



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

Organisation Internationale
de Lutte Biologique et
Intégrée contre les Animaux
et les Plantes Nuisibles

IOBC Oilseed rape meeting Réunion OILB Colza

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Abstracts Résumés



Organized by CETIOM and the UMT Pivert

The « Unité Mixte Technologique PIVERT » is a consortium of 3 research groups, 2 technical instituts and Agro Paris Tech on Versailles-Grignon Campus aiming to promote research on integrated crop protection for winter crops rotations with Wheat and oilseed rape, with the financial support of the French Ministry of Agriculture

UMT Pivert Members are :

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Programme

Monday		
09:00-10:00		Welcome and Coffee
10:00-10:20	G01	CETIOM Welcome address <i>A. Pouzet</i>
10:20-10:40	G02	IOBC Welcome <i>B. Koopmann / B. Ekbom</i>
10:40-11:00	G03	Meeting agenda, organisation <i>X. Pinochet</i>
11:00-11:20	G04	European network for the durable exploitation of crop protection strategies (ENDURE)
	2	N. Evans
11:20-11:40	G07	Utilization of a model (OMEGAsys) to re-design integrated crop management for WOSR
	14	M. Valantin-Morison et al
11:40-12:00	P08	Economic Gains and Integrated Pest Management : An Application to the Sclerotinia and the Canola Crop
	33	S.Marette et al
12:00-12:20	G06	Impact of cabbage root fly on infections of oilseed rape with <i>Verticillium longisporum</i> and <i>Phoma lingam</i>
	21	H. Keunecke
12:20-13:20		Lunch
13:20-14:20		Poster presentation
14:20-14:40	P02	Detecting airborne inoculum to forecasting oilseed rape diseases
	11	J S. West, et al
14:40-15:00	P03	Genetic determinism of Clubroot resistance in WOSR
	41	R.Delourme, M.Manzanares
15:00-15:20	P16	The influence of Trichoderma species on <i>Leptosphaeria maculans</i> and <i>L. biglobosa</i> growth on agar media and in oilseed rape plants
	4	A. Dawidziuk, D. Popiel, M. Jędryczka
15:20-15:40	E06	Mortality factors of the cabbage seedpod weevil, <i>Ceutorhynchus obstrictus</i> (Coleoptera, Curculionidae) in Europe.
	7	T. Haye, U. Kuhlmann
15:40-16:00	E01	Using molecular methods to study pollen beetles: distribution and predation
	1	B. Ekbom
16:00-16:20		Coffee Break
16:20-16:40	E03	Role of the architectural plasticity in the response of oilseed rape plant to flower pruning simulating pollen beetle damages (<i>Meligethes aeneus</i>).
	40	A. Pinet
16:40-17:00	E04	Resistance of pollen beetle (<i>Meligethes aeneus</i> F.) to pyrethroids - Results of a national monitoring in Luxembourg
	45	M. Eickermann
17:00-17:20	E02	Effect of tillage system and larval parasitism on pollen beetle populations'
	27	B. Ulber
17:30-18:00		17:30 Transfer by Metro to Quartier latin for the visit with the guide
18:00-20:00		18:00 - 20:00 visit in the quartier latin
20:30-22:30		20:00 - 22:30 Official Dinner

Tuesday		
09:00-09:20	P01	Biocontrol of <i>Sclerotinia sclerotiorum</i> and <i>Verticillium longisporum</i> by the mycoparasite <i>Microphaeropsis ochracea</i>
	46	M. Stadler, B. Koopmann, A. von Tiedemann
09:20-09:40	P07	Monitoring the sensitivity of <i>Sclerotinia sclerotiorum</i> to new registered fungicides
	36	AS Walker et al
09:40-10:00	P04	Fungicide persistence, application timing and control of sclerotinia stem rot in England in 2007 and 2008
	49	F. Ritchie, P. Gladders, S. Waterhouse
10:00-10:20	P05	Evaluation of a decision making tool for controlling sclerotinia stem rot in WOSR using ROC curves on 2000-2008 data
	32	A.Penaud
10:20-10:40	Coffee Break and posters	
10:40-11:00	P06	Use of infection criteria from SkleroPro to identify infection events for sclerotinia stem rot in England, 1991-2007
	8	P Gladders, J. A.Smith, D. Ginsburg
11:00-11:20	P	Testing of compounds eliciting defence response and resistance in oilseed rape against <i>Leptosphaeria maculans</i>
	53	Lenka Burketova , Vladimír Sasek et al
11:20-11:40	P10	SIPPOM-WOSR, Simulator for Integrated Pathogen POPulation Management: a tool for the conception and evaluation of sustainable strategies to control phoma stem canker on Winter OilSeed Rape at the regional scale
	29	E. Lô-Pelzer et al
11:40-12:00	P20	The prediction of <i>Leptosphaeria maculans</i> - <i>L. biglobosa</i> pseudothecial maturation in Poland
	5	A. Dawidziuk., J.N. Aubertot, M. Jędryczka
12:00-12:20		
	Lunch	
14:00-16:00	Parallel sessions for discussions from 14h00 to 16 h00	
	In Berlin Room : Behaviour of the IOBC oilseed crop group : Multidisciplinarity, others crops : soybean, sunflower, linseed, convenors, next meeting	
	In Lisbonne Room : Topics to promote for european collaboration : answers to european calls? Life+, FP7 2010-2011	
	Others proposals are welcome	
	In Oslo Room : Posters and discussions for smaller groups	
16:00-16:20	Coffee Break	
16:20-16:40	G05	<i>Orobanche ramosa</i> on winter oilseed rape in France: risks and perspectives of control.
	24	P.Simier et al
16:40-17:00	P11	Potential effect of a changing climate on phoma stem canker and light leaf spot of oilseed rape
	48	N.Evans, B.D.L. Fitt, P. Gladders, Y. Huang, J.S. West
17:00-17:20	P12	Genetic determinism of quantitative resistance to <i>L. maculans</i> in WOSR .
	43	C. Jestin et al
17:20-17:40	P14	Avirulence genes of <i>Leptosphaeria maculans</i>: diversity of mechanisms to become virulent and perspectives
	26	MH Balesdent et al
17:40-18:00	P18	A duplex PCR to follow the frequencies of avirulence 1 and 4 alleles in field populations of <i>Leptosphaeria maculans</i>"
	23	J.Carpezat, M. Boillot, X. Pinochet, E. Pic

Wednesday		
09:00-09:20	P17	Characterization of specific resistance to <i>Leptosphaeria maculans</i> in recent winter oilseed rape (<i>Brassica napus</i> L.) commercial varieties
	25	X. Pinochet, T.Rouxel, MH.Balesdent
09:20-09:40	P15	Resistance durability of oilseed rape to Blackleg assessed in multi-year field experiments
	44	H. Brun
09:40-10:00	P19	Are leaf symptôms a way to check an increase of virulent populations on Rlm7 hybrids ?
	30	X.pinochet, MH.Balesdent , H. Brun
10:00-10:20	P21	Are varietal associations of Brassica napus a way to manage efficiently specific resistance genes to <i>Leptosphaeria maculans</i>?
	42	AM Chevre et al
10:20-10:40		Coffee Break and posters
10:40-11:00	E07	Phenologies and diel periodicities of within-crop flight by pests and parasitoids in oilseed rape.
	12	A. Ferguson
11:00-11:20	E08	Influence of insecticide application on host finding of <i>Tersilochus obscurator</i> (Hym.: Ichneumonidae)'
	28	N. Neumann, S. Schuetz, U. Eisenwiener, B. Ulber
11:20-11:40	E09	The potential of entomopathogenic fungi <i>Beauveria bassiana</i> (Bals.) Vuillemin and <i>Metarhizium anisopliae</i> (Metschinkoff) Sorokin to control <i>Helicoverpa armigera</i> (Hübner) on sunflower
	6	W. WAKIL et al
11:40-12:00	G09	News from IOBC, next meeting, general conclusions
		0
12:00-12:20	G10	Closing Adress

N° 1 ORAL

Using molecular methods to study pollen beetles: distribution and predation

Barbara Ekblom

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Abstract: We have studied genetic differentiation among populations of pollen beetles in Sweden and in Europe using Amplified Fragment Length Polymorphism (AFLP) analysis. For Swedish populations there was a high level of genetic variation within populations and a high level of gene flow among populations. European populations showed regional diversification and a low level of gene flow. Another molecular technique we are currently investigating is the use of PCR to detect pollen beetle DNA in selected predators. We hope to gain more information about the timing and frequency of predation events for a variety of predators.

N° 2 ORAL

European network for the durable exploitation of crop protection strategies (ENDURE)

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Abstract: The overall objective of this Network of Excellence (acronym ENDURE) is to reshape European research and development on pesticide use in crops and establish Europe as a leader in the development and implementation of sustainable pest management strategies. ENDURE will create a coordinated structure that takes advantage of alternative technologies, builds on advances and complementary expertise in agricultural sciences, ecology, behaviour, genetics, economics and social sciences and connects researchers to other stakeholders in extension, industry, policy-making and civil society. This multi-disciplinary and cross-sector approach is designed to foster the development and implementation of strategies rationalising and reducing pesticide inputs as well as reducing risks. The specific goals of ENDURE are to integrate research capacity and resources currently fragmented across Europe, to enhance the research-to-R&D innovation process by creating working relationships between researchers and practitioners in extension and farming, to engage with industry, policy-makers and civil society to help define the research agenda, and to pass on knowledge, know-how and resources through training, education, and dissemination.

N° 3 POSTER

Detection of winter rape fungal pathogens by PCR and their survey in Czech Republic

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Abstract: Phoma stem cancer caused by the complex of ascomycete fungi *Leptosphaeria maculans* (Desmaz.) Ces. & De Not. and *Leptosphaeria biglobosa* n. sp. is the most serious disease of oilseed rape in the Czech Republic and worldwide. Sclerotinia stem rot (*Sclerotinia sclerotiorum* (Lib.) de Bary) and Verticillium wilt (*Verticillium dahliae* Kleb. and *V. longisporum* (Stark) Karapapa, Bainbridge & Heale) are the additional damaging diseases of this cruciferous crop. All these pathogens cause specific symptoms and fruiting bodies of asexual stages on different parts of plant tissue. Pycnidia are observed in the center of lesions caused by *L. maculans* and *L. biglobosa*. Black sclerotia are formed inside rape stems damaged by *S. sclerotiorum* and abundant amount of microsclerotia is developed on stem and root affected by *Verticillium* sp. Nevertheless, symptoms especially on stem and root caused by these fungi are similar and easily interchangeable. Therefore the objective of our work was the detection of these pathogens in plant tissue and differentiation of *L. maculans* and *L. biglobosa* by polymerase chain reaction using specific primers for each pathogen. PCR reaction with primer sets described in literature has primarily been optimized using DNA isolated from pure culture of individual fungal species determined by morphological and cultivation methods and fungal DNA has been used as positive control in the following testing. Some of the described primer sets totally failed in our hands. DNA was extracted from plant stem tissue and leaf tissue in the case of primary symptoms of Phoma stem cancer by Gene Elute™ Plant Genomic DNA Miniprep Kit (Sigma) and screened by amplification with primers in pre-optimized temperature conditions. DNA isolation and polymerase reaction was performed firstly on stems with specific symptoms and then on hardly distinguishable symptoms. On the basis of PCR assay, the survey of occurrence of *L. maculans* and *L. biglobosa* in different regions of the Czech Republic was performed during 2007/2008 growing season. In most cases both *L. maculans* and *L. biglobosa* were detected in primary leaf symptoms and stems as well.

This work was supported by the Ministry of Agriculture of the Czech Republic, grant No. QH 81127 and Ministry of Education of the Czech Republic, grant No. MSM 6046070901.

N°4 ORAL

The influence of *Trichoderma* species on *Leptosphaeria maculans* and *L. biglobosa* growth on agar media and in oilseed rape plants

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Abstract

The ascomycete fungi *Leptosphaeria maculans* and *L. biglobosa* cause stem canker of crucifers – one of the most damaging diseases of rapeseed in Poland and worldwide. The pathogens are responsible for major yield losses, which can be economically significant especially in the areas of intensive rapeseed cultivation in Europe, Australia and Canada. The pathogens are observed every year, with a higher proportion of *L. maculans* in west Europe and predominance of *L. biglobosa* in the east. The disease is controlled with chemical sprays performed mostly in the autumn. In many regions of Europe one autumn spray is insufficient to fully control the disease. Recently, great efforts are undertaken to study the possibility of biological control using antagonistic and hyperparasitic fungal species. It is postulated to use their potential to combat plant pathogens and use these organisms in integrated pest management technologies to reduce the amount of pesticides introduced to environment.

