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Agricolo Forestale e Agroalimentare

Agripolis – S.S. Romea, 16 – 35020 Legnaro (PD)

Tel. 049/8293711 – Fax 049/8293815

e-mail: [va@venetoagricoltura.org](mailto:va@venetoagricoltura.org)

[www.venetoagricoltura.org](http://www.venetoagricoltura.org)

**Realizzazione editoriale**

Veneto Agricoltura – Settore Divulgazione Tecnica e Formazione Professionale

Via Roma, 34 – 35020 Legnaro (PD)

Tel. 049/8293920 – Fax 049/8293919

e-mail : [divulgazione.formazione@venetoagricoltura.org](mailto:divulgazione.formazione@venetoagricoltura.org)

**Editing e coordinamento editoriale**

Alessandra Tadiotto – Isabella Lavezzo

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Proceedings

VIII Diabrotica Subgroup Meeting .....	2
 EUROPEAN PROJECT PAPERS	
S.Derridj, F.J. Muller, D.Tauban, M.Renou Egg laying behaviour of <i>Diabrotica virgifera virgifera</i> LeConte and possible associations with its morphology .....	3
S.Derridj, I.Arnault, F.J. Muller Influence of biochemicals present on maize leaf surface on <i>Diabrotica virgifera virgifera</i> (D.V.V.) egg-laying .....	11
J.Moeser, S.Vidal Alternative food resources for adult <i>Diabrotica virgifera</i> <i>virgifera</i> in Southern Hungary .....	19
S.Toepfer, U.Kuhlmann Life table of <i>Diabrotica virgifera virgifera</i> (The full paper was not available before printing) .	25
I. Hatala Zsellér, E. Széll Two years observations on correlation of larvae damage of Western Corn Rootworm and yields (The full paper was not available before printing) .....	27
J.Kiss, K.Bayar, J.Komáromi, J.Igrc-Barčić, R.Dobrinčić, I.Sivcev, C.R.Edwards I.Hatala-Zsellér Is the Western Corn Rootworm adapting to the European crop rotation system? Results of a joint European trial .....	29
I.Zoltán, M.Tóth, G. Vörös, I. Szarukán, T.Gazdag, A.Szeredi Comparison of performance of different trap types for monitoring of <i>Diabrotica virgifera virgifera</i> .....	39
L.Furlan, A. Di Bernardo, V.Girolami, M.Vettorazzo, A.M.Piccolo, G.Santamaria, L.Donantoni, V.Funes <i>Diabrotica virgifera virgifera</i> eradication - containment temptative in Veneto Region: year 2001 .....	47
M.Boriani, E.Gervasini Monitoring of <i>Diabrotica virgifera virgifera</i> LeConte in Lombardy (Northern Italy) in 2001 .....	53

