vse to ima velik gospodarski pomen. Iz tega smo sklepali, da se tudi odziv različnih sort vinske trte na okužbo lahko razlikuje. Tako smo do konca leta 2004, v izbranem vinogradu sorte Laški Rizling, spremljali približno 100 rastlin in jih dvakrat letno testirali na RBDV. Poleg tega smo na Primorskem in Štajerskem testirali različne sorte vinske trte na več lokacijah, da bi ugotovili geografsko razširjenost virusa in njegovo zastopanost v rastlinah različnih sort. Ugotovili smo, da je RBDV razširjen na obeh območjih in da je z njim okuženih več belih sort. Podrobnejši rezultati bodo predstavljeni v prispevku.

**Ključne besede:** 'Raspberry bushy dwarf idaeovirus', trta, detekcija, Slovenija

*ABSTRACT*

### **Discovery of a new virus in grapevine**

In 2001 and 2002 unusual virus symptoms were observed on grapevine grafts (*Vitis vinifera*) of cv. Laški Rizling. In 2002 detailed research of the virus, possibly causing the symptoms, was started. All symptomatic plants tested were positive for *Raspberry bushy dwarf idaeovirus* (RBDV) which is a common pathogen of *Rubus* species. Our finding was a first natural infection with RBDV on non-*Rubus* species. The sensitivity of *Rubus* species to RBDV infection depends on variety. In sensitive varieties it causes development of different symptoms, reduces quality, yield and plant vigour. All this can have a big economic impact. The experience from raspberries and other *Rubus* species led us to think that also the grapevine can react different to RBDV infection. In selected vineyard about 100 plants of cv. Laški Rizling were tested twice a year for RBDV infection to obtain information about reliability of detection and spread of the virus. In Primorska and Štajerska region several varieties from different locations were tested to obtain information about geographical distribution of the virus and its presence in different varieties. The virus was present in both regions and in different white varieties.

**Key words:** 'Raspberry bushy dwarf idaeovirus', grapevine, laboratory detection, Slovenia



## **Biotična raznovrstnost virusa pahljačavosti lista vinske trte (GFLV)**

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Virus pahljačavosti lista vinske trte (GFLV) povzroča bolezen imenovano kužno izrojevanje vinske trte, ki je razširjena po vsej Evropi. Bolezen povzroča bolezenska znamenja, ki se kažejo kot krajšanje medčlenkov, dvojna očesa, bifurkacije, zraslost vitic, cik-cak rast, kloroze v obliki lis ali pik, rumenenje listov, zmanjšano število in velikost socvetij ter osipanje in zmanjšanje jagod. Kužno izrojevanje vinske trte lahko zmanjša pridelek grozdja tudi za 80%. Klasični način omejevanja širjenja virusa je predvsem s testiranjem in uporabo neokuženega sadilnega materiala. Ena od novejših možnosti pa je uporaba transgene vinske trte, odporne na GFLV. Evropski projekt TRANSVIR se ukvarja z znanstvenimi vprašanji v zvezi z varstvom okolja v primeru uporabe transgene vinske trte, v katero je bil vstavljen gen za plaščni protein GFLV (2C gen). Ukvarja se z oceno tveganja v okolju, s poljskimi poskusi ter primerjavo ocene rekombinacij med transgenimi in konvencionalnimi rastlinami. Projekt TRANSVIR je namenjen za znanstveno podporo oblastem Evropske skupnosti pri sprejemnaju regulatornih odločitev za uporabo na viruse odpornih transgenih rastlin v kmetijstvu. Raziskave biotične raznovrstnosti virusa pahljačavosti lista vinske trte (GFLV) se z delom, ki se nanaša na raznolikost gena za plaščni protein (2C gen) vključujejo v projekt TRANSVIR. V raziskavo so vključene vinske trte različnih sort iz vinogradov na različnih lokacijah na Primorskem. Podatki o raznolikosti genoma virusa pahljačavosti lista vinske trte (GFLV) so osnova za sklepanje na pogostost mutacij in rekombinacij med različki virusa v naravi.

**Ključne besede:** biotična raznovrstnost, virus pahljačavosti (GFLV), trta

*ABSTRACT*

## **Biotical diversity of Grapevine fanleaf virus (GFLV)**

Grapevine fanleaf virus (GFLV) is the cause of the grapevine disease named fanleaf degradation, that is spread all over the Europe. The disease symptoms are short internodes, double nodes, fasciations of tendrils, zigzag growth, chromatic alterations of the leaves appearing as rings or spots, yellowing of leaves, bunches are smaller and fewer than normal with shot and unevenly developed berries. Fanleaf degradation can cause up to 80% lower yield. Classical way of limiting of the spread of the disease is testing and usage of healthy planting material. One of the newest possibilities is usage of transgenic grapevines resistant

to GFLV. European project TRANSVIR is dealing with the scientific questions to key environmental safety issues on the release of virus-resistant transgenic grapevines bearing GFLV coat protein (2C gene). It is dealing with field assessment of environmental risks and comparative evaluation of recombination in transgenic vs. conventional crops. The project will assist European Community authorities in taking scientifically-based regulatory decisions for the proper deployment of virus-resistant transgenic crops. With its part on diversity of coat protein gene (2C gene), research of biological diversity of Grapevine fanleaf virus (GFLV) is incorporated in TRANSVIR project. Different cultivars of grapevine from vineyards different locations from part of Slovenia called Primorska are included in the research. Data on Grapevine fanleaf virus (GFLV) genome diversity are the basis for predictions of the frequency of mutations and recombinations between virus strains in nature.

**Key words:** Biotical diversity, Grapevine fanleaf virus (GFLV)



### **Določanje ToMV virusa v vodah s PCR v realnem času**

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Namakalne vode lahko predstavljajo pomemben vir okužbe za kmetijske rastline z znatnimi ekonomskimi posledicami, zlasti ob intenzivni pridelavi vrtnin. Ob namakanju virusi vstopajo v rastline preko koreninskega sistema in lahko povzročijo pojav bolezenskih znamenj na rastlinah in škodo na pridelku. Virusi lahko prehajajo z okuženih rastlin v vodo, preko katere se lahko širijo na druge rastline. Obstaja tudi nevarnost, da se virusi obdržijo v substratu in tako tudi v naslednjih letih na rastlinah povzročijo pojav bolezenskih znamenj. Zato je priporočljivo testiranje namakalne vode na zastopanost patogenih rastlinskih virusov, še posebej v primeru intenzivne pridelave. V vodah so rastlinski virusi navadno v izjemno nizkih koncentracijah, ki jih z običajnimi diagnostičnimi metodami (ELISA test) ne moremo določiti. Zato smo razvili občutljivejšo in specifično metodo PCR v realnem času. Kot model smo uporabili virus mozaika paradižnika (*Tomato mosaic virus* – ToMV), za katerega smo dokazali, da povzroča okužbo rastlin *Nicotiana glutinosa* preko namakalne vode, kjer je v zelo nizki koncentraciji daleč pod mejo detekcije z ELISA testom. Metoda nam omogoča, da določimo ToMV v vodi do koncentracije  $10^{-9}$  mg/ml virusnih delcev. Ta koncentracija je tudi meja detekcije. To pomeni, da lahko določimo koncentracijo virusnih delcev v namakalni vodi do koncentracije 0,001 ng virusnih delcev/ml vode za razliko od občutljivosti ELISA testa, ki predstavlja 1 do 2,5 ng virusnih delcev/ml vode. Občutljivost PCR v realnem času je tako za faktor 1000 večja glede na običajno diagnostično metodo ELISA. Uvedli smo tudi koncentriranje vodnih vzorcev z uporabo anionsko izmenjevalnih CIM<sup>®</sup> QA monolitnih nosilcev. Z njihovo pomočjo smo skoncentrirali in nato določili viruse v vzorcih, kjer je bila koncentracija virusnih delcev pod mejo detekcije za metodo PCR v realnem času. Kombinacija koncentriranja na CIM<sup>®</sup> nosilcih in detekcija z občutljivo metodo bi omogočila

zanesljivo spremljanje kvalitete namakalnih voda, kar bi omogočilo pregled (monitoring) voda in uporabo pridobljenih informacij v intenzivni pridelavi rastlin.

**Ključne besede:** ToMV virus, voda, laboratorijsko določanje, PCR v realnem času

*ABSTRACT*

### **Detection of ToMV virus in water using real-time PCR**

Quality of irrigation waters can have significant economic consequences, as they can represent a source of infection for plants. Viruses, transmitted through water can infect plants through root system and cause the appearance of symptoms and consequently crop loss. Viruses can also be released from infected plants into drainage water and can spread to other plants in surroundings. There is a possibility that viruses will stay in infected substrate and will be transmitted to the plants which would cause impact on crop production also in the following years. Laboratory testing of irrigation water for the presence of plant pathogen viruses is therefore necessary for effective plant production. Concentration of plant viruses in irrigation waters is usually below the sensitivity of frequently used detection methods such as ELISA. Therefore a more sensitive and specific method real-time PCR was developed. As a model we used ToMV (*Tomato mosaic virus*) that can in the concentration of ToMV below the limit of detection for ELISA test cause the development of symptoms on *Nicotiana glutinosa* plants. The limit of detection for real-time PCR method is  $10^{-9}$  mg/ml (virus particles per ml of water). Compared to frequently used ELISA test, this real-time PCR method detects 0,001 ng of virus particles per ml of water as opposed to 1 - 2,5 ng of virus particles per ml of water in ELISA test. This makes our new method 1000 times more sensitive. CIM<sup>®</sup> Convective Interaction Media disk monolithic columns were also used in order to concentrate water samples where the virus concentration was below the detection limit of real-time PCR. They proved to be successful in concentrating ToMV contaminated water by several orders of magnitude. Combination of concentrating procedure using CIM<sup>®</sup> monolith supports and detection of viruses using a more sensitive method can be used to effectively monitor the condition of irrigation waters. Information about the health status of waters could be used in intensive plant production.

**Key words:** ToMV virus, water, real-time PCR, laboratory detection



### **Fitoplazme na sadnem drevju**

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Fitoplazme, najmanjši znani celični organizmi, so bakterije brez celične stene, sorodne gram-pozitivnim bakterijam. Naseljene v sitastih ceveh floema povzročajo več sto gospodarsko



pomembnih boleznih rastlin, ki se prenašajo z žuželčnimi vektorji in cepljenjem. Sadno drevje iz družine rožnic v Evropi resno ogrožajo fitoplazme iz skupine metličavosti jablan (*apple proliferation group*; skupina 16SrX), v katero spadajo fitoplazme metličavosti jablan (*apple proliferation*, AP), leptonekroze koščičarjev (*european stone fruit yellows*, ESFY) in propadanja hrušk (*pear decline*, PD). Nadzor fitoplazemskih obolenj sadnega drevja temelji na vizualnih zdravstvenih pregledih gostiteljskih rastlin in potrditvenih laboratorijskih testih, ki pa so v primerih zakasnelega izražanja znamenj na sadilnem materialu ter latentnih okužb nekaterih sort tudi edini način odkrivanja. V zvezi s tem bomo izpostavili težave, ki nastopajo pri odkrivanju bolezenskih znamenj in diagnostiki obolenj. Nedavno smo odkrili fitoplazme tudi v češnjah, kar je v luči novih spoznanj o poteku fitoplazemskih boleznih morebiti povezano z njihovim propadanjem v zadnjih letih. Predstavili bomo zbrane podatke o posameznih fitoplazmah na sadnem drevju v Sloveniji.

**Ključne besede:** fitoplazme, sadno drevje, detekcija, Slovenija

*ABSTRACT*

### **Fruit tree phytoplasmas**

Phytoplasmas are uncultivable, wall-less and the smallest known cellular organisms related to Gram positive bacteria. They live exclusively in the sieve tubes of their plant hosts and cause several hundred important vector-borne and graft-transmissible plant diseases. In Europe, fruit trees of Rosaceae family are seriously affected by phytoplasmas of apple proliferation group (16SrX group), which include apple proliferation (AP), european stone fruit yellows (ESFY) and pear decline (PD) phytoplasma. The control of these quarantine diseases is based on prompt removal of infected plants in nurseries and orchards. Advantages and drawbacks of visual and laboratory detection will be put forward in particular regarding latent infections and delayed symptom expression in nursery stocks. Since we have recently detected phytoplasmas in cherry trees the possibility of phytoplasma aetiology of cherry tree decline observed in recent years will be discussed. Current data of fruit tree phytoplasma occurrence in Slovenia will be presented.

**Key words:** phytoplasma, fruit trees, detection, Slovenia

**Varstvo poljščin, vrtnin in okrasnih rastlin**

## Spremljanje aktivnosti pet vrst pokalic rodu *Agriotes* (Coleoptera: Elateridae) s feromonskimi vabami v okolici Ljubljane

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Strune, ličinke pokalic so pomembni gospodarski škodljivci okopavin in vrtnin. Na kmetijskih zemljiščih je najpomembnejši rod *Agriotes*, katerega bionomija je pri nas še slabo raziskana. Spremljali smo nalet nekaterih vrst tega rodu - na feromonske vabe, ki so jih zasnovali na Entomološkem inštitutu v Padovi, feromone pa so izdelali na Inštitutu za varstvo rastlin v Budimpešti - v letih 2002 -2004 na Laboratorijskem polju, Biotehniške fakultete, v Ljubljani. Osredinili smo se na vrste: *A. brevis* Cand., *A. lineatus* L., *A. obscurus* L., *A. sputator* L. in *A. ustulatus* Schall. Feromonske kapsule smo v vabah redno menjali na 28 dni. Bionomijo smo spremljali s po eno vabo za vsako vrsto. Vabe smo pregledovali dvakrat tedensko in ulovljene primerke sproti prešteli. Na poskusni lokaciji smo spremljali tudi vremenske razmere. Feromoni so učinkovali zelo selektivno, tako, da se je v posamezno vabo dejansko lovila le vrsta, za katero smo imeli nastavljen feromon. V vseh treh letih opazovanj je bila dominantna vrsta *A. lineatus*, ki se je prvo leto ujela od 19. aprila do 13. avgusta, drugo leto od 16. aprila do 22. julija in tretje od 13. maja do 30. avgusta. Sledi ji *A. brevis*, ki se je prvo leto ujela od 10. maja do 27. septembra, drugo leto od 16. aprila do 22. julija in tretje leto od 10. maja do 27. septembra. Ostale tri vrste so bile manj številčne. *A. sputator* se je ujela prvo leto od 19. aprila do 13. avgusta, drugo leto od 25. aprila do 11. julija in tretje leto od 10. maja do 9. septembra. Vrsta *A. obscurus* se je ujela prvo leto od 30. aprila do 13. avgusta, drugo leto od 18. aprila do 1. julija, tretje leto od 13. maja do 30. avgusta. Najkrajše obdobje aktivnosti v vseh treh letih je imela vrsta *A. ustulatus* in sicer prvo leto od 14. junija do 13. avgusta, drugo 11. junija do 22. julija in tretje leto od 27. maja do 19. avgusta. Nalet vseh pet vrst pokalic na feromonske vabe je v prispevku prikazan v odvisnosti od nekaterih vremenskih dejavnikov po posameznih letih. Vrste, ki zgodaj rojijo se zabubijo že zgodaj spomladi, zato na okopavinah navadno ne povzročajo večje škode (*A. brevis*), vrste, ki rojijo pozno pa so gospodarsko pomembnejše (*A. ustulatus*), še posebno med saditvijo okopavin.

**Ključne besede:** Coleoptera, Elateridae, *Agriotes* spp., pokalice, feromonske vabe, Ljubljana

*ABSTRACT*

### The Monitoring of Five Species of the Genus *Agriotes* (Coleoptera: Elateridae) with the Use of Pheromone Traps in the Vicinity of Ljubljana

Wireworms, larvae of click beetles, are a common pest of root crops and vegetable crops. The genus *Agriotes* has a most important role in farm land. Its bionomy has not been properly investigated yet. The intent of the present study was to examine the accumulation of

some species of this genus using pheromone traps. The traps were designed by the Padova Institute of Entomology and pheromones used were produced by the Plant Protection Institute in Budapest. The study was conducted in the years 2002-2004 in a laboratory field in the vicinity of Ljubljana. The following five species were investigated: *A. brevis* Cand., *A. lineatus* L., *A. obscurus* L., *A. sputator* L., and *A. ustulatus* Schall. Pheromone capsules used in traps were regularly replaced every 28 days. The bionomy was monitored using one trap for each species. The traps were examined twice a week and specimens which were captured were counted. In the study site, weather conditions were also monitored. The effectiveness of pheromones was found to be selective, that is, individual traps captured only the target species. In the whole period of the study, the dominant species was *A. lineatus*, which was captured from April 19 to August 13 in the first year, from April 16 to July 22 in the second year, and from May 13 to August 30 in the third year. The species was followed by *A. brevis*, which emerged from May 10 to September 27 in the first year, from April 16 to July 22 in the second year, and from May 10 to September 27 in the third year. The other three species were less abundant. *A. sputator* was captured from April 19 to August 13 in the first year, from April 25 to July 11 in the second year, and from May 10 to September 9 in the third year. The species *A. obscurus* emerged from April 30 to August 13 in the first year, from April 18 to July 1 in the second year, and from May 13 to August 30 in the third year. In the whole three-year period, the species *A. ustulatus* had the shortest active period of all: from June 14 to August 13 in the first year, from June 11 to July 22 in the second year, and from May 27 to August 19 in the third year. The accumulation of all the five species captured by pheromone traps is presented in relation to some meteorological factors according to individual years. The species which emerge early in the year pupate in early spring and therefore they do not usually cause much damage to root crops (*A. brevis*). But the species which emerge later in the year are of more economic importance (*A. ustulatus*), particularly in the sowing time of root crops.

**Key words:** Coleoptera, Elateridae, *Agriotes* spp., click beetles, pheromone traps, Ljubljana



### **Pojav in rezultati spremljanja koruznega hrošča *Diabrotica virgifera virgifera* LeConte v Sloveniji**

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Koruznega hrošča (*Diabrotica virgifera virgifera* LeConte), uvrščamo med najpomembnejše škodljivce koruze. V Sloveniji smo ga prvič odkrili leta 2003. V okviru sistematičnega spremljanja njegovega naleta smo v letu 2004 vzpostavili 200 opazovalnih točk: 139 v severovzhodni Sloveniji (Pomurje, Podravje), 15 v jugovzhodni Sloveniji (Posavje), 10 v Savinjski dolini, 10 v osrednji Sloveniji (okolica ljubljanskega letališča) ter 26 na Primorskem. Zastopanost vrste smo ugotavljali z madžarskimi PAL feromonskimi vabami in

z rumenimi lepljivimi ploščami, vzporedno z njimi pa smo v letu 2004 preizkusili tudi učinkovitost drugih vab: madžarske VARs+ vabe, nekomercialne Metcalf vabe (Metcalf, 1916-1998) prepojene z ženskim *Diabrotica* spolnim feromonom 8-metildekan-2-il propionatom ali/in prevlečene s sintetičnim kairomon mimikom 4-metoksi-cimetaldhidom (MCA). Na skupno 200 opazovalnih mestih smo koruznega hrošča ugotovili na 55 lokacijah. Ujeli smo 386 osebkov, večino v severovzhodni Sloveniji blizu slovensko-madžarske in slovensko-hrvaške meje, nekaj tudi v bližini Avstrije (Petanjci, Večeslavci, Kuzma, Lešane, Črnci, Šratovci). En primerek smo evidentirali blizu slovensko-italijanske meje (Šempas). Ugotovili smo, da se je največ odraslih osebkov ulovilo na lokacijah: Pince, Dolina pri Lendavi ter Lakoš, njihova populacija pa je dosegla vrh v prvi dekadi avgusta. Na temelju ulova *D.v.v.* v letu 2003 smo s pomočjo ustreznih GIS orodij izdelali simulacijski model širjenja koruznega hrošča v Sloveniji za obdobje desetih let in rezultate primerjali z dejanskim ulovom v letu 2004. Ugotovili smo, da širjenje tega škodljivca v prostoru v severovzhodni Sloveniji ni preseгло simulacijskih predvidevanj ob upoštevanju omejevalnih ukrepov širjenja, a je kljub temu doseglo približno razdaljo 15 km proti zahodu.

**Ključne besede:** *Diabrotica virgifera virgifera* Le Conte, koroza, koruzni hrošč, sistematični nadzor, Slovenija, *Zea mays*

ABSTRACT

### **Phenomenon and results of the spreading of Western Corn Rootworm *Diabrotica virgifera virgifera* LeConte in Slovenia**

Western Corn Rootworm (WCR), *Diabrotica virgifera virgifera* Le Conte, is one of the major maize pests. In the year 2003 the pest was found for the first time in Slovenia. Spreading of WCR in Slovenia in 2004 was monitored by setting up the following 200 checkpoints: 139 in the north-eastern Slovenia (Pomurje, Podravje), 15 in the south-eastern Slovenia (Posavje), 10 in Savinjska dolina, 10 in the central Slovenia (near the Ljubljana airport) and 26 in the region of Primorska. The presence of the species was observed using the Hungarian PAL pheromone traps and yellow sticky traps; parallel to that we also investigated the efficiency of other traps in the year 2004: Hungarian VARs+ trap, the non-commercial Metcalf type traps (Metcalf, 1916-1998) baited with the female *Diabrotica* sex pheromone 8-methyl-decane-2-ol propionate or with the synthetic kairomone mimic 4-methoxy-cinnamaldehyde (MCA) as lures. From the total number of 200 inspected localities in the territory of Slovenia the pest was registered in 55 of them (27.5 %). We caught the total number of 386 specimens. The majority of the specimens were found in the north-eastern Slovenia which is near the Slovenian-Hungarian and Slovenian-Croatian border; some of them were found near the Austrian border (Petanjci, Večeslavci, Kuzma, Lešane, Črnci, Šratovci). Only one specimen was recorded near the border with Italy (Šempas). The greatest number of adult *D.v.v.* was caught on the following locations: Pince, Dolina near Lendava and Lakoš. Their population reached the top in the first decade of August. The simulation model of spreading scenarios of WCR in Slovenia for the next ten years was made and compared with the actual spreading situation of *D.v.v.* in Slovenia. We found out that the spreading of this pest in the north-eastern Slovenia did not exceed the simulation forecast if the restricting measures of spreading were considered, but, in spite of all, it reached an approximate distance of 15 km towards west.

**Key words:** *Diabrotica virgifera virgifera* Le Conte, maize, Western Corn Rootworm, monitoring, Slovenia, *Zea mays*



### **Možnosti biotičnega zatiranja nekaterih škodljivcev v zavarovanih prostorih ob uporabi plenilskih stenic iz družine Anthocoridae (Heteroptera)**

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V Sloveniji se je v zadnjih letih že večkrat pokazala potreba po uporabi biotičnega varstva rastlin pred škodljivimi organizmi. Namen prispevka je pokazati možnosti vnosa biotičnih agensov na primeru vnosa in uporabe plenilskih stenic iz družine Anthocoridae (Heteroptera), ob upoštevanju mednarodne konvencije za varstvo rastlin (IPPC), mednarodnih standardov za fitosanitarne predpise (FAO – ISPM), standardov Evropske in mediteranske organizacije za varstvo rastlin (EPPO) in nacionalne zakonodaje. V prispevku so predstavljene plenilske stenice iz rodov *Orius* in *Anthocoris*, ki jih vključuje tudi seznam biotičnih agensov na območju EPPO in so ob upoštevanju nacionalne zakonodaje ter v skladu s pristopom Slovenije v Evropsko skupnost in prevzemom njenega pravnega reda lahko uporabni tudi v Sloveniji. Fitosanitarna uprava republike Slovenije izdaja dovoljenja za vnos in uporabo tujerodnih vrst organizmov s soglasjem Ministrstva za okolje in prostor, na podlagi ugotovitve, da poseg v naravo ne ogroža naravnega ravnovesja ali biotske raznovrstnosti. Nekateri biotični organizmi se že pojavljajo v Sloveniji in njihovo uporabo je potrebno preučiti z vidika vrstne specifičnosti. V Sloveniji se avtohtono pojavljajo vrste *Orius niger* Wolff, *Orius laevigatus* (Fieber), *Orius majusculus* (Reuter), *Anthocoris nemoralis* L. in *Anthocoris nemorum* L. Ciljni vnos plenilčevih jajčec na gostiteljske rastline v zavarovanih prostorih - iz jajčec se izležejo ličinke, ki plenijo jajčeca žuželk in pršic iz družin Noctuidae, Pyralidae, Aphididae, Eriophyidae, Tetranychidae, Thripidae in Phlaeothripidae - bi ob njihovi ustrezni uporabi zagotovo zmanjšal številčnost škodljivcev v zavarovanih prostorih. Zaradi podnebnih sprememb, ki jih v zadnjih desetih letih ugotavljamo v Sloveniji, lahko pričakujemo tudi najdbo nekaterih drugih vrst plenilskih stenic, ki doslej niso bile ugotovljene ali pa so bile njihove populacije tako majhne, da so bile njihove najdbe redke. Komercialna raba plenilskih stenic je v tujini povezana z uporabo pripravka Thripdor. Gre za vrsto *Orius insidiosus* (Say) in se lahko uporablja v rastlinjakih ob predpostavki da sta bila odobrena vnos in uporaba.

**Ključne besede:** biotično varstvo, mednarodni standardi, plenilske stenice, ciljni vnos, Thripdor, Slovenija

## ABSTRACT

### **Possibilities for the introduction of biological agents in greenhouses using of pirate bugs from the family Anthocoridae (Heteroptera)**

In Slovenia, in the recent years, biotical control has frequently proved necessary as a means of protection of plants against harmful organisms. This article aims at representing the possibilities for the introduction of biotical agents, using the example of the introduction and use of pirate bugs from the family Anthocoridae (Heteroptera), subject to the international plant protection convention (IPPC), international standards for phytosanitary regulations (FAO – ISPM), European and Mediterranean Plant Protection Organisation (EPPO) and national legislation. The article represents pirate bugs from genera *Orius* and *Anthocoris*, which are included also in the list of biotical agents within the EPPO territory and may be applicable also in Slovenia, considering national legislation and pursuant to the accession of Slovenia to the European Union and the adoption of the acquis. The Phytosanitary Administration issues permits for the introduction and use of non-native species of organisms in agreement with the Ministry of the Environment and Spatial Planning, upon establishing that natural balance and biotical diversity are not endangered by the activities affecting the nature. Some biotical control agents may already be found in Slovenia, however their applicability must be examined in the light of their species specificity. Species which are autochthonous in Slovenia are *Orius niger* Wolff, *Orius laevigatus* (Fieber), *Orius majusculus* (Reuter), *Anthocoris nemoralis* L. and *Anthocoris nemorum* L. By the means of a targeted introduction of pirate's eggs onto host plants in protected places – larvae which are hatched from the eggs, are predators of eggs of insects and mites from families Noctuidae, Pyralidae, Aphididae, Eriophyidae, Tetranychidae, Thripidae and Phlaeothripidae – providing for their appropriate use, the number of pests in protected places is sure to be decreased. Due to climate changes in Slovenia over the last ten years also some other species of pirate bugs are expected to be found, which have not been established so far, or if, their populations were so small, that they could be found only now and then. In foreign countries pirate bugs are used for commercial use as preparation Thripor. This preparation contains species *Orius insidiosus* (Say) and may be used in greenhouses, providing to meet conditions for the introduction and use.

**Key words:** biological control agents, greenhouse, pirate bugs, Anthocoridae (Heteroptera)



## **Spremljanje zastopanosti kapusove hrčice (*Contarinia nasturtii* [Kieffer], Diptera, Cecidomyiidae) v Sloveniji s feromonskimi vabami**

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V letu 2004 smo s feromonskimi vabami švicarskega proizvajalca (Agroscope FAW, Wädenswill) spremljali zastopanost kapusove hrčice na kapusnicah na štirih lokacijah (Ljubljana, Rakitnica, Žalec, Škocjan pri Kopru) v Sloveniji. Namen raziskave je bil preučiti gibanje številčnosti škodljivca v rastni dobi, da bi ugotovili koliko rodov razvije na geografsko in podnebno različnih območjih. S tem bi imeli podlago za razvoj strategije varstva kapusnic pred kapusovo hrčico. Rezultati monitoringa nakazujejo, da ima vrsta pri nas tudi v celinskem delu štiri rodove na leto, saj smo na vseh lokacijah ugotovili tudi septembrski rod. V prispevku razpravljamo o bionomiji kapusove hrčice v odvisnosti od okoljskih dejavnikov, predstavljamo tipe poškodb in posledično škodljivost vrste na kapusnicah ter predstavljamo strategijo varstva rastlin pred obravnavanim škodljivcem.

