IWGO – NEWSLETTER XXII 1 / 2

Editorial

THE XXIth IWGO MEETING

THE EPPO ad hoc PANEL on *Diabrotica*

THE FAO *Diabrotica* NETWORK GROUP - Meeting

THE EU – *Diabrotica* Research Project Group Meeting

VENICE, ITALY; Oct. 27 – Nov. 4, 2001

This is the first time within the International Working Group on *Ostrinia* (IWGO) history that both the "big" IWGO – Meeting and the Meetings of all the *Diabrotica* Groups took place at the same time and at the same place. I actually doubt that we will ever find a local organizer who will take on such a workload again ! The response to the first call was larger than we anticipated: more than 120 scientists indicated interest in attending both meetings. And finally we had approximately 100 people from 27 countries attending the meeting. At the XIXth IWGO meeting in Guimares, Portugal, we had 30 participants and in Adana, Turkey, at the XXth IWGO meeting there were approximately 50 participants which we thought might be the peak of attendance of IWGO meetings. In Paris and Stuttgart, places of the most recent *Diabrotica* Subgroup meetings, about 60 people participated.

The reasons for the large amount of participants are two: the appearance of *Diabrotica virgifera virgifera* Le Conte in Europe and a joint meeting of both working groups is certainly the most important reason. The second one is - and I don't hesitate to mention - the place of the meeting, Venice is really worthwhile coming to.

In order to save program money throughout the world for scientific institutions, universities and even private companies, IWGO decided for the first time to combine the IWGO meeting (which originally took place every year and later every second year) with the *Diabrotica* Subgroup Meeting. I believe that combining both meetings into one was also a main reason for the large number of attendees at this meeting.

Previously, the meetings of the FAO Group, the EPPO ad hoc Panel and the EU Research Program Group had joined their meetings, but not together with the IWGO group. But surely *Diabrotica virgifera virgifera* was the main item in this meeting. Since the 1st *Diabrotica* subgroup meeting in Graz in 1995, where 25 colleagues from 6 countries were present, the pest has spread over a large area in central Europe. In 1995, only Serbia was infested. In 2001 the pest is also present in Hungary, Croatia, Romania, Bulgaria, Bosnia – Herzegovina, Slovakia, Italy, Switzerland and the Ukraine too. Austria, Slovenia and Albania are threatened.

IWGO – NEWSLETTER XXII 1 / 2

IWGO is the oldest working group within the Global IOBC and is now in its 33rd year of existence . The group was founded in 1968 during the XIIIth International Congress of Entomology in Moscow. The founders of the group in 1968 were D. HADZISTEVIC (Yugoslavia), who had the original idea of founding a group of international cooperators, H.C. CHIANG (USA), who brought the ideas of the US projects into the group and was its first president, I.D. SHAPIRO from Russia (USSR), T. PERJU (Romania), C. KANIA (Poland) and B. DOLINKA (Hungary), all well-known researchers or maize breeders and founders and first members of IWGO. The second president after the retirement of Prof. Chiang in 1983, was Pierre ANGLADE from Bordeaux, France. Since 1993 I have been the convenor of the group.

The meetings of IWGO (both, the IWGO meeting and the meeting of the *Diabrotica* Subgroup) are well known for its high scientific value and for the output of its scientific work. The meeting in Venice proofed this high scientific standard again.

Finally I want to remember you on our IWGO – home page where you will find reports concerning previous meetings and additional information about future events.

IWGO can be found under : http://www.infoland.at/iwgo/

Please use this new medium to be informed about all IWGO activities.

The abstracts of the XXIth IWGO Meeting, which were presented after the *Diabrotica* subgroup meetings will be published in NEWSLETTER XXIII / 1, to be issued beginning of next year.

Harald K. BERGER
(Editor and IWGO – Convenor)

IWGO – NEWSLETTER XXII 1 / 2

List of Participants of the

6th FAO/TCP Meeting
7th EPPO ad hoc Panel
8th International IWGO – Workshop

XXIth IWGO - MEETING

Venice, Italy; October 27 - November 4, 2001

Scientific Committee:

C. Rich **EDWARDS** (US),
Josef **KISS** (HU),
Stefan **VIDAL** (DE),
Harald K. **BERGER** (AT),
Lorenzo **FURLAN** (IT),
Bruno **MINELLO** (IT),
Marco **VETTORAZZO** (IT),
Vincenzo **GIROLAMI** (IT),
Luigino **DISEGNA,** (IT),
Giovanni **CHILLEMI** (IT)

Organizing Committee:

Franco **NORIDO** (IT),
Harald K. **BERGER** (AT),
Lorenzo, **FURLAN** (IT),
Marco **VETTORAZZO** (IT),
Stefano **BARBIERI** (IT),
Francesca **GRANDIS** (IT),
Silvia **CERONI** (IT),
Vanna **FUNES** (IT)

DUE TO THE LARGE SCALE OF THIS ISSUE OF THE NEWSLETTER THE LIST OF PARTICIPANTS WILL BE PUBLISHED IN THE NEXT ISSUE WHICH WILL BE RELEASED BEGINNING OF NEXT YEAR.

THANK YOU, FOR YOUR UNDERSTANDING

IWGO – NEWSLETTER XXII 1 / 2

ABSTRACTS OF THE PAPERS PRESENTED AT THE

EU – Research Project Meeting on *Diabrotica*
6th FAO/TCP Meeting
7th EPPO ad hoc Panel on *Diabrotica*
8th International IWGO – *Diabrotica* **Subgroup Meeting**

I. EU – Research Project (QLRT-1999 - 01110)

"The threat to maize production in the EU by the exotic corn rootworm pest *Diabrotica virgifera virgifera*: sustainable pest management approaches and ecological background"

S. VIDAL, *GÖTTINGEN, GERMANY* (CONTRACTOR); H. K. BERGER, *VIENNA, AUSTRIA* (PARTNER); S. DERRIDJ, *PARIS, FRANCE* (PARTNER); L. FURLAN, *PADOVA, ITALY* (PARTNER); H. HUMMEL, *GIESSEN, GERMANY* (PARTNER); J. KISS, *GÖDÖLLÖ, HUNGARY* (PARTNER); U. KUHLMANN, *DELEMONT, SWITZERLAND* (PARTNER))

EGG LAYING BEHAVIOUR OF *DIABROTICA VIRGIFERA VIRGIFERA* LE CONTE AND POSSIBLE ASSOCIATIONS WITH ITS MORPHOLOGY

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The contact of insects with the plant surface is a behavioral step during which the host can be recognized and thus induce acceptance for egg laying. The chemical analyses of water-soluble maize surface leaches show that both growth stages and organs of the maize plant can be discriminated by their primary metabolite composition. We have shown that the maize leaf surface water-soluble leaches stimulate egg laying of *Diabrotica virgifera virgifera* (*D.v.v.)* on artificial substrates.
The question is how can the bio-chemicals influence the egg laying behavior and where they are perceived.
Morphology of the ovipositor was observed under microscope. Scanning electron microscopy was used to search for sensilla on legs and on the ovipositor. Laboratory observations were carried out to determine the different steps of *D.v.v.* egg laying behavior on an artificial substrate. Distribution of the insects in a maize field was investigated in Hungary at different times of the day and at two growth stages.

Before laying eggs on artificial substrate, females extrude their ovipositor, which is used for scanning back and forth. preliminary observations show the presence of sensilla on the

tarsae and on the upper side of the ovipositor, which are likely to be gustatory sensilla. both were found to be put in contact with the substrate during the “pre-egg laying” event.
Walking and resting on the leaves and then husks were the main behaviors observed in the fields. Abundance of females on the maize plants varied with the maize growth stage.
We can hypothesize that insect morphology and egg laying behavior are adapted to the use of bio-chemical information given by the plant surface which provides the decision making of egg laying at the plant bottom into the soil.

Acknowledgements to U. Kuhlman and S. Toepfer from CABI Bioscience Centre in Switzerland and to co-workers of the European project present in Hungary.

INFLUENCE OF BIOCHEMICALS PRESENT ON MAIZE LEAF SURFACE ON *DIABROTICA VIRGIFERA VIRGIFERA (D.V.V.)* OVIPOSITION.

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The ovipositional habits of an insect are critical to the survival of the progeny. During the period of egg laying, *D.v.v.* females may be present in the maize fields without feeding. Their abundance in fields follows the maize growth stages. The behavioral events leading insect to egg laying are mediated to a large extent by chemical cues. Maize volatiles emitted by silks, kernel, husk attract *D.v.v.* females. Chemical stimuli which induce *D.v.v.* acceptability of plant and laying eggs at its bottom are not known.

Our hypothesis is that plant metabolites present on the maize surface through leaching could stimulate oviposition of *D.v.v.* and explain maize growth stage discrimination.

We collected maize surface water leaches from two hybrids Borbala and LG 2447 grown in green houses at different growth stages on several organs. Soluble carbohydrates and free amino acids were analyzed. Leaches were tested on oviposition in no choice condition on single wild Hungarian females. Oviposition substrate was nylon cloth impregnated with maize leaches and dried in air flux.

Quantities and proportions of primary metabolites on the maize surface discriminate the growth stages, and also the different organs from each others. Maize leaf surface leaches stimulates *D.v.v* oviposition. The stimulation is correlated with metabolite composition. Reproductive period of maize is particularly stimulant.
Still no firm conclusions can be drawn about the activity of each primary metabolite, and its influence when isolated or associated in a pattern.

Acknowledgements to co-workers of the European project present in Hungary.

ALTERNATIVE FOOD RESOURCES FOR ADULT *DIABROTICA VIRGIFERA VIRGIFERA*. ARE THEY OPPORTUNISTIC FEEDERS?

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Since *Diabrotica virgifera virgifera* LeConte (Galerucinae, Crysomelidae) was introduced into Europe in the beginning of the 90's this maize pest was continuously spreading and invading new areas and habitats in Central and Southeast Europe. Because the European agro-ecosystems presented a new ecological setting for this beetle, intensive studies were required on possible alterations in the ecology and behavior of the Western Corn Rootworm (WCR) adults. The study presented here gives information on the feeding behavior and use of weeds as alternative pollen resource on the basis of gut content analysis.
This study was performed in southern Hungary during a 10 week period collecting beetles in fields with different degrees of weed abundance to estimate the use of weed-pollen by WCR. Beetles were also collected directly from weeds when encountered there. The maize phenology was recorded once a week to gather information on availability of different maize tissues or organs. Furthermore the abundance and diversity of flowering weeds was recorded weekly along a transect inside the maize field. More than 600 beetles were used for a qualitative and quantitative pollen analysis were the insects were acetolysed and only the pollen remained. The pollen were counted and identified using a previously established reference collection of all weeds encountered inside and along the margins of maize fields.
It was possible to identify more than 10 weed species that were used by WCR as alternative pollen resources. from these *Amaranthus* sp. / *Chenopodium album*, *Ambrosia artemisiifolia*, *Xanthium strumarium* and *Helianthus annuus* were the most prominent. The differences concerning the use of weed pollen between adult WCR caught in fields with a high abundance of weeds and in field with a low abundance of weeds were specific for the weed species. Differences were found between the two field categories regarding *Amaranthus* sp. / *Chenopodium album* but not regarding *A. artemisiifolia*. a tendency could be observed that WCR adults are mainly opportunistic pollen feeders but show a preference for some specific weed species.

LIFE TABLE OF *Diabrotica virgifera virgifera*

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The western corn rootworm (*Diabrotica virgifera virgifera*) is an exotic invasive species and offers the possibility of classical biological control through the search for effective natural enemies in the area of origin. Life tables will determine mortality factors acting on *D. virgifera* populations in Hungary and will provide information on the most suitable life stages (egg, three larval instars, pupae and adults) to be attacked by exotic biological control agents. Additionally, this three-year study investigates the fecundity of the beetles as well as their reproductive period in the laboratory and in the field (EU Project QLK5-CT-1999-01110). In order to determine mortality factors in the field, several sets of eggs were exposed to winter conditions in two years and recollected during following springs. Population density and mortality of each larval instar and of pupae were obtained by soil-root sampling in three fields

(96 samples per week per field). Adult density was measured in emergence cages covering 70 plants per study area (0.4 ha). *Diabrotica* adults were collected in selected fields in Hungary, Croatia and Yugoslavia and kept in cages in order to determine parasitism. The population density of each stage was compared and mortality between each stage was calculated. In a second experiment to determine mortality factors, maize plants were artificially infested by L1 and then L2, L3, pupae and adults were recollected.

Highest mortality was found in diapausing eggs and in the first instar larval stage. There was some mortality observed in prediapausing eggs but lowest mortality was determined during hatching of larvae, during second and third instar larvae and in adults. Additional results are provided on the fecundity, longevity and reproductive period of the adults in the field, as well as on the occurrence of *D. virgifera* natural enemies in Hungary.

In conclusion, the key stages for exotic biological control agents are the late larval instars or the adults of *D. virgifera*. CABI Bioscience is conducting investigations on the search for parasitoids in the area of *Diabrotica*'s origin and will test the suitability of exotic parasitoids in Swiss quarantine facilities.