L.Furlan, A.Di Bernardo, M.Vettorazzo, M.Boriani, E.Gervasini, G.Michelatti, G.Caielli, A.Ortez, C.Frausin, G.Agazzi, M.Bariselli <b>The presence of <i>Diabrotica virgifera virgifera</i> LeConte in Italy in 2001: distribution, population levels and what has to be done</b> .....	57
U.Kuhlmann, Feng Zhang, S.Toepfer <b>Selection of potential non-target Coleopteran host species for assessing the host specificity of exotic biological control agents</b> ( <i>The full paper was not available before printing</i> ) .....	61
P.Baufeld, S.Enzian <b>Simulation model spreading scenarios of Western Corn Rootworm (<i>Diabrotica virgifera virgifera</i>) in case of Germany</b> .....	63
L. Wennemann, H.E. Hummel, I. Ujváry, P.Sipos, A. Bándiné-Barlai, K. Szücs-Tóth <b>Analysis of a novel formulation of the plant kairomone mimic 4-methoxycinnamaldehyde (MCA) using UV spectrometry</b> .....	69
L. Wennemann, H.E. Hummel <b>Use of MCA (4-methoxycinnamaldehyde) as an orientation disruption tool for adult Western Corn Rootworm <i>Diabrotica virgifera virgifera</i> LeConte</b> .....	77
<b>FAO WCR NETWORK PAPERS</b>	
J.Kiss, C.R.Edwards, M.Allara, I.Sivcev, J.Igrc-Barčić, H.Festić, I.Ivanova, G.Princzinger, P.Sivicek, I. Rosca <b>A 2001 update on the Western Corn Rootworm, <i>Diabrotica virgifera virgifera</i> LeConte, in Europe</b> .....	83
F.Tóth, J.Kiss, T.Tuska <b>Effect of <i>Theridion impressum</i> (Araneae: Theridiidae) on the silk Clipping of <i>Diabrotica virgifera virgifera</i> adults in Hybrid seed corn in Hungary</b> ( <i>The full paper was not available before printing</i> ) .....	89
I.Rosca, M.Hincu <b>Researches regarding crop rotation, WCR management and pest evolution in Timis District - Romania</b> .....	91
C.K.Gerber, C.R.Edwards, J.Kiss <b>Economic thresholds for WCR adults in Soybean to Predict Subsequent Damage to Corn in Indiana, USA</b> .....	97
T.Tuska, J.Kiss, C.R.Edwards, Z.Szabó, I.Ondrusz, P.Miskucza, A.Garai <b>Effect of silk feeding by Western Corn Rootworm adults on yield and quality of seed corn</b> .....	107
I.Sivcev, A.Galo <b>Monitoring of <i>D. Virgifera virgifera</i> LeConte in Serbia in 2001</b> ( <i>The full paper was not available before printing</i> ) .....	115
H.K. Berger <b><i>Diabrotica</i> Monitoring in Austria 2001</b> .....	117

H.Imgraben <b>Monitoring the WCR (<i>Diabrotica virgifera virgifera</i> LeConte) in Baden-Wurttemberg in 2001</b> ( <i>The full paper was not available before printing</i> ) .	121
A.Pajmon <b>The monitoring of Western Corn Rootworm in Slovenia. A report for year 2001</b> .....	123
J. Igrc Barčić, R.Dobrinčić, M.Milan <b>Current status of WCR in Croatia</b> ( <i>The full paper was not available before printing</i> ) .....	127
R.Dobrinčić, J. Igrc Barčić, C.R.Edwards <b>The investigation of the relationship between the WCR population level and corn yield - Croatian experiences</b> ( <i>The full paper was not available before printing</i> ) .....	129
M.Brmež, D.Džoić, M.Ivezić, E.Raspudić <b>Western Corn Rootworm (<i>Diabrotica virgifera virgifera</i> LeConte) sampling and control of the territory of Gunja, Croatia</b> ( <i>The full paper was not available before printing</i> ) .....	131
H.Festić, H.Berberović, N.Karić, Z.Huremović <b>Investigation of <i>Diabrotica virgifera virgifera</i> LeConte in Bosnia and Herzegovina in 2001</b> .....	133
F.Gogu <b>Monitoring of Western Corn Rootworm (<i>Diabrotica virgifera virgifera</i> LeConte) in Romania in 2001</b> ( <i>The full paper was not available before printing</i> ) .....	137
I.Pălăgesiu, M.Hâncu, I.Grozea <b>Evolution of the pest <i>Diabrotica virgifera virgifera</i> LeConte in the Timis district</b> .....	139
I.Sivcev, A.Galo <b>Education as a factor in suppression of WCR in Serbia</b> .....	151
G.Ripka, G.Princzinger <b>Monitoring of Western Corn Rootworm (<i>Diabrotica virgifera virgifera</i> LeConte) in Hungary in 2001</b> .....	157
P.Sivicek <b>Results of the Western Corn Rootworm – <i>Diabrotica virgifera virgifera</i> monitoring in the Slovak Republic in 2001</b> .....	161
I.Ivanova <b>Monitoring of <i>Diabrotica virgifera virgifera</i> in Bulgaria in 2001</b> ( <i>The full paper was not available before printing</i> ) .....	165
Z.Szabó, I.Ondrusz, P.Miskucz, T.Nyári, J.Kiss, C. R.Edwards <b>Farm level management of Western corn Rootworm at the Mezohegyes</b>	