**Gljučne besede:** kapusova hrčica, *Contarinia nasturtii*, kapusnice, monitoring, Slovenija

### *ABSTRACT*

#### **Monitoring of Swede midge (*Contarinia nasturtii* [Kieffer], Diptera, Cecidomyiidae) in Slovenia using pheromone traps**

In 2004, the occurrence of Swede midge (*Contarinia nasturtii*) on four locations in Slovenia (Ljubljana, Rakitnica, Žalec, Škocjan near Koper) was investigated. Pheromone traps of the Swiss producer (Agroscope FAW, Wädenswill) were set in fields with *Brassica* plants. The aim of the research was to determine a population dynamics of the pest in vegetation period, to establish the number of generations it develops per year in geographically and climatically different regions. Understanding of the pest bionomics would help to set a strategy for control of Swede midge in *Brassica* plants. The results of the monitoring indicate that the species has 4 generations per year, also in the continental part of the country. In all four locations a generation was also established in September. In the present paper a bionomics of Swede midge in dependence of environmental factors is discussed and types of damage are described. Furthermore, harmfulness of the species on Brassicas is presented, as well as the control strategy of the pest in question.



**Key words:** Swede midge, *Contarinia nasturtii*, Brassica plants, monitoring, Slovenia



**Vpliv epikutikularnega voska na listih zelja na škodljivost tobakovega resarja (*Thrips tabaci* Lindeman, Thysanoptera, Thripidae)**

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V obdobju 2001-2002 smo preučevali tolerantnost petih hibridov zgodnjega zelja za napad tobakovega resarja (*Thrips tabaci*), v letu 2002 pa korelacijo med vsebnostjo epikutikularnega voska v zunanjih listih glav in obsegom poškodb zaradi hranjenja tobakovega resarja na teh listih. Hibrid z najdaljšo rastno dobo in največjo trdnostjo glav, 'Vestri', je dosegel največjo povprečno težo glav in največjo povprečno tržno težo glav (teža glav brez odstranjenih, poškodovanih listov), medtem ko sta bila povprečni indeks poškodb na zunanjih listih glav in izguba pridelka zaradi odstranitve poškodovanih listov pri tem hibridu najmanjša. Pri večji gostoti sajenja (16,6 rastlin/m<sup>2</sup>) sta bila oba parametra teže glav približno za polovico manjša kot pri manjši gostoti sajenja (8,2 rastlin/m<sup>2</sup>). V preračunu pridelka na površinsko enoto (m<sup>2</sup>) le pri enem od preizkušanih hibridov ('Destiny') ugotovljamo razlike v pridelku. Povprečna vsebnost epikutikularnega voska v zunanjih listih glav se med hibridi razlikuje, čeprav smo pri vseh ugotovili podobna razmerja v vsebnosti te snovi; najmanjšo povprečno vsebnost v 3. in 4. zunanjem listu v glavi, največjo povprečno vsebnost pa v 1. in 2. ter 9. in 10. zunanjem listu v glavi. V zunanjih listih zelja, gojenega pri večji gostoti, smo ugotovili skoraj dvakrat večjo vsebnost epikutikularnega voska. Kljub navidezno močni negativni korelaciji med vsebnostjo epikutikularnega voska v zunanjih listih glav in povprečnim indeksom poškodb, ki na njih nastanejo zaradi hranjenja tobakovega resarja, smo med parametroma ugotovili komaj zaznavno negativno korelacijo ( $r^2=0,11$  pri gostoti 16,6 rastlin/m<sup>2</sup> in  $r^2=0,19$  pri gostoti 8,2 rastlin/m<sup>2</sup>). Na podlagi rezultatov naše raziskave sklepamo, da epikutikularni vosek v zeljnih listih ne spada med najpomembnejše dejavnike tolerantnosti te vrtnine na preučevanega škodljivca, temveč je le eden od številnih dejavnikov, ki določajo njegovo škodljivost.

**Ključne besede:** *Thrips tabaci*, tobakov resar, epikutikularni vosek, zelje, pridelek, antiksenoza

## ABSTRACT

### **Impact of epicuticular wax content in the leaves of early white cabbage on harmfulness of onion thrips (*Thrips tabaci* Lindeman, Thysanoptera, Thripidae)**

In the period 2001-2002, a susceptibility of 5 hybrids of early white cabbage to onion thrips (*Thrips tabaci*) attack has been researched. In addition, a correlation between epicuticular wax content in the exterior leaves of the cabbage heads and damage caused by feeding of onion thrips on the same leaves was investigated in 2002. The hybrid with the longest growth period and the firmest head, i. e. 'Vestri', had the highest mean weight of the head and the highest net weight of the head, while its mean index of damage and the mean yield loss were the lowest. At higher plant density (16.6 plants/m<sup>2</sup>) both parameters of the weight of the head were approximately less than half as compared to lower plant density (8.2 plants/m<sup>2</sup>). Results of the mean net weight of the heads did not show significant differences between different plant densities if the yield was calculated per area unit (m<sup>2</sup>). The mean content of epicuticular wax in the exterior leaves of the heads differs among hybrids, although all of them show similar relations in its values; the lowest mean content was in the third and the fourth exterior leaves of the heads, the highest mean content was within the first and second, and the ninth and tenth exterior leaves of the heads. In spite of the apparent correlation between the content of epicuticular wax and the mean index of damage caused by feeding of onion thrips hardly perceived negative correlation ( $r^2=0,11$  at density of 16,6 plants per m<sup>2</sup>, and  $r^2=0,19$  at density of 8,2 plants per m<sup>2</sup>) was found between these two parameters using statistical analysis. Based on the results of our research we conclude that epicuticular wax content in the exterior leaves of the heads is not one of the most important factors of cabbage tolerance against onion thrips. However, it is certainly one of many factors, which determine the harmfulness of the pest in question.

**Key words:** *Thrips tabaci*, onion thrips, epicuticular wax content, cabbage, yield, antixenosis



### **Žalovalke (Diptera:Sciaridae) na okrasnih rastlinah**

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Žalovalke je ime za družino Sciaridae iz reda dvokrilcev, katerih ličinke se včasih zberejo na substratu v dolge sprevede. Razširjene so zlasti v rastlinjakih. Ličinke se hranijo na koreninah rastlin, s tkivom potaknjencev in odraslih rastlin. Napadene rastline so bolj izpostavljene glivičnim okužbam, krnijo, venejo in propadajo, tudi odrasle žuželke prenašajo bolezenske povzročitelje. V rastlinjakih se pri nas pojavljajo pri gojenju okrasnih rastlin, kjer povzročajo težave tudi gojiteljem božičnih zvezd (*Euphorbia pulcherrima*), vendar v tej zvezi še niso bile raziskovane. V rastlinjakih na dveh lokacijah (A in B) v

Ljubljani, smo zbrali odrasle osebkke žalovalk najprej zaradi determinacije. Postavili smo tudi lončni poskus z dvema sortama božičnih zvezd 'Sonora Red' in 'Cortez Red', ki smo ju posadili v substrat Stender, sorto 'Cortez Red' pa tudi v substrat Klasman, konec julija 2004. Rastline smo pincirali sredi avgusta, 7. septembra smo jih prenesli v insektarije v laboratorij Inštituta za fitomedicino, na Biotehniški fakulteti (Ljubljana), kjer smo po štiri rastline iz vsake obravnave inokulirali z imagi žalovalk, ki so bile v loncih s krizantemami iz lokacije A. Konec septembra smo začeli tedensko spremljati z rumenimi lepljivimi ploščami izletavanje odraslih, kar je trajalo vse do začetka decembra. Oskrba rastlin je bila povečini standardna. Gnojili smo jih z gnojilom Peters in kalijevim nitratom. Rastline smo fotografirali in njihov videz vizualno ocenili. Ob koncu poskusa smo ocenili tudi videz korenin ter jih stehtali. Na obeh lokacijah v Ljubljani je bila zastopana vrsta *Bradysia difformis* Frey, 1948, ki je ena najpogostejših vrst žalovalk v rastlinjakih (Smith, 2004). V rezultatih prispevka je prikazano število izletelih žalovalk glede na sorto in substrat ter vpliv žalovalk in gojitvenih dejavnikov na božično zvezdo.

**Ključne besede:** Diptera, Sciaridae, *Bradysia difformis* Frey, *Euphorbia pulcherrima*

*ABSTRACT*

### **Sciarid Flies (Diptera: Sciaridae) on Ornamental Plants**

Sciarid flies of the order Diptera (Family Sciaridae) inhabit mainly greenhouses. Their larvae sometimes form long lines in a substrate. They feed on plant roots, on the tissue of cuttings and adults. Attacked plants are more often subjected to fungal infections. Their growth is hampered, they wilt and die. Adult insects also transmit disease agents. In Slovenia they occur in greenhouses in which ornamental plants are grown, where they cause problems to growers of Christmas flower *Euphorbia pulcherrima*. Because information regarding this aspect of the pest is lacking, the intent of the current study was to fill this gap to some extent. Two locations (A and B) were selected in greenhouses of Ljubljana, Slovenia, and some adults of sciarid flies were collected to determine first of all the species. At the end of July 2004, pot trials were also conducted using two cultivars of Christmas flower, 'Sonora Red' and 'Cortez Red', which were both planted into the substrate Stender, while the latter was also planted into the substrate Klasman. The top of the plants were removed off mid-August, and on September 7 the plants were placed into insectaria in the laboratory of the Institute of Phytomedicine at the Biotechnical Faculty, University of Ljubljana. Four plants of each treatment were inoculated with imagoes of sciarids found in pots with chrysanthemums from location A. At the end of September, weekly monitoring of the emergence of adult subjects began, using yellow sticky traps, and it was carried out until the beginning of December. Plants were nourished according to standard procedures. Fertilisers Peters and potassium nitrate were used. Photos of plants were taken to assess their appearance. At the end of the trial, the appearance of roots was also evaluated, and the roots were weighed separately. In both locations the species *Bradysia difformis* Frey, 1948, was found, one of the most common species of sciarids in greenhouses (Smith, 2004). Results of the study show the number of sciarid flies which emerged, according to cultivar and substrate. The effect of sciarids and of cultivation factors on the growth of Christmas flower is also presented.

**Key words:** Diptera, Sciaridae, *Bradysia difformis* Frey, *Euphorbia pulcherrima*

**Fitofarmaceutska sredstva (poljedelstvo, vrtnarstvo)**

## **Nove možnosti izboljšanja učinkovitosti fitofarmaceutskih sredstev z uporabo okolju prijaznejših dodatkov**

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Dodatki škropilnim mešanicom se že več desetletij uporabljajo za povečanje učinkovitosti fitofarmaceutskih sredstev. Prvotno so se predvsem uporabljali pri uporabi herbicidov, zaradi specifičnih lastnosti površine plevelov. Tendenca zmanjševanja uporabe fitofarmaceutskih sredstev na enoto površine, ki posledično pomeni zmanjšanje negativnih vplivov na zdravje ljudi, živali in okolje, pa je povzročila, da se je uporaba dodatkov zelo povečala pri vseh sredstvih za varstvo rastlin. Hkrati pa dodatki naj ne bi dodatno povečevali negativnih vplivov. Ena glavnih skupin dodatkov so močila, ki zaradi svojih fizikalno kemijskih lastnosti, vplivajo na povečanje učinkovitosti škropilnih mešanic. Način delovanja močil je predvsem v zmanjšanju površinske napetosti škropilnih mešanic, ki pri nanašanju povečajo kontaktno površje na listih tretiranih rastlin. Povečanje kontaktnega površja pa posledično pomeni boljši izkoristek fitofarmaceutskih sredstev. V prispevku bomo predstavili novo skupino materialov, ki se lahko uporabljajo, njihov način delovanja in nove tehnike proučevanja lastnost materialov na stičnem površju tretiranih rastlin.

**Ključne besede:** Močila, polielektroliti, elektronska mikroskopija, mikroskopija na atomsko silo, izoelektrična točka

*ABSTRACT*

### **New possibilities for the improvement of the efficiency of plant protection products by the use of environmentally sound additives**

Additives to spraying mixtures have been used for many decades with the purpose to increase effectiveness of plant protection products. They used to be added in particular to herbicides due to specific characteristics of the surface of weeds. The use of additives has increased in connection with all plant protection products due to the tendency to decrease the amount of use of plant protection products per area, which aims to decrease negative effects on human health, animals and the environment. However the additives should not cause the negative effects to be increased even more. One of the main groups of additives are adjuvants, the physico-chemical properties of which are such as to make spraying mixtures more effective. The mode of action of adjuvants is to decrease surface tension of spraying mixtures, which results in larger contact surface of leaves of the treated plants. As a consequence, such larger contact surface provides higher efficiency of plant protection products. The article shall represent a new group of materials, which may be used for the above described purpose, their mode of action and new techniques for the examination of the properties of materials on a contacting surface of treated plants.

**Key words:** Adjuvant, polyelectrolytes, electron microscopy, atomic force microscopy, isoelectric point



### **Amistar Extra – fungicid za zatiranje bolezni žita in sladkorne pese**

Vasja HAFNER

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Amistar Extra vsebuje azoksistrobin in ciprokonazol. Kombinacija dveh aktivnih snovi zagotavlja širok spekter delovanja in veliko zanesljivost pri zatiranju bolezni. Lastnosti obeh aktivnih snovi, kot so vnos v rastlino, gibanje in premeščanje znotraj rastline, sistemčnost, metabolna stabilnost in fiziološki učinki, v pretežni meri prispevajo k izjemni učinkovitosti delovanja. Poleg delovanja na bolezni je za azoksistrobin bistvenega pomena njegov velik vpliv na boljše koriščenje dušika in vode ter na podaljšanje fotosinteze. Posledica so izjemno visoki pridelki boljše kakovosti, kar se je potrdilo tudi v preizkušanjih v Sloveniji.

**Ključne besede:** azoksistrobin, ciprokonazol, fungicidi, žita

ABSTRACT

### **Amistar Extra – fungicide for control of cereal and sugarbeet diseases**

Amistar Extra contains azoxystrobin and cyproconazole. Mix of two active ingredients delivers wide spectrum of activity and robust performance. Active ingredient specifics, such as foliar uptake, movement within plant and redistribution, systemicity, metabolic stability and physiological effects benefit largely to extraordinary efficacy results. Besides disease control, azoxystrobin's exceptional improvement of nitrogen and water use efficiency as well as prolongation of efficient photosynthetic period is of paramount importance. The outcome is exceptionally high yields with improved quality, which was proven in tests in Slovenia, too.

**Key words:** azoxystrobin, cyproconazole, fungicides, cereals



### **Lumax – herbicid za zatiranje vseh enoletnih plevelov v koruzi na osnovi mezotriona**

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Lumax vsebuje mezotrion, S-metolaklor in terbutilazin. Mezotrion, ključna aktivna učinkovina v pripravku Lumax, je edini herbicid iz skupine zaviralcev encima HPPD, ki omogoča prilagodljivo zatiranje širokega spektra enoletnih plevelov tako pred vznikom koruze kot po njem. Lumax je izjemno selektiven za koruzo. Zaradi lastnosti mezotriona je Lumax odlična rešitev za škropljenja zgodaj po vzniku (1-4 listi koruze) z neprimerljivo

skupno učinkovitostjo in zanesljivostjo delovanja v kakršnihkoli vremenskih in talnih razmerah. Odlična selektivnost in zanesljivost sta najpomembnejša razloga, da ima Lumax pri škropljenjih zgodaj po vzniku večje pridelke in boljšo ekonomičnost kot druge rešitve. Škropljenje zgodaj po vzniku je okoljsko bolj ustrezno kot škropljenje pred vznikom. Tri aktivne snovi v Lumaxu delujejo izrazito sinergistično, posledično so v pripravku zastopane uravnovešeno – količine terbutilazina in S-metolaklora na hektar so bistveno manjše kot običajno. Lumax ima zaradi tega dobre okoljske lastnosti, še posebno pri škropljenju po vzniku.

**Ključne besede:** mezotrion, S-metolaklor, terbutilazin, herbicidi, koruza, zatiranje plevelov

#### *ABSTRACT*

#### **Lumax – full range annual weed control maize herbicide based on mesotrione**

Lumax contains mesotrione, S-metolachlor and terbuthylazine. Mesotrione, the core active ingredient in Lumax is the only HPPD enzyme inhibiting herbicide to provide flexible pre and post emergence, broad spectrum and annual weed control. Lumax is extremely safe to corn. Due to mesotrione characteristics Lumax is the product of choice for early post (1-4 leaves stage of the maize crop) sprayings with unprecedented overall efficacy and reliability in any weather and soil conditions. Due to perfect crop safety and reliability in early removal of weeds, early post application delivers higher average of yields with improved economics vs. other solutions. Early post emergence application is environmentally more favourable vs. pre emergence application. The three active ingredients of Lumax are strongly synergistic, which is the basis for a balanced composition with reduced volumes of terbuthylazine and S-metolachlor needed per hectare. For this reason Lumax has fairly good environmental profile, especially in post emergence application.

**Key words:** mesotrione, S-metolachlor and terbuthylazine, herbicides, weed control, maize



#### **Mustang 306 SE - novi herbicid za zatiranje enoletnih in nekaterih večletnih širokolistnih plevelov v ozimni in jari pšenici, ječmenu in koruzi za zrnje in silažo**

Drago MAJCEN

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Mustang 306 SE je novi triazolopirimidin-sulfonilidni herbicid za zatiranje širokolistnih plevelov v žitih in koruzi takoj po vzniku plevelov. Formuliran je v obliki suspenzoemulzije (SE) in vsebuje dve aktivne snovi : florasulam in 2,4-D. Herbicid je razvilo podjetje Dow AgroSciences, namenjen je za zatiranje širokolistnega plevela v žitih (ozimna in jara pšenica, ječmen) in koruzi (za zrnje in silažo) po vzniku plevelov. Ta kombinacija florasulama in 2,4 D (etil heptil estera) je v optimalnem razmerju (6,25 + 300 g aktivne snovi/liter). Florasulam je najnovejša molekula iz sulfonamidne skupine katero je po flumetsulamu (Broadstrike, 1993) in metosulamu (Sansac, Kompal, 1994), razvilo podjetje DOW AgroSciences.

Florasulam je najbolj učinkovita sulfonamidna/sulfonilna urea ki se trenutno trži in deluje že pri 2,5 g aktivne snovi/ha na *Brassica* in *Matricaria* vrste ter večino ostalih enoletnih širokolistnih plevelov. Florasulam je herbicid, ki deluje kot inhibitor sinteze acetolaktatov (ALS). Sinteza acetolaktatov je v kloroplastih in sodeluje v procesu pri sintezi razvejanih aminokislin. Že dve uri po tretiranju z florasulamom se ustavi rast plevela. Je edini proizvod, ki zatira *Galium* in *Matricaria* vrste od vznika pa do višine 25 cm. Ima zelo širok spekter delovanja ki zagotavlja zanesljivo delovanje v zelo raznolikih klimatskih in agrotehničnih razmerah. Mustang 306 SE nudi uporabniku veliko fleksibilnost glede na temperaturo, razvojno fazo gojene rastline in plevelov v času aplikacije. Mustang 306 SE ovira rast občutljivih plevelov na dva načina, kar zmanjšuje možnost pojava odpornosti ali rezistence. V žitih ga običajno uporabljamo od začetka razraščanja do drugega kolenca, možna pa je uporaba od faze 2 listov pšenice oz. ječmena pa do pojava vrhnjega lista. V koruzi ga uporabljamo od faze 2-5 listov koruze dalje. Najboljši učinek dosežemo ko so pleveli v fazi 2-4 listov. Mustang 306 SE se priporoča za zatiranje enoletnih širokolistnih plevelov v koruzi za zrnje in silažo v odmerku 0,5-0,6 l/ha, v pšenici in ječmenu pa v odmerku 0,4 – 0,6 l/ha. Priporoča se enkratna uporaba v rastni dobi z uporabo 150-300 l vode na hektar. Herbicid je popolnoma selektiven za koruzo in žita; ne povzroča fitotoksičnosti in ne vpliva negativno na pridelek. Florasulam je registriran v več evropskih državah: Avstrija, Belgija, Češka, Francija, Nemčija, Madžarska, Italija, Nizozemska, Poljska, Španija, Švica, Anglija... Mustang 306 SE zatira naslednje plevela: *Ambrosia elatior*, *Anthemis cotula*, *Brassica napus*, *Capsella bursa pastoris*, *Centaurea cyanus*, *Chenopodium* spp., *Cirsium arvense*, *Galium aparine*, *Galeopsis tetrahit*, *Matricaria chamomilla*, *Papaver rhoeas*, *Polygonum* spp., *Sonchus* spp., *Stellaria media*, *Thlaspi arvense*... V delu so prikazane fizikalno-kemične, toksikološke in biotične značilnosti pripravka, način delovanja in rezultati poskusov. Mustang 306 SE je naravi prijazen herbicid in bo cenovno ugoden oz. ekonomičen. Pripravek, ki je v Sloveniji v postopku registracije, naj bi bil registriran v letošnjem letu, na našem tržišču pa naj bi se pojavil v letu 2006.

**Ključne besede:** florasulam, 2,4-D, herbicidi, koruza, žita, zatiranje plevelov

#### ABSTRACT

#### **Mustang 306 SE – new herbicide for control of annual and some perennial weeds in cereals and maize**

Mustang 306 SE is a new triazolopyrimidine sulfonilide herbicide to control broad-leaved weeds in cereals and maize in early postemergence. Mustang 306 SE is a suspo-emulsion herbicide, developed by Dow AgroSciences with two active ingredients florasulam and 2,4 D for the control of broadleaf weed in cereals (wheat, barley and oats) and in maize (corn and silage) postemergence. This combination of florasulam and 2,4 D EHE (Ethyl – heptyl Ester) is in optimal ratio (6,25 gai/L + 300 gai/L). Florasulam is the latest development molecule from Dow AgroSciences sulfonamide group after flumetsulam (Broadstrike, 1993) and metosulam (Sansac, Kompal, 1994). Florasulam is the most active sulfonamide/sulfonyl urea currently marketed and it is active already at 2,5gai/ha on *Brassica*, *Matricaria* and other annual BLW-s. Florasulam is a herbicide that acts as an inhibitor acetolactate synthase (ALS). ALS Enzyme is found in the chloroplast where it catalyses branch chained amino



acid biosynthesis. Plant growth is inhibited within 2 h following treatment with florasulam. It is the only product controlling *Galium* and *Matricaria* from seedling stage up to 25 cm height. It has a very broad weed spectrum providing reliable control on very diverse climatic and agronomic conditions. Mustang 306 SE offers a large flexibility to the user in terms of application temperature, crop stages and weed stages. Mustang 306 SE interferes the growths processes in the susceptible weeds on two different sides, thus reducing the risk for tolerance or resistance. On cereals is recommended to spray from beginning of growth till second node, 2-leaf stage up to and including the flag leaf extended stage and in maize we use Mustang 306 SE from 2-to 5-leaf stage. Weeds should be in the 2-to 4-leaf stage at the time of application. Mustang 306 SE can be recommended at 0,5 – 0,6 l/ha rate for broadleaf weed control in maize for corn and silage. This herbicide is totally safe for maize; doesn't give any visual injury and has no negative effect on yield either. Florasulam is already registered in more European countries: Austria, Belgium, Czech Republic, France, Germany, Hungary, Italy, Netherlands, Poland, Spain, Switzerland, United Kingdom... Mustang 306 SE control the following weeds: *Amaranthus retroflexus*, *Ambrosia artemisiifolia*, *Anthemis cotula*, *Brassica napus*, *Capsella bursa pastoris*, *Centaurea cyanus*, *Chenopodium* spp., *Cirsium arvense*, *Galium aparine*, *Galeopsis tetrahit*, *Matricaria chamomilla*, *Papaver rhoeas*, *Polygonum* spp., *Sonchus* spp., *Stellaria media*, *Thlaspi arvense*... Mustang 306 SE is proposed for use as a single application per season in water volume 150-300 l/ha. In the lecture the characteristics of ecotoxicological profile of this product, mode of action and results of trials are shown.

**Key words:** florasulam, 2,4-D, herbicides, weed control, maize, cereals



### **Betanal Expert in Sphere – sodobna zaščita sladkorne pese**

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Pri sodobni pridelavi poljščin si ne moremo zamisliti bolne in zapleveljene pese. Čist in zdrav posevek je predpogoj za doseganje večjih pridelkov sladkorja. Z uporabo herbicida Betanal expert in fungicida Sphere omogočimo pesi nemoteno rast in razvoj. Betanal expert vsebuje že znane aktivne substance: fenmedifam, desmedifam in etofumesate. Nova pa je  $\beta$ -tehnologija, kar pomeni izboljšana mikrokapljična formulacija, ki je prva uporabljena v Betanalu expert. Pripravek ima z vgrajenim tekočim nosilcem aktivnih substanc (tributoxi etil fosfat) mnogo prednosti pred ostalimi herbicidi v pesi. V fungicidu Sphere sta uspešno združeni aktivni substanci ciproconazole (sistemično delovanje) in trifloksystrobine (mezostemično delovanje). Je prvi strobilurinski pripravek, registriran v poljedelstvu. Odlično zatira vse pomembne bolezni na sladkorni pesi, prav tako pa ima tudi močan "greening" efekt. Z uporabo fungicida Sphere lahko dosežemo do 1% več sladkorja v pesi kot pri uporabi ostalih registriranih fungicidov.

**Ključne besede:** herbicid, fungicid, sladkorna pesa, pleveli, bolezni

## ABSTRACT

### Betanal Expert and Sphere – contemporary protection in sugar beet

Contemporary growth of field crops demand healthy sugar beet without presence of weeds. That is preliminary to reach a high sugar level. Herbicide Betanal expert and fungicide Sphere enable better vegetation and growth of sugar beet. Betanal expert contains three already known active ingredients: phenmedipham, desmedipham and ethofumesate and new technology called  $\beta$ -technology, which is advanced micro droplet formulation, first shown in Betanal expert. A liquid bearer of active ingredients enables Betanal expert a lot of benefits in comparison with other herbicides in sugar beet. In fungicide Sphere two active ingredients are successfully combined, cyproconazole (systemic) and trifloxystrobin (mesostemic). Sphere is first strobilurine fungicide, registered in agriculture. Sphere controls the most important diseases in sugar beet and has very strong greening effect. With fungicide Sphere we can achieve 1% more sugar in sugar beet in comparison with all others fungicides.

**Key words:** herbicide, fungicide, sugar beet, weeds, diseases



### Izkušnje uporabe NeemAzal-T/S pri vrtninah

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Preizkušanja pripravkov standardizirano formuliranih ekstraktov iz pečk indijskega drevesa neem (*Azadirachta indica* A. Juss), ki vsebujejo aktivno snov azadirachtin v zelenjavi tečejo od leta 1996. O uspešnem zatiranju različnih škodljivcev na zelju z uporabo 1,5 – 3 l/ha je prvi poročal Manger (1997). Scholz-Doebelin (2000) poroča o veliki učinkovitosti zatiranja rastlinjakove ščitaste uši, listnih zavrtalk in uši z 1 do 3 aplikacijami 0,5% koncentracije NeemAzal-a T/S ob uporabi različnih tehnik nanosa (škropljenje, zalivanje, hladno meglenje) na bučah in paradižniku brez negativnih vplivov na koristne žuželke. V poskusih na peteršilju (Schrameyer, 2000) je bila dokazana velika in dolgotrajna učinkovitost ene same aplikacije (0,5%) na uši *Cavariella aegopodii*. Tretiranje zelja z NeemAzal T/S (Metspalu, 2000) se je pokazalo kot zelo učinkovito v obdobju simultane okužbe s *Plutella xylostella*, *Pieris rapae* in *Brevicoryne brassicae*. El Khafif in Plagge (2000) sta z uporabo NeemAzal-T/S proti zeljnim ušem pridelala 17% višji pridelek kakor na kontroli. Tolerantnost vrtnin na pripravek NeemAzal-T/S je velika, le v posameznih primerih je bil zabeležen zaviralni vpliv na rast zeljnih sadik pred presajanjem na prosto. Od leta 2002 je v Nemčiji uporaba NeemAzal-T/S uradno dovoljena v pridelavi semen zelenjave. Od leta 2004 ima proizvod dovoljenje za zatiranje sesajočih in grizočih insektov v paradižniku, bučah in papriki v Švici, Avstriji in Italiji. Uporaba za zatiranje sesajočih in grizočih insektov je v Sloveniji uradno dovoljena od leta 2003 v sadovnjakih, vinogradih in poljščinah.

