IWGO

10 *International Working Group on Ostrinia and other maize pests*

DIABROTICA SUBGROUP MEETING

9th EPPO ad hoc Panel and FAO Network Group Meeting

14-16 January 2004 – Engelberg - Switzerland

SCIENTIFIC PROGRAMME
ABSTRACTS
AND
PARTICIPANTS

CABI *Bioscience*
A division of CAB *International*

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RAC CHANGINS

IWGO

International Working Group on Ostrinia and other maize pests

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IWGO

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INTERNATIONAL ORGANIZATION FOR BIOLOGICAL CONTROL
OF NOXIOUS ANIMALS AND PLANTS (IOBC)

Dr. André Gassmann
Secretary General of IOBC GLOBAL

14 January 2004

Dear Colleagues,

I would like to welcome you to the 10th Diabrotica *Subgroup Meeting of the International working Group of* Ostrinia *and other maize pests (IWGO) held at Engelberg. IWGO is one of ten global working groups of the International Organization of Biological Control (IOBC).*

IOBC was established in 1956 to promote the development of biological control and its application in integrated pest management programs, and international cooperation to these ends. IOBC collects, evaluates and disseminates information about biological control, and promotes national and international action concerning research, training of personnel, coordination of large-scale application and public awareness of the economic and social importance of biological control. IOBC also publishes a journal, BioControl, *for basic and applied research on biological control of invertebrate, vertebrate and weed pests, and plant diseases.*

I would like to thank the organizers of the 10th Diabrotica *Subgroup Meeting for compiling such an interesting scientific program on all the different aspects of the ecology and management of the western corn rootworm. This meeting will encourage and facilitate international collaboration as well as institutional partnerships with the aim to develop a sustainable and integrated management tool for* Diabrotica *control. It is becoming clear that one control measure will not solve this pest problem and therefore I would like to highlight the need to develop and combine biologically based control measures.*

I wish you a successful meeting and a pleasant stay in Engelberg, Switzerland.

Sincerely yours,

Dr. André Gassmann
CABI Bioscience Switzerland

SCIENTIFIC PROGRAMME

IWGO

International Working Group on Ostrinia and other maize pests

10 **DIABROTICA SUBGROUP MEETING**

9th EPPO ad hoc Panel and FAO Network Group Meeting

14-16 January 2004 – Engelberg – Switzerland

SCIENTIFIC PROGRAMME

Wednesday, 14 January 2004

16:00 ***Registration – Lobby Hotel Europe***

- ***Poster Installation***
- ***Provision of PowerPoint Oral Presentations on CD***

16:00 ***Welcome Coffee/Tea - Lobby Hotel Europe***

19:00 ***Welcome Reception - Lobby Hotel Europe***

19:30 ***Welcome Dinner - Ballroom Hotel Europe***

- ***Welcome Address: Ulli Kuhlmann and Mario Bertossa***

Thursday, 15 January 2004

08:00 ***Opening Address:***

- ***Harald Berger, IWGO-Convenor***
- ***C. Richard Edwards, IWGO Diabrotica Subgroup Convenor***
- ***Ann-Sophie Roy, EPPO***
- ***Jozsef Kiss, FAO Project***

08:20 ***Scientific Session: Monitoring (Part I)***

Chairman: C. Richard Edwards

08:20	SIVCEV, Ivan; STANKOVIC, Sladjan	Population level change of western corn rootworm in SERBIA
08:30	BACA, Franja *et al.*	Western corn rootworm beetles monitoring in REPUBLIC OF SRPSKA in 2003
08:40	EKE, Istvan; RIPKA, Geza; PRINCZINGER, Gabor	The present situation of western corn rootworm in HUNGARY
08:50	IGRC BARCIC, Jasminka; BAZOK, Renata	Current status and results of the monitoring of western corn rootworm in 2003 in CROATIA
09:00	CEAN, Mirela	Monitoring of *Diabrotica virgifera virgifera* LeConte in ROMANIA IN 2003
09:10	FESTIC, Husnija; KARIC, Nedzad	Monitoring of spreading western corn rootworm in BOSNIA and HERZEGOVINA 2003
09:20	IVANOVA, Ivanka	Monitoring of western corn rootworm in BULGARIA in 2003
09:30	FURLAN, Lorenzo *et al.*	*Diabrotica virgifera virgifera* in ITALY 2003: An overview
09:40	SIVICEK, Peter	Results of monitoring western corn rootworm, *Diabrotica virgifera virgifera* in SLOVAK REPUBLIC
09:50	DERRON, Jacques	Monitoring of *Diabrotica* in SWITZERLAND in 2003

10:00 ***Coffee/Tea Break***

10:30 *Scientific Session: Monitoring (Part II)*
Chairman: Ulli Kuhlmann

10:30	OMELYUTA, Victor; FILATOVA, Nataliya	The peculiarities of spread of western corn rootworm, *Diabrotica virgifera virgifera*, in UKRAINE
10:40	VAHALA, Otmar	Monitoring of the occurrence of *Diabrotica virgifera virgifera* LeConte in the CZECH REPUBLIC from 1999 to 2003
10:50	CATE, Peter C.	The 2003 monitoring programme for western corn rootworm (*Diabrotica virgifera virgifera*) in AUSTRIA
11:00	REYNAUD, Philippe	Monitoring of *Diabrotica virgifera virgifera* in FRANCE and first results of the eradication programme
11:10	CHEEK, Sharon *et al.*	First finding of western corn rootworm in the UK
11:20	BAUFELD, Peter	Monitoring of western corn rootworm in GERMANY 2003
11:30	COTA, Ejup	Monitoring of *Diabrotica virgifera virgifera* in ALBANIA 2003
11:40	TSITSIPIS, John A. *et al.*	Monitoring *Diabrotica virgifera virgifera* LeConte (Coleoptera: Chrysomelidae) by pheromone traps in GREECE
11:50	MERONI, Donata	Commission Decision 2003/766/EC: Emergency measures to prevent the spread of *Diabrotica* within the European Community

12:00 *Lunch Break*

13:00 *Scientific Session: Containment Strategies/Management Options*
Chairman: Sylvie Derridj

13:00	BERTOSSA, Mario	Effect of containment strategies against *Diabrotica virgifera virgifera* in Switzerland
13:20	FURLAN, Lorenzo *et al.*	*Diabrotica* eradication – containment in restricted promptly detected focus areas: Veneto study case
13:40	SPRINGER, Bernd	*Diabrotica* management in Europe – preliminary experience with Clothianidin (Poncho®), Bayer Crop Science's new neonicotinoid insecticidal seed treatment
14:00	TOLLEFSON, Jon J.; PARK Yong-Lak	Using spatial dispersion of corn rootworms to improve management efficiency
14:20	HUMMEL, Hans E. *et al.*	Towards biotechnical pest management of *Diabrotica virgifera virgifera* in Illinois, USA

14:40 *Coffee/Tea Break*

15:10 *Scientific Session: GM Maize*
Chairman: Franz Bigler

15:10	PERSHING, Jay; WARD, Dennis P.; DeGooyer, Todd A.; VAUGHN, Ty T.; HEAD, Graham P.	Genetically enhanced maize as a management option for corn rootworm: YieldGard® rootworm maize
15:30	ROMEIS, Jörg, DUTTON, Anna; BIGLER, Franz	Assessing the risks of *Bt*-transgenetic maize for non-target arthropods
15:50	RAPS, Andrea	Regulation of genetically modified crop plants in Switzerland – environmental aspects

16:10 *Scientific Session: Poster Presentation*

Chairmen: Stefan Toepfer and Ralf-Udo Ehlers

Poster 01	MOVCHAN, Oleksyy; KONSTANTINOVA, Nataliya; YAKOVETS, Petro; YAKOBCHUK, Vasyl; MAKOVETSKA, Olena	Monitoring of *Diabrotica virgifera virgifera* LeConte in the UKRAINE IN 2003
Poster 02	LAMMERS, Wiebe; MEIJER, Anneke; STIGTER, Henk	The first finding of the western corn rootworm in the NETHERLANDS
Poster 03	CATE, Peter C.	Present distribution of western corn rootworm (*Diabrotica virgifera virgifera*) in Austria
Poster 04	BORIANI, Marco; FURLAN, Lorenzo	A sustainable management of western corn rootworm in Lombardy: a methodological approach based on farming trials
Poster 05	IMGRABEN, Hansjörg; GLAS, Michael	Monitoring western corn rootworm in Baden-Württemberg (GERMANY) and measures after detection of *Diabrotica virgifera virgifera* near the Euro-Airport Basel-Mulhouse
Poster 06	UREK, Gregor	First report on western corn rootworm (*Diabrotica virgifera virgifera* LeConte) in SLOVENIA
Poster 07	MURESANU, Felicia	The pests from maize crops, the assessment of losses and the possibilities of their control (Transylvania-ROMANIA)
Poster 08	ESTER, Albert; GROTEN, Jos; STIGTER, Henk	Possibilities for control of *Diabrotica virgifera virgifera* in maize in the NETHERLANDS
Poster 09	OMELYUTA, Victor; FILATOVA, Natalia; ADAMCHUK, Olexander	Studies of the harmfulness of the western corn rootworm (*Diabrotica virgifera virgifera*) in UKRAINE
Poster 10	IVEZIC, Marija; TOLLEFSON, Jon J.; RASPUDIC, Emilija; BRMEZ, Mirjana,	Correlation between western corn rootworm damage and the development of secondary corn roots
Poster 11	FRAUSIN, Carlo; GOVERNATORI, Gianluca; MAZZEGA SBOVATA, Stefano	*Diabrotica virgifera virgifera* in the western part of the Friuli Venezia Giulia Region (North Eastern ITALY): first attempt of eradication – containment
Poster 12	TÖEPFER, Stefan; SZUCS, Marianna; LEVAY, Nora; KISS, Jozsef	Initial spread by introduced *Diabrotica virgifera virgifera* towards maize fields
Poster 13	DÖMÖTÖR, Istvan; SZÖCS, Gabor; KISS, Jozsef	IPM of corn at silking stage with special regard to western corn rootworm adults and to cotton bollworm larvae (*Helicoverpa armigera*) in HUNGARY
Poster 14	LEFKO, Steve; BINNING Rachel	Characterization of Cry34Ab1/Cry35Ab1: Evaluating fitness effects on corn rootworm larvae during exposure to roots
Poster 15	AHMAD, A.; WILDE, Gerald	No adverse effect of Coleopteran-specific cry3Bb1 toxin released from root exudates and biomass of transgenic corn on earthworms
Poster 16	SUSURLUK, I. Alper; EHLERS, Ralf-Udo	Persistence and seasonal population dynamics of entomopathogenic nematodes *Heterohabditis bacteriophora* and *Steinernema feltiae*
Poster 17	AHRENDS, Brian; HECK, Werner; HOLMES, Keith ROMEIJN, Andreas; WILHELM, Ronald	REGENT® – a successful Fipronil product for *Diabrotica* spp. control

Poster18	GERHARD, Ralf; KLEMM, Matthias; MAURAS, Rene; TARANTA, Claude; WILHELM, Ronald	Fipronil soil baits - a novel application to control wireworms (*Agriotes* spp.)
Poster 19	BACA, Franja; KAITOVIC, Zeljko; PREDRAG, Jovin; MLADEN, Miric	Damages caused to maize by larvae of western corn rootworm in 2000 following soya bean sowing in 1999 and maize sowing in 1998
Poster 20	BACA, Franja; PLANCAK, V. Jan; TANCIK, V. Jan; TOTH, Miklos	Attractiveness of sweet maize hybrids to western corn rootworm, *Diabrotica virgifera virgifera* LeConte, beetles in the late and stubble crop sowing in 2003
Poster 21	GROZEA, Ioana; LAUER, Karl F.	Development of *Diabrotica virgifera virgifera* Le Conte species in western plain conditions from ROMANIA
Poster 22	SHAW, J.T.; HUMMEL, Hans E.; AREE, G.; METCALF, R.L.†; LAMPMAN, R.L.	Comparing relative trapping efficacy of several *Diabrotica* rootworm beetle trap types in Illinois, USA
Poster 23	TOEPFER, Stefan; KUHLMANN, Ulrich	Natural mortality factors acting on western corn rootworm populations
Poster 24	KERESI, Tatjana; BACA, Franja *et al.*	Capturing of western corn rootworm adults via Ukrainian and PHEROCON® AM sticky traps in Novi Sad and Belgrade in 2003
Poster 25	MELNIK, Pavel; SYKALO, Oksana; BACA, Franja; MOVCHAN, Alexey	Some biological and biochemical aspects of imago *Diabrotica virgifera virgifera* LeConte

17:30 *End of Scientific Sessions*

19:30 *Farewell Dinner - Ballroom Hotel Europe*

Friday, 16 January 2004

08:00 *Scientific Session: Basic Ecology*
Chairman: Jasminka Igrc Barcic

8:00	EDWARDS, C. Richard; GERBER Corey K., RADAVIC Ann; BLEDSOE Larry W.	The impact of area-wide pest management on carabids in Indiana/Illinois, USA
8:20	EHLERS, Ralf-Udo; GUELDENZOPH, C.; TOEPFER, Stefan; BURGER, Regina KUHLMANN, Ulrich	Using augmentative biological control against an invasive maize pest in Europe: testing susceptibility of *Diabrotica* to entomophagous nematodes
8:40	DERRIDJ, Sylvie; ARNAULD, Ingrid; COUZI, Philippe; MULLER, Franck	Evaluation of potential efficiency of maize rotation with other crops against *Diabrotica* oviposition based on plant surface metabolite analyses.
9:00	MOESER, Joachim; HIBBARD, Bruce; VIDAL, Stefan	Nutritional ecology of *Diabrotica virgifera virgifera* LeConte in Europe
9:20	TURLINGS, Ted; RASMANN, Sergio	Below-ground herbivory affects above-ground tritrophic interactions
9:40	RASMANN, Sergio; TURLINGS, Ted	New tools to study below ground tritrophic interactions - the example of *Diabrotica virgifera virgifera* (LeConte)

10:00 *Coffee/Tea Break*

Friday, 16 January 2004

10:30 *Scientific Session: Free Themes*
Chairman: Mario Bertossa

10:30	TOTH, Miklos; UJVARY,Istvan; IMREI, Zoltan; VÖRÖS, Géza	Discovery of an inhibitor of response to pheromone in western corn rootworm and study of possible interactions between the pheromonal and kairomonal communication channels
10:50	ELLSBURY, Michael M.	Supercooling capacity and chilling mortality in corn rootworm eggs
11:10	FRENCH, B. Wade	Spatial distribution of *Diabrotica* in the South Dakota areawide management site
11:30	BAUFELD, Peter; ENZIAN Siegfried	Transboundary spreading scenarios of western corn rootworm for France, Switzerland, and Germany under the new situation
11:50	TOEPFER, Stefan; ELLSBURY, Mike; KUHLMANN, Ulrich	Geostatistical analyses of distributions of *Diabrotica v. virgifera* within maize fields in Central Europe
12:10	VOS, Janny	IPM knowledge transfer – current developments and needs in farmer training for IPM implementation

12:30 *Lunch Break*

13:30 *Scientific Session: Farmer Participatory Training*
Chairman: Harald Berger

13:30	KISS, Jozsef	Integrated Pest Management for western corn rootworm in Central and Eastern Europe: FAO GTFS/RER/017/ITA Project
13:50	BAZOK, Renata; IGRC BARCIC, Jasminka	Principles and experiences of the farmer field school approach in CROATIA
14:05	KOMAROMI, Judit; KISS, Jozsef	Participatory training with farmers for IPM of western corn rootworm in HUNGARY: training methods and outputs
14:20	KARIC, Nedzad; FESTIC, Husnija; MAJDANCIC, Meho	Organization of farmers field school in BOSNIA and HERZEGOVINA
14:35	STANKOVIC, Sladjan; SIVCEV, Ivan	IPM for western corn rootworm participatory training through farmer field school in SERBIA
14:50	PETRACHE, Tomel; ROSCA, Ioan	Evolution of western corn rootworm in 2003, especially in Timis county: role of farmers in pest monitoring during FFS activity in ROMANIA
15:05	KOKORANOVA, Krassimira; PIRONKOVA, Neli; IVANOVA, Ivanka	Farmer training in BULGARIA

15:20 *Final Discussion*
Chairman: C. Richard Edwards

15:45 *Coffee/Tea Break*

16.30 *End of Meeting*

ABSTRACTS

Thursday, 15 January, 8:20h; SIVCEV & STANKOVIC

Population level changes of western corn rootworm in SERBIA

Ivan SIVCEV[1] & Sladjan STANKOVIC[2]

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Population density of *Diabrotica virgifera virgifera* dramatically fluctuates since 1992 when it was discovered in localised outbreak area. At the beginning population was growing and spreading causing each year more and more damages. It was not linear increase since it is mainly dependent on number of cornfields in repeated sowing. Before *Diabrotica virgifera virgifera* was introduced it was estimated that there were under continuous corn around 30-40% of total corn production. Besides that, adverse climatic conditions during winter wheat sowing in some years directly influenced increase in continuous cornfields. Severe damages were the results of such significant population increase. Having damages from WCR on corn during several consecutive years farmers started to rotate corn with other crops. The most significant damages were registered during the period 1998- 2000. After that corn rotation was used by majority of the farmers who experienced damages from *Diabrotica virgifera virgifera* and learned how to control it. Besides that, year 2000 was exceptionally warm and dry, which resulted with probably more important population reduction over large space in Serbia. It is evident that in year 2001 and 2002 there were only sporadic damages in small corn producing areas in the north and south of Serbia. Also, it was registered that after population breakdown in year 2000 it is recovering but slowly.

In the year 2003 population recovering is registered as well as small increase of damaged fields. Areas with economic population are registered over much larger space comparing to previous year. In 2003 there were around 3.000 ha of reported damaged cornfields with damages, which can be characterised as low, ranging up to 30% lower yield.

Monitoring of WCR spreading showed that in 2003 there were no further spreading on the south. Out of 30 counties in Serbia only one (area around city Vranje) is still considered as uninfested. Minor spreading was registered in the southwest of Serbia.

Thursday, 15 January, 8:30h; BACA et al.

Monitoring of western corn rootworm beetles in REPUBLIC OF SRPSKA in 2003

Franja BACA[1], Jovo STOJCIC[2], Vojislav TRKULJA[2], Slavko RADANOVIC[3], Dragisa LOPANDIC[1], Dragica ZIVANOVIC[3] & Dragisa MARKOVIC[4]

[1]MRI, Zemun Polje, 11185 Belgrade-Zemun, Serbia and Montenegro, fbaca@mrizp.co.yu; [2]Institute of Agriculture, Banja Luka; [3]Agricultural Station, Bijeljina; [4]Agricultural Station, Doboj, Republic of Srpska

Western corn rootworm (WCR) imagoes monitoring in Republic of Srpska (RS) has been performed within a monitoring procedure of a new maize pest occurrence and distribution in this region since 1998. The arrangement of traps has been changed over years in a way that the number of locations has been decreasing in the eastern parts, while it has been increasing in the western parts of the region.

In 2003, similar to the preceding year, WCR beetles monitoring was carried out by the application of the Hungarian pheromone traps of a Csalomon make placed in 49 locations distributed in 24 municipalities. The entire territory to the west border with Croatia was covered. Flight monitoring, depending on a location, was performed for 45, 63 and 80 days. In the majority of locations, monitoring was performed from mid June to mid September - 80, 45 and 63 days in eastern, central and western parts of the region, respectively.

Larger plots under maize were selected for trap distributions. The trap replacement was, as a rule, done four weeks after the beginning of monitoring, while counting and removal of trapped beetles were done once a week, or once in two weeks. Obtained data were systematised according to 50-km territory areas. Summarised numbers of trapped beetles were compared with corresponding data of previous years. In order to interpret results, data on the precipitation sum and distribution, mean daily and maximum air temperatures in Bijeljina, Doboj and Banja Luka were taken into account.

According to the east-west territorial division, 241.7 beetles, on the average, were trapped in the first 50 km away from the Serbian border in 11 locations distributed in the municipalities Bijeljina, Br□ko, Lopare, Ugljevik and Zvornik. It is interesting to mention that the same level of the population (241.8) was recorded in the second 50 km, in five locations of the municipalities Modri□a, Pelagi□evo and Šamac. In the further 50 km (100 to 150 km towards west), 192.1 beetles were registered on the average in eight locations of the municipalities Doboj, Srpski Brod and Tesli□. The high numbers of WCR beetles were registered in all 24 locations in each of the stated municipalities. In the territory beyond 150 km towards west, three-fold higher presence of WCR beetles than in 2002 was registered in 22 to 25 locations.

The abundance index (AI) in 2003 in relation to the abundance registered in 2002 was as follows:

- in the first 50 km, (241.7 : 377.1), AI = 64.1
- in the second 50 km (50-100 km), (241.8 : 168.0), AI = 143.9
- in the third 50 km (100-150 km), (192.1 : 107.1), AI = 179.4, and
- beyond 150 km (26.4 : 8.8), AI = 300.0.

The reduction in the number of trapped WCR beetles in the first 50 km can be related to the lowest precipitation sum in relation to further western regions (Doboj and Banja Luku), and to extremely high temperatures due to which traps were less efficient. The increase in the second 50 km and further was quite excepted as maize was grown there on greater areas.

Thursday, 15 January, 8:40h; EKE et al.