<b>State Stud-Estate Corporation, Hungary: a case study</b> <i>(The full paper was not available before printing)</i> .....	167
<b>OTHER WCR PAPERS</b>	
M.Bertossa, J.Derron, L.Colombi, R.Brunetti <b>Update of monitoring data of <i>Diabrotica virgifera virgifera</i> LeConte in Switzerland in 2001</b> .....	169
Alla M.Sadlyak, A.Josifovich Sikura, P.Ivanovich Yakovets <b>Appearance of <i>Diabrotica virgifera virgifera</i> LeConte on a boundary of Ukraine</b> .....	175
V.P.Omelyuta, N.Filatova <b>Western Corn Rootworm (<i>Diabrotica virgifera virgifera</i> LeConte) in Ukraine: reality and outlook</b> .....	179
T.Keresi, R.Sekulic, P.Strbac, F.Baca, D.Latkovic <b>Influence of fertilization and hybrids on Western Corn Rootworm damage on continuous corn</b> .....	185
J.J.Tollefson <b>Methods for evaluating tolerance of corn to corn rootworm (<i>Diabrotica virgifera virgifera</i> LeConte) larval injury</b> .....	191
P.Strbac, T.Keresi, V.Pecarski <b>Occurrence of WCR adults on different traps and hybrids</b> <i>(The full paper was not available before printing)</i> .....	197
K.Mucsi, K.Pálfi, C.Vaszi-Kovács, Ede Petró <b>Study of the sequential sampling for determining the adult population of <i>Diabrotica virgifera virgifera</i> LeConte at field level in Hungary</b> <i>(The full paper was not available before printing)</i> .....	199
K.Mucsi, Ede Petró <b>Demecological study of the adult population of <i>Diabrotica virgifera virgifera</i> LeConte near Szeged in 1999-2001</b> <i>(The full paper was not available before printing)</i> .....	201
J.C. Pershing <b>Biotech approach to Corn Rootworm control: development status of Monsanto's Corn Rootworm resistant maize</b> <i>(The full paper was not available before printing)</i> .....	203
M.Ivezić, J.J.Tollefson, E.Raspudić, B.E.Hibbard, I.Brkić <b>Evaluation of Croatian corn hybrids for tolerance to Corn Rootworm (<i>Diabrotica virgifera virgifera</i> LeConte) larval feeding</b> .....	205
B.Wade French, L.D. Chandler <b>Corn Rootworm Dispersal in the South Dakota areawide management site</b> <i>(The full paper was not available before printing)</i> .....	213

F.Baca, J.Stojcic, V.Trkulja, S.Radanovic, D.Lopandic, D. Zivanovic, D.Paravac <b>Effects of precipitation and temperatures on the level of <i>Diabrotica virgifera virgifera</i> population in the Republic of Srpska in 2000 and 2001</b> (The full paper was not available before printing) .....	215
S.S. Izhevsky, V. N. Zhimerikin <b>Evaluation of potential damage incurred by corn webworm in Russia</b> (The full paper was not available before printing) .....	217
R.F. W. Schroder, T.Brown <b>Invite EC, an arrestant/feeding stimulant for Corn Rootworm control</b> (The full paper was not available before printing) .....	219
O.M. Movchan, P.O. Melnyk, N.A. Konstantynova <b>The Problem of WCR (<i>Diabrotica virgifera virgifera</i> LeConte) in Ukraine</b> ...	221
M.M.Ellsbury, D.D. Malo, S.A. Clay, D.E. Clay, C.G. Carlson <b>Spatial variability of Northern Corn Rootworm distribution in relation to landscape position</b> .....	223
G.Wilde, J.Singh <b>A Comparison of the Trécé and Csalomon (European) CRW Trap for monitoring populations of <i>Diabrotica sp.</i> in Kansas</b> .....	231
<b>XXI IWGO Conference</b> .....	235
<b>EUROPEAN CORN BORE</b>	
F.Bača, H.Berger, P.Anglade <b>Final Results on estimation of IWGO inbreeds resistance to borers <i>Ostrinia nubilalis</i> Hbn. and <i>O. Furnicalis</i></b> (The full paper was not available before printing) .....	237
A.Bărbulescu, C.Popov, I.Sabau <b>The behaviour of a Monsanto maize hybrid - Dekalb 512 Bt to the attack by the European Corn Borer (<i>Ostrinia nubilalis</i>) in Romania</b> .....	239
P.Castañera, M.De La Poza, G.P.Farinós, P.Hernández-Crespo, F.Ortego <b>Monitoring of corn borers resistance to Bt-Maize in Spain: forecast of resistance</b> (The full paper was not available before printing) .....	249
G.P. Farinós, M.de la Poza, P.Hernández-Crespo, F.Ortego, P.Castañera <b>Impact of Bt-Maize on non-target arthropods in Central Spain</b> (The full paper was not available before printing) .....	251