**Ključne besede:** izločki, *Azadirachta indica*, zatiranje, škodljivci, vrtnine

## ABSTRACT

### Experiences with NeemAzal-T/S in vegetables

The first experiments with NeemAzal-T/S - a standardised formulated extract from kernels of the Indian Neem tree *Azadirachta indica* A. Juss containing the active ingredient azadirachtin - in vegetable crop started in 1996. Manger (1997) reported successful applications of 1,5 to 3 l/ha against several pests on cabbage. Scholz-Doebelin (2000) found very good effects of 1 to 3 treatments of 0,5 % NeemAzal-T/S with different application techniques (spray, spill, ULV application with cold fog technique) in cucumber and tomatoes in the control of white flies, leaf miners, aphids. No negative effects on beneficials were observed. In trials on parsley Schrameyer (2000) determined a very high and long-term effect after one application (0.5 %) against the aphid *Cavariella aegopodii*. The treatment of cabbage with NeemAzal-T/S (Metspalu, 2000) was very successful during the simultaneous infestation of cabbage with *Plutella xylostella*, *Pieris rapae* and *Brevicoryne brassicae*. El Khafif and Plagge (2000) used NeemAzal-T/S against cabbage aphid and obtained 17% more cabbage than in the control. NeemAzal-T/S is generally well compatible with vegetable cultures. In individual cases depression of young cabbage leaves were reported before transplanting into the field. Since 2002 NeemAzal-T/S is registered for application in vegetables for seed production in Germany. In 2004 registrations in Switzerland, Austria and Italy followed in tomato, cucumber and pepper against sucking and biting pests. In Slovenia NeemAzal-T/S is registered since 2003 for use in orchards, ornamentals, vineyards, field crops against a lot of sucking and biting pests.

**Key words:** extracts, *Azadirachta indica*, pest control, vegetables



### Program varstva oljne ogrščice s pripravki Pinus in Bayer CropScience

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Oljna ogrščica kot poljščina se v programih intenzivnega poljedelstva ponovno uveljavlja. Kot oljnica si v integriranih programih poljedelstva vedno bolj utrjuje svoj položaj. V stremljenju po čim višjem in kakovostnem pridelku je pri sami tehnologiji zelo pomembno tudi varstvo proti plevelom, boleznim in škodljivcem. V prispevku omenjamo herbicida Devrinol 45 FL in Trikepin, insekticide Mesurool G, Decis ter fungicid Folicur EW 250.

**Ključne besede:** oljna ogrščica, pleveli, bolezni, škodljivci, Devrinol, Folicur EW

*ABSTRACT*

**Crop protection programme for rape by using the preparations manufactured by Pinus and Bayer CropScience**

Rape as an agricultural plant is winning recognition in intensive agricultural programmes again. Its position as an oil-plant is being strengthened in integrated agricultural programmes. Since our efforts are directed to the best possible quantity and quality of the crop, the protection against weed, diseases and pest is a very important issue regarding the technology itself. In this article the herbicides Devrinol 45 FL and Trikepin are mentioned, as well as the insecticide Mesurool G, Decis, and the fungicide Folicur EW 250.

**Key words:** rape, weed, diseases, pest, Devrinol, Folicur EW

## **Entomologija**

## Množični pojavi vrste *Helicoverpa armigera* Hb. v zadnjem obdobju v Sloveniji

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Sovka *H. armigera* Hb. je v Sloveniji predvsem preletna vrsta, ki v naše kraje prileti iz Sredozemlja, predvsem iz Balkana in Male Azije. Selitev vrste vzpodbujajo visoke temperature in pomanjkanje hrane, zato je v vročih letih številčnost vrste pri nas veliko večja kot v zmerno toplih letih. *H. armigera* je gospodarsko zelo pomembna vrsta, najdemo jo celo na karantenskih seznamih EU in EPPO. Gosenice so polifagne. Hranijo se na številnih zelnatih in celo drevesnih vrstah rastlin, najraje pa na rastlinah z debelim strženom (koruza, sončnica, bombaž), plodovkah (paradižnik, paprika) in stročnicah, kjer gosenice zlahka vrtajo rove v mehke dele rastlin. Gospodarska škoda je v intenzivni proizvodnji zelenjave, okrasnih rastlin in v zavarovanih prostorih, lahko zelo velika. Nastopi že v kratkem obdobju, saj gosenice zelo hitro rastejo, varstveni ukrepi pa so zaradi omejitev v aplikaciji insekticidov (vsakodnevno obiranje pridelka) in življenja gosenic v strženu ali plodovih največkrat neučinkoviti. Najbolje se obnesejo: fumigacija, agrotehnični ukrepi in parazitoidi jajčec. V Sloveniji še nedolgo tega s *H. armigera* nismo imeli težav. Prve množične najdbe gosenic smo zabeležili v vročinskih obdobjih v letih 2000 in 2003. Najdbe gosenic na gojenih rastlinah pa so se začele od leta 1999, tako v rastlinjakih, kot na prostem. Pred tem letom s *H. armigera* nismo imeli večjih težav, beležili smo le posamične najdbe metuljev na svetlobne pasti. Prve večje škode smo ugotovili v letu 2000, v glavnem na plodovih paradižnika in paprike v fazi zorenja ter na storžih koruze v fazi mlečne zrelosti, na območju Vipavske doline. Gosenice smo v tem letu našli tudi na hmelju, krizantemah, lucerni, fižolu in na nekaterih debelostebelnih plevelih. V letu 2003 je vročinsko obdobje nastopilo že konec maja in je trajalo vse do jeseni. Že v juniju smo ugotovili prelete migratornih vrst, ki se v Sloveniji pojavijo zelo redko, med temi je bila številčna tudi vrsta *H. armigera*. Leta 2003 smo zabeležili veliko gospodarsko škodo v območjih preletnih smeri, ki čez Slovenijo vodijo v smeri večjih porečij (Drava – Mura, Sava) in v mediteranski smeri – Primorje in Vipavska dolina. Največ škode je bilo na paradižniku in papriki, tako na prostem kot v rastlinjakih ter na hmelju in koruzi. Območja, kjer smo zabeležili škodo pa so bila: Podravje, Posavje, vsa SV Slovenija, Gorenjska in Vipavska dolina. Vrsto *H. armigera* s svetlobnimi vabami v Sloveniji spremljamo že vrsto let. Najbolj natančno pa smo jo spremljali v hmeljiščih v Radljah ob Dravi. Od leta 1999 se je število zabeleženih osebkov na svetlobnih vabah konstantno povečevalo. Najštevilčnejši pa je bil nalet metuljev v letih 2000 in 2003.

**Ključne besede:** *Helicoverpa armigera* Hb., Noctuidae, gospodarka škoda, Slovenija, bionomija, paradižnik, paprika, hmelj, koroza, svetlobne vabe, monitoring

## ABSTRACT

### Mass occurrence of the species *Helicoverpa armigera* Hb. in the recent period in Slovenia

Cotton bollworm (*H. armigera* Hb.) is a species, which flies to Slovenia from the Mediterranean, in particular from the Balkan Peninsula and Asia Minor. Migrations are encouraged by high temperatures and lack of food, therefore in hot years the number of representatives of the species in our country is much bigger than in years of moderate temperatures. *H. armigera* is a species of significant economic importance and may be found even on quarantine lists of the EU and EPPO. Caterpillars are polyphagous. They feed on a number of herbaceous species and even on tree species, however they prefer plants with thick pith (maize, sunflower, cotton), fruiting vegetables (tomato, paprika) and leguminous plants, enabling caterpillars to easily bore holes into soft parts of plants. Intensive production of vegetables, ornamental plants and production in greenhouses may thus suffer great economic loss. Such loss occurs within a rather short period of time, since caterpillars grow quickly and protective measures usually fail due to limitations imposed on the application of insecticides (every-day harvesting) and caterpillars living in pith or fruits. As the most effective proved: fumigation, agrotechnical measures and egg parasitoids. Not long ago *H. armigera* represented no problem in Slovenia. First mass findings of caterpillars were recorded in the periods of high temperatures in 2000 and 2003. In the years prior to 2000 *H. armigera* had caused no significant damage, only individual butterflies could be caught by light traps. First significant damages were recorded in 2000, most of all on tomato and paprika fruits in the ripening phase and on corncoobs in Vipava Valley in the phase of lactic maturity. In that year caterpillars could be found also on hops, chrysanthemus, lucerne, beans and some thick-stem weeds. In 2003 the period of high temperatures started already at the end of May, to end only in autumn. In June over-flights of migratory species, the occurrence of which in Slovenia is rare, were recorded, including a significant number of representatives of the species *H. armigera*. In 2003 significant economic loss was recorded within the areas of flight directions across Slovenia towards bigger river basins (Drava – Mura, Sava) and in Mediterranean direction – Primorje and Vipava Valley. The most significant loss was suffered by tomato and pepper, both in the field and in greenhouses, as well as hops and maize. The loss was recorded in the following areas: the Drava region, the Posavje region, the whole northeast Slovenia, the Upper Carniola and the Vipava Valley. In Slovenia monitoring of the species *H. armigera* with light traps has been taking place already for a long time. The monitoring has been the most precise in fields of hops in Radlje ob Dravi. From 1999, the number of recorded subjects has been constantly increasing. However the flight of butterflies was the most intensive in 2000 and 2003.

**Key words:** Cotton bollworm, *Helicoverpa armigera* Hb., Noctuidae, economic loss, Slovenia, bionomy, tomato, pepper, hops, maize, light traps, monitoring



## Monitoring metuljev z vidika integrirane pridelave hmeljišč v Radljah ob Dravi

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Na hmeljskem posestvu v Radljah ob Dravi že od leta 1999 načrtno, vsak dan v sezoni, spremljamo ulov metuljev na svetlobno vabo, ki ima za vir svetlobe živosrebrno 150 W žarnico. Vaba je obratovala vso noč. Hmeljišča obsegajo več kot 80 ha strnjanih zemljišč, vaba pa je postavljena ob poti sredi hmeljišč. Vzorce ujetih metuljev smo analizirali po dnevih ulova, glede posameznih vrst in števila osebkov posamezne vrste. Podatke o evidentiranih vrstah in številu osebkov smo po ulovih vpisovali v aplikacijo Lepidat, končne rezultate pa smo poleg omenjene aplikacije obdelali še v programih MS Access in MS Excel. Namen spremljanja favne metuljev v hmeljišču je usmerjenost posestva v integrirano pridelavo hmelja, ob čim manjši uporabi fitofarmaceutskih sredstev. S tem načinom smo natančno sledili pojavljanje posameznih vrst metuljev v rastni dobi, tako glede časa, kot številčno. Ob pojavu večjega števila primerkov za hmelj gospodarsko pomembnih vrst smo z vizualnim opazovanjem pojava gosenic presodili o potrebah za izvedbo varstvenih ukrepov. Z omenjenim načinom spremljanja gospodarsko pomembnih vrst metuljev, aktivnih ponoči smo zmanjšali število škropljenj glede na hmeljišča v Savinjski dolini za eno do dve škropljenji na leto. Poleg tega smo favnistično gledano v petih letih zbrali 12.249 podatkov o 598 različnih vrstah metuljev. Od tega je 222 vrst majhnih metuljev (4.337 podatkov, 12.851 primerkov) in 376 velikih metuljev (7.912 podatkov, 17.393 primerkov). Vzrok manjšega števila vrst majhnih metuljev v favni je njihova manjša sposobnost letenja na velike razdalje in delna selektivnost vabe, ki je zaradi višine lovila le višje leteče vrste. Razlike v številu ujetih primerkov pa so precej manjše. Maksimalno število vrst v vzorcih smo določili v obdobju od srede junija do srede avgusta, ki je bilo v tem obdobju precej konstantno. Pojavljala so se le nihanja med leti in nihanja odvisna od vremenskih dejavnikov. Po gostiteljih lahko favno razdelimo na vrste, ki so vezane na hmelj, vrste, ki so vezane na plevelne in na vrste, ki so v preletu. Slednjih je bilo v vzorcih največ, vendar pa so vrste hmelja in plevelne vegetacije po številu primerkov najpogostejše. Vrsta z največjim številom primerkov in največ podatki v času proučevanja je *Xestia c-nigrum* L. Po skupnem številu ujetih primerkov ji sledijo: *Udea ferrugalis* Hb., *Pleuroptya ruralis* Sc., *Plutella xylostella* L., *Rivula sericealis* Sc., *Crambus perlella* Sc., *Helicoverpa armigera* Hb., *Spodoptera exigua* Hb., *Ochropleura plecta* L., *Nomophila noctuella* D.& Sch., *Agrotis exclamationis* L., *Thera variata* D.& Sch. in *Dioryctria abietella* D.& Sch. Vse razen zadnjih dveh se v fazi gosenice hranijo na hmelju ali na plevelni vegetaciji, zadnji dve pa živita na iglavcih, ki so od svetlobne vabe oddaljeni vsaj 500 m. Poleg pogostih vrst smo ugotovili tudi selivce mediteranske favne, ki so bili *Helicoverpa armigera* Hb., *Acantholeucania loreyi* Dup., *Spodoptera exigua* Hb. in *Hellula undalis* F. Vse izmed naštetih se v notranjosti Slovenije pojavijo le v izjemno vročih letih. Ker so polifagne, se hranijo tudi na hmelju.



**Ključne besede:** Lepidoptera, favna, Slovenija, metulji, svetlobna vaba, monitoring, škodljivci, hmelj

ABSTRACT

### **Monitoring of moths in the light of integrated production in hop plantation in Radlje ob Dravi**

Monitoring of moths on an everyday basis in a season, by the means of light traps with mercury 150-watt bulbs, has been carried out in a hop plantation in Radlje ob Dravi since 1999. The trap has been operating for the whole night. It has been situated near a path in the middle of the hop plantation with the surface of more than 80 ha. Samples of the caught moths have been analysed by day of catch, so as to determine the presence of individual species and the number of representatives of a species. Data on the recorded species and the number of specimens have been entered in the application Lepidat. The final results has been processed in the application Lepidat and by programmes MS Access and MS Excel. The monitoring of moths in the hop garden aims at integrated production of hops with minimum application of plant protection products. Thus the occurrence of individual species of butterflies was possible to be monitored accurately, with respect to a season as well as their number. If a species, which is economically important for hops, occurred in high numbers, the need for protective measures had been assessed on the basis of visual examination of the occurrence of caterpillars. Such monitoring of economically important species of moths resulted in the number of spraying of hop gardens in Savinjska dolina to be decreased for one to two sprayings a year. Furthermore, from the faunistic point of view, 12.249 data related to 598 species of moths have been obtained in a five-year period. The number includes 222 species of Microlepidoptera (4.337 data, 12.851 specimens) and 376 species of Makrolepidoptera (7.912 data, 17.393 specimens). Small numbers of species of Microlepidoptera in the fauna are due to their not being as capable of flying over long distances, and to partial selectivity of the trap, which due to its high positioning has been catching only species capable of flying higher. However the differences in the number of caught specimens are significantly smaller. The maximum number of species in samples was being determined within the period from the middle of June till the middle of August, which turned out to be quite constant. Fluctuations occurred between particular years and due to weather conditions. The fauna may be classified by host plants into species, associated with hops, species, associated with weeds and species in over-flight. The latter were the most numerous, however species of hops and weed vegetation proved to be the most frequent as regards the number of specimens. A species which possessed the highest number of specimens and data in the time of examining was *Xestia c-nigrum* L. In respect of the total number of the caught specimens, it is followed by: *Udea ferrugalis* Hb., *Pleuroptya ruralis* Sc., *Plutella xylostella* L., *Rivula sericealis* Sc., *Crambus perlilla* Sc., *Helicoverpa armigera* Hb., *Spodoptera exigua* Hb., *Ochropleura plecta* L., *Nomophila noctuella* D.& Sch., *Agrotis exclamationis* L., *Thera variata* D.& Sch. and *Dioryctria abietella* D.& Sch. In the phase of caterpillar all of them, except the last two, feed on hops or weed vegetation, however the last two live on conifers, which are at least 500 m distant from the light trap. In addition to the most frequent species also migrants of the Mediterranean fauna were found, namely *Helicoverpa armigera* Hb., *Acantholeucania loreyi* Dup., *Spodoptera exigua* Hb. and *Hellula*

undalis F. The occurrence of all above species in central Slovenia is conditioned by extremely high temperatures. Since they are polyphagous, they feed also on hops.

**Key words:** Lepidoptera, fauna, Slovenia, moths, light trap, monitoring, harmful organisms, hops



### **Problematika pojava južne plodovrtke (*Helicoverpa armigera* Hubner) na območju Posavja in Dolenjske**

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Prvi pojav metuljev južne plodovrtke (*Helicoverpa Armiger* HB.) je bil v Sloveniji zabeležen leta 1999. V drugi polovici meseca avgusta 2003 smo na območju jugovzhodne Slovenije opazili prve škode povzročene s strani polifagnih gosenic. Za spremljanje pojava metuljev, napovedovanje ter sporočanje ustreznih ukrepov zaščite smo uporabili več različnih metod ter razvili lasten sistem spremljanja. Spremljali smo s pomočjo feromonskih vab, piramidnimi svetlobnimi vabami in avtomatskimi svetlobnimi vabami. Najpopolnejše rezultate smo dobili pri spremljanju leta z uporabo avtomatskih svetlobnih vab. Na osnovi pridobljenih podatkov smo določili kritični moment ustrezne uporabe pripravkov za varstvo rastlin. Feromonske vabe smo uporabili na treh, svetlobne avtomatske vabe pa na petih različnih lokacijah. Spremljanje z uporabo avtomatskih svetlobnih vab na referenčnih lokacijah ter svetlobnih piramid na najbolj izpostavljenih mestih je zagotavljalo zadovoljive podatke o letu metuljev. Škoda, ki se je pojavljala, je bila največja na plodovih paradižnika v zaščiteneh prostorih in manjša na papriki sajeni na prostem. Ugotovili smo, da so nedozoreli plodovi paradižnika bolj izpostavljeni napadu kot zreli plodovi. V nedozorele plodove se gosenice zavrtavajo v notranjost, pri zrelih se hranijo s povrhnico. V primeru napadenih plodov paprike obstaja možnost zamenjave s škodo, ki jo v veliko večjem obsegu trenutno povzroča koruzna vešča (*Ostrinia Nubilalis* HB). Gosenice škodljivca je zaradi spreminjanja barve in vzorca med razvojnimi stadiji možno zamenjati z gosenicami drugih vrst sov. Hkrati smo iz pridobljenih podatkov o letu metuljev prišli tudi do spoznanj o bionomiji škodljive vrste sov.

**Ključne besede:** *Helicoverpa Armigera*, polifagni škodljivec, svetlobne vabe, vrtnarstvo, plodovke, paradižnik, paprika

*ABSTRACT*

### **Cotton bollworm (*Helicoverpa armigera* Hübner) in Posavje and Dolenjska region**

In Slovenia the first appearance of cotton bollworm (*Helicoverpa armigera* HB.) was recorded in 1999. In the second half of August 2003 we noticed in the southeastern part of Slovenia the first damage caused by polyphagous caterpillars. We used several different methods for monitoring and forecasting and we developed our own monitoring system.

Monitoring was performed with pheromone traps. The most complete results were acquired with the use of automatic light traps. With the use of collected data we established a critical moment for appropriate use of insecticides. Pheromone traps were used on three and automatic light traps on five different locations. Automatic light traps monitoring and pyramid attracting lights gave satisfactory data of moth flight. The damage which occurred was the biggest on tomato crops in greenhouses and lesser on crops of pepper fields. We determined that unripe tomatoes are more exposed to the attack of the bollworm than the ripe ones. Caterpillars drill into the unripe tomatoes and feed on epidermis of ripe ones. In the case of attacked peppers the damage can be mistaken with an European corn borer (*Ostrinia nubilalis* Hb.) which is momentarily causing damage on a big scale. The caterpillar is, because of its color and pattern changes, during the growth cycles easily mistaken with other noctuid caterpillars. During the research we also acquired the knowledge of the bionomy of the noctuid pest which will be useful in our future monitoring and forecasting.

**Key words:** *Helicoverpa armigera*, polyphagous pest, light traps, horticulure, fruit crops, tomato, peper



**Povezanost med napadom posevkov ozimne pšenice in ječmena z listnimi ušmi (Aphidoidea) in obsegom pojava viroze rumena pritikavost ječmena (BYDV) na Hrvaškem**

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Spomladi leta 2002 smo na posevkih ozimne pšenice, posebej pa na posevkih ozimnega ječmena, odkrili močan napad od virusa *BYDV*, ki povzroča virusno bolezen rumeno pritikavost ječmena. Tistega leta se je pridelek zaradi okužb s tem virusom zmanjšal tudi do 30%. Jeseni istega leta smo na posevkih ječmena in pšenice na 26 lokacijah raztreseno po Hrvaški, kjer se je pojavil močan napad virusa *BYDV*, odvzeli vzorce krilatih oblik uši (generacija *alatae*). Na posamezno lokacijo smo odvzeli en vzorec. Zbiranje vzorcev uši smo nadaljevali tudi v letih 2003 (na 27 lokacijah) in v letu 2004 (na 30 lokacijah). Taksonomsko določanje vrst ujetih uši so opravili na ustanovi Zavod za zoologiju Poljoprivrednog fakulteta u Zagrebu. Rezultati analize vrstne sestave ujetih uši so pokazali, da v populacijah uši na njivah, kjer so se pojavljale okužbe z virusom prevladujejo naslednje tri vrste uši; *Rhopalosiphum padi* L., *Rhopalosiphum maidis* Fitch. in *Sitobion avenae* F. Pojav virusa *BYDV* je bil dokaj močan tudi spomladi leta 2003, med tem, ko spomladi leta 2004 pojava virusa nismo uspeli zaznati. V letu 2004 je pojav virusa verjetno izostal zaradi slabih vremenskih razmer za razvoj posevkov koruze, ki je glede na naše raziskave najpomembnejša drugotna rastlina gostiteljica v vzorcih zastopanih vrst uši, v obdobju od žetve in do razvoja mladih posevkov žit v jeseni.

**Ključne besede:** ozimna pšenica, ozimni ječmen, uši, virus *BYDV*

*ABSTRACT*

**Correlation between aphid (Aphidoidea) attack rate and barley yellow dwarf (*BYDV*) virus infection rate in Croatian winter wheat and barley crops**

In spring of 2002 heavy infection of winter wheat and especially of barley crops with barley yellow dwarf (*BYDV*) virus was observed. In that year yield losses reaching 30% were established. In the autumn of the same year on 25 locations throughout Croatia, where heavy infections were observed, the survey of aphid species was carried out. On each location a sample of aphids (winged *alatae*) was taken (altogether 25 samples). The survey was continued in 2003 (27 sampling locations) and 2004 (30 sampling locations). The determination of sampled aphid species was performed by the Institute of Zoology of the Faculty of Agriculture of Zagreb University. The analyses of aphid samples have shown that aphids species *Rhopalosiphum padi* L., *Rhopalosiphum maidis* Fitch. and *Sitobion avenae* F. have been dominant on all locations. Moderate yellow dwarf virus infections were observed also in spring of 2003, but in 2004 virus infections could not be noticed, presumably because of worse weather conditions for development of maize crops, which are according to our findings, prevalent plant hosts of mentioned aphid species in the period from harvest till the development of new winter cereal crops in autumn.

**Key words:** aphids, (Aphidoidea), barley yellow dwarf (*BYDV*) virus, epidemiology, Croatia, winter cereals



**Spremljanje hmeljevega bolhača (*Psylliodes attenuatus* Koch) z barvnimi lepljivimi ploščami**

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Hmeljev bolhač, *Psylliodes attenuatus* Koch (Coleoptera: Chrysomelidae), je pomemben škodljivec hmelja. Odrasli hrošči se pojavijo zgodaj spomladi in se hranijo na listih mladih hmeljnih rastlin. V zadnjem času povzroča poškodbe tudi poletna generacija hmeljevega bolhača, ki ne poškoduje samo liste hmelja temveč tudi storžke. Hmeljevega bolhača smo v letu 2001 in 2002 spremljali v hmeljiščih na različnih mestih z barvnimi lepljivimi ploščami. Uporabili smo tri različne barvne lepljive plošče in sicer rumene, bele in modre, proizvajalca Unichem d.o.o. Največ osebkov hmeljevega bolhača se je ulovilo na rumene lepljive plošče. Na bele in modre se je ulovilo manj hroščev, med katerima pa ni statistično značilnih razlik. Ulov hroščev je bil različen na različnih opazovanih točkah v hmeljišču. Na različnih mestih v hmeljišču in v različnih obdobjih spremljanja se je prav tako ulovilo različno število hroščev.

**Ključne besede:** hmeljev bolhač, *Psylliodes attenuatus*, monitoring, barvne lepljive plošče

*ABSTRACT*

**The hop flea beetle (*Psylliodes attenuatus* Koch) monitoring with color sticky traps**

Hop flea beetle, *Psylliodes attenuatus* Koch (Coleoptera: Chrysomelidae), is a serious pest of hop. The adult beetles are most noticeable in the early spring and feed on young leave hop crops. Lately we have noticed the damage caused by the generation of hop flea beetle in summer which not only affects the hop leaves but also the cones. Color sticky trap experiments were conducted in the hop garden on different observation posts in the season 2001 and 2002. We used to three different color sticky traps, yellow, white and blue, which they produce company Unichem d.o.o. The largest number of hop flea beetles got trapped by yellow sticky traps. Fewer hop flea beetles got trapped by white and blue sticky traps and there were no statistically significant differences between the latter two. The number of hop flea beetles was different on different observation posts in hop garden and so was in different parts of hop garden and at different times of monitoring.

**Key words:** hop flea beetle, *Psylliodes attenuatus*, monitoring, color sticky traps

## **Nematologija**

**Ugotavljanje učinkovitosti štirih vrst entomopatogenih ogorčic (Rhabditida) za zatiranje rastlinjakovega ščitkarja (*Trialeurodes vaporariorum* Westwood, Homoptera, Aleyrodidae)**

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Entomopatogene ogorčice so talni organizmi, katerih uporaba v namene biotičnega varstva je bila doslej vezana zlati na talne škodljivce. Uporaba entomopatogenih ogorčic za zatiranje nadzemskih škodljivcev pomeni novost v biotičnem varstvu rastlin. Namen naše raziskave je bil v laboratorijskih razmerah preučiti učinkovitost štirih vrst entomopatogenih ogorčic (*Steinernema feltiae*, *Steinernema carpocapsae*, *Heterorhabditis bacteriophora*, *Heterorhabditis megidis*) za zatiranje imagov rastlinjakovega ščitkarja (*Trialeurodes vaporariorum* Westwood). S preučevanjem hkratnega delovanja različnih vrednosti okoljske temperature in koncentracije ogorčic v suspenziji [500, 1000 in 5000 ogorčic/ml] smo pridobili pomembne in doslej še malo znane podatke o učinkovitosti obravnavanih vrst entomopatogenih ogorčic za zatiranje rastlinjakovega ščitkarja.