TWO YEARS OBSERVATIONS ON CORRELATION OF LARVAE DAMAGE OF WESTERN CORN ROOTWORM AND YIELDS

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As one of the most infested part in Hungary since 1996 the permanent trapping has been continued in four sites in county Csongrád. Observations took place at the same fields in Csanádpalota, Hódmezovásárhely, Nagylak and Szeged using pheromone (CSALOMON) and yellow sticky (MULTIGARD and PHEROCON) traps.

Besides trapping of adults determination of larvae development was also carried out by weekly root observations.

On each field 10 emergence cages were set up above one corn plant to measure the number of beetles developed within one root system. In the end of the season the damage on roots were rating by the modified IOWA-scale, the yield of each plant was measured and correlation between adults developed in root system and yield production was measured.

Results of permanent trapping showed significant increase in area of Nagylak and Hódmezovásárhely this year. The population established on the same level in Szeged and less number of beetles was caught by the traps in Csanádpalota. Lodged plants were found only in Szeged experimental field.

Development and seasonal flight of WCR can be compared under rather different weather conditions based on data in 2000 and 2001. The weather in the vegetation season of 2000 can be characterized with extremely high temperature without considerable precipitation for a long period. Season of 2001 was less hot and regular precipitation was measured. In 2000 very early larva hatching was observed: on 25 May both L_1 and L_2 stages were found. This

year first L_1 larvae were detected on 30 May. First males occurred 15 June in 2000 and ten days later, 25 June in 2001 in pheromone traps.

The number of emerged adults in cages was low in Csanádpalota and Nagylak observation fields in both years. In Szeged the number of beetles varied between 4 and 53 per plant in 2000. In 2001 number of adults collected in cages increased and varied between 28 and 218. Significant correlation was observed concerning the number of adults, the root damage and the weight of yield of plants.

IS THE WESTERN CORN ROOTWORM ADAPTING ITSELF TO THE EUROPEAN CROP ROTATION SYSTEM? RESULTS OF A JOINT EUROPEAN TRIAL

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The focus of this study was to evaluate how WCR may adapt to European crops grown in rotation with corn. A three-year crop rotation trial was established in 2000 in Szeged in Southern Hungary (EU-5 project). This system was followed within the framework of the FAO WCR Network in Croatia and Federal Republic of Yugoslavia in 2001. This allowed for comparisons to be made among three different regions in Europe (Szeged in Hungary; Tovarnik in Croatia; and Dobanovci, near Belgrade in FRY). The crops rotated with corn were corn (therefore, continuous corn), sunflower, soybean, and a cereal (winter wheat, oat or spring barley). Corn was grown on the trial fields in previous years. The study field was divided into two sections. One section consisted of corn (field A), while the other consisted of 6 replications each of a cereal, sunflower, soybean, and corn (field B). The year after, these two sections were rotated so that the rotated crops in one section were followed by corn and the corn section by the rotated crops. The presence of WCR was assessed and quantified by using Pherocon AM traps and emergence cages (3 each per plot) from mid June to mid September. In addition, corn roots were dug from each plot and rated for WCR larval damage and soil samples were taken from each plot to determine WCR egg populations. Weed cover data were recorded 2 times during the growing season.

In Hungary, results for 2000 showed small catches of WCR adults on Pherocon AM traps and no WCR adults in emergence cages in crops other then corn. The WCR population increased in the area in 2001. For 2001, an increased number of WCR adults were caught on Pherocon AM traps in sunflower, soybean, and cereal (latter harvested) plots, in addition to significant numbers caught on the traps in the corn plots. Some WCR adults were found in emergence cages in corn after soybean and cereal. WCR population in the region was low in FRY, while higher in Croatia in 2001. In FRY, WCR adult occurrence on Pherocon AM traps was low in corn and soybean. In sunflower and oat, there were no WCR adults caught. In Croatia, the numbers of beetles caught on Pherocon AM traps in the corn field were high (similar to those of 2001 in Hungary). Numerous WCR adults were trapped in crops other then corn (again similar to Hungary in 2001). Emergence cages caught some WCR adults in

corn (field A) and no adults in crop rotation strips (field B) in FRY. The number of beetles caught in emergence cages in Croatia in corn field A averaged 34.75 beetles, while in corn field B the average was 5.8 beetles per 3 cages during the growing season. Some WCR adults were trapped in emergence cages in soybean and sunflower, but no beetles were found in the barley. The sex ratio for all WCR adults, root damage ratings, egg washing results, etc., will be presented at the meeting.

COMPARISON OF PERFORMANCE OF DIFFERENT TRAP TYPES FOR MONITORING OF *DIABROTICA VIRGIFERA VIRGIFERA*

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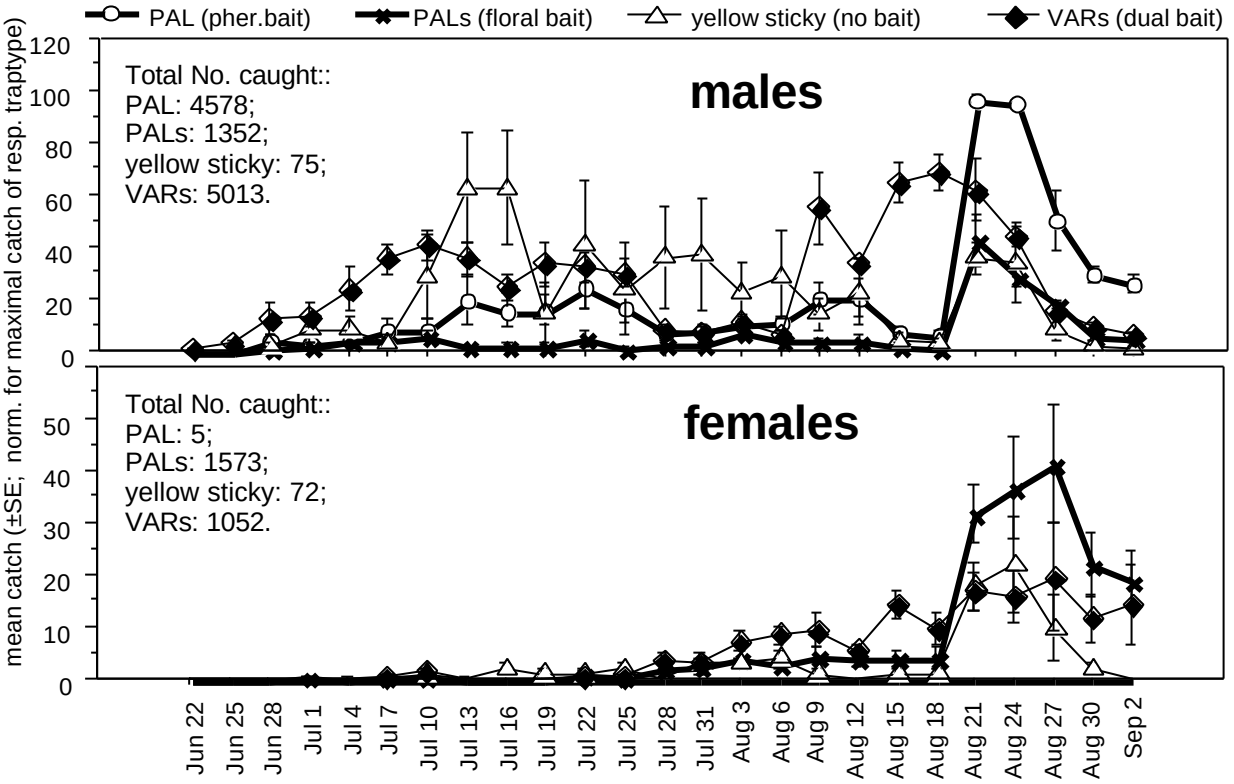
The present results come from the first year of a study aiming at the evaluation the trap types developed at our lab in Hungary or catching *Diabrotica v. virgifera*. Results are presented on trap types PAL (pheromone baited), PALs (floral attractant baited) and VARs (baited with both pheromone and floral baits). For comparison, yellow sticky traps were also included. Traps were tested at three sites in Hungary in 2001.

Males were detected earliest in pheromone baited traps PAL and VARs at approximately at the same time. Later on large numbers of males were continuously captured.

First female catches were recorded much later than male captures, predominantly in both traps with floral lures - PALs and VARs. The two types captured females during similar periods. There were too few beetles in unbaited traps to draw conclusions about natural sex ratios and sex ratios captured in the different trap types. Next year natural sex ratios are planned to be studied through non-discriminating sampling methods parallel to continuos operation of the trap types with the respective baits.

Work carried out within the framework of EU DIABROTICA project (QLK5-CT-1999-01110)

Fig 1 Catches of D. v. virgifera in different trap types at one of three sites (Bácsbokod, Hungary, 2001). Each dot represents the mean(±SE) catch of 4 traps (normalized against maximal catch of resp. trap type for ease of comparison) on the given date.



DIABROTICA VIRGIFERA VIRGIFERRA ERADICATION – CONTAINMENT TEMPTATIVE IN VENETO REGION: YEAR 2001

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3) Freelances

The attempt to eradicate or at least to contain the newly arrived population of WCR near the International Airport of Venice was implemented using the strategies deployed in 1999 and 2000.

MATERIALS AND METHODS

The eradication programs was implemented in and just around a focus area near the Venice Airport. The program was based on:

♦ **Initial focus area (1200 ha)**:

- Monitoring the WCR population: 159 sex pheromone PAL traps were placed out from 25th to 29 of June in the focus area;

- Imposing restrictions on the planting of maize in fields where corn was grown the previous year; in a small area (37 ha) around the fields where 77 WCR specimens were captured in 2000 maize cultivation was completely prohibited; in the rest of the focus area was prohibited to plant maize after maize.
- Applying insecticide treatments to all maize fields to control WCR adults; the insecticide used was Dursban (chlorpyrifos) WG at the rate of 1,1 kg/ha; all maize fields (153 ha) were sprayed between 17th of July and 1st of August; further 20 ha in the part near the safe zone where captures had been recorded were sprayed again between 10th to 23rd of August;
- 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 1st of October.

♦ **Safe area (about 35.000 ha)**:

- Monitoring of WCR population:

In the first phase, 207 PAL traps were deployed from the 9th of July in the safe area according to a 1 km X 1 km grid mainly in monoculture maize fields; later on further 430 PAL traps were added in monoculture maize fields at increasing distances from the focus area. For research purposes 132 more traps of different types were added in focus and safe area.

- Applying insecticide treatments to maize fields (and those all around) where WCR specimens are caught: an area of 54 ha of maize was sprayed between the 24th and 28th of July; 25 ha were sprayed on the 3rd of August and further 43,5 ha on the 10th and 11th of August.

Farmers were required to comply with these measures by Ministerial Decree and by specific ordinances of the Veneto Region through specific meetings. The Region also made money (about 78.000 Euro) available to support the eradication program.

RESULTS

Field checks. After the farmers had been informed of the eradication program by their organizations, all the fields in the focus area that had been planted to maize in 2000 were checked to determine what crop was planted in 2001.

The field checks were completed in late June and 3 fields totaling 0.44 ha of monoculture maize were found. These fields were mechanically destroyed from the 2nd to 20th of July.

WCR captures:

♦ **Initial focus area (1200 ha)**: 6 specimens were captured: on July 17 (1), July 24 (1), August 18 (2), September 7 (2).

All captures were recorded in traps placed out close to the border of the area, near the monoculture maize fields of the safe area;

♦ **Safe area and new focus areas**: in a monoculture maize field 300 m far from the border of the initial focus area, 108 WCR males were captured on a PAL trap over a 4 day-period (16th to 19th of July; trap set up on July 16). Further 49 specimens were captured on the same trap just before insecticide treatment (afternoon of the 24th of July) repeated after 7 days. After the treatments, the traps did not catch any more beetles until the 4th of September. This was the only trap of the first grid of the safe area that captured specimens. An additional focus area (250 ha) was immediately defined. Within few days (from 22nd of July on) many other traps were placed out exclusively in monoculture maize fields at increasing distances from the field where the captures were recorded. Totally 67 more specimens were caught in the first and second group of traps placed out in the safe area. Most of the captures were recorded just before the insecticide treatments; a few further captures were observed after 15 days from the last treatment. Another small focus area (27 ha) had to be defined about 3 km away from the first one; rescue treatments were made in both the newly defined focus areas. No specimens were caught on traps placed out in fields planted to crop different from maize despite the fact these fields were near monoculture maize fields where conspicuous populations had been detected.

Several thematic maps reporting crops, traps and captures positions have been produced.