The present situation of western corn rootworm in HUNGARY

István EKE[1], Géza RIPKA[2] & Gábor PRINCZINGER[1]

[1]Ministry of Agriculture and Rural Development, H-1860 Budapest, Pf. 1, ekei@posta.fvm.hu, princzingerg@posta.fvm.hu; [2]Central Service for Plant Protection and Soil Conservation, H-1519 Budapest Pf. 340, ripka.geza@ntksz.ontsz.hu

In the past few years Western corn rootworm (WCR) (*Diabrotica virgifera virgifera* LeConte, 1868), originating from North America has spectacularly quickly spread in various countries of the European Union. This species has become a major pest of maize also in Europe. In 2003, it caused considerable economic looses by crop lodging in large areas of Hungary. Similarly to the previous years, trapping of the beetle was carried out by the entomologists, forecasting specialists and plant protection inspectors of the plant protection and soil conservation county services. Traps were placed in the fields for two kinds of purposes:

1. Scout trapping. Based on the data of 2002 on the survey for detecting the pest, in 2003 this kind of trapping continued by using sex-pheromone traps at 12 locations of 5 counties where the beetle has not been recorded.
2. Permanent trapping (monitoring) (FAO Standard). In addition to the previous observations, we estimated the populations of the pests in 20 infested fields of 19 counties with Csalomon® sex-pheromone traps and Pherocon® AM yellow sticky traps. The traps were operated from 13 June to harvesting (October), with checking of the catches at 10-day intervals and changing the traps every 30 days.

Assessment of larval damage. From 1997, in every June, thus also in 2003, we assessed larval damage especially in maize grown in monoculture. We determined the severity of the injuries – in 53594 hectares of the 14 counties with the longest history of WCR infestation, on about 5% of all the maize fields – using Hills-Peters's scale on root damage.

We observed the first larvae on 27 May in the southern and central counties of Hungary. Calculating the effective degree-days, we expected hatching of larvae from 12 May. In 2003 flight of the beetles started on 16 June. Seasonal flight of the pest was very intensive in late June – the first part of July. In August a second, lower flight peak was observed. The average beetle catches of both types of traps exceeded previous year's data.

During the representative survey for root damage conducted in 14 counties of the country in 2003, root injuries were recorded in 10922 hectares (20.4 %) of 12 counties. In 5955 hectares (11.1 %), damages reached scale 3 indicated as the economic threshold for root injury. Throughout the country the area affected by larvae was estimated to 105500 hectares, out of which lodging of plants was observed in about 35360 hectares.

Data on the survey for root damage by western corn rootworm in 2000-2003

Year	Nr. of surveyed fields	Surveyed area (ha)	Area infested by WCR larvae (ha)
2000	969	41357	3103
2001	955	44895	10311
2002	919	40621	7488
2003	**1145**	**53594**	**10922***

Growers carried out treatments on several thousands of hectares by soil disinfestations together with sowing, or by in-crop aerial application of insecticides to control the beetles.

Thursday, 15 January, 8:50h; IGRC BARČIĆ & BAŽOK

Current status and results of the monitoring of western corn rootworm in 2003 in CROATIA

Jasminka IGRC BARČIĆ & Renata BAŽOK

Department for Agricultural Zoology, Faculty of Agriculture, Svetošimunksa 25, 10000 Zagreb, Croatia, igrc@agr.hr

A progressive increase of adult population abundance was registered during seven-year monitoring of the occurrence, spreading and population density of the western corn rootworm in Croatia. For years the pest has been spreading on main corn growing area without any visible damage and farmers did not take the WCR a serious pest. The first economic damage caused by WCR occurred in 2002 in region of Baranja. In 2002, big yield reductions were observed only in fields with very heavy larval damages. Rainfalls occurred very often through July and August. Root regeneration was very intensive what diminished yield reduction. Yield loss on one field in Baranja according to the information of the farmer was 85%. In spite of the high attack of the WCR in 2002, the damages were not very visible in numerous fields. Favorable climatic conditions diminished yield loss caused by WCR, but the population level was increased.

In 2003, monitoring of the WCR had 3 main tasks: to establish the further spread of the pest; to establish increase in population density and to establish economic population area and the average yield losses due the WCR larval attack.

In 2003 *Diabrotica virgifera virgifera* LeConte was monitored following a common protocol. Monitoring of the WCR was conducted on 121 monitoring sites. On each site 1 pheromone and 1 Pherocon AM trap were place at least 50 m apart. Traps were placed in the field between June 10th and 17th. Each 7 days traps were checked and beetles collected.

Significant spread of the pest in 2003 was recorded. The new line of the spreading of the pest is on the line Hodošan- Prelog- Donja Dubrava- Donja Stubica- Otok Svibovski- Hrašće- Mala Gorica- Dvor na Uni. WCR has infested an area of about 23.500 km^2. In that area approximately 80 % of all Croatian corn production is conducted.

Alltogether in monitoring action 31760 beetles were caught. Main ratio of beetles was caught on pheromone traps (93,4 %) while only 6,6 % of all beetles were caught on Pherocon AM traps. An increase in population density is occurred. Population growth index for the 2003 is 4, if it was calculated based on the data from all monitoring sites in all previously infested counties. The data from permanent monitoring sites show somewhat lower population growth index, 3.

In 2003, on the 5 fields with visible symptoms of the attack of the WCR larvae, in order to evaluate the damages, root damage rating and plant lodging were conducted. Yield loss by yield weighting was predicted. The average root damage rate on all observed fields was over the economic threshold level. The percentage of the lodged plants was between 26,3 and 91,1%. Yield loss on the lodged plants was between 12,9 and 49,4 %. Extreme drought climatic conditions in 2003 caused very weak germination of corn. Low plant population together with unfavorable climatic conditions in 2003 caused an average yield loss of 30 % on all cornfields in corn production area. Yield loss caused by larval damage on observed fields was between 4,8 and 45%. This yield loss should be added to the previously mentioned yield reduction. Some yield reduction was caused by silk clipping and during harvesting also. Correlation between root damage rate and yield loss in extreme climatic conditions is not so obvious as in regular climatic conditions.

Damages caused by WCR larvae were recorded on the fields located in the Osječko- Baranjska, Vukovarsko- Srijemska, Požeško- Slavonska and Virovitičko- Podravska counties. This is an area of 12.500 km^2. All damages were recorded on continuous cornfields, what stress again the importance of the crop rotation in future corn production. Economic population area from year to year is increasing and probability for the damages in continuous cornfields on larger area is growing.

Thursday, 15 January, 9:00h; CEAN

Monitoring of *Diabrotica virgifera virgifera* LeConte in ROMANIA in 2003

Mirela CEAN

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Monitoring of WCR (*Diabrotica virgifera virgifera* Le Conte) was carried out by the Ministry of Agriculture, Waters, Forests and Environment, through the Central Laboratory for Phytosanitary Quarantine, the County Phytosanitary Units and Border Inspections Points. The observations were done from the beginning of June to mid-September and were carried out in 25 counties (15 infested counties and 10 non infested counties including 3 airports areas:Bucuresti, Constanta, Suceava)

In the year 2003 Romanian and Hungarian pheromone traps and Pherocon® AM yellow sticky traps have been used. The traps were placed in 193 sites, 148 sites were located in infested counties and 45 within non-infested counties. On each site 1 pheromone and 1 Pherocon® AM trap were placed 50m apart. The pheromone traps were changed every 30 days and yellow sticky traps every 15 days.

Diabrotica virgifera virgifera was caught in 15 out of 25 counties. In one infested county (Gorj-first report in 2000) western corn rootworm was not caught in any trap throughout 2003. Economic damages were registered sporadically in county Arad ("small farmers") and Timis.

Comparing the population density from last year it is obvious that in 2003 population increased in the infested areas: total number of captures was 71206 (368,9 beetles/installed trap), while in 2002 total number of captures was 14959 (138,5 beetles/installed traps).

Thursday, 15 January, 9:10h; FESTIC & KARIC

Monitoring of spreading western corn rootworm in BOSNIA and HERZEGOVINA 2003

Husnija FESTIC & Nedzad KARIC

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Our work in Project - Monitoring of Western Corn Rootworm during 2003 is done on the similar way as during previous years. We established 60 monitoring locations: 30 permanent and 30 new locations during 2003. We established new monitoring locations on WCR spreading frontiers from last year. In the beginning we controlled traps every second day but later it is done once per week. Permanent monitoring locations we established again on locations with bigger cornfields with goal to check WCR population density. We used sticky yellow traps at permanent locations and pheromone traps at new locations.

Monitoring done this year showed that WCR spread mainly along rivers and roads –the same as previous years. It is interesting to mention that we noted WCR near the Sarajevo Airport, which is 80 km far away of the nearest location where we noted WCR last year.

It is known that we noted WCR in B&H first time 1997 but there are still no registered corns laying or damages on corn roots. It is probably result of low WCR population density, which is caused by changeable weather condition during last, different soil types and small areas under corn. There are 240000 ha under corn in Eastern and Northern part of B&H. It is mainly about private land and about location, which are quit far away each from other. It could also be reason for low WCR population density.

We are going to do WCR monitoring in future. Also we are going to check reasons for faster or slower pest spreading, for bigger or smaller growth of WCR population density.

The work was conducted under the FAO Project GTFS/RER/017/ITA

Thursday, 15 January, 9:20h; IVANOVA

Monitoring of western corn rootworms in BULGARIA in 2003

Ivanka IVANOVA

Central Laboratory for Plant Quarantine, Sofia 1330, 120, Blvd. N. Mouchanov

The WCR was found in Bulgaria in 1998. A monitoring of WCR has been performed every year ever since. Thanks to the monitoring we can report on the pervasion of the pest and its population dynamics', and it also helps for the preparation of proposals for measures aiming to prevent the damages caused by the pest.

Methods: Soil excavations were initiated late in May and continued in June. Areas in the regions of Vidin and Montana, where high density of the pest was monitored in 2002, were covered. The larvae not found. However, in August and September we have discovered the specific "goose neck" wrench of the stalks in maize areas in the regions of Bregovo, Gramada, Dolna Biala Rechka and Prevala. During the current year the monitoring started at the beginning of June. According to the FAO project for the countries from Central and Eastern Europe, the pheromone and pherocon traps for performing the monitoring, were delivered free of charge. They were allocated and placed in the regions of Vidin, Vratza, Montana, Pleven and Sofia. The total number was 65 and 8 of them were under permanent monitoring. The distances between pheromone and pherocon traps were from 50 to 1000 meters, depending on the region. The traps were checked every 7-10 days and in some places even every 20 days.

Results:

1. The pest is slowly spreading to the east and south. In the region of Peven it was found not only in Knezha but also in Dolni Lukovit, Iskar, Brenitza, Lazarovo.
2. In 2003 it was found for the first time in the region of Dragoman.
3. This year we monitored the specific wrench of the stalks known as "goose neck", which is caused by the WCR larvae.
4. We have found damages on the roots caused by the pest's larvae in the regions of Bregovo, Gramada, Dolna Biala Rechka and Prevala for the first time.
5. No economic losses of the crops were found.
6. The total number of trapped adults in 2003 is 4,770. Their allocation per region is as follows: Vidin – 1,587, Montana – 2,906, Vratza – 82, Pleven – 28, Sofia – 167. The largest number of trapped adults in is Dolna Biala Rechka – 1,735 followed by Prevala – 972, Gramada – 651, Dolni Lom – 448. 4,707 of them were trapped with the pheromone traps and 63 with the pherocon traps.
7. The climatic conditions have significant influence on the pervasion of the pest. During the last years we could see very high temperatures in July and August and just a little bit of rainfalls. These conditions are unfavourable for the maize growth (the vegetation is very limited even in July, the plants are low, the leaves turn yellow). The pest can't be found in the plains and semi-mountainous areas in the regions of Vidin, Montana and Vratza as well as in non-irrigation areas. However, adults can be found in the irrigation areas (Gramada) or in areas with large amount of subsoil waters (Rakitnitza). For example, if we compare Bregovo and Rakitnitza, which have only a few kilometers distance between them, we will see that in Rakitnitza, where the level of subsoil waters in higher, the maize developing better and the number of trapped adults is higher (75 - 100).
8. Population levels – In the maize, which was grown in Dolna Biala Rechka in two consecutive years without rotation, we have established a level of 36 male adults /per pheromone trap/ per day during the population peak.

Diabrotica virgifera virgifera LeConte in Italy in 2003: an overview

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In 2003 monitoring continued using a common protocol. In areas where WCR had not been detected yet sex pheromone traps (mainly PAL) were placed out almost exclusively in monoculture fields at increasing distances from already infested areas or in potential introduction areas. In infested areas some Pherocon AM yellow sticky traps were placed, in addition to the sex pheromone traps, almost exclusively in monoculture maize fields, with the exception of the focus areas where maize monoculture is prohibited. The following quantities of sex pheromone traps have been placed out: more than 270 in Friuli Venezia Giulia, 1488 in Veneto, 212 in Emilia Romagna, more than 350 in Lombardia, 520 in Piemonte, 74 in Trentino, 20 in Campania, 9 in Lazio.

PRESENCE: restricted focus areas where a containment-eradication program based on prohibition of maize monocolture and treatments against the adults was being implemented: in *Veneto* only 4 specimens were captured in the focus area and 4 in the close safe area; in *Pordenone* (Friuli) 3 beetles were captured in the focus areas and 19 in the close safe area; in both cases captures records stopped just after treatments against adults and the size of focus areas had a very limited increase. Largely infested areas: *Lombardia*: in the area where an economic population was detected in 2002 (totally about 5,000 ha of cultivated land) maize planting was allowed only after the 15 June; this resulted in a dramatic reduction of maize fields. No specific prohibitions of maize monoculture and obligations of treatments against the adults were implemented in the other zones. Beetles were found also in the only not infested province in 2002, Mantova, so that currently all the cultivated land may be considered virtually infested with the exception of a restricted area along the boundary with Veneto. *Piemonte*: no containment strategies based on prohibition of maize monoculture and treatments against the adults were implemented. Infested cultivated area increased by about 65,000 ha (totally about 385,000 ha). All the provinces but Asti are at least partially infested. Other regions: the very first specimens were captured in *Emilia Romagna* in the areas of Parma and Piacenza provinces close to the border with Lombardia, in *Trentino*, in a small Valley -Chiese- (about 270 ha of cultivated land) bordering the northern part of Lombardia region, in the provinces of *Udine* and *Gorizia* (north eastern Italy, close to Slovenia). Most of the newly infested fields and those surrounding were treated with insecticide to control the adults within a few days after captures had been noted. *Campania* and *Lazio* no beetles were captured.

POPULATION LEVELS: negligible peaks of male captures were recorded in *Veneto, Friuli Venezia Giulia, Emilia Romagna, Trentino*. In a very restricted area of *Udine* province (Buttrio municipality) at population peak about 75 WCR males/ PAL trap/day and 6 beetles/sticky trap/day were recorded from monoculture maize fields. Negligible captures of beetles were recorded in all the area around. *Lombardia*: due to the measures described above no economic populations (visible lodging and heavy feeding damage on leaf tissues and ears) were observed neither in the area of some dozens of hectares in Como Province seriously damaged in 2002 nor in the surrounding cultivated areas. In the Provinces of Como,Varese and Milano just around the area with planting restrictions levels up to at least 200 WCR males/ PAL trap/day and over 10 beetles/sticky trap/day were recorded while low captures were found in the rest of the region. *Piemonte*: conspicuous populations were detected only in the area where the species had already been detected in 2001. On Pal traps the maximum peak population was over 90 males/trap/day. Negligible captures were recorded on the sticky traps.

Thursday, 15 January, 9:40h; SIVIČEK

Results of monitoring western corn rootworm *Diabrotica virgifera virgifera* in the SLOVAK REPUBLIC

Peter SIVIČEK

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The first occurrence of the WCR in Slovakia took place in 2000. In 2003 we had continued to survey the infestation of the Slovak Republic by *Diabrotica virgifera virgifera* LeConte. We also had made field training for corn growers from infested areas. Both activities had been carried out within the FAO projects. The survey had been carried out by phytosanitary inspectors of the Central Control and Testing Institute of Agriculture and other external observers within the framework FAO project – WCR Network activities. Some data on population density of pest have been obtained from FAO project focused on field farmers training.

We used pheromone traps Csalomon and yellow traps Pherocon AM for survey. The monitoring points have been set as in infested as in endangered corn belts. The pheromone and yellow traps had been set together in infested areas. The pheromone traps only had been set in endangered corn belts. We added a next pheromone traps at need into new endangered areas a later. The monitoring adults of WCR started in half June. We caught adults in new localities in east part of Slovakia but also in districts Piešťany, Hlohovec, Topoľčany, Nové Mesto Nad Váhom and Trenčín.

FAO Project: GTFS/RER/017/ITA

Thursday, 15 January, 9:50h; DERRON

Monitoring of *Diabrotica* in SWITZERLAND in 2003

Jacques DERRON

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In Switzerland the monitoring for the Western Corn Rootworm started in 1999 in the surroundings of the three airports of Geneva, Zurich and Lugano. In 2000 we registered the first 4 beetles in our pheromone traps (Csalomon® PAL) near Lugano, south of the Alps. From 2001 up to 2003 the monitoring network was gradually extended in the south and the north of the Alps, in all the areas where maize is cultivated. Most of the traps were placed in maize fields located around the airports and along the main roads and railways. In the south of the Alps the number of captures has increased continuously since 2000.

In 2003 the first captures were recorded north of the Alps. The first catch (15.07) occurred in a maize field close to the northern exit of the tunnel of Gotthard. Then we caught 3 males along the same motorway farther to the north, near Lucerne (14.08 and 19.08) and 3 other beetles near Basel in a quite isolated field located at approximately 20 km to the south of the Euroairport in Alsace on 28.07, 4.08, 12.08. We finally had one more capture on 15.08 in a maize field close to the tracks of the airport of Zurich.

Five to ten traps were added in the four sites within five days after the first catch. Only one beetle was caught in the supplementary traps.

In 2004 it will be forbidden to grow maize after maize in a radius of ten kilometres around the sites where *Diabrotica* was detected in 2003 and the monitoring network will be substantially strengthened in the north of the Alps.

Thursday, 15 January, 10:30h; OMELYUTA & FILATOVA

The peculiarities of spread of western corn rootworm (*Diabrotica virgifera virgifera*) in UKRAINE

Victor OMELYUTA & Nataliya FILATOVA

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The Western corn rootworm (WCR) was registered officially in Ukraine in 2001 after catching the first beetles into the pheromone traps in the Vinogradovsky and Beregovsky districts of the Transcarpathian Region. Distribution of the pest in the world goes passively by means of transportations and active flight form one place to another. It appeared in Europe form the USA with the help of aviation.

During 2001-2003, there were carried out the visual inspections and pheromone monitoring of the cornfields in the Transcarpathian Region. There were analyzed the reports and publications of other researchers on the pest's distribution in Ukraine and neighbour countries – Hungary and Romania.

As the results of researches and analysis show, the first insects of the WCR were caught with sex pheromone traps in the cornfields not far from the border of settlements on the border with Romania (Dyakovo) and Hungary (Bobove v.). An active stream of the railway and motor transport goes via these settlements from the countries of the former Yugoslavia, Romania and Hungary. However, at the same time (in 2001) the pest was not registered yet in neighbour regions of Romania and Hungary. We discovered not only the first beetles into the traps but and small spots of the loading corn plants that were typical with damage of roots by larvae. There were caught only 6 beetles in 36 traps for the whole season. On these grounds, we suppose that the first females of the pest could be brought with the railway and motor transport as long ago, as 2000. These females could lay the eggs from that the beetles were developed and were caught with the traps.

In connection with increasing pest density in 2002, there was an increase in the number of spots for catching imago of WCR into the traps. For a season, it has been caught 84 beetles with the 63 traps to be situated along railway in the direction of Dyakovo-Chop and motor highways from Romania and Hungary. The outbreaks of the loading corn plants to be typical for damage by larvae were found more often. Because the numbers of the outbreaks and cases of beetles' catching were very small we suppose that the flight in of the beetles isn't confirmed.

In 2003, the beetles were caught practically with all the traps in the cornfields along the railway and motor highways and in valleys of rivers Uzh and Tissa. Distribution of the pest occupied practically all the territory of low-lying marshy lands in the Transcarpathian Region (areas more 3000 km2). For a season, there were caught 656 beetles in 65 traps. So, in the period of July 24-26, it was marked a maximal catching of the beetles into the traps and was their visual counting on the corn plants. It can be thought as an invasion (flight in) of the beetles form zones of the outbreaks in neighbouring countries.

Resume

The WCR was probably brought to the territory of the Transcarpathian Region with the help of transport means in 2001. In 2001-2003, the pest step by step spread over the cornfields along the railways and motor highways and by the valleys of rivers Tissa and Uzh. In 2003, it was noted mass air invasion of the adults. Such situation will promote increasing of areas occupied by the pest and its colonization of the corn plants. This fact gives possibility to forecast an expected damage by WCR in 2004.

Thursday, 15 January, 10:40h; VAHALA

Monitoring of the occurrence of *Diabrotica virgifera virgifera* LeConte in the CZECH REPUBLIC from 1999 to 2003

Otmar VAHALA

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State Phytosanitary Administration (SPA) has been carried out the monitoring of *D. v. virgifera* in the Czech Republic since 1999, especially in the South Moravia region. In 1999 – 2002 this monitoring was carried out in the district of Brno – Province and in the districts of Breclav, Hodonin, Uherske Hradiste and Znojmo.These last 4 districts listed above are adjacent to State borders with Austria and Slovakia which are, point of wiev for *D. v. virgifera* spread into the territory of the Czech Republic, risk states indeed. The majority of observation points for the monitoring were searched and located along these borders. In 2001 the monitoring was initiated at the next risk locality Turany airport in the district of Brno – City.

Pheromone traps (Csalomon® PAL) produced in Hungary, were placed and changed at the observation points to the monitoring *D. v. virgifera* in maize fields each month from 1 July till 30 September.Inspections of the traps (captured males) were carried out once within 7 – 10 days by inspectors of the SPA.Dates and results of the inspections were recorded to special protocols and used traps were sent to the Regional Division of the SPA in Brno to the first check and after for the final check to the Diagnostic Laboratory of the SPA.In the South Moravia region were used a total of 84 traps in 30 cadastres in 1999, 90 traps in 27 cadastres in 2000, 84 traps in 26 cadastres in 2001, 87 traps in 26 cadastres in 2002 and 161 traps in 60 cadastres in 2003.