**Ključne besede:** entomopatogene ogorčice (Rhabditida), *Trialeurodes vaporariorum*, zatiranje škodljivcev, biotični agensi

*ABSTRACT*

**Research on efficacy of four species of entomopathogenic nematodes (Rhabditida) to control greenhouse whitefly (*Trialeurodes vaporariorum* Westwood, Homoptera, Aleyrodidae)**

Entomopathogenic nematodes are soil organisms, the use of which has been up till now related mainly to soil harmful organisms. The use of the entomopathogenic nematodes for the control of the above-ground harmful organisms is relatively new in the biotical control of pests. Our research aimed at examining the efficacy of four species of entomopathogenic nematodes (*Steinernema feltiae*, *Steinernema carpocapsae*, *Heterorhabditis bacteriophora*, *Heterorhabditis megidis*) for the control of adults of greenhouse whitefly (*Trialeurodes vaporariorum* Westwood) in laboratory conditions. Examination of simultaneous effect of different values of air temperatures and concentrations of nematodes in a suspension [500, 1000 and 5000 nematodes per ml] resulted in obtaining important and completely new information on the efficacy of the examined species of entomopathogenic nematodes for the control of greenhouse whitefly.

**Key words:** entomopathogenic nematodes (Rhabditida), *Trialeurodes vaporariorum*, pest control, biological control agent



## **Rezultati preučevanja rumene krompirjeve ogorčice *G. rostochiensis* Woll. (Behrens) v Sloveniji**

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V obdelovalnih tleh se v Sloveniji poleg rumene krompirjeve ogorčice *Globodera rostochiensis* pojavlja tudi gospodarsko nepomembna vrsta rmanova ogorčica *G. achilleae*, medtem ko je bila izredno nevarna bela krompirjeva ogorčica *G. pallida* večkrat prestrežena pri uvoznih pošiljkah. Pravilna determinacija vrst rodu *Globodera* je nujna, zato imamo na KIS na voljo več neodvisnih metod (morfometrija, PCR, PhastSystem). Rezultati sistematičnega nadzora nad krompirjevimi ogorčicami v Sloveniji kažejo, da se rumena krompirjeva ogorčica *G. rostochiensis* počasi, a vztrajno širi na različna pridelovalna območja. Sistematični nadzor poteka pod okriljem KIS že od leta 1963. Na rumeno krompirjevo ogorčico smo naleteli prvič leta 1971 v vasi Dobrava pri Dravogradu kasneje pa še v Libeličah pri Dravogradu leta 1999, Šenčurju pri Kranju leta 2000 ter na Okroglem pri Zlatem polju leta 2003. V letu 2004 smo ugotovili napad *G. rostochiensis* v Posočju (dolina Trente, Bovško do Kobarida) ter na njivi jedilnega krompirja na Sorškem polju. V primeru Posočja, kjer ni pomembnejše pridelovalno območje in se krompir prideluje zgolj za samooskrbo so predlagani fitosanitarni ukrepi usmerjeni v preprečevanje širjenja izven okuženega območja. Po drugi strani pa je bilo na Koroškem potrebno izvajati fitosanitarne ukrepe za izkoreninjenje omenjenega škodljivca, ker se na tem območju prideluje precej jedilnega in semenskega krompirja.

**Ključne besede:** *Globodera*, identifikacija, Posočje, Gorenjska, fitosanitarni ukrepi

### *ABSTRACT*

#### **Results of the study of the yellow potato cyst nematode *G. rostochiensis* Woll. (Behrens) in Slovenia**

In addition to the potato cyst nematode (PCN) *Globodera rostochiensis*, the economically unimportant yellow cyst nematode *G. achilleae* is mainly found in the arable soils of Slovenia while very dangerous *G. pallida* has been intercepted only in imported deliveries. Since the proper identification of *Globodera* species is necessary, several independent methods were introduced for that purpose at Agricultural Institute of Slovenia (morphometrics, PCR, PhastSystem). The results of the PCN monitoring show a slow but undeniable spreading of *G. rostochiensis* into different parts of Slovenia. The PCN monitoring has been performed by the Agricultural Institute of Slovenia since 1963. The PCN *G. rostochiensis* was found for the first time in Slovenia in Dobrava near Dravograd in 1971. After that it was found in Libeliče near Dravograd (1999), Šenčur near Kranj (2000) and Okroglo near Zlato polje (2003). In 2004, *G. rostochiensis* was found in Posočje (Trenta valley, the area of Bovec to Kobarid) and in the potato field in Sorško polje. Posočje is a rather extensive area for potato production; therefore, the plant protection measures were



focused mainly on the prevention of spreading outside the infested area. On the other hand, as Koroška represents an intensive seed and ware potato production area, the plant protection measures were aimed at eradicating the pest.

**Key words:** *Globodera*, identification, Posoče, Gorenjska, phytosanitary measures



### **Razširjenost ogorčic koreninskih šišč *Meloidogyne* spp. v Sloveniji**

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Ogorčice koreninskih šišč *Meloidogyne* spp. so obligatni zajedavci številnih eno- in dvokaličnic. Na koreninah gostiteljskih rastlin povzročajo odebelitve (koreninske šiške), v katerih se prehranjujejo in razmnožujejo. Vrste rodu *Meloidogyne* uvrščamo v skupino gospodarsko škodljivih organizmov, povzročena škoda pa je odvisna od vrste gostiteljske rastline in vrste ogorčice. Do zdaj so bile v Sloveniji ugotovljene štiri vrste iz tega rodu in sicer: *M. hapla* (izolirana je bila iz različnih gostiteljskih rastlin iz različnih krajev Slovenije), *M. incognita* (prvič smo jo izolirali leta 2002 iz korenin paprike, ki je rasla v rastlinjaku), *M. ethiopica* (ugotovljena na koreninah paradižnika iz rastlinjaka v Dornberku; prva najdba te vrste v Evropi) in *M. arenaria* (najdena na prostem na koreninah paprike v okolici Ljubljane – prva najdba pri nas). Identifikacijo omenjenih ogorčic koreninskih šišč smo opravili z morfometrijsko metodo in potrdili z izoencimsko gelsko elektroforezo (PhastSystem). V prispevku podrobneje predstavljamo tudi vrsti *M. chitwoodi* in *M. fallax*, ki sta v Sloveniji in drugih državah EU na listi IA2 škodljivih karantenskih organizmov.

**Ključne besede:** *Meloidogyne*, identifikacija, razširjenost, karantenske vrste

*ABSTRACT*

### **The presence or root-knot nematodes *Meloidogyne* spp. in Slovenia**

Root-knot nematodes *Meloidogyne* spp. are obligatory pests of several mono- and dicotyledons. They are able to induce swellings (root galls) on the host roots on which they develop and propagate. *Meloidogyne* spp. belong to the economically important harmful organisms. The extent of the harm caused depends on the host type and the root-knot nematode species. So far, four species of *Meloidogyne* have been established in Slovenia: *M. hapla* (in Slovenia it was isolated from many host plants growing in different locations), *M. incognita* (in Slovenia it was isolated for the first time in 2002 from the roots of the hot pepper plants grown in greenhouse), *M. ethiopica* (in 2003 it was isolated for the first time in Europe from the roots of tomato plants grown in a greenhouse situated in Dornberk, Slovenia) and *M. arenaria* (first finding – open field infested soil samples in Ljubljana). The identity of the nematodes was determined using the morphometrical method and confirmed by isozyme gel electrophoresis (PhastSystem). Quarantine species of root-knot nematodes *M. chitwoodi* and *M. fallax* are also presented in this contribution.

**Key words:** *Meloidogyne*, identification, spreading, quarantine species



## Longidoridne ogorčice v vinogradnih tleh Slovenije

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Longidoridne ogorčice, med katere spadajo vrste rodov *Longidorus* in *Xiphinema*, prištevamo med pomembne prenašalce nepovirusov. V obdobju 2002 – 2004 smo v delu slovenskih vinogradov opravili precej obširno raziskavo zastopanosti in geografske razširjenosti posameznih vrst družine Longidoridae. Vzorce tal smo jemali iz globine 0 – 40 cm, iz njih pa smo izločali ogorčice z metodo krožnega gibanja in z modificiranim Baermannovega sistema. Izločene longidoride smo fiksirali v TAF-u, jih mikroskopsko pregledali in morfometrijsko obdelali s pomočjo računalniškega programa LUCIA. Iz vzorcev tal, odvzetih iz posameznih vinogradov na vzhodnem in zahodnem delu Slovenije smo izločili 2 vrsti rodu *Longidorus* in 5 vrst rodu *Xiphinema*. Vrsti *Longidorus juvenilis* in *Longidorus* sp. (vrsta v času pisanja izvlečka še ni determinirana) smo v Sloveniji ugotovili prvič, njuno zastopanost pa smo ugotovili na vzhodu Slovenije (Svetinje oz. Juršinci). Na vrste rodu *Xiphinema*: *X. rivesi*, *X. pachtaicum* and *X. index* smo naleteli v Vipavski dolini in Krasu, medtem ko smo na Štajerskem (Strežetina oz. Svetinje) ugotovili zastopanost vrst *X. brevicole* in *X. wuittenezi*.

**Ključne besede:** *Longidorus*, *Xiphinema*, vinogradna tla, Slovenija

ABSTRACT

### Longidorids species from Slovenien vineyard soils

The nematodes belonging to the genera *Longidorus* and *Xiphinema*, commonly referred to as longidorids are well known vectors of several Nepoviruses. The occurrence and geographical distribution of members of the Longidoridae in Slovenian vineyards was comprehensively examined during 2002 and 2004. Soil sampling was accomplished at 0 to 40 cm depth using nematological probe. The nematodes were extracted from soil by whirling motion method and modified Berman's funnel method. Longidorids specimens were collected, fixed in TAF and examined under microscope using LUCIA image analyser software. Two *Longidorus* and five *Xiphinema* species were identified from soil samples collected in vineyards and were restricted to discrete areas. *L. juvenilis* and *Longidorus* sp. were found in Slovenia for the first time and were present in the eastern part of the country (Svetinje and Juršinci respectively). *X. rivesi*, *X. pachtaicum* and *X. index* were extracted from samples taken from vineyards from the west of the country (Vipavska dolina, Kras), while *X. brevicole* and *X. wuittenezi* were present in the east (Štajerska region, Strežetina and Svetinje respectively).

**Key words:** *Longidorus*, *Xiphinema*, vineyard soil, Slovenia

## **Mikologija**



## Kap vinske trte in njeni možni povzročitelji v vinorodni deželi Primorska

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V Sloveniji so kap vinske trte na podlagi bolezenskih znamenj ugotovili na Primorskem pred približno desetimi leti. V poskusu smo poskušali izolirati glive, ki so možne povzročiteljice bolezenskih znamenj kapi vinske trte na Primorskem. Problematiko kapi vinske trte smo spremljali na štirih sortah vinske trte (*Vitis vinifera* L.); 'Malvazija', 'Merlot', 'Refošk' in 'Sauvignon'. Na petih lokacijah smo zbrali vzorce trsov z značilnimi bolezenskimi znamenji kapi vinske trte. Glive smo izolirali v laboratoriju, na PDA gojišču, po standardnih postopkih. Izolate smo determinirali s pomočjo determinacijskih ključev in primerjalnih glivnih kultur iz mikoloških zbirk Biotehniške fakultete Univerze v Ljubljani in Kemijskega inštituta Slovenije. V vzorčnem materialu smo največkrat izolirali glive iz rodu *Phaeoacremonium*, v 31,5 % izolatov. Izolirali smo še glivi *Phaeomoniella chlamydospora* W. Gams, Crous, M.J. Wingfield & L. Mugnai in *Fomitiporia punctata* (P.Karst.) Murill. Naštete vrste najpogosteje povezujejo s pojavom bolezenskih znamenj kapi vinske trte.

**Ključne besede:** kap vinske trte, vinska trta, Primorska, Slovenija, parazitske glive

*ABSTRACT*

### Esca disease and possible causal agents in Primorska viticulture region

The Esca disease has been determined in Slovenia in the Primorska vine-growing region on the basis of symptoms approximately ten years ago. In the experiment fungi associated with Esca disease in grapevine in the Primorska vine-growing region were to be isolated. The Esca disease was observed in four grapevine varieties (*Vitis vinifera* L.); 'Malvazija', 'Merlot', 'Refošk' and 'Sauvignon'. In five locations samples of grapevine with specific symptoms of Esca disease were collected. Fungi were isolated in the laboratory, using standard laboratory techniques. The main fungi isolated were identified by determination keys and by comparing strains obtained in fungi collection of Biotechnical Faculty of University of Ljubljana and National Institute of Chemistry of Slovenia. The most frequent fungi isolated in the sample material belong to the genus of *Phaeoacremonium*, determined in 31.5 % of isolates. Fungi *Phaeomoniella chlamydospora* W. Gams, Crous, M. J. Wingfield & L. Mugnai and *Fomitiporia punctata* (P. Karst.) Murill. were isolated too. These fungi are most frequently associated with esca-affected grapevines.

**Key words:** Esca disease, Grapevine, Primorska, Slovenia, parasitic Fungi



***Septoria lactucae* Pass. ali *Septoria birgatae* Bedlan**

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Leta 2001 smo v sortnem poskusu glavnote solate (*Lactuca sativa* L. var. *capitata* L.) na laboratorijskem polju Biotehniške fakultete opazili na listih bolezenska znamenja v obliki rjavih nepravilnih peg. Po okuženosti je najbolj izstopala sorta 'Vanity'. Sprva smo mislili, da je povzročitelj bolezni gliva *Septoria lactucae* Pass. Z natančnejšo analizo in ob pomoči avstrijskih strokovnjakov smo ugotovili, da gre za vrsto *Septoria birgatae* Bedlan, ki je bila leta 1999 prvič opisana. Vrsta je prvič ugotovljena tudi v Sloveniji. V prispevku so opisana bolezenska znamenja, povzročiteljica bolezni in mere ter značilnosti njenih razmnoževalnih organov.

**Ključne besede:** solata, *Septoria lactucae*, *Septoria birgatae*, Slovenija

*ABSTRACT*

***Septoria lactucae* Pass. or *Septoria birgatae* Bedlan**

In 2001 an assortment trial of lettuce (*Lactuca sativa* L. var. *capitata* L.) was conducted at the Laboratory field of Biotechnical Faculty. Brown spots of irregular form were observed on the lettuce leaves. The infection turned out to be most intense on the variety 'Vanity'. Though at first we believed that the disease was caused by *Septoria lactucae* Pass, a more accurate analysis and the assistance of the Austrian experts finally led us to the conclusion that the symptoms were caused by the species *Septoria birgatae* Bedlan. It was first reported in 1999. The species was for the first time determined in Slovenia. In the paper the symptoms of the disease, the pathogen, dimensions and characteristics of the reproductive structures are described.

**Key words:** lattuce, *Septoria lactucae*, *Septoria birgatae*, Slovenia



### ***Microsphaera azaleae* U. Braun v Sloveniji**

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V začetku meseca septembra 2004 smo dobili v analizo vzorce okuženih azalej iz okolice Litije (Slovenija) z značilnimi znamenji okužbe s pepelovko. Po rutinskem mikroskopskem pregledu smo ugotovili le nespolno obliko glive *Oidium* sp., ki je bila močno parazitirana z antagonistom *Ampelomyces quisqualis* Ces. Glede na znane literaturne podatke smo povzročitelja pripisali vrsti *Oidium ericinum* Erikss., ki je znan patogen rodu *Rhododendron* in drugih rodov iz družine Ericaceae (vresovke). Med pregledom okuženih delov smo opazili strukture podobne začetkom tvorbe kleistotecijev. Po mesecu dni smo ponovno vzeli vzorce iz okuženih rastlin. Na njih so bili popolnoma oblikovani spolni razmnoževalni organi – kleistoteciji. Vrsta je bila determinirana kot *Microsphaera azaleae* U. Braun. Gliva je bila v letu 2004 prvič ugotovljena v Sloveniji na hibridih listopadnih azalej, Knaphill 'Berry Rose' in 'Gibraltar'.

**Ključne besede:** azaleja, pepelovka, *Microsphaera azaleae*, Slovenija

#### *ABSTRACT*

### ***Microsphaera azaleae* U. Braun in Slovenia**

At the beginning of September 2004 we received a sample of azalea from the vicinity of Litija (Slovenia) to be analysed, as on the leaves typical symptoms of infection with powdery mildew were evident. By means of a routine microscopic analysis only the asexual stadium of *Oidium* sp. was found. The pathogen was heavily parasitized with an antagonistic fungus *Ampelomyces quisqualis* Ces. According to the known literature data, the fungus was determined as *Oidium ericinum* Erikss., which is a known pathogen of the *Rhododendron* and other genus from the Ericaceae family. During the examination of the infected parts we traced structures resembling cleistothecia in its earlier form. After a month samples from the infected plants were taken again and it was established that the fungus developed sexual reproductive structures – cleistothecia. The species was determined as *Microsphaera azaleae* U. Braun. Thus, in 2004 we traced the first occurrence of *Microsphaera azaleae* in Slovenia in 2004 on deciduous azalea hybrids, Knaphill 'Berry Rose' and 'Gibraltar'.

**Key words:** azalea, powdery mildew, *Microsphaera azaleae*, Slovenia



## Razvoj novih diagnostičnih metod za določanje izolatov glive *Verticillium albo-atrum* na hmelju

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Hmeljni izolati gliv *Verticillium albo-atrum* Reinke & Berthold in *V. dahliae* Klebahn so zaradi povzročanja velike gospodarske škode v hmeljarstvu uvrščeni na EPPO A2 seznam karantenskih organizmov. Omenjeni glivi sta razširjeni na večini hmeljarskih območij Evrope, pri čemer izolati glive *V. albo-atrum* povzročajo največ težav pridelavi hmelja. V Sloveniji sta bila z uporabo patogenih testov identificirana dva različno virulentna hmeljna patotipa PG1 in PG2 glive *V. albo-atrum* od katerih se je slednji pojavil leta 1997. Patotip PG2 je trenutno omejen na območje zahodnega dela Savinjske doline, kjer vsako leto povzroča letalno obliko hmeljeve uvelosti ter posledično propadanje hmeljišč. Identifikacija patotipov je bila potrjena tudi z AFLP molekularno analizo in odkritjem 17 patotipsko specifičnih DNA fragmentov. V raziskavi smo na osnovi odkritih DNA fragmentov razvili patotipsko specifične začetne oligonukleotide (SCAR), katerih specifičnost v PCR namnoževanju smo preizkusili na izolatih gliv *V. albo-atrum* in *V. dahliae* iz različnih geografskih območij, gostiteljskih rastlin in na nekaterih pogosteje zastopanih vrstah talnih gliv. Visoko specifične markerje smo nadalje uporabili pri razvitju diagnostičnega testa z »multipleks« PCR metodo, ki omogoča hitro in zanesljivo določanje obeh hmeljnih patotipov. Z namenom testiranja rastlin brez predhodne izolacije gliv in rastlin, ki ne izražajo bolezenskih znamenj, smo uspešno razvili tudi »nested« PCR metodo za določanje zastopanosti izolatov patotipa PG2 v hmeljnih rastlinah.

**Ključne besede:** hmelj, Slovenija, *Verticillium albo-atrum*, *Verticillium dahliae*, diagnostične metode

*ABSTRACT*

### Development of diagnostics methods for detection of *Verticillium albo-atrum* isolates from hop

Hop isolates of *Verticillium albo-atrum* Reinke & Berthold and *V. dahliae* have caused major economic damage in the hop growing industry, and have therefore been included in the EPPO A2 list of quarantine organisms. These fungi exist in the majority of European hop growing areas, with *V. albo-atrum* being the principal pathogen. In Slovenia, pathogenicity tests have identified two *V. albo-atrum* hop pathotypes, PG1 and PG2. The latter appeared in 1997, and has since been causing the lethal form of hop wilt, resulting in the destruction of

hop gardens. Pathotype identification has also been confirmed by AFLP molecular analysis, and 17 pathotype specific DNA fragments have been identified. Based on these DNA fragments, we developed hop pathotype specific primers (SCAR), the PCR amplification specificity of which were tested on *V. albo-atrum* and *V. dahliae* isolates from different geographical regions, hosts, as well as in some isolates of common saprotrophic soil fungi. Highly specific markers were further used in the development of »multiplex« PCR, which enable quick and reliable identification of PG1 and PG2 hop pathotypes. In addition, »nested« PCR analysis for PG2 detection was employed for testing plants without previous fungi isolation and symptomless plants.

**Key words:** hop, Slovenia, *Verticillium albo-atrum*, *Verticillium dahliae*, diagnostic methods



### **Nadzor fitoftorne sušice vejic (*Phytophthora ramorum* Werres, de Cock & Man in 't Veld) v Sloveniji v letih 2003 in 2004**

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Fitoftorna sušica vejic (*Phytophthora ramorum* Werres, de Cock & Man in 't Veld) je pred kratkim odkrit, glivam podoben škodljiv organizem, ki v nekaterih delih Evrope in Severne Amerike povzroča škodo na številnih vrstah gojenih in samoniklih lesnatih rastlin. Povzročitelj fitoftorne sušice vejic ima v Evropi zaradi tveganja, ki ga predstavlja za gozdove, podoben status kot karantenski škodljivi organizmi. V Sloveniji smo v letih 2003 in 2004 opravljali nadzor zaradi preprečevanja vnosa in širjenja. Pregledi so potekali v okrasnih in gozdnih drevesnicah, vrtnih centrih parkih in vrtovih. V letu 2003 je bilo opravljenih 87 pregledov občutljivih rastlin in analiziranih 45 vzorcev. Prvič je bila ugotovljena vrsta *P. ramorum* v Sloveniji. Okužene rastline iz rodov *Viburnum* in *Rhododendron* so bile najdene na štirih lokacijah: v dveh vrtnih centrih, eni drevesnici in v zasebnem vrtu. V letu 2004 se je nadzor, zaradi najdbe v preteklem letu, razširil tudi na gozd. Opravljenih je bilo 250 pregledov. Analizirali smo 161 vzorcev in odkrili okužene okrasne rastline iz rodov *Rhododendron* in *Kalmia* v desetih centrih za distribucijo ali prodajo okrasnih rastlin. Večje število okuženih rododendronov smo našli tudi v parku na Gorenjskem. V vseh primerih pozitivnih najdb je fitosanitarna inšpekcija odredila ukrepe za izkoreninjenje bolezni. Po dosedanjih rezultatih nadzora se v Sloveniji bolezen še ni razširila na samonikle rastline.

**Ključne besede:** fitoftorna sušica vejic, *Phytophthora ramorum*, nadzor, Slovenija



## ABSTRACT

### Survey of *Phytophthora ramorum* in Slovenia in the years 2003-2004

*Phytophthora ramorum* Werres, de Cock & Man in 't Veld is a recently described pathogen causing damage to woody plants of different botanical species in some parts of Europe and North America. The status of *Phytophthora ramorum* in Europe is similar to that of quarantine organisms because of its potential threat to forests. The survey of *P. ramorum* was carried out in 2003 and 2004 to prevent its introduction and spread in Slovenia. A total of 87 inspections of susceptible ornamental plants were made in nurseries, garden centres, forests and parks in 2003 and 45 samples were taken for diagnosis. Infected plants of *Viburnum* and *Rhododendron* were found in two garden centres, in a nursery and in a private garden and the presence of *P. ramorum* in Slovenia was confirmed for the first time. Due to the positive findings in the previous year in 2004 the survey was extended to forest sites. A total of 250 inspections were made and 161 samples were analysed. Ten retail and garden centres were found in which the plants from genus *Kalmia* or *Rhododendron* were infected with *P. ramorum*. There was also a positive finding in a park situated in the Gorenjska region where many recently planted rhododendrons were infected. Phytosanitary measures were taken at all infected sites to eradicate the disease. The results of survey work indicate that *P. ramorum* is not present on native plants in Slovenia yet.

**Key words:** *Phytophthora ramorum*, survey, Slovenia

## **Varstvo gozdnih in okrasnih drevnin**

## Vpliv različnih dejavnikov na kostanjevega listnega zavrtača (*Cameraria ohridella* Deschka&Dimić) na divjem kostanju

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Kostanjev listni zavrtač (*Cameraria ohridella* Deschka&Dimić, Lepidoptera, Gracillariidae) je nova invazijska vrsta, ki se je v zadnjih letih ustalila v Evropi. Ličinke metuljčka vrtajo izvrtine v listih belocvetočega divjega kostanja (*Aesculus hippocastanum* L.), sledi predčasno rjavenje, sušenje in odpadanje listov. V Sloveniji smo kostanjevega listnega zavrtača prvič ugotovili v juniju leta 1995. Vrsta se je zelo hitro razširila v vse dele države in danes predstavlja resno težavo v mestnih parkih, drevoredih in zasebnih vrtovih. V letih 2003 in 2004 smo v parku Tivoli v Ljubljani izvedli poskus, kjer smo preučevali bionomijo kostanjevega listnega zavrtača. Pojav metuljčkov smo spremljali s feromonskimi vabami. V poskusu smo potrdili, da ima vrsta *Cameraria ohridella* v osrednji Sloveniji tri generacije letno. V preučevanih letih smo opazili razlike v času pojava in gostoti metuljčkov posameznih generacij. Različni biotični in abiotični dejavniki vplivajo na bionomijo kostanjevega listnega zavrtača in posledično tudi na obseg poškodb na kostanjevih listih. Izpostavili bomo vpliv temperature, padavin in antagonistični odnos med žuželko *Cameraria ohridella* in glivo *Guignardia aesculi* /Peck./Stev.

**Ključne besede:** kostanjev listni zavrtač, *Cameraria ohridella*, bionomija, feromonske vabe, Tivoli, Ljubljana

ABSTRACT

### Influence of various factors on horse chestnut leafminer (*Cameraria ohridella* Deschka&Dimić)

*Cameraria ohridella* Deschka&Dimić (Lepidoptera, Gracillariidae) is a new invasive species which has recently settled in Europe. Mining holes into the leaves of white-flowering horse chestnut trees (*Aesculus hippocastanum* L.) by the larvae causes premature browning, drying and defoliation of the leaves. In Slovenia horse chestnut leafminer was first recorded in June 1995. The species quickly spread to all parts of the country and nowadays it represents a serious problem in city parks, alleys and private gardens. In 2003 and 2004 research was carried out in the Tivoli park in Ljubljana with the aim of following the ecology of horse chestnut leafminer. The appearance of the moths was followed by pheromone traps. The research confirmed that in central Slovenia *Cameraria ohridella* develops three generations per year. Various biotic and abiotic factors influence the bionomy of horse chestnut leafminer, and consequently the extent of damage on horse chestnut leaves. In the years of research differences in the time of emergence and density of moths of a particular generation were noticed. The influence of temperature, precipitations and interaction between *Cameraria ohridella* and fungus *Guignardia aesculi* /Peck./Stev. will be discussed.

**Key words:** horse chestnut leafminer, *Cameraria ohridella*, bionomy, pheromone traps, Tivoli, Ljubljana



## **Prerazmnožitev gobarja (*Lymantria dispar* L.) na območju Primorske in vpliv na gozdno vegetacijo**

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Gobar (*Lymantria dispar* L.) je prvenstveno škodljivec gozdov, ki se navadno pojavlja v manjših populacijah in zato poškodbe dreves niso znatne. V primeru prerazmnožitve pa lahko postane zelo pomemben škodljivec gozdnih ter ostalih drevesnih in grmovnih vrst, med drugim tudi sadnega drevja. V letu 2004 smo bili na Primorskem priča močni prerazmnožitvi gobarja na vzhodnem in južnem pobočju Sabotina, obrobju Trnovskega gozda v spodnji Vipavski dolini in na gozdnatih pobočjih nad Vipavo proti Nanosu. Izjemno močan napad pa smo zabeležili na širšem območju Krasa in na kraškem robu nad Črnim Kalom. Od gozdne vegetacije so bili najbolj prizadeti sestoji črnega gabra (*Ostrya carpinifolia*) in hrasta (*Quercus* spp.), pri sadnem drevju pa smo največ poškodb zasledili na češnjah (*Prunus avium* L.), višnjah (*Prunus cerasus* L.), slivah (*Prunus domestica* L.) in kutinah (*Cydonia oblonga* Mill.). Občasna prerazmnožitev gobarja sicer ni nič posebnega, razsežnost omenjene prerazmnožitve pa je izjemna, saj take stopnje napadenosti in poškodb na Primorskem ne beležimo že več desetletij.