The aim of this work was to examine possibilities of biological control of *Leptosphaeria maculans* and *L. biglobosa* using hyperparasites from the genus *Trichoderma*. Members of this genus are among the most potent biocontrol agents applied against plant pathogens. The fungi are known to produce extracellular cell wall degrading enzymes, including chitinases and β -1,3-glucanases. The mycolytic activity of these enzymes is considered to be a major factor of the hyperparasitic mechanism.

Trichoderma cultures used in our experiment were obtained from oilseed rape and yellow lupin plants as well as from soil. The isolates belonged to *T. harzianum*, *T. hamatum*, *T. longibrachiatum*, *T. atroviridea* and *T. koningii*. The experiment was performed in laboratory conditions using dual cultures as well as in the field. *Trichoderma* isolates caused significant decrease of growth rate, especially as concerns *L. biglobosa*. On the other hand *L. maculans* showed antibiosis activity. The species of *Trichoderma* differed in their hyperparasitic effect towards *Leptosphaeria* sp. The influence of isolates from oilseed rape was significantly greater than this from *Trichoderma* originating from lupin.

N°5 ORAL

The prediction of *Leptosphaeria maculans* - *L. biglobosa* pseudothecial maturation in Poland

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Abstract:

Fungal pathogens *L. maculans* (Desm.) Ces. et de Not. and *L. biglobosa* Shoemaker & Brun are responsible for phoma stem canker – the disease regarded as the most damaging to oilseed rape (*Brassica napus* L.) worldwide. In Europe, rapeseed plants are mostly infected in the autumn by ascospores produced in pseudothecia. These perfect stage fruiting bodies are formed on dead stems of oilseed rape plants infected in a previous growing season. It was proved that fungicide treatments against these pathogens are more effective when applied during the period of mass ascospore release, which occurs after a few rain events following a full pseudothecial maturation. The prediction of the rate of *L. maculans*-*L. biglobosa* fruiting bodies development is therefore an important piece of information for the optimisation of agrotechnical and chemical practices in cultivation of oil plant species.

The prediction of *L. maculans* - *L. biglobosa* pseudothecial maturation in Poland was based on a 10 year dataset (1998-2007), comprising biological observations of fungal development and two basic weather data: mean daily temperature and rainfall, beginning at harvest time of the previous cropping season of oilseed rape. The total number of studied site-years was 148, with one experiment site per year between 1998 and 2003 and the average of 35.5 sites per year in the later period. From 1998 to 2005 weather data were collected at the experiment field and since 2005 the average distance from a field to a weather station was 13.3 km.

The model hypothesises that the probability of pseudothecial maturation follows a Gaussian distribution, as a function of the number of cumulated days favourable for maturation. The parameterisation of the model led to the following values: minimum daily temperature = 4.9 °C; maximum daily temperature: 20.3 °C; minimum cumulated rainfall over a 14-day period = 4 mm. The efficiency of the model was greater than 0.77. This enables the model to be used in a decision support system.

N°6 ORAL

The potential of entomopathogenic fungi *Beauveria bassiana* (Bals.) Vuillemin and *Metarhizium anisopliae* (Metschinkoff) Sorokin to control *Helicoverpa armigera* (Hübner) on sunflower

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Abstract

The potential of two isolates of each entomopathogenic fungi *Beauveria bassiana* (Bals.) Vuillemin (WG02; WG03) and *Metarhizium anisopliae* (Metschinkoff) Sorokin. (WG04; WG05) were investigated under the laboratory conditions against the 2nd instar larvae and the pupae of *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) on sunflower. Both of the fungi were used alone or in all the possible combinations (WG02; WG03; WG04; WG05; WG02 + WG04; WG02 + WG05; WG03 + WG04; WG03 + WG05 and WG02 + WG03 + WG04 + WG05) at three dose rates viz. 10⁵, 10⁷ and 10⁹ conidia ml.⁻¹ of each treatment. The mortality of 2nd instar larvae of *H. armigera* was affected at all the dose rates of the fungal isolates used and also the emergence of the pupae reduced. The results of the present study clearly suggest that the blending of the four isolates have a greater bio-efficacy to control both the larvae and the pupae of *H. armigera*.

Key words: *Beauveria bassiana*, *Metarhizium anisopliae*, *Helicoverpa armigera*, sunflower, Pakistan

N° 7 ORAL

Mortality factors of the cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Coleoptera, Curculionidae) in Europe

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Abstract: The cabbage seedpod weevil, *Ceutorhynchus obstrictus*, is a serious pest of canola and oilseed rape, *Brassica napus* and *B. rapa*, in North America and Europe. In Europe, several hymenopteran parasitoids are known to attack *C. obstrictus*, but the most important are the larval ectoparasitoids *Trichomalus perfectus* and *Mesopolobus morys* (Hymenoptera: Pteromalidae). These European parasitoids show the greatest potential for incorporation into an integrated pest management system for cabbage seedpod weevil in North America. Here we present a life table study that shows the actual impact of parasitoids, predators and other mortality factors on cabbage seedpod weevil populations in Europe.

Key words: cabbage seedpod weevil, mortality, life table

N° 8 ORAL

Use of infection criteria from SkleroPro to identify infection events for sclerotinia stem rot in England, 1991-2007

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Abstract: Stem rot (*Sclerotinia sclerotiorum*) has increased in importance in England but risk assessment and decisions on fungicide use remain difficult for individual crops. Stem rot levels in winter oilseed rape in 2007 were the highest yet recorded and the most severe since 1991. This prompted an investigation of the factors affecting the development of the 2007 epidemic. Petal tests indicated that sclerotinia inoculum was present despite very low rainfall in the spring. Weather data were collated from a range of meteorological stations to represent the main areas of production. The number of periods during flowering that met the infection criteria used in SkleroPro (minimum of 23 h with relative humidity >80% and temperature >7°C) were identified. Comparisons were made between 2007 and 2006 (a 'non-epidemic' year) for met stations in England. Further comparisons were made between ADAS Rosemaund, Hereford (west) and ADAS Boxworth, Cambridge (east) for the years 1991-2007. Infection events were identified in all years during flowering of winter oilseed rape. The SkleroPro infection criteria were useful for identification of infection events and interpretation of fungicide experiments where sclerotinia inoculum was present. At ADAS Boxworth where little sclerotinia developed in most years, inoculum was considered to be limiting. The development of more effective guidance for stem rot management will require quantification of inoculum and prediction of infection events.

N° 9 POSTER

Nitrogen fertilization of winter oilseed rape: impact on insect pests, their parasitoids and plant diseases

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Abstract: Nitrogen fertilization is essential for higher oilseed rape yields. However, very little is known about the impact of fertilisation on insect pests and diseases. Therefore we studied the impact of additional nitrogen on winter oilseed rape pods number, disease abundance, oviposition activity of insect pests *Meligethes aeneus* and *Ceutorhynchus assimilis* and their parasitoids. Insect sampling, pods counting and disease assessments were carried out at seven different N-fertilizer levels (0, 60, 80, 100, 120, 140 and 160 kg/ha). Fertilization increased significantly the number of pods and decreased the disease scores of most severe plant disease *Alternaria brassicae*. There were no clear correlation between fertilization and insect damages. The least preferred plants for *M. aeneus* were in plots with 140 kg/ha and with no additional nitrogen fertilization. There were no significant difference between plots in the number of damaged pods caused by *C. assimilis*. Parasitisation rate of *M. aeneus* was low and of *C. assimilis* 100%. This study showed that intermediate nitrogen fertilization did not attract the insect pests but was propitious to parasitoids and might even reduce plant disease problems, such as dark pod spot.

N° 10 POSTER

Detection and quantification of airborne ascospores of *Sclerotinia sclerotiorum* by quantitative-PCR

Sarah L. Rogers, Simon D. Atkins, Jon S. West

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Abstract: A new SYBR-green quantitative PCR (qPCR) method was developed to quantify airborne inoculum of *Sclerotinia sclerotiorum*. This was tested on DNA extracted from spores deposited onto wax-coated plastic tapes, such as those used in Burkard (Hirst-type) spore traps and rotating-arm traps. A linear relationship between ascospore numbers and *S. sclerotiorum* DNA indicated a mean of 0.35 pg DNA per spore. The method could detect DNA representing as few as 2 ascospores. The technique was insensitive to DNA of the host plant, *Brassica napus*, and other plant pathogens, including *S. minor*, *S. trifoliorum* and *Botrytis cinerea*, and common airborne fungal genera such as *Cladosporium* and *Penicillium*. Specific quantification of *S. sclerotiorum* was achieved in the qPCR method by including a heating step to 79°C to melt off any exogenous products such as primer dimers that would otherwise falsely contribute to the calculation of target DNA present. This step also eliminated products produced from any DNA of *B. cinerea*, if present in the sample. The feasibility of using the method in disease forecasting schemes was tested using archived DNA from air samplers that operated at Rothamsted in April-May in three different seasons, which happened to have contrasting sclerotinia stem rot (SSR) epidemics; 2007 had a severe SSR epidemic in England and high numbers of airborne ascospores were trapped at Rothamsted; while both 2003 and 2004 had a very low incidence of SSR in England and low numbers of airborne ascospores trapped at Rothamsted. The severe SSR season of 2007 occurred throughout a large part of northern-Europe and was not predicted in the UK by climate-based disease-forecasts. This study showed that there was no relationship between rainfall and numbers of airborne ascospores of *S. sclerotiorum* present at Rothamsted during the period of infection in the severe SSR season (2007). In addition to the example application tested in this study, the qPCR method reported here has potential to evaluate the presence and quantity of *S. sclerotiorum* in a wider range of environmental samples such as soil, seed or plant tissues such as petals or stems. In the case of airborne inoculum, further research is required to develop methods to rapidly apply the *S. sclerotiorum*-specific qPCR to air samples and to confirm that airborne inoculum is a reliable indicator of SSR risk by testing over a wider geographical range and number of seasons.

Key words: qPCR, air sampling, airborne spores, sclerotinia stem rot

N°11 ORAL

Detecting airborne inoculum to forecast oilseed rape diseases

Jon West, Bart Fraaije, Juliet Motteram, Sarah Rogers, Maureen Lacey & John Lucas
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Abstract: Many fungal diseases of oilseed rape are caused by air-dispersed spores. The timing of spore release changes each season due to the weather because the maturation and release of spores is usually affected by moisture (rain, dew and relative humidity) and temperature. Most airborne spores are dispersed only short distances from a source but many others still travel long distances although spore concentrations and viability in air reduces over time. Spore deposition results in individual disease foci when occurrence of viable inoculum and infection conditions are rare; as a gradient in a crop when a large number of spores are produced from a nearby source; or as a uniform infection when there is a large but distant source or multiple local sources of inoculum. Epidemics of common monocyclic diseases of widespread crops, such as phoma stem canker and sclerotinia stem rot of oilseed rape are usually initiated by airborne spores produced either a long distance from the crop or from multiple sites throughout a region. Therefore it should be possible to predict such epidemics regionally using suitably located spore samplers in order to enhance integrated disease control methods. Appropriate DNA-based diagnostic methods can be integrated with many different types of air samplers and are now providing new information about species that previously could not be identified accurately by visual microscopy methods. For example a new diagnostic for *Sclerotinia sclerotiorum* (Rogers *et al.* 2008) has shown potential for warning of the presence of airborne inoculum. It showed elevated levels of pathogen DNA in air at Rothamsted in April-May 2007 compared to previous years and this coincided subsequently with the highest incidence of sclerotinia stem rot for over ten years (which was unexpected because April 2007 had been unusually dry). Furthermore, where reliable climate-based disease forecasts have been developed (e.g for *Leptosphaeria maculans*), air sampling integrated with DNA-based diagnostics can also provide useful information at the sub-species level, to monitor populations for traits such as the development of fungicide resistance (in a similar way to that found with strobilurin resistance in *Mycosphaerella graminicola*, Fraaije *et al.*, 2005) or changes to the pathotype race-structure in response to deployment of resistant cultivars. Further work is required: to investigate the spatial variability in spore numbers in air at different sites; how changes in numbers of airborne spores at particular heights above or distances away from crops are related to subsequent disease severity; and to develop methods to analyse samples and disseminate results rapidly.