CONCLUSIONS

The most important conclusions from this year's work can be summarized as follows:
- The strategies implemented in focus area proved to be very effective in stopping WCR populations; the few specimens captured (6) were collected in the border of the focus area near (within 600 m distance) the small monoculture fields in the safe area where WCR populations were recorded; therefore a recolonisation of the initial focus area coming from monoculture fields of the safe area (where probably the species had arrived years before but not detected) was observed.
- The key factor of eradication/containment of the species appears to be the interruption of monoculture on all the fields of the focus area; also very small continuous maize fields can allow high WCR reproduction and spread; most of the maize fields where conspicuous captures were recorded were monoculture fields; few specimens were caught in first-year maize near to monoculture fields where high WCR populations had been observed.
- Insecticide treatments directed against the adults are very effective in significantly reducing the populations and stopping their spread.

THE PRESENCE OF *DIABROTICA VIRGIFERA VIRGIFERA* LE CONTE IN ITALY IN 2001: DISTRIBUTION, POPULATION LEVELS AND WHAT HAS TO BE DONE.

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Over the past several years, extensive monitoring of *Diabrotica virgifera virgifera* (WCR) was carried out in different regions of Northern Italy (Friuli Venezia Giulia, Veneto, Emilia Romagna, Lombardy, Piemonte) following a common protocol. Maize fields were selected, in addition to the already defined focus areas, in sites where maize is often grown for multiple years and also at potential introduction areas (such as nearby airports, custom institutions, etc.). PAL sex pheromone traps were set up mainly, or exclusively, in maize after maize fields. In maize fields where high WCR captures had been recorded the root systems of at least 20 plants/field were evaluated following established protocols from the USA.

PRESENCE.
In Friuli Venezia Giulia and Emilia Romagna no specimens were caught over the last 3 years. In Veneto: in the focus or safe area defined after the first captures recorded in 1998, specimens were captured each year from 1999 to 2001 in monoculture maize fields. The current infested area is about 1500 ha. No specimens in the other sites (five to fifty km away from the focus area) were caught despite the fact that hundreds of PAL traps had been deployed in monoculture fields. Lombardy: three specimens were captured on a few traps placed out near Milan-Malpensa Airport (Varese) in 2000; many traps were placed out in 2001 and numerous specimens were captured in a area of over 100.000 ha including the provinces of Varese, Como, Lecco, Bergamo, Sondrio, Milano, Lodi and Cremona. Piemonte: in 2001 several specimens were captured in an area of about 17.800 (Novara province) which borders the focus area of Lombardy defined in 2000.

POPULATION LEVELS.
Adults: levels up to 30 – 40 WCR males/ PAL trap/day at the peak of the swarming period were recorded from monoculture maize fields in Lombardy and in Veneto while the peak population observed in Piemonte was about 15 males/trap/day. Only in fields planted to maize for at least two subsequent years did PAL traps capture conspicuous numbers of adults; more than 90% of the infested fields were monoculture maize fields, the others being first-year maize fields located near infested monoculture fields. Pherocone AM yellow sticky traps, which are often used in USA to determine the presence of economic WCR populations within a field, were placed in some fields where high captures had been recorded on Pal traps. These Pherocon traps, however, did not capture any specimens. No adult feeding damage on leaf tissues or ears was observed despite observations made on thousands of plants in the fields where the highest numbers of WCR males were recorded on the sex pheromone traps. Larvae: in none of the maize fields in Veneto and Lombardy did root systems show any visible WCR injury. Therefore NO economic populations are present so NO insecticide treatments for usual maize cultivation are needed in 2002.

STRATEGIES FOR THE FUTURE.
Veneto: the eradication/containment program should be continued following the strategies implemented in the previous years enlarging the area where the cultivation of maize after maize is prohibited (including fields five km from the area where specimens had already been captured). Lombardy, Piemonte: in order to stop or at least to slow down *Diabrotica* spreading a strip five km wide with NO maize after maize fields should be created along the border of the area where WCR specimens have been detected. This measure should be supported by an intensification of the information program on WCR biology and the importance of crop rotations that is targeted at farmers in the regions. Friuli Venezia Giulia, Emilia Romagna and other regions: monitoring should continue following the instructions utilized over the last several years.

SELECTION OF POTENTIAL NON-TARGET COLEOPTERAN HOST SPECIES FOR ASSESSING THE HOST SPECIFICITY OF EXOTIC BIOLOGICAL CONTROL AGENTS

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The ability of introduced natural enemies to persist in the environment, to reproduce and to spread gives classical biological control a unique advantage as a pest control method. As an exercise in applied ecology, biological control has always been challenged to predict the outcome of complex population processes. Despite many proven benefits, classical biological control has recently come under scrutiny because introduced natural enemies may adversely affect native species, especially rare and endangered species. Concerns should be based on non-target impacts at the population level, rather than attack on individuals but there is debate on which species should be considered when evaluating non-target impacts.

The EU Project DIABROTICA (QLK5-CT-1999-011110) aims to select specific biological control agents of western corn rootworm for potential importation and establishment in Europe. With regard to the safety of biological control the guidelines of the European and Mediterranean Plant Protection Organisation (EPPO) for the importation and release of

exotic natural enemies will be followed. Natural enemy surveys carried out in Mexico and Argentina revealed that parasitoids belonging to the genus *Celatoria* (Diptera: Tachinidae) and *Centistes* (Hymenoptera: Braconidae) are found to parasitize adults of *Diabrotica* and *Acalymma* species (Coleoptera: Chrysomelidae).

Prior to the importation of these adult parasitoids, a literature survey has been conducted to determine the host specificity of these potential biological control agents. In addition, the literature has been scanned to determine Coleopteran species present in the European cultivated agricultural habitats (with emphasis on maize, alfalfa, squash, wheat, sunflower, and grassland habitats) which might be at risk to from being parasitized by exotic parasitoids. In Hungary, field surveys using sweep net samples were carried out to identify the Coleopteran species present in selected habitats. Simplifying principles have been developed to select potential non-target Coleopteran host species of greatest relevance for assessing the physiological host range of potential biological control agents in quarantine laboratory.

SIMULATIONS MODEL FOR SPREADING SCENARIOS OF WESTERN CORN ROOTWORM (*Diabrotica virgifera virgifera*) IN CASE OF GERMANY

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The dispersal rate of the Western corn rootworm (WCR) in Europe was analyzed 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 program 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: $$\mathbf{K = \frac{concentration\ of\ maize\ in\ \% \cdot 2}{100}}$$

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

WCR: $$\mathbf{AR = FD \cdot K}$$

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 analyzed in the infested areas of Southeast Europe. Analysis showed that the WCR is not able to fly over 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 favor progressive dispersal.

All information is utilized in the simulation model on the spreading of the WCR. Calculations are carried out the basis of the GIS software ArcView/ArcInfo. This simulation model was used for the first time to simulate the spreading rate in Germany over ten years for two cases: Introduction via the international airport of Frankfurt am Main with and without containment measures and progression of „natural spread“ via Austria with the starting point in Passau (Southeast Bavaria on the Danube river at the border to Austria) with and without containment measures.

As a result of the simulation an infested area in case of an introduction via Frankfurt am Main of 475.740 ha without and 23.107 ha with containment measures was calculated for a period of ten years. In the second case of „natural spread“ from Passau calculation gave 358.691 ha without and 118.419 ha with containment measures for the same period.

DETERMINATION OF THE CONCENTRATION OF THE PLANT KAIROMONE MIMIC 4-METHOXYCINNAMALDEHYDE (MCA) USING UV SPECTROMETRY

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A number of field experiments have already been conducted to evaluate the impact of the plant kairomone mimic MCA as an orientation disruptant on field populations of the western corn rootworm *Diabrotica virgifera virgifera* LeConte (Coleoptera: Chrysomelidae) in corn in Hungary and Yugoslavia. Preliminary studies indicated that the application of the non-toxic MCA in corn fields decreased orientation towards MCA and pheromone baited traps The principle of a permeation of a corn field is that the strong smell of this organic substance causes orientation disruption and might mask the female sex pheromone as well.

For the formulation MCA was dissolved in acetone and blended with corn grits (‘grits’) using a cement mixer. Grits, available in different sizes, are a by-product after corn is harvested and separated from the cob. To identify the optimal formulation technique, mixing experiments in 2000 were conducted with different amounts of acetone, various spraying methods (fog or jet) and in a covered or in an open mixer. Samples were taken directly after formulation and on regular intervals for 10 days after grits were exposed to the atmosphere. In 2001, grit samples were taken directly after the formulation and over several days after application in a corn field. The residual MCA of the grits was determined by extraction with ethanol, and UV spectrometric analysis at 320 nm. Furthermore, additional experiments were carried out to determine MCA in the atmosphere. Aerial MCA was absorbed on a charcoal filter within a glass tube attached to an air pump after field treatment at 80 gr./ha in a 12-m^2 plot.

MCA release rates were essentially the same for the different mixing techniques. The results of grit extraction and analysis showed that over 85% of the applied MCA can be recovered from the formulation. The MCA content of the grit formulations was demonstrated to decrease exponentially with a ca. 2.5 days half life for the experiments in 2000 and 2001.

The MCA collected in the charcoal filter was below the UV-spectrometric detection limit. The project is supported by EU framework 5 project QLK%-CT-1999-01110.

USE OF MCA (4-methoxycinnamaldehyde) AS AN ORIENTATION DISRUPTION TOOL FOR ADULT WESTERN CORN ROOTWORM *Diabrotica virgifera virgifera* LeConte

L. WENNEMANN & H.E. HUMMEL

MCA is an organic substance which is investigated for its potential as an orientation disruption tool with a possible effect as a mating disruptant for the western corn rootworm *Diabrotica virgifera virgifera* LeConte (Coleoptera: Chrysomelidae). For the formulation: A cement mixer was used to blend MCA dissolved in Acetone and corn grits ('grits'). Grits are a by-product after corn is harvested and separated from the cob.

This year's studies included the improvement of the formulation technology by investigating a) 4 corn grit sizes b) 3 loads of the mixer and c) variation in the amounts of liquid mixing media in conjunction with a food color. Distribution patterns by collecting grits in plastic dishes and counting grits on corn plants were investigated in the field after aerial and high wheel tractor application. Impact of MCA on beetle orientation in experimental fields sites in Kardoskut (Hungary) and Kula (Serbia) were evaluated by comparing number of beetles collected in Yellow Sticky traps, VAR trap, PAL traps and plastic cups coated with tanglefoot in the MCA treated and the control plots and by putting each a female into a 3-cm plastic can on top of a sticky trap sealed by a gaze. Females were collected in the treated and control plots after different time intervals. The spermatheca was checked for the absence and the presence of sperm to identify mating status.

Results of the formulation experiments showed that the optimal mixer load is 20 kg grits and MCA dissolved in 1 L of acetone. Both application techniques are valuable for grit distribution in the field. Preliminary analysis of the data showed variable orientation disruption of adult western corn rootworms. The tanglefoot coated plastic cups proofed to be a cheap and an excellent trapping device for adult rootworm. Single female traps revealed variable catching results in both the treated and untreated field. The dissection of the spermatheca did not show an effect of the MCA application on the mating status.

II. FAO Net Work (LoA No. PR 19713)

M. ALLARA-CARLIN, (FAO; ROME), J. KISS, (HUNGARY; COORDINATOR) C.R. EDWARDS, (USA; INT. EXPERT) I. IVANOVA, (BULGARIA), J. IGRC-BARCIC, (CROATIA), I. SIVCEV (FRY), H. FESTIC (BOSNIA AND HERZEGOVINA), P. SIVICEK (SLOVAKIA), I. ROSCA (ROMANIA), G. PRINCZINGER (HUNGARY)

III. EPPO ad hoc PANEL

IV. IWGO – Diabrotica Subgroup

EFFECT OF *THERIDION IMPRESSUM* (ARANEAE: THERIDIIDAE) ON THE SILK CLIPPING OF *DIABROTICA VIRGIFERA VIRGIFERA* ADULTS IN HYBRID SEED CORN IN HUNGARY

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Hybrid seed corn is more sensitive to biotic and abiotic factors affecting its silk than commercial corn. Silk clipping is the main damage of *Diabrotica virgifera virgifera* adults in corn. Therefore, silking hybrid seed corn can be a sensitive indicator of the actual and potential predatory pressure on *D. v. virgifera* adults. *Theridion impressum* was found to be the most important spider predator of *D. v. virgifera* in Hungary in our earlier studies (Tóth et al. 1998, 1999, 2000).

The present study aimed to determine the ability of *T. impressum* to decrease the silk clipping of *D. v. virgifera* in hybrid seed corn.

The study was conducted in Mezohegyes, in 2001 (see Tuska et al. this volume). 80 corn ears were isolated with ear cages and 48 corn plants with whole-plant cages. The isolated ears were infested with 0, 3, 6 or 9 *D. v. virgifera* adults, and were treated with 0 or 1 *T. impressum* adult female in the latter case (9 beetles/ear) 1-2 days prior to silking (R1). The isolated whole plants were infested with 0 or 9 beetles and were treated as above. Number of replicates was 16 in each case. Silk length was measured daily until the end of silking. Other quantitative and qualitative parameters of the ears and kernels will be measured after harvest in October.

Both the cage types and treatments had a considerable and statistically significant effect on silk length. *Theridion impressum* females could decrease but not terminate silk clipping. Effect on yield parameters and methodological consequences are going to be discussed in details.

