International Organisation for Biological and
Integrated Control of Noxious Animals and Plants

IOBC-WPRS
OILB-SROP

8th – 10th October 2013
BELVAUX, LUXEMBOURG

IOBC – Working Group Meeting

Integrated Control in Oilseed Crops

Centre de Recherche Public
Gabriel Lippmann

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IOBC-Working Group

INTEGRATED CONTROL IN OILSEED CROPS

Biannual Meeting

8 – 10 October 2013

at the

Centre de Recherche Public
Gabriel Lippmann

Belvaux/Luxembourg

Contents

SCHEDULE OF THE WORKING GROUP MEETING

Programme Overview

Day	Event	Start	End	Room
October 8th	Registration	10:30	14:00	Entry Hall
Tuesday	Welcome	14:00	14:40	F 0.11
	Introduction IOBC/WPRS	14:40	15:00	F 0.11
	Election of ICOC-Convenor	15:00	15:30	F 0.11
	General Session I	15:30	16:10	F 0.11
	Coffee Break	**16:10**	**16:50**	F 0.11
	General Session II	16:50	17:50	F 0.11
	Election Results	17:50	18:00	F 0.11
October 9th	Morning Session Entomology	09:00	10:30	F 0.11
Wednesday	Morning Session Pathology	09:00	10:30	F 0.11-2
	Coffee Break	**10:30**	**11:10**	F 0.11-1
	After Coffee Break Session Entomology	11:10	12:40	F 0.11
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	Lunch Break	**12:40**	**13:40**	Canteen
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	Coffee Break	**15:10**	**15:40**	F 0.11-1
	Poster Session	15:40	17:00	Entry Hall
	Bus transfer to the Moselle	18:30	19:30	
	Guided Tour at Wine Cellar “Bernard-Massard” at Grevenmacher	19:30	20:30	
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	Bus transfer back to Belvaux	22:30	23:00	
October 10th	Morning Session Entomology	09:00	10:30	F 0.11
Thursday	Morning Session Pathology	09:00	10:30	F 0.11
	Coffee Break	**10:30**	**11:15**	F 0.11-1
	After Coffee Break Session Entomology	11:15	11:50	F 0.11
	After Coffee Break Session Pathology	11:15	11:50	F 0.11-2
	Final Group Session Debate and Honours / Closing	11:50	12:30	F 0.11

Programme Details
8th October, Tuesday, All

10:30	14:00	REGISTRATION

Start	End	Welcome and Introduction	#
14:00	14:40	Birger Koopmann & Sam Cook (IOBC-ICOC convenors) Michael Eickermann & Lucien Hoffmann (Centre de Recherche Public – Gabriel Lippmann) Marc Weyland (Administration des Services techniques de l'Agriculture)	
14:40	15:00	Introduction to IOBC/wprs Lene Sigsgaard (Vice-President of the Executive Committee IOBC-WPRS and Liason Officer of ICOC)	
15:00	15:30	Election of ICOC-Convenor with self-introduction of the candidates	
15:30	17:50	General Session	
15:30	16:10	Current diseases of oilseed rape in Europe and worldwide and their control *Malgorzata Jedryczka*	G01
16:10	16:50	Coffee Break	
16:50	17:20	Spatial distribution of root maggot larvae (*Delia radicum*) and club-root symptomatic plants (*Plasmodiophora brassicae*) in winter oilseed rape *Marek Seidenglanz and Vojtěch Hlavjenka*	G05
17:20	17:50	Regional climate change effects on pest insects in oilseed rape *Michael Eickermann, Lucien Hoffmann and Jürgen Junk*	G02
17:50	18:00	Election results	

9th October, Wednesday, Entomology Subgroup

ENTOMOLOGY – Morning Session

Start	End	Entomology Chair: Sam. M. Cook	#
09:00	09:30	The expanding oilseed rape insect pest community in Estonia *Gabriella Kovács, Riina Kaasik, Anne Luik and Eve Veromann*	E01
09:30	10:00	Early plant injury as an indicator of infestation level of the cabbage stem flea beetle? *Helle Mathiasen, Peter Esbjerg and Jens Bligaard*	E02
10:00	10:30	Field monitoring of cabbage stem flea beetle and rape winter stem weevil autumn flights *Céline Robert*	E05
10:30	11:10	Official Group Photo and Coffee Break	

9th October, Wednesday, Entomology Subgroup

ENTOMOLOGY – After Coffee Break Session

Start	End	Entomology Chair: Bernd Ulber	#
11:10	11:40	Population dynamics and sex ratio of adult forms of stem mining weevils in Croatia *Ivan Juran, Tanja Gotlin Čuljak and Dinka Grubišić*	E06
11:40	12:10	Effects of various resyntheses, lines, and cultivars of oilseed rape on rape stem weevil (*Ceutorhynchus napi* Gyll.) infestation *Heike L. Schaefer-Koesterke and Bernd Ulber*	E07
12:10	12:40	A study to assess the parasitism of insect pests in winter oilseed rape in Belgium: preliminary results *Jean-Pierre Jansen and Sandrine Chavalle*	E09
12:40	13:40	Lunch Break at Canteen	

ENTOMOLOGY – After Lunch Session

Start	End	Entomology Chair: Michael Eickermann	#
13:40	14:10	A large field trial to assess the short-term and long-term effects of 4 insecticides used to control the pollen beetle on parasitic hymenoptera in oilseed rape *Jean-Pierre Jansen and Gilles San Martin Y Gomez*	E13
14:10	14:40	Developing and integrated pest management strategy for pollen beetles in oilseed rape - Part I *Sam. M. Cook, Andrew W. Ferguson, Matthew P. Skellern, Nigel P. Watts, Janet L. Martin, Lesley E. Smart, Christine M. Woodcock and John A. Pickett*	E19
14:40	15:10	Olfactometer screening of repellent essential oils against the pollen beetle (*Meligethes* spp.) *Claudia Daniel and Christian Urech*	E15
15:10	15:40	Coffee Break	

9th October, Wednesday, Pathology Subgroup

PATHOLOGY – Morning Session

Start	End	Pathology Chair: Neal Evans	#
09:00	09:30	Global warming and oilseed rape pathogens: potential impacts and adaptation strategies in Northern Germany *Magdalena Siebold and Andreas von Tiedemann*	P01
09:30	10:00	Interactions between WOSR canopy structure at flowering and *Sclerotinia sclerotiorum* epidemiology *Allart Chloé, Gourrat M, Tauvel O, Geloen M, Guerin O and Xavier Pinochet*	P03
10:00	10:30	SYield' – a risk alert system for *Sclerotinia* in oilseed rape *Jon West, Stuart Wili, Gail Canning, Steph Heard, Sophie Weiss, Patrick Jackman, Zac Coldrick, Andrew Mortimer, Guido Drago, Graham Johnson, Bruce Grieve, Keith Norman, Katherine Elsom, Katarzyna Kozan, Chris Easton, Gary Jobling, Ben Magri, Sarah Armstrong, Sarah Perfect, Derek Scuffell and Shradha Singh*	P04
10:30	11:10	Official Group Foto and Coffee Break	

PATHOLOGY – After Coffee Break Session

Start	End	Pathology Chair: Jon West	#
11:10	11:40	Light leaf spot (*Pyrenopeziza brassicae*) - a resurgent problem in the UK *Neal Evans, Rishi R. Bulakoti, Peter Gladders, Faye Ritchie, Judith A. Turner and Bruce D. L. Fitt*	P05
11:40	12:10	Loop-mediated Isothermal AMPlification as a good tool to study changing *Leptosphaeria* populations in oilseed rape plants and air samples *Malgorzata Jedryczka, Adam Burzynski, Andrzej Brachaczek and Joanna Kaczmarek*	P06
12:10	12:40	Detection of *Leptosphaeria maculans* races on winter oilseed rape in different geographic regions of Germany and efficacy of monogenic resistance genes under varying temperatures *Mark Winter, Coretta Klöppel and Birger Koopmann*	P07
12:40	13:40	Lunch break at Canteen	

9th October, Wednesday, Pathology Subgroup

PATHOLOGY – After Lunch Session

Start	End	Pathology Chair: Malgorzata Jedryczka	#
13:40	14:10	*Verticillium longisporum*: Pathogen Detection, Diagnostics and Varietal Resistance in U.K. Oilseed Rape (*Brassica napus*) *Thomas Wood, Sandra Chapman and Jane Thomas*	P09
14:10	14:40	Cross-resistance in winter oilseed rape (*Brassica napus*) against multiple vascular pathogens *Daniel Lopisso, Muhammad Farooq, Birger Koopmann and Andreas von Tiedemann*	P10
14:40	15:10	Studies of clubroot (*Plasmodiophora brassicae*) on oilseed rape in the Czech Republic *Veronika Řičařová, Khushwant Singh Sandhu, Jan Kazda, Miloslav Zouhar, Evženie Prokinová, Lenka Grimová and Pavel Ryšánek*	P11
15:10	15:40	Coffee Break	

9th October, Wednesday, Poster Session, All

ENTOMOLOGY – Poster Session

15:40	16:30	Entomology Poster	#
		Quantification of ecological services for sustainable agriculture *John Holland, Philippe Jeanneret, Wopke van der Werf, Anna-Camilla Moonen, Jozsef Kiss, Maarten van Helden, Maria Luisa Paracchini, James Cresswell, Philippe Pointereau, Bart Heijne, Eve Veromann, Daniele Antichi, Martin Entling and Bálint Balázs*	G03
		Oilseed crops in the Czech Republic and their health stage in 2013 *Jana Poslušná and Eva Plachká*	G04
		Effects of different soil cultivation after oilseed rape on the increase of *Plasmodiophora brassica* and *Delia radicum* *Simone Dohms, Nazanin Zamani-Noor and Holger Kreye*	G06
		Challenges and potential for organic rapeseed production in Denmark *Lars Egelund Olsen, Kathrine Hauge Madsen, Lene Sigsgaard and Jørgen Eilenberg*	E03
		Parasitism of cabbage stem flea beetle in oilseed rape and turnip rape *Alexander Döring, Dorothea Mennerich and Bernd Ulber*	E04
		Screening of *Brassica napus*, *Sinapis alba* and intergeneric hybrids for resistance to cabbage root fly *(Delia radicum* L.*)* *Henrike Hennies and Bernd Ulber*	E08
		Pyrethroid resistance of oilseed rape pest insects in Germany *Udo Heimbach and Meike Brandes*	E10
		Effect of two different insecticides on the reproduction of pollen beetles in field tests *Meike Brandes, Udo Heimbach, Gerrit Hogrefe and Bernd Ulber*	E11
		A multiannual study under semi-field conditions on the efficacy of insecticides against *Meligethes aeneus* F. – Methodical approach and analysis *Caroline Kaiser, Inga Bormann, Martin Ahlemann, Klemens Thierbach, Robert Engelmann, Loreen Schanze, Christa Volkmar, Beate Müller and Joachim Spilke*	E12
		Parasitism of pollen beetle, *Meligethes aeneus* F., in different regions of Northern Germany *Helge Stahlmann and Bernd Ulber*	E14
		Flight activity of *Meligethes aeneus* at a range of altitudes *Alice Mauchline, Sam Cook, Wilf Powell, Jason Chapman and Juliet Osborne*	E18
		Results of a small survey amongst farmers and advisers on their evaluation of the proPlant pollen beetle migration tool and its influence on their practice *Andrew W. Ferguson and Sam M. Cook*	E20

9th October, Wednesday, Poster Session, All

PATHOLOGY – Poster Session

15:40	16:30	Pathology Poster	#
Field inoculations of winter oilseed rape *Eva Plachká, Jana Poslušná, and Ivana Macháčková*			P02
Evolution of *Leptosphaeria maculans* populations in a small area of the region Centre (France) following the introduction of oilseed rape hybrids carrying the Rlm7 specific resistance gene. *Xavier Pinochet, Julien Carpezat, S. Bichot, Gilles Sauzet and Martine Leflon*			P08

9th October, Wednesday, All

All-Evening

18:30	Bus transfer to the Moselle *We will meet in front of the CRP building*
Guided tour at winery "Bernard-Massard" at Grevenmacher Afterwards Conference Dinner	BERNARD-MASSARD MAISON FONDÉE 1921

22:30	Bus transfer back to Esch and Belvaux

Winery Bernard-Massard

A family managed company, Bernard-Massard is the main producer of traditional method sparkling wines of Luxembourg and by extension of the Benelux countries.

The company was established in 1921 by a young and brilliant wine-maker from Luxembourg, Jean Bernard-Massard, who had learnt his skills in Champagne.

With the financial support of a small group of enthusiasts from Luxembourg and Belgium, he brought his project to fruition with the construction of the beautiful Grevenmacher winery on the banks of the Moselle River**.**

His aim was to create quality sparkling wines in Luxembourg and to make the most of the new markets opened up by the then recent establishment of the Customs Union between Belgium and Luxembourg.

After more than 92 years of existence, the company remains true to the values of quality and entrepreneurship of its founder.

It is with a constant passion that, together with 85 employees, the company elaborate and market Cuvees and Luxembourgish wines. Bernard-Massard is Luxembourg's first privately owned wine producer with about 4 million bottles leaving yearly our cellars.

Today, Bernard-Massard exports both its still and sparkling wines to numerous countries including Belgium, the Netherlands, Finland, Norway, the United Kingdom, the United States, Canada, Russia, and India.

10th October, Thursday, Entomology Subgroup

ENTOMOLOGY – Morning Session

Start	End	Entomology Chair: Eve Veromann	#
09:00	09:30	Differential rates of attack of oilseed rape genotypes by the pollen beetle: the cues may be in the bud wall *Maxime Hervé, Nathalie Marnet, Mélanie Leclair, Régine Delourme and Anne Marie Cortesero*	E16
09:30	10:00	The impact of semi-natural habitats on the abundance of pollen beetle adults in winter oilseed rape fields *Riina Kaasik, Gabriella Kovács, Janne Mölder, Kaia Treier, Liis Vaino and Eve Veromann*	E17
10:00	10:30	Developing and integrated pest management strategy for pollen beetles in oilseed rape - Part II *Sam. M. Cook, Andrew W. Ferguson, Matthew P. Skellern, Nigel P. Watts, Janet L. Martin, Lesley E. Smart, Christine M. Woodcock and John A. Pickett*	E19
10:30	11:15	Coffee Break	

ENTOMOLOGY – After Coffee Break Session

Start	End	Entomology Chair: Sam. M. Cook
11:15	11:50	General discussion about perspectives and future cooperation and projects

10th October, Thursday, Pathology Subgroup

PATHOLOGY – Morning Session

Start	End	Pathology Chair: Birger Koopmann	#
09:00	09:30	The importance of post harvest soil management in oilseed rape fields in reduction of clubroot severity *Nazanin Zamani-Noor*	P12
09:30	10:00	Random sampling of agricultural soils in Poland reveals frequent infestation with *Plasmodiophora brassicae* *Malgorzata Jedryczka, Marek Korbas, Ewa Jajor and Joanna Kaczmarek*	P13
10:00	10:30	Identification of the chromosome complement and genome recombination in interspecific hybrids and mutants within the genus Brassica, with known resistance to clubroot *Alicja Gronowska, Malgorzata Jedryczka, Janetta Niemann, Joanna Kaczmarek and Tomasz Książczyk*	P14
10:30	11:15	Coffee Break	

PATHOLOGY – After Coffee Break Session

Start	End	Pathology Chair: Birger Koopmann
11:15	11:50	General discussion about perspectives and future cooperation and projects

10th October, Thursday, All

Final Group Session

Start	End	Joint Session
11:50	12:30	Debate and Honours / Closing

ABSTRACTS

GENERAL SESSION

IOBC-Working Group Integrated Control in Oilseed Crops,
8 – 10 October 2013, Belvaux/Luxembourg

G01

GENERAL SESSION - Oral presentation

Current diseases of winter oilseed rape worldwide and their control

Malgorzata Jedryczka
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Abstract: Increased areas of oilseed rape in Europe – and worldwide are resulting from demand of the common market for plant oil and farmers' response to high profitability of this crop. This has had a high impact on the pest and diseases pressure of the crop. High intensity of oilseed rape cultivation has resulted in large monocultures (block cropping) and reduced rotations, which greatly increase the risk of disease epidemics. The literature list several groups of diseases of winter oilseed rape: seed-borne, soil-borne, foliar-base, viruses and phytoplasms. Their correct identification and knowledge on their spread is crucial, as it determines the best control strategy. Disease symptoms caused by most phytopathogenic fungi are easy to recognise by experts with good quality training. Low expertise may result in misidentification of the causal agent, and this may lead to the use of unnecessary or even counterproductive control measures, such as the use of improper biological and chemical treatments. The lack of sufficient knowledge makes it possible to confuse plant infection with harmful microorganisms, insect pest damage or lack of nutrients. The most important diseases worldwide and in Europe are phoma leaf spot and stem canker, Sclerotinia stem rot or white mould, black spot and clubroot. The first three are caused by phytopathogenic fungi, whereas clubroot is caused by a protist. In some regions grey mould and/or Verticillium has been observed. Plants of oilseed rape are also commonly attacked by powdery and downy mildews. It is less common to encounter light leaf spot or Fusarium. Many of the diseases occurring at the very start of seed germination and cotyledon development are well controlled by seed treatments. The control of numerous diseases strongly depends on the accuracy of pathogen detection at genus or species level. Current techniques of molecular biology allow quick identification, not only at species level, but also in relation to chemotype, pathogenicity group, the allele of avirulence gene, race composition and resistance status to specific fungicides. Beside early detection and identification, current strategies of integrated pest management also include forecasting the occurrence of different stages of a pathogen, such as mature fruiting bodies, spores or other forms of inoculum. Current decision support systems include real-time detection of the pathogen (eg. SPEC, www.spec.edu.pl) or weather and pathogen biology based mathematical models (eg. Blackleg Sporacle, SimMat, SIPPOM, SimAsco). Research on biological control of oilseed rape pathogens is under way.