**Ključne besede:** gobar, *Lymantria dispar*, Primorska, črni gaber, hrast, češnja, višnja, sliva, kutina

### *ABSTRACT*

## **High densities of gypsy moth (*Lymantria dispar* L.) on Primorska region and its ascendancy on forest vegetation**

Gypsy moth (*Lymantria dispar* L.) is in the first place important as pest of the hardwood forests, which usually remains at low densities and causes no discernible damage. Occasionally the populations reach high densities and these populations may cause discernible damages on forest vegetation and on fruit trees. During the year 2004 on Primorska region, abundant populations of gypsy moth were appearing on east and south slope of Sabotin, on margin parts of Trnovski gozd up to Vipavska dolina and on forest areas up to Vipava towards to Nanos. Extremely high populations were appearing on wide part of Kras and on Kras-margin up to Črni Kal. Damages were noticed on hornbeam (*Ostrya carpinifolia*) and on oak (*Quercus* spp.) among forest vegetation, and on cherries (*Prunus avium* L.), sour cherries (*Prunus cerasus* L.), plums (*Prunus domestica* L.) and quince (*Cydonia oblonga* Mill.) among fruit trees. High densities of gypsy moth from time to time is nothing special, but abundant populations on some areas on Primorska region in year 2004 were extreme because the high damage caused by this pest in year 2004 were absent for decades.

**Key words:** gypsy moth, *Limantria dispar*, Primorska, hornbeam, oak, cherry, sour cherry, plum, quince



**Študija preference hranjenja listnega zavrtača (*Leucoptera sinuella* Rtti., Lepidoptera, Leucopteridae) z listjem različnih klonov črnega topola**

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Med večletnim delom pri klonski selekciji topolov na Inštitutu za raziskave topola v Novem Sadu so vzgojili veliko število klonov, ki jih odlikuje velika rastnost in bujnost rasti. Veliko rastnost in bujnost obravnavajo kot pozitivni lastnosti, ki sta cilj selekcije. Ugotovili so, da nove klone napada veliko število škodljivih organizmov, ki ovirajo njihov razvoj in oblikovanje visoko produktivnih krošenj. Med njimi, ima v zadnjih letih, pomembno vlogo listni zavrtač (*Leucoptera sinuella* Rtti.). Zaradi posledic hranjenja gosenic v listih (oblikovanje izvrtin) se značilno zmanjša asimilacijska površina in aktivnost listja, kar povzroča dobro znane posledice (zmanjšan letni prirast lesa). Pri nekaterih klonih se ob močnem napadu asimilacijska površina listja zmanjša tudi za 60%. Ugotovili so, da so bile stopnje napada listja pri različnih klonih različne. Iz tega so sklepali, da imajo gosenice te vrste listnega zavrtača dobro izraženo preferenco (večje ali manjše nagnjenje) za hranjenje na različnih klonih topola, ki so jih obravnavali v selekcijskem postopku. Ugotovitve o večji stopnji napada pri posameznih klonih je možno uporabiti za ocenjevanje ustreznosti posameznih klonov za širšo uporabo pri pogozdovanju. Po drugi strani, pa je klone, s katerimi se ta vrsta zavrtača najraje hrani, moč uporabiti za privabljanje metuljev za koncentrirano zatiranje v konceptu integriranega varstva pred škodljivci v drevesnicah in nasadih. Preferenco hranjenja smo preučevali pri petih klonih, ki so bili izbrani za dokončanje postopka registracije novih sort (B-227, S6-7, 665, 187/81 in 129/81) in pri uveljavljenih primerjalnih klonih - sortah (Robusta in Panonia), ki jih že množično uporabljajo za pogozdovanje. Preferenco škodljivca smo določili tako, da smo pri sadikah različnih klonov gojenih na gredicah poskusne drevesnice inštituta prešteli povprečno število rogov na list in število oblikovanih bub na lubju debel. Največjo stopnjo napada (največ rogov in odloženih bub) smo ugotovili pri klonih 129/81 in B-229, najmanjšo pa pri klonih Robusta in 182/81.

**Ključne besede:** črni topol, *Leucoptera sinuella*, preferenca hranjenja, klonska selekcija

## ABSTRACT

### **Study of *Leucoptera sinuella* Rtti. (Lepidoptera, Leucopteridae) predilection for feeding on the leaves of different black poplar clones**

During their multiannual work on selection, the researchers of the Poplar Research Institute in Novi Sad developed a great number of black poplar clones characterised by growth vigour, which is evaluated as a very favourable property. However, it was shown that a number of harmful organisms obstruct their vigorous growth and the maximal volume. Among them, in the last years, leaf miner *Leucoptera sinuella* Rtti. has a significant position. By its feeding on leaf tissue, i.e. by creating the "mines" in the poplar leaves in general, it reduces their assimilation area with all the known consequences. The reduction of the assimilation area in some clones amounted up to 60% of the crowns. It was observed that the degree of attack by this miner differed depending on the clone. Therefore it was inferred that there was predilection (preference) of this miner for some clones which are included in the selection procedure. By detecting the predilection for some clones, we can get a clear idea of the individual hazard by this insect pest, and thus the clone potential of wider use in afforestation. On the other hand, they can be used as "bait" plants in plantations and nurseries in carrying out the integral protection. Predilection was researched on five clones in the narrow selection list for starting the procedure for cultivar registration, i.e. the clones B-227, S6-7, 665, 187/81 and 129/81, and the test clones were "Robusta" and "Panonia", which are widely used in afforestation practice. Based on the number of mines and cocoons eaves of the above clones in the stool bed of the gene pool of the Institute's Experimental Field, we determined the degree of predilection. The highest number of cocoons and "mines", i.e. the greatest degree of predilection in this study was shown by *L. sinuella* for the clones 129/81 and B-229, and the lowest degree of predilection occurred for the clones "Robusta" and 182/81.

**Key words:** *Leucoptera sinuella*, predilection, black poplars, clones.



### **Zatiranje plevelov z uporabo herbicidov v drevesnici za pridelavo sadik topolov**

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Zatiranje plevelov v drevesnicah za vzgojo gozdnih rastlin je zahtevno opravilo, ki zahteva celovit pristop varstva rastlin. V vojvodinskih gozdnih drevesnicah pleveli v glavnem zatirajo z uporabo mehanskih metod, vendar se v zadnjem času uveljavlja tudi uporaba herbicidov. Ustrezna izbira herbicidov in njihovih kombinacij in uporaba v času, ko so pleveli v najbolj občutljivih stadijih, sta nujna pogoja za uspešno zatiranje plevelov v drevesnicah topolov. V prispevku so predstavljeni rezultati raziskave učinkovitosti delovanja in selektivnosti herbicidnih pripravkov na podlagi mešanice acetoklora in prometrina ali

oksifluorfena. Poskuse smo izvedli v letu 2003 na poskusnem polju inštituta inštituta za nižinsko gozdarstvo in okolje. Poskus je bil zasnovan po statistični zasnovi naključnih blokov v štirih ponovitvah. Tip tal na poskusnem zemljišču je bil fluvisol. Na podlagi štetja plevelov v tretiranih parcelicah in kontrolnih parcelicah smo izračunali stopnjo učinkovitosti delovanja herbicidov. Stopnjo fitotoksičnosti pripravkov smo ocenili po lestvici Evropskega združenja za preučevanje plevelov s skalo od 1 do 9. Na poskusnih parcelicah smo določili 14 različnih vrst plevelov. Prevladovali so širokolistni pleveli, med tem, ko je bilo ozkolistnih plevelov malo. Uporaba herbicidov je zmanjšala zapleveljenost, tako število zastopanih vrst plevelov, kot število rastlin na površinsko enoto. Kombinacija herbicidov acetoklor in prometrin je dala boljše rezultate, kot pripravek na podlagi oksifluorfena. Uporabljeni herbicidi niso imeli fitotoksičnega učinka na sadike topolov.

**Ključne besede:** drevesnica, topol, zatiranje plevelov, acetoklor, prometrin, oksifluorfen

*ABSTRACT*

### **Weed control by herbicides in poplar nurseries**

Weed control in forest nurseries is a very complex task which requires an integral system of plant protection. Nevertheless, in Vojvodina, in nursery production of forest planting material, weed suppression is mostly performed by mechanical methods, although during the past years the application of herbicides has been increased. The correct selection of herbicides, their combination and the application during the most vulnerable stages of weed development, are the necessary conditions for the solution of the problem of weed spreading in poplar nurseries. This paper presents the study results of the efficiency and selectiveness of herbicides based on acetochlorine + prometrin and oxyfluorfen. The study was performed during 2003 at the experimental field of the Institute of Lowland Forestry and Environment. The experiment was established by random block system in four repetitions on the soil type fluvisol. Based on the data on weed number per m<sup>2</sup> on the control and treated areas, the coefficient of efficiency of the applied herbicides was calculated, and the phyto-toxicity was assessed by EWRC-scale from 1-9. During the study, 14 weed species were identified on the sample plot. The dominant species were broadleaf weed species, while narrow-leaved species were represented to a less degree. The applied herbicides caused the reduction of weed species and number per unit area. A better efficiency in the reduction of the number of weed species and the number of weeds was shown by the combination of herbicides acetochlorine + prometrin. The applied herbicides did not have a phyto-toxic effect on poplar seedlings.

**Key words:** poplar nursery, weed control, acetochlor, prometrin, oxyfluorfen



**Nekatere izkušnje pri izvajanju konvencionalne odbire in žlahtnjenja  
pravega kostanja (*Castanea sativa* L.) na tolerantnost proti okužbam z glivo  
*Cryphonectria parasitica* (Murrill) Barr.**

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V prispevku so predstavljene nekatere izkušnje pri raziskavah klasične selekcije in žlahtnjenja pravega kostanja (*Castanea sativa* L.) na tolerantnost proti okužbam z glivo *Cryphonectria parasitica* (Murrill) Barr. Izvajanje konvencionalne odbire (selekcije) je zaradi velike popularnosti biotehnoloških pristopov (genetski inženiring) skoraj popolnoma zamrlo. Uporaba konvencionalnih metod odbiranja je še naprej smiselna in potrebna, ker zgolj z bio-tehnološkimi metodami do sedaj še tudi niso uspeli pridobiti zanesljivo in trajno odpornih populacij kostanjev, ki bi poleg visoke stopnje tolerantnosti proti okužbam z omejenim številom virulentnih tipov glive, imeli tudi ustrezno visoko stopnjo prilagodljivost na lokalne rastiščne razmere. Med stopnjo tolerantnosti na okužbe in prilagodljivostjo populacij pravih kostanjev na variabilne rastiščne razmere verjetno obstaja tesna povezava. Predstavljeni so rezultati petletne odbire rastlin za oblikovanje starševskega (parentalnega) materiala za začetek programa križanja. Podana je ocena primernosti eksperimentalne tehnike umetnega okuževanja rastlin s trosi ali micelijem virulentnih tipov glive za ocenjevanje odpornostnega odziva kostanjevih dreves starih od enega do štirih let.

**Ključne besede:** pravi kostanj, *Castanea sativa*, *Cryphonectria parasitica*, selekcija, žlahtnjenje na tolerantnost, eksperimentalna tehnika

*ABSTRACT*

**Experiences with conventional selection and genetic improvement of tolerance of the European chestnut (*Castanea sativa* L.) to infections with *Cryphonectria parasitica* (Murrill) Barr**

The article presents experiences that were obtained during research associated with selection and genetic improvement of the European chestnut (*Castanea sativa* L.) tolerance to infections with *Cryphonectria parasitica* (Murrill) Barr. The conventional breeding methods aimed at creating tolerant populations no longer popular because of prevailing biotechnological approach, especially genetic engineering. The conventional selection is still needed due to the fact that biotechnology applied alone cannot assure the creation of plant materials that, beside high level of durable tolerance to infection against limited number of virulent fungus types, are also well adapted to highly variable local growing conditions. Probably, there is a close relationship between the tolerance level of chestnut plants to fungus infection and disease development, and the level of adaptability to



existing growing conditions. Five year practical work associated with the selection of tolerant genotypes was focused on creating parental material for genetic recombination. The work included critical evaluation of suitability of infection methodology (infections with fungal spores and mycelium) for quantification of tolerance response of young chestnut plants.

**Key words:** Chestnut Blight, chestnut, conventional selection, genetic improvement of tolerance to disease

## **Splošna sekcija**

## Spremljanje učinkov ozona na vegetaciji

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UNECE ICP je program, ki je bil ustanovljen leta 1987 znotraj WGE konvencije CLRTAP. Nameni programa so: 1. kvantifikacija rizikov, ki jo za kmetijske rastline in polnaravno vegetacijo v območjih EU predstavlja troposferski ozon; 2. ugotavljanje depozicije težkih kovin v vegetaciji (bioakumulacija v mahovih); 3. ugotavljanje odziva rastlin na mešanico onesnažil in ugotavljanje obremenitve vegetacije z dušikovimi spojinami; 4. vse aktivnosti podpirajo dejavnosti CLRTAP. Koncentracije ozona v zraku se spremljajo kot vrednosti AOT40 (seštete koncentracije povprečnih urnih koncentracij ozona nad 40 ppb v svetlih urah dneva). Kritične vrednosti za posamezne recipiente znašajo:

- kmetijske rastline: (AOT40) 3 ppm h v treh mesecih, učinek: zmanjšan pridelek
- hortikulturene rastline: (AOT40) 6 ppm h; 3,5 meseca, učinek: zmanjšan pridelek
- polnaravna vegetacija (trajna travišča): (AOT 40) 3 ppm h; 3 meseci ali rastna sezona; zmanjšana rast trajnic in zmanjšana rast in produkcija semen enoletnic
- gozdna drevesa: (AOT 40) 5 ppm h; rastna sezona, zmanjšana rast

V Sloveniji spremljamo učinke troposferskega ozona od leta 1996 na treh stalnih in več občasnih lokacijah. Odziv rastlin spremljamo s sledenjem pojavljanja listnih poškodb indikatorskih rastlin, meritvami biomase in analizo biokemičnih in fizioloških parametrov izpostavljenih rastlin. V vseh obdobjih opazovanja se se pojavile poškodbe na občutljivih klonih plazeče detelje, največje na Kovku, Iskrbi, Zavodnjah in Vnajnarjih. Medletna nihanja med akumuliranimi vrednostmi AOT40 so velika, kar je posledica različnih vremenskih razmer. Meritve ozona kot tudi odzivi rastlin kažejo, da je ostaja onesnaženje z ozonom v Sloveniji pereč problem, še posebej zaradi naraščanja prometa. Kritične vrednosti za ozon so za vse tipe vegetacije na vseh mestih prekoračene. Država bi morala v okviru aktivnosti slovenskega nacionalnega okoljskega programa zagotoviti sredstva za vsaj minimalen monitoring učinkov vseh pomembnejših zračnih onesnažil v okviru programa ICP-Vegetation.

**Ključne besede:** ozon, vegetacija, Slovenija

*ABSTRACT*

### Monitoring of Tropospheric Ozone Effects on Vegetation

UNECE ICP-Vegetation is programme which was founded in 1987 within WGE of CLRTAP convention. The aims of the programme are: 1 – quantify risks from tropospheric ozone within EU region on crop plants and seminatural vegetation; 2 – detect deposition of heavy metals by bioaccumulation in mosses; 3 – determine of plant response to air pollutants mixture and impact of nitrogen compounds on vegetation; 4 – support all activities within CLRTAP convention by the data obtained. As threshold value for tropospheric ozone

concentration the AOT 40 was implemented (accumulated ozone concentrations above 40 ppb of ozone in light hours of day). Critical levels for separate recipients area:  
crop plants: 3 ppm h (AOT40) in 3 months, during the vegetation season; effect: yield loss  
-horticultural plants: 6 ppm h (AOT40) in 3,5 months in vegetation season; effect: yield loss  
-seminatural vegetation (permanent grasslands): 3 ppm h (AOT40) 3 months or vegetation season, effect: decreased growth of perennials and reduced seed production in annuals  
-forest trees: 5 ppm h (AOT 40); vegetation season; effect: decreased growth  
Effects of tropospheric ozone on vegetation are monitored in Slovenia since 1996 at three permanent and several temporal stations. Plant response to ozone was monitoring by injuries of indicator plants. Apart from leaf injuries, biomass reduction was measured and biochemical and physiological responses of plants to ozone were analysed. Typical ozone induced injuries were evidenced in sensitive biotypes of indicator plants in all years and location of experiment, being the highest at the sites Kovk, Iskrba, Zavodnje and Vnajarje, all rural sites. Pronounced climate induced fluctuations in AT40 values and plant response to ozone were detected. Data on AOT 40 for ozone measurements as plants responses show that tropospheric ozone becomes a major air pollution problem in Slovenia, connected to increased traffic. Critical loads for all types of vegetation were exceeded at all sites. In order to control this kind of air pollution the state should support at least minimal running of ICP-Vegetation programme in the framework of Slovenian national environmental programme what is recently not yet the case.

**Key words:** Ozone, vegetation, Slovenia



### **Občutljivost rastlin na ozon v interakciji s herbivori**

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Ozon, škodljivci (herbivori) in bolezni (glive, bakterije, virusi) lahko povzročajo na kmetijskih rastlinah pomembno ekonomsko škodo. V preteklosti je bila večina raziskav o interakciji vplivov ozona in herbivorov na rastline opravljenih v nadzorovanih ali delno nadzorovanih laboratorijskih gojitvenih razmerah. V naravnem okolju, kjer so rastline izpostavljene še drugim okoljskim dejavnikom, pa je teh raziskav zelo malo. Ozonske poškodbe na listih rastlin so lahko zamenljive z drugimi poškodbami, nastalimi zaradi škodljivcev. Raziskovalci morajo biti zato dobro izurjeni v prepoznavanju znamenj in ugotavljanju vzrokov nastalih poškodb, za kar potrebujejo osnovno znanje iz entomologije in fitopatologije. Rastline reagirajo na ozon najprej na biokemijsko-fiziološki ravni in zaradi spremenjene kemične sestave postanejo manj ali bolj atraktivne za herbivore. V večletnem lončnem poskusu smo uporabili dva na ozon različno odporna klona plazeče detelje sorte Regal, ki smo ju izpostavili na štirih poskusnih mestih. V rednih dvotedenskih presledkih smo poleg ozonskih poškodb ocenjevali zdravstveno stanje rastlin. Določili smo

povzročitelja poškodb in število listov s poškodbami na rastlino. Cilj raziskave je bil ugotoviti ali je tolerantnost rastlin na ozon povezana z velikostjo pojavljanja poškodb zaradi žuželk, polžev, gliv in virusov. Več poškodovanih listov zaradi objedanja polžev in manj poškodb od listnih zavrtačev smo ugotovili pri na ozon občutljivem klonu plazeče detelje. Sklepamo, da je obnašanje samic zavrtačev pri odlaganju jajčec povezana z odpornostjo rastlin na ozon. Samice zavrtačev raje odlagajo jajčeca v liste brez ozonskih poškodb odpornega klona plazeče detelje 'Regal', kar je lahko povezano z večjo količino razpoložljive hrane za rast in razvoj ličink.

**Ključne besede:** ozon, herbivori, *Trifolium repens* 'Regal', ozonske poškodbe, polži, žuželke, listni zavrtači

#### ABSTRACT

#### Plant sensitivity to ozone in interaction to herbivores

Ozone, pests (herbivores) and diseases (fungi, bacteria and viruses) may cause great economic damage to agricultural plants. In the past, the majority of research on the interaction of ozone and herbivores has been carried out on plants in controlled or semi-controlled laboratory growing conditions. However, there were few investigations conducted in the natural environment, where plants were exposed also to other environmental factors. Ozone injury on plant leaves might be mistakenly taken to be injuries caused by pests. Researchers must be therefore well-trained in recognizing the symptoms and determining the causes of injuries, and this demands from them basic knowledge of entomology and phytopathology. Plants first react to ozone at the biochemical-physiological level, and become less or more attractive to herbivores due to the changed chemical composition of their structure. In our pot experiment conducted over several years, we used two clones of the 'Regal' white clover with different ozone tolerance. They were exposed at four trial sites. Ozone injury and the state of health of the plants were assessed at regular fortnight intervals. We determined the cause of the injuries and the number of injured leaves per plant. The aim of the research was to ascertain whether plant ozone tolerance had any influence upon the extent of injury caused by insects, slugs, fungi and viruses. More leaves injured by slugs and less injuries caused by leaf-miners were determined with the ozone-sensitive white clover clone. It was concluded that the behaviour of females of the leaf-miner when laying eggs depended on the ozone tolerance of plants. They preferred to lay eggs in leaves of the ozone-tolerant 'Regal' white clover clone with no ozone injury, which might be connected with a higher amount of food available for the growth and development of larva.

**Key words:** ozone, herbivores, *Trifolium repens* 'Regal', ozone injury, slugs, insects, leaf-miners



## **Vpliv uporabe bakrovih pripravkov v obdobju polnega cvetenja jablan (*Malus domestica* Borkh.) na zunanjo kakovost plodov**

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V dveh poskusih smo v nasadih jablan opazovali pojav poškodb (fitotoksičnost) na cvetovih in plodičih zaradi uporabe bakrovih pripravkov med polnim cvetenjem. Preučevali smo pripravke na podlagi bakrovega hidroksida (Champion), bakrovega oksiklorida (Kuproin, Cuprablau Z ultra) in bakrovega oksisulfata (Kupro). Pri sorti Topaz (poskus 1) smo pripravke nanesli s pršilnikom pri porabi vode 200 l/ha. Vse preučevane pripravke smo nanesli v odmerkih 0,25 in 0,50 kg čistega bakra na hektar. Pri sortah Elstar, Jonagold, Zlati delišes, Idared, Gala in Braeburn (poskus 2) smo pripravke nanesli z ročno nahrbtno škropilnico pri porabi vode 800 l/ha. Nanesli smo 1 kg čistega bakra/ha. Pri sorti Topaz uporaba bakrovih pripravkov med cvetenjem pri nobenem od uporabljenih odmerkov in pripravkov ni povzročila značilnih pojavov fitotoksičnosti na cvetovih, plodičih in mladih plodovih. Pri uporabi 1 kg čistega bakra na hektar se je pojavila zmerna fitotoksičnost pri sorti Zlati delišes, kjer so se pri 1,5 do 2,5% plodičev pojavile majhne površinske oplutenele poškodbe. Pri sorti Gala smo ugotovili nekoliko povečan odmet plodičev, ki pa ni bil statistično značilno večji od odmeta v kontrolnih parcelicah. Pri ostalih sortah škropljenje z bakrovimi pripravki v cvet ni imelo statistično značilnega vpliva na število plodičev, število plodov in kakovost plodov. Na podlagi opravljenih poskusov lahko sklenemo, da uporaba bakrovih pripravkov v odmerku manj kot 1 kg čistega bakra na hektar, v času polnega cvetenja, pri preučevanih sortah jablan ne povzroča značilnih poškodb na cvetju in pozneje na razvijajočih se plodičih in plodovih.

**Ključne besede:** jablana, cvetenje, bakrovi pripravki, fitotoksičnost pripravkov za varstvo rastlin

ABSTRACT

### **Influence of application of copper fungicides at the full bloom stage of apples (*Malus domestica* Borkh.) on apple fruit quality**

Two trials were carried out in apple plantations to study the phytotoxicity of copper (Cu) fungicides when applied to apple trees at full bloom stage. The damage on young fruits was assessed after application of fungicides based on copper hydroxide (Champion), copper oxychlorid (Kuproin, Cuprablau Z ultra) and copper sulphate (Kupro). In trial 1 all four fungicides were applied at rates 0.25 or 0.50 kg of pure Cu per hectare to trees of Topaz cultivar by means of tractor mounted sprayer at 200 l/ha spray volume. In trial 2, copper fungicides were applied to trees of cultivars Elstar, Jonagold, Golden delicious (GD), Idared, Gala (GA) and Braeburn with knapsack sprayer at 800 l/ha spray volume at the rate of 1 kg of pure Cu per hectare. In trial 1 (cv. Topaz) none of four tested fungicides and none

of two rates had significant phytotoxic effects on blooms and fruits. In trial 2, phytotoxic effects were observed in GD and gala GA trees. In GD all four studied fungicides applied at the full bloom stage caused moderate phytotoxicity (predominantly surface russetting) on 1.5 to 2.5% of young fruits (observation made in middle of June). At GA some increase in young fruit drop was observed, but was not statistically significant in comparison to the control. On the basis of these two trials it can be concluded that application of less than 1 kg of pure copper per hectare in the form of copper fungicides at the full bloom stage of studied apple cultivars does not present important phytotoxic risk for their blooms and external apple fruit quality.

**Key words:** copper fungicides, phytotoxicity, apple, blossom stage, apple fruits



### **Vpliv uporabe bakrovih pripravkov na mrežavost plodov jablan**

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V letih 2003 in 2004 smo na sortah jablan 'Zlati delišes', 'Idared' in 'Jonagold' preizkušali vpliv štirih bakrovih pripravkov (Champ formula 2FLO, Cuprablau Z ultra, Kocide DF in Nordox 75 WG) na pojav mrežavosti na plodovih. V letu 2003 smo škropili 10. in 29. julija. V letu 2003 ni bilo razlik v stopnji mrežavosti na plodovih med uporabljenimi pripravki in kontrolo. V letu 2004 smo škropili prvič 7. maja, drugič 20. maja in tretjič 3. junija. Največjo stopnjo mrežavosti na sortah 'Zlati delišes' in 'Idared' smo ugotovili pri pripravku Nordox 75 WG (28,2% oz. 37,3%). Pri sorti 'Jonagold' smo največjo stopnjo mrežavosti ugotovili pri pripravku Kocide DF (27,5%).

**Ključne besede:** jabolana, bakrovi pripravki, fitotoksičnost pripravkov za varstvo rastlin

#### *ABSTRACT*

### **Influence of using copper fungicides on appearance of skin russetting on apple fruit**

In the years 2003 and 2004 we tested four different copper fungicides (Champ formula 2FLO, Cuprablau Z ultra, Kocide DF and Nordox 75 WG) on the apples species 'Zlati delišes', 'Idared' and 'Jonagold' on appearance of skin russetting. In the year 2003 we sprayed on 10<sup>th</sup> and 29<sup>th</sup> of July and we didn't observed any difference in level of skin russetting between copper fungicides and non treatment control. In the year 2004 we sprayed three times (7<sup>th</sup> and 20<sup>th</sup> of May and 3<sup>rd</sup> of June). The highest level of skin russetting on the species 'Zlati delišes' and 'Idared' were observed by Nordox 75 WG (28,2% respectively 37,3%) on the species 'Jonagold' we observed the highest level of skin russetting by Kocide DF (27,5%).

**Key words:** copper fungicides, phytotoxicity, apple, apple fruits



## Vpliv dodajanja biotičnih fungicidov na rast micelija glive *Nectria galligena* gojene na gojišču v petrijevkah

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V laboratorijskih razmerah smo preučevali vpliv dodajanja biotičnih fungicidov v gojišče (krompirjev dekstrozni agar) na razvoj glive *Nectria galligena* Bres. gojene v petrijevkah. Biotične fungicide (BF) na podlagi izločkov alg (*Ascophyllum* sp.), preslice (*Equisetum* sp.), mineralov glin, žvepla in bakra smo dodajali neposredno v gojišče ob pripravi v štirih različnih koncentracijah. Razvoj micelija v petrijevki smo spremljali 14 dni na način, da smo merili površino priraslega micelija (cm<sup>2</sup>). Na podlagi primerjave prirastkov micelijev v petrijevkah z dodanimi ali brez dodanih fungicidov smo določili obseg zaviralnih ali pospeševalnih učinkov na rast micelija. Zaviralni učinki dodanih BF na prirast micelija glive *N. galligena* v čisti kulturi so bili podobni zaviralnemu učinku anorganskih fungicidov na podlagi bakra in žvepla. Pri dodajanju BF v visokih koncentracijah se je prirast glive zmanjšal za več kot 80 %. Rezultati nakazujejo možnost uporabe preučevanih biotičnih pripravkov za zatiranje boleznih jablanovega raka v ekoloških nasadih jablan.