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RESEARCHES REGARDING CROP ROTATION, WCR MANAGEMENT AND PEST EVOLUTION IN TIMIS DISTRICT - ROMANIA

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First occurrence of *Diabrotica virgifera virgifera* LeConte was detected in Romania in 1996 in Nadlag, district Arad in western region closed to Hungary and Yugoslavia, from that till now the pest was spread towards east and northwest being recorded in more tan half of Romania border in this year being district Mures and river Olt. In 2001 the biggest population was registered, by pheromone traps (CSALOMON) and also by yellow sticky traps (Pherocon AM) only in three southwestern districts (Timis, Arad and Caras-Severin).

The Western Corn Rootworm, during 2001, was monitorised in Timis district, regarding the symptoms of attacked plant (goose neck) in field, number of adults/plants, in 81 cornfields, number of adults/pheromone trap and yellow sticky traps in plant protection centers from Timisoara, Topolovatu Mare, Sanicolau Mare, Deta and Lugoj. In two cornfields from Jimbolia and Deta, was registered number of WCR larvae/plant and frequency and intensity (1-6 Iowa notes) of root damages. There are and other 5 fields counted for root damages.

In Timis district areas cultivated with corn after corn has decreased year after year, from 60.6 % in 1997 to 11.9 % in 2001, but has arise number o adult captured in pheromone traps from 13,167 in 1997 to 35,240 in 2000 and remains stationery in yellow sticky traps from 1,043 in 1997 to 910 in 2000.

In an FAO WCR Network research it was chosen one field with 3 years of corn cultivation and in different plots with corn, sunflower, soybean and wheat, presence of *Diabrotica virgifera virgifera* was assessed and quantified in 2001 through installing 3 pheromone traps, 3 yellow sticky traps and 3 emergence cages/field cultivated with these four cultures after corn.

During 2001, it was organized a farmers training system for district Timis, in which was printed an spread to farmers a booklet with WCR importance, biology, a system for pest and his attack recognizing and practical advice. Field training of team from plant protection centers and at the district level of farmers, which are in the influence zone of these centers, together with presentation of this WCR problem at the session of agriculture responsible from district Timis.

IWGO – NEWSLETTER XXII 1 / 2

ECONOMIC THRESHOLDS FOR WCR ADULTS IN SOYBEAN TO PREDICT SUBSEQUENT DAMAGE TO CORN IN INDIANA, USA

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Adult western corn rootworm (WCR), *Diabrotica virgifera virgifera* LeConte, sampling methods were tested in soybean fields, and larval damage was evaluated in first-year cornfields located in northwest Indiana from 1997-2000. The sampling methods included Pherocon® AM unbaited sticky traps, cucurbitacin vial traps, Pherocon® CRW (corn rootworm) non-lure traps, and a 14.5cm diameter sweep net. Calculations for the minimum sample size required for 15% and 25% level of precision was determined for each sampling method using Southwood's formula $n = (s/Em)^2$. Corn root damage was compared with analysis of variance procedures and mean separation using Fisher's protected LSD test. Economic thresholds also were determined by regressing the number of WCR adults collected with Pherocon AM and Pherocon CRW traps in soybean during 1998 and 1999 with corn root damage in fields the proceeding years, 1999 and 2000. Damage to corn root systems was significantly higher in untreated plots than treated plots in 1997-2000. The Pherocon AM traps and Pherocon CRW traps, at the 25% precision level, required the least number of traps (4.39 and 5.32, respectively) to determine the estimated adult WCR population in soybean fields. The regression equations developed by adult collections using the Pherocon CRW traps revealed R^2 values of 0.067 and 0.008 in 1998-1999 and 1999-2000, respectively. Adult collections using Pherocon AM traps during the same time period revealed R^2 values of 0.579 and 0.360. An R^2 value of 0.460 was determined when the Pherocon AM trap data was combined for both trapping cycles. Although a range of thresholds resulted from this experiment, the economic threshold, as estimated by a root damage rating of 3.5, has been determined as eight WCR adult beetles per Pherocon AM trap per day.

EFFECT OF SILK FEEDING BY WESTERN CORN ROOTWORM ADULTS ON YIELD AND QUALITY OF SEED AND COMMERCIAL CORN

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Economic larval damage caused by western corn rootworm (WCR) to corn root systems has been reported from Europe. However, little is known about silk feeding damage caused by WCR adults and its impact on production of corn hybrids and commercial corn in Europe. Silk feeding by WCR adults on inbred lines was tested and economic thresholds developed in the USA by Culy, Edwards, and Cornelius, 1992. The build-up of the WCR population in

Europe requires that tests be conducted to determine the potential effect of WCR adult silk clipping on hybrid and commercial corn production.

The study was conducted on two inbred corn lines (one early and one late) and on one commercial corn hybrid under field production conditions in Mezohegyes, Hungary, in 2001. Seed corn plots were established with male and female plants arranged in a 1:2 and 2:4 planting configuration for early and late lines, respectively. Four densities of WCR adults (0, 3, 6, and 9 per ear) were placed into individual, cylindrical nylon bridal veil ear cages (40 by 25 cm, with 1 mm openings) at the plant growth stage R1. WCR beetles were randomly collected from a nearby cornfield 2-3 days prior to beginning the study. Two control treatments (0 beetles), one with ear cages and one without were included in the study to assess the impact of the bridal veil ear cages on pollination. Each treatment (beetle density) for each inbred line or commercial hybrid was replicated 16 times.

Presence of WCR adults was observed and silk length was measured daily at the same hour until silks dried. The WCR population density over the field was determined by counting beetles on 4x25 corn plants and on 12 Pherocon AM traps. Cages were removed after pollination and the ears were allowed to mature. Ears were harvested, dried, and stored for further testing.

Data on silk length, cob length, kernel number, thousand-kernel weight (inbred lines and commercial corn), and kernel fraction (inbred lines) will be correlated with beetle densities.

First-year preliminary results indicate that the economic threshold for WCR adults is between 3-6 adults/ear for inbred lines and above 9 adults/ear for commercial corn. (The authors thank Dr. Mike Culy, Dow AgroSciences, Indianapolis, IN, USA, for information supporting this study)

MONITORING OF *D. virgifera virgifera* LeConte IN SERBIA IN 2001

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In 2001 we continued with monitoring of WCR (*D. virgifera virgifera* LeConte) dispersal in Serbia. Sex pheromone traps produced by the Plant Protection Institute, Budapest, were used on 240 sites in order: a) to check presence or absence of WCR imagoes and b) to check population density. Further spread on the south east was registered, along the border with Bulgaria. Economic population and damages were registered sporadically within the area registered during last year. In 2001 there were no newly registered areas with damages from larvae. In general, corn fields were significantly less infested and damaged. Due to abundant rainfalls during the spring damaged corn plants recovered and it was difficult to find heavily damaged fields with logged plants. Yield reduction was insignificant.
Comparing the population density from last year, it is obvious that in 2001 population was reduced significantly on the whole territory of Serbia.

Diabrotica MONITORING IN AUSTRIA 2001

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Monitoring of *Diabrotica virgifera virgifera* was carried out by the Federal Office and Research Centre for Agriculture, Main Division Research Integration in Vienna together with co-operators of the relevant Plant Protection Departments in the Chambers of Agriculture of Lower Austria, Upper Austria, Tyrol, Carinthia, Burgenland and Styria and the Pioneer Seed company. In all cases pheromone traps were used.

Out of a total area of 1.382.000 ha of field crops the share of corn is approximately 19 % of is 2/3 grain corn. On most of this area maize is rotated with other crops so the amount of maize monoculture is rather low.

The observations started between June 20th and July 6th. The traps, pheromones and sticky surfaces were changed three times during the whole observation time. The final checks were made between August 28 and September 13, 2001. Other checks were made continuously between these days.

Diabrotica virgifera virgifera was not caught in any trap throughout 2000. Therefore, we can say with large likelihood that *Diabrotica virgifera virgifera* is not present in territory of Austria in the surveyed Federal countries (Lower Austria, Upper Austria, Burgenland, Styria, Carinthia, Tyrol).

MONITORING THE WCR *(Diabrotica virgifera virgifera* LeConte) IN BADEN-WÜRTTEMBERG IN 2001

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Baden-Württemberg is an important area for the production of grain maize, maize for silage and maize seed production in Germany. Since 1997 the Land Baden-Württemberg carries out a monitoring program with the aim to detect Diabrotica if it appears in the country.

On the basis of the current Diabrotica occurrence in Europe, it is considered, that the beetle will be imported by airplane or other means of transport. The WCR could also arrive along the Danube first to Bavaria and then to Baden-Württemberg.

In the year 2001 the number of the monitoring locations and the number of the pheromone traps were increased in particular near airports and airfields. As in the previous years traps were set out furthermore along motorways, near railway stations, near warehouses and customs stations. Altogether in the year 2001 at 67 locations in the country traps were set up.

The monitoring extended to the Rhine Valley, the area from the Bodensee to the Danube, the region around Stuttgart as well as the eastern section of Baden-Württemberg.

As in the previous year only pheromone traps (type PAL, Hungarian origin) were used. The traps were set out at the beginning of July and controlled regularly.

Diabrotica virgifera beetles were not found in the traps.

THE MONITORING OF WESTERN CORN ROOTWORM IN SLOVENIA A REPORT FOR YEAR 2001

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In Slovenia, a major part of the farming land is sown with corn. Western corn rootworm (*Diabrotica virgifera virgifera*) population is quickly approaching our border. For this reason, monitoring is more frequently applied in Slovenia. In 2001, baits have been controlled and replaced at control points more often. Furthermore, the number of control points has also been increased to 56 which is more than in previous years. In the vicinity of Italian border we set 10 control points, around the international airport of Ljubljana (Brnik) were another 8 of them. Along the borders with Croatia and Hungary, which is in the eastern Slovenia where the corn production is the most intensive, 38 control points were set. At each point, a pheromone bait and yellow sticky plate were set. The monitoring was done from the end of June to mid-September while the pheromone baits and yellow sticky plates were regularly controlled and replaced with new ones. Despite the fact that western corn rootworm was found in Croatia in 2000 only 27 km away from the Slovenian border, it has not yet been detected in Slovenia. Therefore, there is a strong possibility that western corn rootworm will be found in Slovenia next year.

CURRENT STATUS OF WCR IN CROATIA

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The occurrence of *Diabrotica virgifera virgifera* LeConte in Croatia was registered in 1995. In the year 2000 WCR was spread on a 14,000 sqkm area. Of that area, there was about 700,000 ha of arable land on which 200,000 ha of corn was sown.

The Department of Agricultural Zoology, Faculty of Agriculture Zagreb has carried out nation-wide survey of Western Corn Rootworm (*Diabrotica virgifera virgifera* LeConte) in Croatia since 1995.

As in previous years, pheromone and Pherocon AM traps were provided through FAO WCR Network.

The traps were placed out on 145 sites and 75 monitor were involved in the monitoring action. On each site 1 pheromone and 1 Pherocon AM trap were placed 50 m apart. Traps were placed in the field on June 27th. Each 7 days the traps were checked and beetles

collected. Fifty five sites (38%) were located at the infested regions, 48 sites (33%) along the line of spread in 2000, and 42 (29%) within uninfested areas. Ten monitoring sites are the permanent ones.

The first catch on pheromone trap was registered on June 28th. Before disposing all results on 130 monitoring sites 16,353 beetles were caught. Most of the beetles were caught on pheromone traps. The maximal catch, 62.5% of all caught beetles were caught between July 10th and August 10th.

The WCR population density varied from locality to locality, we evaluate that the increase factor in the earlier infested area for 2001 is between 1.5 and 2.5. The data from 10 permanent monitoring sites confirms that statement.

Only on one monitoring site located outside of the area infested in 2000 one WCR male was caught until now. We can state that in 2001 WCR spread toward west (60km) to the village Dubrovcak Lijevi. This spread occurred along the river Sava. No spread along the river Sava was registered in 2000. No further spread along the river Drava and the Hungarian border was recorded until now.

Three monitoring sites were located around the International Airport Zagreb. WCR has not been found on any of these traps.

In 2001, corn roots in the soil insecticide trial in Tovarnik were dug and evaluated for WCR damage. Plants in a few continuos corn fields in the region Baranja were also evaluated. The average root rating in untreated plots in soil insecticide trial was between 2.5 and 3 (same as in 1999). In some inspected fields in Baranja we found lodged plants. The average root rating in these fields was between 3.5 and 4.0. In one seed corn field a high adult population and the silk damage were registered. The yield loss will be established.

Altogether, in 2001 an area of approximately 15,500 km^2 is infested with WCR, in which area approximately 220,000 ha of corn is grown.

Further spread and an increase in the root damages in 2002 are expected.