Key words: qPCR, air sampling, airborne spores

N° 12 ORAL

Phenologies and diel periodicities of within-crop flight by pests and parasitoids in oilseed rape.

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Abstract:

Parasitoids have been shown to have great potential to suppress pest populations in oilseed rape in Europe yet they are vulnerable to effects of insecticides, the conventional means of pest control. Temporal targeting of insecticide against the cabbage seed weevil (*Ceutorhynchus assimilis*) has been shown to reduce harm to its parasitoids and to benefit conservation biological control. The objective of this study was to establish whether the same principle could be used to protect parasitoids of other pests when insecticides are applied during bud or flowering stages for control of pollen beetle (*Meligethes aeneus*) or cabbage seed weevil. Yellow water traps were used to establish the phenology of these pests and of three species of tersilochine parasitoids in oilseed rape. The diel within-crop flight periodicity of pollen beetles and two tersilochine species were established using Malaise traps with automated time-sorting heads and were analysed in relation to meteorological data. *Phradis interstitialis* and *Tersilochus heteroceris* (larval parasitoids of pollen beetle) and *Tersilochus obscurator* (a larval parasitoid of cabbage stem weevil, *Ceutorhynchus pallidactylus*) were all active in the crop during flowering. Whereas they would be protected from insecticides used at bud stage, the recommended timing for pollen beetle control, all three species were active in the crop at mid flowering and potentially vulnerable to insecticides applied for seed weevil control. Peak flight activity of pollen beetles, *T. obscurator* and *P. interstitialis* was around midday and the former two species showed marked diel periodicity. Flight activity was positively correlated with solar energy and average air temperature and weakly negatively correlated with wind speed. Few insects were caught before 10:00 h which was probably related to flight temperature thresholds. The difficulty of defining days when insecticide applications do not risk significant injury to parasitoids is discussed. It is suggested that parasitoids present in the crop might be less at risk from selective insecticides if applied when the insects are not flying and that this is worthy of further investigation.

Key words: pests, parasitoids, phenology, diel periodicity, flight, oilseed rape, insecticide, conservation biocontrol, temporal targeting.

N°13 POSTER

Effect of nitrogen fertilization, cultivar and species on attractiveness and nuisibility of two major pests of winter oilseed rape (*Brassica napus* L.): pollen beetle (*Meligethes aeneus* F.) and stem weevil (*Ceutorhynchus napi* Gyl.).

Rusch Adrien, Valantin Morison Muriel

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Abstract

Insect pest management, that includes several chemical treatments, is one of the most important issues of winter oilseed rape crops (WOSR). Pollen beetle and stem weevil are among the most damaging insect pest of WOSR throughout severe bud and stem injuries. Moreover recent monitoring programs have shown the important development of metabolic resistance to pyrethroids resulting in inefficient insecticide's treatments. Better comprehension of the relationships between crop management and pest's nuisibility has been investigated in order to adapt new control strategies. To analyze the effects of crop management, we measured population's dynamics and nuisibility of both pollen beetles and stem weevils on a split plot testing three fertilization levels and two cultivars as main factors. Species effects were investigated through a farmer's field experiment with turnip rape borders. Growth stage, plant biomass/m² and glucosinolates content of edible parts have been measured at different moments. High isothiocyanates concentrations cultivar was more attractive than the low isothiocyanates cultivar. Crop attractiveness is function of N fertilization throughout crop variables. Indeed, stem weevil select his host on stem elongation and is sensible to crop height, whereas pollen beetle is sensible to an important dry weight. Furthermore a major role of growth stage development on host selection was found: the more advanced stage was the more colonized. Those results have never been observed at field level. Our results confirmed a high attractiveness of the turnip rape due to delayed growth stage. No effect of N fertilization and cultivar was reported on the number of damaged buds. However, important effect of fertilization on stem weevil nuisibility was also recorded. Nitrogen fertilization interacts with yield losses due to pollen beetle by compensation mechanisms principally occurring on seed weight. Compensation capacities are determined by time and rates of nitrogen applications and by pest population's dynamics. These results bring new challenges for crop management, particularly for organic crops, through trap crop strategies and adapted nitrogen applies

N°14 ORAL

Utilization of a model to re-design integrated crop management for WOSR

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Abstract

Concerns about the adverse impacts of pesticides on the environment and their inevitable negative side-effects on non-target organisms have been growing since the 1960's. As a consequence, regulatory bodies take into account the environmental effects of pesticides applications, leading to increased restrictions in their use or to their banning (van der Werf, 1996). For winter oilseed rape (*Brassica napus* L.) in France, herbicides and fongicides and insecticides constitute the largest component of variable operating costs : it can achieve 20% of the gross margin. On the other hand, in order to avoid disease occurrence, weeds infestation and pests attack, diverse elementary control methods (genetic, cultural, mechanical, chemical control) could be applied in an integrated pest management strategies (Dhaliwal et al., 2004, El Titi et al., 1993). Since each technical operation is likely to modify the sanitary status of a crop, it is therefore possible to design cropping systems to minimize crop loss induced by pest population with a limited use of chemical control. Because of the complexity of the considered systems due to interactions between cultural practices, crop status, soil, climate and pest populations, modelling is a key tool to propose innovative cropping systems less vulnerable to pests. Several experiments (1994-2004) have been used to analyze and simulate (i) the effects of agricultural practices on the pests and their interaction with the crop and (ii) the yield losses induced by pests. A bio-economic model, named OMEGAsys, has been developed in order to represent the effects of crop management either on crop yield, weeds biomass and stem cancer attacks. The first aim of this model is to help in building environmental friendly crop management. The inputs of the model are climatic variables and the combination of each element of crop management, while the outputs are potential, attainable yield, number of pesticides treatments and gross margin. An algorithm of gross margin optimization is combined to the agronomic model in order to rank the diverse combinations of crop practices. This paper makes a short description of the OMEGA sys, gave some results of assessments and illustrates the new integrated crop managements than can be obtained with such methodology in two agronomical contexts and with two weed/disease pressures. Depending of the economic scenario, the first crop managements selected by the Omega-sys are characterized by no or few pesticides utilization. The best crop managements selected are different between the different agronomic context (soil, preceding crop and weed pressure).

N°15 POSTER

The effect of fertilizers on the pests in oilseed rape

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Abstract :

The consumption of petroleum products in Croatia and in the world at large is on the rise. It is expected that the consumption of motor fuels will rise because of the rapid development of transportation, while the consumption of fuel for heating will decrease. On the other hand, the production of crude oil will fall from 1.37 million tons in 2000 to 0.6 million tons in 2010, while in 2030 a production of no more than 0.4 million tons of crude oil is forecast. An alternative to mineral fuels is the production of biodiesel from various plant oils, as well as from beef suet and used cooking oils (from households and restaurants). The most important raw materials for the production of biodiesel are oil seed rape (82.82% of the total) and sunflower (12.50%). The production of biodiesel in the world is constantly rising, and the areas of land devoted to oilseed rape and other crops for the production of biodiesel are expanding, which necessarily involves problems of protecting these crops from disease, pests and weeds, as well as of the development of pest-resistance to pesticides (Maceljčki and Jelovčan, 2007; Jelovčan and Gotlin Čuljak, 2007; Jelovčan et al., 2007)). In order to achieve high yields, fertiliser application is of great importance, and yet if it is excessive, it can have a bad effect with respect to the incidence of pests. Hence during this research the objective was to determine the effect of various quantities of fertiliser on the appearance of the weevils *Ceutorrhynchus napi* and *Ceutorrhynchus pallidactylus* (Coleoptera: Curculionidae) on oilseed rape. The experiment was set up with the Triangle variety of oilseed rape on the Vinokovščak site (Varaždin, Croatia) during 2008. The investigation was conducted on a 1 hectare plot, divided into three fields. Fertiliser (KAN) was applied to the fields in three different quantities: 150, 200 and 250 kg/ha. During the vegetation period, two visual inspections of the oilseed rape plants were made: on April 20 (BBCH 62-64) and May 37 (BBCH 77-79). Ten plants in four repetitions were taken from each experimental field. The plants were dissected and the number of perforations, lengths of corridors and number of *Ceutorrhynchus napi* and *Ceutorrhynchus pallidactylus* larvae were recorded. Statistical analysis of the results showed that there are significant correlations between pest attack and the differing quantities of fertiliser, i.e., that their abundance is greater the higher the amount of fertiliser applied. The data obtained show the need to analyse the total amount of nitrogen in the soil and a fertiliser that corresponds to the real condition of nitrogen in the soil, as well as of the needs of the plant that we are sowing (oilseed rape in this case) for nitrogen.

N°16 POSTER

The effect of seed treatment on growth and development of oilseed rape

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The development and growth of oilseed rape depend on the choice of variety or hybrid, on fertiliser, climatic condition, type of soil and pests. In Croatia oilseed rape seed treated with the preparation Chinook FS 200 is generally sown, which enables the protection of this crop from autumn pests in the early development stages (BBCH 0-14). The aim of the investigation was to determine the effect of thiametoxam (Cruiser OSR FS) and imadiclopid (Chinook FS 200) on the pests, development, and growth of oilseed rape. The research was carried out during the vegetation period of 2007/2008 at two sites: Koprivnički Bregi and Popovača. At Koprivnički Bregi two visual inspections of the plants were made (November 13, 2007 and March 1, 2008) on the variety Mohican. Ten plants in six replicates were inspected. At Popovača only one visual inspection was made, on March 4, 2008, with the variety Oase. Ten plants in three replicates were examined. The impact of the mentioned active ingredients on the pests was low (pests infestations were very low). The impact on the growth and development of the oilseed rape plants was determined by measuring the length of the root, the weight of the plant, the number of leaves and the number of plants per square metre. Through a statistical analysis of the data obtained it was found that the number of leaves on the plants whose seed had been treated with thiametoxam was significantly greater than that on the plants treated with imidaclopid. The one-year results show that the research should be continued and expanded to determine the impact of thiametoxam on the growth and development of different oilseed rape hybrids.

N°17 POSTER

Accessing slug risk and slug control in oilseed rape

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Abstract :

Slugs are among the most important pests of oilseed rape. In order to predict slug damage and need for applying slug pellets in oilseed rape, trapping of slugs was conducted in stubble, prior plant emergence (using upturned flowerpot saucers, terracotta colored, 25 cm diameter, with 20 ml of chicken layers' mash placed in a small heap on the soil). The number of slugs counted in traps varied from 1 to 4, what was sufficient to justify the application of slug pellets. Field experiment was conducted from 20th September to 9th October 2007, from plant emergence to four-true-leaf stage. In field experiment three compounds: metaldehyde, methiocarb and Fe (III) pyrophosphate were tested for ability to reduce damage caused in oilseed rape by *Arion* sp. Férussac 1819 (Gastropoda: Pulmonata: Arionidae). All three treatments of molluscicide protected rape from severe crop loss, with significant differences among methiocarb and other treatments in the last week of the field trial evaluation, what could be explained by wet weather. Also harmful effect of methiocarb to carabid beetle populations and earthworm was evidenced.

N°18 POSTER

Do insecticide resistant pollen beetles suffer a higher mortality during hibernation?

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Abstract: Pollen beetles (PB) are common pests of oilseed rape. There are now very few products registered for controlling ORPB and for many years only pyrethroids have been permitted. As a consequence farmers applied pyrethroids more often, which selected for resistance in PB. Although the biology of PB has been widely studied in oilseed rape fields, where it hibernates and especially mortality during hibernation have not been studied in detail. Therefore it is unknown if after hibernation PB colonizes oilseed rape fields in spring with the same level of resistance as they had the previous year.

In winter 2007/2008 BTL collected soil samples at different times from different locations in Bavaria, Brandenburg and Mecklenburg-Western Pomerania. The beetles in these samples were extracted alive in the laboratory and the susceptibility to different insecticides, including pyrethroids, of those that emerged from hibernation and colonized oilseed rape fields the following spring, were analyzed.

The results of this study will be presented.