**Ključne besede:** *Nectria galligena*, biotični fungicidi, izločki alg, izločki preslice, minerali glin, baker, žveplo, zatiranje

### ABSTRACT

#### The influence of adding biological fungicides into growing media on the growth of *Nectria galligena* Bresad. fungus grown in Petri Dishes

The impact of adding biological fungicides into the potato dextrose agar growing media on the growth of the mycelium of fungus *Nectria galligena* Bresad. was studied in laboratory conditions in Petri Dishes. Fungicides based on extracts of sea algae (*Ascophyllum* sp.), horsetail weed (*Equisetum* sp.) and mixtures of clay minerals, copper and sulphur were added to growing media in four concentrations. The growth of fungal mycelium was quantified by measurements of mycelium colony surface area (cm<sup>2</sup>) in 14-day period of time. According to comparisons of mycelium growth in Petri Dishes with or without added fungicides the conclusions about inhibition or acceleration effects of added fungicides were made. Adding of fungicides to growing media caused in most cases significant decrease in mycelium growth. At highest studied concentrations more than 80% decrease in mycelial growth was observed. The inhibition of mycelial growth after adding copper and sulphur based fungicides was similar to the one achieved when adding fungicides based on weed and algae extracts or clay mineral mixtures. The results of our experiment indicate the possible use of studied biological fungicides for control of European Nectria Apple Canker disease in ecologically maintained plantations of apples.



**Key words:** *Nectria galligena*, biological fungicides, apple, equisetum extracts, algae extracts, clay-mineral fungicides, copper fungicides, sulphur fungicides



## **Nova spoznanja o biostimulatorju Agrostemin**

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Agrostemin, izvleček iz plevelne rastline navadni kokalj (*Agrostemma githago*), je biostimulator naravnega izvora, ki poveča pridelek od 5 – 15% (in več), izboljšuje kvaliteto proizvodov (do 30% več suhe snovi, kar pomeni več okusa), zmanjšuje stroške gnojenja od 20 – 30%.

### **KAKO?**

- ✓ Večja energija kaljenja – boljše klitje,
- ✓ daljša in bogatejša – bolj učinkovita korenina,
- ✓ močnejši nadzemni del (z več klorofila),
- ✓ kvalitetnejši metabolizem,
- ✓ izboljšana odpornost na bolezni, škodljivce, vremenske ekstreme (suša, pozeba, preveč vlage, toča...)

### **NOVA SPOZNANJA:**

- Povečuje količino lahko dostopnih hranil v zemlji (posebno P<sub>2</sub>O<sub>2</sub>),
- hitrejše pridobivanje teže pri postrveh,
- povečuje odpornost postrvi na plesen *Saprolegnia*,
- presenetljivo okrevanje eksperimentalnih živali (podgane) po nuklearnem sevanju.

**Ključne besede:** Agrostemin, *Agrostemma githago*, naravni biostimulator

### **New realizations about the natural bioregulator Agrostemin**

Agrostemin is a non toxic natural growth regulator which is obtained from the seeds of corn cockle (*Agrostemma githago*), a common weed of wheat.

The final effects of the application of Agrostemin are higher yields (from 5 – 15% and more), a better quality of fruits (up to 30% increase in dry matter which means better taste) and a cut in the costs of fertilizing (from 20 – 30 %).

### **FAVOURABLE EFFECTS OF AGROSTEMIN:**

- ✓ An increased energy of germination,
- ✓ faster sprouting,

- ✓ faster initial growth and longer small roots,
- ✓ a more intensive photosynthesis (increase in the content of chlorophyll),
- ✓ a more efficient metabolism,
- ✓ better resistance to disease, pests and weather extremes (drought, rain, frost, hail...)

#### NEW REALISATIONS:

- Agrostemin also increases the quantity of easy-accessible nutritives in the soil (especially  $P_2O_2$ ),
- It has an effect on better growth of trouts,
- it increases resistance of trouts to the fungus *Saprolegnia*,
- research has shown surprising recovery of experimental animals (rats) after exposure to nuclear radiation.

**Key words:** Agrostemin, *Agrostemma githago*, natural growth regulator



#### Vpliv načina premazovanja listov baržunastega osleza (*Abutilon theophrasti* Medik.) s herbicidi na podlagi glifosata, sulfosata in glufosinata na učinkovitost njihovega delovanja

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V poljskem poskusu zasnovanem v bločni zasnovi z več dejavniki smo preučevali vpliv načina premazovanja listov baržunastega osleza (*Abutilon theophrasti* Medik.) s herbicidi na podlagi glifosata, sulfosata in glufosinata na učinkovitost njihovega delovanja. Informacije pridobljene v poskusu so koristne za konstruktorje naprav za zatiranje plevelov s postopkom premazovanja. Herbicide smo na listje osleza nanašali s pomočjo pleskarskega valčka, omočenega s koncentrirano raztopino herbicida. Preučevali smo interaktivni učinek med koncentracijo raztopine za premazovanje (raztopina s 15%, 30% in 45% priprava) in deležem premazane listne površine osleza (25%, 50%, 75% premazane površine od celotne površine plevela) ter višino oslezov v času premazovanja. Pri nanosu herbicidnih raztopin vseh treh preučevanih herbicidov se je učinkovitost povečevala s povečevanjem koncentracije raztopine za premazovanje in s povečevanjem deleža premazane površine listov, tako pri 40 cm, kot pri 80 cm visokih rastlinah. Interakcija med koncentracijo raztopine in deležem premazane površine je bila značilna pri 80 cm visokih rastlinah, ne pa pri 40 cm visokih rastlinah. Če smo s 45% raztopino pripravka premazali 25% površine listov 80 cm visokih rastlin smo dosegli podobno učinkovitost, kot če smo s 15% raztopino premazali 75% celotne površine listov oslezov.

**Ključne besede:** *Abutilon theophrasti*, glifosat, glufosinat, sulfosat, zatiranje s premazovanjem

## ABSTRACT

### **The influence of wiping method of velvetleaf (*Abutilon theophrasti* Medik.) leaves on the efficacy of herbicides based on glyphosate, sulphosate and gluphosinate**

In a field trial, the impact of wiping method of velvetleaf (*Abutilon theophrasti* Medik.) plants on efficacy of herbicides based on glyphosate, sulphosate and gluphosinate was studied. The obtained results are useful information for designers of weed wiping devices. The herbicides were manually applied on velvetleaf leaves by using a painting roller moistened with herbicides. The trial was arranged as a block factorial design involving three factors - the first being herbicide concentration of wiping solution (15 %, 30% and 45 % of herbicide formulation), the second was the amount of foliage surface wiped with herbicides (25 %, 50 % and 75 % of total foliage area of the plants), and the third was the height of plants (40 cm and 80 cm) at the time of wiping. The efficacy of all applied herbicides increased when using higher concentrations of herbicide solution for wiping and when the wiped leaf area (in case of 40 and 80 cm high plants) was larger. The interactive effect between herbicide concentration and the portion of wiped leaf surface on herbicide efficacy was not significant when herbicides were applied to 40 cm high plants, but was significant in case of 80 cm high plants at all three studied herbicides. When herbicide formulations were applied at 15 % concentration on 75 % of total leaf area of 80 cm high plants, the obtained efficacy was similar to the one obtained with 45 % herbicide solution applied on only 25 % of total leaf area of wiped plants.

**Key words:** *Abutilon theophrasti*, glyphosate, sulphosate, gluphosinate, weed control, wiping methods

## **Posterska sekcija**

## **Spremljanje zastopanosti pesnega molja (*Scrobipalpa ocellatella* Boyd, Lepidoptera, Gelechiidae) v Sloveniji s feromonskimi vabami**

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Pesni molj (*Scrobipalpa ocellatella* Boyd) je v Sloveniji nov škodljivec sladkorne pese. Za peso so škodljive gosenice, ki napadajo liste in korene. Poškodovani koreni gnijejo, pridelek korenov je manjši in vsebnost sladkorja v njih nižja. V Sloveniji je bil prvi večji napad škodljivca zabeležen leta 2003, ki je bilo izrazito suho in vroče. Takšne vremenske razmere tej vrsti še posebej ustrezajo. V letu 2004 smo v Cvetkovcih, Rakičanu, Gornjem Lenartu pri Brežicah in Kranju izvajali monitoring škodljivca. S feromonskimi vabami, ki smo jih postavili na robovih njiv s sladkorno peso, smo spremljali letanje pesnega molja. Največ metuljčkov se je v vabe ujelo v Gornjem Lenartu, kjer so v letu 2003 v neposredni bližini pridelovali sladkorno peso. V Kranju se škodljivec še ni pojavil. Na podlagi enoletnih podatkov monitoringa pesnega molja sklepamo, da je imel škodljivec v letu 2004 v Sloveniji 2 rodova. Gospodarski prag škodljivosti je sicer presežen, ko na 70 % rastlin ugotovimo 4-5 gosenic. Ker pesni molj v Sloveniji doslej ni povzročal večjega zmanjšanja pridelka, pri nas ni registriranih insekticidov za njegovo zatiranje.

**Ključne besede:** sladkorna pesa, pesni molj, *Scrobipalpa ocellatella*, feromonske vabe

### *ABSTRACT*

#### **Monitoring of sugarbeet moth (*Scrobipalpa ocellatella* Boyd, Lepidoptera, Gelechiidae) in Slovenia using pheromone traps**

The sugarbeet moth (*Scrobipalpa ocellatella* Boyd) is a new sugarbeet pest in Slovenia. Larvae eat leaves and roots causing damage in such a way that the roots rot and consequently decrease the yield of roots and the sugar content in the roots. The first noticeable occurrence of the pest was recorded in 2003, which was distinctively drier and warmer than an average year. Such weather conditions are especially suitable for this species. In 2004 monitoring of the pest was carried out on four locations: Cvetkovci, Rakičan, Gornji Lenart pri Brežicah and Kranj. The occurrence of the pest was determined by means of setting pheromone traps on the margins of the sugarbeet fields. The greatest number of sugarbeet moths was caught in traps in Gornji Lenart, where sugarbeet was grown in close vicinity in 2003. In Kranj there was no trace of the pest at all. Based on one-year results of the monitoring of the sugarbeet moth we came to a conclusion that in 2004 in Slovenia the pest had 2 generations. The economic damage threshold is exceeded when 4-5 larvae are found on 70% of plants. The sugarbeet moth has caused no severe yield loss in Slovenia so far. Consequently, no insecticides have been registered for its control as yet.

**Key words:** sugarbeet, sugarbeet moth, *Scrobipalpa ocellatella*, pheromone traps



## **Hruševa stenica (*Stephanitis pyri* Fabricius) v nasadih jablane na območju jugovzhodne Slovenije**

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Območje jugovzhodne Slovenije obsega tri geografsko ločene regije s skupno površino 257.492 ha. Zaradi geografskih ovir se vremenski dejavniki v Beli Krajini razlikujejo od Dolenjske in Posavja. Za vse tri regije pa je bil v letu 2003 glede na dolgoletno povprečje značilen občuten dvig povprečnih mesečnih temperatur. Kot indikator temperaturnih sprememb se kaže pojavljanje termofilnih vrst organizmov. Primer je hruševa stenica (*Stephanitis pyri* Fabricius) iz družine Tingidae, ki je izrazito termofilna fitofagna vrsta. Prehranjuje se predvsem na hruški, višnji, češnji, breskvi in slivi. Od okrasnih rastlinskih vrst pa se jo najpogosteje zasledi na vrstah iz rodov *Cotoneaster* spp., *Rosa* spp. *Crataegus* spp., *Chaenomeles* spp. in drugih. V naših ekoloških razmerah se stenica pojavlja kot sekundarni škodljivec in do sedaj ni imela ekonomskega pomena. V letu 2003 smo konec meseca junija v bližini Krškega zasledili njen pojav v intenzivnem nasadu jablane. Kot posledica hudega napada se je zaradi poškodb listov pojavila celo delna defolicija dreves. Napadeni nasad je bil izoliran od ostalih, sosednjih nasadov in je obsegal površino 1 ha. Na listih naseljenih s hruševno stenico je bila najdena tudi parazitoidna osica iz družine *Ichneumonidae*. V nasadu hrušk na isti pridelovalni parceli hruševe stenice ni bilo zaslediti. V času ugotovljenega pojava so bili ugotovljeni vsi razvojni stadiji škodljivca. Istega leta smo kasneje v mesecu septembru zasledili njen pojav tudi v zanemarjenem visokodebelnem ekstenzivnem nasadu jablane in na drevesih sadnega vrta na Dvoru pri Žužemberku. Površina napadenih parcel je merila 2 ar. V obeh primerih je šlo za izolirano pojava in na sosednjih gostiteljskih rastlinah škodljivke ni bilo.

**Ključne besede:** hruševa mrežasta stenica, sekundarni škodljivec, termofilna vrsta, poškodbe listov, defoliacija

### *ABSTRACT*

## **Pear tingid (*Stephanitis pyri* Fabricius) in apple orchards of south-east Slovenia**

Southeast part of Slovenia extends over three geographically separated regions with total area of 257.492 ha. Geographic barrier divides Bela Krajina from Dolenjska and Posavje region showing diverse weather conditions. In all three regions was in 2003 a significant rise in average monthly temperatures regarding longterm period. As an indicator of temperature changes is the appearance of thermophil organisms. Proper example is Pear tingid (*Stephanitis pyri* Fabricius) from the Tingidae family, which is distinctive thermophil and phytophagous species. It feeds primarily on pear, sour cherry, cherry, peach and plum –tree. On the ornamental plants it is most often to find it on the following host species: *Cotoneaster*

spp., *Rosa* spp. *Crataegus* spp., *Chaenomeles* spp., etc. In local ecological conditions was the bug until now appearing only as an secondary pest and didn't have any economic importance. In late June 2003 we discovered *Stephanitis pyri* nearby Krško in the apple orchard. As a result of heavy attack on leaves there was present also partial defoliation. Attacked area was isolated from the others neighbouring orchards and had surface of 1 ha. On leaves with Pear tingid there was also parasitoid wasp from the family *Ichneumonidae* present. In the pear orchard on the same parcel we didn't detect any Pear tingid. In the time of confirmed appearance there were present all growth stages of the bug. Later in the same year we discovered in mid September another location of appearance in the neglected extensive apple orchard and fruit garden in Dvor at Žužemberk. Attacked area measured 2 ar. In both cases the areas were isolated and on the neighbouring host plants Pear tingid's presence was not confirmed.

**Key words:** Pear lace bug, secondary pest, thermophil species, leaf damage, defoliation



### **Spremljanje pojava lesnih zavrtačev v intenzivnih nasadih na Dolenjskem, Beli Krajini in Posavju**

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Lesni zavrtači so pogosti škodljivci v gozdnih sestojih, lahko pa napadajo tudi sadno drevje, večinoma jablano, hruško, slivo in češnjo. Škodo povzročajo predvsem v nasadih, ki so na sončnih legah z malo padavinami, težkimi tlemi, kjer je večja verjetnost za pojav suše in kjer je v bližini gozd. Pri nas smo zasledili pojav zavrtačev vrste *Xyleborus dispar* F. (vrtni zavrtač). Hkrati pa tudi pojav lesnih zavrtačev (Cossidae), ki delajo podobne poškodbe, predvsem vrsto modro sitce (*Zeuzera pyrina* L.). Zatiranje obeh škodljivcev je težavno, ker preživijo večino svojega življenja znotraj drevesa v rovih. Pojav vrtnih zavrtačev (*Xyleborus dispar* F.) smo spremljali s posebnimi lepljivimi ploščami, rumene barve, obdane z obstojnim lepilom odpornim na vremenske razmere. Pod lepljivo ploščo je bila nameščena plastična posoda, napolnjena z raztopino alkohola. Vabo smo obesili sredi aprila v krošnje dreves in škodljivca spremljali do konca maja. Hrošče s temi vabami smo jali na dveh lokacijah. Na lokaciji na Dolenjskem smo zasledili največji ulov v prvi dekadi maja (število ujetih osebkov 40), na lokaciji v Posavju pa v drugi dekadi maja (število ujetih osebkov 43). Število vrtnih zavrtačev v obeh nasadih, se je nato začelo zmanjševati. Ti dve lokaciji sta imeli podobne ekološke razmere, razlike so se pojavile pri povprečnih dnevni temperaturah (lokacija v Posavju je imela povprečno dnevno temperaturo nižjo). Pojav gosenic modrega sitca (*Zeuzera pyrina* L.) smo zasledili v obdobju od druge dekade maja do prve dekade julija. Posebej jih nismo spremljali. Glede na to, da v Sloveniji za zdaj ni registriranih nobenih fitofarmaceutskih sredstev, lahko spremljanje in nadzor izvajamo samo s feromonskimi vabami za *Zeuzera pyrina* L. in z atraktanti za *Xyleborus dispar* F.

**Ključne besede:** *Xyleborus dispar*, *Zeuzera pyrina*, poškodbe lesa, sekundarni škodljivci, lepljive plošče

## ABSTRACT

### **Monitoring of ambrosia beetle (*Xyleborus dispar* F.) and leopard moth (*Zeuzera pyrina* L.) in intensive plantation in region of Dolenjska, Bela Krajina and Posavje**

Tree borers are frequent pests in forests, but they can also attack fruit trees as: apple tree, pear tree, plum tree and cherry tree. They are causing damage on the plantation that is in sunny position, with lack of water, on heavy ground and near the forest. We noticed in our region tree borer, ambrosia beetle (*Xyleborus dispar* F.). And at the same time also another pest, whose damages are similar to the damages of ambrosia beetle. His name is *Zeuzera pyrina* L. (leopard moth). The use of pesticides is very complex. These pests spend most of their life cycle inside the trees in tunnels. We have done the monitoring of ambrosia beetle (*Xyleborus dispar* F.) with yellow sticky traps. Under the trap we placed a bottle with alcohol, which attracts the beetles from the beginning of April until the end of May. We placed traps in two locations. The largest catch on location in Dolenjska region was traced in the beginning of May (number of subjects was 40) and on location in Posavje region in the middle of May (number of subjects was 43). After that time the population on both locations started to decrease, but we were catching them until the end of May. These two locations had similar ecological conditions, the only difference was in average day temperatures (location in Posavje region had average day temperatures lower). We notice the appearance of caterpillars of the leopard moth (*Zeuzera pyrina* L.) from the middle of May to the beginning of June. But we did not make any significant monitoring on this pest. The plant protection for these pests in Slovenia is not allowed, so we can monitor them only with the pheromone traps for *Zeuzera pyrina* L. and with "attract and kill" traps for *Xyleborus dispar* F.

**Key words:** *Xyleborus dispar*, *Zeuzera pyrina*, damaged wood, secondary pests, sticky traps,



### **Varstvo gojenih gob pred mušicami žalovalkami z uporabo zajedalskih ogorčic**

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Pri pridelovanju gob vrste *Agaricus bisporus* se srečujemo s številnimi povzročitelji bolezni in škodljivci. Najpomembnejše in najbolj pogosto odkriti škodljivci so mušice žalovalke, kot so na primer vrste *Lycoriella auripilla*, *L. solani*, *L. mali* in *Bradysia tritici*. Na prirejenih substratih gojene glive težko varujemo pred škodljivimi organizmi, ker so organski substrati, ki jih uporabljamo za gojenje gliv pripravljene iz dozorelega komposta idealna hrana tudi za škodljive organizme. Gojene gobe se zelo hitro razvijajo, kar ovira uporabo kemičnih fitofarmacevstkih sredstev za zatiranje škodljivih organizmov. Popsod po svetu za varovanje gojenih gob pred škodljivimi organizmi uporabljajo in raziskujejo tudi metode biotičnega varstva. Ena od takšnih metod je tudi uporaba zajedalskih ogorčic (entomopatogene nematode), ki živijo v sožitju z bakterijami in se hranijo z zuželkami. Tema tega prispevka je uporaba zajedalskih ogorčic za zatiranje mušic žalovalk. Leta 2004 smo na



Fakulteti za kmetijstvo Georgikon Faculty of Agriculture, University of Veszprém izvedli poskuse v katerih smo preučevali uporabo zajedalskih ogorčic vrste *Steinernema feltiae* apliciranih v obliki pripravkov Nemasys M in *Steinernema feltiae* C. Zajedalske ogorčice vrste *S. feltiae* po tem, ko jih apliciramo na gojitveni substrat poiščejo ličinke mušic žalovalk in skozi njihove naravne odprtine prodrejo vanje. Ob tem telo ličink žalovalk okužijo z s specifičnimi bakterijami, ki so simbionti ogorčic, hkrati pa so patogene za ličinke žalovalk in povzročijo njihov pogin. Oba pripravka smo preučevali v različnih odmerkih izraženo s številom ogorčic v raztopini. Tako smo oba pripravka aplicirali na površje gojitvenega substrata v treh odmerkih (1, 1,5 ali 2 milijona ličink na liter aplicirane tekočine). Z uporabo rumenih lepljivih vab smo spremljali populacijo žalovalk in tako ugotavljali učinek uporabe obeh biotičnih pripravkov. Med pripravkoma ni bilo značilnih razlik v učinkovitosti zatiranja žalovalk. Na lepljive plošče obešene nad gojitvenimi kontejnerji (vrečami), kjer smo aplicirali ogorčice se je ujelo manj žalovalk, kot nad kontejnerji, kjer pripravkov nismo uporabili. Uporaba pripravkov ni imela vpliva na ulov drugih žuželk (predstavniki iz družin Phoridae, Drosophilidae in Psychodidae), ki pogosto spremljajo pridelavo gob. Na podlagi tega lahko sklepamo, da uporabljena vrsta ogorčic ne zajeda ličink teh vrst žuželk. Žalovke so pomembni prenašalci povzročiteljev bolezni zato velikost njihove populacije vpliva na obseg okužb gob z boleznimi.

**Ključne besede:** *Agaricus bisporus*, gojenje gob, mušice žalovalk, biotično zatiranje, *Steinernema feltiae*, zajedalske ogorčice

ABSTRACT

#### Protection against mushroom-flies using entomopathogenic nematodes

In the mushroom- production (*Agaricus bisporus*) we meet lots of pathogenic organisms and pests. The most important and mostly found pests are the Sciarid-flies, like for example *Lycoriella auripilla*, *L. solani*, *L. mali* and *Bradysia tritici*. The produced mushrooms are hard to protect, because the production needs lots of organic ingredients and suitable ripe compost and these organic materials also feed the different pathogenic organisms. The mushroom lifecycle are very fast, that is why the chemical protection are limited in the production. All over the world people examine and use biotical protection in the mushroom-production. One of the possibilities the use of entomopathogenic nematodes, which live together with entomopathogenic bacteria. Our essay subject is about the biotical protection against the Sciarid-flies with the help of nematodes. In August, 2004. experiments were carried out at University of Veszprém, Georgikon Faculty of Agriculture. *Steinernema feltiae* species of entomopathogenic nematodes were used our experiment. We examined the effects of two biopesticides, one of them is Nemasys M and the other is *Steinernema feltiae* C. The active ingredient in these products is a naturally occurring, insect parasitic nematode (*Steinernema feltiae*) that seeks out Sciarid-larvae, enters their natural body openings and releases symbiotic bacteria which kill pests. Both biopesticides were tested in three different concentration. The solution contained 1, 1.5 or 2 million larvae, which we applied on the soil surfaces. We examined the effects by placing isolators above every compost bag and we also used yellow fly-paper on which we counted the insects. No difference could be observed in the efficiency of the two pesticides. The results show that there were less Sciarid-flies on the fly-papers of the protected bags than on the control bags. Together with the Sciarid-flies

there were also Phoridae and unimportant Drosophilidae and Psychodidae, which the nematodes did not take effect. The mushroom-flies are also important in spreading different mushroom diseases. In the experiment after the second half of the production period we also noticed, that there were not any healthy mushroom on the compost.

**Key words:** *Agaricus bisporus*, mushroom production, Sciarid-flies, biotical control, antomopathogenetic nematodes, *Steinernema feltiae*



### **Prvi rezultati preučevanja možnosti uporabe silikona in pripravka »Phyto-balsam« za zatiranje hrčice *Helicomyia saliciperda* Duf na vrbah**

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Mlade rastline bele vrbe (*Salix alba*) in deli krošenj starejših dreves, ki še imajo tanko lubje so lahko značilno oslabiljeni od napada hrčice *Helicomyia saliciperda* Duf. (Diptera, družina Cecidomyiidae), ki povzroča nastanek šišk v lubju. Če je gostota šišk velika, te povzročijo odmiranje delov vejic in vej nad njimi. Poškodbe od tega škodljivca so posebej pogoste v drevesnicah in v nasadih mladih dreves bele vrbe. Zaradi pojava gospodarske škode v objektih gojenja bele vrbe se je pojavila potreba po varovanju rastlin pred tem škodljivcem. Dosedanji pristopi pri zatiranju niso dali ustreznih rezultatov zato smo začeli z raziskavo, katere namen je bil, preučiti učinkovitost uporabe silikona in pripravka »Phyto-balsam« za zatiranje hrčice na način, da se pripravka nanese na lubje dreves. Preučiti smo želeli, ali premazovanje šišk s tega pripravkoma prepreči izletavanje odraslih hrčic iz bub, ki se nahajajo v šiškah (tkiva vodovodnih cevi in skorje) in ali premazovanje nenapadenih delov lubja v okolici šišk prepreči odlaganje jajčec in zavrtavanje ličink v lubje. Izvedli smo poljski poskus zasnovan tako, da je bila možna statistična obdelava podatkov s postopkom ANOVA. Poskus je pokazal, da je premazovanje lubja s preučevanima pripravkoma značilno zmanjšalo izletavanje odraslih hrčic iz napadenih tkiv v primerjavi z netretiranimi drevesi. Prvi rezultati poskusa nakazujejo, da je potrebno raziskavo nadaljevati, predvsem v smislu določanja velikosti območja, ki ga je potrebno premazati, da v dovolj velikem obsegu preprečimo izletavanje hrčic. Dodatno je potrebno preučiti ali postopek premazovanja vpliva tudi na celjenje ran povzročenih od tega škodljivca.

**Ključne besede:** *Salix alba*, *Helicomyia saliciperda*, zatiranje, silikon

## ABSTRACT

### **The first results of the potential application of silicon and "Phyto-balsam" in the control of *Helicomyia saliciperda* Duf.**

*Salix alba* young plants and the older tree parts with thin bark are significantly endangered by *Helicomyia saliciperda* Duf. (Diptera, fam. Cecidomyidae) causing galls which often spread over the entire area, leading to the dying of the plant parts above the gall. The damage is especially significant in the nurseries and in younger plantations. For this reason, it is necessary to protect the plants against this pest, as the previously applied measures did not show satisfactory results. We started the research aiming at the efficient measures of protection by the application of silicon and "Phytobalsam". To prevent the swarming, i.e. the emerging of the adults from the xylem and cortical tissue, and also to prevent the new egg laying and tunnelling of the larvae into the bark, the galls and the surrounding tissue were covered with the above mentioned preparations. The experiment was established in the field by the method and to the extent which enables the statistical processing (ANOVA). The results show that the emergence of the adults from the treated plants was statistically significantly lower compared to untreated plants. The first results indicate that the research should be continued, especially in the direction of determining the extent of the zone around the gall which should be treated, as well as the rate of healing the damage.

**Key words:** *Salix alba*, *Helicomyia saliciperda*, control, silicon



### **Prerazmnožitev poljskega majskega hrošča (*Melolontha melolontha* L.) na Idrijskem**

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V posterju opisujem škodo na travnikih in njivah, ki so jo povzročili ogrci poljskega majskega hrošča (*Melolontha melolontha* L.) na Idrijskem v letu 2002, 2003 in v letu 2004. V letu 2002 so ogrci v stadiju 3. levitve ( $L_3$ ) popolnoma uničili travno rušo na 370 ha. Številčnost ogrcev je bila od 60 pa do 120 ogrcev na  $m^2$ . V letu 2003 se je škoda še stopnjevala na zemljiščih, kjer niso izvedli mehanskega zatiranja. V letu 2004 so delali škodo tudi odrasli osebk. Po izleganju jajčec je populacija še narasla, saj smo na planoti našli več kot 120 ogrcev na  $m^2$ . Ogrci so že v stadiju 1. levitve ( $L_3$ ) poškodovali travno rušo do 50%.