Key words: diseases of oilseed rape, diagnosis, integrated pest management, forecasting, modelling

IOBC-Working Group Integrated Control in Oilseed Crops,
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G02
GENERAL SESSION - Oral presentation

Impact of regional climate change on pest insects in oilseed rape

Michael Eickermann, Lucien Hoffmann and Jürgen Junk
Centre de Recherche Public – Gabriel Lippmann, Département Environnement et Agro-biotechnologies (EVA), 41, rue du Brill, L-4422 Belvaux, Luxembourg

Abstract: Global (GCM) and regional climate models (RCM) are suitable tools to simulate the future climate. However, climate change projections are afflicted with different uncertainties, e.g. due to an incomplete coverage of all physical processes involved. A new way to deal with these uncertainties is to analyze an ensemble of equally valid, possible realizations of RCM projections. Furthermore, the use of an ensemble of future climate projections leads to more accurate estimates of the potential future changes, because the effect of the internal variability can be more accurately addressed. Examples of multi model ensemble approaches in agriculture are discussed in the literature. Aside from effects on agricultural practice, possible impacts of global change are also expected on pest species in crop production, e.g. species distribution or shifting of crop invasion. Since 2009, an expert group of meteorologists, entomologists and modellers is investigating the effect of regional climate change on pest species in oilseed crops for Luxembourg in the framework of several research projects. So far, projections have been done for the rape stem weevil, *Ceutorhynchus napi* Gyll., the cabbage stem weevil, *Ceutorhynchus pallidactylus* (Mrsh.) and the pod midge, *Dasineura brassicae* Winn. Based on an ensemble of 15 regional climate change projections, the bandwidths of possible change signals and the uncertainty associated with these projections were investigated per decade for the near (2021 until 2050) and far future (2069 until 2098) in comparison to a reference time period (1961 until 1990). All projections were based on the Special Report on Emissions (SRES) A1B emission scenario of the Intergovernmental Panel on Climate Change, IPCC (IPCC, 2007). This scenario describes anthropogenic emissions of a future world with rapid economic growth, an increasing global population until the middle of this century and a balanced use of fossil and non-fossil energy resources.

The presentation will give a short introduction about the development of regional climate change models, an overview about the advantages of bias-corrections and several results of climate change impacts on pest species in oilseed rape.

Key words: bias-correction, crop invasion, ensemble projection, impact study, regional climate change

Acknowledgement: We gratefully acknowledge the financial support of the Ministère de l'Enseignement supérieur et de la Recherche (MESR) of the Grand Duchy of Luxembourg in the framework of the REMOD program.

IOBC-Working Group Integrated Control in Oilseed Crops,
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G03
GENERAL SESSION – Poster presentation

Quantification of ecological services for sustainable agriculture

John Holland[1], Philippe Jeanneret[2], Wopke van der Werf[3], Anna-Camilla Moonen[4], Jozsef Kiss[5], Maarten van Helden[6], Maria Luisa Paracchini[7], James Cresswell[8], Philippe Pointereau[9], Bart Heijne[10], Eve Veromann[11], Daniele Antichi[12], Martin Entling[13] and Bálint Balázs[14]

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Abstract: The project aims to identify the key semi-natural habitats (SNH), outside and within crops, providing essential ecological services (ES). Vegetation traits will be linked to potential ES provision, case studies will measure actual ES levels and inform models which will show unused opportunities and trade-offs among ES by SNH from habitat to landscape scale. This will be achieved for a range of representative cropping systems and farming intensities in regions dominated by agriculture and matched to the requirements of local and national stakeholders. Surveys will identify key SNH and existing literature will be used to link their vegetation traits to ES provision. ES provision will be measured in existing habitat types (SNH to crop) across economically important cropping systems, farming intensities and four European agro-climatic zones using simple techniques in 16 case studies. A case study is defined by a unique combination of region, crop species, and service. Each case study will concentrate on locally important cropping system and the main ES required. Pollination and pest control have been identified as main ES needed, but also soil fertility, weed control and social services will be considered. The relative socio-economic weight of the studied ecosystem services will be appraised using feedback from national experts using a semi-quantitative method. Data will parameterise spatially explicit models to determine how the vegetation composition, management, shape, area, and placement of SNH in agricultural landscapes affect the distribution of mobile-agent based ecosystem services from farm to landscape level. To investigate synergies and trade-offs in ecological services, multi-criteria analysis will be developed to combine a suite of modules in an integrative modelling framework. Outputs are designed to inform local, national and EU stakeholders on how to improve ES provision from SNH and will include a novel web-based tool.

Key words: semi-natural habitats, trade-off, landscape, cropping system, agro-climatic zone

Funding: FP7- KBBE-2012, Collaborative project.
Project coordinator: PhD. John Holland, Game and Wildlife Conservation Trust, UK. The **QuESSA project** is funded by the European Commission through the Seventh Framework Programme. Contract Number 311879

IOBC-Working Group Integrated Control in Oilseed Crops,
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G04

GENERAL SESSION - Poster presentation

Oilseed crops in the Czech Republic and their health stage in 2013

Jana Poslušná[1] and Eva Plachká[2]
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[2]*OSEVA Research and Development Ltd, Workplace Opava, Purkyňova 1653/10, 746 01 Opava, Czech Republic*

Abstract: The Czech Republic grows the following crops as oilseeds: winter oilseed rape (*Brassica napus*), white mustard (*Sinapis alba*), sunflower (*Helianthus annuus*), poppy (*Papaver somniferum*), brown mustard (*Brassica juncea*), oilseed flax (*Linum usitatissimum*), and small amounts of soya (*Glycine soja*) and peanuts pumpkin (*Cucurbita oleifera*).

The area of oilseeds grown increases every year and the most significant percentage is the proportion of winter oilseed rape. In 2013 the rapeseed area reached 401.3 thousand ha, the average yield for the last three years was 2.73 t / ha. In 2012 the production was 1.109 thousand tons. Rapeseed contains 35-40 % oil. From one hectare of oilseed rape we get about 3 tons of seed, which are squeezed to get approximately 1.100 kg of rapeseed oil, from which 70 thousand tons of methyl esters were produced as additives for fuels last year. Rapeseed oil is very low in saturated fatty acids and high in monounsaturated and essential fatty acids, omega-6 and omega-3. In the Czech Republic the winter form of oilseed rape is usually cropped; spring oilseed rape (*Brassica napus* convar. *napus* f. *anua*) occupies less than 1% of the sown area. In the association the Czech Rape our organizations are engaged in breeding Czech linear varieties of winter oilseed rape. Most recently registered varieties include Oponent (2006), Oksana, Opus, Aplaus (2007), Benefit (2009), Cortes, Orion, Oceánie (2012) and Rescator (2013). Among the most important fungal diseases of oilseeds are Phoma blackleg (*Phoma lingam*) and white rot of oilseed rape (*Sclerotinia sclerotiorum*). Another fungal disease *Peronospora parasitica* does not cause serious problems at present. The importance of clubroot (*Plasmodiophora brassicae*) is primarily localized in contaminated areas especially when early sowing and volunteer oilseed rape plants occur. Among the important pests of oilseeds are stem and pod weevils, pollen beetle (*Meligethes aeneus*) and Brassica pod midge (*Dasyneura brassicae*). In the Czech Republic an increased level of tolerance of pollen beetles to pyrethroids was found. In recent years damage to plants (roots) has been caused by cabbage root flies (*Delia radicum*).

The second most important oil plant in the Czech Republic is the sunflower. In 2012 it was grown ont 24.6 thousand ha, production amounted to 56.9 thousand tons of seeds and the average yield for the last three years amounted to the equivalent of 2.3 tons / ha. Sunflower seeds contain on average 45 % oil. The sunflower oil is commonly used as edible oil in food, for frying and deep-frying, as well as a moisturizing ingredient in cosmetics. The most significant adverse factors affecting sunflower in the Czech Republic include gray mold (*Botrytis cinerea*), sunflower white rot (*Sclerotinia sclerotiorum*), and aphids – *Brychycaudus helichrysi* and *Aphis fabae*.

Poppy takes third place of crop area grown. Poppy in the Czech Republic is grown mainly as a food material. Poppy straw (capsules and upper part of poppy stem) are also used in pharmacology. Poppy was grown in 2012 on 18.36 thousand ha, harvested seed production amounted to 12.8 thousand tons. The average yield for the last three years was 0.67 t / ha. Poppy seeds contain 45-50% oil. Poppy seed oil is easily digestible, contains large amounts of vitamin E and has no narcotic effects. Poppy seed contains particularly high doses of tocopherols other than vitamin E (alpha-tocopherol). Poppy seed oil is used in food preparation. Other applications include the manufacture of paints, varnishes and soaps; poppy oil is also used in medical radiology. Among the major diseases of poppy in the Czech Republic are poppy mildew (*Peronospora arborescens*) helminthosporiosis of poppy (*Dendryphiella* sp., *Dendryphium penicillatum*), gray mold of poppy (*Botrytis cinerea*), Alternaria

spots of poppy and blacks on capsules (*Pleospora herbarum*). In 2013, the incidence of diseases was low. In some crops there were reports of poppy mold, helmithosporiosis and occasionally gray mold.

Mustard was cultivated in the Czech Republic on 16.94 thousand ha in 2012, and production was 15.46 thousand tons of seed. Large areas covered grafts (11.023 ha in 2012). The average seed yield for the last three years was 0.81 tons / ha. Among the major diseases of white mustard are Sclerotinia white rot (*Sclerotinia sclerotiorum*), Alternaria leaf spot of Brassica (*Alternaria* spp.) and gray mold of crucifers (*Botrytis cinerea*). *S. sclerotiorum* impairs the quality of the harvest especially in seed crops. Increased incidence is particularly visible from rich rainfall during ripening.

Among the important factors affecting the quality and quantity of production, followed by the quality of the processed oils, includes the health of crops. Monitoring of fungal diseases in oilseeds (mainly rapeseed, mustard, poppy and sunflower) is important and research is currently underway to improve this for the long term. The year 2013 was from a phytopathology view not significant; fungal disease pressure was low overall and crop growth was healthy. However, the incidence of pests was significant.

Key words: Czech Republic, oilseeds, oilseed rape, sunflower, poppy, mustard, diseases, pests

Acknowledgement: Obtained results were also obtained for project support NAZV QJ1310227 and CZ 1.07/2.3.00/35.0013 "Partnership for popularizing the R & D support and further education in the popularization of technology transfer in the field of agriculture, food and bio-energy."

IOBC-Working Group Integrated Control in Oilseed Crops,
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G05
GENERAL SESSION - Oral presentation

Spatial distribution of root maggot larvae (*Delia radicum*) and clubroot symptomatic plants (*Plasmodiophora brassicae*) in winter oilseed rape

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Abstract: Damages caused with root maggots (*Delia radicum*) and clubroot (*Plasmodiophora brassicae*) in winter oil seed rape fields in the Czech Republic (CZ) have been increasing recently. Distribution of root maggot larvae (RML) and clubroot symptomatic plants (CRP) in winter oilseed rape were assessed on six fields at Olomouc region in CZ during the autumn 2012 (Spatial Analysis by Distance IndecEs; SadieShell 1,22). On all localities marginal parts of fields were more infested by RML (Fig. 1). However, it would be incorrect to conclude that the insect pest threatens only field margins. The distributions of RML in fields were not uniform, individuals mostly aggregated into the clusters. The sizes and orientation of the infestation focuses (places with markedly higher level of infestation of roots) were different in the compared fields. They did not occur only along field margins. Significant positive correlations between the damaged area of roots and the width of hypocotyls were recorded on four localities (Spearman´s **r**: 0.38 – 0.59; $p<0.05$). Significant positive correlation between the portion of plants infested by RML and the width of hypocotyls showed only on two localities (Spearman´s **r**: 0.41 – 0.47; $p<0.05$). CRP were recorded on four localities. Three localities were slightly infested, CRP were concentrated in one or two focuses. One locality (Libina) was severely infested and almost uniform distribution of the CRP was recorded here (Fig. 2). On the locality significant negative correlation between the portion of CRP and the damaged area of roots (caused by RML) was recorded (Spearman´s **r**: - 0.56; $p<0.05$), (comparison of Fig. 1 and 2).

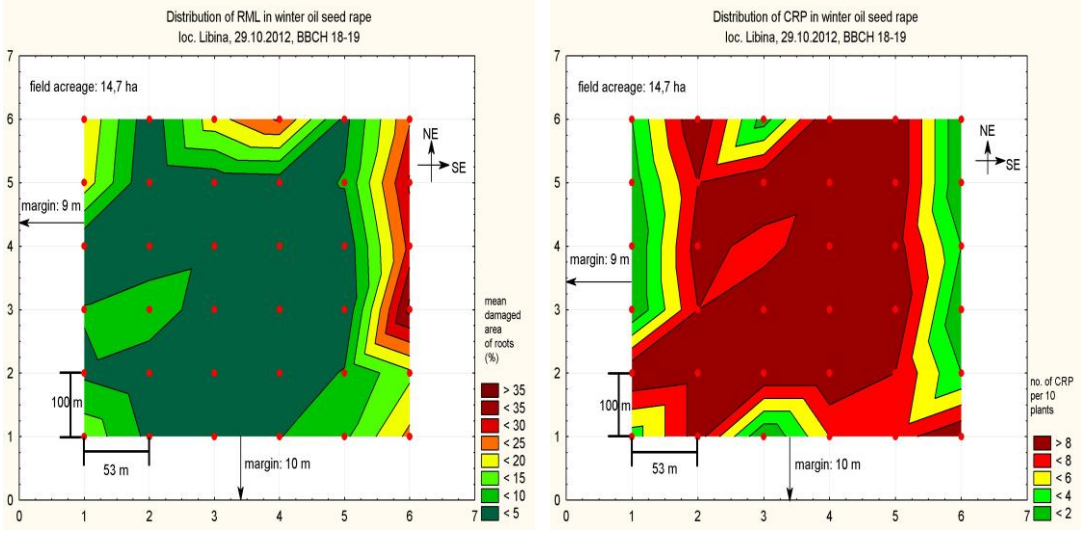

Fig. 1, 2 - Distribution of RML and CRP in winter oil seed rape in Libina (12.10.2012)

Key words: *Delia radicum*, clubroot, oilseed rape, spatial distribution

Acknowledgement: This work was funded by the grant QJ1230077 from the Ministry of Agriculture of the Czech Republic.