The inspectors of the SPA preferred, when the traps were placed in fields, where maize was grown in continuous cropping or monocultures, namely in cadastres with a higher concentration of maize cultivation, especially corn maize.

The first record of *D. v. virgifera* in the South Moravia region and also in the territory of the Czech Republic was confirmed in the district of Hodonin in the cadastre Cejc (faunistic quadrat 7067) on 10 July 2002 (1 male) and on 11 July 2002 (1 male). These males were identified at the Regional Division of the SPA in Brno and at the Mendel University of Agriculture and Forestry in Brno and after the beetles were sent for confirmation to the Diagnostic Laboratory of the SPA in Olomouc.The same year other males of *D. v. virgifera* were captured in the district of Breclav in the cadastres Hrusky (1 male) and Lanzhot (1 male), in the district of Hodonin in the cadastres Cejc (2 males), Luzice (1 male) and Sudomerice (1 male) and in the district of Uherske Hradiste in the cadastre Borsice u Blatnice (1 male).A total of 9 males were captured till 27 September 2002.These results the SPA published in scientific and agricultural journals and presented at meetings for growers of maize.

In 2003 the method of the monitoring was used in the same way as in previous years, however all 61 observation points were located by GARMIN GPS.The Regional Division of the SPA in Brno also established the monitoring net for continual observation of the occurrence and population density of *D. v. virgifera* in all 14 districts of the South Moravia region. The number of the observation points in odd districts (3 - 7), depending on the occurrence of *D. v. virgifera* in the district in 2002, the vicinity of the district with infested districts and the number of Extraordinary Phytosanitary Measures, which were imposed to the growers of maize in the district a wiev of eradication of this pest. In this year 13 growers got from the Pioneer company the traps for the self-monitoring. The occurrence of *D. v. virgifera* was confirmed in the district of Breclav in the cadastres Bohumilice (1 male) and Lanzhot (8 males), in the district of Hodonin in the cadastres Cejc (2 males), Kostelec (1 male), Sudomerice (3 males) and Vnorovy (1 male), in the district of Uherske Hradiste in the cadastre Uhersky Brod (1 male) and in the district of Vyskov in the cadastre Mouchnice (2 males). Total number of captures was 19 males (6 males on the traps of the Pioneer company) from 22 July till 11 September 2003.

Thursday, 15 January, 10:50h; CATE

The 2003 monitoring program for western corn rootworm (*Diabrotica virgifera virgifera*) in AUSTRIA

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The first WCR beetles were caught in Austria in 2002. The monitoring program was intensified and extended to all Austrian provinces in the following year. In 2003 a total of 581 traps were installed in all parts of the country. Trap procurement and data compilation and distribution was coordinated by AGES, trap installation and monitoring was conducted by the provincial plant protection offices. For research purposes AGES also installed and monitored traps in those areas where the largest numbers of beetles were caught in 2002 as well as in some other regions.

Pheromone traps of the Csalomon PAL type were used in all cases. The provincial monitoring systems were set up at the beginning of July and discontinued at the end of August. Traps and pheromones were renewed at the beginning of August, after approx. 4 weeks. Trap locations were determined by GPS, monitoring results were sent to AGES weekly. Data from the whole country was then compiled and sent to the provincial plant protection offices on a weekly to bimonthly basis.

Of the 581 traps installed in Austria, beetles were recorded in 256 traps. The grand total of beetles captured was 8673, whereby 8330 were caught in Burgenland province, 339 in Niederösterreich and 4 in Steiermark. In 2003 we see an influx of WCR along the entire eastern border of the country, a distance of 231 km from north to south. Distribution ranges up to approx. 30 km into Austrian territory, whereby new infections were primarily recorded in the southern areas. In the North the range of the pest increased by only a few kilometres inland, compared to 2002. No beetles were recorded in other parts of the country.

In order to determine begin and end of beetle flight in Austria, AGES installed traps in the middle of June and monitored them until the middle of October or until harvest. The first beetle was captured on July 4th, the last on October 9th. 57.18% were captured in July, 37.25% in August, 5.32% in September and 0.25% in October. This means that 94% of the total beetle catch was captured in July and August.

Thursday, 15 January, 11:00h; REYNAUD

Monitoring of *Diabrotica virgifera virgifera* in FRANCE and first results of the eradication programme

Philippe REYNAUD

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Since 1999, a traps network has been carried out in cornfields and near international airports by the French Ministry of Agriculture (*DGAL*: *Direction générale de l'alimentation* – Food Directorate-General) with the help of the Interprofessional Association of corn producers (*ARVALIS*). The 2002 survey network made possible the detection for the first time of *Diabrotica virgifera virgifera* Leconte in France near Paris international airports.

1/ Official survey

In 2003, a network of 401 sites (2 PAL traps by site) was active during July and August, the most favourable period to the insect flight (**Figure 1**).

The monitoring was carried out half in corn areas and half near "at risk" zones, essentially close to airports (**29%** of the sites) or to motorways (**16%**). The inspection network detect **a new outbreak** near **Blotzheim** (*Alsace* region) on July 30, 2003 near the Basel-Mulhouse-Freiburg international airport (Euroairport), close to the German border (4,7 km) and the Swiss border (4,8 km). The identification was confirmed by the entomology laboratory of DGAL on July 31.

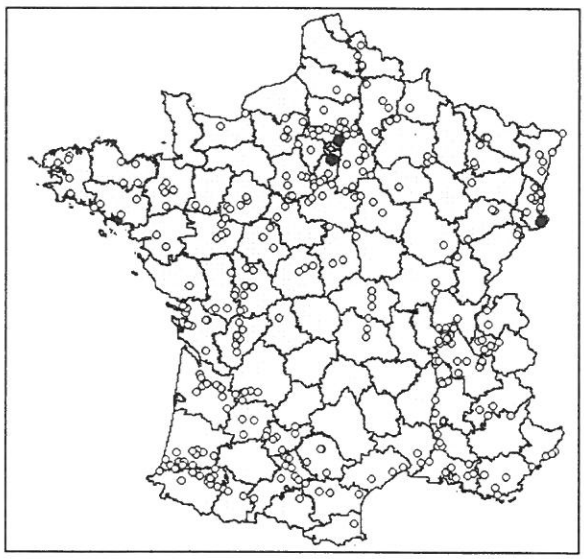

Figure 1 : 2003 traps network with currents WCR outbreaks (○ : traps location, ● : outbreaks location)

2/ Eradication measures

In accordance with the European Directive of October 24, 2003 on emergency measures to prevent the spread within the Community of *Diabrotica virgifera* LeConte (2003/766/EC), an eradication program is in progress in known outbreaks.

In ***Ile-de-France* region** (Orly and Roissy), corn seeds used in the focus zone (5 km radius) and the safety zone (10 km) were treated with imidacloprid. In the focus zone, 539 ha of corn received a carbofuran application. Monoculture is prohibited during one or two years in these 2 zones. Two hundred trapping sites (PAL or VARs+ traps) were set up in 2003. In all, 9 adults were trapped in the core of the outbreak (first captures on July 10). Some additional individuals were captured on volunteers' corn on a fallow following corn. A double adulticide treatment was carried out at the end of July (deltamethrin plus oil) on 1630 ha of corn and fallow in the core of outbreaks. These measures will be continued in 2004.

In ***Alsace* region**, the same phytosanitary measures that in *Ile-de-France* region were implemented as soon as July 31, 2003. Corn production is very significant in this area, in particular for animal consumption. Corn represent about 70% of the acreage surface in focus and safety zones. A reinforcement of the trapping (92 traps) led to the capture of a total of 9 specimens in 2003 in a radius of 5 km. For the moment, origin of the contamination is not known because a significant motorway network coming from Switzerland is also present. Adulticides treatments (deltamethrin) were carried out in August. Official measures will be continued in 2004.

First findings of the western corn rootworm *Diabrotica virgifera virgifera* in the UK

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The first pest risk analysis (PRA) to determine the risks posed by the western corn rootworm (WCR), *Diabrotica virgifera virgifera* to the UK was carried out in 1994. This supported the recommendation for listing the pest in Plant Health legislation within the European Union, but indicated only a marginal risk to the UK due to the limited area of maize production and cool summer temperatures. Following the detection of the pest around Paris in 2002, the PRA was reviewed. Dramatic increases in the area of maize grown and climatic warming were found to have substantially increased the risks of WCR establishment in the UK. Whilst the southeast of England is under greatest threat, with climate change, the area of potential establishment in very hot summers, which might be expected to occur every [ten] years will include most of the maize-growing areas in the UK. However, given that the impact of the pest could be limited, the cost-benefit analysis suggests that action involving destruction of crops and the loss of crop rotation might not be justified.

A monitoring programme was instigated for the first time in 2003 with the placement of over 60 pheromone (PAL) traps in maize fields near to international civil and military airports. In late August/ early September the pest was confirmed in forage maize crops at four holdings near Heathrow airport and a further site near Gatwick airport. At one of the sites, a few miles from Heathrow, trap counts indicated that the pest might have been present for one or more years prior to the finding. Pesticide application on the growing crop was considered, but the height of the mature crop (>2.5 metres) precluded the option of high-clearance tractor-mounted ground spraying, and authorisation for aerial spraying could not be obtained, partially due to the close proximity of urban areas and risk of bystander exposure. Measures were therefore taken to minimise risk of spread during harvest operations and extensive additional trapping was carried out in the outbreak area. On confirmation of continuing adult activity, an insecticide was applied post-harvest to the primary outbreak field. Whilst crop rotation remains the primary recommendation for long-term management of this pest, insecticide-treated seed also provides a useful option as a protective measure for maize grown in the vicinity of the outbreak area. Investigations are continuing to clarify the extent of current and potential establishment of the pest in the UK, the potential economic impact and the suppression measures that can be implemented without destroying maize growers' and dairy farmers' livelihoods.

Thursday, 15 January, 11:20h; BAUFELD

Monitoring of western corn rootworm in GERMANY 2003

Peter BAUFELD

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The monitoring of western corn rootworm (WCR) has been executed in Germany since 1997 and started in the federal land Baden-Wuerttemberg. In 2003, 459 traps were placed on 305 locations in Germany. All federal lands are involved in the supervision of *Diabrotica virgifera virgifera* except two federal lands (Hamburg and the Saar). In the first line the Hungarian pheromone traps of type PAL were used, in Baden-Wuerttemberg in addition traps of type PALs. The traps were located in maize fields, at points of entry, in the near of airports, rail and road terminals (transhipment places), motorway parking places and seed corn-breeding stations. The most intensive monitoring with 248 traps was carried out in Baden-Wuerttemberg because of the latest, close introductions of the WCR into Alsace (France) and Baselland canton (Switzerland) in 2003, 4.7 km and 11 km respectively from the German border.

The WCR was not found in Germany.

Thursday, 15 January, 11:30h; COTA

Monitoring of western corn rootworm (*Diabrotica virgifera virgifera LeConte*) in ALBANIA 2003

Ejup ÇOTA

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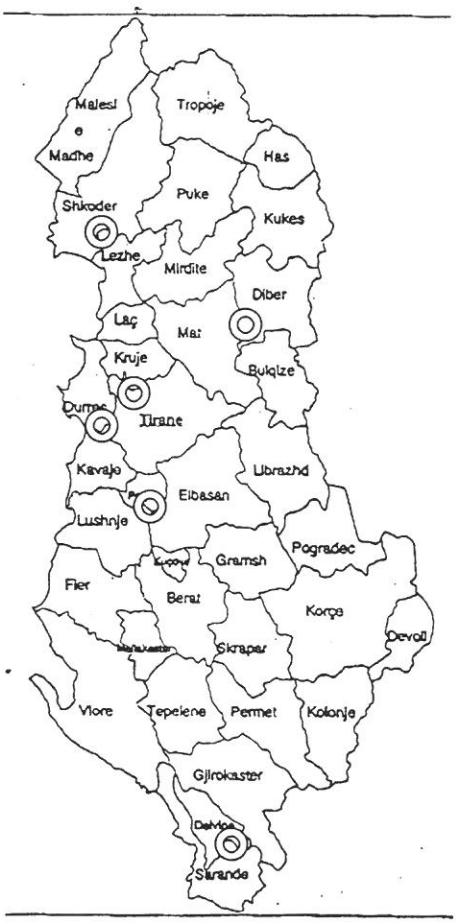
The Albanian Plant Protection Institute, since 1999 has carried out a nationwide survey of Western Corn Rootworm (WCR) in Albania every year.

Trapping: On 6 locations of our country, Hungarian pheromone traps (Csalomon^{R}) were placed in cornfields. In the uninfested area of 6 counties (Shokodra, Rinas International Airport, Elbasan, Dibra, Durres, Saranda) the traps were monitored from 20 June until the end of September at intervals of 7 days. The traps were replaced every month.

Also, in the same counties Multigard yellow sticky traps were placed. The distance between Csalomon and Multigard traps was 50m.

In all locations the pheromone and Multigard yellow sticky traps were placed, no *Diabrotica* specimen was found. Some other *Chrysomelid* specimens were collected near the International Rinas Airport, but identification confirmed that there was not any *Diabrotica virgifera virgifera* LeConte.



Monitoring *Diabrotica virgifera virgifera* LeConte by pheromone traps in GREECE

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A survey was performed for the presence of Western Corn Rootworm (WCR), *Diabrotica virgifera virgifera* LeConte (Coleoptera: Chrysomelidae), in several regions of Greece for the years 2002 and 2003. The survey was deemed essential in Greece, since WCR has been introduced to the Balkans in 1992 (Serbia) and thereafter it is considered as a serious potential quarantine pest. The study focused on corn-cultivated areas adjacent to main state civil or military airports, since these are considered as the most important sources of passage of WCR in Greece. The survey was performed under the supervision of the Greek Ministry of Agriculture and in cooperation with several institutions.

In 2002, four main airport-adjacent areas were selected: Thessaloniki, Kavala, Alexandroupoli (northern Greece) and Patra (southern Greece). In total, 16 "VARs+ funnel" pheromone traps were set up in cornfields. Each trap bore two pheromone dispensers: one sex attractant for males and one bait attractant for both sexes. Traps were serviced once weekly and attractant dispensers were changed every 40 days. Traps were set up in late July and monitoring period lasted until mid-October (maize harvest).

In 2003, three airports were selected: Kavala, Alexandroupoli and Thessaloniki (Thermi, Vassilika, Epanomi and Nea Redestos) along with two more maize-cultivated regions near the national borders to the north (Promahonas, Serres and Orestiada, Evros). In total, 17 traps were set up that year in early August and kept until mid-October. In both years, no WCR adults' captures were recorded in all monitoring sites.

Monitoring will continue in Greece for the year 2004.

COMMISSION DECISION

of 24 October 2003

on emergency measures to prevent the spread within the Community of *Diabrotica virgifera* Le Conte

(notified under document number C(2003) 3880)

(2003/766/EC)

THE COMMISSION OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Community,

Having regard to Council Directive 2000/29/EC of 8 May 2000 on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community [1], as last amended by Commission Directive 2003/47/EC [2], and in particular Article 16(3), third sentence thereof,

Whereas:

(1) France and Austria informed the other Member States and the Commission in 2002 of outbreaks of *Diabrotica virgifera* Le Conte (hereinafter referred to as 'the organism') for the first time in their respective territories and of the measures taken to control them.

(2) In 2002, monitoring was conducted in areas in Italy already infested by the organism, in particular in areas of maize monoculture and at potential introduction places of the organism such as airports and customs stations. It appears that eradication measures taken in the Veneto region proved to be effective to contain the organism and population levels of the organism have decreased; in Lombardia and Piemonte many adults of the organism were captured in different provinces, whilst an outbreak was detected for the first time in the Friuli-Venezia Giulia region.

(3) A recent Community research study on the establishment potential of the organism within the Community has demonstrated that the main factors of establishment, like trophic and climate conditions, are present in the Community.

(4) Moreover, from that study, it became apparent that the organism and its damaging effects could be of significant plant health concern to the Community maize production, because of the potential of economic loss, the potential for increased reliance on insecticides and the challenge to find an alternative crop to maize in the rotation circle.

(5) Directive 2000/29/EC prohibits the introduction into and the spread within the Community of the organism only. However no Community measures are available when new outbreaks are recorded by Member States in free areas or when the organism is detected in an early stage of development of the population. Consequently such measures should be defined, with the aim of eradication of the organism within a reasonable period of time.

(6) Those measures should include general surveying for the presence of the organism in the Member States.

(7) The measures should apply to control the spread within the Community of the organism, the delimitation of demarcated zones, the movement of host plants, soil and machinery, as well as to crop rotation in demarcated zones.

(8) It is appropriate that the results of such measures be continuously assessed, and possible subsequent measures be considered in the light of the results of that assessment.

(9) The measures provided for in this Decision are in accordance with the opinion of the Standing Committee on Plant Health,

HAS ADOPTED THIS DECISION:

Article 1

Member States shall ensure that the suspected occurrence or confirmed presence of *Diabrotica virgifera* le Conte, hereinafter referred as 'the organism' is reported to their own responsible official bodies within the meaning of Directive 2000/29/EC.

Article 2

1. Member States shall each year conduct official surveys for the presence of the organism in areas in their territory, where maize is grown.

2. Without prejudice to Article 16(1) of Directive 2000/29/EC, the results of the surveys provided for in paragraph 1 shall be notified to the Commission and to the other Member States by 31 December of each year.

Article 3

1. When the results of the surveys referred to in Article 2, confirm the presence of the organism in an area which was previously known to be free from the organism, Member States shall define demarcated zones which consist of the following parts:

[1] OJ L 169, 10.7.2000, p. 1.
[2] OJ L 138, 5.6.2003, p. 47.

(a) a focus zone around a field where the organism has been captured, of at least 1 km radius, and

(b) a safety zone around the focus zone of at least 5 km radius.

In addition Member States may also define a buffer zone around the focus and safety zone.

2. The exact delimitation of the area of the zones referred to in paragraph 1 shall be based on sound scientific principles, the biology of the organism, the level of infestation, and the particular production system of the host plant of the organism in the Member State concerned.

3. If the presence of the organism is confirmed in another point than the original point of capture of the organism situated in the focus zone, the delimitation of the demarcated zones shall be changed accordingly.

4. If no captures of the organism are detected two years after the last year of capture, the demarcated zones shall cease to exist and no further eradication measures referred to in Article 4 shall be necessary.

5. The Member States shall inform the other Member States and the Commission of the areas of the zones referred to in paragraph 1 by providing suitable scale maps.

Article 4

1. In each of the parts of the demarcated zones, Member States shall monitor the presence of the organism using appropriate sex pheromone traps which have to be arranged like a grid and checked regularly. The type and number of traps to be used as well as the method of trapping shall take into account the local circumstances, and the characteristics of the demarcated zones.

2. In addition to the provisions of paragraph 1, Member States shall ensure that in the focus zone:

(a) there is no movement of fresh plants of *Zea mais* L., or fresh parts thereof out of this zone between dates in the year of occurrence of the harmful organism, set on the basis of the biology of the organism, the level of captures of the organism, and the climatic conditions prevailing in the relevant Member State, to ensure that there is no spread of the organism;

(b) there is no movement of soil of maize fields from inside the focus zone to outside the focus zone;

(c) maize is not harvested between dates in the year of occurrence of the organism, set on the basis of the biology of the organism, the level of captures of the organism, and the climatic conditions prevailing in the relevant Member State, to ensure that there is no spread of the organism;

(d) in the maize fields a crop rotation takes place whereby during any period of three consecutive years maize is only grown once, or maize is not cultivated for two years after the last year of capture in the entire focus zone;

(e) an appropriate treatment on maize fields until the end of the oviposition period is carried out against the organism in the year of its occurrence and the year thereafter;

(f) agricultural machinery used on maize fields is cleaned of all soil and debris before leaving the zone;

(g) volunteer maize plants are removed in non-maize fields.

3. In addition to the provisions of paragraph 1, Member States shall ensure that in the safety zone at least:

(a) a crop rotation takes place whereby during any period of two consecutive years maize is only grown once; or

(b) an appropriate treatment on maize fields is carried out against the organism in the year of its occurrence and the year thereafter.

4. In addition to the provisions of paragraph 1, Member States may lay down that in the buffer zone a crop rotation takes place whereby, during any period of two consecutive years, maize is only grown once.

Article 5

Member States shall provide the Commission and the other Member States by 31 December of each year with the information on:

— the areas of the zones referred to in Article 3(5),

— the dates set and the justification thereof referred to in Article 4(2)(a) and (c),

— the treatment carried out referred to in Article 4(2)(e) and Article 4(3)(b).

Article 6

Member States shall adapt by 1 December 2003 at the latest, the measures they have adopted with a view to prevent the spread of the organism in such a manner that the measures comply with this Decision and shall forthwith inform the Commission of the adapted measures.

Article 7

The Commission shall review the operation of this Decision by 28 February 2005, and by 28 February of each subsequent year.

Article 8

This Decision is addressed to the Member States.

Done at Brussels, 24 October 2003.

For the Commission

David BYRNE

Member of the Commission

Thursday, 15 January, 13:00h; BERTOSSA

Effect of containment strategies against *Diabrotica virgifera virgifera* in SWITZERLAND

Mario BERTOSSA

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In 2000 the first western corn rootworm (WCR) beetles have been detected in south Switzerland. Since that moment containment measures have been enacted in the infested regions. In the following we present the effects where measures have been acted. Since the first detection in a region, two main decrees have been acted and strictly controlled: First, a minimum one year, field oriented, corn cultivation stop, second, the elimination of spontaneous corn in the alternative crop, especially in soybeans after corn. The municipalities had the supervision on corn-cultivated fields and reported them to the Phytosanitary service of Canton Ticino.

The evolution of the WCR population after introduction of the rotation decrees has been observed using a same number of pheromone traps (Csalomon≤ PAL). In two selected fields second year corn was observed in detail searching for eggs, larvae, adults and root damage.