## AGRIOTES

- L. Furlan, M.Tóth, V.Yatsynin, I.Ujváry  
**The project to implement IPM strategies against Agriotes species in Europe: what has been done and what is still to be done** . . . . . 253
- M. Tóth, Z.Imrei, I.Szarukán, R.Körösi, L.Furlan  
**First results of click beetle trapping with pheromone traps in Hungary 1998-2000** . 263
- K.Karabatsas, V.Tsakiris, K.Zarpas, J.A. Tsitsipis, L. Furlan, M. Tóth  
**Seasonal fluctuation of adult and larvae *Agriotes spp.* (*Coleoptera: Elateridae*) in Central Greece** . . . . . 269
- L.Furlan, A.Di Bernardo, S. Maini, R.Ferrari, L.Borioni, P.Nobili, G.Bourlot, A.Turchi, V.Vacante, C.Bonsignore, G.Giglioli, M.Tóth  
**First practical results of click beetle trapping with pheromone traps in Italy** . 277
- S.Gomboc, L.Milevoj, L.Furlan, M.Tóth, P.Bitenc, A.Bobnar, F.Celar  
**Two-years of monitoring Click Beetles and Wireworms in Slovenia** . . . . . 283
- L.Furlan, M.Tóth, W.E.Parker, M.Ivezić, S.Pancic, M.Brnez, J.J.Stross Mayer, Dobrinčić, J.I.Barčić, F.Mureşan, M.Subchev, T.Toshova, Z.Molnar, B.Ditsch, D.Voigt  
**The efficacy of the new Agriotes sex pheromone traps in detecting wireworm population levels in different european countries** . . . . . 293
- A.Ester, K. van Rozen, F. C. Griepink  
**Previous research of monitoring of *Agriotes spp.* with sex pheromones** . . . . . 305
- V.G.Yatsynin, E.V. Rubanova  
**Objectives of the research on click beetle species in Kuban region** . . . . . 311
- W.E.Parker, L.Furlan, M.Tóth  
**Future European priorities for wireworm research** . . . . . 317

## CORN BORES AND OTHER PROBLEMS

- A.Butrón, P.Soengas, P.Revilla, A.Ordás, R.A.Malvar  
**Genetics of resistance to Pink Stem Borer attack in flint maize populations** . 323
- M. Güllü, S.Kornoşor  
**Yield losses caused by lepidopterous pests on second crop maize in Cukurova Region of Turkey (*The full paper was not available before printing*)** . . . . 331
- S.Öztemiz, S.Kornoşor  
**The effects of different irrigation system on inundative release of *Trichogramma evanescens* Westwood (*Hymenoptera: Trichogrammatidae*) against *Ostrinia nubilalis* Hubner (*Lepidoptera: Pyralidae*) in the Mediterranean Region of Turkey (*The full paper was not available before printing*)** . . . . . 333
- F.Mureşan, D.Mustea  
**Methods for assesment the efficiency of chemical and biological treatment in the reduction of ECB (*Ostrinia nubilalis* Hbn.) in Transylvania** . . . . . 335