N°20 POSTER

Pathogenic microbiota of rape in Belarus

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Abstract:

In the article, the specific composition of winter and spring rape fungal diseases agents in Belarus are presented. 16 species of disease agents: *Alternaria brassicae* Sacc, *A. brassicicola* Wilts, *A. alternata* (Fr.) Keissler ; *Sclerotinia sclerotiorum* (Lib.) de Bary.; *Sclerotinia trifoliorum* Eriksson.; *Fusarium oxysporum* f. *brassicae* (Schlecht.) Snyd. et Hans.; *Fusarium avenaceum* (Fr.) Sacc.; *Fusarium nivale* (Fr.); *Typhula incarnata* Jasch. ex Fr.; *Erysiphe cruciferarum* Oxiz. et Junell ; *Phoma lingam* (Tode) Desm.; *Cylindrosporium concentricum* Grev.; *Botrytis cinerea* (Fr.); *Olpidium brassicae* (Wor.) Dang; *Pythium* spp. are revealed and identified.

The symptomatics and forms of disease manifestation is described. Their spread and harmfulness is determined. The economically important rape diseases in Belarus are *Alternaria* blight, *Sclerotinia* blight , *Fusarium* wilt and gray mould.

Key words: rape, fungal diseases, symptomatics.

N° 21 ORAL

Impact of cabbage root fly, *Delia radicum*, on infections of oilseed rape by *Verticillium longisporum* and *Phoma lingam*

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Abstract :

Oilseed rape is an economically important crop in German Agriculture. As a result of intensive cultivation, an increasing incidence of some brassica-related fungal diseases and pests has been observed recently. *Verticillium longisporum* and *Phoma lingam* are causal agents of Verticillium wilt and Phoma stem canker respectively. *Verticillium longisporum* is a soilborne vascular pathogen, which infects the plant roots by direct penetration or through open wounds. The pathogen enters the vascular system and then moves upwards in the xylem vessels. Resulting from infection, premature ripening of the seed may occur. *Phoma lingam* (*Leptosphaeria maculans*)- infections are initiated in autumn, when leaves become infected by airborne ascospores. The fungus grows from the lesions down the petiole to the stem base, where it causes canker and subsequent yield loss. The cabbage root fly, which appears in three generations in spring, summer and fall, is thought to be a relatively new pest of oilseed rape. Female flies generally lay their eggs in the soil alongside selected host plants. Emerging larvae feed on main and lateral roots, which can lead to severe physical damage. Apart from directly harming the plant, root feeding may provide openings for fungal infection. Furthermore plant defence towards fungal pathogens possibly will be impaired, thus accelerating infection and disease progress. Between 2005 and 2008, several field and greenhouse experiments were performed to determine the impact of root damages, caused by the cabbage root fly, on infections and symptom development of oilseed rape by *Verticillium longisporum* and *Phoma lingam*. In the field, meshes were used to prevent certain plots from root fly attack in autumn and/ or spring. In greenhouse trials, root fly infestation was adjusted by laying eggs on to the root collar. The results obtained showed that root damages in autumn facilitate infections with *Verticillium longisporum*. The effect was most pronounced in moderately susceptible cultivars (towards Verticillium) and when soil inoculum was low. In contrast, cabbage root fly damage had only little effect on Verticillium wilt in highly susceptible cultivars. Field and greenhouse experiments studying the impact of cabbage root fly on Phoma stem canker revealed, that larval feeding on the hypocotyl region was favouring lesions on the stem base.

N° 22 POSTER

Effect of sowing date on health status of open pollinated, composite hybrid and restored hybrid cultivars of winter oilseed rape (*Brassica napus* L.)

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Abstract:

Oilseed rape is one of the most economically important plants cultivated in Poland. It can be attacked by numerous pathogens. Fungi from *Leptosphaeria* genera: *L. maculans* and *L. biglobosa*, the casual agents of black leg are the most dangerous pathogens of oilseed rape in climatic conditions of Poland. They can strongly decrease the yield of seeds. Other important oilseed rape disease is black spot caused by *Alternaria* spp. Fungi from this genera can decrease yield quality very often due to mycotoxins they can produce.

The aim of the study was to evaluate an effect of sowing date on health status of open pollinated, composite hybrid and restored hybrid cultivars of winter oilseed rape. The experiment was conducted in 2003-2005 under field conditions in Experimental Station in Balcyny owned by Department of Crop Production of University of Warmia and Mazury in Olsztyn. Contact, Kaszub and Kronos oilseed rape cultivars were used. The second factor was sowing dates as follows: beginning of the first decade of August, 7 and 21 days after first term of sowing.

Significantly less black leg symptoms were observed on plants sowed in second and third term. The higher level of disease symptoms occurred on 'Contact' and significantly less infected was 'Kronos'. The less susceptible to infection with *Phoma* spp. was 'Kaszub'. There was not any effect of studied factors on black spot occurrence on plants.

N°23 ORAL

A duplex PCR to follow the frequencies of avirulence 1 and 4 alleles in field populations of *Leptosphaeria maculans*

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Abstract : Phoma stem canker (blackleg), caused by *Leptosphaeria maculans*, is one of the most damaging diseases of oilseed rape worldwide. *L. maculans* exhibits gene-for-gene interactions with its host plant, where fungal avirulence (*AvrLm*) genes are the counterparts of plant resistance (*Rlm*) genes. The pathogen is able to rapidly adapt to the selection pressure exerted by a novel resistance gene. In France for instance, the large-scale cropping of *Rlm1* cultivars was followed by the loss of efficiency of this resistance gene within a few years, as the virulent allele at the *AvrLm1* locus became prevalent in the fungal population. Methods to follow the avirulence alleles frequencies in the pathogen populations are therefore needed to allow a more durable use of available resistance genes. The duplex PCR method described here makes it possible to jointly identify the alleles at the *AvrLm1* and *AvrLm4* loci in *L. maculans* isolates which are avirulent at the *AvrLm7* locus (*i.e.* nearly all the isolates, since the avirulence at this locus is highly prevalent at the moment). Based on two simplex PCR methods of INRA BIOGER (Versailles, France), the method was further simplified since no DNA extraction is needed. It is therefore much less time-consuming than cotyledonary tests. The method was validated on 200 isolates that had previously been characterised by cotyledonary tests : 100 isolates were avirulent at the *AvrLm1* and *AvrLm7* loci and virulent at the *AvrLm4* locus, and 100 were avirulent at the *AvrLm4* and *AvrLm7* loci and virulent at the *AvrLm1* locus. The results of the PCR test were in accordance with the expected ones in 99,5 and 99 % of the cases for the *AvrLm1* and *AvrLm4* loci, respectively. The next step of the work will be to improve the method so that isolates that are virulent at the *AvrLm7* locus can also be analysed.

Key words : avirulence gene, blackleg disease, durability, *Leptosphaeria maculans*, resistance

N°24 ORAL

***Orobanche ramosa* on winter oilseed rape in France: risks and perspectives of control**

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Abstract :

Orobanche ramosa (Broomrape) is an obligate parasitic plant affecting several crops such as oilseed rape, tobacco, hemp or melon. This parasite causes yield losses by competing against its host for nutrients and water. Its presence has been reported for a long time in France, but it became really damaging in oilseed rape crops since about 1990, especially in the region Poitou-Charentes. The areas concerned by *O. ramosa* are in expansion, and actually effective methods are available neither to reduce the field infestations and the damages caused by *O. ramosa*, nor to limit the extension of the parasite. Several factors make the control of *O. ramosa* hard, notably the high number and the viability of seeds produced by broomrape and the potential of broomrape seed germination in a large range of environment. Since a few years, different ways are explored to control broomrapes, either to reduce broomrape seed bank in infested fields, or to limit the impact of the parasite on crop yield.

The best way to reduce seed bank in soil is the induction of suicide germination, combined with the limitation of seed production by plants. The germination of *O. ramosa* seeds occurs only in response to stimulants present in exsudates from host roots. A set of species was screened in order to identify species that induce the germination of *Orobanche* and that enable (trap-species) or not (false-hosts) the parasite to reach ripeness. The introduction (i) during the intercropping period of trap-species, that have to be destroyed to stop the development of the parasitic plant, or (ii) of false hosts in the rotation, is promising to reduce soil seed bank. Simultaneously, weeds are also tested for their susceptibility to *Orobanche* in order to advice farmers in weeding for limiting the number of potential hosts in field.

Different cultural practices were also tested to limit the infestation of oilseed rape by *Orobanche*, but the most promising way is the use of plant genetic resistance. The genetic variability of oilseed rape cultivars is investigated in order to find resistance mechanisms. Actually, only partial resistances have been detected, but as they seem to correspond to different mechanisms, we expect that it will be possible to cumulate them to create more resistant cultivars.

N°25 ORAL

Characterization of specific resistance to *Leptosphaeria maculans* in recent winter oilseed rape (*Brassica napus* L.) commercial varieties

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Blackleg is currently, with *Sclerotinia*, the main disease of oilseed rape worldwide (Howlett 2004, Fitt et al 2006). Its impact on the production level has led to an increase of research efforts in Canada, Australia, and Europe in the fields of agronomy, plant pathology and plant breeding. Among the ways to control the disease at the production level, the use of tolerant or resistant varieties is the most developed (Pinochet et al 2003). Breeders have introduced quantitative as well as specific resistance. Compared to a long and difficult process needed to breed quantitative resistance genetic factors, the introduction of known specific resistance genes looks easier and quicker for breeders, and efficient for users. Nevertheless, in the recent years breakdown of resistance have occurred in several places. In France, the widely used *Rlm1* gene was overcome in the late 90's as demonstrated by Rouxel et al 2003. A similar situation occurred in Australia with the *Sylvestris* specific resistance introduced in Surpass 400, a popular variety (Sprague et al 2006). Characterization of new specific resistances has been very active in recent years in *Brassica napus* and in its parental species (Delourme et al 2006, Rimmer 2006, Rimmer et al 2007, Leflon et al 2007). Nevertheless, controlled introductions with backcrosses and marker-assisted breeding are not so easy, mainly due to clustering of major resistance genes on the genome (Delourme et al 2004). For extension bodies it has become a main objective to be able to identify such resistance in commercial varieties, in addition of traditional evaluation of the disease susceptibility under field conditions. This information is needed to develop and promote durable management strategies of such resistances. In Europe several extension bodies like CETIOM in France (Pinochet et al 2003, 2004, Gladders et al 2006) have started advising farmers for durable management of resistance. In France, in connexion with INRA, commercial varieties characterization is going on since 2002. After 6 years, and more than 150 new varieties characterized, this paper aims describing what have been the results and how resistance genes are associated in commercial varieties.

N° 26 ORAL

Avirulence genes of *Leptosphaeria maculans*: diversity of mechanisms to become virulent and perspectives

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Leptosphaeria maculans, a dothideomycete fungus causing stem canker on oilseed rape, develops gene-for-gene interactions with its host plants, oilseed rape (*Brassica napus*) and related species (*B. rapa*; *B. juncea*...). Such interactions imply direct or indirect recognition of avirulence gene products ('AvrLm', for Avirulence gene of *L. maculans*) by resistance genes ('Rlm' for Resistance to *L. maculans*). Recently, we have cloned three *AvrLm* genes, *AvrLm1*, *AvrLm6* and *AvrLm4-7*, which was a starting point to analyse the molecular events responsible for the loss of avirulence function when the fungal populations are faced with the deployment of novel *Rlm* genes. All three *AvrLm* genes were found to be located in a peculiar genomic context, i.e. solo genes within large non-coding, heterochromatin-like regions rich in truncated and inactivated repeats. Such a genomic environment probably conditions evolution mechanisms towards virulence, as the two main events identified were either large deletions of a chromosomal segment spanning the avirulence gene, or inactivation of the gene by RIP ('Repeat Induced Point') mutations. RIP is a mechanism of gene inactivation usually directed toward duplicated sequences in fungal genomes, and it is suggested that the location of the Avr genes in repeat-rich region may led to frequent RIP inactivation of Avr genes in *L. maculans*. However, other mechanisms of inactivation may also be found, including insertion of repeated sequences in the gene, small-scale deletions or even single-base mutations. The diversity of these mechanisms, along with the sexual mating occurring each year in the life cycle of the fungus, may explain how rapidly *L. maculans* populations adapt to selection pressure exerted by cultivars harbouring novel resistance genes.