THE INVESTIGATION OF THE RELATIONSHIP BETWEEN WCR POPULATION LEVEL AND CORN YIELD – CROATIAN EXPERIENCIES

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It is well known that larvae of *Diabrotica virgifera virgifera* are oligophagous (Branson and Krysan, 1969,1970). The only damage effectuated by larvae on cultivated plants was found in corn. Quantitative relationship between population level and corn yield was investigated by Hills and Peters (1971), Turpin et al. (1972), Branson et al. (1980,1982, 1983), Chiang et al. (1980), etc. Some investigations were carried out under the conditions of artificial infections

and in the presence of high natural WCR population levels. Most authors agree that climatic and edaphic factors can impact yield at the same population level.

The aim of this study was to check how the USA literature data about the correlation between WCR population level and corn yield corresponds to the Croatian conditions of low to moderate population level.

In the region with the highest infestation of WCR, a four year program started in 1998. In continuos corn fields, emergence cages (3 cages per replication) were placed to evaluate number of emerged beetles per plant. To determine the larval population level in the same fields, 20 plants per replication were dug and root damage (using the Iowa 1-6 scale) was rated. To determine the yield, 20 plants per replication were harvested and the yield was measured.

The data from the first 3 years (1998-2000) of the investigation showed that the damage caused by larval feeding on roots in Croatia corresponds to the damage caused in USA. At this level of infestation, the regression coefficient between larval damage and yield could not be established. The literature showed that this coefficient is between 310 and 670 kg/ha of yield loss for each root rating (Iowa 1-6 scale). The full linear correlation (r^2 =0,924) between the number of emerged beetles per plant and the root rating was established (**$y = 2.2 + 0.031x$**). Thirty-two emerged beetles per plant caused an increase in the root damage rating.

The data obtained in 2001 will be added to and presented at the meeting.

INVESTIGATION OF Diabrotica virgifera virgifera LeConte IN BOSNIA AND HERZEGOVINA IN 2001

HUSNIJA FESTIC

PAPER NOT AVAILABLE

MONITORING OF WESTERN CORN ROOTWORM (*Diabrotica virgifera virgifera* Le Conte) IN ROMANIA IN 2001 *)

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INTRODUCTION

Since 1995 the monitoring of *Diabrotica virgifera virgifera* Le Conte has been carried out by the ministry of agriculture, food and forestry through the central laboratory for phytosanitary quarantine and the county phytosanitary departments. The first find of *D. virgifera* was made in 1996 at Nadlac, near Hungarian border. In the following years , the pest has spread towards the north-east and the population levels have increased, especially in Caras-Severin, Timis, Arad and Mehedinti counties.

*) not presented at the meeting

METHOD

In 2001 the WCR monitoring system was organized in 22 counties (10 non-infested counties and 12 WCR infested counties), from 25 June till the end of September . We used Pheromone traps (Csalomon ®) and Pherocon AM traps in 21 counties and Romanian Pheromone traps in one county (Bistrita Nasaud). The traps were placed in 202 sites: 120 sites in infested counties and 82 sites in non infested counties. The pheromone traps (traps and capsules) were changed every 30 days and Pherocon traps every 15 days. All the traps were checked every 7 days and the results were recorded on the survey sheets.

RESULTS

This year *D. virgifera* was trapped in 15 out of 22 counties, (much more three counties than in 2000). The new infested counties are: Sibiu – 325 captures, Mures- 14 captures and Bistrita Nasaud – 151 captures. The pest is spreading north- east, along the river Mures and in the southern part of the country no further spread was recorded . The farthest point of spread toward north- east is approximately 400 km away from Nadlac (the first site with captures in 1996). The attached map shows the spread of *D. virgifera* in Romania from 1996 to 2001.

The monitoring of *D. virgifera* in Romania – 2001

No.	County	Total sites	Sites with captures	Captures/ pheromone	Captures/ Multigard	Total captures
1.	Alba	10	10	695	0	695
2.	Arad	8	8	7,160	118	7,278
3.	Arges	8	0	0	0	0
4.	Bihor	9	5	292	29	321
5.	Bistrita Nasaud	8	6	151	-	151
6.	Caras- Severin	9	9	4,105	324	4,429
7.	Cluj	8	0	0	0	0
8.	Dolj	8	8	234	55	289
9.	Dambovita	5	0	0	0	0
10.	Gorj	5	1	4	0	4
11.	Giurgiu	13	0	0	0	0
12.	Hunedoara	10	10	1,709	6	1,715
13.	Maramures	8	0	0	0	0
14.	Mehedinti	17	13	1,015	9	1,024
15.	Mures	4	2	14	0	14
16.	Olt	10	1	11	0	11
17.	Satu-Mare	15	8	1,114	75	1,189
18.	Sibiu	4	4	242	83	325
19.	Salaj	10	10	413	0	413
20.	Teleorman	16	0	0	0	0
21.	Timis	9	9	10,970	838	11,808
22.	Valcea	8	0	0	0	0
TOTAL		**202**	**104**	**28,129**	**1,537**	**29,666**

The WCR captures are presented in the attached table. The total number of captured adults was 29,666 (28,129 on the pheromone traps and 1,537 on Multigard traps). The average value of captures in this year, was 146.9 beetles/ installed trap. The highest population density was in Timis county (1,312 beetles/ trap). WCR population have been increased considerable in counties Arad (from 377.7 beetles/trap in 2000 to 909.8 beetles/ trap in this year) and Timis (from 840.1 beetles/trap in 2000 to 1,312 beetles/ trap in this year). At country level most beetles were caught in August: 17,574 beetles (59%) while in July were caught only 7,539 beetles (25%).
The monitoring of larval damages have been performed in the continuous corn fields from 12 counties which were infested in 2000. This year, the larval damages have been observed in counties Arad, Caras-Severin and Timis, but not at economic level.

EVOLUTION OF THE PEST *Diabrotica virgifera virgifera* LE CONTE IN THE TIMIS DISTRICT

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Diabrotica virgifera virgifera Le Conte was found for the first time In 1996, in Romania in the Arad District. In 1997 it was detected in the Timis District too, which neighbors with the Arad District end also with Yugoslavia and Hungary.
The paper presents the results concerning the pest's evolution from 1997 to 2001 in the Timis District (South-West of Romania).
For its monitoring FAO pheromone traps (Csalomon R), Romanian pheromone traps (Cluj-Napoca), Multigard yellow sticky traps and cucurbitacin traps were utilized from June to October.
In 1997 the Diabrotica virgifera virgifera Le Conte adults was very frequent along the border with Yugoslavia, but it was also registered in the area near to Hungary. In 1998 the pests spread from West to East, within almost the whole Timis District. The Diabrotica population heave increased strongly year by year up to 2001. For monitoring the best results with FAO sex pheromone were obtained. In 2000 the first areas with larval attack in a maize field of the Jimbolia zone was found. In this year the attack in stronger than before.
It results that Diabrotica virgifera virgifera Le Conte is a large disseminated pest in the Tims district and in consequence his control will be necessary.

EDUCATION AS A FACTOR IN SUPPRESSION OF WCR IN YUGOSLAVIA

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Majority of corn producers in Yugoslavia are “small farmers”. Many of them are growing the corn in long monoculture since their needs for corn are significant. In some villages in southern Banat even 80% of their agricultural land was under the corn. In general, we

presume that more than 30% of the corn production is in repeated sowing (two and more years on the same field).

When population of WCR reached economic level, damages on corn root from larvae feeding occurred. Although farmers were informed about the presence of new corn pest and advised to rotate the crop or to apply soil insecticides, many of them continue growing the corn in monoculture without applying the insecticides.

After having serious damages in consecutive two or three years these farmers realized that in presence of economic population of WCR it is no longer possible to grow corn in monoculture and even in repeated sowing (two years on the same field). In general, having low corn yield, it is expensive for these farmers to buy soil insecticide and applicator. Therefore majority of farmers started with crop rotation. As a result of crop rotation presence of corn on agricultural land felt down – below 50%.

From our point of view it was good to know that we learned farmers that crop rotation is vary effective but from the other side it was not productive since the surface under the corn was lowered.

We noticed that farmers are rotating the crop, as a general rule, without estimating real need for that. In many cases it is possible to repeat corn sowing on the same field. In order to educate farmers how to estimate necessity for crop rotation or soil insecticide application (risk assessment) we started program for farmers training. This program was sponsored by FAO LoA PR 19713 and by Federal Ministry of Agriculture. The program is based on "The Whole–Plant Count Technique" and "The Pherocon AM Sticky Trap Technique". By this program several farmers in two different regions were selected. About 500 ha, in both regions, were used in order to train the owners and to represent techniques for population estimation/risk assessment.

The program should continue in other regions in order to cover more farmers.

MONITORING OF WESTERN CORN ROOTWORM (*Diabrotica virgifera virgifera* LeConte) IN HUNGARY IN 2001

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The Hungarian Plant Protection Organisation has carried out a nation-wide survey of western corn rootworm (WCR) (*Diabrotica virgifera virgifera* LeConte) in Hungary since 1996. The Plant Protection and Soil Conservation Services in all counties have participated in the study. Similarly to the previous year, in 2001 too, the WCR monitoring system was based on two examinations:

1. Scout trapping
On 49 locations where the WCR was absent in 2000, Hungarian sex-pheromone traps (Csalomon®) were placed out in maize fields. In the non-infested areas of 8 counties, the

traps were monitored from 11 June till the end of September at 10-day intervals. Within 30 days the traps were replaced by new ones.

2. Permanent Monitoring Network

To determine WCR population build-up Hungarian pheromone traps (Csalomon®) and Pherocon® AM yellow sticky traps were placed out in pairs on 35 sites of 16 WCR-infested counties. The distance between pheromone and Pherocon® AM traps was 50 m. In maize fields the traps were monitored from 11 June to early October. From 2 July Multigard® yellow sticky trap and PALs (flower volatile baited) trap were also used for trapping on 15 and 7 sites, respectively. All traps were changed at intervals of 30 days. Catches were recorded decadely.

WCR was trapped in all (19) Hungarian counties till late August. Out of 49 scout traps, 17 ones had catches over WCR-infested area. These traps caught a total of 316 beetles. The average number of catches was 6,4 adults/trap.

Out of 35 permanent monitoring pheromone traps, 34 ones had catches. A total of 14500 beetles were caught. The average catch was 229,8 beetles/trap. Out of 35 Pherocon® AM traps catches were observed on 25 traps. 2788 WCR adults were captured. The average catch was 79,6 beetles/trap. Multigard® sticky traps caught more beetles, viz. 4403, on average 293,5 beetles/trap than did Pherocon AM traps and pheromone traps. The two trapping systems caught a total of 22007 WCR adults, much more than in 2000 (16211 beetles). In addition the seven PALs traps caught a total of 4077 adults. The average catch was 582,4 beetles/trap. WCR population considerable increased in counties Fejér, Tolna, Somogy, Baranya, Békés and Hajdú-Bihar. At country level most beetles were caught in August, viz. 13672 adults (52,4%), but the catch in July was also high, with 12073 beetles (46,2%). In June 339 adults were trapped only. It is much less than in 2000 (1945). In southern part of Baranya, Tolna and Bács-Kiskun counties on long-term (lasting 5-7 years) continuous corn fields, the adult density was very high in the last decade of July and first decade of August. In these counties several hundreds hectares corn fields were sprayed with insecticides using aerial application, in the beetle control program.

The invasive species was found in counties Vas, Gyor-Moson-Sopron and Szabolcs-Szatmár-Bereg where it was absent in the previous year. The farthest point of the WCR spread to the northwest also northeast is about 40 km.

In 10 WCR-infested counties WCR larval damages were surveyed in 955 maize fields on 44895 ha. It is approximately 5% of total maize fields of these counties. Vast majority of the inspected fields was continuous corn field. The Iowa scale was used for the evaluation of root damage. In counties Baranya, Bács-Kiskun, Békés, Csongrád and Tolna larval damages were observed on 10311 ha. In counties Baranya, Bács-Kiskun and Tolna the root damages reached the economic level (3<Iowa scale) on 3058 ha. Lodging plants were found in several corn fields of these counties.

THE RESULTS OF *Diabrotica v. virgifera* MONITORING IN 2001 IN THE SLOVAK REPUBLIC

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INTRODUCTION
The corn is growing approximately on 220 000 ha in the Slovak Republic. The corn is one of important crops in Slovakia. It is produced for grain, silage, seeds, popcorn and also sugar corn. For this reason *Diabrotica v. virgifera* present the danger for crop and its monitoring is carried out since 1996 by phytosanitary inspectors.

PURPOSE OF THIS PAPER
The purpose of this paper is present the results of the *D. v. virgifera* monitoring and training for farmers in Slovakia in 2001.

METHODS and procedures
Monitoring of WCR carried out the phytosanitary inspectors of the Central Control and Testing Institute of Agriculture in 2001. The monitoring starts on June 18, and finish on September 30. For monitoring was used pheromone Csalomon traps and also Pherocon AM traps. Both Csalomon and Pherocon AM traps we put along south state border with Hungary and also into localities where WCR occurred in 2000. The pheromone traps were put to the margin of mentioned regions where we predict the occurrences in this year. Traps were put also near airports (Bratislava and Košice). The monitoring and training were prepared with financial contribution of FAO project.