With the same amount of traps per region the WCR population has decreased the first year after rotation in 2003, then increased in 2003 in the border regions of the Canton Ticino, farer away from the border near Bellinzona/Locarno region a 46% decrease after rotation introduction was observed this year.

The second year cornfields showed important population growing's from one year to another. For the first time in Switzerland it was possible to see free flying WCR adults and slight leaf and silk damage was noted. Soil and root analyses are still on the way.

We can conclude that a strictly controlled crop rotation can be successful to keep the WCR population under an economic damage level. Even in the border region with a relative dense population no lodging plants were observed.

Thursday, 15 January, 13:20h; FURLAN et al.

Diabrotica virgifera virgifera eradication – containment in restricted promptly detected focus areas: Veneto study case

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The attempt to eradicate or at least to contain the newly arrived population of *Diabrotica virgifera virgifera* (WCR) near the International Airport of Venice was implemented using the strategies deployed in previous years.

MATERIALS AND METHODS: The eradication program was based on: ι **Initial focus area (3000 ha of cultivated land)**: - monitoring the WCR population: 567 sex pheromone traps (most of them PAL) were placed out; most of them from the 30th of June to the 16th of July. - Imposing restrictions on the planting of maize in fields: it was prohibited to plant maize after maize. - Applying insecticide treatments to maize fields to control WCR adults; the insecticide used was Dursban (chlorpyrifos) WG at the rate of 1,1 kg/ha; 286 ha of maize fields were sprayed between the 7th to the 30th of July. - Prohibiting the movement of fresh maize or soil in which corn was grown the previous year outside of the focus area. - Not allowing maize to be harvested before September 1st. ι **Safe area (about 25.000 ha of cultivated land)**: - monitoring of WCR population: totally 368 sex pheromone traps were deployed (most of them from the 17th to the 27th of June) in all the monoculture maize fields of the part of safe area (named safe-endangered area) close to the border of focus area (about 2-3 km around); 105 PAL traps were placed out according to a 2 km X 2 km grid in monoculture maize fields localized in the rest of the safe area. In the first part of the season trap inspections were done twice per week, subsequently once per week. - Applying insecticide treatments to maize fields (and those all around) where WCR specimens are caught: 23 ha of maize fields, including the field in safe-endangered area where one specimen was captured by a PAL trap and all the maize fields around, were sprayed. ι **Other sensitive sites in Veneto region:** further 448 PAL traps were deployed in sensitive sites of the region where a jumping movement of the species may occur; particularly around other airport facilities, in areas where there is an high presence of maize fields and along the border with Lombardia (infested region). All the traps were placed out in monoculture fields, most of them planted with maize for 3 to 20 subsequent years.

RESULTS: **Field checks in focus area**: all the fields in the focus area that had been planted to maize in 2002 were checked to determine what crop was planted in 2003. Four fields totaling 1,45 ha of monoculture maize were found and destroyed. Eight PAL traps placed out in these fields before the destruction captured no specimens. **WCR captures**: ι **Initial focus area**: 4 beetles were captured on 3 traps from the 10th to the 14th of July in three maize field kept at set aside or planted with soybean in the previous year, all planted with maize in 2001. ι **Safe area and new focus area**: in a monoculture maize field about 500 m north of the border of the initial focus area, 1 WCR male was captured on a PAL trap on August 29th. Two further specimens were captured in a monoculture maize field on the same day in the western part of the safe area, beyond the urban centre of Mestre, near Venice Port. One further specimen was found nearby on September 17th. After insecticide treatments, the traps did not catch any more beetles until the end of the season. The focus area was enlarged to about 4000 ha of cultivated land. ι **Other sensitive sites in Veneto region:** no specimens were caught.

CONCLUSIONS: The strategies implemented in Veneto proved to be very effective in stopping WCR populations; the population has been kept at very low level for 6 years (first detection in 1998). Differently from all the other sites in the world where the species was detected, in six years there was no significant spread from the initial focus area and a dramatic reduction of the population levels despite the fact that the area proved to be suitable for WCR population development. In 2003 the same strategies proved to be effective in Pordenone province too.

Diabrotica management in Europe – preliminary experience with Clothianidin (Poncho®), Bayer CropScience's new neonicotinoid insecticidal seed treatment

Bernd SPRINGER, Wolfram ANDERSCH & Wolf C. BECKER

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Diabrotica virgifera virgifera, the western corn rootworm (WCR), was first detected in Europe near Belgrade airport in 1992 and has since spread within Europe. First outbreaks in the EU were reported in Italy in 1998 and in both Austria and France in 2002. Latest observations in 2003 have revealed the pests' arrival in the Netherlands near Schipol airport and more recently in the UK, close to Heathrow airport, and in Belgium around Brussels airport.

WCR is a pest of major economic importance in maize, originating in the Midwest USA, where in 2003 over 13,5 mio ha were infested causing yield losses between 10-90 %. The adult beetle lays its eggs in the soil and the larvae emerge during the following spring and feed on the roots of the crop, with older stages penetrating the roots and feeding internally. The larvae pupate in the soil and then adults emerge to feed on the leaves and 'silks' on the cobs. Because the larvae feed on the roots, nutrients and water up-take are restricted, leading to a reduction in yield. Depending on the degree of infestation, maize plants may grow poorly, and severe root damage can result in crop lodging which can severely reduce harvest.

Current *Diabrotica spp.* control practice in the USA is the application of granular insecticides such as Bayer's tebupirimfos based insecticide Aztec® to the soil at sowing.

In 2003, Bayer CropScience received registration for it's new neonicotinoid seed treatment product Poncho® (active ingredient *Clothianidin*) in maize in the USA against all major pests including *Diabrotica spp.* at 1,25 mg active ingredient per seed. The insecticide is highly root systemic and enters the transpiration stream through the roots of germinating seedlings and developing plants. Pests become toxified mainly through ingestion of protected plant tissue causing an early anti-feeding reaction.

In 2003, Bayer CropScience conducted trials with Poncho in maize in Europe. The results confirmed the excellent Diabrotica management potential of Poncho at 1,25 mg ai./seed. Crop damage caused by root feeding larvae was significantly reduced enabling treated crops to realize their full yield potential. Respresentative results from Croatia, Hungary and Italy are presented.

Seed treatment has clear safety and handling advantages as the products are contained "on-the-seed" and "in-the-bag". By comparison, soil applied insecticides have the disadvantage of the cost and time required to install and calibrate the granule applicator equipment, the loading of granules during planting and the handling and return of the insecticide containers.

In addition to its excellent activity against *Diabrotica spp.* Poncho shows outstanding control of important European maize pests including wireworms *(Agriotes sp.)*, frit fly (*Oscinella frit*), plant hoppers *(Macrosteles spp., Zyginidia spp.)* at 0.5 mg active ingredient per seed.

With its confirmed technical profile, Poncho is set to play a key role in Diabrotica management in Europe.

Using spatial dispersion of corn rootworms to improve management efficiency

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The control tactics that have been most widely used to manage corn rootworms are crop rotation and insecticides applied at planting time. This past season, genetically engineered corn that prevents corn rootworm larval injury was registered and sold commercially in the United States. All of these control tactics are preventive; they are applied at the time of planting before the larval stage is present. Usually they are applied to a whole field without any knowledge of the distribution of the insect in the field. Prevention of corn rootworm larval injury would be less costly if the controls could be directed toward only those portions of fields where control was warranted, i.e., site-specific pest management.

A three-year study of the within-field spatial distribution of corn rootworms was conducted. In this study, there was within-field spatial correlation of adult numbers between years and the within-field distribution of larvae was related to adult numbers the previous season. The best predictor of larval numbers was adult density at peak beetle numbers in August. By specifying the amount of root injury that would be tolerated, maps of the area where controls should be applied were generated. While it is not likely that growers will target insecticides at only portions of their fields, mapping larval infestations may have utility in the planting of genetically engineered corn. When corn rootworm, genetically engineered corn is planted, a 20% refuge (non-transgenic corn) must be planted. By sampling adult populations in August, the grower will be able to plant the more expensive genetically engineered corn where the pest populations are greatest and plant the non-transgenic, susceptible corn where corn rootworm losses will be the least.

Towards biotechnical pest management of *Diabrotica virgifera virgifera* in Illinois, USA

Hans E. HUMMEL[1], J.T. SHAW[2], C. KUNIYOSHI[2] & G. AREE[2]

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With one billion US dollars of annual damages and losses in the US, the western corn rootworm *Diabrotica v.v.* (Col.: Chrysomelidae) (*D.v.v.*) is among the dozen most destructive insect species worldwide. Efforts to reduce *D.v.v.* populations therefore have been in effect within the US Corn Belt for several decades-with many surprises along the way. In the 1960's, *D.v.v.* developed cyclodiene resistant strains now found throughout North America. Very recently, a behavioral ecotype with the ability for "crop rotation resistance" has been found expanding from Illinois into adjacent parts of the Corn Belt. Thus, *D.v.v.* demonstrated its ability to surprise entomologists time and again until the early 1990's when the species was accidentally introduced to Belgrade/Serbia. Subsequently it spread into surrounding countries of *southeastern* and from there to *central* Europe. As of Sept. of 2003, only Germany, Denmark and Poland are still assumed to be virtually "Diabrotica free". In spite of considerable efforts and support by the EU commission there remains a need for sustainable, non-toxic management approaches in both North America and Europe.

As a new biotechnical approach to population reduction in Illinois we tried during August and Sept. of 2003 mass trapping combined with a "shielding/deflection" strategy along a line of traps baited with the synthetic kairomone 4-methoxy-cinnamaldehyde as a medium range attractant (for both males and females) combined with cucurbitacin powder as a short range attractant. Those *D.v.v.* adults landing on the center strip of the newly designed "Intensive Rootworm Collection (IRC) trap" are ingesting a lethal dose of carbaryl mixed with the cucurbitacin powder bait and soon fall down into a screw top jar where they can be easily counted and sexed. Classical mass trapping with *D.v.v.* is running against considerable odds because of the unfavorable ratio of *total* adults within maize fields (100-250 000 adults / ha in August) to *trappable* adults. It is estimated that with reasonable costs and efforts not more than 10-20% of the beetles in a field can be trapped. However, mass trapping in combination with "shielding and deflecting" the mobile adults along a trap line, we are finding *significantly* reduced adult populations on plants inside of the "shielded field" in comparison to an adjacent maize field of equal size (0.27 ha) without such a shielding trap line. Immigration and emigration events take place predominantly within a flight space ranging from 0 to 3 m above ground as we can prove by IRC traps mounted at vertical distances of 1 m along tall poles standing at the perimeter of the field. A deflecting/shielding trap line of sufficient density mounted at ear height of the very late planted maize field therefore will be a promising management tool for reducing *D.v.v.* beetle fluctuation across this line. *D.v.v.* egg numbers recovered from soil in the "shielded" field are also lower (17 vs. 93) than in the unshielded control plot.

Genetically enhanced maize as a management option for corn rootworm: YieldGard® rootworm maize

Jay C. PERSHING, Dennis P. WARD, Todd A. DeGOOYER, Ty T. VAUGHN & Graham P. HEAD

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Maize (*Zea mays* L.), the world's third leading cereal crop following wheat and rice, is grown commercially in over 25 countries. In 2002, worldwide production of maize was approximately 594 million metric tons. In the United States (US) its production covered 32 million hectares that yielded 229 million metric tons and had a net value of US$21.2 billion. Maize, also referred to as corn, has been a staple of the human diet for centuries. Maize grain and processed fractions are consumed in a multitude of food and animal feed products. Hybrid maize is an extremely productive crop, yielding an average of 8.16 metric tons ha^{-1} in the US during 2002. High yield makes maize one of the most economical sources of usable energy for feeds and of usable starch and sugar for food and industrial products. The majority of maize harvested is fed to livestock.

Maize yields are negatively impacted by a number of insect pests. One of the most pernicious in the US Corn Belt is the corn rootworm. Corn rootworm larvae damage maize by feeding on the roots which reduces the ability of the plant to absorb water and nutrients from soil and causes harvesting difficulties due to plant lodging. Corn rootworm is the most significant insect pest problem for maize growers in the US Corn Belt from the standpoint of chemical insecticide usage. An estimated 5.7 to 10.1 million hectares of maize in the US are treated annually with organophosphate, carbamate, pyrethroid, and phenyl pyrazole insecticides to control this pest. Corn rootworms have been described as the billion-dollar pest complex, based on costs associated with the application of conventional soil insecticides and crop losses due to pest damage. Incomplete protection of maize root systems with larval insecticides, the development of resistance to adult control insecticides, and the biological adaptation of corn rootworms to crop rotation have diminished the effectiveness of currently available pest management practices.

Future management strategies for the control of corn rootworms will include the planting of genetically enhanced maize that resists larval root feeding and protects grain yields. This case study examines current management strategies and their limitations in US maize production and the potential benefits of managing these pests with corn rootworm-protected maize developed by Monsanto Company.

Assessing the risks of *Bt*-transgenic maize for non-target arthropods

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One of the primary concerns related to the adoption of insect resistant transgenic plants in the environment is the detrimental effect that these may pose on non-target organisms, including entomophagous arthropods (parasitoids and predators) which play an important role in natural pest regulation.

We propose a framework for pre-release risk assessment to evaluate the effects of insect resistant plants on entomophagous arthropods. Using maize expressing the *Bacillus thuringiensis* gene, which codes for the Cry1Ab toxin as an example, we illustrate the procedure necessary for assessing the risks. As a first step, it is required to identify the economically and/or ecologically important entomophagous arthropods in the agricultural system in which the transgenic crop will be deployed. Since the risk that a transgenic crop poses for entomophagous arthropods depends on both, their exposure and their sensitivity to the insecticidal protein, it is necessary to determine, as a second step, if and to what extent the organisms are exposed to the transgenic product. Exposure will be associated with the feeding behaviour of phytophagous and entomophagous arthropods together with the tissue and cell specific temporal and spatial expression of the insecticidal protein. For those entomophagous species that could potentially be exposed to the insecticidal protein, the toxicity of the compound has to be assessed. A tiered testing approach should be applied, starting with 'worst case' toxicity tests (1st tier) using both the pure transgenic compound (dose-response tests) and transgenic plant material, followed by semi-field (2nd tier) tests that assess toxicity at exposure levels representing more closely the field situation and eventually field (3rd tier) tests in cases in which a potential risk is indicated by lower tiered tests. Taking the green lacewing *Chrysoperla carnea* as an example, we propose a procedure on how to perform tests and give evidence that *Bt*-maize poses no risk to this predator.

Dutton A, Romeis J & Bigler F (2003) Assessing the risks of insect resistant transgenic plants on entomophagous arthropods: Bt-maize expressing Cry1Ab as a case study. BioControl 48: 611-636.

Thursday, 15 January, 15:50; RAPS

Regulation of genetically modified crop plants in Switzerland - environmental aspects

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Genetically modified crop plants get authorised for cultivation by the Swiss Federal Office for Agriculture based on the authorisation procedure laid down in the Ordinance on Seeds, which for the environmental assessment refers to the Ordinance on the Release of Organisms into the Environment (Release Ordinance, RO). According to the Release Ordinance the authorisation application must include data required for the assessment of the risks posed to people and the environment and a permit may only be issued if:

- the requirements of the authorisation procedure are fulfilled,
- examination of the environmental data leads to the conclusion that given the current status of knowledge and experience, the placing on the market cannot endanger people and the environment, and
- the Federal Office for Public Health (FOPH) and the Swiss Agency for the Environment, Forests and Landscape (SAEFL) give their consent to the placing on the market.

Up to now, the environmental assessment has to be made according to the procedure laid down in the Release Ordinance. However, on January 1, 2004 a new law on gene technology - The Federal Law relating to Non-human Gene Technology (Gene Technology Law, GTL) – entered into force specifying the requirements for an authorisation. The GTL in its core is an environmental protection law including additional provisions related to the protection of production without genetically modified organisms, product flow segregation, freedom of choice, labelling and public information. According to the GTL genetically modified organisms (GMO) shall be handled in such a way that they, their metabolites or wastes cannot endanger humans, animals or the environment and do not impair biological diversity or the sustainable use thereof. Authorisation for a GMO intended for use in the environment can only be given if experiments in contained systems of field trials have shown that

- it does not impair biodiversity;
- it does not cause severe or permanent impairment of the material balance of the environment;
- it does not cause severe or permanent impairment of important functions of the ecosystem in question, in particular the fertility of the soil; and
- it does neither disperse, nor spread its traits in an undesired way.

Further, GMO containing inserted resistance genes to antibiotics used in human or veterinary medicine may not be placed on the market at all.

Currently, the public administration is working on the implementation of these provisions into the ordinances affected (Release Ordinance, Ordinance on feed, Ordinance on Seeds etc.).

All laws and ordinances can be found on http://www.umwelt-schweiz.ch/buwal/eng/fachgebiete/fg_biotechnologie/national/lois/index.html.

Monitoring of *Diabrotica virgifera virgifera* LeConte in the UKRAINE

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In 2003 the total corn acreage in Ukraine amounted to 3.5 million hectares. The specialists of the Ukrainian National Service, researchers of plant quarantine monitored and revealed the western corn rootworm. On the territory of 1200 000 ha 25 regions were visually inspected and by means of pheromone traps of both Moldavian and Ukrainian production 15000 ha in 325 districts of 24 regions of Ukraine were monitored. There were defined the main ways of *Diabrotica* spread into Ukraine (Tabl 1). Major attention was paid to the regions of Odessa, Chernivtsi, Ivano- Frankivsk, Lviv, Zakarpattya bordering with Romania, Slovakia, and Hungary where the corn rootworm had already settled. The pheromone and cucurbicit traps were installed in the first half of July, starting 1 July 2003. Every 7 days the inspectors of the Phytosanitary Service counted and defined the traps, sent to quarantine labs for analysis. The pheromone capsules were changed every 30 days.

In 2003 Ukrainian specialists of the Phytosanitary service revealed 2590 males end 3 female (Table 1) of *Diabrotica virgifera* in 61 inhabited locations of 10 district: Vynogradiv, Beregovo, Uzhgorod, Mukachiv, Khust, Irshava, Perechyn, V.Bereznyy, Svalyava, Tyachiv in Zakarpattya. These locations are situated in the frame of 50-60-km zone from the border with Slovakia, Hungary, and Romania. WCR imagoes in the Zakarpatsky region were found on pheromone traps July 10 to July 18, 2003. The corn plantations monitored revealed no larvae of the western corn rootworm. Thus they migrated from the border regions of Hungary, Romania, and Slovakia. The results of the investigations were published in the special journal. *Diabrotica virgifera virgifera Le* Conte was identified by Zakarpatska zone quarantine laboratory (the city of Uzhgorod) and confirmed by the Central scientific-research quarantine laboratory (the city of Kyiv). In other locations and regions of Ukraine monitoring of the WCR in 2003 gave no positive results.

Based on the knowledge on the western corn rootworm there were edited methodical recommendations, letters and posters, articles were published in scientific and agricultural journals and other media, some TV programs were dedicated to this topic.

Tabl 1: The review of *Diabrotica virgifera virgifera* LeConte occurrence in Zakarpattya region in 2003

	District	Namber of caught adults	
		Male	Female
1	Beregovo	312	-
2	Uzhgorod	512	3
3	Vynogradiv	1348	-
4	Mukachiv	104	-
5	Khust	84	-
6	Irshava	166	-
7	Perechyn	26	-
8	V.Bereznyy	5	-
9	Svalyava	21	-
10	Tyachiv	12	-
	Total	2590	3

First finding of the western corn rootworm in the NETHERLANDS

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The Plant Protection Service of The Netherlands has carried out annual monitoring with PAL-traps in maize fields for *Diabrotica virgifera virgifera* LeConte (WCR) since 1997. In 2003, pheromone traps were placed at about 120 locations, mainly in monoculture maize fields at risk locations such as airports, harbours and military airbases. August 14, 2003 two adult beetles of WCR – first observation of WCR in The Netherlands – were detected in one maize field near Amsterdam (Schiphol) Airport and the Aalsmeer flower auction. This particular field had been part of the monitoring network for five consecutive years.

As soon as the Entomology Section confirmed the detection of WCR, an eradication programme was implemented. The implemented measures, which followed the control measures as described in the EU-Commission proposal, were included in a national regulation and published.

A **focus zone** of one km radius was demarcated around the field where the two adult beetles were found. Only three maize fields (six ha) are situated within this focus zone. The respective maize fields were treated with *deltamethrin* a few days after the finding of WCR. Two weeks later, the chemical treatment was repeated. The following measures were also implemented:

* no harvest of maize allowed before the October 1;
* no movement of maize and soil from maize fields from within the focus zone to outside this zone;
* crop rotation of 1:3;
* compulsory removal of volunteer maize plants in the following year(s).
* compulsory cleaning of equipment and machinery used on maize fields

In the surrounding demarcated **safety zone** with a radius of five km, crop rotation of 1:2 has been implemented for the forthcoming years. Within this zone, the maize fields were not treated with an insecticide.

Monitoring with pheromone traps (PAL and a few PALs traps) was intensified after the finding of WCR: twenty-six traps were placed within the focus zone (three maize fields), fifty-eight traps within the safety zone (seventeen maize fields) and one hundred traps on maize fields surrounding the safety zone. Not a single specimen of WCR was caught in this area or elsewhere in The Netherlands after August 14.

Conclusion

The maize field where the two adult beetles of WCR were caught is situated both close to Amsterdam (Schiphol) Airport and the Aalsmeer flower auction. Therefore, a plausible explanation for the introduction of the beetles in this area is, apart from transport by aeroplane, transport by trucks. Because not a single beetle was caught after the first finding of August 14, it is assumed that the situation is under control.

Because the recent outbreaks in the Netherlands, France and Belgium are cause for great concern for an ongoing spread of WCR in these regions, The Netherlands will further increase the monitoring intensity throughout the country in 2004.