IOBC-Working Group Integrated Control in Oilseed Crops,
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G06

GENERAL SESSION - Poster presentation

Effects of different soil cultivation after oilseed rape on the increase of *Plasmodiophora brassica* and *Delia radicum*

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Abstract: In terms of the increasing density of cultivation of winter oilseed rape and the increasing trend to modern cost-efficient management practices, the oilseed rape stubbles remain on the soil surface more often. Therefore the volunteer oilseed rape grows for a longer period on the harvested areas. The presence of volunteer oilseed rape can lead to the proliferation of different pathogens and pests in oilseed rape fields. In particular, the third generation of *Delia radicum* develops on the oilseed rape stubble and clubroot disease occurs on the volunteer oilseed rape plants. In this project the effect of soil cultivation after rapeseed harvest of the pathogen and pest was investigated.

Field experiments were done for three years at Julius Kühn Institute in Braunschweig. Different soil cultivations (plow, cultivator and disc harrow) were applied at two different time points (2 weeks after harvest or 4 weeks after harvest). The field trials were observed separately for the occurrence of clubroot and *Delia radicum.*

The results show that the development of clubroot disease can be reduced by a flat tillage at least two weeks after harvest. Later treatment led to a strong increase of clubroot disease. A total reduction of clubroot with different tillage systems is not possible. The observed result on *Delia radicum* was similar to the clubroot disease. A reduction of the rate of flies was reached in all treatments. The best results (70% reduction) were achieved by the plow and the cultivator.

Key words: clubroot, cabbage root fly, tillage, phytosanitary effect

ABSTRACTS

ENTOMOLOGY SESSION

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E01
ENTOMOLOGY SESSION - Oral presentation

Expanding the oilseed rape insect pest community in Estonia

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Abstract: The increase in oilseed rape cultivation over the last two decades has led to the introduction of a "new" pest to Estonian farmers. The brassica pod midge, *Dasineura brassicae* (Winnertz, Diptera: Cecidomyiidae) is a pest of potential economic importance in Europe. Its presence in oilseed rape fields in Estonia became clear during a study conducted to measure the number of overwintered oilseed rape pests and hymenopteran parasitoids within fields and in field edges. Soil samples were collected and incubated in emergence traps from different fields that grew winter oilseed rape in the previous year in Tartu County. Only a low number of pests emerged from these samples from which we can assume that despite the widespread opinion amongst Estonian farmers, most pests do not stay in or near the fields for overwintering. However, the most abundant pest collected was the brassica pod midge, indicating that it does prefer to stay in or near the fields for winter. Additionally, significantly more parasitoids emerged than pests indicating that these natural enemies also chose their overwintering sites within or near the fields. Hence, instead of ploughing, a well-planned and strict crop rotation should be favoured to lower the threat of this relatively new pest.

Key words: *Dasineura brassicae*, *Meligethes*, *Ceutorhynchus*, parasitoids, oilseed rape pests

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E02

ENTOMOLOGY SESSION - Oral presentation

Early plant injury as an indicator of infestation level of the cabbage stem flea beetle?

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Abstract: Forecasting abundance of the cabbage stem flea beetle, *Psylliodes chrysocephala*, is based on monitoring of adult beetles with yellow water traps but there is not always a direct correlation between trap catches and larval density. The objective of this study was to investigate assessment of early plant injury as a monitoring method. This was done, in a field cage experiment, by testing the relationship between absolute number of adult beetles and immediate and subsequent plant injury from adults feeding on plants and from larvae mining plant stems. A statistically significant relationship between the number of adult beetles and plant injury was not found when plant injury was expressed as damaged plants or feeding holes. However the experiment revealed a small but significant increase in number of damaged leaves per plant at increasing density of beetles. The observed mean number of damaged leaves per plant was 0.48, 0.58, 0.55 and 0.79 at 2, 4, 8 and 16 beetles after four weeks. There was a statistically significant relationship between number of adult beetles per cage and larval density per plant. The observed mean numbers of larvae per plant were 0.15, 0.38, 0.87 and 1.42 per plant at 2, 4, 8 and 16 beetles. A range from low to high infestation level was not achieved in this experiment since the observed mean number of larvae per plant representing high infestation level was as low as 1.42. Overall the present study demonstrates a correlation between absolute number of adult beetles and larvae per plant. However, early plant injury was not a satisfactory indicator of infestation level. These results may reflect a need of including a wider range of beetle densities and not least conditions for beetle activity in further experiments.

Keywords: Monitoring, forecasting, Cabbage stem flea beetle, *Psylliodes chrysocephala*, plant injury and larval density

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E03

ENTOMOLOGY SESSION – Poster presentation

Challenges and potential for organic rapeseed production in Denmark

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Abstract: The current organic oilseed rape area in Denmark is approximately 470 ha (Danish AgriFish Agency, 2012). However, the Danish market potential for organically grown oilseed rape is at least ten times higher than the current production (Nilsson, A. J., Statistics Denmark, personal communication June 2012). This gap between supply and demand is primarily due to frequent and severe attacks by two insect pest species, the cabbage stem flea beetle (*Psylliodes chrysocephala* (L)) and the pollen beetle (*Meligethes aeneus* F.).

In autumn and winter, cabbage stem flee beetle adults feed on seedling winter oilseed rape and can cause considerable damage. Their larvae tunnel leaf stalks and stems.

The pollen beetle adults feed on pollen. On a flowering crop this is not problematic, however prior to flowering the adults bite holes into the green buds to feed on the pollen. The pistil is often dam-aged, resulting in sterility or premature loss of the flower.

Often organic rape seed crops have to be ploughed under in spring because of low crop plant survival after attacks by the cabbage stem flea beetle. Even with acceptable crop densities in spring, attacks by invading pollen beetles may subsequently minimize seed setting. Therefore, oilseed rape it is considered a high risk crop to grow for Danish organic farmers.

A current Danish project (financed by two national funding bodies: 'Fonden for Økologisk Landbrug' and 'Promilleafgiftsfonden') is investigating management strategies to prevent and/or reduce attacks by insect pests in organically produced oilseed rape in order to increase the organic oil seed rape production. A further goal of this project is to initiate a transnational exchange of knowledge and practical experiences combined with development of pest control strategies e.g. conservation biocontrol, inundation and inoculation biocontrol, and also trap cropping.

Currently, a Danish field experiment with different management tactics are being conducted in commercially grown winter oilseed rape fields at 3 locations. The experimental treatments are based on promising non-chemical control methods, described in the literature, targeting the cabbage stem flea beetle. Five different management tactics have been chosen: mixing oilseed rape with turnip, which has been found more preferable to the cabbage stem flea beetle than oilseed rape; physically covering the crop plants with wood pellets at the early stages; lime stone treatment to create an environment unsuitable for egg laying; physically drying out eggs by repeated hoeing/harrowing; and hoeing to cover the base of the young oilseed rape plants with soil (Barari et al. 2005; Daniel & Dierauer 2013). Prerequisites for the chosen experimental sites are that the fields are certified as organic, the previous crops were leguminous, and the most recent oilseed rape crops in the fields were grown at least 4 years ago. Each plot has 2 replicates. The treatments are:

1. Variety Exclusiv, sown with a 12 cm row distance between the rows
2. Variety Ladoga with 25 cm row distance and hoeing at the 1-2 leaf-stage
3. Variety Exclusiv at 25 cm row distance and hoeing at the 1-2 leaf-stage
4. Variety Exclusiv in mixture with turnip, at 25 cm row distance between rows of the mixture, hoeing at the 1-2 leaf-stage of oilseed rape.
5. Variety Exclusiv and turnip in alternating rows. 25 cm between rows, hoeing at the 1-2 leaf-stage of oilseed rape.

6. Variety Exclusiv at 25 cm row distance, a cover of wood pellets is placed at the 1-2 leaf stage in a band surrounding the crop row.
7. Variety Exclusiv at 25 cm row distance, a cover of agricultural lime is placed at the 1-2 leaf stage in a band surrounding the crop row.
8. Variety Exclusiv, at 25 cm row distance, repeated hoeing/harrowing strategy starting at the 1-2 leaf stage with succeeding cultivations at 10 day intervals.

Preliminary results from the ongoing field experiment will be presented on the poster; the final results from the experiments will be assessed in the spring of 2014.

Key words: cabbage stem flea beetle (*Psylliodes chrysocephala*), organic oilseed rape, crop management tactics, pest control

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E04

ENTOMOLOGY SESSION - Poster presentation

Parasitism of cabbage stem flea beetle in oilseed rape and turnip rape

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Abstract: The cabbage stem flea beetle (*Psylliodeschrysocephala* L.) is one of the most devastating insect pests of winter oilseed rape in northern Europe. While adult feeding rarely causes economic losses severe damage is commonly caused by larval feeding within petioles and shoots of juvenile plants. Control of cabbage stem flea beetle mainly relies on insecticide applications. In addition, previous studies have shown that natural enemies like the endoparasitic larval parasitoid *Tersilochus microgaster* (Hym.; Ichneumonidae) can have substantial impact on pest populations. This study aimed to compare the larval parasitism of cabbage stem flea beetle in winter oilseed rape and three varieties of winter turnip rape.

In two years' field trials winter oilseed rape (*Brassica napus*, cv 'Robust') and winter turnip rape (*Brassica rapa*, cvs 'Largo', 'Malwira' and 'Perko') was grown in a complete randomized plot design, with four replicated plots of each treatment, in the region of Goettingen (Northern Germany). Larvae of cabbage stem flea beetle were collected from plant samples in March 2010 and April 2011, respectively, and stored in 70% ethanol. The level of parasitism was assessed by dissection of larvae under a microscope. Additionally, subsamples of the collected larvae were reared in the laboratory to adulthood and parasitoid females emerging from parasitized larvae were identified to species level. All parsitoid females were determined as *T. microgaster*.

In both years the level of plant infestation by larvae of cabbage stem flea beetle was higher on turnip rape compared to oilseed rape. This difference was significant only in 2010. There was no significant difference between larval infestation in the three turnip rape varieties. The dissection of larvae of cabbage stem flea beetle resulted in parasitism rates exceeding 50% in some treatments. In 2010, the level of parasitism was significantly higher in larvae collected from the three varieties of turnip rape (ca 50%) than in larvae collected from oilseed rape (ca 23%). In 2011, the parasitism of larvae was on a similar level on oilseed rape and on two varieties of turnip rape, but was significantly lower on turnip rape cv. Malwira. Thus, differences between parasitism rates in the tested species and varieties of host plants were not consistent between years.

Our results confirm the importance of natural biocontrol for regulation of pest populations in crops of winter oilseed rape. The effect of plant species and variety on parasitism of cabbage stem flea beetle differed between years, and might have been affected by annual plant phenology and morphology. Larval parasitism was not significantly correlated with host density.

Key words: *Psylliodes chrysocephala*, larval parasitism, *Tersilochus microgaster*, *Brassica napus*, *Brassica rapa*

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E05

ENTOMOLOGY SESSION - Oral presentation

Field monitoring of cabbage stem flea beetle and rape winter stem weevil autumn flights

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Abstract: Cabbage stem flea beetle (*Psylliodes chrysocephala*) and rape winter stem weevil (*Ceutorhynchus picitarsis*) are two important pests of winter oilseed rape in France. Adults of these two species colonize fields in autumn. Weevil adults are not harmful unlike flea beetle adults that can cause important damage when they arrive on very young crop plants. However, for both species, the larvae are more harmful. They grow in leaf stalks in winter and autumn and can migrate into the stem and destroy the terminal raceme.

Since 2009/2010, infestations by these two species have become very important in some French areas and despite repeated treatments, farmers are unable to control them. Several hypotheses can explain this situation including re infestation, and resistant populations to pyrethroids. Since autumn 2011, CETIOM (The Technical Center for Oilseed Crops and Industrial Hemp) began studies to understand the phenomenon. This study has two main purposes: (1) to determine if colonization happens through several flights which could explain why treatments are ineffective; (2) to acquire biological data to determine e biological traits like the stimuli inducing flights or the delay before egg laying for weevils, which could help farmers to spray at the right time.

In France, flea beetles usually colonize fields via one massive flight induced by a fall followed by a climb of maximal temperatures around 20°C. The monitoring revealed some exceptions: several flights were observed with unknown causes. Unlike the flea beetle, rape winter stem weevils colonize fields via several flights. The monitoring confirms that catches of *C. picitarsis* in yellow traps are not representative of the actual infestation in fields, and shows the limit of this tool to manage this pest. We also checked the delay before egg laying, because in France farmers are recommended to spray just before the observation of the first egg in plants since pyrethroids are not effective against eggs or larvae. This delay is historically estimated around 8 to 10 days after field colonization. We noticed that this delay could be longer when flights arrive early in autumn.

Key words: cabbage stem flea beetle (*Psylliodes chrysocephala*); rape winter stem weevil (*Ceutorhynchus picitarsis*), monitoring

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E06
ENTOMOLOGY SESSION - Oral presentation

Population dynamics and sex ratio of adult forms of stem mining weevils in Croatia

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Abstract: In oilseed rape two stem weevil species occur, the cabbage stem weevil (*Ceutorhynchus pallidactylus* Marsham, 1802) and the rape stem weevil (*C. napi* Gyllenhal, 1837). Both are among the most important oilseed rape pests that appear in spring. The monitoring of appearance of stem mining weevils was conducted in period from 2010 to 2012. Four yellow water traps were set up in the field at the beginning of leaf development (BBCH 12). Samples were collected once a week until harvest. According to morphological marks on the legs, the sexes were determined. The first peak of the flight of cabbage stem weevil usually occurs in February and both sexes immigrate at the same time but in different proportions. Males and females of the rape stem weevil start to immigrate two to three weeks later in the spring and in lower abundance compared to the cabbage stem weevil. As a consequence of the different time of appearance and sex ratio, two insecticide applications are necessary for their successful control.

Key words: oilseed rape, stem mining weevils, population dynamic, sex ratio

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E07

ENTOMOLOGY SESSION - Oral presentation

Effects of various resyntheses, lines, and cultivars of oilseed rape on rape stem weevil (*Ceutorhynchus napi* Gyll.) infestation

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Abstract: In Germany oilseed rape crops are treated each year several times with insecticides. High levels of pest infestation are accompanied by increasing resistance of oilseed rape pests to the registered pyrethroid insecticides. To minimize the number of insecticide applications in integrated pest management systems, pest-resistant cultivars of oilseed rape are required. Genetic host plant resistance might provide a promising alternative to the extensive use of chemical plant protection products. The univoltine rape stem weevil, *Ceutorhynchus napi* Gyll. (Col., Curculionidae), is one of the major pests of winter oilseed rape (*Brassica napus* L.) in Europe. Yields of oilseed rape can be reduced by stem mining weevils by up to 800 kg/ha.

Nine *Brassica* genotypes showing a broad genetic variability were evaluated in a field trial with 4 replicated plots of each genotype in 2012/2013. To assess the oviposition and larval infestation by rape stem weevil, the number of eggs and larvae within the stem pith of genotypes were recorded from plant samples collected at weekly intervals during the infestation period in April and May 2013. Additionally, the length of the stem and the C:N ratio of the stem tissue was measured.

Genotypes differed not only with respect to their stem length but also to the C:N ratio of the stem tissue. We found that the plant genotype significantly influenced plant infestation by rape stem weevil. The resynthesized oilseed rape S30 showed the lowest infestation whereas the old (++) cultivar Sollux showed the highest level of infestation. The number of eggs and larvae per plant significantly differed between the genotypes on several sampling occasions. Different ratios of the number of deposited eggs and the number of larvae found within individual genotypes at subsequent sampling dates indicated antibiosis effects. There was a negative correlation between stem length on April 22nd and the number of eggs per plant on April 29th in 2013. Furthermore, negative correlations were determined between the total number of eggs and larvae and the stem length on several sampling occasions. Although C:N ratio is known to affect the performance of herbivorous insects, we found no correlation between the C:N-ratio of the stem tissue and the infestation by rape stem weevil.
Our results confirm that stem length has a strong influence on oviposition performance of *C. napi*. Other plant factors might affect egg and larval development during the infestation period. More investigations are needed to identify possible other plant traits responsible for pest resistance, for instance secondary metabolites like glucosinolates.