RESULTS AND CONCLUSIONS
We noted very significant shift of this pest to news localities in the south districts on the west part of Slovakia. The spreads pest to new localities was not as significant as we predict in middle and east part of south Slovakia. Monitoring points were set also in southeast districts of Slovakia but pest was not caught there. For farmers were carried out three training meetings up to this time. Our preliminary results are presented in the table and the map.

District	Number localities wit pest occurrence	Number caught adults in Csalomon traps	Number caught adults in Pherocon AM traps
Bratislava	3	6	2
Dunajská Streda	5	11	0
Komárno	6	61	0
Nové Zámky	1	134	5
Levice	3	22	0
Velký Krtíš	2	69	0
Lucenec	2	4	0
Rimavská Sobota	1	1	0
Rožnava	0	0	0
Košice	0	0	0
Trebišov	0	0	0
TOTAL	**23**	**308**	**7**

MONITORING OF *Diabrotica virgifera virgifera* IN BULGARIA IN 2001

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The *D. virgifera* has been found for the first time in Bulgaria in 1998. The pest has spread in northwest in Bulgaria near the borders with Serbia and Romania.
In 2001 the monitoring had following goals:
1. permanent observation posts for reporting of the population density
2. limits of the dissemination of the pest
3. eventual damages in the area in which the corn has been grown as monoculture and where in year 2000 were determined adults

METHODS USED:
For discovering of larvae in the region where in 2000 were determined higher numbers of adults of WCR May - June were completed soil digging. soil sampling were taken in Bregovo, Dolna, Bijala, Retchka, Prevala and in other places in the regions of Vidin and Montana. Soil digging were accomplished from selected places that were plants obviously with deviation from the norms of development and also occasionally chosen normal plants.
The WCR monitoring program for determination of the limits of the spreading and the population density continued with 40 yellow sticky traps and 130 pheromone traps. They were situated on 41 monitoring sides (8 permanent sites). They were situated of Northwest Bulgaria The monitoring started in beginning of July in the regions of Vidin, Vratza, Sofia.
Results: Until now there were not found larvae and damages by them in the digging activities on places. On 12.07 in Bregovo were captured the first adults -12, in D. B. Retchka – 6. The higher numbers was caught in Gramada –548. Followed by highest numbers in Prevala – 265, Bregovo –149. Total numbers of trapped specimens was 1795.

CONCLUSION:
1. the distribution of WCR continued forward south and east.
2. for the first time were determined damages in the corn silk and leaves in prevala. damages in other area where was considered great density of WCR, were not determined.
3. the pest has been found near town Kneja and also south of Stara Planina (near Godetch)
4. from several years in the region of Iom, where the pest was discovered for the first time were not found adults.

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IWGO – NEWSLETTER XXII 1 / 2

FARM LEVEL MANAGEMENT OF WESTERN CORN ROOTWORM AT THE MEZOHEGYES STATE STUD-ESTATE CORPORATION, HUNGARY: A CASE STUDY

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In 2001, the western corn rootworm (WCR) population exceeded the economic threshold level in many regions of Hungary. As a result, farmers need WCR management tactics that can be implemented within their typical, multi-crop farming system. This paper looks at the various available management options with special regard to the areawide pest management strategy.

The Mezohegyes farm encompasses an area of 9500 ha of which 3300 ha are in corn (73% seed, 14% silage, 11,7% sweet, and 1,4% commercial corn in 2001). The remaining 6200 ha are made up of wheat, oats, sunflower, peas, alfalfa, sugar beet, and various vegetables. Of the 9500 ha, 5000 ha are under irrigation.

Each year, preparation of a preliminary risk assessment for WCR is required for each field. This is accomplished by estimating the overwintering WCR population in the various fields (pre-crop, pest management applications in pre-crop) and by considering planned insecticide applications (soil application, control of other pests, etc.), while taking into account WCR immigration from the surrounding fields.

For 2001, a preliminary risk assessment was prepared for the total corn growing area of the farm (50% is first-year corn, 45% is second-year corn, and 5% is third-year corn). Thirty-two (32) cornfields were selected for WCR population determinations by surveying with Pherocon AM traps from early July to late August (6 traps on each field, checked weekly).

The WCR infestation level on the farm was highly variable from field to field. The highest number of WCR adults trapped over a seven-day period was 23,1 adults/trap/day in third-year silage corn, 1,7 adults/trap/day in second-year seed corn, 1,1 adults/trap/day first-year seed corn.

Field application tests were made with Cidetrak (Tréce Inc., USA) and Invite (Florida Foods Inc., USA), gustatory stimulant in combination with a small amount of toxicant. Timing of adult control with these compounds and management experiences will be presented in the talk.

IWGO – NEWSLETTER XXII 1 / 2

UPDATE OF MONITORING DATA OF *Diabrotica virgifera virgifera* LeConte IN SWITZERLAND IN 2001

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After detecting four (4) western corn rootworm (WCR) adults on sex pheromone traps (Csalomon®) near the airport of Lugano-Agno in 2000, measures were taken to eradicate the supposed hazard to maize within the region. It was easy to believe that this infestation occurred at this location since flights into the Lugano Airport from Serbia took place in the early summer 2000.

METHODS

The measures that have been taken as a result of 2000 WCR catches, among others, was the use of an increased number of traps for 2001. A total of 74 traps were placed in 37 selected sites of the Swiss territory: 10 sites in the German part, 13 in the French section, and 14 in the Italian part (Ticino), including the Lugano Airport site. The traps were primarily placed along the main transportation routes in the main maize growing regions. Ticino is a territory that accounts for about 1200 ha of maize in small structured fields. The topography of Ticino shows three distinguishable maize regions, each separated by mountains and lakes. These include the border region in the south, hereinafter called Zone A; the Lugano region in the middle, Zone B; and the Magadino plain region 40 km northward, Zone C. All the traps were attached to a stake and placed approximately at ear height. They were set out in pairs within 20 m distance of each other near the edge of maize fields. The traps were monitored once per week from the 5th July until the end of September, with the pheromone being changed every 30 days, or 2 times for the sampling period (except 2 sites with a third exchange).

RESULTS

Italian part of Switzerland: Ticino

ZONE A: in the four trapping sites during the 12-week trapping period, an average of 143 adults per week was found. The first beetles were observed the 5th of July. a total of 1710 insects were trapped with 75 % coming from one maize field. the rest were equally distributed in the remaining locations and a relevant number of adults appeared there only 3 weeks later.

Zone B: During the same period, an average of 39 adults per week was found. However, catch numbers for July were not significant. The main flight period occurred within the August 2nd and 22nd time period with an average of 108 beetles trapped per week. A total of 462 WCR were captured. The distribution over all sites was almost equal.

Zone C: Only 2 WCR beetles per week were trapped over the same monitoring period

French and German parts of Switzerland:

In the remaining 23 locations no WCR beetles were found over the 12 weeks.

CONCLUSIONS

The number of *Diabrotica* detected in 2001 would indicate that a population of WCR is established near the border zone of Chiasso. In the Lugano zone, where in 2000 the first specimens were found near the airport, it's not clear whether an established resident

population is involved. Time delay in appearance, number of trapped WCR in 2000 and 1999 near Lugano Airport, equal distribution between the locations, and crop rotation regulations that have been enacted indicate a possible migrant population. But there is no certainty that the traps were located at sites that would prove this.
The four adults captured in 2000 possibly have an origin other than arriving by airplane. They easily could have migrated by themselves from zone a or from the bordering area of Italy. As the most prolific trap is only few meters away from the border and very near to the main railway station, it is possible that the beetles arrived one or more years before 2000 and became established in the region. In the maize field where beetles were first captured, which has a surface area of one hectare, maize has been grown five times in eight years with 2 interruptions.

For next year, authorities have decided to forbid the growing of maize in the same field in Zones A and B. The transport of silage from Zones A and B to C are also forbidden. An eradication strategy seems inappropriate since the insect is well established in Northwestern Italy and would serve as a source for reintroduction of WCR no matter the steps taken by Switzerland to eradicate it.

THE PROBLEM OF CORN ROOTWORM – *Diabrotica virgifera virgifera* Le Conte - IN UKRAINE

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Corn is one of the most important cultures in Ukraine, where much attention is paid to its growing. Yearly this culture occupies the square equal to 1,7 mil. Ha.
Taking into account a considerable potential of corn in the frames of general corn balance, all technological processes directed at providing its stable production, are under special attention of specialists and scientists.
Control over the development of harmful organisms, prognosis and control in advance aimed at avoiding damages of yield, gained special weight today.
As the adventive species of Diabrotica virgifera virgifera appeared in Ukraine, the first years were dedicated, first of all, to propagandizing the knowledge about this harmful species not only among specialists, but also among common public.
As a result, these years the multitude of conferences, TV and radio programs were organized, methodical recommendations, posters and postcards were edited, containing detailed data (according to American and European authors) on biology, morphology, and other data concerning the development and harmfulness of Diabrotica virgifera virgifera.
Ukraine gave its specialists the opportunity to take part in all international conferences, dedicated to this problem. Specialists and scientists were informed about the materials, provided by researchers from abroad.
During the recent years Ukrainian National Service of Phytosanitary has been monitoring Diabrotica virgifera virgifera. Active and goal-oriented work of specialists gave its results. It helped to discover the pest in August, 2001 in Zakarpattya, on the bordering line of Ukraine with Hungary and Romania. They were caught on the pheromone traps, made in Moldova. Revealing in-time provides the effective control over distribution of Diabrotica virgifera virgifera in Ukraine in the future.

On the whole, in 2001 the specialists of National Service monitored the territory of 500 thousand Ha in 25 geographical regions and 106 administrative units of Ukraine. In general, pheromone traps of Moldavian, partly Hungarian and Ukrainian syntheses were used. The total amount of 1200 traps were made use of

Pheromone traps were installed in the second half of July. Every ten days the inspectors of Phytosanitary Service made calculations and took specimen from pheromone traps, which were sent afterwards for analysis to the Laboratory of Quarantine. Pheromone capsule in traps was changed every 30 days.

During investigations more attention was drawn to Zakarpattya, Chernivtsi and Odessa regions, as they are bordering with Hungarian and Romanian regions where Western Corn Rootworm is widely distributed.

On August 15, 2001 the first time in Ukraine the imago of Diabrotica virgifera virgifera was revealed by specialists of Phytosanitary Service in such inhabited places as Kholmovets, Julivtsi and Bobove of Vynogradiv region in Zakarpattya, a bit later - also in Dyakovo. On August 22, 2001 in Beregiv region of Zakarpattya the imagoes of Western Corn Rootworm were noticed in Kosyno and Chetovo, later - in Astcj (see Table I). These dwelled places are situated 1-7 km from Hungarian and Romanian borders. Visual inspections of corn plantations found no larvae of Western Corn Rootworm. The results of all conducted tests were recorded in a special journal.

Western Corn Rootworm was detected in the Laboratory of Quarantine in Zakarpattya zones. The identification of Diabrotica virgifera virgifera Le Conte was confirmed by Central Scientific Laboratory of Quarantine.

Table 1: The review of Diabrotica virgifera virgifera Le Conte occurrence in Ukraine in Zakarpattya region in 2001.

District	Place of occurrence	Date of occurrence	Number of caught adults
Vynogradiv	Holmovets	15.08.2001	1
		27.08.2001	1
		13.09.2001	1
	Yulivtsyi	15.08.2001	2
		27.08.2001	1
		13.09.2001	1
	Dyakovo	27.08.2001	4
	Bobove	15.08.2001	1
		27.08.2001	1
Beregove	Kosyno	22.08.2001	1
	Chetovo	22.08.2001	1
		12.09.2001	1
	Asteii	12.09.2001	1

Scientific institutions continue their researches. So, Ukrainian Scientific Research Station of Plant Quarantine synthesized 8 analogues of natural genital liquids.

Some of them were installed along the perimeter with Romanian border in three regions of Ukraine. At the same time, thanks to friendly assistance of partners from Hungary, these liquids were used in the region with stable development of Diabrotica virgifera virgifera. The signs of effectiveness of different liquids as well as their modifications were defined and necessary results were attained. It'll be the basis of further improvement of their effectiveness and fitting to modern requirements.

At this point we'd like to underline that such co-operation helps to work out the system of control over development and distribution of adventive species on European territory more effectively.
Besides, scientific searching for the signs of corn plants resistance to Diabrotica virgifera virgifera also took place. According to this, Ukrainian Scientific Research Station of Plant Quarantine modified the device (published before by Dr. F.Bocza from Yugoslavia) for the identification of the maturity stage of corn root-system in the first half of vegetation. By means of this device we received data about resistance of root-system in different hybrids. This can be used in further approaches to selection and age of the seed of hybrids with strongly developed root-system.
So, in Ukraine the main directions of control over Diabrotica virgifera virgifera have been already identified.

APPEARANCE OF *Diabrotica virgifera virgifera* LeConte ON A BOUNDARY OF UKRAINE.