Thursday, 15 January, Poster Presentation 16:10h; CATE

Present distribution of western corn rootworm (*Diabrotica virgifera virgifera*) in AUSTRIA

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The first WCR beetles were caught in Austria in 2002. The monitoring program was intensified and extended to all Austrian provinces in the following year. Of the 581 traps installed in Austria, beetles were recorded in 256 traps. The grand total of beetles captured was 8673, whereby 8330 were caught in Burgenland province, 339 in Niederösterreich and 4 in Steiermark. In 2003 we see an influx of WCR along the entire eastern border of the country, a distance of 231 km from north to south. Distribution ranges up to approx. 30 km into Austrian territory, whereby new infections were primarily recorded in the southern areas. In the North the range of the pest increased by only a few kilometres inland, compared to 2002. No beetles were recorded in other parts of the country.

Table: Beetles captured in Austria in 2003

Province-district	No. of traps	No. of traps with beetles	No. of beetles
B-Neusiedl am See	168	150	8135
B-Eisenstadt Umgebung	31	6	8
B-Mattersburg	24	13	33
B-Oberpullendorf	28	5	11
B-Oberwart	30	4	6
B-Güssing	30	20	47
B-Jennersdorf	40	27	90
Burgenland total	**351**	**225**	**8330**
N-Bruck an der Leitha	31	17	257
N-Gänserndorf	29	9	78
N-Mistelbach	30	1	4
Other districts	69	0	0
Niederösterreich total	**159**	**27**	**339**
St-Fürstenfeld	7	2	2
St-Radkersburg	12	2	2
Other districts	10	0	0
Steiermark total	**29**	**4**	**4**
Other provinces	**42**	**0**	**0**
Austria total	**581**	**256**	**8673**

In order to determine begin and end of beetle flight in Austria, AGES installed traps in the middle of June and monitored them until the middle of October or until harvest. The first beetle was captured on July 4th, the last on October 9th. 57.18% were captured in July, 37.25% in August, 5.32% in September and 0.25% in October. This means that 94% of the total beetle catch was captured in July and August.

Peak of beetle catch differed according to the time of trap and pheromone renewal, ranging from the third decade of July to the second decade of August. We believe that the reason for this discrepancy lies in diminishing viscosity of the lime used for trapping, probably due to the very high summer temperatures. We noticed repeatedly that beetles could free themselves from the lime and be found on neighbouring plants.

Twenty fields were monitored with two traps approx. 20 meters apart instead of the usual one trap per field as generally used in the Austrian monitoring program. In only 5 cases (25%) were two traps more effective than one.

Thursday, 15 January, Poster Presentation 16:10h; BORIANI & FURLAN

A sustainable management of western corn rootworm in Lombardy: a methodological approach based on farming trials

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Western corn rootworm control should be based on a thorough understanding of the habitat, food, preferences and other behaviour of the pest, so that the most effective biological, cultural, as well as chemical controls can be combined in an ecologically and economically sound integrated pest management (IPM) strategy. The aim of IPM is to maximize natural and cultural controls, and use pesticides only as a last resort.

Cultural control reduces pest damage through manipulation of the environment and it is often associated with mechanical operations such as tillage, interplanting, crop rotation and adjusting the time of planting and harvesting. Although cultural practices alone may not give satisfactory control, they are important in minimizing pest injury. In particular crop rotation and biological diversity have long been utilized very successfully in traditional corn rootworm control.

There is a growing awareness of the need to adopt more sustainable and integrated systems of agricultural production, which depend less on chemicals and other energy-based inputs. Such systems can often maintain good yields and at the same time lower the cost of inputs, increase farm profits and solve ecological problems.

Strategies for establishing a sustainable agricultural system in western corn rootworm control in Lombardy, the region with the highest populations, should be based on an integrated pest management and on the extension of sustainable agriculture to farmers.

The process to introduce IPM strategies in Lombardy should be based on:

- education and extension programs to be conducted for consumers as well as for farmers, since information and more research are needed, not only on new technology for sustainable agriculture but also on marketing strategies to ensure a profitable return for the farmer.
- farming experimentation: the possible strategies should establish and implement an areawide pest management research action program for corn rootworm as part of a maize management. This may be obtained setting up IPM strategies in on farming trials in real conditions, at the same time making the involved farmers used and convinced to introduce and divulgate to colleagues the new approaches and the new techniques in the next future. This implies to set up simple on farming trials in known pilot farms.

The main features of the pilot farm should be:

- being suitable for organizing demonstrative trials;
- having main features representatives of the soil and climatic characteristics of the zone;
- being well known by most of the other farmers around;
- being well connected with roads;
- being available to host demonstrative trials and farmers visiting the new experiences.

This approach was being initiated in Lombardy. Main on farming trials concerned the introduction of treatments against the adults taking into consideration the interactions with the other pests and useful insects, of new rotations and new agronomic strategies. The evaluation of effectiveness of the strategies has already been planned.

Indicators to compare initial situation with situation after the completion of the process should be:

- cultivated lands planted with monoculture maize;
- surface planted with maize;
- surface planted with new crops;
- number of captures in pheromone and yellow traps;
- amount of insecticides used per farm;
- number of farmers having reliable information about *Diabrotica* and IPM strategies.

Monitoring western corn rootworm in Baden-Württemberg (GERMANY) and measures after detection of *Diabrotica virgifera virgifera* LeConte near the Euroairport Basel-Mulhouse

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Placed in the southwest of Germany, Baden-Württemberg has a total area of about 140,000 hectares maize cultivation. About half of this is grain maize (incl. CCM) and half is silage maize. Most of grain maize is grown in the Rhine valley. The maize production there dominantly takes place in monoculture. Therefore already in 1997 a WCR-monitoring programme started in the governmental district of Freiburg with a few traps and from 1999 the monitoring with PAL traps included all of Baden-Württemberg. In 2003 248 PAL traps were set up. Besides focusing on important maize growing areas, high-risk locations for introduction were targeted such as airfields, airports, truck stops, railway reloading stations etc. Traps are generally placed in pairs at each monitoring site (minimum distance: 20-25m).

The first occurrence of *Diabrotica virgifera virgifera* in the Rhine Valley was registered in Southern Alsace, France, in July 2003. Dibarotica beetles were discovered near the Basel-Mulhouse airport about 5 km from the German border. Also in Switzerland 2 beetles were caught in a trap near Therwil in the "Kanton Basel Land", 10 km from the German border.

In France a 5 km focus zone and a 10 km safety zone around the centre of the outbreak was defined and control measures were executed. The zones extended across the River Rhine into Germany. Following the outbreak near the Euroairport Basel-Mulhouse the local district administration in Freiburg issued an order on 13 August defining the area concerned in Germany and prescribing the following measures to be taken:

- The existing monitoring program with 62 PAL-traps in the district Freiburg was strengthened by setting up 32 further lure traps (28 PAL, 4 PALs; Baden-Württemberg altogether 248 traps).
- Aridity-damaged corn (approx. 20 ha) was allowed to harvest as silage maize up to 18 August for use in the 5 km zone only.
- An insecticide treatment was prescribed with "Karate Zeon" (Lambda-Cyhalothrin) by a contractor for all maize remaining after the 18 August. The treatment took place with a stilt tractor on about 130 ha and was paid by the Land of Baden-Württemberg (5700 €).

Result of the monitoring: In 248 traps, including 32 additional traps *D. virgifera virgifera* was not found.

According to the new EU legislation the focus zone measures at least 1 km (radius) and the safety zone at least 5 km (radius). In the safety zone the individual farmers can decide, whether they will implement crop rotation or carry out an appropriate treatment of their maize fields in the zone. For the sowing in 2004, it will be determined that the first measure is a seed treatment with the insecticide "Poncho Pro" (Clothianidin) on all maize fields in the safety zone. The other measures will be executed after a German guideline to the conversion of the EU legislation.

Thursday, 15 January, Poster Presentation 16:10h; UREK & MODIC

First report on western corn rootworm (*Diabrotica virgifera virgifera* LeConte) in Slovenia

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Maize is one of the major crops in Slovenia covering about 40 % of all arable fields. Since our country has suitable climatic and trophic conditions for the establishment of *D. virgifera virgifera*, we joined a project team which is active in frame of EPPO by monitoring the spreading of WCR in 1995 and started its monitoring in Slovenia in 1997.

The monitoring of WCR in 2003 was carried out by Agricultural Institute of Slovenia in co-operation with the inspectors of Phythosanitary inspectorate. It was financed by Administration for plant protection and seeds (Ministry of Agriculture, Forestry and Food). The control spots were set in maize fields (53) and pumpkin fields (5) between 23 and 26 June in the regions of Pomurje, Podravje, Posavje, Gorenjska, Norhern Primorska.

The monitoring was carried out from the end of June (23. 06.) tc the end of August. During that time, pheromone and yellow sticky traps were checked regulary in 7 – 10 day intervals. At the end of July pheromone traps were replaced. Yellow sticky traps were replaced more frequently.

At each control spot (altogether 58), one pheromone trap and one yellow sticky trap were set 50 meters away from each other. When the first beetles were caught in the region of Pomurje on 23 July two additional control spots were established in Veš□ica and Velika Polana using only one pheromone trap per spot. Similarly, two additional spots were established in Northern Primorska (Ajševica and Vogrsko) when WCR was caught in Vogrsko on 6 August. The monitoring of *D. virgifera virgifera* finished in 2003 at the end of August since the maize was harvested one month earlier than in previous years because of very dry weather conditions in the summer.

A total of 62 pheromone traps and 58 yellow sticky traps in the Slovenian regions of Pomurje, Podravje, Posavje, Gorenjska and Primorska were monitored. Male beetles were confirmed in 14 of them; altogether, 19 beetles were caught by pheromone traps and no beetles by yellow sticky traps.

The pest was found for the first time in Slovenia on 23 July 2003 near the villiages Gibina (1 beetle), Benica (2 beetles) and Mostje (1 beetle) in Pomurje and on 24 July 2003 near the villiage Jastrebci (1 beetle) in Podravje, not far away from the border of Hungary and Croatia. Further monitoring showed that the pest was not yet extended in Slovenia since only few beetles were caught in Pomurje afterwards. WCR was also confirmed on 30 July in pheromone traps placed in maize fields in Pince (2) and Domanjševci (1), on 6 August 2003 in Domanjševci (1), Loperšice (1), Motvarjevci (1) and Grabe (2), on 13 August 2003 in Žitkovci (1) and finally on 20 August 2003 in Gaberje (1).

On 6 August 2003, males of *Diabrotica virgifera virgifera* were caught for the first time in pheromone traps placed in Vogrsko (1), Northern Primorska, 10 km from the Slovenian-Italian border and afterwards in Ajševica (1) on 19 August and in Bukovica (1) on 27 August 2003.

Thursday, 15 January, Poster Presentation 16:10h; MUREŞANU

The pests from maize crops, the assessment of losses and the possibilities of their control (Transylvania – ROMANIA)

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The maize crop in Transylvania occupies a large area, the plants being attacked from the very beginning, from the coming up, till after the earing up by different pests.

In this paper are presented, the results obtained between 2001-2003 regarding the abundance of pests presented in maize crop, the losses assessment of the most damaging pest European Corn Borer (*Ostrinia nubilalis* Hbn.) at the hybrids created in ARDS Turda and the possibilities of controlling the pests using different methods. The highest frequency of attack was recorded at the corn borer (20-80%), *Agrotis* larvae (3-30%), wireworm (*Agriotes* spp., 8-30%), earth flears (*Phyllotreta* spp., 20-50%), and also beginning with 2002 the western corn root (*Diabrotica virgifera virgifera*, 8-19% attack, and 20-50 adults/pheromones traps). The produced damages by these pests consisted of significantly yield losses, which were correlated with attack frequency being between 12,7 and 23,7%.

As controlling methods of mentioned pests were utilized the seed treatments, treatments on the vegetation with different products and sexual pheromone traps. The seed treatments with Fipronil (5l/t), Thiametoxam (10l/t), Imidacloprid (10l/t), Acetamiprid (2,5l/t), realized a significantly coming up and yield increase (4,0-15,0% come up plants and 6,5-22,0% yield increase).

The treatments applying on the vegetation with Fipronil (0,1l/ha), Fenoxicarb (0,3kg/ha), Lufenuron (1,0l/ha), Thiametoxam (0,1l/ha), Cipermetrin+Clorpirifos (0,7l/ha), Clorpirifos metil (1,5l/ha), then Bacillus thuringiensis (1,5kg/ha), *Trichogramma maidis* (200.000 indiv. /ha), reduced the attack of European Corn Borer with 15-30%.

The pheromone traps – efficiency biotechnical method- reduced significantly the number of lepidopterous pests (30-40%), establishing also the proper moment of applicancy for treatments that means actually money and timesavings.

For realizing an efficient control of pests, is necessary a linking of agrotechnical, biological, chemical methods, the utilising of resistant hybrids, which represents control systems and counts on technological, ecological and economical elements. All of these contributes to reducing the number of treatments, and also in reducing the environmental pollution and protecting the useful insects.

Possibilities for control of *Diabrotica virgifera virgifera* in maize in the NETHERLANDS

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Since 2002 and 2003, *Diabrotica* beetles are monitored and caught for the first time at several places in Western Europe. All the beetles were collected in the maize fields, which were situated in the neighbourhood of the airports, like Paris, Amsterdam, Brussels and London. The appearance of the *Diabrotica* beetles means that a research programme should be started. The main area with a high-risk is the monoculture maize and is situated in the east and southern part of the Netherlands. There are in total 35,000 hectare grain maize and 200,000 hectare silage maize grown in the Netherlands. Most of the maize is grown by cattle farmers, what means they grow maize for many years at the same field (monoculture), without any rotation system. Cattle farmers had more interest in animals, but less in growing plants. What means, that those farmers do not have the interest in the observation of *Diabrotica* beetles. Fields which are infected by *Diabrotica* should be destroyed, what mean the loss of the crop. This has the consequence that the roughage source production especially for dairy cattle shall decrease and a shortage of food can be expected for the following year.

The research programme should be focussed on:

- Chemical control by seedcoating with insecticides, to protect the roots and the seedling of the maize plants against the larvae in the first two months after sowing the seeds. This method has a low input of chemicals. This application with one insecticide should lead to the control of the *Diabrotica* and the wireworm (*Agriotes* spp.). Both are major pests in maize.
- Biological products, which are used as an anti-feedant or repellent.
- Entomophage nematodes as a biological agent applied, as a row application should be tested. This system could be of interest for the organic farmers.

The research should be focussed on the larvae stage of the western corn rootworm only. Field experiments with the adults should be carried out in fields with high population densities.

Studies of the harmfulness of the western corn rootworm (*Diabrotica virgifera virgifera*) in UKRAINE

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In 2001, the Western corn rootworm (WCR) was found for the first time in fields of the corn in Ukraine with the help of pheromone traps in the Transcarpathian Region. For the period 2002-2003, there were carried out a visual monitoring of plant damade by larvae and beetles and also catching of imagoes on diverse crops using glue traps with sex pheromones. These traps were able to catch both males and females. A small degree of pest colonization of plants let us to find plants with the traits of damage by the larvae (lodging, ulcerated roots) in the heading stage of a panicle and flowering of corncobs, when larvae have completed their feeding, pupated, and flight of imagoes began. The damaged corn plants within a field were disposed with small groups (10-18 pieces) and in the whole ones didn't exceed 10% overall number. In 2003, in July-August, the beetles were discovered visually on the corn plants. In so doing, their high density was marked in July 24-26. Then, the imagoes dispersed. In August, the beetles being on the corn plants disposed on the threads and naked seeds of corncobs (the milk stage) where they fed (Fig. 1. 2). It was stated that the corncobs of lodging plants, that were probably damaged by the larvae earlier, were colonized later on by the beetles in average in 78% with the number 2.98 adult per corncob. At that time the corncobs of closely situated undamaged by larvae plants were colonized by the beetles to a level 3.4% with the number of 0.09 adult per corncob (Table 1). Ratio of the females to males was 1:0.38. The damage degree of the corn plants by the beetles and larvae was insignificant because of low pest population density. The beetles were not found out visually on other species of crops (the haricot, pumpkin). The imagoes of the WCR were caught in the corn fields with sex pheromone traps. Their density increased year in year out: in 2001- only 6 adults, in average 0.17 beetles per trap for a season; in 2002 - 84 and 1.33; in 2003 - 656 and 10.09, correspondingly. In the traps to be settled in the fields of other crops (the sunflower, alfalfa, barley, winter wheat), the beetles were not caught.

Correlation between western corn rootworm damage and the development of secondary corn roots

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Since Western Corn Rootworm (*Diabrotica virgifera virgifera* LeConte) occurred in Croatia (1995), it became a very severe pest of corn, which can cause economic losses. In the last few years, in the county of Eastern Slavonia and Baranya, lots of cornfields had great percentages of lodged plants.

Our investigation was based on evaluation of corn tolerance against WCR. Measuring of the root size and its weighting are one of the main parameters for evaluation of the hybrid tolerance. Plants with better-developed secondary roots are able to give high yields even after WCR larvae feeding. The aim of this investigation was to evaluate the development of the secondary roots after WCR larval feeding.

The trials were done in USA (Iowa) and in Croatia (Gunja and Osijek) during three years (2001, 2002, and 2003). Nine Croatian (Institute of Agriculture, Osijek) and two Pioneer Hi-Bred Int. Inc. (Johnston, Iowa, USA) commercial corn hybrids were evaluated by using randomized complete block design with four replications. Secondary roots were evaluated by visual scale 1-6 (1 means the best and 6 is the worst), and evaluation was also measured by weighing (g) the root regrowth at Iowa plots.

Strong positive correlations were determined between weighting the roots in grams and visual scale, in Iowa, during all three years of investigations. Average regrow of the secondary roots between the two weightings (two weeks), were 12,06 g. The best hybrids were: OSSK 644, OSSK 596R, OSSK 617 and OSSK 602. Those hybrids were the most tolerant in investigation.

The results showed that visual scale is good for root regrowth evaluation and it can replace the evaluation by weighting roots, which means less of human work.

Diabrotica virgifera virgifera in the western part of the Friuli Venezia Giulia Region (North Eastern ITALY): First attempt of eradication-containment

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A monitoring network to survey the possibility of introduction of Western Corn Rootworm (WCR), *Diabrotica virgifera virgifera* LeConte, had been settled in the Friuli Venezia Giulia region since 1995. It covered the whole region and focused mainly on the areas more exposed to the pest introduction.

Up to 1996 monitoring was carried out by using yellow sticky trap (PhAM), some of which were baited by attractive substances (cucurbitacin). Afterwards more effective sexual pheromones traps (PAL) set up by Plant Protection Institute of Budapest (H) were employed.

In 2002 Western Friuli Venezia Giulia monitoring network (Pordenone district, about 30.000 ha of maize crops) was made of 78 traps located on maize monocultures fields.

Between 24th July and 4th September 2002 the first 31 specimens of WCR were found in monoculture maize fields, near Aviano USAF Air Base, not far from survey stations of previous years. After first records the net was reinforced at increasing distance from finding out places. Plant Protection Service adopted eradication measures immediately. Not later than 48 h after findings, concerned fields and other adjacent maize crops (about 230 ha) were sprayed on plant's top using 1,10 kg/ha of Dursban 75WG (chlorpyriphos ethyle, 75%). No other captures occurred after spraying insecticide.

On September 2002, the Plant Protection Service issued a specific rule defining a focus area (1.300 ha of cultivated land) and a corresponding safe area (3.500 ha of cultivated land). In the focus area the following binding phytosanitary measures were adopted: maize rotation (with limited exception for small part of the land of some dairy farms located at the border of the focus area), prohibition to move fresh parts of maize and soil of maize fields outside the area, prohibition to harvest maize grain before 1st October; treatment of all maize fields with an appropriate insecticide against adults of the species. These measures were adopted following the positive results obtained in similar conditions in the neighbouring Veneto region. The same phytosanitary measures were carried out by most of the farmers themselves for the safe area.

A specific rule was issued to support the economic losses caused by enforcement of phytosanitary measures of farms situated in the focus and safe areas. It provides 75 €/ha to cover spray costs and further 300 €/ha to partially cover the economic losses resulted from the forced crop rotation.

In 2003, the monitoring network was enforced: 116 pheromone PAL traps were spotted in the whole maize cultivated in the district, 84 of which located in the focus and safe areas. End June 2003, 22 new captures occurred: 19 were found between 25th June and 24th July, only in maize monoculture fields inside 2002 safe area and three specimens on 30th June in 2002 focus area (two in maize after soybean fields, one in a monoculture field allowed to be planted at the border of focus area). Moreover, in 2003, few days after first findings (from end June to late July), more than 1.000 ha of maize crops in focus area (190 ha, sequential other crops) and in safe area were sprayed with insecticide following the same procedure used in 2002. No WCR has been detected since End July 2003.

The positive results obtained in controlling the WCR population show the high efficiency of the phytosanitary measures adopted: in most part of focus area no population out-break occurred and no WCR capture was detected. Furthermore, the majority of WCR new records interested a very restricted area included inside 2002 safe area.

Unfortunately, in the summer of 2003 new conspicuous WCR foci appeared 30 km eastern, not far from the borderline between Friuli and Slovenia.

Initial spread by introduced *Diabrotica virgifera virgifera* towards maize fields

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In the late 1980s a new maize pest was accidentally introduced from North America into Serbia. Within 10 years, this invasive beetle, *Diabrotica virgifera virgifera* (Western Corn Rootworm, Coleoptera: Chrysomelidae), was rapidly spreading over Central Europe. Recently several new spots of isolated introductions were reported in Europe, such as in Lombardy (Italy), around Paris (France), Basel (France and Switzerland), Amsterdam (The Netherlands), and London (UK). Those multiple introductions rises the question on the process of initial spread of the beetles over non-native habitats towards maize, being one of the potential key factors behind the invasiveness of *D. v. virgifera*.