Key words: insect resistance, plant breeding, oilseed rape, *Ceutorhynchus napi*, oviposition, larval abundance, stem length

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E08

ENTOMOLOGY SESSION – Poster presentation

Screening of *Brassica napus*, *Sinapis alba* and intergeneric hybrids for resistance to cabbage root fly *(Delia radicum* L.*)*

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Abstract: The cabbage root fly (*Delia radicum* L.) (*Dipt.; Anthomyiidae*) is of increasing importance as an insect pest in oilseed rape production in Europe. Plant damage occurs when larvae feed on the root tissue of young plants. In recent years the larvae of this pest have been controlled by neonicotinoid insecticide seed coating. The usage of this group of insecticides as seed treatment will be strongly restricted in the EU from December 2013 onwards. Hence, there is an urgent need to find alternative strategies for control of cabbage root fly. Cultivars of oilseed rape resistant to the cabbage maggot could comprise an important component in an IPM system.

No-choice feeding experiments were conducted under controlled environmental conditions (19 ± 1 °C; 18 h L : 6h D photoperiod) to evaluate the resistance levels of 30 Brassica genotypes (*S. alba*, *B. napus* and introgressions of *S. alba* x *B. napus*) to the cabbage maggot. Potted test plants were artificially infested with eight eggs / plant at growth stage BBCH 15-16. Upon hatching the larvae were allowed to feed on plants for a four week time span. At the end of the experimental period the roots were scored for the extent of damage and the soil around the roots was examined for larvae and pupae. Individual larvae or pupae were counted and weighed. The taproots were washed and the degree of root injury was evaluated.

Among the genotypes tested only three cultivars of *S. alba* showed a significant reduction of feeding damage and survival of the larvae. There were only minor differences between root damage and larval performance on the tested intergeneric hybrids and the *B. napus* cultivars. Thus, further introgressions are required to transfer the resistance mechanisms of *S. alba* into genotypes of *B. napus.*

Key words: insect resistance, plant breeding, oilseed rape, feeding damage, larval performance

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E09

ENTOMOLOGY SESSION - Oral presentation

A study to assess the parasitism of insect pests in winter oilseed rape in Belgium: preliminary results

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Abstract: A survey of the parasitoids found in commercial winter oilseed rape was initiated in 2012 and 2013 in the South part of Belgium, using both aerial sampling techniques and soil analysis. Fifteen fields located in two distinct areas and with two different tillage regime (normal and reduced or no tillage) were selected for before and just after flowering. Adult parasitic hymenoptera were weekly sampled over 8 weeks using sweep net. Pollen beetle larvae, *Meligethes aeneus* (F.) (Col.; Nitulidae), were collected and their parasitism rate assessed. Samples of soil were taken from 4 fields in 2012 and 8 in 2013 to collect brassica pod midge cocoon, *Dasineura brassicae* (Winnertz) (Dip.; Cecidomyiidae), and to assess their parasitism. The soils were gently washed into sieves and cocoons were isolated in Petri dishes until midge or parasitoid emergence.

The main parasitoid wasps found in the sweep net samples belong to the Tersilochinae family. However, though adults of this family were regularly collected in large numbers, and were synchronized with their host, the parasitism level of the pollen beetle larvae remained low, with many of the fields below 10-15% parasitism. Preliminary analysis shows that there were no apparent differences between the two distinct areas and between the two different tillage regimes. The main explanation of this low parasitism rate could be the high occurrence of the insecticide applications, as most of the farmers regularly applied one or two insecticides during the season: the first to control pollen beetle before flowering and the second to control other insects later (e.g. seed weevil, brassica pod midge). The highest level of parasitism of pollen beetle larvae (43%) was found in an untreated field. The identification of the species is in progress.

The analysis of brassica pod midge cocoons showed that the parasitism rate was low in 2012 (0-5%). However, these results were probably underestimated due to a high mortality of the cocoons during the rearing process. If the parasitism rates were expressed on the basis of rearing success (brassica pod midge or adult parasitoid emerged), the parasitism rate reached up to 59.6% in one specific site, with 58.8% due to 4 Ceraphronidae species and 48.6% due to one species, *Ceraphron serraticornis* Kieffer. In 2013, the parasitism rate was low (0-3.0%), despite a high success in the cocoon rearing process.

These results have shown that several species of parasitic Hymenoptera are present in Belgium, causing in some cases high parasitism levels. A better use of these parasitoid wasps in the biological or integrated control of several oilseed rape pests is possible, but there is a need to focus on improving understanding of the factors that could explain the variability of the parasitism between sites and the actions that could promote the activity of these beneficial insects and protect their existing populations.

Key words: parasitism, parasitoids, oilseed rape, pollen beetle *Meligethes aeneus*, brassica pod midge *Dasineura brassicae*, Tersilochinae, Ceraphronidae

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ENTOMOLOGY SESSION - Poster presentation

Pyrethroid resistance of oilseed rape pest insects in Germany

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Abstract: Pyrethroid resistance of pollen beetle (*Meligethes aeneus*) has been monitored in Germany since 2005 using biotests (Adult-Vial-Test). Since then resistance has spread all over Germany and its intensity has increased. Besides pollen beetles, other pest insects such as weevils and flea beetles were also analysed for pyrethroid resistance. In the German region with the longest tradition and intensity of oilseed rape production, pyrethroid resistance of *Psylliodes chrysocephala* and *Ceutorhynchus obstrictus* with resistance factors of up to 81 and 140 was detected in 2008 and 2010, respectively. This sensitivity change in the biotest was in line with control problems in the field.

Key words: pyrethroid resistance, oilseed rape, pollen beetle (*Meligethes aeneus*), cabbage stem flea beetle (*Psylliodes chrysocephala*), cabbage seed weevil (*Ceutorhynchus obstrictus*)

Acknowledgement: Part of the work was funded by the BLE for the Federal Ministry of Food, Agriculture and Consumer Protection and by the UFOP.

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ENTOMOLOGY SESSION - Poster presentation

Effect of two different insecticides on the reproduction of pollen beetles in field tests

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Abstract: One of the most important pests of oilseed rape is the pollen beetle (*Meligethes aeneus* F.). Beetles emerging from overwintering sites in spring immigrate to oilseed rape crops and feed on the buds to get access to pollen, which results in bud abortion and high yield loss.

In the past 30 years control of pollen beetle in Germany was mainly based on the application of synthetic pyrethroids. The extensive and indiscriminate use of this insecticide class resulted in a high selection pressure on the beetles, ensuing in the formation of resistance, which has spread over many European countries. Replacement of pyrethroids by insecticides with other mode of action is limited as only few alternative active substances are available.

One of these alternative substances is the neonicotinoid Biscaya (active ingredient thiacloprid). To test the effect of Biscaya and of the pyrethroid Karate Zeon (active ingredient lambda-cyhalothrin) on the reproduction of pollen beetles, a field trial was carried out near Braunschweig. The field trial was divided into control plots without insecticide application, and plots sprayed on different dates with Biscaya or Karate Zeon. Shortly before and after application, the number of beetles was counted in the different plots. Additionally the number of eggs per bud and the number of larvae dropping to the ground for pupation was recorded. Furthermore samples of adult pollen beetles were analyzed for resistance to pyrethroids and sensitivity to thiacloprid by using the Adult-Vial-Test.

Key words: pollen beetle (*Meligethes aeneus*), insecticide, efficacy

Acknowledgement: Part of the work was funded by the UFOP.

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ENTOMOLOGY SESSION - Poster presentation

A multiannual study under semi-field conditions on the efficacy of insecticides against *Meligethes aeneus* F. – Methodical approach and analysis

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Abstract: Oilseed rape (*Brassica napus* L.) is one of the important oil crops in the world after soybean (*Glycine max*). One of the major pests is the pollen beetle (*Meligethes aeneus* F.) of the family *Nitidulidae*. For more than 30 years, pyrethroids were used almost exclusively in their control. Since 2005 loss of sensitivity has been reported in Germany and in many European countries. Information about the development of resistance is shown in the study of Julius Kühn - Institute using vial tests. Insecticides against the pollen beetle were also tested in the field. Our testing method under semi-field conditions is new. The insecticides were sprayed in field. The treated plants were cut at nine dates and brought into the greenhouse. We collected a pollen beetle population from untreated fields of Magdeburger Börde. Ten living beetles were count and then placed into a perforated bag with a treated oilseed rape plant from the field, to simulate a real habitat. After two and five days the vitality of the beetles were observed. The beetles were divided into three categories (alive, damaged and dead). These observations were interpreted as a realization of classified ordered categorical random variables. For the analysis we used a threshold model which belongs to the class of generalized linear models. The dependence of the observations due to repeated observations on the same plant was accounted for by a random plant effect. The comparison of the different insecticides and their significance test was made using the marginal expectation values. For the computational implementation, we used the procedure NL MIXED (SAS 9.3). The poster will present an overview about the methodical approach and selected results from the experimental years (2010, 2011 and 2013).

Key words: oilseed rape, insecticides, pest management

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ENTOMOLOGY SESSION - Oral presentation

A large field trial to assess the short-term and long-term effects of 4 insecticides used to control the pollen beetle on parasitic hymenoptera in oilseed rape

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Abstract: A large scale field trial was performed in spring 2013 to assess the effects of Plenum (pymetrozine), Mavrik 2F (tau-fluvalinate), Biscaya (thiacloprid) and Pyrinex (Chlorpyriphos-ethyl) used to control the pollen beetle *Meligethes aeneus* (F.) (Col.; Nitidulidae) on pest and beneficial arthropods populations in winter oilseed rape. The insecticides were applied at their commercial rate soon before flowering on large strips of oilseed rape (30mx200m), divided into four plots of 50mx30m. A strip was left untreated as control. Insects were weekly sampled with the help of beating methods and sweep net from one day to 50 days after product application. The direct effects of the products were assessed on adult pollen beetle (target pest), adult cabbage seed weevil *Ceutorrhynchus obstrictus (Marsham) (Col.; Curculionidae)* (secondary pest) and adults of parasitic hymenoptera related to these insects (*Tersilochinae* and *Pteromalidae*). In the context of IPM, long term effects were assessed on pollen beetle larvae to determine their number, the parasitism rate and to estimate the balance of parasitic hymenoptera/pollen beetle that could be produced by the field for the next season.

Biscaya, Pyrinex and Mavrik 2F were effective in controlling the adult pollen beetle population and had also an activity on cabbage seed weevil despite the fact that this pest only occurred 2 or 3 weeks after the application of the product. Plenum was only effective in controlling the pollen beetle population 1 day after treatment and had no significant impact on cabbage seed weevil.

All the insecticides tested had a significant impact on adult parasitic hymenoptera populations compared to the control. Plenum had a limited effect while the other insecticides reduced by 59% - 72% the captures in the sweep net samples. The main effects were observed on adults of the *Tersilochinae* family that are mainly specialised in the parasitism of pollen beetle larvae. Biscaya had also a significant impact on *Pteromalidae* captures, a family containing species specialised in the parasitism of weevils, despite the 4-week delay between the day of the treatments and the first arrival of these hymenoptera into the crop.

Biscaya significantly reduced the parasitism rate of the pollen beetle larvae, that dropped to less than 15% compared to 43.2% in the control. Pyrinex also decreased the parasitism rate, with only 23% larval parasitism, but the differences were not significant. Biscaya and, to a lesser extent Pyrinex, reduced the balance between parasitic hymenoptera/pollen beetle while Plenum and Mavrik 2F resulted, by the end of the growing season, in the same ratio as the untreated control. These results suggest that the regular use of Biscaya and/or Pyrinex on a large scale before flowering is favourable to the long term development of pollen beetle populations by negatively impacting the populations of their parasitoids, despite their good short-term efficacy to control this pest.

Key words: non-target effects, insecticides, parasitoids

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ENTOMOLOGY SESSION - Poster presentation

Parasitism of pollen beetle, *Meligethes aeneus* F., in different regions of Northern Germany

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Abstract: Hymenopterous parasitoids have the natural potential to regulate populations of pollen beetle (*Meligethes aeneus* F.). The univoltine larval endoparasitoids *Tersilochus heterocerus* and *Phradis* spp. (Hym.; Ichneumonidae) have been reported as key natural enemies of pollen beetle in oilseed rape fields from various European countries. Previous studies have shown that the level of larval parasitism of pollen beetle varies widely between different locations and years. To obtain more information on possible factors causing spatial and temporal variation between the levels of parasitism, crops of winter oilseed rape were selected in four different regions along a transect from west to east of Northern Germany (districts of Diepholz, Uelzen, Flaeming, Oder-Spree) , with 3 – 6 crops in each region. Among other factors, these regions differed with regard to mean annual temperature, mean precipitation and the proportion of arable land grown with oilseed rape.

In the years 2011 and 2012, larval parasitism of pollen beetle was determined in samples collected from plots without insecticide application (1000m²) within commercial crops of oilseed rape. First and second instar larvae of pollen beetle were collected during full flowering (BBCH 65 - 69) from a total of 16 and 17 crops, respectively, by beating the main inflorescenses into a tray. Pollen beetle larvae were dissected in the laboratory under a binocular microscope to determine the level of parasitism. Parasitism by *T. heterocerus* and *Phradis* spp. was recorded by assessing dark pigmented parasitoid eggs and neonate larvae, respectively.

The results showed substantial variation between the levels of larval parasitism of pollen beetle in crops of oilseed rape at closer scales (within regions; distance 0.5 – 45 km) and between the two years. Total parasitism ranged between 4 – 25 % in 2011 and 1.8 – 26 % in 2012. At larger scales (distance 115 – 375 km), in 2011 the mean level of parasitism differed between the four regions while in 2012 mean parasitism was on a similar level in the two eastern and the two western regions, respectively. Regarding the relative abundance of parasitoid species, the proportion of *T. heterocerus* and *Phradis* spp. on the total parasitism differed between the four regions but also within the regions between years. Except of the Diepholz region, *T. obscurator* was the predominating parasitoid species in all regions and years. Generally, the data have not provided clear indications that larval parasitism of pollen beetle is influenced by regional longitude or spatial scale (distance). Future data analyses will focus on field specific parameters like field size, insecticide application and percentage of oilseed rape grown in the area surrounding the studied fields. Furthermore, data of a third year (2013) will support the upcoming analyses.

Key words: winter oilseed rape, *Meligethes aeneus*, larval endoparasitoids, *Tersilochus heterocerus*, *Phradis* spp., spatial effects.

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ENTOMOLOGY SESSION - Oral presentation

Olfactometer screening of repellent essential oils against the pollen beetle (*Meligethes* spp.)

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Abstract: Essential oils can have an impact on pollen beetle (*Meligethes spp.)* host plant location behaviour (Mauchline et al. 2013). Lavender oil (*Lavendula angustifolia*) showed the highest repellency value in laboratory studies comparing five different essential oils (Mauchline et al. 2005). However, lavender oil is one of the most expensive essential oils – a fact that could seriously hamper on-farm implementation of this strategy. To find a cheaper essential oil with comparable efficacy to lavender oil, we compared the essential oils of *Mentha arvensis, Eucalyptus globulus, Melaleuca alternifolia, Citrus sinensis, Citrus paradisi, Citrus limon, Juniperus mexicana, Abies sibirica, Illicium verum, Gaultheria procumbens, Cymbopogon flexuosus, Syzygium aromaticum,* and *Litsea cubeba* using a Y-tube-olfactometer. Essential oils were diluted 1:10 in acetone and 40 µl of the dilution were applied on a 3.1cm^2 filter paper. Filter papers were placed in the odour containers of the olfactometer together with a flower cluster of spring oilseed rape (variety Hero) with 5 open flowers and 10-15 buds. Filter papers treated only with acetone were used as a control. Hungry pollen beetles were released individually into the olfactometer. The choice of the beetles and the time until choice were recorded. Flowers and essential oils were changed between replicates. Six replicates with six beetles each were conducted. Highest repellency values were obtained for *Mentha arvensis, Cymbopogon flexuosus*, and *Litsea cubeba. Citrus paradisi* and *Lavendula angustifolia* also showed good results. These five oils were subsequently tested in a 1:100 dilution. These oils in combination with a flower cluster were also compared to an empty odour container in the olfactometer.