N° 27 ORAL

Effect of tillage system and larval parasitism on pollen beetle (*Meligethes* spp.) populations

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Population densities of pollen beetle can fluctuate widely from year to year. Weather conditions, area grown with oilseed rape, duration of bud and flower stage, overwintering mortality, and natural control, have been identified to contribute to these changes. Crop management practices, like insecticide application and tillage regime, may as well influence pollen beetle abundance. Soil management practices can affect the population dynamics of pest insects particularly during their development from larvae to teneral within the soil.

During three years (1997-1999), samples of adults and larvae of pollen beetle were collected from a long-term field experiment subjected to three different tillage systems ((i) ploughing to 25 cm depth, furrow roller, rotary harrow – conventional tillage; (ii) rototiller - conservation tillage; (iii) direct drilling - no till) throughout the rotation (winter wheat, winter barley, winter oilseed rape). The abundance of overwintered beetle generations was determined by repeated counts on plants. Mature larvae dropping from the plant to pupate in soil were captured in water trays positioned below the crop canopy. Emergence of new generation beetles was assessed by using ground-photoelectors. Larval parasitism was determined by dissection of larvae.

In all years, the abundance of old generation beetles showed only little difference between conventional tillage, conservation tillage and no till. The number of mature larvae per m² was significantly reduced in conventional tillage only in 1997. In contrast, consistently more new generation beetles emerged from conventional tillage plots as compared to conservation tillage and no till plots. Related to the abundance of mature larvae dropping to the ground, the mean rate of beetles emerging from conventional tillage, conservation tillage and no till was 9.2 %, 7.5 % and 4.3 %, respectively.

The mean level of larval parasitism by *Phradis interstitialis* and *Tersilochus obscurator* (Hym.; Ichneumonidae) increased from 47.5 % in 1997 to 76.0 % and 77.6 % in 1998 and 1999, respectively. This provides evidence that parasitism was a major factor for pollen beetle mortality in soil. However, percent parasitism was not affected significantly by the tillage system applied before sowing oilseed rape. Consequently, the different emergence rates of new generation beetles found in different tillage systems may have been caused mainly by distinctive physical properties of the soil, regulatory effects of predators, or other factors.

Our results suggest that soil management practices like conservation tillage and no till can be adequately used to decrease pollen beetle populations and to benefit natural populations of parasitoids, thus contributing to Integrated Pest Management in oilseed rape.

N°28 ORAL

Influence of insecticide application on host finding of *Tersilochus obscurator* (Hym.; Ichneumonidae)

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Host location of hymenopterous parasitoids is mainly based on olfactory cues. The volatile compounds are emitted by infested host plants or host larvae and might be particularly important for detecting plant-mining host larvae hidden within stems or petioles. In this study, we used behavioural and electrophysiological methods to determine sublethal effects of insecticides on host finding of *Tersilochus obscurator* (Hym.; Ichneumonidae), a specialist parasitoid of the larvae of cabbage stem weevil, *Ceutorhynchus pallidactylus* (Mrsh.), that feed within petioles and stems of oilseed rape.

In dual-choice cage experiments, oilseed rape leaves infested by cabbage stem weevil larvae were more attractive to *T. obscurator* females than uninfested leaves. In Y-olfactometer experiments, *T. obscurator* females showed a significant preference for volatiles emitted by infested leaves as compared to volatiles from uninfested leaves. The volatile compounds were sampled using an entrainment technique for headspace analysis. In coupled EAG – GC/MS analyses of the volatile blends released from uninfested and infested leaves of oilseed rape, *T. obscurator* females responded particularly to terpene and aldehyde compounds (e.g. Decanal, Nonanal, Octanal) that were emitted frequently by leaves infested by larvae.

To study the effect of insecticide spray deposits on the host finding success of *T. obscurator*, insecticide-treated (thiacloprid ‘BISCAYA’ and lambda cyhalothrine ‘KARATE ZEON’) and untreated leaves, both infested by larvae of cabbage stem weevil, were offered to *T. obscurator* females for parasitisation in dual-choice experiments. Females spend less time foraging on insecticide-treated leaves compared to untreated leaves or even avoided treated leaves. Further, on insecticide-treated leaves they performed less ovipositor probings than on untreated leaves. Coupled EAG-GC/MS analyses provided evidence that *T. obscurator* females can discriminate between odours released from treated and untreated leaves.

Further studies will focus on identifying whether insecticide spray deposits inhibit host finding of *T. obscurator* females by changes in plant volatiles or by masking of specific plant volatiles needed for host location. A direct repellent action of insecticide residuals might also affect the level of parasitism by *T. obscurator*.

N°29 ORAL

SIPPOM-WOSR, Simulator for Integrated Pathogen POpulation Management: a tool to help design and evaluate sustainable strategies to control phoma stem canker on Winter OilSeed Rape at the regional scale

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Key words: *Leptosphaeria maculans*; *Brassica napus*; Cultural control; Integrated Crop Management; Resistance Durability.

Phoma stem canker, also known as blackleg, is a world-wide major disease of oilseed rape. Among the different means to control the disease - chemical treatments, agronomic practices and plant genetic resistances – the use of resistant cultivars is the most efficient. Winter oilseed rape cultivars have two types of resistance to phoma stem canker, either specific or quantitative. New specific resistances are really efficient but may lack durability.

Combining genetic, cultural and chemical control methods at the multiple-years and regional scales could help contain phoma stem canker and preserve the efficiency of specific resistances, while ensuring economic profit for farmers and satisfying the environmental and toxicological exigencies of Integrated Crop Management. Given the considered scales and the number of technical operations that have to be taken into account, it is highly difficult to test disease management strategies using traditional field experiments.

A model has been developed to evaluate the agronomic, economic and environmental performances of spatially distributed cropping systems: SIPPOM-WOSR, a Simulator for Integrated Pathogen Population Management, for Winter OilSeed Rape. SIPPOM consists of 5 sub-models simulating i) primary inoculum production, ii) ascospore dispersal, iii) crop growth and attainable yield, iv) dynamics of pathogen population genetic structure, and v) infection and relative yield loss. The output variables are disease severity indices and the associated yield losses, actual yields, gross margins, energetic costs of cultural practices and Treatment Frequency Indices. It also calculates the genetic structure of pathogen populations under the effect of four evolutionary forces: migration, selection, recombination, and the Allee effect. A sensitivity analysis has been carried out to study the sensitivity of the sub-models to parameter variations. It showed that SIPPOM can be confidently used to rank contrasted integrated control strategies. The evaluation of each submodels revealed correct predictive quality. A comparison between simulated and observed data during the breakdown period - 1994 to 2000 - of the Rlm1 specific resistance gene in the Centre of France was satisfying. Nevertheless, the results underlined the interest of introducing virulence costs in SIPPOM. Further simulations are currently being carried out to assess the behaviour of SIPPOM for realistic field spatial distributions and to test different strategies minimising the severity of phoma stem canker and the risk of specific resistance breakdown.

N° 30 ORAL

Are leaf symptoms a way to check an increase of virulent populations on Rlm7 hybrids?

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Abstract: Recently new genotypes of oilseed rape were introduced commercially in France. Their excellent resistance to blackleg (*Leptosphaeria maculans*) is mainly due to a new major resistance gene, *Rlm7*. Such varieties are potentially exposed to a resistance breakdown risk. The main objective of extension bodies is to promote a durable management and try to anticipate on a possible breakdown. This objective necessitates being able to detect as soon as possible the first step of the pathogen population switch toward the virulent side. Two ideas could be developed for such an aim. Firstly, the comparison between leaf symptom density on cultivars having or not the targeted specific resistance may be used as an indirect indicator of the increase of the virulent isolates in the population. The second way is directly to check virulence profiles of the pathogen populations. The two ways have been tested since autumn 2004 in the central region of France from fields located between the 2 towns of Issoudun and St Florent sur Cher. The first approach seems to work during the first two experimental years. Nevertheless epidemics were too low during the two last years to conclude clearly. Virulence profiles were surveyed in this region and also in experimental fields in Versailles, Grignon and Rennes, from isolates sampled from leaf symptoms. Results have shown that AvrLm7 (avirulent) spores are able to produce leaf symptoms on *Rlm7* varieties. However these leaf lesions are often smaller than those due to virulent isolates, with a huge variability of leaf symptoms morphology, even on the same genotype, in the same field under the same climate. Only a few number of isolates from *Rlm7*-leaf symptoms were identified as *avrLm7*. The results underline the risk of overestimation of virulence allele frequencies based on foliar symptoms, the need for pedagogic documents and teaching sessions to help experimentators and local advisors to detect the beginning of resistance break-down in a biovigilance approach.

N°31 POSTER

First occurrence of ring spot (*Mycosphaerella brassicicola*) in France

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Abstract : For two years ring spot like symptoms have been observed in the west coast region of France. On leaves, lesions were round, light brown to grey-brown, bearing numerous small black fruiting bodies and surrounded by a yellow halo. They could be confused with *Phoma* leaf spot and *Alternaria* leaf spot. Later in the season, similar symptoms were observed on pods. Although the fungus failed to be isolated, the causal agent could be *Mycosphaerella brassicicola*. Its epidemics could be due to high humidity and mild temperatures during the winter. Some DMI fungicides sprayed at stage 60 were efficient but did not provide control on pods until the harvest.

Keywords : winter oilseed rape, ring spot, *Mycosphaerella brassicicola*, chemical control

N°32 ORAL

Evaluation of a decision making tool for controlling sclerotinia stem rot in WOSR

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Abstract : Sclerotinia stem rot is considered as a major disease of oilseed rape in France. Severe yield losses usually occur two to three times a decade. For controlling the disease by spraying a fungicide only when it is necessary CETIOM has improved and evaluated a diagnostic test based on a measured proportion of oilseed rape flowers infected by *Sclerotinia sclerotiorum*. The score of this test is used as a risk indicator. Receiver operating characteristic (ROC) curves are used to determine a decision threshold according to the sensitivity and specificity values. The threshold of 30% infected flowers generally leads to correct decisions except when disease pressure was too high such as in 2007.

Keywords : oilseed rape, *Sclerotinia sclerotiorum*, decision making means

N°33 ORAL

Economic Gains and Integrated Pest Management: An Application to the Sclerotinia and the Canola Crop

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Abstract

Agronomic experimental data are used for simulating some economic implications linked to an integrated pest management applied to the sclerotinia in France. This integrated pest management is a diagnostic test allowing farmers to reduce the fungicide application for canola. Before 2007, simulations show that the use of a diagnostic test about sclerotinia provides economic gains for farmers slightly lower than the common used practice of spraying preventively with chemicals. However, the canola price increase in 2007 makes the diagnostic test about sclerotinia less attractive for farmers compared to the systematic fungicide application. Various political scenarios including a test subsidy or an insurance program linked to the diagnostic test are examined.

N°36 ORAL

Monitoring the sensitivity of *Sclerotinia sclerotiorum* to new registered fungicides

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Abstract: *Sclerotinia* isolates from oilseed rape are monitored every year for fungicides resistance. By the past, the use of carbendazim was very popular and led to a widespread resistance among *Sclerotinia sclerotiorum* populations, especially in the oilseed rape cropping areas. Regarding dicarboximides (eg iprodione, vinclozoline or procymidone), very few resistant isolates have been detected in several French regions, not affecting field efficacy. These fungicides are not registered anymore. For two years new fungicides belonging to carboxamides and DMIs families have been registered to control this disease. Thus, determining *S. sclerotiorum* baseline sensitivity to these new compounds is necessary to manage a sustainable use. A method based on mycelial growth on synthetic agar medium amended with a concentration of 2 mg/l was developed for boscalid, prothioconazole and metconazole. These methods allowed us to determine the sensitivity to boscalid of around 1400 field isolates; no resistance to boscalid was detected in 2007. The method was less reliable for DMI compounds.