**Ključne besede:** travniki, njive, poljski majski hrošč, *Melolontha melolontha*, poškodbe

## ABSTRACT

### **A great increase of population of Common Cockchafer (*Melolontha melolontha* L.) on Idrija region**

In poster presentation I introduce the damage on grasslands and fields that was caused by larvae of the cockchafer species (*Melolontha melolontha* L.) on Idrija region in years 2002, 2003 and 2004. In year 2002 have grubs in 3<sup>rd</sup> stadium of slough (L<sub>3</sub>) completely destroyed grass sod on area of 370 ha. Numerous of grubs was on average from 60 to 120 grubs on m<sup>2</sup>. In year 2003 was damage to increase on earea where mechanical oppress wasn't performed. In year 2004 had damage that was caused by the imago, after hatching the eggs the population was increased on more than 120 grubs on m<sup>2</sup>. Grubs in at 1<sup>st</sup> stadium of slough (L<sub>1</sub>) destroyed grass sod about 50 %.

**Key words:** grassland, field, cockchafer, *Melolontha melolontha*, damage



### **Vpliv štirih vmesnih posevkov na škodljivost tobakovega resarja (*Thrips tabaci* Lindeman, Thysanoptera, Thripidae) na čebuli**

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V letu 2004 smo na Laboratorijskem polju Biotehniške fakultete v Ljubljani preizkušali učinkovitost štirih vmesnih posevkov za zmanjševanje škodljivosti tobakovega resarja (*Thrips tabaci*) na čebuli (*Allium cepa* L.). V bločnem poskusu smo ugotavljali ustreznost pasje trave (*Dactylis glomerata* L.), ajde (*Fagopyrum esculentum* Moench.), facelije (*Phacelia tanacetifolia* Benth.) in plazeče detelje (*Trifolium repens* L.) za privabljanje škodljivca, z namenom zmanjšanja njegove številčnosti in posledičnega obsega poškodb na listih dveh kultivarjev čebule, 'Holandska rumena' in 'Rdeči baron'. Plazeča detelja je imela v poskusu vlogo kontrolnega posevka, saj se je doslej v številnih fitomedicinskih raziskavah izkazala za učinkovit vmesni posevek v pridelavi čebule. Obseg poškodb na listih čebule smo s standardno metodo (Richter et al.) ugotavljali v dveh terminih, 22. julija in 3. avgusta. Statistično značilno največji indeks poškodb smo obakrat ugotovili na listih čebule, ki je rasla v mešanem posevku s pasjo travo in belo deteljo. Čebula, gojena z ajdo in facelijo kot vmesnima posevkoma, je bila statistično značilno manj poškodovana od ličink in imagov tobakovega resarja. Čebula v mešanem posevku s pasjo travo in belo deteljo je 10. avgusta, ko smo pobirali pridelek, dosegla statistično značilno največji pridelek, medtem ko smo najnižji pridelek ugotovili na parcelicah, kjer je čebula rasla skupaj s facelijo. Podobna

razmerja v stopnji poškodovanosti listov čebule in v pridelku čebulic ugotavljamo med obravnavanji tako pri skupni (analiza obeh kultivarjev) kot individualni statistični analizi (analiza posameznih kultivarjev). Na podlagi rezultatov pričujoče raziskave ugotavljamo, da sta bela detelja in pasja trava ustrezna vmesna posevka za gojenje čebule, medtem ko sta se ajda in facelija pokazali kot manj ustrezni. V prispevku razpravljamo o vzrokih dobljenih rezultatov in napovedujemo potencialno spremembo razmerij med škodljivcem in različnimi gostitelji v letih z masovnim pojavom škodljivca.

**Ključne besede:** vmesni posevki, integrirano varstvo rastlin, čebula, tobakov resar, *Thrips tabaci*

*ABSTRACT*

**Impact of four intercrops on harmfulness of onion thrips (*Thrips tabaci* Lindeman, Thysanoptera, Thripidae) in onion**

In 2004, the effectiveness of four intercrops on reduction of harmfulness by onion thrips (*Thrips tabaci*) in onion was tested on the experimental field of Biotechnical Faculty (Ljubljana). In a randomized block experiment suitability of orchard grass (*Dactylis glomerata* L.), buckwheat (*Fagopyrum esculentum* Moench.), lacy phacelia (*Phacelia tanacetifolia* Benth.) and white clover (*Trifolium repens* L.) to attract the pest with the intention of reduction its abundance and consequently damage dimension on the leaves of two onion cultivars ('Holandska rumena' and 'Rdeči baron') was studied. White clover was used as control crop, because in many past entomological researches its suitability as a intercrop showed good results in onion production. Damage range on onion leaves was assessed by the standard method (by Richter et al.) at 22<sup>nd</sup> of July and 3<sup>rd</sup> of August. Intercropping with orchard grass and white clover influenced the appearance of the highest extent of damage on the leaves of onion. Onion grown with buckwheat and lacy phacelia as intercrops was statistically less damaged from larvae and adults of *Thrips tabaci*. The highest yield (date of harvesting was 10<sup>th</sup> August) was obtained on the plots where onion was grown with orchard grass and white clover and the lowest was measured on plots intercropped with lacy phacelia. Similar proportions in level of leaf damage and bulb yield are established between treatments when making group (both cultivars) or individual (single cultivar) statistical analysis. Based on results of the present experiment we conclude that white clover and orchard grass meet the criterion for intercropping in onion production, meanwhile buckwheat and lacy phacelia are less suitable. Reasons for obtained results are further discussed and potential change in ratio between the pest and different hosts in years of mass appearance of the pest is forecast.

**Key words:** intercrops, IPM, onion, onion thrips, *Thrips tabaci*



## Občutljivost južnoameriških vrst rodu *Solanum* na okužbe s krompirjevim Y virusom

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Krompirjev Y virus (Potato virus Y (PVY)) je član rodu Potyvirus in družine Potyviridae, ki je gospodarsko (ekonomsko) najbolj pomembna družina rastlinskih virusov. Bolezen nekrotično virusno obročkavost gomoljev krompirja so prvič opisali leta 1984 na Madžarskem raziskovalci Beczner in njegovi sodelavci. V obdobju zadnjih dvajsetih let se je ta različek krompirjevega Y virusa razširil po vsem svetu. Povzročča velike izgube pridelka in ima veliko sposobnost premagovanja mehanizmov odpornosti gostiteljev, zato imajo raziskave rastlin, ki so vir genov za odpornost in raziskave novih gostiteljev tega virusa poseben pomen. V poskusu smo preučevali občutljivost potomcev (akcesij) petih divjih južnoameriških (*Solanum avilesii* PI. 498092, *S. candolleanum* PI. 498226, *S. clarum* PI. 283099, *S. mochiquense* PI.: 338616, *S. phureja* PI.: 320360) vrst iz rodu *Solanum* proti okužbam z NTN (PVY<sup>NTN</sup>) različkom krompirjevega Y virusa. Za okuževanje je bil uporabljen originalni izolat različka Maradona PVY<sup>NTN</sup>. Virusi PVY<sup>NTN</sup> uporabljeni za mehanično inokulacijo rastlin iz akcesij divjih južnoameriških vrst so bili razmnoženi na tobakovih rastlinah (*Nicotiana tabacum* cv. *Xanthi-nc*). Inokulacija je bila opravljena, ko so poskusne rastline imele razvitih 8 do 10 listov. Vsakič smo okužili sedem rastlin posamezne akcesije divjih rastlin rodu *Solanum*. Po okuževanju smo izvajali opazovanje pojavljanja značilnih znamenj okužbe. Pet tednov po okužbi so bile vse rastline testirane na zastopanost preučevanega virusa s serološko metodo z uporabo DAS-ELISA testa. Uporabljena oprema in material za izvedbo testiranja (KIT) je bila od proizvajalcev Loewe Biochemica in Boehringer Mannheim. Meritve absorpcije - ekstinkcije so bile izvedene pri valovni dolžini 405 nm s čitalcem proizvajalca LabSystem Multiscan ELISA reader. Vzorce smo obravnavali kot pozitivne, če so bile odčitane absorpcijske vrednosti dvakrat večje od tistih pri vzorcih iz neokuženih rastlin. Okužbe smo dodatno dokazovali z re-inokulacijo neokuženih rastlin tobaka (*Nicotiana tabacum* cv. *Xanthi-nc*) s sokom iz okuženih rastlin divjih *Solanum* vrst. Vse akcesije preučevanih divjih *Solanum* vrst so se izkazale kot občutljive na okužbe z preučevanim različkom PVY<sup>NTN</sup> saj so okužene rastline kazale znamenja značilnega mozaika, presvetlitve žil in nekroze žil. V poskusu smo dokazali možnost razvoja virusa PVY<sup>NTN</sup> v novih gostiteljih iz skupine divjih ameriških vrst rodu *Solanum* (nove kombinacije kompatibilnih gostiteljev in virusa).

**Ključne besede:** virus PVY<sup>NTN</sup>, odpornost, občutljivost, *Solanum* sp., DAS-ELISA, odnos gostitelj-patogen

## ABSTRACT

### Susceptibility of south american wild *Solanum* species to *Potato Virus Y*

*Potato virus Y* (PVY) is the type member of *Potyvirus* genus in the family Potyviridae, which is economically the most important family of plant viruses. The potato tuber necrotic ring spot disease (PTNRD) was first described in Hungary by Beczner *et al.* (1984). During the past twenty years the virus strain distributed all over the world. Due to the destructive and resistance breaking nature of potato tuber necrotic ring spot strain, the search of resistance sources and for new host species has special importance. The susceptibility of 5 (*Solanum avilesii* PI. 498092, *S. candolleianum* PI. 498226, *S. clarum* PI. 283099, *S. mochiquense* PI.: 338616, *S. phureja* PI.: 320360) South American wild *Solanum* species and accessions to NTN strain of PVY (PVY<sup>NTN</sup>) were studied. The original Maradona isolate of PVY<sup>NTN</sup> was used for infection. PVY<sup>NTN</sup> was propagated previously on *Nicotiana tabacum* cv. *Xanthi-nc* plants. *Solanum* species and their accessions were mechanically inoculated at 8-10 leaves stage with PVY<sup>NTN</sup>. Seven plants of each accession were inoculated in each time. The inoculated plants were symptomatologically checked after inoculation. Five weeks after mechanical inoculation, accessions were tested serologically by DAS-ELISA. Kits for ELISA derived from Loewe Biochemica and Boehringer Mannheim. Substrate absorbance was measured at 405 nm on Labsystem Multiscan ELISA reader. Test samples were considered positive if their absorbance values exceeded twice that of the healthy control. Back inoculation was also made to *Nicotiana tabacum* cv. *Xanthi-nc* plants. All of studied *Solanum* accessions were susceptible to PVY<sup>NTN</sup> showing mosaic, vein clearing and vein necrosis symptoms. In our experiments new compatible host-virus relations among *Solanum* accession and PVY<sup>NTN</sup> have been found.

**Key words:** PVY<sup>NTN</sup> virus, resistance, susceptibility, *Solanum* sp., DAS-ELISA, host-patogen relationship

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### Interakcije rastlina – rastlina v povezavi z interakcijami virus – rastlina

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Poznamo več vrst sovplivnih (interferenčnih) interakcij med višjimi rastlinami. Nekatere opisujemo kot interakcije tekmovanja (kompetitivne), druge kot alelopatske interakcije (zaviralne ali vzpodbujevalne). Kadar v odnosih med rastlinami prevladuje primarni zaviralni

alelopatski odnos, donatorska rastlina izloča snovi iz skupine drugotnih presnovnih izločkov (sekundarni metaboliti), ki imajo zaviralen učinek na razvoj rastline sprejemnice (recipientke) teh snovi. V sedanjem času v okvir alelopatskih odnosov ne uvrščamo zgolj interaktivnih odnosov med višjimi rastlinami, temveč tudi interaktivne odnose med mikroorganizmi in rastlinami. Namen naše študije predstavljene v tem prispevku je bil ugotoviti povezavo med alelopatskim učinkom izločkov nekaterih plevelov na poskusne rastline in odnosom med poskusno rastlino in virusom, s katerim je poskusna rastlina okužena. V našem primeru smo kot poskusni rastlini sprejemnici uporabili pasje zelišče (*Solanum nigrum*) in tobak (*Nicotiana tabacum* cv. Samsun), ki smo jih v stadiju 4 do 6 listov okužili z virusom ObPV (Obuda pepper virus). Poskusne rastline smo vsak dan škropili z vodnimi izvlečki pridobljenimi iz naslednjih plevelov: *Abutilon theophrasti* (baržunasti oslezovec, poganjki), *Asclepis syriaca* (sirski svilnica; poganjki, korenine ločeno), *Cirsium arvense* (njivski osat, poganjki) in *Convolvulus arvensis* (njivski slak; poganjki). Pet tednov po okužbi testnih rastlin v virusom smo s tehtanjem svežih rastlin določili njihovo maso. Za določitev virusov v testnih rastlinah smo uporabili serološki test (DAS ELISA), za kvantifikacijo koncentracije virusa v soku testnih rastlin pa smo uporabili kar odčitke ekstinkcijskih vrednosti. Masa svežih rastlin pasjega zelišča se je ob dodajanju vodnih izvlečkov iz korenin svilnice in poganjkov slaka zmanjšala za 41 oziroma 45%. Dodajanje izvlečkov plevelnih rastlin ni vplivalo na koncentracijo ObPV virusa v testnih rastlinah pasjega zelišča. Koncentracija virusa v testnih rastlinah tobaka sorte Samsun se je pod vplivom dodajanja vodnih izvlečkov korenin svilnice in izvlečkov poganjkov njivskega slaka značilno zmanjšala. Razvoj poskusnih rastlin tobaka je bil občutno zavrt ob dodajanju izvlečkov iz poganjkov svilnice in oslezovca. Na podlagi preliminarnih rezultatov raziskave ugotavljamo, da med zaviralnim alelopatskim učinkom preučevanih plevelov na pasje zelišče in tobak in med odnosom gostitelj-virus, ni povezave.

**Ključne besede:** interferenca, rastline, alelopatija, *Solanum nigrum*, *Nicotiana tabacum*, *Abutilon theophrasti*, *Asclepis syriaca*, *Cirsium arvense*, *Convolvulus arvensis*, ObPV virusa

#### ABSTRACT

#### Plant-plant and plant-virus interactions

Interaction among higher plants is called interference. One type of it is called as competition, while the other type is called allelopathy. In case of predominance of allelopathy, donor plants excrete secondary metabolites, which always have inhibitory effect on the recipient (acceptor) species. Today the term allelopathy has been broadened, including not only plant-plant, but also plant-microorganisms interactions. The aim of our present work was to study the effect of some allelopathic weeds on the development on recipient species and virus concentration. Donor species (*Solanum nigrum*, *Nicotiana tabacum* 'Samsun') were sprayed daily with the water extracts of *Abutilon theophrasti*, *Asclepias syriaca*, *Cirsium arvense*, *Convolvulus arvensis* shoots, and those of *A. syriaca* roots. Test plants were inoculated at 4-6 leaves stages with *Obuda pepper virus* (ObPV). Five weeks after inoculation the fresh weight of the test plants were measured. Virus infection was valued by DAS ELISA method, and virus concentration in hosts was determined on the basis of extinction values. Fresh weight of *S. nigrum* was reduced by 41 and 43%, due to *A. syriaca* root and *C. arvense* shoot extracts. Plant water extracts did not reduce virus concentration in *S. nigrum*. Virus



concentration in *N. tabacum* 'Samsun' host was significantly reduced due to *A. syriaca* root, and *C. arvense* shoot extracts. Development of *N. tabacum* 'Samsun' plants was considerably inhibited due to *A. syriaca* and *A. theophrasti* shoot extracts. On the basis of our preliminary results no relation was observed between allelopathic inhibitory effect on the test plants and host-virus relations.

**Key words:** interference, plants, allelopathy, *Solanum nigrum*, *Nicotiana tabacum*, *Abutilon theophrasti*, *Asclepis syriaca*, *Cirsium arvense*, *Convolvulus arvensis*, *ObPV* virusa



### **Dinamika porazdelitve makro hranil po organsih njivskega slaka (*Convolvulus arvensis*)**

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Njivski slak (*Convolvulus arvensis*) je eden najpomembnejših trajnih plevelov njiv, vinogradov, vrtov, nekmetijskih zemljišč in obcestnih zemljišč. Po podatkih pridobljenih v raziskavah četrtega Madžarskega nacionalnega popisa plevelov, ki je potekal v letih 1996 in 1997 je slak glede na pogostost pojavljanja zavzemal šesto mesto, s povprečno stopnjo pokrovnosti 1,66% v vseh opazovanih sestojih plevelnih združb. Lahko uspeva skoraj na vseh tipih zemljišč. Ta hitro rastoč in ovijajoč se plevel ima horizontalno in vertikalno razpreden koreninski splet, ki sega do globine dveh metrov in več. Stebla dosežejo dolžino od 20 do 200 cm. Slak zelo težko zatremo (iztrebimo) zaradi velike obnovitvene sposobnosti s podzemnimi živicami in korenikami. Korenike rastlini služijo kot shramba za hranilne snovi. Poznavanje biotičnih lastnosti plevelov in njihovih značilnosti pri odvzemu hranil je pomembno za učinkovito zatiranje plevelov. Namen raziskave opravljene na slaku je bil preučiti značilnosti odvzema hranil pri tem plevelu in slediti njihovo porazdelitev po rastlini. V obdobju od aprila do decembra leta 2002 smo na njivah nabirali vzorce rastlin slaka. Ugotavljali smo maso svežih poganjkov in korenin, maso suhe snovi poganjkov in korenin in določili vsebnost (koncentracijo) dušika, fosforja, kalija in kalcija v suhi snovi. Vsebnost hranil v poganjkih in koreninah slaka mora biti povezana s fiziološkimi procesi rastline. Zelo intenziven odzem hranil ima pomembno vlogo pri njegovi veliki tekmovali sposobnosti. Koncentracije dušika, fosforja in kalcija v nadzemnih poganjkih je bila v poletnem obdobju do začetka jeseni večja, kot v koreninskem sistemu, konec oktobra se je koncentracija teh hranil v poganjkih izenačila s koncentracijo v koreninskem sistemu. Koncentracija kalija je bila v nadzemnih delih rastline konstantno, v vseh preučevanih obdobjih rastne dobe večja, kot v koreninskem sistemu.

**Ključne besede:** *Convolvulus arvensis*, rastlinska fiziologija, odzem hranil, dušik, fosfor, kalij, kalcij

## ABSTRACT

### Dynamic of macronutrients in plant parts of *Convolvulus arvensis*

*Convolvulus arvensis* – field bindweed - is one of the most important perennial weeds of the fields, vineyards, gardens, uncultivated areas, and roadsides. On the base of IV. Hungarian National Weed Survey 1996-1997, it takes the sixth place in the dominance sequence, with 1,66 % average covering. It can be found almost on every soil types. This fast-growing and twining weed has vertical and horizontal root system, to 2 m or more depth. Stems are 20-100 cm long. This weed difficult to eradicate because it can reproduce successfully and vigorously by underground rootstocks. These rootstocks serve as storage nutrients for the plant. Knowledge of biotical characteristics and nutrient uptake of weeds essential for effective weed control. Our aim was to follow the nutrient uptake and their changes in plant parts of *Convolvulus arvensis*. Plants were collected from the fields from April to December in 2002. We measured the fresh and dry mass of root and shoot samples and determined their nitrogen, phosphorus, potassium and calcium concentration. Changes of nutrient concentration of shoots and rootstocks must be connecting with physiological processes of the plant. Intensive nutrient uptake of *Convolvulus arvensis* has an important roll in its considerable competitive capacity. Nitrogen, phosphorus and calcium concentration of shoots was higher than roots until autumn and became equal at the end of October. Potassium content of shoots remained higher than of roots in all examined period.

**Key words:** *Convolvulus arvensis*, plant physiology, nutrient uptake, nitrogen, phosphorus, potassium, calcium



### Virusi na paradižniku v Sloveniji

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V okviru stalnega nadzora škodljivih organizmov, ki ga vršita fitosanitarna uprava in fitosanitarna inšpekcija, izvajamo na Nacionalnem inštitutu za biologijo laboratorijsko diagnostiko karantenskih in drugih škodljivih virusov na okrasnih rastlinah in vrtninah. Zadnja leta smo na paradižniku najpogosteje našli virusa CMV (*Cucumber mosaic virus*) in PVY (*Potato virus Y*), redkeje pa tudi AMV (*Alfalfa mosaic virus*), TMV (*Tobacco mosaic virus*), ToMV (*Tomato mosaic virus*) in TSWV (*Tomato spotted wilt virus*). Poleg tega smo z elektronskim mikroskopom opazili virusne delce, ki jih natančneje nismo uspeli identificirati, po morfologiji pa ustrezajo cucumo-, gemini- in tobamovirusom. Karantensko škodljivih virusov kot so PepMV (*Pepino mosaic virus*), TYLCV (*Tomato yellow leaf curl virus*) in ToRSV (*Tomato ringspot virus*) do sedaj v Sloveniji še nismo našli. Pogosto paradižnik okužujeta CMV in PVY hkrati, našli pa smo tudi druge mešane okužbe, kot npr. kombinacijo PVY in TSWV, pri kateri smo opazili nekroze na steblih in pecljih ter zvijanje listov. ToMV smo leta 2004 našli v enem rastlinjaku, kjer je povzročil sušenje in nekroze rastlin paradižnika, na listih pa smo opazili tudi kloroze in gubanje. Leta 2003 smo v

testiranje prejeli paradižnik z nenavadnimi bolezenskimi znamenji: na plodovih so bili klorotični madeži in gube, liste pa je imel ozke in nekrotične. Z ELISA zgoraj omenjenih virusov v tem vzorcu nismo dokazali, smo pa v mehansko inokuliranih testnih rastlinah *Nicotiana tabacum* cv. White Burley, *Nicotiana clevelandii* in *Nicotiana benthamiana* pod elektronskim mikroskopom opazili viruse iz družine Rhabdoviridae in neznane izometrične virusne delce.

**Ključne besede:** laboratorijska diagnostika, virusi, paradižnik, Slovenija

*ABSTRACT*

### **Viruses infecting tomato in Slovenia**

Diagnostic laboratory at the National Institute of Biology is performing laboratory testing of viruses on vegetables and ornamentals, in the frame of a monitoring of quarantine and harmful pathogens carried out by the Phytosanitary Administration and Phytosanitary Inspection Service of the Republic of Slovenia. During last few years most frequently found viruses on tomato were CMV (*Cucumber mosaic virus*) and PVY (*Potato virus Y*). Occasionally, AMV (*Alfalfa mosaic virus*), TMV (*Tobacco mosaic virus*), ToMV (*Tomato mosaic virus*) and TSWV (*Tomato spotted wilt virus*), were found. Other, not identified particles were observed by electron microscopy, with the morphology corresponding to Cucumoviruses, Geminiviruses and Tobamoviruses. Quarantine pests, such as PepMV (*Pepino mosaic virus*), TYLCV (*Tomato yellow leaf curl virus*) and ToRSV (*Tomato ringspot virus*) have not been found, yet. CMV and PVY were often found in mixed infection, as well as in combinations with other viruses, for example a combination of PVY and TSWV was found, causing necrosis on stem and petioles, and leaves curling. ToMV, found in one tomato glasshouse in 2004, causing wilting and necrosis, the leaves were also wrinkled and chlorotic. In 2003, we analysed tomato plant expressing unusual symptoms of distinct chlorotic spots and wrinkles on fruits, and narrow, necrotic leaves. No above mentioned viruses were found by ELISA. Electron microscopy revealed very clear Rhabdoviridae particles and isometric particles of an unknown identity in sap of mechanically inoculated test plants *Nicotiana tabacum* cv. White Burley, *Nicotiana clevelandii* and *Nicotiana benthamiana*.

**Key words:** laboratory testing, viruses, tomato, Slovenia



## Ugotavljanje virusa šarke v rastlinah zunaj rodu *Prunus* s serološkimi in molekulsko biološkimi metodami

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Da bi ugotovili možen pomen rastlin zunaj rodu *Prunus* kot vira okužbe s PPV, smo v letih 2000-2004 v več s PPV okuženih breskovih nasadih in na hišnem vrtu z okuženimi marelicami in slivami zbrali 811 vzorcev rastlinskih vrst iz 73 rodov. Do poletja 2002 smo zbrane vzorce analizirali samo serološko (DAS-ELISA) in s to metodo potrdili PPV v 2 od skupno 7 vzorcev *Clematis* sp., 18 od skupno 97 vzorcev *Taraxacum officinale* in edinem vzorcu *Cichorium* sp. Od poletja 2002 smo za preverjanje rezultatov serološkega testiranja uporabili molekulsko metodo (IC RT-PCR). Od skupno 403 vzorcev, analiziranih z DAS-ELISA, je bilo 50 pozitivnih. Razen teh smo z molekulsko metodo preverili še 56 vzorcev s sumljivimi rezultati DAS-ELISA testa. PPV smo potrdili le v 3 vzorcih in sicer v enem DAS-ELISA pozitivnem vzorcu *Convolvulus arvensis*, enem DAS-ELISA pozitivnem vzorcu *Solanum nigrum* in 1 vzorcu iz rodu *Viola*. Ugotavljamo torej, da je bila večina DAS-ELISA pozitivnih rezultatov lažno pozitivnih, verjetno zaradi nespecifične vezave rastlinskih snovi na virusna protitelesa. Glede na dosegljivo literaturo ugotavljamo, da *Convolvulus arvensis* in *Viola* sp. do sedaj še nista bili znani kot gostiteljici virusa šarke. Mazyad et al. (1992) so potrdili PPV v *Solanum nigrum* po mehanski inokulaciji, mi pa smo prvi potrdili okužbo te vrste s PPV v naravnih razmerah.

**Ključne besede:** virus šarke, PPV, DAS-ELISA, IC RT-PCR

*ABSTRACT*

### Detection of PPV in NON-Prunus hosts by serological and molecular methods

In order to study the importance of non-*Prunus* species as a possible reservoir off PPV, 811 samples of species belonging to 73 genera were collected in the years 2000 - 2004 in several PPV infected peach orchards and one home garden with PPV infected plums and apricots. Until summer 2002 collected samples were tested only serologically (DAS-ELISA). 2 out of 7 samples of *Clematis* sp., 18 out of 97 samples of *Taraxacum officinale* and the only sample of *Cichorium* sp. gave positive results. From summer 2002 molecular testing (IC RT-PCR) was used for verification of serological results. Out of 403 samples analysed by DAS-ELISA 50 samples showed positive results and were checked for the presence of PPV by IC RT-PCR. Additionally 56 samples with suspicious DAS-ELISA readings were analysed with molecular technique. PPV was confirmed in only 3 samples: one DAS-ELISA positive sample of *Convolvulus arvensis*, one DAS-ELISA positive sample of *Solanum nigrum* and one suspicious sample of *Viola* sp. We conclude that the majority of DAS-ELISA positive results were false, probably due to the cross-reaction of plant substances with the viral

antiserum. To our knowledge *Convolvulus arvensis* and *Viola* sp. have not yet been reported as PPV hosts by other authors. After artificial inoculation Mazyad *et al.* (1992) confirmed a systemic infection with PVV in *Solanum nigrum*, but ours is the first finding of natural PPV infection of *Solanum nigrum*.