Key words: *Meligethes* spp., organic agriculture, essential oil, lavender, mentha

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ENTOMOLOGY SESSION - Oral presentation

Differential rates of attack of oilseed rape genotypes by the pollen beetle: the cues may be in the bud wall

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Abstract: Attraction of the pollen beetle (*Meligethes aeneus*) towards oilseed rape (*Brassica napus*) crops has been well studied over the last 20 years. Volatile compounds emitted by plants, especially isothiocyanates, are the main cues used by adults to locate their host plant. However, little is known about the interaction between the plant and the insect once it arrives on the crop plant. Determining which cues are responsible for the attack once the insect is in contact with its host plant could help to design new crop protection strategies based on resistant (i.e. less attacked) cultivars. We investigated the feasibility of this strategy in the laboratory, by using six oilseed rape genotypes in a no choice feeding experiment. Results clearly showed that a large variation exists in bud attack levels among plant genotypes, with a difference between the two extreme genotypes up to 2.5 times. We further looked for the determinants of the attack, by hypothesizing that the balance between phagostimulants and deterrent compounds in the tissues eaten by the beetles (i.e. bud wall and stamens) could be the origin of the observed variability. For that purpose we analysed compounds present in bud wall and stamens of the different genotypes studied, by using gas and liquid chromatography. Fifty compounds from different biochemical classes (sugars, free amino acids, glucosinolates and flavonoids) were identified and quantified. We found that chemical composition of the bud wall was very well correlated to attack level, showing that this tissue could play an essential role in the interaction between the plant and the insect. Some of the identified compounds, known from the literature to be phagostimulant or deterrent for other beetles, could play a crucial role. Artificial feeding experiments are needed to confirm the role of these compounds in the contrasting levels of attack found.

Key words: oilseed rape, *Meligethes aeneus*, contact cues, phagostimulants, bud wall

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ENTOMOLOGY SESSION - Oral presentation

The impact of semi-natural habitats on the abundance of pollen beetle adults in winter oilseed rape fields

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Abstract: Pollen beetle dispersal in the field depends on several different factors, such as the phenological stage of the crop; its odour and yellow colour during flowering are especially attractive to pollen beetles. The dispersal of the scent depends on wind direction and therefore pollen beetles' dispersal follows upwind anemotaxis.

This experiment was conducted to investigate the effect of different semi-natural habitats (woody linear, woody areal, herbaceous linear and herbaceous areal) surrounding winter oilseed rape fields on the abundance of the pollen beetle. Beetles were counted from oilseed rape plants using the beating method. The results showed higher number of pollen beetles on fields bordered with herbaceous linear elements than with other studied semi-natural habitat elements.

Key words: *Meligethes*, oilseed rape, semi-natural habitat, pests' abundance

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ENTOMOLOGY SESSION - Poster presentation

Flight activity of *Meligethes aeneus* at a range of altitudes

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Abstract: The pollen beetle, *Meligethes aeneus*, is a significant pest of oilseed rape crops and there is considerable research effort focused on developing novel, sustainable methods of integrated control. These insects rely on flight for all dispersal movements and this paper reports on a study into the importance of flight at different altitudes in the ecology of *M. aeneus* using a novel combination of data from suction traps, vertical-looking radar and field counts. These data will help determine the best timing for different control measures within an Integrated Pest Management strategy.

Key words: pollen beetle (*Meligethes aeneus*), flight activity, vertical-looking radar, suction traps

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ENTOMOLOGY SESSION - Oral presentation

Developing and integrated pest management strategy for pollen beetles in oilseed rape

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Abstract: We have developed an integrated pest management strategy (IPM) for pollen beetles in winter oilseed rape (OSR) based on risk assessment, monitoring and alternative crop management that can be used as a framework by growers and crop consultants to manage pollen beetles with reduced insecticide inputs - and the confidence to do so. This will prolong insecticide life by reducing selection for resistance, reduce environmental impacts and contribute towards the sustainability and profitability of OSR in the UK. One of the major limitations to the use of action thresholds is that proper monitoring of the populations is time consuming and has to be conducted over a prolonged period. To encourage and facilitate their use, we tested and developed tools to improve risk assessment and monitoring. We conducted a pollen beetle monitoring study over 4 years in 178 OSR crops across the UK. Pollen beetles were sampled using sticky traps and plant sampling along transects in the crop. The data were used to help test a decision support system (DSS) for pollen beetles and to develop a monitoring trap. proPlant Expert is a DSS available in mainland Europe that uses a model of pollen beetle immigration and local meteorological data to forecast the start and end of pollen beetle immigration into the crop and main risk periods and advises when to monitor. We tested the model under UK conditions using data from our study and compared monitoring advice with the current advice system on the CropMonitor website (advises monitoring when the crop is at green-yellow bud stage and temperature >15°C). Both performed reassuringly well in prompting monitoring that would detect breaches of spray thresholds. However there were considerable reductions provided by proPlant in the need for consultation of the system (30%) and advised monitoring days (34-53%) in comparison with current advice. Use of the proPlant DSS could therefore focus monitoring effort to when it is most needed. It could also help to reduce unnecessary sprays in cases where beetle numbers are *approaching* threshold but consultation of the system returns a poor immigration risk forecast or an immigration complete result. The proPlant tool is now freely available to growers and crop consultants in the UK via the Bayer CropScience website. A monitoring trap for pollen beetles would help to more easily and accurately identify when spray thresholds have been breached than monitoring plants in the crop. We developed a baited monitoring trap for pollen beetles which will be commercially available from Oecos. The trap comprises a yellow sticky card mounted at 45°, baited with phenylacetaldehyde, a floral volatile produced naturally by several plant species. Unfortunately using data from our study we were unable to calibrate the trap catch to a given action threshold expressed as the number of beetles per plant using a simple linear relationship. However, the monitoring trap still has value for risk assessment, especially if used together with DSS. We tested the potential of turnip rape (TR) trap crops, planted as borders to the main OSR crop to reduce pollen beetle numbers in a field scale experiment conducted over three years on two sites. We found evidence that the strategy worked well in some years, but not others. This tactic is probably practically and economically worthwhile only for organic growers.

Key words: pollen beetle (*Meligethes aeneus*), petal colour, visual cues, photoreceptors

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E20

ENTOMOLOGY SESSION - Poster presentation

Results of a small survey amongst farmers and advisers on their evaluation of the proPlant pollen beetle migration tool and its influence on their practice

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Abstract: One of the major limitations to use of action thresholds for pollen beetle control in oilseed rape is that proper monitoring of the populations is time consuming and has to be conducted over a prolonged period. proPlant Expert is a decision support system (DSS) that uses a model of pollen beetle immigration and local meteorological data to forecast the start and end of pollen beetle immigration into the crop and main risk periods, and advises when to monitor. To encourage and facilitate the use of action thresholds for pollen beetle control, we tested the proPlant expert.map tool under UK conditions and found that the model (which was originally designed using data from mainland Europe) predicted extremely well pollen beetle immigration in the UK (which has a maritime climate). The proPlant expert.map pollen beetle migration forecasting tool was made publicly available on the Bayer CropScience website in spring 2012, encouraged by the success of our validation trials. Three forecasting maps were provided each day with s traffic light warning stsytem indicating risk of : (1) Start of migration – indicates whether pollen beetles have started to migrate this season (2) New Migration – indicates whether further migration is expected in the next 2 days (3) Percent Migration – indicates the percent completion of pollen beetle migration to date.

We conducted a small impact survey in spring 2012 to obtain feedback from users of the forecasting tool to support future improvements to the tool and its delivery and thereby to encourage uptake. The survey consisted of a one page multiple-choice questionnaire with 17 questions grouped under five headings:

A. Ease of understanding and interpretation proPlant expert.map for pollen beetles
B. Your use of proPlant expert.mapn
C. Influence on your management of pollen beetles
D. Your over-all evaluation of proPlant expert.map
E. Where did you hear about proPlant expert.map forecasting tool?

Eighteen farmers and agronomists responded to the call for survey participants. Of these, 10 completed the survey, giving a response rate of 56%. In this small survey there was overwhelmingly positive feedback. There was clear endorsement of the manner in which the pollen beetle risk forecasting tool was presented and explained. Most users found the tool informative and all found it helpful. Feedback indicated that users were making intelligent use of proPlant expert.map in the context of their experience in the field, as intended. Respondents found that the forecasts corresponded with events in the field and reported that the tool increased their confidence in decision-making, giving them peace of mind. Moreover, using proPlant expert.map reduced eight out of ten users' estimation of pollen beetle risk and seven believed they had used fewer sprays for pollen beetle control as a result. Eight out of the ten respondents said they would certainly recommend proPlant expert.map to a friend.

Key words: pollen beetle (*Meligethes aeneus*), decision support systems (DSS), proPlant, Bayer Pollen beetle predictor

ABSTRACTS

PATHOLOGY SESSION

IOBC-Working Group Integrated Control in Oilseed Crops,
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P01

PATHOLOGY SESSION - Oral presentation

Global warming and oilseed rape pathogens: potential impacts and adaptation strategies in Northern Germany

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Abstract: Within the research framework "KLIFF – climate impact and adaptation research" potential effects of increasing air and soil temperatures on the life cycle of economically important oilseed rape pathogens in Lower Saxony were studied theoretically and experimentally. In climate chamber and field experiments utilizing a soil warming facility, air and soil warming treatments reflected current climate change scenarios in Lower Saxony for the periods 2001-2030 and 2071-2100 as projected by the regional climate model REMO. Two-year investigations included (1) Phoma leaf spot development in autumn as well as subsequent stem canker development in spring (field only), (2) apothecia production of *Sclerotinia sclerotiorum* in spring and (3) the infection of winter oilseed rape with *Verticillium longisporum*.

Climate chamber and field results were compared on a thermal time scale by calculating degree-days (dd) from day of sowing and March 1st until sampling. Regression analysis showed that plant growth in spring responded almost linearly to increasing thermal time, whereas colonization of plant tissue by *V. longisporum* showed an exponential increase when exceeding 1300–1500 dd and reaching plant growth stage BBCH 74/75, potentially leading to higher inoculum densities after harvest and an increased economic importance of this pathogen under future warming. Sclerotia germination of *S. sclerotiorum* reached its maximum at 600–900 dd. Hence, warming may lead to earlier apothecia production and an advance of the infection window, whereas the future importance of the pathogen may remain constant. Severity of phoma crown canker increased linearly with increasing thermal time, but showed also large variation in response to the warming treatments, suggesting that factors such as canopy microclimate in autumn or leaf shedding over winter may play a bigger role for infection and disease severity than higher soil temperatures. Potential direct and indirect adaptation strategies for farmers to encounter these changes, based on experimental and additional modelling results, were presented.

Key words: climate change, *Sclerotinia sclerotiorum*, *Leptosphaeria maculans*, *Verticillium longisporum*, soil warming, degree days

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PATHOLOGY SESSION - Poster presentation

Field inoculations of winter oilseed rape

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Abstract: The aim of our work was to increase the explanatory power of field tests on the health of oilseed rape. We worked with the pathogen *Sclerotinia sclerotiorum* sclerotia and conidiospores of *Phoma lingam* (teleomorph *Leptosphaeria maculans*). Pathogen isolates were obtained by collecting infected tissues of plants and isolating the pathogens from this. Sclerotia were applied to the soil at concentration of 1.5 sclerotia per 1 m^2 when sowing oilseed rape. Conidiospores were applied by foliar spray in the autumn and in spring at a concentration of 20×10^9 conidia per 1 ha. Monitoring was carried out on three varieties of winter oilseed rape with different resistance level to monitor pathogens. Field trials were established in years 2011/2012 and 2012/2013 at three locations in the Czech Republic – in Opava, Šumperk and Chlumec nad Cidlinou. We investigated the effect of year, location and infection pressure from the pathogens. The experiments revealed different effects of the treatments. Whereas all varieties were more severely diseased after inoculation with *S. sclerotiorum*, phoma inoculations displayed higher disease severites only on cultivars Asgard and NK Morse but had no significant effect on cultivar Da Vinci.

Key words: oilseed rape, field inoculation, *Sclerotinia sclerotiorum*, *Phoma lingam*

Acknowledgement: The results were obtained with financial support of the Technology Agency of the Czech Republic, Programme Alfa, project No. TA 01010815.

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P03

PATHOLOGY SESSION - Oral presentation

Interactions between WOSR canopy structure at flowering and *Sclerotinia sclerotiorum* epidemiology

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Absract: Sclerotinia stem rot is one of the major diseases of winter oilseed rape and the main control method is fungicide application. Risk occurrence is estimated on the petals, though the use of a petal kit. Nevertheless this epidemic potential is often limited by different environmental factors and plant infection capacities are strongly restricted. At the field level, canopy structure can modulate conditions to make conditions more or less favourable for epidemic development. We investigated canopy structures that were able to modify disease impact. The initial hypothesis was that a closed canopy would favour disease development by increasing local relative humidity and temperature. Field trials were carried out during two agronomic seasons with different genotypes and different plant densities. Infection potential, plant branching, petal fall kinetics on different parts of the canopy, wetness and temperature conditions inside the canopy and symptoms occurrence were observed. Results showed (*i*) confirmation of the plasticity of oilseed rape and its ability to compensate at low plant densities, (*ii*) the number of infected fallen petals that stuck to leaves were not limiting for epidemic development, (*iii*) microclimatic differences inside and outside the canopy were not as important as previously thought, (*iv*) disease incidence was higher in plots with the lowest plant densities at two of the locations where symptoms were observed. The results provide new hypotheses that have yet to be tested.

Key words: rapeseed**,** sclerotinia stem rot, canopy architecture, integrated disease management, winter oilseed rape.

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P04

PATHOLOGY SESSION - Oral presentation

'SYield' – a risk alert system for Sclerotinia in oilseed rape

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Abstract: The fungus *Sclerotinia sclerotiorum*, causes sclerotinia stem rot of oilseed rape (OSR, canola) and also infects several other important crops such as sunflower, soya, beans, carrots and lettuce. Spores of this fungus do not infect healthy plant tissue directly as they need to colonise senescing leaves or petals, which provide an energy source, to allow production of the main pathogenicity factor, oxalic acid, which kills healthy tissue into which the pathogen grows. Infection typically occurs when there is a coincidence of airborne spores, a susceptible crop growth stage (flower petal fall) and suitable infection conditions. Although weather-based disease forecasts exist, these are often based only on infection conditions or operate at regional scales. In many countries, including the UK, epidemics are sporadic and have not been well-predicted by current models, which combined with high crop value, leads to many farmers spraying two or three times at flowering. A more precise inoculum-based warning has potential to optimise fungicide spray applications, improving disease control and avoiding unnecessary sprays. The 'SYield' system is an automated 'lab-in-a box' connected to an innovative air sampler that traps airborne particles and incubates them in a suitable semi-selective growth medium. After incubation, an assay for oxalic acid is made using a biosensor. Each day, results from the incubated samples are transmitted wirelessly to a server, along with hourly met data collected from an integrated met station. These results are processed to make a risk prediction, which is texted to the farmer. The system is intended to work as a network of sensors, which will reinforce risk alerts on a regional scale. Satellite image data could also be used to optimise deployment of the sensors, interpreting results based on wind direction and proximity to locations of previous susceptible crops. Initial results in 2012 compared well with results from established Hirst-type spore traps that were operated alongside the prototype units and analysed retrospectively using lab-based qPCR. Results from more extensive field testing in 2013 using several farm and rooftop

sampling-sites will be presented. This and similar automated detection of spores of other pathogens offers the potential for precision disease control as part of integrated pest management.