A.Ostojčić, M.Ivezić, E.Rasputić, M.Brmež <b>Control of European corn borer (<i>Ostrinia nubilalis</i> Hubner) in seedcorn production</b> . . . . .	343
G.S.Germinara, G.Rotundo, A. De Cristofaro <b>Field trapping of <i>Sesamia nonagrioides</i> (Lefèbvre) (Lepidoptera: Noctuidae) using multicomponent blends of sex attractants</b> . .	349
G.Rotundo, G.S.Germinara, A.De Cristofaro, P.Riolo <b>Sex pheromone of the Italian population of <i>Sesamia cretica</i> (Lederer) (Lepidoptera: Noctuidae).</b> . . . . .	357
L.Furlan, V.Girolami, A.Pavan, M.Bianchi <b><i>Ostrinia nubilalis</i> population levels in North Eastern Italy: long period data and practical considerations</b> . . . . .	365
A.Bărbulescu, I.Voinescu, D.Sadagorschi, A.Penescu, C.Popov, S.Vasilescu <b>A new product - Cruiser 350 FS for maize seed treatment against <i>Tanymecus dilaticollis</i> Gyll</b> . . . . .	369
C.Popov, A.Bărbulescu, C.Roibu, A.A. Alexandri, V.Preoteasa <b>Control of Wireworms in some field crops by seed treatment in Romania</b> . . .	377
I.Rosca, I.Sabau <b>Researches regarding influence of Roundup treatment and Roundup ready corn cultivation on usual fauna</b> . . . . .	387
<b>OTHER MAIZE PESTS</b>	
M.M.Pereira, A.M.Mexia <b>Abundance and spatial distribution of spider mites (<i>Acari: Tetranychidae</i>) populations on corn fields (Portugal)</b> . . . . .	393
J. A. Tsitsipis, J.T. Margaritopoulos, E. Smyrnioudis, R. Harrington, N. I. Katis <b>Seasonal appearance of cereal and maize aphids in Greece and factors associated with BYDV epidemiology in maize</b> . . . . .	399
L.Furlan, S.Zangheri, S.Barbieri, S.Lessi, I.Delillo, A.Barbi, F.Brichese <b>Black Cutworm alert programme in Italy</b> . . . . .	407
<b>IWGO - International Group on Ostrinia and other Maize Pests</b> . . . . .	413
<b>Veneto Regional Phytosanitary Service</b> . . . . .	415
<b>Veneto Agricoltura</b> . . . . .	415
<b>Scientific Committee</b> . . . . .	416
<b>Organizing Committee</b> . . . . .	416
<b>XXI IWGO Conference - VIII Diabrotica Subgroup meeting - Participants</b> . .	417

## BLACK CUTWORM ALERT PROGRAMME IN ITALY

*Lorenzo Furlan, Sergio Zangheri,*  
Department of Agronomy, Entomology, University of Padova,  
Agripolis-Via Romea 16-35020 Legnaro PD, Italy  
e-mail: lorenzo.furlan@inwind.it

*Stefano Barbieri,*  
Veneto Agricoltura, Corte Benedettina, via Roma 34, Legnaro PD

*Susanna Lessi, Irene Delillo, Adriano Barbi,*  
A.R.P.A.V., Meteorological Center of Teolo,  
via Marconi 55, 35037 Padova

*Francesco Bricchese,*  
Regione Veneto

### Abstract

*Agrotis ipsilon* (BCW) has caused severe damage to maize in some years in Italy. Therefore a black cutworm alert programme able to inform farmers in a timely manner about the presence of black cutworm economic populations has been tested in Veneto region. The procedure suggested by Corn Belt of USA Universities and Extension Services was implemented in Veneto region beginning in 1991. Sex pheromone traps were placed in maize fields of the different Veneto provinces beginning in late February of each year. Air and soil temperatures, information about direction and strength of winds were supplied by A.R.P.A.V. Degree days (development zero = 10.4 °C) were calculated beginning with the first captures on the traps. Ten maize fields in the area where males had been captured were investigated every 2 days beginning in late April of each year.