**Key words:** PPV, DAS-ELISA, IC RT-PCR



### ***Pseudomonas* ssp. na vzorcih z bolezenskimi znamenji ožiga**

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Patogene bakterije rodu *Pseudomonas* so v Sloveniji precej razširjene. Pri okuženih drevesih so sadeži slabše kvalitete, pridelek je manjši, hkrati so rastline bolj občutljive na druge povzročitelje bolezni. V letu 2003 smo bakterije iz rodu *Pseudomonas* izolirali tudi iz rastlin s posebej hudimi znamenji ožiga. Bolezenska znamenja povzročena z bakterijami iz rodu *Pseudomonas* in tista, ki jih povzroča okužba z bakterijo *Erwinia amylovora* je zelo težko razlikovati. Tako smo v letu 2003, v sklopu sistematičnega nadzora bakterijskega hruševega ožiga, ki ga koordinira Fitosanitarna uprava RS, testirali 441 vzorcev z bolj ali manj tipičnimi bolezenskimi znamenji hruševega ožiga. Med izolacijo bakterije *Erwinia amylovora* na gojiščih SNA in King B, smo pri 35 vzorcih (8%) opazili in izolirali kolonije morfološko podobne bakterijam iz rodu *Pseudomonas*. V letu 2004 smo patogene bakterije rodu *Pseudomonas* izolirali iz 29 od skupno 129 vzorcev (22,5%). Okužene gostiteljske rastline so bile jablana, hruška, kutina, ognjeni trn, panešplja, japonska kutina, vrtnica in fotinia. Za vse izolate smo izvedli LOPAT teste. Na podlagi preliminarnih testov smo z namenom zajeti čim večjo raznolikost gostiteljev in izolatov izvedli še dodatne teste, kot so profil maščobnih kislin, profil celotnih celičnih proteinov, test patogenosti na različnih gostiteljih ter biotest tvorbe toksinov. Od molekularnih tehnik smo izvedli 16S rDNA RFLP in tipizacija z rep-PCR. Preliminarni rezultati kažejo, da imajo vsi izolati s pozitivno hipersenzitivno reakcijo (HR) na tobaku drugačen 16S rDNA - *RsaI* restrikcijski profil od izolatov z negativno hipersenzitivno reakcijo. Opazili smo tudi veliko raznolikost HR pozitivnih izolatov (ki so glede na dosedanje rezultate najbolj verjetno patovarji *Pseudomonas syringae* ali *Pseudomonas syringae* pv. *syringae*) na testih patogenosti na različnih gostiteljih in tudi po molekularnem profilu, pridobljenem z rep-PCR. Bakterije rodu *Pseudomonas* so znani inhibitorji drugih bakterij, zato smo preverili njihovo sposobnost inhibicije rasti *Erwinia amylovora* na gojišču King B, ker bi to lahko oviralo določanje te bakterije. Sposobnost inhibicije smo potrdili pri 4 od 46 testiranih sevov.

**Ključne besede:** *Pseudomonas* ssp., *Erwinia amylovora*, 16S rDNA RFLP, rep-PCR

ABSTRACT

***Pseudomonas* spp. from samples with blight symptoms**

Plant pathogenic bacteria belonging to the genus *Pseudomonas* are very common in Slovenia. They reduce fruit quality and may lower yield. Trees infected by those pseudomonas pathogens are also more susceptible to other pathogens. In 2003 some *Pseudomonas* isolates were obtained that were apparently associated with more severe blight symptoms of apple shoots than are usually observed. *Pseudomonas* and *Erwinia amylovora* infections are difficult to distinguish. In 2003 a systematic survey of fire blight coordinated by the Phytosanitary Administration of the Republic of Slovenia was performed, where 441 samples showing more or less typical fire blight symptoms were tested. During *Erwinia amylovora* isolation on sucrose nutrient agar and King's B media *Pseudomonas*-like colonies were observed and isolated from 35 samples (8 %). In 2004 pathogenic bacteria from genus *Pseudomonas* were isolated from 29 (22,5%) out of 129 samples tested on *Erwinia amylovora*. Infected samples included apple and pear trees, quince, *Pyracantha*, *Cotoneaster*, Japanese Quince, rose and *Photinia*. Biochemical (LOPAT) tests were performed for all isolates. On the basis of preliminary tests isolates from different hosts plants were selected and further tested using fatty acids profile analysis, whole cell protein profiles, toxin production bioassay, pathogenicity tests on various hosts and molecular methods such as 16S rDNA RFLP and rep-PCR. Preliminary results of 16S rDNA RFLP show that isolates that produce hypersensitivity in tobacco (HR) display a *RsaI* restriction profile that is different to HR negative isolates. High diversity of the HR-positive strains (most likely pathovars of *Pseudomonas syringae* or *P. syringae* pv. *syringae*) was observed in pathogenicity tests and rep-PCR profiles. Because bacteria from genus *Pseudomonas* often show inhibitory effects on growth of other bacteria their possible influence on efficacy of *Erwinia amylovora* detection was checked. Marked inhibitory effects on *Erwinia amylovora* on King's B media were observed in 4 out of 46 tested isolates.

**Key words:** *Pseudomonas* ssp., *Erwinia amylovora*, 16S rDNA RFLP, rep-PCR



**Pomlajevalna rez trt prizadetih od ECSA bolezn**

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O pojavu ECSA bolezn trte na območju Vojvodine (okoliš Fruška Gora) so prvič poročali leta 2000. Ta uničujoča bolezen je razširjena tudi v drugih vinorodnih okoliših Srbije in povsod po svetu. Ugotovljeno je bilo, da sta glivi *Phaeoconiella chlamydospora* in *Phaeoacremonium aleophilum* pogosto naseljeni v tkivih trt, ki propadajo z znamenji ESCA bolezn. Glivi bi naj spadali v skupino primarnih povzročiteljev, ki omogočijo prodor in razvoj ostalih povzročiteljev bolezn, ki si sledijo v zaporednem nizu. Neposredno zatiranje

povzročiteljev bolezni je eden od najpomembnejših dejavnikov pri preprečevanju širjenja bolezni. Za zdaj ne poznamo metod zatiranja povzročiteljev, ki bi bile uporabne, ko so se ti že zajedli globoko v tkiva trte. Posledično je pomlajevalna rez, pri kateri izrežemo cone trte, ki kažejo značilna znamenja (razbarvane in trohneče zajede klinaste oblike), edina rešitev za ohranitev trt in njihove pridelovalne sposobnosti. Izvedli smo študijo, v kateri smo preučevali vpliv izrezovanja napadenih tkiv na obnovo okuženih trt. Na trtah, ki so v letu 2001 kazale znamenja okužbe smo pozimi leta 2002 opravili pomlajevalno rez, pri kateri smo popolnoma ali delno odstranili kordone ali debela z očitnimi znamenji. Naslednje leto so pomlajene trte pognale mladike iz preostalega starega lesa, ki smo jih uporabili za nov ogrodni in rodni les. V letih 2002 in 2003 smo nato opazovali pojav znamenj bolezni na pomlajenih trtah. Na njih so se znamenja na listih pojavila pri 18% trt, nenadna kap pa pri 14% trt. 17% poskusnih trt je bilo tako močno okuženih, da pomlajevanje ni bilo uspešno in so popolnoma propadle. Veliko pomlajenih trt, ki so po dveh letih kazale zgolj blažja znamenja, značilna za kronično obliko bolezni, je imelo normalno vegetativno rast in oblikovale so pridelek. Za oceno dolgoročnega učinka pomlajevalne rezi je potrebno še nadalje spremljati razvoj pomlajenih trt.

**Ključne besede:** vinska trta, ESCA, obrezovanje, zatiranje bolezni

#### *ABSTRACT*

#### **Effects of remedial surgery to esca - affected vines**

Esca was first reported to occur in northern Serbia, province Vojvodina, in viticultural area in Fruška Gora in the year 2000 also it is devastating disease in some other regions of Serbia and all over the world. It has been established that *Phaeomoniella chlamydospora* and *Phaeoacremonium aleophilum* are involved in the disease. These fungi acting in combination of forming a succession of microorganisms are believed to be prime causal agents of esca. The control of the pathogenic fungi associated with esca disease is one of the most important factors for vinegrowers. Currently there are no methods of eradicating the fungi once it become established. Consequently, remedial surgery is often used to renew infected vines by cutting out the infected tissue that in cross-section appears as a distinct wedge of discoloured tissue. A study were conducted to determine the effectiveness of remedial surgery and here we report the two year effect of the procedure After assessment of foliar symptoms in July 2001, cordons or and trunks partly or completely were removed from infected vines in the winter 2002 to remove rotted and discoloured wood. The following spring wather shoots initiated from the trunk. The appearance of or cordons were trained to replaced the conopy. Symptoms were observed in summer 2002 and 2003 The leaf alternation symptoms and sudden death of shoots were visible on 18 % of vines and 14 % respectively in 2002 and 2003. Further more, 17 % of vines contained infections that could not be removed, vines were completely dry. However, vines effected with esca managed by remedial surgery showed good growth, full grape production and lower symptoms (only chronic) after two years. Further data now required to determine longer term effectiveness of remedial surgery.

**Key word:** grapevine, ESCA, disease control, training system



## **Ontogenetski modeli kot orodje za odločanje v varstvu poljščin**

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Ontogenetski modeli služijo za simulacijo razvoja kmetijskih rastlin. V triletnem projektu je bila preučevana ustreznost razpoložljivih modelov (CERES, ONTO in AGROSIM, ki temeljijo na temperaturnih vsotah) za simulacijo poteka razvoja ozimne pšenice. Največja skladnost med dejanskimi in napovedanimi BBCH vrednostmi je bila ugotovljena pri modelu ONTO. Z namenom izboljšanja natančnosti simulacije, je bil z združitvijo modelov CERES in ONTO izdelan nov ontogenetski model SIMONTO. Model odraža vpliv temperature, fotoperiode in vernalizacije na razvoj posevka z množitvijo teh parametrov. Najboljši rezultati so bili ugotovljeni, če so bile rastline izpostavljene vernalizaciji med razvojnima stadijema BBCH 10 in BBCH 30. Uporaba modela SIMONTO je bila razširjena tudi na druge posevke, parametri modela pa so bili ocenjeni za ozimno rž, ozimni ječmen, ozimno tritikalo in ogrščico. Modeli SIMONTO so uporabni kot orodje pri načrtovanju ukrepov varstva in gnojenja in so del sistemov za podporo pri odločanju za varstvo žit in oljne ogrščice pred boleznimi in škodljivci.

**Ključne besede:** Ontogenetski modeli, SIMONTO, podpora pri odločanju, varstvo žit

*ABSTRACT*

### **Ontogenetic models as a tool in decision making in arable crop protection**

Ontogenetic models are employed to simulate the development of crops. In a three-years project available model approaches (CERES, ONTO, AGROSIM, temperature sum – based models) were tested for their ability to simulate the ontogenetic development of winter wheat crops characterised by the BBCH-code. Highest congruence of observed and predicted BBCH-values were obtained by ONTO. In order to improve the precision of the simulations new ontogenesis models (SIMONTO) were elaborated combining CERES and ONTO approaches. A SIMONTO-model reflecting the influence of temperature, photoperiod and vernalisation on the developmental rate of the crop by multiplying the three effectiveness rates and which vernalisation is effective during a period ranging from BBCH 10 to BBCH 30 gave best results. SIMONTO-approach was expanded to further crops and model parameters were estimated for winter rye, winter barley, winter triticale and winter oilseed rape. SIMONTO-models can be used as a steering tool for crop protection and fertilisation measures and are coupled to decision support systems for several pests and diseases of cereal crops and oilseed rape.

**Key words:** Ontogenetic models, SIMONTO, decision support systems, protection of cereal





## **Primerjava med konvencionalnim, integriranim in ekološkim gojenjem pora (*Allium porrum* L.)**

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Poleg konvencionalnega vrtnarstva novejša raziskava nakazuje tudi možnost gojenja vrtnin z alternativnimi načini, ki so do okolja prijaznejši, toda še vedno dajejo zadovoljive gospodarske rezultate. Cilj naše raziskave je bil primerjati vplive konvencionalnega, integriranega in ekološkega gojenja pora ter vpliv endomikorize na nekatere morfološke lastnosti in na pridelok pora. V letih 2003 in 2004 je bil poskus s porom v treh ponovitvah postavljen v Otočcu (Hrvaška). Uporabljena je bila split-plot poskusna zasnova. Preučevana sta bila dva dejavnika: način gojenja na treh ravneh (konvencionalni, ekološki in integrirani) in vpliv mikorize na dveh ravneh (sadike pora, inokulirane z endomikorizno glivo *Glomus mossae*, in sadike brez inokuluma). Prejšnja rastlina na parcelicah z ekološkim načinom gojenja je bil grahor (*Vicia sativa* L.), ki se je pokošen uporabil kot zastirka. Druge parcelice so bile prekrivane s črno-belo folijo. Pridelava je temeljila na priporočenih metodah za vsakega od načinov gojenja pora. V letu 2004 je bila statistično značilno najmanjša gostota rastlin dosežena pri integriranem gojenju (9,76 rastline m<sup>2</sup>; načrtovano 10,67 rastline m<sup>2</sup>). V istem letu so imele rastline v ekološki pridelavi daljše lažno steblo (za 36 oziroma 44 %) v primerjavi z integriranim oziroma konvencionalnim gojenjem. V obeh letih so rastline, gojene integrirano in konvencionalno dosegle od 17 do 34 % večji premer lažnega stebela od ekološko gojenih rastlin. Prav tako je bila v obeh letih teža rastlin v integrirani in konvencionalni pridelavi za 45 do 70 % večja od rastlin, ki so bile gojene ekološko. Zato je bil v obeh letih tudi tržni pridelok v integrirani in konvencionalni proizvodnji večji kot v ekološki, in sicer za 60 do 71 %. Endomikoriza ni vplivala na raziskovane lastnosti. Med dejavnikoma način gojenja in vpliv mikorize ni bilo do interakcije.

**Ključne besede:** konvencionalna pridelava, integrirana pridelava, ekološka pridelava, endomikoriza, por, *Allium porrum* L.

### *ABSTRACT*

#### **A comparison of conventional, integrated and organic leek (*Allium porrum* L.) management**

In spite of conventional horticulture of newer research point out possibility of growing vegetables also by the means of alternative ways, which are to environment kinder, but still give of satisfactory economic results. The goal of this research was to determinate the influence of endomycorrhiza on some morphological features and yield of leek. During 2003 and 2004 two-factor trial with three repetitions and split-plot design was set up in Otočac

(Croatia). Main factor "crop management" had three levels (conventional, integrated and organic) while the sub factor "mycorrhiza" had two levels (leek seedlings inoculated with endomycorrhizal fungus *Glomus momossae* and non-inoculated seedlings). On plots assigned for organic crop management, common vetch plants (*Vicia sativa* L.) grown on the plots, before the leek, were mowed down and used as mulch. Other plots were mulched with black polyethylene film. Cultivation measures were performed according to basic principles of conventional, integrated and organic crop management system. In 2004, lowest density of plants achieved at integrated management (9.76 plant m<sup>2</sup> planned 10.67 plant m<sup>2</sup>) was statistically significant. Plants in ecological cultivating had longer blanched stem in the same year (for 36 or 44%) in comparison with integrated and conventional crop management system. In both years, plants cultivated on integrated and conventional manner achieved between 17 and 34% larger diameter of blanched stem than plants from ecological management. Likewise in both years weight of plants in integrated and conventional production was between 45 and 70% higher from plants, that they were cultivated on ecological manner. Consecutive was in both years also market crop in integrated and conventional production higher as ecological production namely between 60 and 71%. No significant crop-management-by-endomycorrhiza interaction was indicated in the morphological features and yield of leek.

**Key words:** conventional crop management, integrated crop management organic crop management, endomycorrhiza, leek, *Allium porrum* L.



#### **Rezultati monitoringa ostankov fitofarmaceutskih sredstev v kmetijskih pridelkih v Sloveniji v letih 2003 in 2004**

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Na Kmetijskem inštitutu Slovenije v okviru nacionalnega monitoringa od leta 1999 spremljamo kontaminacijo kmetijskih pridelkov z ostanki fitofarmaceutskih sredstev. V okviru strokovnih nalog v kmetijstvu pa je ta dejavnost potekala že od leta 1987. Stalno spremljanje je zaradi intenzivne proizvodnje kmetijskih pridelkov in večje rabe kemijskih sredstev za varstvo rastlin nujno. Zbrani podatki so služili za ugotavljanje skladnosti z zakonsko predpisanimi najvišjimi dovoljenimi količinami ostankov (MRL), za ugotavljanje izvora oziroma vzroka onesnaženosti, za ugotavljanje skladnosti pridelave z dobro kmetijsko prakso, ter za oceno zdravstvene ogroženosti potrošnikov. Naša dejavnost je temeljila na smernicah in ciljih Zakona o fitofarmaceutskih sredstvih (Ur.l. RS št. 11/01), na Uredbi o monitoringu pesticidov v živilih in kmetijskih proizvodih (Ur.l. RS št. 13/99) in Pravilniku o ostankih pesticidov v oziroma na živilih in kmetijskih pridelkih (Ur.l. RS št. 73/03 in 84/04). Zaradi primerjave stanja obremenjenosti ljudi z ostanki pesticidov v Sloveniji s stanjem tovrstne obremenjenosti ljudi v evropski skupnosti prilagajamo naše delo usmeritvam, ki so podane v priporočilih EU (Commission recommendation 02/663/EC in 04/74/EC).

Vzorčenje so izvajali kmetijski inšpektorji in je potekalo naključno na pridelovalnih območjih Celja, Kopra, Kranja, Nove Gorice, Novega mesta, Murske Sobote, Maribora in Ljubljane. Vsebnost ostankov fitofarmaceutskih sredstev v vzorcih krompirja, solate in jabolk spremljamo vsako leto, medtem ko izbor ostalih kmetijskih proizvodov letno usklajujemo s smernicami EU. V letu 2003 smo iz kmetijskih pridelovalnih območij Slovenije pobrali vzorce krompirja (35), solate (24), jabolk (36), paprike (15), cvetače (10), pšenice (15) in grozdja (15). V letu 2004 pa smo pobrali vzorce krompirja (30), solate (28), jabolk (40), paradižnika (24), glavnatega zelja (15) in jagod (13). Vzorčenje je potekalo ob spravi kmetijskih proizvodov, po poteku karence za uporabljene pesticide ali v skladiščih. Vse vzorce smo analizirali na vsebnost izbranih aktivnih snovi. V letu 2003 smo v laboratoriju določali ostanke 51, v letu 2004 pa 57 različnih spojin s tremi različnimi metodami:

- multirezidualna metoda za določitev 49 spojin v letu 2003 in 55 spojin v letu 2004: organokloriranih, organofosfornih, piretroidov itd.,
- metoda za določitev skupine ditiokarbamatov: maneba, mankozeba, metirama, propineba, zineba
- metoda za določitev benzimidazolov: benomila in karbendazima ter tiabendazola.

**Ključne besede:** monitoring, obremenjenost prebivalcev, onesnaženje okolja, pesticidi, sredstva za varstvo rastlin

#### *ABSTRACT*

#### **The results of monitoring the pesticide residues found in agricultural products in Slovenia in the years 2003 and 2004**

Contamination of agricultural products with pesticide residues has been monitored in frame of the national monitoring at the Agricultural Institute of Slovenia since 1999. In the range of expert projects in agriculture this activity has been pursued since 1987. Permanent monitoring is essential due to the intensive production of agricultural products and more intensive use of chemicals. The collected data were used for the determination of harmony with legally prescribed maximum residue level (MRL), for the determination of source or cause of contamination, for the determination of production conformity with the good agricultural practice and for the evaluation of health risk of consumers. Our activity was based on the guidelines and goals of the Law on Plant Protection Products (Of.G. of RS No. 11/01), on the Decree on Monitoring of Pesticides in Foodstuffs and Agricultural Products (Of.G. RS No. 13/99) and on the Regulation on Pesticide Residues in or on Foodstuffs and Agricultural Products (Of.G. RS No. 73/03 and 84/04). Due to the comparison of human exposure to pesticide residues in Slovenia with that in the European Union we have adjusted our work to the guidelines given in the EU recommendations (Commission Recommendation 02/663/EC and 04/74/EC). Samples were taken by agricultural inspectors at random in the production areas of Celje, Koper, Kranj, Nova Gorica, Novo mesto, Murska Sobota, Maribor and Ljubljana. The content of pesticide residues in the samples of potato, lettuce and apples is monitored each year while the choice of other agricultural products is harmonised with the EU guidelines on an annual basis. In 2003 the samples of potato (35), lettuce (24), apples (36), pepper (15), cauliflower (10), wheat (15) and grapes (15) were taken in the agricultural

production areas of Slovenia. In 2004 we took the samples of potato (30), lettuce (28), apples (40), tomato (24), headed cabbage (15) and strawberries (13). Samples were taken at the harvest of agricultural products after the expired preharvest interval of pesticides used or in storages. All the samples were analysed for the content of chosen active substances.

In 2003, pesticide residues of 51 and in 2004 of 57 different compounds were determined in the laboratory using three different methods:

- multiresidual method for determination of 49 substances in 2003 and 55 substances in 2004: organochlorinated, organophosphate and pyrethroids etc.,
- method for determination of the group of dithiocarbamates: maneb, mankozeb, metiram, propineb, zineb and
- method for the determination of benzimidazoles: benomyl and carbendazim and thiabendazole.

**Key words:** environmental pollution, human exposure, monitoring, pesticides, plant protection products



### **Publikacije Urada za meteorologijo**

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Na Uradu za meteorologijo v okviru Agencije RS za okolje redno pripravljamo širok nabor informacij, ki jih ponujamo v različnih medijih, ki se po tehničnih značilnostih in ciljni publiki med seboj močno razlikujejo, zato jih tudi uporabljamo namensko in poskušamo čim bolj izkoristiti njihove prednosti ter se izogniti pomanjkljivostim.

V zadnjem obdobju daje vodstvo Agencije RS za okolje največji pomen informacijam, ki so dostopne na spletnih straneh ARSO. Spletne strani imajo številne prednosti, izpostavimo lahko njihovo ažurnost pri obnavljanju podatkov in obsežno ponudbo ter skoraj neomejeno možnost nadgrajevanja in razslojevanja informacij. Podatke na spletnih straneh lahko najhitreje prilagajamo izkazanemu interesu in potrebam uporabnikov. Vendar svetovni splet še zdaleč ni edini uporaben način širjenja meteoroloških informacij. Radio in televizija kot bolj tradicionalna medija še vedno ostajata zelo pomembna in učinkovita, vendar imata precejšnje omejitve. Teletekst še ohranja precejšnjo vlogo, čeprav ga izpodrivajo sodobnejši mediji. Pripravljamo tudi tiskano gradivo, ki je namenjeno predvsem naknadnim analizam in iskanju povezav med vremenom, podnebjem in rastlinami. Izpostavimo Mesečni bilten, ki ga redno pripravljamo že dvanajsto leto. Vsebuje podatke in primerjave z običajnimi razmerami s področja podnebja, vremena, agrometeorologije, hidrologije, kakovosti zraka in seizmologije. Prednost Mesečnega biltena je prav v celovitem naboru okoljskih podatkov, ki jih zbira Agencija RS za okolje. Bolj ozko specializiran je nabor podatkov in izvedenih količin v Meteorološkem letopisu, ki smo ga začeli pripravljati in izdajati takoj po osamosvojitvi. Podrobno so predstavljeni meteorološki in agrometeorološki podatki. Tematski zvezki iz niza »Klimatografija Slovenije« so celovit prikaz razmer na osnovi

podatkov, kart in opisa značilnosti posameznih elementov podnebja. Izdajamo tudi priložnostne publikacije, ki povzemajo rezultate projektov in so namenjene osveščanju javnosti ali pa vsebujejo konkretna priporočila uporabnikom. Nabor informacij bi radi še bolj približali potrebam in željam uporabnikov, saj se prava vrednost informacij pokaže šele ob njihovi uporabi.

**Ključne besede:** Urad za meteorologijo, publikacije, Mesečni bilten, Meteorološki letopis, Klimatografija Slovenije

*ABSTRACT*

#### **Publications issued by Meteorological Office**

On the regular base we prepare a whole set of information for end users. We are trying to make the best use of these media taking into account their peculiarities. During the last years the Environmental Agency gives the highest priority to internet. It has several advantages, like it is easy to be kept up to date and suitable for publishing on line data. Radio and TV being more traditional media remain important and efficient in spite of several limitations. Teletext keeps its role in information distribution, but other media more and more replaces it. Printed publications are used to publish data, analysis and research results on relationship between weather, climate and plants. The most important publication is Monthly bulletin, which has been regularly published during the last 11 years and we are looking forward to continue this tradition. The main advantage of the Monthly bulletin is its integral set of environmental information; in it one can find meteorological, agro-meteorological and hydrological data and data on air pollution, quality of surface waters and earthquakes for the month in question. It was in 1991 that we started to issue Meteorological Annals of Slovenia. It is divided into two parts; in the first, climatic characteristics and meteorological data are involved.

**Key words:** Meteorological Office, Publications, Monthly bulletin, Meteorological Annals of Slovenia



#### **Certificiranje – Del tehnične zakonodaje za naprave, ki nanašajo fitofarmacevtska sredstva**

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Certificiranje naprav za nanašanje fitofarmaceutskih sredstev je temeljno načelo poslovnega sodelovanja na reguliranem področju države, ki je urejeno z zakonom in posebnimi tehničnimi pravilniki. Certificiranje je dejanje, ki ga izvaja tretja stranka s katerim dokazuje, da zagotavlja primerno zaupanje, da natančno določen izdelek ustreza določenemu zakonskemu dokumentu.

SISTEN 45011 : 1992.

**Ključne besede:** Tehnična zakonodaja, certificiranje, stroji za nanašanje fitofarmaceutskih sredstev

#### **ABSTRACT**

The certification of machines used for the application of phytopharmaceutical products is a basic principle in the business cooperation in the regulated area of the state which is managed by laws and special technical regulations. Certification is carried out by the third party which thereby asserts that a defined product is in compliance with the requirements of the legal document. SISTEN 45011 : 1992.

**Key words:** Technical legislation, certification, machines for the application of phytopharmaceutical products.



#### **Analiza gospodarnosti gojenja in predelave dalmatinskega bolhača (*Chrysanthemum cinerariifolium* [Trevir.] Vis.)**

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Hrvaška je pradomovina dalmatinskega bolhača, obenem pa je bila do leta 1920 celo v svetovnem merilu z 2000 ha njiv med pomembnejšimi pridelovalci te rastline. S svojimi primerjalnimi prednostmi (neonesnaženim okoljem in pedoklimatskimi razmerami) ima v primerjavi z drugimi evropskimi državami veliko možnosti, da se uveljavi kot evropski center ekološkega kmetijstva in ekološkega turizma, kar je tudi strateški cilj hrvaškega gospodarstva. Ker je v ekološkem kmetijstvu uporaba sintetičnih insekticidov omejena, je uporaba naravnega piretrina, pridobljenega iz dalmatinskega bolhača, sredstvo, brez katerega bi si težko predstavljali varstvo rastlin pred škodljivci v taki proizvodnji. V raziskavo, ki je potekala v okolici Poreča (Hrvaška), so bili vključeni trije kloni dalmatinskega bolhača. Opravljene analize gojenja in predelave dalmatinskega bolhača so pokazale zadovoljive rezultate, kar zadeva proizvodne in ekonomske kazalce. Ugotovljeno je bilo, da je gojenje dalmatinskega bolhača gospodarsko upravičeno le ob strojnem spravilu pridelka (proizvodna cena za enega od klonov je višja od prodajne cene), medtem ko je proizvodnja povsem nedonosna ob ročnem spravilu (proizvodna cena je pri vseh treh klonih višja od prodajne cene). Zato je treba nadaljevati gojenje dalmatinskega bolhača v poljskih poskusih z namenom da bi izboljšali tehnično-tehnološke osnove v njegovi proizvodnji.

**Ključne besede:** dalmatinski bolhač, *Chrysanthemum cinerariifolium* (Trevir.) Vis., analiza gospodarnosti, gojenje, predelava

*ABSTRACT*

**Economic feasibility analysis on Dalmatian pyrethrum (*Chrysanthemum cinerariifolium* [Trevir.] Vis.) growing and processing**

Croatia is the homeland of Dalmatian pyrethrum, in the 20-ties of 20 century it had a production on 2000 hectares. With comparative merits (clear environment and favourable climatic conditions) comparing to other European countries, Croatia has a great possibility to be a centre of eco agriculture and eco tourism, what is also a strategic goal of Croatian economic policy. As ecological agriculture disapproves usage of chemically sintetisized means, the natural piretrin from pyrethrum could be necessary for pest treatment. On a location in Poreč, Croatia we examined three clones of pyrethrum. Production and processing was analysed. The results showed economically favourable effects. We noticed that production is feasible only with mechanised harvesting (because the production of one clone is more expensive than the rand some sum); while with manual harvest it costs more than the production of three clones. Therefore it is necessary to continue field research on Dalmatian pyrethrum in order to improve technical and technological base for production.

**Key words:** Dalmatian pyrethrum, *Chrysanthemum cinerariifolium* (Trevir.) Vis., economic analysis, growing, processing

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