In order to investigate such an initial colonisation movement of *D. v. virgifera* adults from unfavourable areas into maize fields, mark release - recapture techniques were applied. Two non-maize areas were chosen as release areas of marked beetles in southern Hungary. Two maize plots were established 300 m apart from a centred release point. Moreover, all non-crop and crop habitats were recorded in longer distances around the release areas. For recapturing beetles, non-baited yellow sticky traps (Pherocon AM), were placed in three circles around the centred release point, totalling in 416 traps in each of the two study areas. About 12000 beetles were marked with fluorescence powder and released in each of the totally 5 releases. Every second to third day, beetles were recollected and their vectors of movement were recorded, i.e. distance and direction.

Preliminary results suggest, that *D. v. virgifera* is a very active flyer and is able to move over longer distances, however, no major vectors of directed flight were found. Together with the expected results in 2004 it will be possible to correlate *D. v. virgifera* movement to weather parameters and habitat structures such as maize, wheat, grassland, forests and others.

Acknowledgments for technical support to the Plant Health Service of Csongrad Country and the Hodmezogozda RT Agricultural Company, both placed in Hodmezovasarhely in Southern Hungary. The EU M. Curie Fellowship program (QLK5-CT-2002-51515) supported this study.

IPM of corn at silking stage with special regard to western corn rootworm (*Diabrotica virgifera virgifera)* adults and to cotton bollworm (*Helicoverpa armigera*) larvae in HUNGARY

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The western corn rootworm (*Diabrotica virgifera virgifera* LeConte) (*Coleoptera: Chrysomelidae*) and the cotton bollworm (*Helicoverpa armigera* Hübner) (*Lepidoptera: Noctuidae*) became the most important pests of corn in Hungary in the past ten years. The damage caused by these two pest species increases from year to year. The western corn rootworm adults feed on the silks, which impacts seed quality and quantity. The cotton bollworm larvae also chew the silks first, then feed on seeds under the husky leaves. *Fusarium* infestation may also occur on damaged seeds. Adult peak flight of the single generation of *D. virgifera virgifera* and that of the second generation of *H. armigera* is reported to overlap each other in course of the season. Therefore, these two pests should be managed together during the silking period as follows:

- Forecast;
- control decision (additive ETLs);
- consideration of short term options (application of parasitoids (*H.amigera*) and pesticides (*D.virgifera.virgifera.*);

In order to measure how long coincides the respective flight periods of *D. virgifera virgifera* and *H. armigera*, we monitored the seasonal flight pattern of *D. virgefera virgifera* by sticky yellow sheets (Pherocon AM), while *H. armigera* was monitored by sticky and funnel types of pheromone traps (Csalomon, Plant Protection Institute), in corn fields in South Hungary, in 2003.

We found that the flight of *H. armigera* peaked around July 10-20, and during this period the number of the western corn rootworm beetles were increasing, and tended to reach its maximum. Our poster will demonstrate overlapping of flight periods and control decision options in details.

Financially supported by a grant of the Hungarian National Science Foundation (OTKA T037355)

Thursday, 15 January, Poster Presentation 16:10h; LEFKO & BINNING

Characterization of Cry34Ab1/Cry35Ab1: Evaluating fitness effects on corn rootworm larvae during exposure to roots

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Bacillus thuringiensis strain PS149B1 produces binary insecticidal crystal proteins named Cry34Ab1/Cry35Ab1. This trait is under commercial development through a collaborative research effort between Pioneer Hi-Bred/DuPont and Dow AgroSciences LLC. Maize hybrids expressing Cry34Ab1/Cry35Ab1 insecticidal crystal proteins are being developed for control of larval stage corn rootworm. Effect of this trait on corn rootworm larvae was evaluated using a laboratory seedling assay system. This test system relies on measures of larval fitness over sequential sample points. Preliminary results suggest roots expressing Cry34Ab1/Cry35Ab1 are protected from damage by all instars. These findings and their implications for trait durability are discussed.

Thursday, 15 January, Poster Presentation 16:10h; AHMAD & WILDE

No adverse effect of Coleopteran-specific cry3Bb1 toxin released from root exudates and biomass of transgenic corn on earthworms

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Transgenic corn has been genetically modified to express Bt toxin (Cry3Bb1) in corn roots to control corn rootworm. Previous studies with other toxins suggest Bt toxin may be present in the root exudates or plant residue. If Bt toxin is released into the soil rhizosphere, it may affect other organisms that occur there. Two different greenhouse studies were conducted to determine the effect of root exudates and biomass on weight and mortality of earthworms, *Lumbricus terrestris* (Annelida: Lumbricidae). Preliminary results from these studies showed that there was no significant differences in weight (gm) and percent mortality of earthworms after 45 days in soil planted with Bt and non-Bt corn plants or after 45 days in soil contaminated with ground air dried biomass of Bt or non-Bt plants.

Persistence and seasonal population dynamics of entomopathogenic nematodes *Heterorhabditis bacteriophora* and *Steinernema feltiae*

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The establishment and persistence of entomopathogenic nematodes (Heterorhabditis bacteriophora and Steinernema feltiae) was investigated in organic agriculture. Nematodes were sprayed at a dose of 5x105 infective juveniles/m². *S. feltiae* was applied on red clover in October 2001 on an area of 18 x 500 m. In spring 2002 oats were sown. *H. bacteriophora* was applied on oil seed rape in October 2001. White clover was sown in autumn 2002. In June 2002 *H. bacteriophora* was again applied on field beans, which were followed by winter wheat. The latter nematode was always applied on an area of 9 x 500 m. To monitor the natural nematode population before and immediately after spraying, 100 soil samples per field of approximately 35 g (soil core of 2 cm diameter and 10 cm depth) were collected. Later samplings took 50 samples per field. The samples were transferred to 25°C and 2 last instars of *Galleria mellonella* were added for 3 days. Trapping of nematodes was replicated twice and the percentage of samples with nematodes was recorded. After the application in October 2001 the population of *H. bacteriophora* decreased to 50% and that of *S. feltiae* to 25% of the released amount. Both nematode populations applied in October 2001 disappeared during the winter and nematodes were again recorded during the summer until September and were than again detected at 2% positive samples in February 2003. A natural population of *H. bacteriophora* was never detected, but the released population invaded the neighbouring controls probably due to anthropological influence. As the occurrence of *S. feltiae* in the *H. bacteriophora* field did not differ from that in the field that was applied with *S. feltiae* we consider that the natural population was not suppressed by the introduction of *H. bacteriophora*. The establishment of *H. bacteriophora* in June 2002 in beans seemed to be more successful as over 50% of the samples were positive for H. *bacteriophora* in the following months. The population was quite frequently detected also during the winter. The beans suffered from an attack of *Sitona lineatus*, which could have supported the successful establishment. It cannot be concluded about an effect on the natural population of *S. feltiae* in this field because this species was not detected neither in the treated nor in the untreated areas.

REGENT® - a successful Fipronil product for *Diabrotica spp.* control

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Fipronil is currently the only commercialised member of the phenyl pyrazoles class of insecticides. Since its first registration in 1993 Fipronil has been proven to offer highly effective insect control at low dose against a broad range of economically important pests. Fipronil based products are registered in more than 70 countries for the control of insect pests in more than 100 crops.

Fipronil showed its potent insecticidal activity on Western corn rootworm (*Diabrotica virgifera virgifera* LeConte) in early greenhouse screening. Since then it was further developed for field applications and has EPA approval in the United States of America against *Diabrotica virgifera virgifera* and registration in Brazil against *Diabrotica speciosa* on maize.

In the field, good control of *Diabrotica virgifera virgifera* larvae is obtained with 100-200 g ai/ha applied either as granule or soil spray with in-furrow or band, at-planting application.

Fipronil also very well controls other soil insect pests such as wireworms (*Agriotes spp.),* grey weevil (*Tanymechus dilaticolis*), seedcorn maggots (*Hylemia spp.*), etc., when applied for corn rootworm control.

Numerous observations by farmers and users have shown an enhanced plant growth following a successful pest control which significantly could increase the crop yields.

Fipronil soil baits – a novel application to control wireworms (*Agriotes spp.*)

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The concept of fipronil soil baits is based on bringing the pest to the insecticide rather than the insecticide to the pest. Baits offer several advantages over conventional treatments including significantly reduced dose rates and lower environmental impact.

Fipronil is uniquely suited for the soil bait technology. The molecule is highly active by ingestion and different to many other insecticides, does not show repellency to insect pests.

Fipronil soil baits, proposed brand name: GOLDOR , are formulated as soil granules containing 0.5 % fipronil, a feeding attractant and some other formulation components. The application rate is lower compared to conventional uses and is depending on crop and application technique. Under field conditions the product provides excellent wireworm (*Agriotes spp.*) control when applied either with in-furrow or band, at-planting application. Fipronil soil baits show good residual activity, very good plant compatibility and a favourable environmental profile.

Damages caused to maize by larvae of western corn rootworm in 2000 following soya bean sowing in 1999 and maize sowing in 1998

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The combination of two crop (maize-soya bean) rotation in the moderate continental climate of the US maize growing region (Corn Belt) became insufficiently effective in control of western corn root worm *Diabrotica virgifera virgifera* LeConte (WCR) in the beginning of the last decade of the 20th century. When plant lodging and damages to maize were observed, it was considered that maize volunteer plants had been natural attractants and that WCR females had been attracted to lay eggs in soil under the soya bean crop. It was officially confirmed at the meeting of entomologists held in Chicago in 1995 that soya bean - maize rotation ceased to be an effective cultural practice in WCR control.

The analogous behaviour of WCR was established in our country by the first observations of eggs laid in soya bean crops and also in maize crops sown after soya bean.

This statement is based on results obtained for lodged plants in a demonstration trial with two sowing dates and a trial with two growing systems - soya bean-maize and wheat- soya bean-maize rotations. Imago flights were monitored by pheromone (PhT) and yellow sticky traps (YsT) placed in plots with the soya bean crop. Furthermore, the imago abundance is comparatively monitored in maize crops succeeding soya bean crops and in a long-term continuous cropping of maize.

In 2000, hybrids of FAO maturity groups 300-800, i.e. FAO maturity groups 100-200 were sown on April 15, i.e. May 15, respectively. Lodging was evaluated at the end of July and beginning of August. The number of imagoes was monitored by YsT and/or PhT traps during the growing season, and obtained data were grouped on the basis of the plant species and the crop rotation variant.

Results on plant lodging were classified according to the following:

- FAO groups: FAO 100-200 - 19 hybrids, 0.60% plants lodged, FAO 300-400 - 18 hybrids, 1.14% plants lodged, FAO 500-600 - 18 hybrids, 1.27% plants lodged, FAO 700-800 - 9 hybrids, 0.60% plants lodged
- properties: sweet maize - 1 hybrid, 8.11% plants lodged, popping maize - 3 hybrids, 33.92% plants lodged, prolific maize - 5 hybrids, 8.42% plants lodged
- sowing dates: regular date - April 15 - 60 hybrids, 3.76% plants lodged and delayed date - May 15 - 19 hybrids, 0.60% plants lodged.

Results on number of WCR beetles registered on YsT and PhT placed in the production crop of soya bean in 1998 indicate significant attractiveness for WCR beetles. Pheromone traps were also placed in the soya bean crop in 1999 and 2000. Obtained results on soya bean attractableness for WCR beetles show the following:

- Soya bean to maize ratio in the crop rotation amounted to 136: 140, i.e. almost 1:1; abundance index was 99.6
- The same ratio in long-term continuous cropping amounted to 136: 494, i.e. 1: 3.6, while abundance index was 27.5.

According to the gained results the following can be concluded:

- Results previously obtained on the effects of sowing dates on survival rates of larvae were confirmed. The later sowing the lower both survival rate of larvae and plant lodging.
- Attractableness of the production crop of soya bean for WCR beetles was at the level of maize crop attractableness in the maize-wheat rotation. Furthermore, damages on maize caused by WCR larvae were also observed in other locations in which soya bean preceded the maize crop.

Attractiveness of sweet maize hybrids to western corn rootworm (*Diabrotica virgifera virgifera* LeConte) beetles in the late and stubble crop sowing in 2003

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Sweet maize was sown on regular sowing dates (April to the mid-May) and both, its harvest maturity and harvest, occurred prior to mass migration of imagoes of Western corn rootworm (WCR). Late sowing dates or sowing of sweet maize as a stubble crop cause plant attractiveness to WCR beetles migrating in search for food. Considering that this production is performed under regular irrigation, beside greater plant attractiveness, soil is softer and more suitable for egg laying.

The aim of this study was to confirm effects of a hybrid and a sowing date on crop attractiveness to WCR imagoes and to estimate efficiency of four types of traps in the examination of the population and risk levels for the repeating maize sowing in the following year.

The plant test material consisted of five commercial sweet maize hybrids sown on two sowing dates. The following hybrids were sown on the first sowing date: Dallas (June 6 and 16), then Royalty, Empire and Boston (June 6). Dallas (July 4) and CLX (July 7) were sown on the second sowing date. Each hybrid was sown on the area of 10 ha. The trial was carried out under irrigation conditions on the plot of over 100 ha in the location of Ruski Krstur. The following traps were used to monitor attractiveness of the stated hybrids and their combinations with sowing dates: yellow Pherocon AM (YsT), then new pheromone traps (VARs♀♂) for both sexes and (VARs♂) just for males and cylindrical traps with cucurbitacine as an attractant. The traps were set on maize plants sown in June and on the 1.5-m stakes in the crop sown in July. The traps were set on August 11 (YsT and VARs♀♂), 12 (cucurbitacine) and 13 (VARs♂). The reading started the following day and ended on September 8. The first nine readings were carried out every day, and after the 9th day it was continued once a week. The cucurbitacine traps were replaced during each control, while the replacement of YsT & VARs traps was done once in two weeks.

A total of 265 WCR beetles were trapped during the first four weeks of monitoring. Out of this number, 221 WCR beetles were trapped in the hybrid CLX on VARs♂, 24 in the hybrid Royalty on VARs♀♂, i.e. 245 WCR beetles were trapped on the VARs traps. Twenty beetles were trapped on Pherocon AM traps, while not a single beetle was trapped on cucurbitacine traps. Two, i.e. eight beetles were trapped on YsT in the hybrid Dallas sown in June, i.e. July, respectively. On August 13, Dallas and Royalty sown in June were chemically treated against European corn borer. The chemical treatment undoubtedly affected the number reduction of trapped WCR beetles. Therefore, results obtained on hybrid attractiveness and effects of sowing dates could be considered only as the orientative data whose verification is necessary in the following years.

The dynamics of the WCR imago migration over weeks of monitoring was as follows: the first week (August 11-19): 75 or 28.3%, the second week (August 20-26): 89 or 33.6%, the third week (August 27-September 2): 41 or 15.5% and the fourth week (September 3-8): 60 or 22.6%.

As there were no data on efficiency of the cucurbitacine traps set in all hybrids for WCR beetles abundance monitoring, the results on differences in attractiveness were not obtained. The gained results on the number of beetles trapped on four traps confirm the efficiency of the Hungarian VARs traps. Even the lowest level of WCR beetles can be registered by these traps.

Thursday, 15 January, Poster Presentation 16:10h; GROZEA & LAUER

Development of *Diabrotica virgifera virgifera* LeConte adults in western plain conditions from ROMANIA

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The first adults of western corn rootworm (*Diabrotica virgifera virgifera* Le Conte) in Romania were discovered in a cornfield from Arad district (Nadlac) in 1996. In Timis district (western part of Romania) the first beetles were observed in 1997 (Deta) and the first damage occurred in 1999 in a monoculture cornfield. Since 1996, the pest has spread year by year in another counties from Romania; the main cause of spreading of this pest was cultivation of corn in monoculture on many hectares.

Because the first appearances of adults were registered in western part of country the researches regarding some aspects of biology of WCR it could be presented only in these places.

The other developmental stages of WCR (larvae, pupae, eggs) have been observed in next years. The larvae were observed on the maize roots from Timis district for the first time in July, in the year 2000. In soil samples collected from field in 2000, in August, eggs were found for the first time. The first observations of pupae in soil were made in 2002.

Researches carried out in Timis County in 2003 showed that adults were present from June 24 until September 22 in maize fields and they had two flight picks in July 15 (119 adults/trap) and August 1 (120 adults/trap), respectively. The males have appeared earlier than females with approximate 4-6 days. The females begin to lay eggs in June 30.

Larvae were found from beginning of May to beginning of August in soil. Pupae were observed from the end of June until the middle of August. These observations were made in monoculture cornfields. The larval and pupae populations were checked weekly.

Some of researches were carried out in laboratory conditions. The results showed that imago, larvae and pupae in laboratory emerged earlier than in field conditions. The adults were registered from May 15 until August 1 with a maximum flight in May 29. The larvae stage was observed from April 3 to June 6 and pupae from May 2 until June 24. Laying eggs in laboratory conditions began in May 30.

Comparing relative trapping efficacies of several *Diabrotica* rootworm beetle trap types in Illinois, USA

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A number of different trap designs for *Diabrotica spp.* (Col.:Chrysomelidae) (*D.v.v.*) are described in the literature. Some of them are commercially available; some can be put together on the spot with a minimum of dexterity, material, and cost. There is probably not anyone *optimal* trap for all different applications, all rootworm beetle species, different times within the growing season, different population densities, different crops, requirements of omnidirectionality, or stability in sunshine, wind, and rain. However, in our hands, a few trap designs clearly stood the test of time, both in terms of practicality, trapping efficacy, ease of handling, and costs.

Three trap types have been compared side by side during September of 2003 in Illinois late planted maize fields: 1. the cylindrical "Shaw vial trap" of 1984, 2. the conical sticky cup trap ("Metcalf trap") of 1988, and 3. the newly developed "*Intensive Rootworm Beetle Collection (IRC) trap*" of 2003. The trap design features will be depicted, and some of the results will be tabulated in the poster.

Briefly, all 3 trap types are rather inexpensive, are made from easily accessible materials, and will not require any special tools apart from hammer, drill, metal wire cutter, screw driver, scissors, glass pipettes, glue, insect adhesive, spatula (the latter for type 2 only), and specific lures. Types 1 and 3 are omnidirectional, type 2 can be modified to become fully omnidirectional. Given specific pheromone or kairomone lures, the 3 types have a surprisingly high degree of *specificity* for *Diabrotica spp.* The *relative* efficacy ratios of traps 1, 2, and 3 for adult WCR beetles can be characterized as:

1: 91: 23 for type 2 and 3 being baited with	MCA alone,
1: 36: 10	with MCA plus MPE,
1: 4: 3	with MPE alone, and
1: 11: 11	with *D.v.v.* sex pheromone alone.

MCA and MPE stand for the synthetic kairomone lures 4-methoxy-cinnamaldehyde and 4-methoxy-phenylethanol, resp., as developed by R.L.Metcalf and R.L.Lampman in 1988. Trap 3 is in the process of further development. Implications for population survey and *D.v.v.* management will be discussed.

Thursday, 15 January, Poster Presentation 16:10h; TOEPFER & KUHLMANN

Natural mortality factors acting on western corn rootworm populations

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The Western Corn Rootworm, *Diabrotica virgifera virgifera* LeConte, invaded Europe about 50 years later after its successful invasion into all North American maize growing areas. In order to successfully combat invasions, we need to thoroughly understand the population dynamics of this alien pest species in the invaded regions. This study focused on assessing natural mortality factors acting on life stages of *D. v. virgifera* by conducting life-table studies in Hungary in 2000 and 2002. This knowledge was used to rank the mortality factors regarding their intensity in reducing *D. v. virgifera* populations, and finally to discover key mortality factors acting on *D. v. virgifera* life stages and thereby influencing population growth.

In order to determine mortality factors during the overwintering period of the pest insect, several sets of eggs were exposed to winter conditions in the field and recollected during the following spring. In order to determine mortality factors among the larval instars and pupae, several sets of 50 maize plants were artificially infested in the field each year. Larval instars and pupae were recollected using soil-root samples, and stage-specific mortality factors were determined. Adult density was measured in 50 emergence cages covering artificially infested single plants in maize fields each year. The population density was compared between each developmental stage, and the apparent mortality of each stage was calculated to construct a life table for two generations of *D. v. virgifera.*

In summary, a total mortality of over 95 % during the life cycle of *D. v. virgifera* appears to be typical for this maize pest; however, its populations are still able to growth. Populations of *D. v. virgifera* were mainly reduced by mortality factors acting on the first instar stage and by not realising the potential fecundity. Nonetheless, large variations in the realisation of fecundity, in the overwintering mortality, and in the mortality of late larval instars resulted in the highest impact to influence population growth rates of *D. v. virgifera*.

We acknowledge for the technical support of the Plant Health Service of Csongrad Country in southern Hungary. The Bundesamt für Bildung und Wissenschaft (BBW), Switzerland, financed this work within the framework of the EU project DIABROTICA (QLK5-CT-1999-011110).

Capturing of western corn rootworm adults via Ukrainian and PHEROCON® AM sticky traps in Novi Sad and Belgrade in 2003

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A group of researches, working at the Ukrainian Scientific Plant Quarantine Station Boyani and the State Inspection of Plant Quarantine in cooperation with researchers from Novi Sad and Belgrade (Zemun Polje) tested several pheromone compounds, synthesised in Ukraine, in 2003. The aim of this study was to provide the possibility to monitor western corn rootworm (WCR) beetles (*Diabrotica virgifera virgifera* LeConte) on the Ukrainian territory. Efficiency testing of eight selected compounds in monitoring of WCR imagos was performed in two locations of Serbia: Novi Sand (NS) and Belgrade (Zemun Polje - ZP). The traps were placed in large-scale three- (ZP) and four- (NS) factorial trials with full season maize hybrids. Pherocone≤ AM yellow sticky traps (YsT) were used as a sticky plates to test eight (01, 05, 07, 10, 11, 12, 13 and 14), i.e. nine + № 7 pheromones made in Ukraine. One YsT and one Pheromone-Csalomon trap (PhT) were used as checks and/or standards. The traps were placed in ca. 20 and 30 m apart. Beetles were counted at three and four day intervals: from July 8th to September 23rd at ZP and from July 10th till the end of August in NS. Pherocone AM traps were replaced at two-week intervals, Ukrainian attractants every week, while PhT trap was replaced just once in NS, on August 17th and three times at ZP, on July 22nd, August 12th, and September 2nd.