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The prompt territorial diffusion Diabrotica virgifera in the countries next to Ukraine, in particular with the Zakarpatye region (Hungary, Romania, Slovakia), demands realization of careful monitoring in boundary territories.
For this purpose in middle of July 2001 lengthways near border with Hungary, Romania and Slovakia in 22 populated localities, and also in villages of the central part of region on sowings of maize were exposed pheromone traps and color (yellow) traps.

The traps were exposed on edges of a maize field on approximately through every 1000 meters, alternating yellow plastic cylindrical traps, yellow cardboard rectangular traps and pheromone traps. The pheromones of the Hungarian and Moldavian production were used.

At analysis of August 15 of a biological stuff in traps with the Hungarian and Moldavian pheromone first four specimens of *Diabrotica virgifera* were revealed in three frontiers populated localities.

Thus, with the help of pheromone traps exposed on sowings of maize along border, it was possible to reveal appearance first individual specimens on terrain of the Zakarpatye region that testifies that the depredator closely has come nearer to Ukraine.

WESTERN CORN ROOTWORM (*Diabrotica virgifera virgifera* LeConte) IN UKRAINE: REALITY AND OUTLOOK

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The analysis of date on geographic - coordinate, zoogeographic and agroclimatic characteristics of Ukraine and the range of the western corn rootworm (WCR), which is a native species in America and an invading species in Europe gives the grounds to suppose

that WCR is able to inhabit all the territory of Ukraine. Nevertheless, because intensity of growing of the corn and the usage of repeated corn fields in a shift of crop system are different in various agroclimatic zones , it is advisable to propose the following three regions as to occurrence and damage of WCR in this country.

1. The region of mass occurrence and high damage that spreads on the most part of the area of Ukraine - the Steppe zone, southern part of the Forest-Steppe zone.
2. The region of common occurrence and sporadic damage on repeated fields of the corn in the central and western parts of the Forest-Steppe zone where the area occupied by the corn composes 10-20% of the arable area.

3. The region of possible occurrence which spreads over the north part of the Forest-Steppe and Forest zones, where the corn occupies less than 10% of the arable area, and repeated usage the corn in a shift of crop system is not practiced.

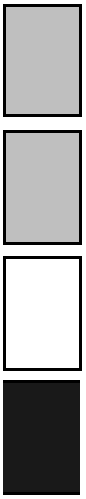
The first beetles (three imagoes on three fields) were found out by the authors by means of pheromone traps in August of 2001 in Vynogradovo District of Transcarpathia Regions. Moreover, in the same time in a field, it was recorded two clearings every with an area up to ten square meters with symptoms characteristic for damage by larvae of WCR, namely: lodging. This fact allows to suppose that primary penetration of the beetles has occurred in previous year - 2000, whereas the presence of WCR has been recorded in the second year as it is known in Yugoslavia.

It is quite probably that in 2002-2005 WCR will spread actively over the lowland part of Transcarpatha Region bearing damage to the corn, which is used in repeated fields in a shift of crop system. The mountain part of Transcarpathia Region where the corn is nearly out of growing will serve as a reliable obstacle for spreading of WCR. The practice of spreading of other quarantine pest species (Hyphantria cunea Drury, Grapholitha molesta Busck.) confirms this supposition.

Fig. The regions of occurrence and damage by WCR in Ukraine.

The agroclimatic zones

I.Forest
II. Forest – steppe
III. Steppe
IV Dry steppe



The regions of occurrence and damage by WCR .

2 - Mass occurrence and high damage

3 - Possible occurrence

4 - It is found out appearing of WCR in 2001

An appearing of WCR in the rest of Ukrainian territory should be forecasted for the Districts of Odessa Region close to Donau River from Romania when this species would seize the Donau lowland. It is possible an appearing of WCR in other places in Ukraine in a result of passive transferring of it by aviation and military techniques arrived from dislocation of Ukrainian peace-keeping forces in Yugoslavia. A possibility of such a transportation is confirmed by arising of infestation spots of WCR in Italy and Switzerland.

WESTERN CORN ROOTWORM (*Diabrotica virgifera virgifera* LeConte) SAMPLING AND CONTROL IN THE TERRITORY OF GUNJA, CROATIA *)

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A new insect pest was identified in 1995 in Croatia - the western corn rootworm (*Diabrotica virgifera virgifera* LeConte). The first objective of this research was to determine the population density of all stages, except eggs in commercial corn fields. The second objective was to investigate the efficacy of three organophosphate insecticides on larvae. The experiment was conducted in 1999 and 2000 in Gunja, Croatia (44°87'N, 18°94' E). Treatments were corn hybrids (OSSK 444, OSSK 552, Florencia,) and three soil insecticides (terbufos, chlorpyriphos-ethyl, chlormephos) applied at planting. Results showed the highest number of larvae per plant (0.70) in the untreated plot of OSSK 552. In 1999, significant differences in larval numbers occurred between hybrids, but not between the insecticides. In 2000, larval numbers only differed statistically between the insecticide treatments. The

*) not presented at the meeting

highest beetles population counted per plant was 0.55 in 2000. This population level is very close to economic threshold of 0.70 beetles per plant. Significant differences in beetle numbers per plant between hybrids were only detected in 2000. Pheromone traps containing the lure, Csal?m?N, caught significantly more beetles than the Multigard® yellow sticky-trap. Terbufos was the only soil insecticide providing a significant yield advantage to the hybrids, but only in 2000. Based on the current value of corn and cost of insecticide, terbufos is the only soil insecticide that would be cost-effective for growers. These studies should be conducted with other insecticides, and growers should avoid planting corn after corn in their fields.

INFLUENCE OF FERTILIZATION AND HYBRIDS ON WCR DAMAGE ON CONTINUOUS CORN

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Since it has been realized that the chemical control of the Western corn rootworm (*Diabrotica virgifera virgifera* Le Conte) is complicated and uncertain, it became important to determine which agrotechnical measures permit continued growing of corn in monoculture.

With this objective in mind, we have studied the effect of fertilization systems and corn hybrids on the harmfulness of the WCR. Experiments were conducted in 2000-2001, in the vicinity of Novi Sad, in a trial with corn monoculture established in 1951. The trial includes three fertilization variants (1. NPK, 2. crop residues + NPK, 3. manure + NPK) and the non-fertilized control and several maize hybrids of different maturity groups (FAO 300, 500, 600, 700). WCR damage was assessed via plant lodging, root damage and yield reduction.

In dry 2000, plant lodging were significantly higher in variants 2 and 3 (52.4 and 61.1%) than in the control (37.6%), while the situation was reverse in wet 2001. In the first year, plant lodging was most intensive in FAO groups 300 and 600 and least intensive in FAO 700. In the second year, the most intensive lodging occurred in FAO group 600 and the least intensive in FAO 300.

In both experiment years, root damage (on the scale 1-6) was largest in the control (4.57 and 4.91) and lowest in variant 2 (3.35 and 4.15). The differences were significant in the first year and non-significant in the second. In 2000, root damage ranged in the hybrids from 4.07 to 4.31, with non-significant differences. In 2001, FAO groups 300 and 500 experienced significant damages (4.74 and 4.63, respectively) in relation to the two hybrids in FAO group 600 (4.16).

In 2000, the highest yield (2.74 t/ha) was obtained in variant 2, which is significantly higher than in the control and variant 3 (1.18 and 1.25 t/ha). Yields of FAO groups 700 (2.45 t/ha) and 600 (1.96-2.08 t/ha) were significantly higher than those of groups 300 and 500 (1.00 and 1.49 t/ha). The yields in 2001 will be assessed in October.
Because of the extremely opposite weather conditions (particularly rainfalls) in 2000-2001, relevant conclusions may be expected on the basis of long-term data.

EVALUATION OF CROATIAN CORN HYBRIDS FOR TOLERANCE TO CORN ROOTWORM (*Diabrotica virgifera virgifera* LeConte) LARVAL FEEDING

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The western corn rootworm (*Diabrotica virgifera virgifera* LeConte (WCR)) is a major pest of corn in the USA. It was first recorded in Europe from Yugoslavia in 1992. The pest arrived in Croatia in 1995, and today over 200,000 ha are infested. In the USA, insecticides are regularly used to control WCR, but the cost is high, can pose environmental risks, and may become ineffective due to resistance. Growing corn resistant to corn rootworms would be a valuable alternative to insecticides.

Ten Croatian (Institute of Agriculture, Osijek) and two Pioneer Hi-Bred. Int. Inc. (Johnston, Iowa, USA) commercial corn hybrids were evaluated for WCR resistance at four locations using a randomized block design with four replications. Two locations were in east Croatia (Gunja, Osijek) and two were in the USA (Iowa, Missouri). At the Missouri location the plots were artificially infested with WCR eggs; the others contained natural rootworm infestations. At all locations, root injury was rated using the Iowa State University Node-Injury Scale (0-3) and the hybrids' tolerance to larval feeding was compared by evaluating root size and root regrowth. In addition the Iowa experiment contained side-by-side insecticide treated and untreated rows to measure yield tolerance.

In an analysis of variance combined across locations, root injury, size and regrowth were significantly different among hybrids and there was a significant location by environment interaction for each response variable. Root injury ratings in the USA averaged 1.52 and 1.67 at Iowa and Missouri, respectively, and 0.07 and 0.36 at Osijek and Gunja, respectively. Analysis by location showed the hybrids differed significantly in root injury and root size at Croatia and Iowa, but not Missouri. Root regrowth was significantly different among hybrids at all four locations.

OCCURRENCE OF WCR ADULTS ON DIFFERENT TRAPS AND HYBRIDS

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Since its first occurrence, until now, Western Corn Rootworm (*Diabrotica virgifera virgifera* Le Conte) has spread quickly, first in the main maize growing area of Yugoslavia, and then in other parts of country. This pest has tendency of further spreading, occupying first of all neighboring countries, followed by some European ones, whose ecological conditions favor to its reproduction and development.
With the aim to prevent economical losses, different sampling techniques and programs have been developed for all stages of corn rootworm. Imagoes sampling, i.e. plant inspection for damage prediction represents a standard method.

Trap use has advantages, for population assumption is done in longer time period, whereas during plant inspection it is performed in definite terms only, with the risk of being subjective. By trap use need for well-educated specialists for inspection of whole plants is eliminated. However, opinions on efficiency and credibility of different trap use are divided.
From the given reasons, during 2001, in the region of mid Banat (Yu), in hybrid fields of different ripening groups (NS 680, NS 644, NS 599 and NS 420), USA yellow sticky traps ("Pherocon AM" and "Multigard") and Hungarian pheromone trap were tested. Traps were set up on July 18, and the last reading was on September 5. Trap assessment and visual assessment of plants was performed weekly.
The greatest occurrence of WCR adults was during August in all hybrids, after which population kept reducing. The greatest total imagoes number was caught in the field of the hybrid NS 599. Hybrids NS 680 and NS 640 had similar imagoes number, whereas the smallest population was in the field of the hybrid NS 420. Among different traps have been determined significant differences in catch. The highest catch was on pheromone, similarly lower on yellow "Pherocon AM" and "Multigard" trap, with somewhat lower catch by visual assessment. These differences among applied traps and methods are evident in all studied hybrids.
The results should be considered preliminary ones. In the following year studies will continue and probably be completed by data on larvae density and harmfulness, as well as by the number of adults in emergence cages.

STUDY OF THE SEQUENTIAL SAMPLING FOR DETERMINING THE ADULT POPULATION OF *DIABROTICA VIRGIFERA VIRGIFERA* LE CONTE AT FIELD LEVEL IN HUNGARY

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In 2000, the Western corn rootworm (WCR) was present all over Hungary, except for three counties (Gyor-Moson-Sopron, Zala and Szabolcs-Szatmár-Bereg). This year, the traps have caught individuals in all regions of the country.

Supported by the forecasting specialists of the Hungarian Plant Protection Organisation, a sequential sampling was adapted according to the American literature.
Investigations were made between 23 July and 7 September 2001.
The survey procedure is simple and rapid, easy to learn for everybody and no special equipment and tools are required.

During the sampling process, the growing in monoculture and in one-year field is studied in a separated way. Investigations are made on minimum 20 and maximum 50 plants/pair of plants.
Putting the obtained data in a table of infestation threshold, a rapid and simple decision can be made on whether treatments are needed or not on the particular field.
This technique does not only provide a simple decision model for specialists, but it can be easily learnt and safely applied by farmers.

IWGO – NEWSLETTER XXII 1 / 2

DEMECOLOGICAL STUDY OF THE ADULT POPULATION OF *DIABROTICA VIRGIFERA VIRGIFERA LE CONTE NEAR SZEGED IN* 1999-2001*) **)

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Result of the first-year structure analysis were reported in 2000. The investigations have been continued and the results were compared with those of the previous year.
This year again six surveys have been made in the region of Szeged and the results were analyzed on the basis of formal and functional structure elements.
The obtained results were analyzed and compared with data of the American literature.
Changes of the distribution, in time, of the population density were examined in 2000, in dry and rainless weather, while in 2001, in a relatively rainy weather.