Very low numbers of moths were observed in some years. In those years, no black cutworm damage on maize plants was observed. The alert programme gave reliable results by using soil surface temperatures in calculating Degree Day accumulations, while the use of air temperature underestimated the DDA. In most years, the first fourth larval instars were observed some days before the date forecasted by the model (176 DDA for 50% of 4<sup>th</sup> instar larvae in the population). It was possible to forecast the period of larval damage thus making effective the rescue treatments where threshold had been met. Information was transmitted through a specific bulletin issued by A.R.P.A.V., Internet, newspapers and television channels.

Key words: *Agrotis ipsilon*, Alert Programme, maize.

## INTRODUCTION

*Agrotis ipsilon* Hufnagel, (Lepidoptera, Noctuidae) (BCW) represents a serious problem in Europe (Bues *et al.*, 1990; Hachler, 1988, 1989); in Italy it has caused severe damage to maize and other crops (thousands of hectares were destroyed) in some years particularly in 1971 and 1983 (Zangheri and Ciampolini, 1971; Zangheri *et al.*, 1984). Almost yearly, local outbreaks can cause reductions of corn stand or even the need for replanting (Furlan, 1989). Usually the farmers realize the extent of damage too late and rescue treatments become ineffective. Studies carried out in Italy demonstrated that the irregular outbreaks of the Noctuid in Northern Italy could usually be associated with the oviposition of migrant females at the beginning of spring (Zangheri *et al.*, 1998). Therefore, a black cutworm alert programme that can inform the farmers about the presence of black cutworm economic populations in real time has been tested in the Veneto region.

## MATERIALS AND METHODS

The procedure suggested and used by Universities and Extension Services in Corn Belt of USA (Archer and Musick, 1977, 1980; Showers *et al.*, 1985, 1986; Showers, 1997; Troester *et al.*, 1982; Von Kaster and Showers, 1984) was implemented in Veneto region beginning in 1991. Sex pheromone traps (Hartstack baited with lures prepared by INRA and Plant Protection Institute of Budapest, at least 10 to 35 per year) were placed in maize fields of the different Veneto provinces from late February of each year. Air and soil temperatures, information about direction and strength of winds were supplied by A.R.P.A.V. Degree days (development zero = 10.4 °C, Luckmann *et al.*, 1976) were accumulated (average of maximum-minimum method) beginning with the first captures on traps. These captures occurred just after strong winds coming from Southern regions. 176 DDA were considered for 50% of 4<sup>th</sup> instar larvae in the population. Tens maize (and sometimes sugar beet and sunflower) fields (0,5 to 2 hectares each) in the area where males had been captured were investigated every 2 days from late April of each year to when the 4<sup>th</sup> instar larvae started damaging the young plants. Each field was scouted by choosing 8 random areas of 20 m X 10 maize rows per field and observing all plants. Plants with typical black cutworm damage were individually checked and all the larvae found near the collars on each plant were collected and determined to species. At least 20 to 200 larvae per year were collected on damaged plants. The larval instar of captured BCW was estimated by using the head capsule data of Archer and Music (1977).

## RESULTS

Moth captures greatly varied in different years and in different provinces of the region (table 1). Very low numbers of moths were observed in some years, especial-

ly when no or weak southern winds occurred; in these years (1992, 1993, 1995, 1997) no black cutworm damage on maize plants was observed. In contrast in 1998, first significant migrant flight was observed between 5 and 12 April just after strong southerly winds had occurred. Soil temperatures were constantly higher than air temperatures and thus reach 176 DD 2-3 days earlier (*table 2*).