Key words: inoculum warning, IPM, miniature virtual impactor, networked sensor, biosensor

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P05

PATHOLOGY SESSION - Oral presentation

Light leaf spot (*Pyrenopeziza brassicae*) - a resurgent problem in the UK

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Abstract: Since 2006, the incidence and severity of light leaf spot (*Pyrenopeziza brassicae*) in winter oilseed rape in the UK has increased so that the disease is now the primary disease concern for growers with respect to yield loss. For example, in the springs of 2011, 2012 and 2013, >70% of crops and >30% of plants surveyed in England were affected by the disease. Crops have been severely affected in southern England as well as in the north. It is thought that the increase in the prevalence of light leaf spot may be due to a combination of factors, such as recent unusual weather conditions, a lack of resistance in currently grown varieties and poor disease control from poorly timed fungicide applications. Seasonal guidance for growers has been provided for a number of years by the online light leaf spot forecast but there is a need to fine tune predictions with respect to epidemic onset in autumn in order to improve fungicide timing and overall disease management. National survey data highlight the need for new research to investigate the reason for this cyclic change in disease prevalence. This paper describes the state of the art with respect to our understanding of light leaf spot and describes work to be done in two new projects. One project aims to investigate pathogen development/epidemic onset in autumn and the importance of subsequent components of the epidemic on epidemic progression. The other (PhD) project aims to investigate aspects of the light leaf spot pathogen populations with respect to improving varietal resistance.

Key words: apothecia, ascospores, conidia, *Cylindrosporium concentricum*, epidemiology, forecasting, modelling, spore trapping

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PATHOLOGY SESSION - Oral presentation

Loop-mediated isothermal AMPlification as a good tool to study changing *Leptosphaeria* populations in oilseed rape plants and air samples

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Abstract: LAMP is an innovative, simple, rapid, specific and cost-effective nucleic acid amplification method. The reaction happens under isothermal conditions at 65°C and depending on the material being studied, the reaction lasts from between 15-30 minutes. The sensitivity and specificity of LAMP techniques are significantly higher than standard PCR techniques, as two or three specific primer pairs are used. These factors lend the LAMP technique to be regarded as a perfect tool for pathogen DNA detection and identification. In isothermal premixes for LAMP reaction, an innovative GspSSD (Optigen) polymerase enzyme was used, which enables amplification under isothermal conditions, without denaturation of the DNA template. The enzyme exhibits minor activity on reverse-transcriptase, so simultaneous reverse transcription and LAMP amplification reactions are possible to be done in one test-tube. We have used this technique to study the population of *Leptosphaeria* on oilseed rape plants and from air samples obtained in Poland during the seasons 2010/2011 and 2012/2013. In both cases the results obtained using LAMP were the same as those obtained using traditional PCR. Moreover, the detection was much easier and faster, due to the lack of need to isolate the pathogen from the plant tissues. The detection was successful both from newly collected materials and from old leaves and stems of the plant, as well as from DNA from spore tapes. Results obtained using pure isolates of *L. maculans* and *L. biglobosa*, as well as DNA extracted from these isolates with the CTAB method were identical. The DNA extraction from plants was simplified to the use of a short 5 step fast purification method with magnetic particles (Novazym Polska). Even though DNA extraction was done directly from plant tissues, no or low inhibitory effects were observed. In contrast to the studies performed in 2002-2003, the analysis of plant samples collected in the autumn from oilseed rape leaves in West European countries has shown higher amounts of *L. biglobosa*, whereas the samples from Central Europe contained more isolates of *L. maculans.*

Key words: LAMP, *Leptosphaeria maculans*, *Leptosphaeria biglobosa*, population study, air sampling, infected plant tissue, species ratio

Acknowledgement: This work was supported by the National Science Centre, project N N310 298439 and by DuPont Poland.

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PATHOLOGY SESSION - Oral presentation

Detection of *Leptosphaeria maculans* races on winter oilseed rape in different geographic regions of Germany and efficacy of monogenic resistance genes under varying temperatures

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Abstract: Blackleg disease, caused by *Leptosphaeria maculans* is one of the most important fungal diseases in oilseed rape production word-wide (Fitt et al. 2006). Genetic resistance is an important tool to control this disease. Seedling resistance is conferred by single major genes. Due to its sexual propagation, *L. maculans* isolates evolve rapidly from avirulent to virulent strains on cultivars harbouring major resistance genes. Therefore, resistance of oilseed rape against *L. maculans* conferred only by major resistance genes was often overcome and led to severe yield losses in the past in France and Australia (Rouxel et al. 2003; Sprague et al. 2006). Therefore, we cultivated two oilseed rape (OSR) cultivars in 4 different geographical regions in northern Germany in the growing seasons 2011/12 and 2012/13: i) one cultivar harboring no known major gene against *L. maculans* (Lirabon) and ii) one resistant cultivar (Exocet), harboring the major gene *Rlm7*. In autumn and spring we collected true leaves with typical Phoma lesions to gain isolates of *L. maculans*. Isolates obtained from leaves of Lirabon were considered to represent the whole range of virulent isolates in a region. Single spore isolates were tested on a French differential set consisting of 7 OSR genotypes with known major resistance genes for the presence of the avirulence genes *Avr1, 2, 3, 4, 7* and *9* in a cotyledon inoculation test. Thereby, the frequency of virulent isolates in a region was determined. Isolates gained from Exocet were considered to represent the frequency of *Rlm7* resistance breaking isolates, which was tested in the cotyledon inoculation test with a *Rlm7* harboring cultivar (Caiman). The frequency of virulent isolates on *Rlm1, 2, 3, 4* and *9* was very high with over 80%. The frequency of virulent isolates on *Rlm7* was very low (< 5%). We assume that choice of cultivars with different compliment of resistance genes leads to a different spectrum of virulent isolates per region. Furthermore we tested the efficacy of major resistance genes against *L. maculans* under varying temperatures for cotyledons and stems in controlled-environment experiments. Therefore, the resistant cultivars Caiman with *Rlm7* resistance and Uluru with *LepR3* resistance as well as Lirabon as susceptible control were used. For each resistant cultivar an avirulent and a virulent *L .maculans* isolate were selected. Cotyledon resistance was tested with spore suspension, whereas adult resistance was tested at the stem base by inoculation with a mycelium plug. The plant-pathogen interactions were examined at different temperature regimes. Incompatible interactions found on cotyledons of Uluru turned to be compatible, whereas only an increase of *L. maculans* DNA was found for cotyledons of Caiman at higher temperatures (≥27 °C). Major gene resistance actively reduced disease severity in stem tissue. Especially Caiman was strongly dependent on its *Rlm7* resistance gene, whereas resistance of Uluru relied more on quantitative resistance. High temperature treatment did not change incompatibility into compatibility at stem bases.

Key words: *Leptosphaeria maculans*, race distribution, efficacy, major resistance genes, Rlm7, LepR3

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PATHOLOGY SESSION - Poster presentation

Evolution of *Leptosphaeria maculans* populations in a small area of the region Centre (France) following the introduction of oilseed rape hybrids carrying the Rlm7 specific resistance gene

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Abstract: The specific resistance to blackleg conferred by Rlm7 has beens used in commercial oilseed rape cultivars since 2004. Varieties carrying RLm7 have since become wide spread today with a very large market share at the national level. In order to evaluate consequences of the selection pressure exerted by the resistance gene on populations of *Leptosphaeria maculans* (causal agent of blackleg), samples of isolates of *L. maculans* were collected for nine years on plants both with and without Rlm7 in a small area in the central region of France. Changes in frequency of virulent isolates towards Rlm7 in these samples as well as changes in the methods used for this analysis are presented.

Key words: stem canker, oilseed rape, virulence, resistance breakdown, molecular diagnostic

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PATHOLOGY SESSION - Oral presentation

Verticillium longisporum: pathogen detection, diagnostics and varietal resistance in U.K. oilseed rape (*Brassica napus*)

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Abstract: *Verticillium longisporum* is an emerging pathogen of oilseed rape (*Brassica napus*) in the U.K. and both incidence/distribution of the disease appears to be increasing. The delay of expression of symptoms in the host and the soil-borne nature of the pathogen hamper accurate detection and diagnosis. Chemical control strategies are currently ineffective and rotational management is the only option to minimise risk of disease. The identification of sources of genetic resistance is therefore a desirable strategy through which to reduce disease. In an effort to identify strategies to manage the risk posed by *V. longisporum* we generated a series of inoculated trials to screen a range of current U.K. varieties for resistance and used a CTAB/silicon dioxide pre-extraction, followed by conventional extraction to obtain DNA from a range of soil samples for subsequent analysis. Development of Loop Mediated Isothermal Amplification (LAMP) and qPCR based assays have enabled us to accurately detect and diagnose *V. longisporum* in a range of naturally and artificially infected soil samples. *B. napus* varieties varied for incidence of the disease and although complete resistance would appear to be absent in the varieties screened, a range of partial resistance was observed in specific cultivars. Soil detection assays currently provide semi-quantitative data for respective DNA concentrations and low (<50 microsclerotia/50g soil), moderate (<100/50g) and high (>200/50g soil) levels of infection can be detected. The identification for variation in resistance to *V. longisporum* amongst current varieties and the development of new diagnostic techniques will be utilised to investigate pathogen dynamics, yield loss and also to develop strategies to manage the risk posed to growers.

Key words: *Verticillium longisporum*, oilseed rape, detection, varietal resistance

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PATHOLOGY SESSION - Oral presentation

Cross-resistance in winter oilseed rape (*Brassica napus*) against multiple vascular pathogens

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Abstract: Oilseed rape (OSR) is one of the most important oilseed crops in the world. Due to its high yielding potential and a wide range of uses, the value of OSR has increased overtime and currently it is intensively cultivated in many regions of the world. However, these situations created conditions for the emergence of economically important diseases including vascular pathogens. Due to the unique life style and means of survival, limited options are available to control vascular diseases and studies suggest that plant resistance, which provides a reasonably sustainable solution, remains the preferred strategy. In the present study the resistance reactions of two winter OSR cultivars previously identified as resistant and susceptible to *Verticillium longisporum* (VL), were tested against *V. dahliae* (VD), *Fusarium oxysporum f. sp. conglutinans* (FOC) *and Xanthomonas campestris pv. campestris* (XCC). The experiment was conducted under greenhouse conditions. VL, VD and FOC inoculations were performed with root-dip inoculation method. Infection with XCC was done by injecting bacterial cultures into major veins of young leaves. Disease development was assessed by evaluating disease severity, stunting effects, and reduction of plant biomass. Accumulation of the plant-defence related phytohormone salicylic acid (SA) was quantified by HPLC.

The results showed that unlike the VL-susceptible cultivar Falcon, resistance of cultivar SEM to VL was verified as evidenced by significantly lower levels of net AUDPC, relative stunting, and dry matter yield reduction values. Interestingly, SEM also showed complete resistance towards FOC with mean disease index value of 0.78 compared to 6.56 in the VL-susceptible cultivar Falcon. Seven days after inoculation, FOC significantly reduced (63%) dry matter (DM) yield in Falcon but had little effect on SEM and plants remained healthy even after 28 DPI with no significant difference between mock-inoculated plants. In contrast, the rate of FOC disease development in susceptible plants was very fast and caused complete death in less than 10 days which might take at least four weeks for VL. Both VL and FOC induced stunting and reduction of stem diameter in Falcon and SEM but the effects were more pronounced due to VL and in the cultivar Falcon. In contrast to VL and FOC, infection with VD and XCC had no significant effect in all evaluated parameters. As expected, infection with VD did not induce disease in both genotypes confirming its non-pathogenicity to *B. napus*. Similarly, XCC infection did not cause distinct symptoms in both cultivars and infection was restricted only to infected leaves. This might be either due to less aggressiveness of the XCC strain or both genotypes might also be tolerant to this particular bacterial strain. Analysis of total SA (free and conjugated) accumulation in hypocotyl tissue revealed that irrespective of genotype, infection with FOC and VL induces significantly higher levels of SA. At 7 DPI, total SA accumulation in mock-inoculated SEM and Falcon plants was 75 and 243µM/g DW but infection increased the levels to 1.327 and 1.516µM/g DW respectively. Similarly, at 28 DPI, VL induced up to a 4 and 10 fold increase in total SA levels in SEM and Falcon, respectively. In contrast, VD and XCC infection did not significantly alter accumulation of SA in both cultivars which is in agreement with the results obtained from the evaluation of disease parameters.

In conclusion, the resistance response of cultivar SEM to different vascular pathogens suggests that previously reported horizontal VL-resistance mechanisms in *B. napus* (vascular occlusions, phenolics and lignin) might also effectively work against other aggressive pathogens that colonize the vascular system. The significantly higher accumulation of SA in infected resistant and susceptible

cultivars and the very strong correlation existing between disease levels and accumulation of SA due to VL (r^2 = 0.93) and FOC (r^2 =0.87) indicated that SA played no significant role in conferring resistance in the pathosystem. Nevertheless, exploring the mechanisms behind cross-resistance of *B. napus* towards multiple vascular pathogens forms the focus of our future study.

Key words: cross-resistance, vascular pathogens, *Brassica napus*, *Verticillium longisporum*, *Fusarium oxysporum*

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PATHOLOGY SESSION - Oral presentation

Studies of clubroot (*Plasmodiophora brassicae*) on oilseed rape in the Czech Republic

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Abstract: Clubroot, caused by the pathogen *Plasmodiophora brassicae* (Wor.) has been spreading on winter oilseed rape in Czech Republic during the past three years. Research on *P. brassicae* in Czech Republic has taken on great importance since there is an immediate need to adopt effective management strategies against clubroot under Czech environmental conditions. Preliminary experiments with clubroot resistant cultivars of winter rape started in 2012. Experiments were done under greenhouse and field conditions. For greenhouse experiments, soil samples were collected from contaminated fields. Seeds of oilseed rape varieties declared by seed companies as resistant, together with susceptible controls (variety Rohan and chinese cabbage variety Granaat) were sown both into soil samples and in field severely and homogeneously contaminated by *P. brassicae*. Incidence and severity of symptoms on roots was evaluated after eight weeks. Presence of *P. brassicae* in roots was tested by PCR. Results obtained from both experiments were identical. The resistant cultivars Mendel, Mendelson, Alister and Andromeda showed no visible symptoms in any soil sample, although PCR confirmed pathogen presence in all cases. Similarly, the soil samples were also tested for the presence of *P. brassicae* using PCR. Furthermore, testing of soil samples at different dilutions by RealTime-PCR using TaqMan probes and SYBR green is in progress. Monitoring the diversity of clubroot *P. brassicae* pathotypes in the Czech Republic is also planned and has already started.

Key words: clubroot, monitoring, management strategies

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PATHOLOGY SESSION - Oral presentation

The importance of post harvest soil management in oilseed rape fields in reduction of clubroot severity

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Abstract: *Plasmodiophora brassicae* Woronin is an obligate biotroph pathogen with a wide host range of 300 species of cruciferous plants and is an emerging threat to German oilseed rape (*Brassica napus*) production. To date, few commercially acceptable resistant cultivars are available and no fungicides are currently registered for the control of this pathogen on OSR in Germany. Previous studies indicated that oilseed rape volunteers and weeds play a critical role in predisposing of disease incidence and severity. A series of studies were conducted under greenhouse conditions with a susceptible OSR cultivar to clubroot disease to assay the effect of foliar application of the herbicide glyphosate and mechanical destruction of OSR volunteers in reducing clubroot disease severity. Plants were inoculated by injecting spore suspension ($2*10^7$ spores/ ml) beside root hairs at BBCH 13-14. To determine the effect of timing of applications, plants were treated early (seven days after inoculation, dpi) or late (21 dpi). Plants were examined for clubroot development 35 days after inoculation. The roots were dug from the soil, washed with the tap water and assessed for the severity of gall formation. Visual disease assessments after early and late applications showed variation among the treatments in symptom development. Changing the time of application had a significant effect on control efficiency. Results from this study demonstrated that the early application of glyphosate as well as the early mechanical destruction significantly decreased, relative to untreated control, the development of clubroot symptoms on infected roots. In particular, early glyphosate treatment reduced disease incidence and severity in treated plants. The results suggest the herbicide affected the development of the pathogen's host plant which had the effect of weaking the obligate pathogen. An early application of glyphosate could potentially interrupt the pathogen's development and suppress the establishment and survival of the resting spores.