Made in the frame of the SKK/SooC project

*) Study carried out on the occasion of the 80th birthday of Dr. NAGY Barnabás
**) not presented at the meeting

BIOTECH APPROACH TO CORN ROOTWORM CONTROL: DEVELOPMENT STATUS OF MONSANTO'S CORN ROOTWORM RESISTANT MAIZE.

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Maize is the largest crop in the United States in terms of acreage planted and net crop value. In 2000, the U.S. maize crop covered **79** million acres. The western corn rootworm (CRW), *Diabrotica virgifera virgifera* LeConte, (Coleoptera: Chrysomelidae) is one of the most serious pests of maize in the United States. Larvae damage maize through feeding on the roots, which reduces the ability of the plant to take up water and nutrients from the soil and causes harvesting difficulties due to lodging. There are currently two common options for controlling CRW larval feeding, including synthetic insecticides and crop rotation. The later tactic can be ineffective as a result of behavioral modifications. The most common insecticide regime is an at planting time application, where the most widely used insecticides have been the organophosphate and synthetic pyrethroid insecticides. In 2000, these insecticides for CRW control were applied on over 18% of the maize acreage. This accounted for the largest insecticide usage in any one crop, totaling approximately 12 million pounds of active ingredient targeting CRW.

Recently, a third option has been developed using molecular biological techniques to produce transgenic maize expressing a *Bacillus thuringiensis (B.t.)* Cry3Bb protein. The Cry3Bb protein has been successfully transferred to corn to produce maize resistant to CRW feeding.

This new transgenic management tool has demonstrated superior larval feeding protection over current insecticides and has the potential to greatly reduce the amount of insecticides

applied in maize cropping systems, thus benefiting the environment and potential adverse effects throughout the manufacturing, distribution and use chain.

This presentation describes the development status of Monsanto's Cry3Bb expressing maize, including the results of efficacy and safety testing.

METHODS FOR EVALUATING TOLERANCE OF CORN TO CORN ROOTWORM (*Diabrotica virgifera virgifera* LeConte) LARVAL INJURY

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The mechanisms of host resistance to insects have been classified as non-preference, antibiosis, and tolerance. Non-preference describes plants that have lower populations of a pest because they are relatively less preferred than others. Antibiosis refers to the harmful effects of a host on a pest, resulting in suppression of pest densities. Tolerance is the ability of a host to produce higher yields while sustaining similar densities of a pest. Because resistance due to non-preference and antibiosis results in the presence of fewer pests, pest density is commonly used to evaluate these forms of resistance. With tolerance, however, pest densities do not differ measurably and comparisons must be made using differences in host growth and yield.

In the USA, an extensive search has been made for corn germplasm that is resistant to western corn rootworm (*Diabrotica virgifera virgifera* LeConte (WCR)) larval feeding. The WCR larvae are subterranean, making density estimates difficult to obtain. Consequently plant indices of larval density have been used to screen for non-preference and antibiosis. The most common index has been the root-injury rating. Plant characteristics that have been used to compare corn germplasm for tolerance to CRW larval feeding include: root size, root re-growth, plant lodging, and the amount of vertical force required to pull plants from the soil.

Attempts have been made to contrast root size using volumetric displacement of water and visual ratings. The volumetric displacement of water provides a quantitative measurement of size, but the measurement error has been too large for it to be useful. While visual ratings subjective, statistical differences in the ratings have been found and the ratings have been useful in ranking tolerance.

Root re-growth is the measure of a plant's ability to recover from injury caused by WCR larvae. Quantitative measurements of re-growth have been made by weighing root masses during and after larval feeding and calculating the difference. Visual ratings of re-growth have also been used to evaluate for tolerance using a 1 – 6 scale of fibrous root growth. While root weights are more precise than the subjective visual ratings, they are more difficult to obtain because the plots must be evaluated twice and the root masses dissected, dried, and weighed.

Plant lodging and the force required to pull plants from the soil are general estimates of root mass and health. Because lodging only results under certain environmental conditions, it has not been a reliable indicator of corn tolerance to WCR feeding. The force required to pull plants from the soil is less subject to environmental variability and has been more useful.

The measurements of pulling force are quite variable, however, requiring sample sizes that are larger than visual estimates of root size and re-growth.

CORN ROOTWORM DISPERSAL IN THE SOUTH DAKOTA AREAWIDE MANAGEMENT SITE*)

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The use of transgenic maize may soon be a reliable substitute for insecticides as a control tactic for corn rootworms (CRW). However, resistance among CRW could quickly evolve thereby diminishing the durability of the transgenic maize. To counteract the spread of resistance, refugia (non-transgenic maize) probably will be planted to sustain non-resistant CRW numbers. To keep resistant numbers low, gene flow among resistant and non-resistant CRW populations must occur. Dispersal is a means by which gene flow occurs among populations. Our goal is to examine the dispersal and reproductive biology of the western and northern CRW under field conditions. With respect to CRW movement, we wish to estimate the dispersal potential of western and northern CRW across the landscape in relation to sex, size, and reproductive status. Our study location is in the South Dakota CRW areawide management site. Using sticky traps, we captured 2460 northern CRW and 1116 western CRW dispersing between fields of continuous maize, first year maize, and soybean. Peak dispersal occurred in August for western CRW and August through September for northern CRW. Most CRW were captured between continuous and first year maize fields and at canopy height. Also using sticky traps attached to the top of conduit poles to detect vertical flight, we captured 805 northern CRW and 45 western CRW. More northern CRW were captured emigrating from maize fields than immigrating into maize fields. We found no differences in the number of western CRW immigrating and emigrating from maize fields. The number of western CRW was extremely low and may not be indicative of their migratory behavior into and out of maize fields.

*) not presented at the meeting

EFFECTS OF PRECIPITZATION AND TEMPERATURES ON THE LEVEL OF *Diabrotica virgifera virgifera* POPULATION IN THE REPUBLIC OF SRPSKA IN 2000 AND 2001

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At least 200 mm of precipitation during the maize growing season are necessary for maize growth under rainfed conditions. Two-fold higher precipitation sum is considered satisfactory,

while 500-600 mm are considered ideal. Effects of drought and high temperatures in the eastern regions of RS fill a role of stress in 2000. Temperatures induced earlier larval hatching in region of Semberia. The more precipitation sum approached the minimum value of 200 mm, the more unfavorable effects on maize and WCR were. On the other hand, precipitation and temperatures in 2001 were not a limiting factor in all regions of RS.
Monitoring of incidence and spreading of WCR imagoes over pheromone traps were done as in previous years. The obtained results were analyzed by comparison of the number of WCR imagoes over years and sums of precipitation and temperatures in Bijeljina, Doboj and Banja Luka. The favorable year of 1999 supported the development of the WCR population in 2000. Moreover, very warm April in 2000 with about 1500C HU accelerated larval hatching in maize continuous cropping in the area of Bijeljina; it also slowed down and reduced maize root development. Lack of nutrients and faster silk maturing resulted in significant WCR reduction in 2000 in comparison to 1999.
In 2001, the population increased by about 50% in relation to 2000 and equaled the abundance in 1999. The total number of imagoes per population amounted to 3532, 1972 and 3722 in 1999, 2000 and 2001, respectively.
Fluctuation of population abundance 2000:1999 and 2001:2000

	Distribution			**Years**	**Index**
East-West	**1999**	**2000**	**2001**	**2000:1999**	**2001:2000**
< 50 km	202.4	133.4	256.6	66	192
51-100 km	43.0	58.5	94.8	136	162
101-150 km	43.5	68.6	41.1	158	60
> 150 km	0.2	0.4	5.8	200	1450

The data obtained by imago monitoring in RS during 2000 and 2001 point out to a fact that a significant reduction of WCR population can occur in years with extreme weather conditions such as 2000 was. The population abundance increased westward.

INVITE* EC, AN ARRESTANT / FEEDING STIMULANT FOR CORN ROOTWORM CONTROL

ROBERT F. W. SCHRODER, Director of Entomology Research; Tom BROWN, Vice President for Marketing
Florida Food Products, Inc, P.O. Box 1300, Eustis, Florida USA, 32727-1300

The corn rootworm is one of the most serious pests on corn in the United States. Growers routinely apply soil insecticides to 50-60% of the 30 million acres of corn annually to control the pest. Insecticides are routinely applied prophylactically and are frequently unnecessary, and may cause imposed health risks to growers, livestock and wildlife, in addition to possible ground water and environmental contamination. Florida Food Products, Inc, in cooperation with USDA, identified, extracted and developed a feeding stimulant/arrestant specific to the corn rootworm, known as Invite*. Invite*EC is an inert, emulsifiable concentrate that is mixed with low levels of insecticides (less than 10%) to control adult corn rootworm beetles. Invite* contains a naturally occurring, EPA approved arrestant/feeding stimulant upon which the corn rootworm compulsively feeds. We have clearly demonstrated in our field trials and aerial applications this summer that Invite* applied with low levels of organophosphates, carbamates, pyrethroids and other inert products dramatically enhanced insecticide activity,

resulting in accelerated knockdown and sustained performance. The impact of Invite* mixed with reduced rates of pesticides on non-target insects including lady beetles, honey bees, lacewings, and other parasites and predators has been minimal. Invite* was applied with reduced rates of pesticides to over 50,000 acres of corn in 2000 and several 100,000 acres in 2001 with excellent results. We have provide the farmer with an alternative, safe, economical and effective product for control of the corn rootworm pest complex. We are planning to market this product in Europe and South America.

POSTER SESSION

MONITORING OF *Diabrotica virgifera virgifera* LeConte IN LOMBARDY (NORTHERN ITALY) IN 2001

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Maize is the most important field crop in Lombardy (Northern Italy) where over 350.000 hectares are cultivated. In 2000, the maize pest western corn rootworm (WCR), *Diabrotica virgifera virgifera* Le Conte (Coleoptera: Chrysomelidae), was detected for the first time near the Milan Malpensa Airport (Varese). Three specimens were collected on two farms using pheromone traps. As a result, two distinct areas of infestation were identified and within these maize cultivation was prohibited in 2001.
An extensive monitoring campaign was carried out in 2001 and over 300 PAL pheromone traps were placed in the 11 provinces of the region. WCR was found at different population levels in 8 provinces covering over 100.000 hectares of maize. In Como and Varese provinces, the highest numbers of WCR adults/trap were observed when compared to the other provinces. However, damage caused by larvae and adults was not noted. Preliminary evidence suggests that the area of Malpensa Airport is not the real origin of WCR spreading and that a different hypothesis on the matter is advanced here.
The results of adult monitoring and population levels observed are also reported.

SPATIAL VARIABILITY OF NORTHERN CORN ROOTWORM DISTRIBUTION IN RELATION TO LANDSCAPE POSITION

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Survival and development of the soil-dwelling immature stages of northern corn rootworms are influenced by soil-mediated processes that produce spatial variability in larval injury to corn roots and in patterns of adult rootworm emergence from the soil. The influence of the soil environment on survival of corn rootworm immature stages begins at the time eggs are laid in the soil and continues through one or two overwintering seasons and into the pupal stage. The existence of spatial variability in corn rootworm distributions suggests that site-specific management of these insects may be possible. However, the high cost of grid sampling prevents use of this approach for determining spatial distributions of rootworms or identifying management zones for application of site-specific control measures. Soil properties such as soil moisture, pH, and clay content are known to affect rootworm survival. We hypothesize that measurable soil parameters, particularly soil electrical conductivity, may be useful as ancillary variables to predict corn rootworm spatial distribution because, like the immature stages of rootworms, these soil properties also are influenced by soil moisture, pH, and clay content. Grid-sampled data for distribution of rootworm eggs in the soil, larval injury to corn roots, emergence patterns of adult corn rootworms, and soil electrical conductivity in relation to landscape position are discussed comparatively with reference to prospects for

the site-specific management of corn rootworms in two corn fields with distinctly different topography and soil types. These results suggest that the complexity and field-to-field variability of insect pest/soil interactions is such that a multivariate approach rather than use of a single predictor such as soil electrical conductivity may be necessary for site-specific management of insect pests in the soil environment.

IWGO – NEWSLETTER XXII 1 / 2

IWGO – NEWSLETTER XXII 1 / 2

IWGO ITEMS

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In any case you can read the NEWSLETTER on the IOBC Web site

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The next meeting of the Diabrotica Subgroup, the EPPO ad hoc Panel and the FAO Network Group will take place in Belgrade, Yugoslavia end of 2002.

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The XXIIth meeting of IWGO probably takes place in 2003 or 2004 in Spain. There are still discussion about time and place. IWGO – NEWSLETTER will you inform in time.

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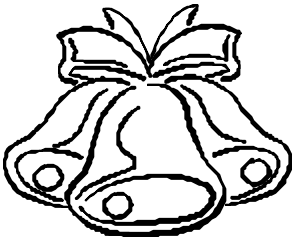

*Last but not least **IWGO – NEWSLETTER** wishes all IWGO – members and readers a peaceful and merry **Christmas** and a successful and happy **New Year**.2002*