A total of 1377 beetles or 172 beetles per trap were captured by Ukrainian attractants in Novi Sad for seven weeks. During the first three weeks of monitoring, a total of 145 beetles per trap or 6.9 beetles per day per trap were registered. A corresponding number of beetles amounted to 27.3 or 1 during four weeks of August. The total catch on standard variants with YsT and PhT traps amounted to 228 and 370 beetles per trap, respectively.

Data on efficiency of certain compounds according to the number of caught beetles in NS and ZP significantly differ. The differences between the number of captured WCR beetles on YsT without pheromones at ZP (13) and NS (228) could be attributed to the pheromones. An actual efficiency was registered in Novi Sad in two compounds (11 and 14), while the total number WCR beetles in other compounds on the traps with pheromone was smaller than on YsT traps with no pheromones.

ZP results indicate a definite, but much lower efficacy of each compound of Ukrainian pheromones, except № 11. This compound showed the best results in NS. Efficacy ranged from 6 in combinations 07 and 13, to 33 and 28 in combinations 12 and 05, respectively. A total of 370 and 712 beetles were caught on PhT in NS and ZP, respectively. The ratio between efficacy of Ukrainian pheromones and PhT as a standard ranged from 1:2.2 to 1:2.4 in NS, while this ratio at ZP amounted to 1:10.2 for the last year compound and to 1:21.6 for the variant 12.

It can be concluded that a significant difference in two locations was very much influenced by the level and genetically different background or different strains of WCR populations. Such hypotheses could be checked during the next year on the material previously collected.

The impact of areawide pest management on Carabids in Indiana/Illinois, USA

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The Areawide Pest Management Program (AWPMP) was carried out over a 6-year period in a 41.4 km^2 contiguous area located in Indiana and Illinois. The primary target of the program was the western corn rootworm (WCR), *Diabrotica virgifera virgifera* LeConte. This study was designed to test the feasibility of using semiochemical (cucurbitacins) insecticide-baits as the primary management tool for WCR on an areawide basis. Carbaryl, at 10% the normal rate, was used as the toxicant in the baits.

In the study area, the WCR has adapted to the corn/soybean rotation system by laying a significant number of eggs in soybean fields. This development has virtually eliminated crop rotation as an effective tool for managing this WCR "variant".

The AWPMP enlisted the partnership of 44 growers and approximately 4,658 ha of land under corn and soybean production. A 3,726-ha "managed" area was treated with an insecticide-bait whenever populations of rootworm beetles exceeded set levels. Several fields, either adjoining or within 3.22 km of the managed area, were also monitored for rootworm beetle populations; however, treatments were not applied. These fields comprised the control area. Comparisons between managed fields and control fields were used to determine the effectiveness of treatment applications.

In the first 3 years of the AWPMP, the behavior-modifying semiochemical bait, Slam®, was used. In the following 3 years, Invite® was used. Both are cucurbitacins, where as Slam was derived from the buffalo gourd, *Cucurbita foetidissima,* Invite was derived from the Hawkesbury watermelon, *Citrullus vulgaris.* Observations made in 2000 indicated that the Invite semiochemical insecticide-bait might be negatively impacting some non-target organisms. As a result, a study was undertaken in 2001-2002 to determine the impact of the bait on non-target organisms. The study was carried out in 8 fields (4 within the WCR managed area and 4 within the control area). Four sampling methods were utilized to gauge impact on non-targets; pitfall traps, sweep-net sampling, Pherocon® AM traps, and direct counts of non-targets on plants.

Although non-target data were taken on all sampling methods, primary emphasis was placed on collections from pitfall traps. Six pitfall traps were placed in each field. Carabid species (pooled) were the most abundant species observed. The data showed that significantly lower numbers of carabids were found within the managed area following treatment when compared to the control area. This indicates that the AWPMP had a negative effect on this non-target group. However, heavy rainfall confounded the results to some degree and the impact of rainfall on carabids needs to be examined. It is not known at this point whether the toxic effect observed was the result of the semiochemical alone, the combination of the semiochemical with the insecticide, the insecticide alone, or one of the previous in combination with rainfall. Additional studies need to be conducted to determine the exact cause(s).

Using augmentative biological control against an invasive maize pest in Europe: Testing susceptibility of *Diabrotica* to entomopathogenic nematodes

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The western corn rootworm, *Diabrotica virgifera virgifera* (LeConte) (Coleoptera: Chrysomelidae), was first introduced in Europe in 1992. It is considered a severe pest in maize production and causes high yield loss in infested areas every year. It spread at a rapid pace from Serbia throughout Central Europe, and is invading most of the major maize producing countries in Europe. The larvae of *Diabrotica* feed on the roots of maize plants, with high infestations of larvae causing significant physiological damage to the root system resulting in instability and lodging of the plants. In addition, adults feed on the cobs, silks and leaves, further contributing to the damage caused by these insects.

According to studies carried out in 2000 to 2002, no European natural enemies attacking *Diabrotica* larvae or adults have been reported. However, existing literature on biological control of the *Diabrotica* with entomopathogenic nematodes (EPNs) raises the possibility that nematodes could be implemented as potential biological control agents to suppress *Diabrotica* populations.

To assess the virulence of EPN strains, several European and eastern European nematode strains, supplied by the collaborating company *e-nema* GmbH, Raisdorf, Germany, were tested under quarantine laboratory conditions in order to evaluate their potential to attack *D. virgifera* larvae and adults. Since a high potential to successfully infest *Diabrotica* larvae has been found among the eight tested EPN strains, an implementation of EPN applications as a management tool for *Diabrotica* control in Europe appears to be possible. It might be economically feasible for smallholder Polenta maize production but also of economic interest for seed maize production in Europe. It is suggested that the most successful EPN strains, *H. bacteriophora* and *S. feltiae,* are further tested in the open field, most likely in Hungary, where economic infestations of *Diabrotica* beetles have been reported.

Evaluation of the potential efficiency of maize rotation with other crops on *Diabrotica virgifera virgifera* oviposition based on plant surface metabolite analyses

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The efficiency of crop rotation against *D. virgifera virgifera (D.v.v.)* populations is linked to the specificity of females to lay their eggs in cornfields and of larvae to feed on corn (*Z. mays* L.) roots. There was no problem in USA until the insect adapted himself to the rotation corn/soybean used in Illinois. As the insect has been introduced in Europe an important question was to evaluate the risk of oviposition out of cornfields and the efficiency of corn rotation as a pest management.

Feeding and orientation of *D.v.v.* and sensorial physiology experiments in USA showed that the insect is stimulated by sugars and some free amino acids. In our laboratory we demonstrated that these metabolites are present on the plant surface by passing through the cuticle. Corn leaf surface washings stimulate oviposition of *D.v.v.* (wild insects from Hungary). The leaf washings of vegetative stages (V8, V14-15 BBCH)) from two hybrids (Borbala and LG 2447) were less stimulant than VT and R3 stages. PCA (principal component analyze) based on soluble carbohydrate and free amino-acid quantities and ratios present in the leaf surface washings of the different corn stages cultivated in 2001 discriminate the stages in a similar way as *D.v.v.* for oviposition.

Assuming the hypothesis that these primary metabolites may be concerned in the *D.v.v.* oviposition we analyzed these metabolites in leaf surface washings of different crops at several stages on the whole plants. Plant crops and growth stages chosen were those which may be present during the period of *D.v.v.* oviposition in Hungarian fields studied simultaneously by Pr Kiss J.: for corn *Borbala* at V 8-9, VT, R3, R4 (BBCH) stages, *LG 2447*: V8-9, VT, R3; for soybean: *Borostyan* and *Urloa* varieties at 70, 76, 80 (BBCH) growth stages; for winter wheat *Audace* variety, 22-23 growth stages (BBCH); for sunflower variety *Sunrisa* 75 growth stage (BBCH).

Results on year 2002 showed clearly that the quantities of 18 metabolites present on leaf surface discriminate corn whatever the growth stages from sunflower and winter wheat (axe 1: 71.9%, axe 2: 15% of the explanation). Soybean at the stage 80 is not discriminated from corn. Within corn growth stages we can say that those, which stimulate D.v.v. oviposition, are still separated from the others as in 2001.

Surprisingly free amino acids do not discriminate corn from soybean 80. Our experience on composition of leaf surface washings showed that they usually permit to discriminate plant species one to the others. This may be an explanation of *D.v.v.* host shift for oviposition from corn to corn and soybean...

The results corroborate those obtained by Pr Kiss J. in rotation essays in Hungary. They showed that the insect present in this country, prefer to lay eggs in corn but according to the season period may lay eggs in other crops (in less number). This is also demonstrated by damages of corn after rotations observed in 2003 in Hungary.

We did not still demonstrate that these metabolites are the key factors for *D.v.v.* oviposition. When this step will be reached it would be rather useful to analyze them on different crops for prediction of rotation success against *D.v.v.* as a pest management.

Nutritional ecology of *Diabrotica virgifera virgifera* LeConte in Europe

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A thorough understanding of the ecological background is mandatory for a successful management of invasive species. The nutritional ecology is one of the key factors in invasive herbivore insect pests. In the case of the invasion of Europe by the Western Corn Rootworm *Diabrotica virgifera virgifera* the relationship of this maize pest to European varieties of its main host plant maize as well as to alternative hosts that occur in its new expansion range needed to be investigated.

We therefore studied the impact of maize varieties from different European countries as well as monocot weeds and crops on the larval development. Significant differences were found with regard to larval weight gain, amount of ingested food and food conversion efficiency on the various hosts tested. Biochemical parameters such as the C/N ratio and phytosterols were used to explain the differences in larval performance. Moreover, we compiled the information on the nutritional ecology in North America and compare the potential host plant spectrum of WCR in North America and Europe. Based on these data sets we will discuss management strategies for WCR in Europe.

Friday, 16 January, 9:20h; TURLINGS & RASMANN

Below-ground herbivory affects above-ground tritrophic interactions

Ted TURLINGS & Sergio RASMANN

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The release of volatiles by plants in response to insect attack can function as an indirect plant defence by attracting natural enemies of the herbivores. Such tritrophic interactions have been studied for simplified systems with the plant usually being attacked by just one herbivore. Under natural conditions plants are likely to be attacked by multiple antagonists, each of which may induce a specific plant response and potentially affect the emission of volatile signals.

We studied the consequence of a simultaneous attack of maize plants by an above- and a below-ground herbivore for the production of induced leaf volatiles and their attractiveness for the parasitoid *Cotesia marginiventris*. The common maize pests *Spodoptera littoralis* and *Diabrotica virgifera virgifera* served as the respective above- and below-ground herbivores. *C. marginiventris* is highly attracted to volatiles emitted by maize plants under *Spodoptera* attack. Olfactometer assays in which wasps were given a choice between the odours of singly (*Spodoptera* only) and doubly (both herbivores) infested plants revealed that the wasps' responses largely depended on their previous experiences with the odours. Wasps that had oviposited in a host on a singly infested plant afterwards significantly preferred the odour of such a plant, whereas naïve wasps and wasps with an oviposition experience on doubly infested plants did not show a preference. This first demonstration of an effect of below-ground herbivory on above-ground tritrophic interactions corroborates the complexity of plant-insect interactions and the experience-dependent responses illustrate the adaptability of natural enemies to deal with this complexity.

Friday, 16 January, 9:40h; RASMANN & TURLINGS

New tools to study below ground tritrophic interactions – The example of *Diabrotica virgifera virgifera* (Le Conte).

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Plants under attack by arthropod herbivores have been shown to employ a strategy of indirect defence by attracting natural enemies of the herbivores. Such interactions may also occur below ground when insects-damaged roots release compounds that attract entomophatogenic nematodes.

We investigated this for maize plants under attack by larvae of *Diabrotica virgifera virgifera*. With the use of a newly developed below ground olfactometer we found that the nematode *Heterorhabditis megidis* was highly attracted to *Diabrotica*-damaged maize roots, compared to mechanically damaged roots or healthy roots. Additional experiments showed that water extracts of *D.v.virgifera* damaged roots are also very attractive, indicating that the roots release a compound or a blend of compounds in the soil and that these compounds are used by entomopathogenic nematodes to locate phytophagous larvae near the roots. Interestingly, there are dramatic differences in the attractiveness between different maize lines, suggesting a different response of the plants under attack. The identification of these below ground plant signals should help us enhance the efficacy of nematodes as biological control agents against *Diabrotica*.

Discovery of an inhibitor of response to pheromone in western corn rootworm and study of possible interactions between the pheromonal and kairomonal communication channels

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Compounds closely related structurally to the WCR pheromone molecule were screened for biological activity in the field, presented alone or in combination with the pheromone. None of the compounds showed attraction when presented alone. However, when presented in combination with the pheromone, catches in traps containing 8-methyldecane-2-yl acetate as a second component were dramatically reduced, suggesting strong inhibitory activity for this compound. To our knowledge this is the first discovery of an inhibitor of response to pheromone in WCR. 8-Methyldecane-2-yl acetate is a sex attractant of *Diabrotica cristata* (Guss et al, 1983, Environ. Entomol. 12:1296-1297) so its inhibitory activity towards males of WCR may reflect a role in maintaining reproductive isolation among the two taxa.

In case the inhibitory effect was a result of general repellence, by presenting the new inhibitor together with the floral WCR lure males could be repelled, resulting in more selective female captures. When testing this hypothesis however, the presence of the inhibitor in the same trap together with the floral bait did not influence male catches, suggesting that the inhibitor might exert its action through interference with the perception of the pheromone molecule. Our results suggested that in this respect there was no interaction between the pheromonal and floral channels of chemical communication in WCR. This supported our earlier findings, where we failed to show out any interference in male captures when pheromone and floral baits were placed together in one trap.

Since the above results indicated a total independence of the two communication channels, as supplementary data we recorded the daily rhythm of beetle responses towards the floral and the pheromonal WCR baits, resp. Mean hourly captures at the floral bait occurred exclusively during daytime hours. On the other hand, captures at the pheromone bait were recorded also well into the night. These supplementary observations support the idea that there is no interaction whatsoever between the pheromonal and kairomonal chemical communication channels in WCR.

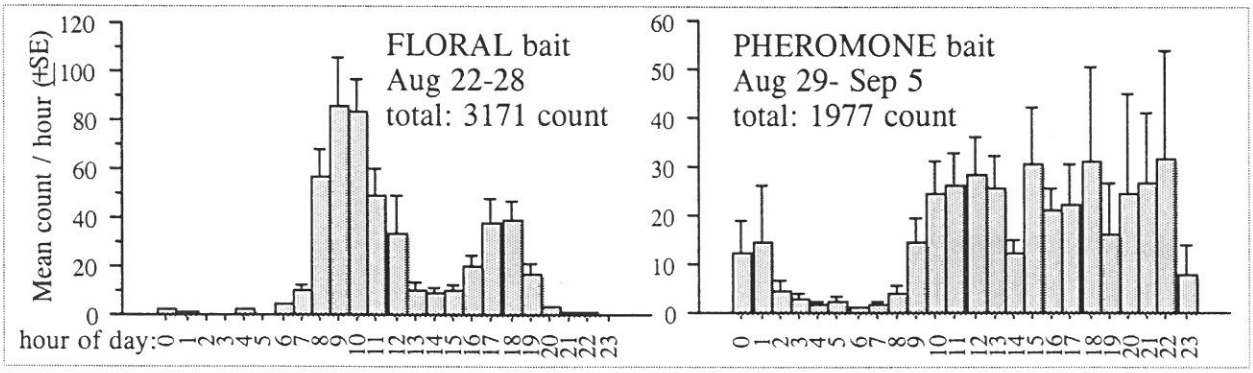

Fig. Mean hourly catches of WCR in floral- or pheromone-baited traps as recorded by an automatically counting trapping device in Hungary (Szekszárd, Tolna county, 2003)

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Friday, 16 January, 10:50h; ELLSBURY & LEE

Supercooling capacity and chilling mortality in corn rootworm eggs

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Oviposition by northern corn rootworms, *Diabrotica barberi* Smith and Lawrence, and western corn rootworms, *Diabrotica virgifera virgifera* LeConte (Coleoptera: Chrysomelidae), key pests of corn in the Great Plains of the United States occurs in the soil during late summer. Overwintering eggs are exposed to variable soil moisture and temperature below –5 °C. Winter mortality of eggs in the soil is a primary factor that determines the potential for larval injury to corn the following spring.

The objectives of our studies were to determine the comparative supercooling capacities of northern and western corn rootworm eggs and to assess egg mortality following brief exposure to extreme cold temperature, ranging from –12.0 to –21.5 °C, under three moisture regimes. Cohorts of 200 eggs for each rootworm species were placed on 7-cm filter paper discs and distilled water was applied to simulate a variable soil moisture environment. Mean ± s.e. moisture content (% wet mass) of eggs was determined for both species. Eggs subjected to a one-hour exposure to subzero temperature treatments were incubated at 25 °C to determine hatching rates. Supercooling points were determined for egg cohorts subjected to moisture treatments. Groups of three to five eggs from each moisture treatment were attached to the tips of 36-gauge copper-constantan thermocouples with a light coating of petroleum jelly and positioned in two nested 10-ml disposable pipette tips. Pipette tips with thermocouples and eggs were placed in a refrigerated ethanol bath that was initially set at 0 °C, and cooled at 1.5 °C per min until all eggs froze. The temperature at which an exotherm was first detected was recorded as the supercooling point.

Eggs of northern corn rootworm supercooled to a temperature as low as –27 °C and survived supercooling to a greater extent than did western corn rootworm eggs. Moisture treatment prior to supercooling had little effect on northern corn rootworm eggs. Western corn rootworm eggs were more resistant than northern corn rootworm eggs to effects of desiccation followed by supercooling. Survival of northern corn rootworm eggs was better than western corn rootworms under dry conditions, followed by exposure to temperatures of –12.0 and –17.5 °C, but was very low at –21.5 °C, regardless of moisture regime.

Results suggest that moisture and temperature may interact in the soil environment to determine overwintering survival of corn rootworms. It is evident from these studies that both rootworm species experience mortality at temperatures well above the supercooling points of the eggs, but that differences exist in the effects of substrate moisture treatments on the cold-hardiness of eggs from the two species.

Friday, 16 January, 11:10h; FRENCH

Spatial distribution of *Diabrotica* in the South Dakota areawide management site

B. Wade FRENCH

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Western corn rootworms (WCR, *Diabrotica virgifera virgifera* LeConte) are serious economic pests of maize (*Zea mays* L.) in the U.S. Corn Belt, and have adapted to traditional management strategies such as crop rotation and insecticides. Even so, soil insecticides often are used indiscriminately to control WCR. In order to minimize the use of insecticides and protect the environment, the United States Department of Agriculture, Agricultural Research Service implemented a corn rootworm areawide pest management program in 1996. This program was established in five geographic locations, four in the U. S. Corn Belt (Iowa, Illinois/Indiana, Kansas, and South Dakota) and one in Texas.

We used Geographical Information Systems (GIS) to study the spatial relationships of WCR in the South Dakota Areawide Management Site from 1997 – 2001. Each field was georeferenced using global positioning systems (GPS). Pherocon AM yellow sticky traps were used to capture WCR. We also used GPS to georeference all sticky traps. For each year, we calculated landscape metrics on continuous maize, first year maize, and all maize. These metrics included number of patches, percent of landscape, cumulative area, mean area, proximity index, and nearest neighbor distance. Based on WCR captured in the sticky traps, we used the inverse distance weighted interpolation technique to create raster map layers of WCR spatial distribution, and focused our analyses on the interpolated maps in relation to topography, soil type, crop type, and landscape metrics.

We found significant relationships of WCR spatial distribution with crop type, soil type, and elevation. We also found significant correlations of WCR distribution with several landscape metrics. Our research emphasizes the potential role for GIS and landscape analyses in insect pest management. Larger geographic areas can easily be incorporated into GIS and managed by finding patterns in the landscape that promote high pest population densities.

Friday, 16 January, 11:30h; BAUFELD & ENZIAN

Transboundary spreading scenarios of western corn rootworm for FRANCE, SWITZERLAND and GERMANY under the new situation

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The dispersal rate of the Western corn rootworm (WCR) in Europe was analysed starting with the introduction to Serbia in the beginning of the 90ies. The dispersal rates of the WCR differed from year to year. The spreading of the WCR ranged from 60 to 100 km per year without and from 0 to 37 km with containment measures (FAO programme TCP/RER/6712). The simulation model used as average a maximum spreading rate of the population of the WCR of 80 km per year without and of 20 km per year with containment measures. The maximum spreading rate is reached by WCR in the succeeding year only if continuous maize is available in the infested area. The concentration of maize in crop rotation is the main factor in the simulation model. In case of low maize concentration, the multiplication factor and spreading pressure are very low. In that case we reduced the spreading rate by a correction factor **K** which is defined as follows: In case of >= 50 % of maize in crop rotation **K = 1** and

in case of < 50 % of maize in crop rotation: $$\mathbf{K} = \frac{\textbf{concentration of maize in \% x 2}}{\textbf{100}}$$

The following formula was used in the simulation model to calculate the spreading rate of the WCR:

AR = FD x K

where **AR** = spreading rate of the WCR

FD = distance of flight with (20 km/year) or without containment measures (80 km/year)

K = correction factor (see above)

Furthermore, the topography was analysed in the infested areas of Southeast Europe. Analysis showed that the WCR is not able to fly regularly above altitudes of 900 m, which was considered in the simulation model. The lowest mountain chain in Western Europe is up to 800 m and has valleys (often with maize) which favour progressive dispersal. Tunnels (like in Switzerland) could have also an influence on the spread but were not considered.