Key words: clubroot, control measures, timing, efficacy

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PATHOLOGY SESSION - Oral presentation

Random sampling of agricultural soils in Poland reveals frequent infestation with *Plasmodiophora brassicae*

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Abstract: The rapid increase of oilseed rape production worldwide has caused enormous intensification of crop production and has resulted in tight rotations. This in turn leads to an accumulation of pests as well as foliar and soil diseases. One of the biggest concerns of oilseed rape growers in recent times is clubroot, caused by the soil-borne protist *Plasmodiophora brassicae*. The pathogen may be present in ground water as well as in lakes and irrigation water used in irrigation systems. It can be easily transmitted from one field to another by water, soil particles and dust. Our team has been involved in an extensive study of the incidence of *P. brassicae* in agricultural soils of Poland. The study was done in 2012 and 2013, from 997 fields in 326 districts of Poland. Each sample was collected at several sites per field, using a soil auger by Spychalski and Kosiada (Agroekspert Polska). A biotest to detect the presence of *P. brassicae* was done in greenhouse conditions using seedlings of *Brassica rapa* ssp. *pekinensis* and the Polish variety of oilseed rape Monolit. These susceptible plant species were used as bait plants. Where the presence of the pathogen was detected in a soil sample, clubs (galls) were formed on the roots of the bait plants. An assessment was done using a 0 to 4 scale, where 0 was a healthy plant with fully developed roots and 4 was a small plant with infected roots. A district was regarded as free from the pathogen when none of the studied samples caused infections on any of the bait plants tested. Based on our study we can conclude that clubroot is widespread in Polish agricultural soils. One third of the districts studied contained at least one soil sample infested with *P. brassicae*. The majority of soil samples containing *P. brassicae* originated from the provinces located in Pomorze (Pomerania, north-west of Poland), Warmia (north-east), Silesia and Opole regions (south-west). The pathogen was also present in soils of the provinces previously regarded as free from clubroot, such as Wielkopolska (Great Poland, central-west of Poland), Malopolska (Little Poland, central-south) and Podkarpacie (Carpathian Foothills, south east).

Key words: clubroot, soil monitoring, biotest, bait plants

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PATHOLOGY SESSION - Oral presentation

Identification of the chromosome complement and genome recombination in interspecific hybrids and mutants within the genus *Brassica*, with known resistance to clubroot

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Abstract: Amphidiploid rapeseed as a very important oil plant became a widely cultivated crop in many countries worldwide. Searching for forms with improved traits is highly desirable and from that point of view, interspecific crossing is a valuable tool for widening the variability of useful traits, e.g. seed quality and resistance to some diseases such as clubroot caused by soil-inhabiting protist *Plasmodiophora brassicae*, which causes severe damage to oilseed rape and vegetable brassicas. The main sources of resistance used to date originate from different species of the genus *Brassica*, including *B. campestris* (A-genome), *B. oleracea* (C-genome) and *B. napus* (AC-genome). Different experimental approaches have been applied to study chromosome rearrangements in *Brassica* allotetraploid and ancestral genomes, such as the production of synthetic allopolyploids compared to natural forms using chromosome mapping and cytogenetic analysis including fluorescence and genomic *in situ* hybridization (FISH/GISH). Physical mapping of 5S and 18S–5.8S–26S (35S) rRNA genes by FISH provides valuable chromosomal landmarks, and their characteristic positions enable chromosome identification, which allows detection of chromosome variability. In this ongoing research, we focus our attention on (i) an analysis of ribosomal DNA (rDNA) loci number and location in individuals of F_3-F_6 generations, which resulted from the interspecific crosses between *B. napus* and *B. campestris* ssp. *pekinensis* as well as *B. campestris* ssp. *trilocularis*, (ii) determination of the parental genomes using FISH with C-genome specific BAC-based probes (BAC-FISH) and (iii) an assignment of known *Brasssica* chromosomal markers to their corresponding genomes in *Brassica* forms studied. Among *Brassica* interspecific hybrids, different number of both kinds of rDNA sequences was observed, indicating the genome re-organization. The use of *B. oleracea* BAC clone revealed the chromosome re-arrangements between A- and C-genomes in the synthetic *B. napus* forms, which can be a rapid response to formation of the allotetraploid *B. napus* genome. The resistance of the different plant genotypes was studied using a biotest performed in controlled environment conditions. The seeds of hybrids, their parental lines and the mutants of *B. napus* were germinated for 5 days on petri dishes, then the small seedlings were transplanted to soil substrate and inoculated with spore suspensions of different isolates/races of *P. brassicae*. Susceptibility/resistance of particular lines was assessed 8 weeks after plant inoculation and interpreted based on the results of cytogenetic studies. In this work, the identification of chromosome identity and their re-arrangements in synthetic *B. napus* forms will be presented.

Key words: clubroot resistance, oilseed rape, ancestors, allopolyploids, chromosome rearrangements

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VENUE INFORMATION

From iron production to the "City of Science" – The history of Esch-Belval

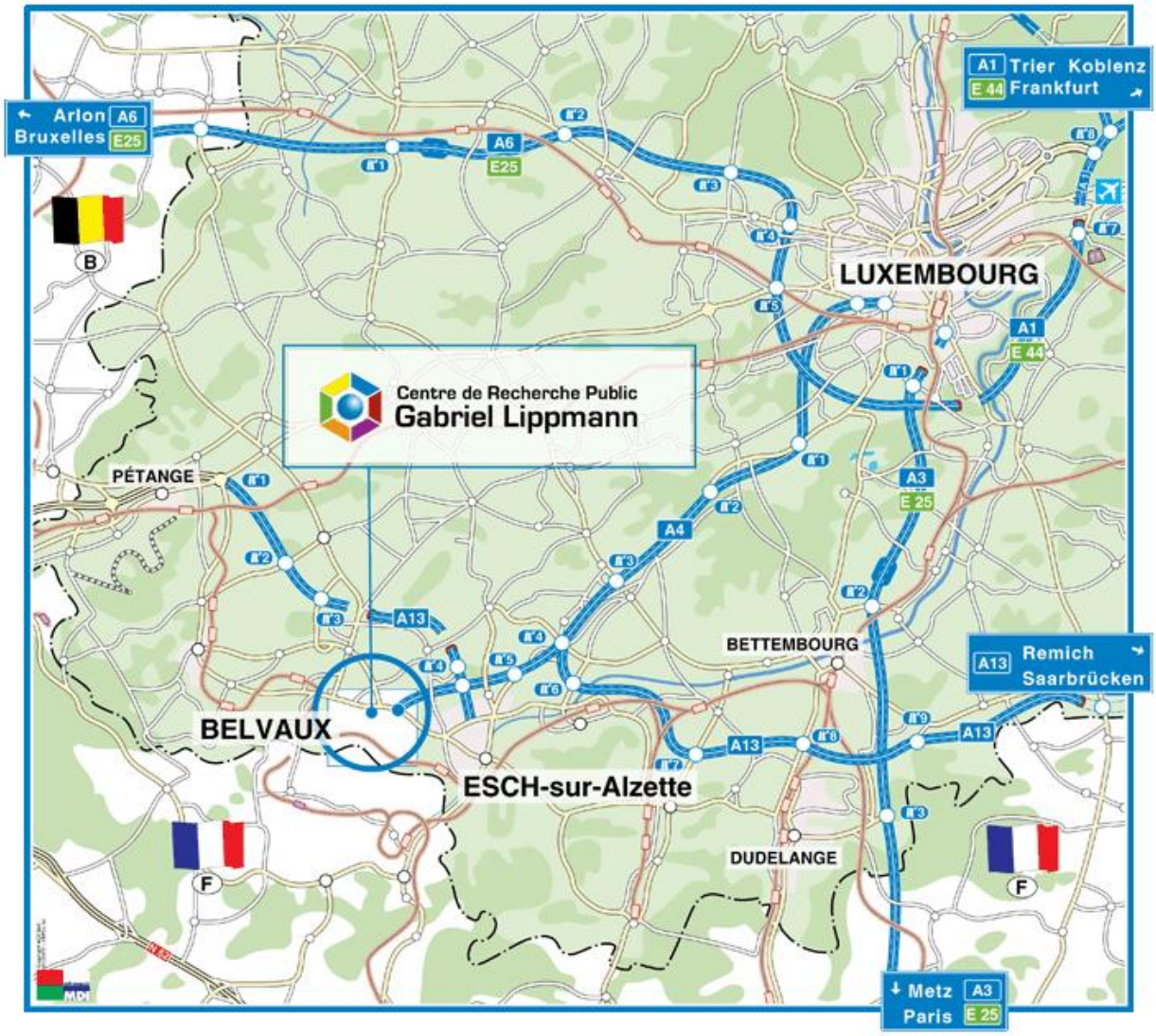
In 1907, the company Gelsenkirchener Bergwerks AG decided to construct a new factory. The brother Adolf and Emil Kirdorf could not acquire the terrain necessary for their project at the commune Lorraine Russange in France. As a result, they turned to the municipality Esch-sur-Alzette. Situated between Esch-sur-Alzette and Belvaux, the factory Adolf-Emil, constructed from 1909 to 1912, was integrated in every step of the iron production, from the preparation of ore to the final product. In addition to that, the factory disposed of a blast furnace and of steelwork. It ranged over a terrain of 222 ha. Six blast furnaces with a daily output of 200 barrels at a time, a gigantic compressor, a Thomas steelwork with two mixers (800 barrels) and four convertors (18 barrels), even so a core lamination of six streams allow production of a wide diversity of intermediate products sold outside (ingot and bar) to finished products leaving the mill (beams, U-irons, irons sections, piling, Hardware, oversized). In 1913, 3.131 workers (65% foreigners) produced 400.000 barrels of cost iron, 360 000 barrels of iron steel and 297 000 barrels of rolled steel. The factory was upgraded in the 1960s. Three new blast furnaces replaced the six original elements. In 1973, the factory persists of 6875 workers and 1006 employees and had its strongest daily production: 1782000 tones of steel and 1513000 tones of iron. The steel crises in the 1990s forced the ARBED group to make technical restrictions. The blast furnaces were shut down one after the other; the last one held until the 28th of august 1997. After this point, the steel production was made in the electric ovens, supplied, with discarded metal. In May 1997 an electric oven, made by Mannesmann Demag Hüttentechnik (MDH) and with an inside diameter of 7, 6 meters and a capacity of 155 tones, is activated. IN September 1996 the new masticator built by SMS/Paul Würth is also activated, its production is declined since then in three dimensions: bars, skelps and iron girders.

On the East side of the factory, the production continuous, the West side however decreases to an industrial fellow. Then the Western area grows suddenly to an urban zone. One of the three blast furnaces was sold to China, while the other two (A and B) will be developed to be a part of a tour of the future national centre of industrial culture, and are part of the industrial heritage. The whole area around the old blast furnaces is part of the scientific quarter, of research and innovation. It will host different structures of the University of Luxemburg, many research centres (like Centre de Recherche Public – Gabriel Lippmann) and the national archives.

In the immediate surroundings of the blast furnaces, the national centre of industrial culture (CNCI) will be developed. The mission of this new structure will keep the knowledge about industrial commissioning alive, the built-up of historical documents about the industrialisation as well as to insist on the subject of work today. The blast furnaces will be the main subject of several public visits. The impressive buildings of the blast furnace A will serve as location for many various exhibitions. For an aerial view see page 75.

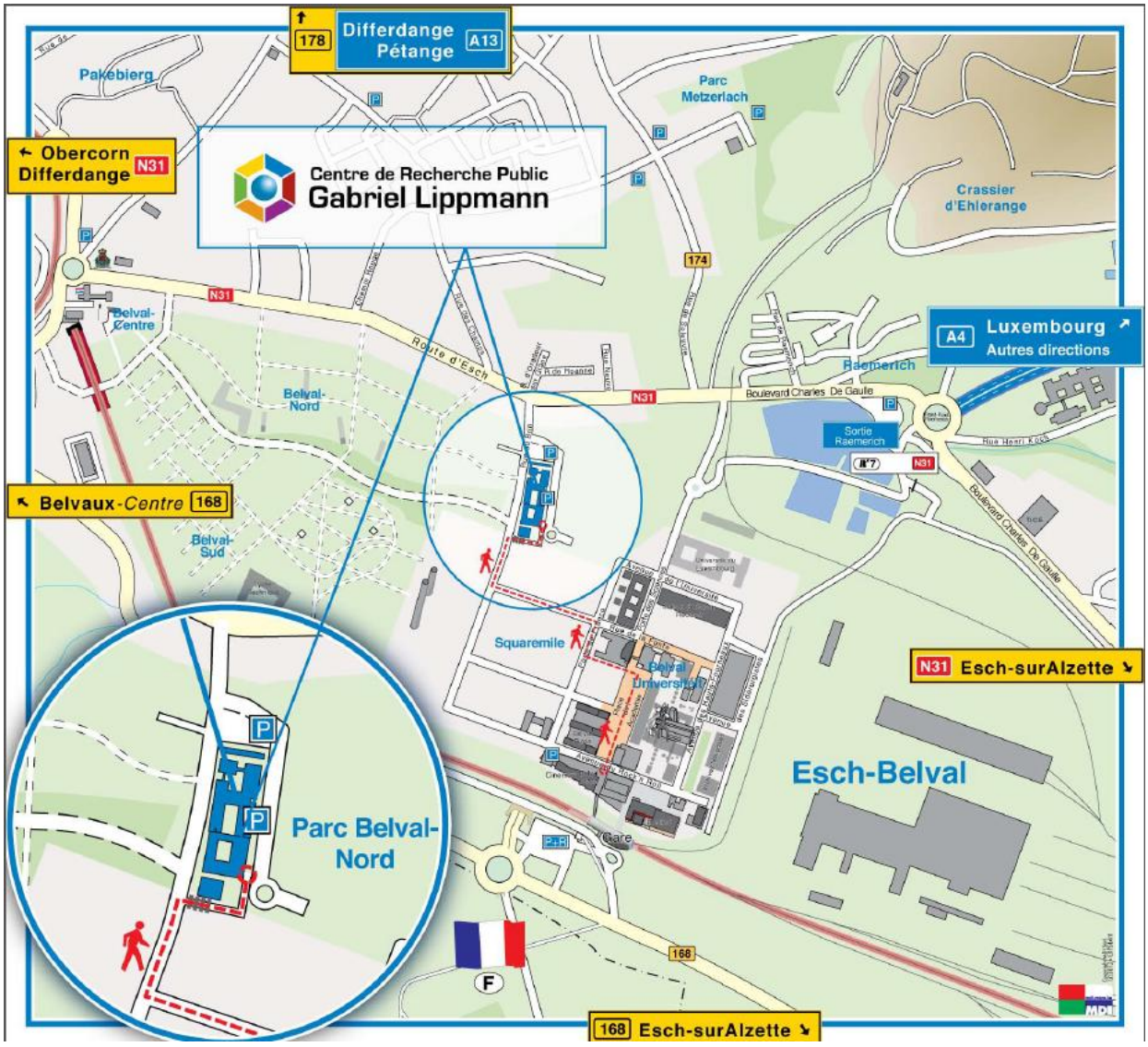
Reaching Esch-Belval by car

Major Roads



Reaching Esch-Belval by car

Map of Esch-Belval (Cité des sciences / City of Science)



Reaching the Esch-Belval by train

You can reach Esch-Belval by train. Most visitors from other countries (Germany, France, Belgium) arrive at Luxembourg Gare–Central (Central Station). From Luxembourg Gare – Central, you can reach Esch-Belval every 15 minutes by train (Line 60, direction Esch-Alzette – Petange – Rodange). The trip will take nearly 30 minutes (see schedule on page 74)

You can buy a ticket (so called Kuerzzäitbilljee, Billet courte durée, price is 2,- EUR) at Luxembourg Gare-Central (the counter is named “Tickets nationaux”) and also aboard the train from the conductor (please, have some coins ready for paying).

The stations you are passing by are: Berchem, Bettembourg, Noertzange, Schifflange, Esch-sur-Alzette. Please leave the train at the station “Belval-Université” (6th station after leaving Gare Central). It is situated in the Belval-Plaza shopping complex. The “Hôtel Ibis Esch Belval” is next to the train station.

The CRP - Gabriel Lippmann is approximately a 10-minute walk from railway station, “Belval-Université”. To reach the CRP on foot (see the map on page 71), exit the shopping centre, cross the road and go down the steps in front of you. Walk through the large square and, just in front of the large red building (RBS-Dexia), take the steps on the left leading out of the square. Cross the road and turn left into the blocked-off road along the right-hand edge of the car park. Turn right at the end and right again to go down the metal steps. The wood-clad building you see on your left is the CRP.