Keywords: *Sclerotinia sclerotiorum*, fungicide resistance, carboxamides, DMI fungicides

N° 37 POSTER

First results of the monitoring of the resistant pollen beetles (*Meligethes aeneus*, Fabricius 1775) occurrence in the Czech Republic

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Abstract:

The laboratory experiments were conducted testing the effects of the active substances of two different pyrethroids on the imagoes of the pollen beetles (*Meligethes aeneus*, Fabricius 1775) collected in various areas of the Czech Republic in 2008 (15 localities for lambda-cyhalothrin; 5 localities for etofenprox). The tested pyrethroids were: lambda-cyhalothrin as a specimen of the ester pyrethroids (type II) and etofenprox as a specimen of the other group of pyrethroids (type I, ether pyrethroids). The type I pyrethroids would be less prone to the pyrethroid resistance, which is thought to be metabolic in nature. As the test method an adult-vial-test (IRAC Susceptibility Test Method No. 11) was used.

The pyrethroids were applied in the glass tubes (internal surface area: 37,97 cm²). The lambda-cyhalothrin was applied in these doses: 0 µg.cm⁻² (acetone only); 0,003 µg.cm⁻² (4% of the European field application rate of 7,5 g a.i. ha⁻¹); 0,015 µg.cm⁻² (20% rate); 0,075 µg.cm⁻² (100% rate). The etofenprox was applied in these doses: 0 µg.cm⁻² (acetone only); 0,016 µg.cm⁻² (4% of the Czech field application rate of 40 g a.i. ha⁻¹); 0,080 µg.cm⁻² (20% rate); 0,400 µg.cm⁻² (100% rate). The collected insects were exposed to the dried residues of the insecticides for up to 24 hours. The numbers of individuals filled into the one of the four categories in according to their reactions to the insecticidal residues were always recorded after 1, 5 and after 24 hours from the beginning of the tests. The active imagoes without any symptoms of infliction were filled into the category 1, the imagoes with slight symptoms of infliction (slight discoordination but retained ability to move on legs) were filled into the category 2, the hardly affected beetles (hard discoordination, immobility, tremor) were filled into the category 3 and the dead imagoes were filled into the category 4.

There were found out the significant differences among the reactions of the pollen beetles originated from the fifteen compared localities to the lambda-cyhalothrin applied in 100% rate (ANOVA for the counts after 5 hours : F = 4,450; df = 14, 28; F_{tab} = 2,726; P = 0,01). The differences in the lambda-cyhalothrin effectiveness expressed in according to Abbott exceeded 50 per cents among the several localities. On the contrary there were not found out any significant differences among the reactions of the pollen beetles originated from the five compared localities to the etofenprox applied in 100% rate (ANOVA for the counts after 5 hours : F = 0,748; df = 4, 8; F_{tab} = 3,838; P = 0,05). The differences in the etofenprox effectiveness expressed in according to Abbott (and in the pollen beetles mortalities) were minor on the compared localities. On the base of other analysis it is also possible to conclude that the localities where the beetles showed the significantly different reactions to the lambda-cyhalothrin were not different in this aspect concerning the etofenprox.

Keywords: *Meligethes aeneus*, pollen beetle, insecticide resistance, lambda-cyhalothrin, etofenprox, adult-vial-test

N°38 POSTER

Influence of *C. pallidactylus* females' delay in flying into the oil-seed rape fields on the effect of insecticidal treatments applied at different terms during the spring on the pest

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Abstract:

The effects of several pyrethroids and one combination of organophosphate and pyrethroid (alpha-cypermethrin, etofenprox, chlorpyrifos + cypermethrin) on *Ceutorhynchus pallidactylus* (Marshall, 1802) - highly predominated species in all years of the assessment; and *Ceutorhynchus napi* (Gyllenhal, 1837), (*Coleoptera: Curculionidae*) were investigated under the field conditions in the Czech Republic in 2006 – 2008.

The terms of spraying were derived from the results of fly activity monitoring of the both species through the yellow water traps in each of the years. The traps were located just in the trial (4 traps per trial at least) and also in the adjacent 1 ha area intended for monitoring purposes only (36 traps in regular grid). The traps were emptied twice a week. The terms of spraying were (ideal treatment plan): 1) When the first imagoes of the monitored species appeared in the traps or as soon as it was practically possible 2) When the total number of caught imagoes exceeded the Czech threshold values or when it approached the thresholds at least 3) When the first females without eggs appeared in the traps in somewhat higher quantity (not only scattered individual females) 4) When the substantial portion (approximately 50 %) of the total number of caught females were going to lay eggs (females with mature eggs).

There were always made several particular assessments in each of the years (2006, 2007, 2008). Always 20 plants per plot were sampled. 1) The number of larvae in leaf stalks per plant 2) the number of infested leaf stalks with larvae per plant 3) the positions of infested leaf stalks on plants 4) the number of larvae per stem 5) the total number of larvae per plant and 6) the degree of stem infestation with larvae were recorded for every trial. The effects of compared treatments were expressed for the all mentioned assessments separately in each of the years.

There were recorded significant differences in effects of the compared insecticides on *C. pallidactylus* (*C. napi* occurrences were negligible for all the time on the trial locality) for the particular assessments in each of the years (2006 – 2008). Just the combination of chlorpyrifos + cypermethrin brought about remarkable decrease of infestation levels in each of the three years. On the base of results it is obvious that it was less important to establish the most convenient time for spraying at the application (chlorpyrifos + cypermethrin) to obtain satisfactory results in comparison with the other treatments. The results of individually applied pyrethroids were not so stable. The effectivenesses of individually applied pyrethroids were significantly influenced with the time of spraying. The effects of the pyrethroids applied solo achieved the results of chlorpyrifos + cypermethrin only when the time of spraying was optimal. The most convenient time of spraying varied from the time when the first females without eggs appeared in the traps in somewhat higher quantity and the time when the substantial portion of the total number of caught females were going to lay eggs.

Key words: *Ceutorhynchus pallidactylus*, cabbage stem weevil, insecticide, alpha-cypermethrin, etofenprox, chlorpyrifos + cypermethrin, effectiveness

N° 40 ORAL

Role of the architectural plasticity in the response of oilseed rape plant to flower pruning simulating pollen beetle damages (*meligethes aeneus*).

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Key Words : Brassica, yield losses, meligethes, compensation, source/sink relationships, yield components, seed quality.

Winter oilseed rape is a multipurpose crop (farm-produce industry for oil and cattle-cake, biofuel...) and is therefore becoming the focus of increasing interest in Europe throughout the world. Moreover winter oilseed rape is an excellent rotations crops for cereals as it helps to disrupt the cycle of soil-borne pathogens. However winter oilseed rape suffers from a lot of bioagressors (cabbage seed weevil, cabbage fly, rape stem weevil, pollen beetle...). Thus, currently objectives for this production are to insure standards of yield, seed quality, environmental impact and effective control of the bioagressors's populations.

Amongst them pollen beetle, a pollinivorous coleoptera is responsible for important yield losses: beetle feed pollen from flower buttons or open flowers leading to flower losses and finally to pod losses. The final yield losses will depends on both the pollen beetle attacks intensity (that can be controlled at landscape scale) and the compensation capacities of the crop. Our work will focus on the second strategy: improving compensation capacities of the plants. Many studies were realised on this topic (Lerin, 1988 ; Free et Williams, 1978a ; Free et Williams, 1978b ; Podalskai et al, 1996 ; Daebeler, 1985 ; Axelsen et Nielsen, 1990 ; Sylven et Svensson, 1976). These authors indicate that plant compensation capacities involve architectural plasticity. They show as an example that pruning induces (i) the development of vegetative and basal ramifications, (ii) the growth of pods usually aborted and (iii) the increase of seed weight. But efficiency of these compensations is variable and conditions of a significant compensation are still unknown.

Our hypotheses are (i) that the amount of reproductive organs (flowers and pods) that the plant can still produce after a pollen beetle attack is an important factor of plant's compensation, (ii) genotypes with contrasted architectures and contrasted dynamics of flower development may have different compensation capacities. Thus it seems necessary to understand the dynamics of reproductive organ apparitions and their implication in plant compensation.

To test these hypotheses we conducted an experimentation in which we generated different dynamics of ramification and flower development. Therefore, we use two N fertilisation treatments and three varieties with contrasted architectures (Pollen, Gamin, Exocet). We assumed that pollen beetle attacks could be simulated by flower prunings. Plant compensations (ie, the architectural plasticity) will be interpreted by the sink/source concept using an Structural Functional Plant Model (GreenLab ; Jullien, 2007).

Our work will allow defining architectural ideotypes that better compensates pollen beetles's attacks. It's carried out in the framework of PhD that started in September 2007. The poster will present the main hypotheses, the first year of experiment and the first results.

N° 42 ORAL

Are varietal associations of *Brassica napus* a way to manage efficiently specific resistance genes to *Leptosphaeria maculans*?

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ABSTRACT

It is now well established that specific resistance genes to *Leptosphaeria maculans* can be overcome by the pathogen after few years of commercialization or of recurrent pathogen selection in field experiments when they are introduced into susceptible varieties. We can hypothesize that a decrease of the selection pressure on pathogen populations may allow maintenance of the specific resistance gene efficacy. One way could be to grow varietal associations (mixtures of resistant and susceptible plants) to decrease durably the size of pathogen populations and protect the susceptible plants in the mixture if the pathogen has secondary cycles of multiplication. For assessing the efficacy of a specific resistance gene in varietal associations, we have produced nearly isogenic lines carrying a specific resistance gene, *Rlm6*, introduced from *Brassica juncea* in winter type varieties with ('Darmor') or without ('Eurol') polygenic resistance. We sowed varietal associations with 0, 30, 70 or 100% of seeds with *Rlm6* for both varieties over a three year field experiment and varietal associations with 0, 25, 50 or 75% of *Rlm6* gene for the 'Eurol' variety over two additional years of field experiment. The presence of *Rlm6* gene was checked using a molecular marker specific to the introgression carrying the gene. Leaf spots in autumn and stem canker in spring were scored. We showed that (1) the proportion of resistant plants in plots well corresponded to the initial seed mixtures, (2) the frequency of plants attacked, the average number of leaf spots per plant and the G2 index of stem canker were proportional to the amount of susceptible plants introduced in the mixtures, (3) the isogenic lines on 'Darmor' genetic background are more resistant than the ones on 'Eurol' variety, (4) susceptible plants were less attacked in the mixture containing the highest level of resistant plants depending on the year of experiment. According to these results, experiments are in progress to assess the durability of the efficacy of the resistance gene over years by studying the evolution of *avrLm6* virulent gene frequency in the pathogen population in isolated fields contaminated either by pure 'Eurol' or 50% 'Eurol-*Rlm6*' mixture or pure 'Eurol-*Rlm6*' residues.

N° 43 ORAL

Genetic determinism of quantitative resistance to *Leptosphaeria maculans* in WOSR

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Blackleg (phoma stem canker) caused by the fungus *Leptosphaeria maculans* (*Phoma lingam* Tode) is a major disease of *Brassica napus* worldwide causing serious losses on crops in Europe, Australia and North America. The most common and effective way to control this disease is the use of resistant cultivars. Two types of resistance are distinguished. The first type is a qualitative resistance which is considered as single-gene specific and quickly overcome by the pathogen. The second type is a quantitative resistance which is a partial, polygenic resistance mediated by Quantitative Trait Loci (QTL) and considered more durable. To reduce the breakdown risk of the resistance, the enhancing sustainability of resistance goes through the exploitation of quantitative resistance. In this pathosystem, QTLs for blackleg resistance have only been identified in the variety 'Darmor' in two biparental segregating populations (Pilet *et al.*, 1998, 2001).

In this context, we proposed to use different methodologies in a complementary way to both identify new QTLs exploring different genetic backgrounds and improve the accuracy of QTLs.

To reduce the confidence interval of QTLs, we tested a method using a rational choice of doubled haploid (DH) from 'Darmor-*bzh*' * 'Yudal' population. To identify new QTLs and clarify their effects in different genetic backgrounds, we have proposed to realize both a study of association mapping (AM) and a detection of QTL using jointly a collection of winter oilseed rape varieties and connected multiparental populations

The rational choice of DH helped us to clarify the confidence interval of some resistance QTLs. A collection of 130 oilseed rape varieties characterized for their level of blackleg resistance and structured with 74 markers (SSR, SCAR) allowed us, (i) to choose resistant varieties genetically distant from 'Darmor' and create connected population used in the QTL detection; (ii) to realize a more exhaustive search of loci associated with resistance by an AM approach. Using this last approach, we showed that markers alleles were associated with the blackleg resistance and were mapped in the QTLs previously identified but also in other genomic regions on the map 'Darmor-*bzh*' * 'Yudal'. This suggests the presence of original quantitative resistance factors within the collection in comparison to 'Darmor'. The identification of resistance QTLs within connected populations is in progress. All QTLs identified thanks to different approaches will be analyzed and QTLs will be compared in terms of position and / or effect and / or precision.