All information is utilised in the simulation model on the spreading of the WCR. Calculations are carried out on the basis of GIS software ArcView/ArcInfo. The model was used to simulate the spreading rate of WCR over ten years. Starting from the newly infested location Blotzheim, near airport Basel-Mulhouse (located 4.7 km from Germany and 4.8 km from Switzerland), in Alsace (France) in 2003, the spread was simulated with and without containment measures („natural spread"). Simulation showed the dramatically ongoing spread, despite the borders of France, Switzerland and Germany, along the high concentration of maize in Alsace and in the Rhine valley in Baden-Wuerttemberg without any measures. In this region WCR find ideal conditions for multiplication, and the spreading pressure would be high in case of failure of eradication. On the other hand containment measures would significantly reduce the ongoing of the spread according to simulations.

Geostatistical analyses of distributions of *Diabrotica virgifera virgifera* within maize fields in Central Europe

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Recently, the chrysomelid *Diabrotica virgifera virgifera* LeConte became a serious pest in European maize production, and farmers or researchers have to measure its population dynamics for pest forecasting or analysing economic thresholds. Both often face the problem of clumped distributions of *D. v. virgifera* larvae in the soil as well as of adults on the maize plants in a field. Reasons for such clumped distributions might be (a) spatial differences in the soil conditions of a field that influence oviposition, larval movement, and mortality or (b) spatial vegetation patterns, that influence search for food and choice of oviposition sites by adults.

In this three-year study, the influence of spatial soil and vegetational parameters on the distribution of *D. v. virgifera* larvae and adults was investigated in continuous maize fields in southern Hungary. Larval distributions were analysed by determining numbers of larvae in four randomly taken soil-root samples in each of 24 plots (12 x 12m) of each maize field. Adult distribution was measured by visually searching for beetles at four randomly chosen maize plants in the same plots once a week. Soil bulk density and soil humidity were determined twice in four randomly taken soil cores in the same plots. Total numbers of plants and plant species, the vegetation coverage, and densities of each weed species were recorded in 5 rows of each of the 24 maize plots in each field.

Neither a correlation between the distribution of *D. v. virgifera* larvae and the distribution of adult *D. v. virgifera* of the previous year, nor a correlation of larval distributions between subsequent years was found. Adults of *D. v. virgifera* were mainly found in maize plots, where higher larval densities also were recorded in early summer of the same year.

The distribution of *D. v. virgifera* larvae showed that lower numbers were correlated with higher soil bulk density. The larval distribution was correlated neither with the soil humidity distribution nor with the vegetation parameters in the studied field. The adult distribution was not correlated with the soil humidity or bulk density or distribution of vegetation parameters.

We acknowledge the technical support of Szucs Marianna and the Plant Health Service of Csongrad Country in southern Hungary. The BBW Switzerland financed this work within the framework of the EU project DIABROTICA (QLK5-CT-1999-011110).

Friday, 16 January, 12.10h; VOS

IPM knowledge transfer – current developments and needs in farmer training for IPM implementation

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To become successful producers, farmers need access to information that helps them make better and more open choices about their own livelihoods. Globalisation poses a threat to smallholders unless they get more effective support in accessing new technologies and markets, and in meeting new standards of quality and reliability. The extension role needs to move towards a mode ranging from advice and training on specific technologies to facilitation in relation to technologies (e.g. improved access) but also in relation to a wider service context (including credit, input supply, processing, marketing). The research role needs to be linked and move towards a mode of seeking to solve farmers' problems and addressing their needs. Examples are given of tackling pest problems through farmer participatory training modes. Farmer Participatory Training (FPT) focuses on transfer of knowledge through discovery learning, facilitated by field staff from extension or elsewhere. Farmer Participatory Research (FPR) focuses on knowledge generation through novel farmer experimentation, with resource persons and facilitators. The focus in FPR is on meeting farmers' needs and demands in appropriate knowledge generation through local technology development and/or validation. The focus of knowledge transfer and generation is indirectly to achieve food security in the widest sense, but first and foremost to improve smallholder producers' livelihoods. Impact assessments of participatory training programmes show more stable production with improved product quality and increase in farmers' incomes. However, for these programmes to move beyond pilot stages, it is concluded that a wider focus would be needed to involve more stakeholders in the IPM knowledge system.

Friday, 16 January, 13:30h; KISS

IPM for western corn rootworm in Central and Eastern Europe: FAO GTFS/RER/017/ITA project

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The first detection, spread and population build-up of Western Corn Rootworm (*Diabrotica virgifera virgifera* LeConte, WCR) in Europe resulted in broad regional cooperation activities among scientific communities, governmental organizations, countries and individuals in recent years. Regional activities (FAO TCP 6712 A project 1997-1999, EU-5 R&D Project 2000-2003, EU-5 Marie Curie Fellowship 2003-2005) and national inputs generated significant bulk of knowledge on WCR. The question is now how farmers in Europe have access to this new information, and how they can interpret and adapt available information to their regional/local farming conditions? This challenge is particularly high in Central and Eastern Europe. In a broader political and socio-economic context, this region is in a transition phase affecting the agricultural sector, i.e. the corn production in terms of management practices, people's participation and their role in corn production phase, and their access to the market. Currently an extremely wide range of farm sizes and management structures are present in the region. However, the Central and Eastern European countries are restructuring their agricultural sector, new roles of stakeholders are emerging and new skills are required for decision making in rapidly changing environment. Farmers in this region are more exposed to the risk caused by WCR as very limited services are provided for farmers and for national institutions. The involvement of people and communities in developing their future strategies is particularly weak in systems of former top-down operation.

Prior activities (WCR monitoring, pilot farmers training) conducted in the region under Letters of Agreement with the Food and Agriculture Organization of the United Nations served for developing a broad IPM program from 2000 to 2002. This new program was elaborated and submitted while the project documents were officially signed by the representatives of donor (Government of Italy), of FAO and of the Recipient Governments (Bosnia-Herzegovina, of Bulgaria, Croatia, Hungary, Romania, Serbia and Montenegro and Slovak Republic) and entered into force on 16 July 2003. The overall development objective of this three-year project is:

"Corn production in Europe protected from losses in production caused by WCR through the development and implementation of IPM strategies by farmers, based on sound understanding of local agro-ecosystems and protection of local biodiversity as the main element of sustainability of agricultural production".

Thematic working areas of the project are:

- Participatory research and training in farmer field schools;
- WCR monitoring and IPM development;
- Bio-diversity studies;
- Socio-economic and policy studies.

Immediate objectives of the project are:

- To establish a participatory training and research program in farmer field schools;
- To achieve better understanding of WCR spread and biology in Europe;
- To achieve better understanding of different components of local agro-biodiversity;
- To obtain better understanding of socio-economic aspects.

The project implementation has already started in the 2003-year corn-growing season. National Project Leaders (NPLs) and National Training Coordinators (NTCs) in each country were responsible for the local implementation under the Regional Coordinator with assistance of national and international consultants and with the technical and operational backstopping from relevant FAO Units. The Regional Steering Committee is the governing body of the project.

The project has made a significant progress in the first year. Developing of farmers training and research as well as of participatory WCR monitoring activities will be presented by NPLs and NTCs (see other abstracts).

Friday, 16 January, 13:50h; BAZOK & IGRC BARCIC

Principles and the experience of the farmers field school approach in CROATIA

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Within the frame of the FAO project, based on FFS methodology, three FFS groups in Croatia were formed. Two groups were located in highly infested area of Croatia, one group was located on the west line of the spread of the pest. Each group was meeting together with a facilitator every 10 days. Work in each group was conducted in 3 subgroups. Groups conducted small studies on their experimental fields.

Following studies were conducted: a) Impact of different hybrids on WCR population density and damages; b) Impact of different previous crops on WCR population density and damages; c) WCR population density and biology

Every 10 days farmers together with a facilitator observed plant development stage, presence of the weeds, natural enemies, other pests and all data related to the WCR and conducted study. At the end of the season farmers collected all data from experimental field, analyzed their study and made final conclusions. Study results in Topolje and Tovarnik showed to farmers that between 3 hybrids, which were used in trials, no high difference in the WCR larval population and damages occurred. Farmer's could conclude that used hybrids didn't show different tolerance on WCR larval attack. In Tovarnik hybrid Bc 566 showed highest root damage than other 2 hybrids. In Topolje hybrid Bc 544 showed lower root damage than other 2 hybrids. Also on all 3 treatments number of beetles on yellow sticky traps didn't differ. Some of used hybrids are not very common in the region of Slavonija and Baranja because they have short vegetation (FAO group 400). Farmer's could see that in extreme climatic conditions yield on FAO 400 hybrids didn't differ from yield on FAO 500 and FAO 600 hybrids. Farmer's from Tovarnik were able to see from the results of the 2nd study that WCR larvae were present on corn roots only if corn was previous crop. They also didn't find WCR larval damages on corn roots if sunflower or wheat were the previous crops. They found WCR adults on all three observed fields. On corn after corn and corn after sunflower number of beetles was similar while on corn after wheat number of beetles was lower than on previous 2 fields. Farmers from Rugvica region found WCR adults in the field where WCR wasn't present in 2002. They found beetles in both, continuous cornfield and in cornfield after wheat. They also found beetles in both fields located in previously infested area. They didn't find WCR larvae and larval damage.

Except of the main study farmers together with a facilitator and with resource persons discussed different special topics as were: Plant nutrition, corn production, natural enemies and their impact on WCR population density, other corn pests, problems of weeds in corn etc.

FFS from Croatia were conducted in-country and regional exchange visits. The main principle of the exchange visit is for the farmers to exchange their experiences in FFS work and in a wide range of their problems related to the WCR and corn production.

Farmers improved their knowledge about the pest, its biology and ecology. They became familiar with methods of monitoring WCR population level for the purpose of monitoring (Rugvica region) and also for the purpose of predicting damages in next year (Tovarnik and Topolje). They became familiar with the methods of damage evaluation, collected beneficial fauna from Barber's pots and realized the importance of beneficial insects in soil. Farmer's also collected beneficial insects and pests on the plants and they realized their importance in corn ecosystem.

Problems and questions from all conducted activities encountered are: a) number of the group members; b) how to move special topics in the field; c) motivation of the farmers; d) how to get feedback from the farmers; e) how to find future facilitator, how to train them and how to improve facilitation skills; f) sustainability of the project. There is a need to continue to work with the same groups of farmers. Most farmers are willing to continue the work and they already have showed interest in some topics.

Activities were carried out under the FAO GTFS/RER/017/ITA project.

Friday, 16 January, 14:05h; KOMAROMI & KISS

Participatory training with farmers for IPM of western corn rootworm in HUNGARY: Training methods and outcomes

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In Hungary farmers are often approached by seed and chemical companies, private extension specialists offering solutions in pest control, and therefore farmers' knowledge and decision is often only based on this information. For this reason their knowledge is one-sided, and they often consider chemical control as the only solution in pest control, and in particular against the invasive western corn rootworm (*Diabrotica virgifera virgifera* LeConte). Moreover, farmers are not closely connected to ongoing research projects on alternative control strategies for IPM in maize, resulting in a lack of information transfer, what makes farmers reluctant to accept those strategies. Farmer Field Schools are a tool to overcome this problem as they focus on the education of farmers, by using non-formal education and participatory approach. The aim of such approach is to enhance farmers' knowledge and to make them thinking about several solutions for pest control and management in maize including the whole agro-ecosystem.

In Hungary, totally eight Farmer Field Schools were organised in 2003 under the ongoing GTFS/RER/017/ITA project in regions where western corn rootworm populations are well established. About 120 farmers were participating in trainings, and 50% of farmers were present on more than 60% of the meetings. The training of farmers started in March, and the last (evaluation) meeting was in October or November. The farmers expressed their interest for continuing this type of training for the future, including the winter time period.

The studies were mainly focusing on:

1. The effect of crop rotation on the WCR population;
2. The efficacy of soil and foliar insecticide application on WCR population and damage (based on farmers interest);
3. WCR population shift to other crop stands than maize and its importance for crop rotation.

In all FFS the training focused on learning the morphology, biology and damage of maize pests and how to monitor population build-up of pests. Farmers were trained to focus on the biodiversity in the corn stand, and they were leaded towards understanding the role of different elements of the agro-ecosystem.

When the training program started, such approach was strange for the farmers, and they were asking for immediate solutions for their different problems in maize production. As the program was running and developing, they started to ask questions based on their observations. With participatory methodology several questions were answered by them. Furthermore farmers became more open minded, started to come up with new ideas what we have to focus on, and where starting to find own solutions for their specific problems on their own farm. Next year farmers' research can be established based on the farmers ideas and needs and FFS will be increased up to 18 groups.

In summary, the farmer field schools are a good tool that can contribute to develop long-term management options in maize production, since farmers will be able to search for alternative solutions on their specific local requests and problems, and will understand and accept the idea of integrated pest management in maize. As farmer field schools against western corn rootworm are running in many Central and Eastern European countries, their outcome will help to reduce the pest populations and economic damages in the region.

Supported by FAO GTFS/RER/017/ITA Project

Friday, 16 January, 14:20h; KARIC & FESTIC

Organization of farmers field school in BOSNIA and HERZEGOVINA

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Western Corn Rootworm (*Diabrotica virgifera virgifera* Le Conte) is registered in B&H first time 1997. From that year until now WCR is registered almost at 1/3 of B&H territory. It has specially spread in the North and East part of B&H where are about 70% of our cornfields. There are only some smaller corn areas in Central and Western part of B&H, which are not infested by WCR. There has been permanent monitoring process from 1997 and it is primary concentrate on pest spreading and pests population density arising. There have not been registered economic damages caused by WCR until now but increasing of pest population density almost reaches critical value. It means that in case of repeated corn sowing possibilities for economic damages arise.

WCR is a new pest in B&H and there has not been much knowledge about it. When it was noted the first time on our territory, we immediately started farmers training about WCR. In the beginning training included lectures and visits to corn fields as well as further training which was more concentrate on visits to WCR infested corn fields. This training grew into Farmers Field School (FFS) during 2003 trough FAO Pilot Project in B&H. Training during this year has showed great farmers interest to learn more about this pest and ways for corn protection as well as for further training. We started FFS quite late in 2003 but we had success to realize 95% of jobs planed through Project. Also we solved many problems, which showed during this first year of Project. We established 4 farmers groups with 12-15 farmers in each of them on different territories of B&H during 2003. First of all we chose locations where we should do monitoring, then we chose one facilitator for each location and each facilitator established one farmer group and worked with that farmers group during whole corn season. This work was mainly done trough ordinary groups meetings, which was organized by facilitator every 10-15 days. There were 13-14 meetings of each farmers group. National Program Leader and National Training Coordinator took part during first meeting of each farmers group and also visited each group once more during season. This second visit was organized with intention to check and solve troubles, which appeared during monitoring. Also we organized and gave farmers the chance to visit each other to exchange their experiences. In our opinion this working method showed very good results. Farmers visit to farmers in Croatia was even more useful. Our main goal in this Project was to give farmers in B&H chance to learn more: about WCR, about methods, which could stop WCR spreading and population arising and also about methods for WCR possible suppressing. But we have to point that our farmers also learned more about field experiments and how important they are. Farmers also learned more about other agricultural matters as the importance of optimal sawing time, crops rotation, right choosing of culture-hybrid, irrigation, and weed protection.

We can conclude that results, which we got through this Project during 2003, were very good especially if we talk about Project implementation, organization, farmers' interest for Project and farmers participating in field experiments.

The work was conducted under the FAO GTFS/RER/017/ITA Project.

Friday, 16 January, 14:35h; STANKOVIC & SIVCEV

IPM for western corn rootworm participatory training through famer field school in SERBIA

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Introduction: FFS activities in Serbia, under FAO project "IPM on WCR in ECE", were held in five villages. Each village has a history of WCR presence and damages on corn. FFS and NFE had significant impact for corn producers. Through FFS farmers get basic information on WCR and IPM at the beginning followed by more specific activities and topics. New approach in farmer's education – NFE and participatory training were quite beneficial and efficient, giving to farmer new knowledge and self-confidence, for the first time. Regular meetings, honest expectations, intercourse respect and dedication of facilitators to FFS gained effects of NFE. Life knowledge enlarges farmer's motivation and confidence in FFS model, developing it together.

Practices / methods used by facilitators were the following: **Need assessment:** work based on farmer's needs provided participation of farmers. Need assessment was done for all important questions including special topics. **Cropping calendar** and questionnaire were basis for FFS activities. Activities were also adjusted to actual field situation. **Group facilitation and dynamic** included Icebreakers and Team building, as well as Exercises based on Philippine's guidebook. These exercises were basis for development of new ones. Brain breakers bring more participants in discussions on IPM and agro economy. **Force field analysis**: some problems were processed in this way. It provided additional participant's contribution for some topics, such as ETL for WCR soil and seed treatments vs. IPM. **AgroEcoSystem Analysis (AESA)** was powerful tool for education. It gives a lot of information about field situation and helps in understanding of corn ecosystem. It provided significant feedback for discussion, exchange of experiences and farmer participation. AESA was the key activity, during the growing season, which determined other activities. Farmers could verify facts about WCR morphology, biology, behaviour and control. At the same time they were valuable source of information. Together with facilitators, they completed WCR mosaic, based on facts, personal observations and exchange of experiences. Farmers appreciated AESA that included: 1) Observation – work in small groups 2) Data collecting and use of questionnaire 3) Analysis, discussions and presentations. **Structured learning experiences - Study fields** on IPM practice were one of the most effective tools for farmer's education on IPM. During FFS meetings, farmers were able to monitor all important parameters of study. Finally, results were discussed in a comprehensible way and farmers evaluated effects of study fields and proposed field studies for next season. Field studies were set up in each FFS, covering different farmer's interests. Study titles: 'The new cropping practice: ridging', 'Influence of different sowing times on WCR damages' (in 2 FFS), 'Influence on WCR damages on corn after bean' and 'Influence of different fertilizers on corn yield'. **Risk assessment** was the final stage of FFS activities, which provided data to farmers for decision-making on crop rotation, as basic IPM measure for next season. It gives powerful tool to farmers for community action, and better insight in WCR control. Farmers highly appreciated this life knowledge that could be updated and used in following seasons. **Special topics** were significant part of FFS activities and divided in two groups: 1) WCR related topics and 2) Other topics of farmer's interest. WCR related topics were: WCR morphology, biology, behaviour, control and risk assessment. Other topics, based on farmer's request, included other corn pests, pesticide use, agriculture machinery, drought, land cultivation, corn hybrids and GMOs, etc. In some cases, for example agriculture machinery, special experts held special topics.

Conclusion: Project objectives and methodology were accepted by farmers. Main indicators of project valorisation: 1) No dropouts during season, 2) Positive evaluation by farmers, 3) Farmer's wish to participate next year, 4) Increase of knowledge on WCR and IPM, demonstrated through discussions, field activities, etc., 5) Interest of farmers from near villages. Project objectives, content and methodology, considering all effects and evaluations are highly satisfactory.

The work was conducted under the FAO GTFS/RER/017/ITA Project.

Friday, 16 January, 14:50h; PETRACHE & ROSCA

Evolution of WCR in ROMANIA in 2003, especially in Timis county, role of farmers in monitoring this pest in FFS activities

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The western corn rootworm (*Diabrotica virgifera virgifera* LeConte) was found in 1996 in Romania and after 7 years, from the first registration, the pest is present in almost half of the country. The population of *Diabrotica virgifera virgifera* has increased strongly, year by year, as indicating by pheromone traps captures reported by Central Laboratory of Quarantine. It is presented the pest spreading in Romania, especially in Timis county, role of farmers in monitoring this pest in FFS activities.

The populations of pest has increased strongly, year by year, as indicating by pheromone traps captures reported. In a FAO WCR NETWORK project PR 19713/2001 and PR 21261/2002, the Western Corn Rootworm, was surveyed in Timis district, regarding the symptoms of attacked plant (gooseneck) in field, number of larvae/plants, number of adults/plants, in cornfields with and without continuous corn, number of adults/pheromone trap and yellow sticky traps. Efficiency of different pheromone traps it is presented.

It was done a comparison between WCR and the most important corn pests, till now in Romania. The actual IPM strategies, which should be adopted in Romania, based of the improvement of knowledge of small farmers, in an FFS concept, which is an attempt to control WCR and other corn pest in connection with AESA and preserving of natural environment, is presented. Farmers training for special purpose (WCR monitoring) was done by themselves in own fields, checking the pheromone and AM yellow sticky traps for recording *Diabrotica virgifera* capture.

The higher fly is situated between first decade of July and second decade of August, exist some variations of number of the WCR adults in the maxim fly period, because the attract power is lower after 30 days or after rain, the pheromone traps attracted a higher number of WCR adults compare with yellow sticky traps.

Supported by FAO GTFS/RER/017/ITA Project.

Farmer training in BULGARIA

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Diabrotica virgifera was found in Bulgaria for the first time in 1998 and a monitoring is being performed every year ever since. The National plant protection service and the Central laboratory for plant quarantine have been performing the monitoring.

In 2001 five farmers' groups were organized in our country – in the cities of Bregovo, Vidin, Gorna Biala Retchka, Prevala and Asparuchovo. Another five groups in Gramada, Drenovtz, Kanitz and Montana were formed in 2002. The farmers participated in monitoring for traps' checks and observation of damaged leaves. However, most of the time the farmers were just watching and listening to the specialists from our services. This experience was used as basis for establishment of the Farmer Field Schools. Thanks to several meetings, which were held in Hungary, we obtained a lot of skills and knowledge necessary for FFS. The training in Asia was also successful. For us, the most important event was the second meeting in May, where FAO experiences with FFS were transmitted.

In 2003, four FFS were organized in the regions of Vidin and Vratza. In FFS in Bregovo, Gramada, Belogradtchik and Dolna Biala Retchka, four facilitators trained 34 participants. Approximately 13 to 16 meetings were organized.

Supported by FAO GTFS/RER/017/ITA Project.

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