Reaching the Esch-Belval by bus

Three bus lines stop at the corner of the street in which the CRP is situated, the "rue du Brill":

Luxembourg-Belvaux-Differdange (line 202)

From the bus stop "Charlys-Gare", situated in the avenue Emile Reuter in Luxembourg, bus 202 RGTR takes you to the stop "Belvaux-Brill" in 24 minutes.

Esch-Belvaux (lines 1 and 2)

From Esch-sur-Alzette railway station, the best way to reach the CRP is to take line 1 or line 2 TICE. Journey time to the "Belvaux-Brill" bus stop, located at the corner of the rue du Brill, is approximately 10 minutes.

	RE 6905	RB 6805	RE 6955	RB 6355	RE 6906	RB 6806	RB 6856	RE 6956	RB 7666	RE 6907	RE 86520	RB 6807	RE 6957	RB 6857	RE 6908	RE 86524	RB 6808	RE 6958	RB 6858	RE 6909	RB 6809	RE 6959	RB 6859	RE 6910	RB 6810
Luxembourg	5 05	Ⓐ 5 20	Ⓐ 5 35	Ⓐ 5 50	✕ 6 05	Ⓒ 6 20	Ⓐ 6 22	✕ 6 35	✕ 6 50	✕ 7 05		7 20	✕ 7 35	✕ 7 50	✕ 8 05		8 20	✕ 8 35	✕ 8 50	✕ 9 05	9 20	✕ 9 35	✕ 9 50	✕ 10 05	10 20
Berchem	5 11	5 26	5 41	5 56	6 11	6 26	6 28	6 41	6 56	7 11		7 26	7 41	7 56	8 11		8 26	8 41	8 56	9 11	9 26	9 41	9 56	10 11	10 26
Bettembourg	5 17	5 32	5 47	6 02	6 17	6 32	6 33	6 47	7 02	7 17		7 32	7 47	8 02	8 17		8 32	8 47	9 02	9 17	9 32	9 47	10 02	10 17	10 32
Noertzange	5 21	5 36	5 51	6 06	6 21	6 36	6 37	6 51	7 06	7 21	ⓓ	7 36	7 51	8 06	8 21	ⓓ	8 36	8 51	9 06	9 21	9 36	9 51	10 06	10 21	10 36
Schifflange	5 25	5 40	5 55	6 10	6 25	6 40	6 41	6 55	7 10	7 25	Ⓐ 7 32	7 40	7 55	8 10	8 25	Ⓐ 8 30	8 40	8 55	9 10	9 25	9 40	9 55	10 10	10 25	10 40
Esch-sur-Alzette	5 30	5 45	6 00	Ⓐ 6 13	6 30	6 45	6 45	7 00	7 15	7 30	7 36	7 45	8 00	8 15	8 30	8 36	8 45	9 00	9 15	9 30	9 45	10 00	10 15	10 30	10 45
Belval-Université	5 34	5 49	6 04	ⓓ	6 34	6 49	6 49	7 04	7 19	7 34	7 41	7 49	8 04	8 19	8 34	8 41	8 49	9 04	9 19	9 34	9 49	10 04	10 19	10 34	10 49
Belval-Lycée	|	5 51	|	|	|	|	6 51	6 51	|	|	7 21	|	|	7 51	|	|	8 21	|	|	8 51	|	9 21	|	9 51	|	10 21	|	10 51
Belval-Rédange	|	5 53	|	|	|	|	6 53	6 53	|	|	7 23	|	|	7 53	|	|	8 23	|	|	8 53	|	9 23	|	9 53	|	10 23	|	10 53
Belvaux-Soleuvre	|	5 56	|	|	|	|	6 56	6 56	|	|	7 26	|	|	7 56	|	|	8 26	|	|	8 56	|	9 26	|	9 56	|	10 26	|	10 56
Oberkorn	|	5 59	|	|	|	|	6 59	6 59	|	|	7 29	|	|	7 59	|	|	8 29	|	|	8 59	|	9 29	|	9 59	|	10 29	|	10 59
Differdange	5 42	6 02	6 12	|	6 42	7 02	7 02	7 12	7 32	7 42	7 48	8 02	8 12	8 32	8 42	8 48	9 02	9 12	9 32	9 42	10 02	10 12	10 32	10 42	11 02
Niederkorn	|	6 05	|	|	|	7 05	7 05	|	7 35	|	|	8 05	|	8 35	|	|	9 05	|	9 35	|	10 05	|	10 35	|	11 05
Pétange	5 50	6 10	6 20	|	6 50	7 10	7 10	7 20	7 40	7 50	7 55	8 10	8 20	8 40	8 50	8 55	9 10	9 20	9 40	9 50	10 10	10 20	10 40	10 50	11 10
Lamadelaine	|	6 12	|	|	|	7 12	7 12	|	ⓓ 7 42	7 52	ⓓ	8 12	|	8 42	|	ⓓ	9 12	|	9 42	|	10 12	|	10 42	|	11 12
Rodange O	5 53	Ⓐ 6 15	Ⓐ 6 23	|	✕ 6 53	Ⓒ 7 15	Ⓐ 7 15	✕ 7 23	✕ 7 45	✕ 7 55	Ⓐ 7 58	8 15	✕ 8 23	✕ 8 45	✕ 8 53	Ⓐ 8 58	9 15	✕ 9 23	✕ 9 45	✕ 9 53	10 15	✕ 10 23	✕ 10 45	✕ 10 53	11 15

	RE 6960	RB 6860	RE 6911	RB 6811	RE 6961	RB 6861	RE 6912	RB 6812	RE 6962	RB 6862	RE 6913	RB 6813	RE 6963	RB 6863	RE 6914	RB 6814	RE 6964	RB 6864	RE 6915	RB 6815	RB 6867	RE 6965	RB 6865	RE 6916
Luxembourg	✕ 10 35	✕ 10 50	✕ 11 05	11 20	✕ 11 35	✕ 11 50	✕ 12 05	12 20	✕ 12 35	12 50	✕ 13 05	13 20	✕ 13 35	13 50	✕ 14 05	14 20	✕ 14 35	14 50	✕ 15 05	Ⓒ 15 20	Ⓐ 15 20	✕ 15 35	15 50	✕ 16 05
Berchem	10 41	10 56	11 11	11 26	11 41	11 56	12 11	12 26	12 41	12 56	13 11	13 26	13 41	13 56	14 11	14 26	14 41	14 56	15 11	15 26	15 26	15 41	15 56	16 11
Bettembourg	10 47	11 02	11 17	11 32	11 47	12 02	12 17	12 32	12 47	13 02	13 17	13 32	13 47	14 02	14 17	14 32	14 47	15 02	15 17	15 32	15 32	15 47	16 02	16 17
Noertzange	10 51	11 06	11 21	11 36	11 51	12 06	12 21	12 36	12 51	13 06	13 21	13 36	13 51	14 06	14 21	14 36	14 51	15 06	15 21	15 36	15 36	15 51	16 06	16 21
Schifflange	10 55	11 10	11 25	11 40	11 55	12 10	12 25	12 40	12 55	13 10	13 25	13 40	13 55	14 10	14 25	14 40	14 55	15 10	15 25	15 40	15 40	15 55	16 10	16 25
Esch-sur-Alzette	11 00	11 15	11 30	11 45	12 00	12 15	12 30	12 45	13 00	13 15	13 30	13 45	14 00	14 15	14 30	14 45	15 00	15 15	15 30	15 45	15 45	16 00	16 15	16 30
Belval-Université	11 04	11 19	11 34	11 49	12 04	12 19	12 34	12 49	13 04	13 19	13 34	13 49	14 04	14 19	14 34	14 49	15 04	15 19	15 34	15 49	15 49	16 04	16 19	16 34
Belval-Lycée	|	11 21	|	11 51	|	12 21	|	12 51	|	13 21	|	13 51	|	14 21	|	14 51	|	15 21	15 51	|	16 21	|
Belval-Rédange	|	11 23	|	11 53	|	12 23	|	12 53	|	13 23	|	13 53	|	14 23	|	14 53	|	15 23	15 53	|	16 23	|
Belvaux-Soleuvre	|	11 26	|	11 56	|	12 26	|	12 56	|	13 26	|	13 56	|	14 26	|	14 56	|	15 26	15 56	|	16 26	|
Oberkorn	|	11 29	|	11 59	|	12 29	|	12 59	|	13 29	|	13 59	|	14 29	|	14 59	|	15 29	15 59	|	16 29	|
Differdange	11 12	11 32	11 42	12 02	12 12	12 32	12 42	13 02	13 12	13 32	13 42	14 02	14 12	14 32	14 42	15 02	15 12	15 32	15 42	16 02	16 02	16 12	16 32	16 42
Niederkorn	|	11 35	|	12 05	|	12 35	|	13 05	|	13 35	|	14 05	|	14 35	|	15 05	|	15 35	16 05	|	16 35	|
Pétange	11 20	11 40	11 50	12 10	12 20	12 40	12 50	13 10	13 20	13 40	13 50	14 10	14 20	14 40	14 50	15 10	15 20	15 40	15 50	16 10	16 10	16 20	16 40	16 50
Lamadelaine	|	11 42	|	12 12	|	12 42	|	13 12	|	13 42	|	14 12	|	14 42	|	15 12	|	15 42	ⓓ 16 12	|	16 42	|
Rodange O	✕ 11 23	✕ 11 45	✕ 11 53	12 15	✕ 12 23	✕ 12 45	✕ 12 53	13 15	✕ 13 23	13 45	✕ 13 53	14 15	✕ 14 23	14 45	✕ 14 53	15 15	✕ 15 23	15 45	✕ 15 53	Ⓒ 16 15	Ⓐ 16 15	✕ 16 23	16 45	✕ 16 53

	RB 6816	RE 6966	RE 86528	RB 6866	RE 6917	RB 6817	RE 6967	RB 6867	RE 6918	RE 86532	RB 6818	RE 6968	RB 6868	RE 6919	RB 6819
Luxembourg	16 20	✕ 16 35		16 50	✕ 17 05	17 20	✕ 17 35	17 50	✕ 18 05		18 20	✕ 18 35	18 50	✕ 19 05	19 20
Berchem	16 26	16 41		16 56	17 11	17 26	17 41	17 56	18 11		18 26	18 41	18 56	19 11	19 26
Bettembourg	16 32	16 47		17 02	17 17	17 32	17 47	18 02	18 17		18 32	18 47	19 02	19 17	19 32
Noertzange	16 36	16 51	ⓓ	17 06	17 21	17 36	17 51	18 06	18 21	ⓓ	18 36	18 51	19 06	19 21	19 36
Schifflange	16 40	16 55	Ⓐ 17 00	17 10	17 25	17 40	17 55	18 10	18 25	Ⓐ 18 29	18 40	18 55	19 10	19 25	19 40
Esch-sur-Alzette	16 45	17 00	17 06	17 15	17 30	17 45	18 00	18 15	18 30	18 36	18 45	19 00	19 15	19 30	19 45
Belval-Université	16 49	17 04	17 11	17 19	17 34	17 49	18 04	18 19	18 34	18 41	18 49	19 04	19 19	19 34	19 49
Belval-Lycée	16 51	|	|	17 21	|	17 51	|	18 21	|	|	18 51	|	19 21	|	19 51
Belval-Rédange	16 53	|	|	17 23	|	17 53	|	18 23	|	|	18 53	|	19 23	|	19 53
Belvaux-Soleuvre	16 56	|	|	17 26	|	17 56	|	18 26	|	|	18 56	|	19 26	|	19 56
Oberkorn	16 59	|	|	17 29	|	17 59	|	18 29	|	|	18 59	|	19 29	|	19 59
Differdange	17 02	17 12	17 18	17 32	17 42	18 02	18 12	18 32	18 42	18 48	19 02	19 12	19 32	19 42	20 02
Niederkorn	17 05	|	|	17 35	|	18 05	|	18 35	|	|	19 05	|	19 35	|	20 05
Pétange	17 10	17 20	17 25	17 40	17 50	18 10	18 20	18 40	18 50	18 54	19 10	19 20	19 40	19 50	20 10
Lamadelaine	17 12	|	ⓓ	17 42	|	18 12	|	18 42	ⓓ	ⓓ	19 12	|	19 42	|	20 12
Rodange O	17 15	✕ 17 23	Ⓐ 17 28	17 45	✕ 17 53	18 15	✕ 18 23	18 45	✕ 18 53	Ⓐ 18 57	19 15	✕ 19 23	19 45	✕ 19 53	20 15

	RE 6969	RB 6869	RB 6820	RB 6870	RB 6821	RB 6871	RB 6822	RB 6872	RB 6823	RB 6873	RB 6850	RB 6804
Luxembourg	✕ 19 35	19 50	3 20 20	3 20 50	3 21 20	3 21 50	3 22 20	3 22 50	3 23 20	3 23 50	1 0 50	5 ⓜ
Berchem	19 41	19 56	20 26	20 56	21 26	21 56	22 26	22 56	23 26	3 23 56	0 56	1 06
Bettembourg	19 47	20 02	20 32	21 02	21 32	22 02	22 32	23 02	23 32	3 0 02	1 02	1 11
Noertzange	19 51	20 06	20 36	21 06	21 36	22 06	22 36	23 06	23 36	0 06	1 06	1 15
Schifflange	19 55	20 10	20 40	21 10	21 40	22 10	22 40	23 10	23 40	0 10	1 10	1 19
Esch-sur-Alzette	20 00	20 15	20 45	21 15	21 45	22 15	22 45	23 15	23 45	0 15	1 15	1 23
Belval-Université	20 04	20 19	20 49	21 19	21 49	22 19	22 49	23 19	23 49	0 19	1 19	1 27
Belval-Lycée	|	20 21	20 51	21 21	21 51	22 21	22 51	23 21	23 51	0 21	1 21	1 28
Belval-Rédange	|	20 23	20 53	21 23	21 53	22 23	22 53	23 23	23 53	0 23	1 23	1 31
Belvaux-Soleuvre	|	20 26	20 56	21 26	21 56	22 26	22 56	23 26	3 23 56	0 26	1 26	1 34
Oberkorn	|	20 29	20 59	21 29	21 59	22 29	22 59	23 29	3 23 59	0 29	1 29	1 37
Differdange	20 12	20 32	21 02	21 32	22 02	22 32	23 02	23 32	0 02	0 32	1 32	1 40
Niederkorn	|	20 35	21 05	21 35	22 05	22 35	23 05	23 35	0 05	0 35	1 35	1 43
Pétange	20 20	20 40	21 10	21 40	22 10	22 40	23 10	23 40	0 10	0 40	1 40	1 48
Lamadelaine	|	20 42	21 12	21 42	22 12	22 42	23 12	23 42	0 12	0 42	1 42	1 50
Rodange O	✕ 20 23	20 45	3 21 15	3 21 45	3 22 15	3 22 45	3 23 15	3 23 45	4 0 15	4 0 45	1 1 45	3 1 53

Les informations sont données à titre indicatif et sous réserve de modifications.

1 † et les 29.déc., 5.jan., 11.mai, 3.,10.,17.,24.août, sauf les 25.,26.déc., 1.jan.
2 sauf le 24.déc.
3 sauf le 25.déc.
4 Ⓐ jusqu'au 27.juil. et à p. du 31 août; sauf les 29.déc., 5.jan., 11.mai
5 les Ⓐ vers Longwy (sauf les 2., 9.mars)
ⓜ vers Longwy
ⓓ vers Athus
ⓕ de Thionville
arrivée
O origine à Howald; correspondance bus de Luxembourg-Gare dép. 0.50

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Horaire

Validité du 09.12.2012 au 14.12.2013

Luxembourg
Belval-Université
Belval-Lycée
Belval-Rédange
Belvaux-Soleuvre
Oberkorn
Differdange
Niederkorn
Pétange
Lamadelaine
Rodange

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MIR BRÉNGEN ICH WEIDEN

Aerial view of Esch-Belval (Cité des sciences / City of Science)

1 = Centre de Recherche Public – Gabriel Lippmann
2 = Hôtel Ibis Esch Belval
3 = Train staion « Belval Université »
4 = Concert hall « Rockhal »
5 = Industrial heritage
6 = Building area of the new «Luxembourg University»