This work will propose an efficient methodology to determine more accurately the structural organization and diversity of resistance QTLs in different genetic backgrounds. This study will also provide a set of blackleg resistance QTLs as well as elements of choice for the breeders.

N°44 ORAL

Resistance durability of oilseed rape to Blackleg assessed in multi-year field experiments

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Abstract

The durability of resistance is an important question in plant disease resistance breeding. To assess resistance durability of oilseed rape to *Leptosphaeria maculans*, we performed several multi-year field experiments, separately for each resistance or combination of resistances. The objective was to simulate in small trials the selection pressure that might be exerted by the resistant lines on fungus populations after their commercial use. The protocol was based on the recurrent selection of *L. maculans* populations on a resistant line during each growing season, the residues of which were used as primary inoculum in next autumn to contaminate the trial of same multi-year series. This method was used to assess the durability of resistant genotypes in two agricultural regions with distinct agro-climatic characteristics and distant from each other of several 100 kms (Brittany and Center of France). Similar dynamics of resistance overcoming was observed. New highly effective resistances to *Leptosphaeria maculans* conditioned by *Rlm6* (MX) and *Rlm10* (LA4+) were introgressed either from *Brassica juncea* to a susceptible *B. napus* genotype or from *B. nigra* into cv. Darmor with quantitative resistance, respectively. Using this protocol the resistance durability of the former is very short *i.e.* 3 years after the first sowing, conversely the latter resistance gene displays a longer durability at least 4 years. For assessing the effect of quantitative resistance on the resistance durability of a major gene, *Rlm6* was introduced by backcrosses into two genetic backgrounds, Eurol (susceptible) and Darmor (quantitative resistance). From the nearly isogenic lines without (Eurol, Darmor) and with *Rlm6* (EurolMX, DarmorMX), a multi-year field experiment was conducted for 5 years. Each year, 4 separate field trials were established and each inoculated recurrently with fungal populations selected on 1 of the 4 genotypes. In both trials where Eurol and Darmor residues were used recurrently similar frequency of avirulence/virulence alleles and similar ranking of genotypes for resistance/susceptibility were observed over years. In both trials where residues of MX lines were used in the 2nd year, the size of fungus population dramatically decreased. EurolMX resistance broke down in the 3rd year when the primary inoculum was recurrently selected on EurolMX. In contrast, in the trial where the primary inoculum was the residues of DarmorMX the disease pressure remained low over years and the resistance of DarmorMX was still highly effective in the 5th year of the experiment. These results suggest a slower adaptation and multiplication of the virulent isolates on this latter line and therefore an effect of the polygenic quantitative resistance on the durability of the resistance.

N° 45 ORAL

Resistance of pollen beetle (*Meligethes aeneus* F.) to pyrethroids - Results of a national monitoring in Luxembourg

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Abstract: Following reports about severe resistance problems for pyrethroids to control the pollen beetle (*Meligethes aeneus* F.) in oilseed rape in several European countries, the efficacy of the type II pyrethroids have been tested on 27 populations of the pollen beetle in Grand Duchy of Luxembourg. Cases of resistance to type II pyrethroids have been found on 11 locations. The level of resistance cannot be described as moderate anymore, since populations showed resistance at normal field application rate. Most of the resistant populations have been found near borders with neighbouring countries, e.g. Canton Redange (near Belgium), Canton Remich (near France) and Cantons Grevenmacher (near Germany). Two populations of showing a high level of pyrethroid resistance have been found in isolated places, surrounded by wooded area. Additionally, tests with the type I pyrethroid Bifenthrin and organophosphate Chlorpyrifos-methyl demonstrated that these active substances are still efficient on resistant populations for the moment. The results of this study suggest the hypothesis that an increase in pyrethroid resistance can be expected in the coming years in Luxembourg.

N°46 ORAL

Biocontrol of *Sclerotinia sclerotiorum* and *Verticillium longisporum* by the mycoparasitic fungus *Microsphaeropsis ochracea*

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Microsphaeropsis ochracea is a new mycoparasitic Coleomycete, which was firstly isolated in the 1990s from dead apple leaves originated from Canadian apple orchards (Bernier et al., 1996). It has been shown by both *in vitro* and field experiments that *M. ochracea* is capable to control the plant pathogenic fungal species *Botrytis squamosa*, *Rhizoctonia solani* and *Venturia inaequalis* (Carisse et al., 2000, 2001 and 2006).

We investigated the antagonistic effect of *M. ochracea* on the oilseed rape pathogens *Sclerotinia sclerotiorum* and *Verticillium longisporum* in laboratory and field experiments. In laboratory studies we could prove that germination rates of sclerotia and microsclerotia were reduced by *M. ochracea* treatments. Decrease of germination strongly depends on *M. ochracea* inoculum densities, incubation temperatures and incubation times.

For studying the field efficiency of *M. ochracea* treatments on the fore mentioned oilseed rape pathogens, we designed two long-term experiments: Two crop rotations are studied enclosing oilseed rape-monoculture and a rotation of oilseed rape and winter wheat. We applied *M. ochracea* as a formulated product (2.5×10^9 spores/g) in autumn before sowing and in spring before the start of the vegetation period. Applications were varied with rates of 1kg/ha and 2kg/ha, respectively. First results show lower levels of *S. sclerotiorum* infestations within *M. ochracea* treated plots compared to untreated controls.

References:

Bernier et al (1996), Phytoprotection 77, 129-134; Carisse et al. (2000), Phytopathology 90, 31-37; Carisse et al. (2001) Phytopathology 91, 782-791; Carisse et al. (2006) BioControl 51, 107-126.

N°47 POSTER

Parasitoids efficiency of controlling the population size of *Ceutorhynchus assimilis* (Payk.) (Coleoptera: Curculionidae) on winter oilseed rape

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Abstract

Ceutorhynchus assimilis (Paykull) (Coleoptera: Curculionidae) (cabbage seed weevil) is widely distributed and major pest of oilseed rape in Europe. In Estonia, they are generally more abundant on winter oilseed rape and little is known about the occurrence, importance and efficiency of their parasitoids as biocontrol agents. In this four year study, the damage of *C. assimilis* and their larval parasitization rates were assessed in winter oilseed rape. Pod samples were collected from oilseed rape plants in 2004–2007 from three commercially grown unsprayed winter oilseed rape crops at the pods maturing stage (BBCH 81–83) and incubated in emergence traps. Thereafter emerged larvae, their exit holes and parasitoids were counted, identified and percentage of damaged pods and parasitism rate was calculated. Although, the number of damaged pods by larvae of *C. assimilis* was quite low, it increased continuously during study years. The number of parasitized larvae was the lowest in 2005 and this was the only year when parasitism rate decreased compared to previous year. Notwithstanding this, the parasitization level showed generally a strong increase over the four years and reached noticeable 96% in 2007. The most abundant parasitoid was *Trichomalus perfectus* (Walker) (Hymenoptera: Pteromalidae). This study showed that parasitoids of *C. assimilis* were capable to establish a viable population over four years in suitable conditions. We conclude, therefore, that parasitoids of *C. assimilis* can efficiently control the population size of their host and that these natural enemies have a significant value for environmentally-friendly crop protection.

Key words: *Ceutorhynchus assimilis*, winter oilseed rape, larval parasitization rate.

N°48 ORAL

Potential effect of a changing climate on phoma stem canker and light leaf spot of oilseed rape

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Abstract: Phoma stem canker (*Leptosphaeria maculans*) and light leaf spot (*Pyrenopeziza brassicae*) are the two most serious diseases of winter oilseed rape in the UK. Despite expenditure of more than £12M on fungicides each growing season, these two major diseases account for more than £160M of losses (at a price of £300 t⁻¹). The distribution of each disease is affected by climate, with phoma stem canker most severe in the warmer, dryer south and east of the UK and light leaf spot most severe in the wetter, cooler west and north with epidemics being particularly severe in Scotland. Little work has been done to predict the effects of climate change on plant disease epidemics. To investigate possible effects, a weather-based disease forecasting model for phoma stem canker was combined with a climate change model predicting UK temperature and rainfall under high and low carbon emissions for the 2020s and 2050s. Multi-site data collected over a 15-year period from across the UK was used to develop and validate the model to forecast the severity of epidemics on oilseed rape. The model predicted that phoma stem canker epidemics would increase in severity and the range of the disease would spread northwards into Scotland by the 2020s. However, using the same climate change scenarios, a weather-based light leaf spot forecast model predicted that light leaf spot would become less serious throughout the UK, especially in southern England.

Crop protection and resistance to these two major UK pathogens make important contributions to climate change mitigation, since low-yielding diseased crops use more nitrogen fertilizer per tonne of grain and require more crop-area to achieve the same national yield of oilseed rape. This work suggests that predictions of effects of climate change on other plant diseases are needed since predictions are useful to guide policy and practice in adapting to effects of climate change on food security and wildlife.

N°49 ORAL

Fungicide persistence, application timing and control of sclerotinia stem rot in England in 2007 and 2008

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Abstract: Stem rot (*Sclerotinia sclerotiorum*) on oilseed rape can cause significant yield losses for growers and levels of stem rot reported in the UK have been high in 2007 and 2008. This highlights the importance of having fungicidal control measures in place where crops are at high risk. Industry-funded fungicide trials in the West Midlands and in Kent investigated the effect of application timing and fungicide product on stem rot control in 2007 and 2008. These trials showed fungicide application timing and fungicide persistence relative to crop infection to be significant factors in controlling stem rot in oilseed rape. In 2007, initial infection occurred in late April/early May and in late May whereas infection occurred mainly in mid to late May in 2008. Fungicides applied in late April gave good control of the early epidemic in 2007. In contrast in 2008, fungicides applied in late April did not control the epidemic as effectively as those applied in early May due to the later onset of the epidemic. Data from both years showed that well timed fungicide applications prior to infection events reduced disease development and significantly improve yields compared to untreated crops. Fungicides only protected crops very efficiently for about 3 weeks so that early to mid-flowering treatments did not prevent infection at the late flowering stage. With the current high value of rapeseed, more growers are likely to use at least two fungicide applications to protect the crop during flowering.

N°50 POSTER

Search for promising entomopathogenic fungal isolates for use against pollen beetles

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Abstract: Twenty five isolates of entomopathogenic fungi belonging to the species *Beauveria bassiana* (Balsamo) Vuillemin (19), *B. brongniartii* (Saccardo) Petch (4), *Paecilomyces fumosoroseus* (Wize) (1) and *Metarhizium anisopliae* Sorokin (1) were screened for virulence against pollen beetle *Meligethes aeneus*. Several of the selected *B. bassiana* isolates originated from naturally infected pollen beetles collected in Switzerland. For the bioassays in the lab adult pollen beetles were dipped into a conidial suspension of 1×10^7 spores per ml (0,05% Tween 80) and incubated at 22°C, 70% rh, L:D 16:8. Infection rates were recorded after 15 days. Six isolates of *B. bassiana* as well as one isolate of each *B. brongniartii* and *P. fumosoroseus* achieved infection rates of $\geq 67\%$. Twelve isolates caused intermediate infection rates of 34-66%, whereas five *B. bassiana* isolated showed only insufficient virulence ($\leq 33\%$ infection rate). Besides virulence additional parameters such as temperature activity, host range and mass production parameters were investigated for selected isolates. Furthermore it could be shown that both lethal time and infection rate could be strongly increased if plant oil-based formulations of the fungal conidia were applied instead of conidial suspensions in 0,05% Tween 80. Prospects and constraints of increasing the potential of entomopathogenic fungi for use against pollen beetles are outlined.

N°51 POSTER

Phenotypic distortions of winter rapeseed in successive generations after primary infection with phytoplasmas.