Table 1 - Synthetic results of the implementation of the Black Cutworm Alert programme in Veneto over the last 11 years

Year	First month captures	First significant flight	Flight level	4th instar first larvae	peak of 4th instar larvae	Forecast date for 176 DD	Damage level
1991	6 March	21-26 March	medium	NO larvae found			very low
1992	1 April	3-6 April	low	NO larvae found			NO DAMAGE
1993	29 March	6 April	low	NO larvae found			NO DAMAGE
1994	4 March	23 - 26 March	medium	5 May	7-8 May	8-13 May	medium
1995	11 March	NO	very low	NO larvae found			NO DAMAGE
1996	18 March	3 April	medium	2 May	6-8 May	9-11 May	medium
1997	24 March	NO	very low	NO larvae found			NO DAMAGE
1998	16 March	5-12 April	high	13 May	15-17 May	8-13 May	medium
1999	26 March	6 April	low	10 May	14 May	5-10 May	low
2000	29 March	29 March - 5 April	medium	4 May	8 May	4-8 May	low
2001	2 March	17 March	medium	29 April	1-2 May	5-9 May	medium

**Flight level:** *very low* means less than 1 moth/trap/day at the peak; *low* means 1 to 5 moths/trap/day at the peak; *medium* means 5 to 10 moths/trap/day at the peak; *high* means > 10 moths/trap/day at the peak

**Damage level:** *very low* means no or less than 0.1% of plants damaged in all the fields; *low* means no replanted fields and number of plants damaged 0.1 to 2%; *medium* means 0.5 to 5% of sampled surface replanted and in other fields number of plants damaged 2 to 30%.

Table 2 - BCW Alert programme. Differences between the number of days to reach 176 Degree Days forecast using soil temperatures and that forecast using air (2 m) temperatures in different localities of Veneto region in different years

year	Vazzola	Sorgà	Portogruaro	Legnaro	average annual differences	average difference 1996-2001	standard deviation 1996-2001
	0	2	8	5	3,75		
1996	5	4	3	2	3,5		
1998	2	4	2	3	2,75		
1999	2	6	2	-1	2,25		
2000	2	2	2	-2	1		
2001	3	-	4	0	2,33	2,60	2,24

Since the 1<sup>st</sup>-3<sup>rd</sup> *A. ipsilon* instars live off young weed and crop plants close to soil surface, soil temperatures were chosen to implement the model. When conspicuous larval populations established model performances varied significantly (*table 1*) as was observed by Kaster and Showers, 1984. In some years (1998, 2000) the prediction matched very well to the field observations. In most cases, the first 4<sup>th</sup> instar larvae were found a few days (3-7) before the date forecast by BCW Alert

programme. The differences were smaller taking into consideration the peak of larval presence (year 1994, 1996, 2001). These data are in agreement with those of Story *et al.*, 1984 who observed that 4<sup>th</sup> and 5<sup>th</sup> BCW instars may be present in fields when < 125 degree-days (sine wave method) or 100 degree-days (average of maximum-minimum method) have accumulated since 1 January using developmental data of Luckmann *et al.*, 1976. Only in one year (1999) was the predicted date slightly earlier than actual findings in the field, but in this case the population level was very low so that it is likely that the first larvae that moulted to 4<sup>th</sup> instar were not found.

## CONCLUSIONS

Moth capture levels by Hartstack traps can reliably indicate the years at risk from BCW. The BCW alert programme gave more reliable results by using soil surface temperatures in calculating Degree Days accumulation, while the use of air temperatures underestimated the DDA. The model tends to indicate 4<sup>th</sup> instar larvae presence in corn fields some days later than actual findings. Some years the prediction was quite correct, while in other years the first fourth instar larvae were observed 3 to 7 days before the date forecast by the model (176 DDA for 50% of 4<sup>th</sup> instars larvae in the population). Therefore, scouting in high-risk maize fields must begin about 7 days earlier than the model predicts to make sure that the first outbreaks can be detected in time. Taking this into consideration, it was possible to forecast the period of larval damage. This allowed for effective rescue treatments where thresholds had been reached or exceeded. Information was transmitted through specific bulletins issued by A.R.P.A.V., Internet, newspapers and television channels.

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