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Every year “shaggy” plants infected with phytoplasmas can be observed on winter rapeseed plantations. The symptoms are so characteristic that finding such affected plants is very easy. At present it is possible to identify the pathogen and its polymorph forms by molecular methods (DNA analyze). Deformation of plants can occur before flowering, it can also appear during and after flowering period. Seed development depends on timing when the symptoms come out. In general seeds do not set when the changes are present before rapeseed plants come into blossom. In case of late symptoms a small amount of seeds can be expected. The seeds are capable of germination. The flowers of infected plants are strongly deformed. Petals usually turn into leaf-like, light-green forms with empty, distended 5cm long pistils. Our survey confirmed, using the analyze of DNA that the reason of the disease was undoubtedly recognized as phytoplasmas. Bertaccini et al. (1998) described similar symptoms on attacked rapeseed plants, but analyze of the progeny of infected plants was not performed. Analyze of progeny raised from homozygotic forms (DH lines) was performed in the Laboratory of Resistance Breeding Method of PBI (IHAR) in Poznań. Seeds were collected from isolated plants which had visible symptoms of phytoplasma disease. Isolation of flowers with paper isolators provided self-pollination. The next generation comprises of deformed plants. The deformations caused strange shape of plants like creeping or funnel-like leaves. The plants were used in crossing programme. It was stated that distortions have fixed character and they have hereditary character. In all androgenic, both haploid and double-haploid plants grown in vitro, phenotypic deformations were observed. Some fragments of primary distorted plants were grown in vitro conditions on agar medium (Gamborg B₅) with antibiotics (carbenicillin). From stems which were cut off from infected plants received healthy organisms. After re-planting in the soil they developed as normal rapeseed plants and gave normal seeds. It means that the plants made a full recovery. On the other side the offspring of infected plants showed fixed deformations. It suggests that the changes caused by phytoplasmas are on the level of DNA (mutations) and there is no possibilities to recovery such mutated plants.

The results, besides cognitive aspect has also utilitarian meaning for breeders and seed producers. They show that deformed shaggy-like infected plants must be removed from the breeding fields, nurseries and seed plantations because their pollen can be a source of unexpected distorted plants in next generations.

N°53 ORAL

Testing of compounds eliciting defence response and resistance in oilseed rape against *Leptosphaeria maculans*

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Abstract: As an alternative to chemical control, treatment with compounds that activate plant's defence could be a promising strategy in managing blackleg disease in oilseed rape. We selected several compounds of natural origin including collagen hydrolysates and extracts from oak bark, curcuma or ginger and we tested their effects on *Brassica napus* cotyledons under laboratory conditions. In our previous work we identified EST from *B. napus* with high homology to known *Arabidopsis* defence related genes. Expression analysis (RT qPCR) of these genes in treated leaves showed that collagen hydrolysates are strong inducers of two genes which are regulated by two distinct signalling pathways. One of the genes (*PR-1*) is salicylic acid responsive, whereas the other one (*HEL*) is ethylene responsive. The both hormones play an important role in *B. napus* - *L. maculans* interaction. Unlike *PR-1*, the *HEL* gene is probably induced also by potassium formate which forms during collagen hydrolysis. No changes in gene expression were measured after treatment with plant extracts. As a next step, the direct effect of the treatment on disease development was determined by inoculation test. *B. napus* cotyledons were treated with particular compound and subsequently inoculated with *L. maculans* spore suspension. Two weeks later, the lesion area was measured using image analysis. This work was supported by Czech Ministry of Agriculture, grants NAZV QH 72117 and QH 81201 and by grant No. 21180/1312/3128 of the FAFNR Czech University of Life Sciences.

N°54 POSTER**Occurrence of *Phoma lingam* pathotypes on oilseed rape cultivars with different resistance gene background****Siv Ahlers, Andreas von Tiedemann and Birger Koopmann***Department of Crop Sciences, Division of Plant Pathology and Crop Protection, Georg-August-University Göttingen, Grisebachstr. 6, D-37077 Göttingen, Germany*

Phoma lingam is the incitant of stem canker of oilseed rape. This disease is the economical most important threat to oilseed rape production worldwide. Early studies reported on different pathotypes of this pathogen (e.g. Cunningham, 1927). Epidemics were related to the occurrence and frequency of aggressive forms of this fungus, which now are believed to belong to the species *Leptosphaeria maculans*, whereas less damaging pathotypes are assigned to the species nov. *L. biglobosa*. The huge damage related to *L. maculans* epidemics lead to breeding programmes intended to screen for new resistance sources and introgress new resistance genes. Nowadays, there are numerous major resistance genes reported (*Rlm1-9* and others), which are used for the development of commercial cultivars. Comparably new are *Rlm7*-cultivars, which possess a resistance gene with broad efficacy against all German *Phoma* pathotypes known so far. This resistance is also performing very effective under German growing conditions. The aim of this study was to monitor the occurrence of *avr7*-isolates (virulent on *Rlm7* genotypes) on both *Rlm7* and *rlm7* cultivars with respect to the durability of this resistance.

In a field study with artificially enhanced *Phoma* disease pressure, we investigated disease incidence and severity of *Phoma lingam* on a small set of cultivars at a single location close to Göttingen. Visual assessments were performed on leaves, stems and the root collar. Furthermore, isolations from single pycnidia or diseased tissues were conducted. Isolates were differentiated into pathotypes via the cotyledon test using the differential set Lirabon, Quinta, Glacier, Jet Neuf, Doublol (all *rlm7*) and Caiman (*Rlm7*). There were no significant differences between natural infections and inoculated variants. Natural infections lead to high disease incidences. Also disease severities of inoculated variants were not significantly different. Control of *Phoma* by intense spraying of ERIA (ai: Difenoconazol, spraying intervals of about 3 weeks) was always significant in all *rlm7* cultivars (Cooper, Oase, and Toccatà). Disease severity displays the superior field resistance of cultivar Caiman (*Rlm7*) compared to the other *rlm7*-cultivars tested. *Rlm7* field resistance was similar effective than intense chemical control achieved by ERIA applications. Yield of the different variants planned to be surveyed was not recorded due to a hailstorm two weeks before harvest leading to total losses. Isolations were performed at three different time points from cultivars Caiman and Oase. A number of 279 single pycnidiospore and hyphal tip isolates were checked in a first screen on cotyledons of cv. Lirabon to differentiate *L. maculans* (virulent on cv. Lirabon) and *L. biglobosa* (avirulent on cv. Lirabon). About 52 % of isolates were assigned to *L. maculans*. Significantly more *L. maculans* isolates originated from cv. Oase. *L. biglobosa* was predominant on cv. Caiman (about 96%). Race differentiation showed that diversity of *Phoma* pathotypes was higher on cv. Oase than Caiman. Among the isolates originating from cv. Oase there were 9 *avr7*-isolates.

In conclusion (i) *L. maculans avr7*-isolates were isolated in a frequency of 3.3% at our experimental site in Central Germany; (ii) Although *avr7* isolates were detected, field resistance of cv. Caiman was superior to other cvs.; (iii) Isolates from cv. Caiman mainly proofed to be *L. biglobosa*; (iv) Although cv. Caiman possess *Rlm7*, *Avr7*-isolates were isolated from leaf and stem lesions; (v) Due to the presence of *avr7*-isolates, there is a further need to monitor the *Rlm7*-adaptation of the *L. maculans* population with respect to the durability of *Rlm7*.

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List of communications (Oral and Posters)

1	Using molecular methods to study pollen beetles: distribution and predation
2	European network for the durable exploitation of crop protection strategies (ENDURE)
3	Detection of winter rape fungal pathogens by PCR and their survey in Czech Republic
4	The influence of <i>Trichoderma</i> species on <i>Leptosphaeria maculans</i> and <i>L. biglobosa</i> growth on agar media and in oilseed rape plants
5	The prediction of <i>Leptosphaeria maculans</i> - <i>L. biglobosa</i> pseudothecial maturation in Poland
6	The potential of entomopathogenic fungi <i>Beauveria bassiana</i> (Bals.) Vuillemin and <i>Metarhizium anisopliae</i> (Metschinkoff) Sorokin to control <i>Helicoverpa armigera</i> (Hübner) on sunflower
7	Mortality factors of the cabbage seedpod weevil, <i>Ceutorhynchus obstrictus</i> (Coleoptera, Curculionidae) in Europe
8	Use of infection criteria from SkleroPro to identify infection events for sclerotinia stem rot in England, 1991-2007
9	Nitrogen fertilization of winter oilseed rape: impact on insect pests, their parasitoids and plant diseases
10	Detection and quantification of airborne ascospores of <i>Sclerotinia sclerotiorum</i> by quantitative-PCR
11	Detecting airborne inoculum to forecast oilseed rape diseases
12	Phenologies and diel periodicities of within-crop flight by pests and parasitoids in oilseed rape.
13	Effect of nitrogen fertilization, cultivar and species on attractiveness and nuisance of two major pests of winter oilseed rape (<i>Brassica napus</i> L.): pollen beetle (<i>Meligethes aeneus</i> F.) and stem weevil (<i>Ceutorhynchus napi</i> Gyl.).
14	Utilization of a model to re-design integrated crop management for WOSR
15	The effect of fertilizers on the pests in oilseed rape
16	The effect of seed treatment on growth and development of oilseed rape
17	Assessing slug risk and slug control in oilseed rape
18	Do insecticide resistant pollen beetles suffer a higher mortality during hibernation?
19	Breeding of oilseed rape on resistance to diseases in Belarus
20	Pathogenic microbiota of rape in Belarus
21	Impact of cabbage root fly, <i>Delia radicum</i> , on infections of oilseed rape by <i>Verticillium longisporum</i> and <i>Phoma lingam</i>
22	Effect of sowing date on health status of open pollinated, composite hybrid and restored hybrid cultivars of winter oilseed rape (<i>Brassica napus</i> L.)
23	A duplex PCR to follow the frequencies of avirulence 1 and 4 alleles in field populations of <i>Leptosphaeria maculans</i>
24	<i>Orobanche ramosa</i> on winter oilseed rape in France: risks and perspectives of control
25	Characterization of specific resistance to <i>Leptosphaeria maculans</i> in recent winter oilseed rape (<i>Brassica napus</i> L.) commercial varieties

26	Avirulence genes of <i>Leptosphaeria maculans</i> : diversity of mechanisms to become virulent and perspectives
27	Effect of tillage system and larval parasitism on pollen beetle (<i>Meligethes</i> spp.) populations
28	Influence of insecticide application on host finding of <i>Tersilochus obscurator</i> (Hym.; Ichneumonidae)
29	SIPPOM-WOSR, Simulator for Integrated Pathogen POPulation Management: a tool to help design and evaluate sustainable strategies to control phoma stem canker on Winter OilSeed Rape at the regional scale
30	Are leaf symptoms a way to check an increase of virulent populations on Rlm7 hybrids?
31	First occurrence of Ringspot in France (<i>Mycosphaerella brassicicola</i>)
32	Evaluation of a decision making tool for controlling sclerotinia stem rot in WOSR
33	Economic Gains and Integrated Pest Management : An Application to the Sclerotinia and the Canola Crop
34	Cancelled
35	cancelled
36	Monitoring the sensitivity of <i>Sclerotinia sclerotiorum</i> to new registered fungicides
37	First results of the monitoring of the resistant pollen beetles (<i>Meligethes aeneus</i> , Fabricius 1775) occurrence in the Czech Republic
38	Influence of <i>C. pallidactylus</i> females' delay in flying into the oil-seed rape fields on the effect of insecticidal treatments applied at different terms during the spring on the pest
39	Cancelled
40	Role of the architectural plasticity in the response of oilseed rape plant to flower pruning simulating pollen beetle damages (<i>Meligethes aeneus</i>).
41	Genetic determinism of Clubroot resistance in WOSR
42	Are varietal associations of <i>Brassica napus</i> a way to manage efficiently specific resistance genes to <i>Leptosphaeria maculans</i> ?
43	Genetic determinism of quantitative resistance to <i>Leptosphaeria maculans</i> in WOSR
44	Resistance durability of oilseed rape to Blackleg assessed in multi-year field experiments
45	Resistance of pollen beetle (<i>Meligethes aeneus</i> F.) to pyrethroids - Results of a national monitoring in Luxembourg
46	Biocontrol of <i>Sclerotinia sclerotiorum</i> and <i>Verticillium longisporum</i> by the mycoparasitic fungus <i>Microsphaeropsis ochracea</i>
47	Parasitoids efficiency of controlling the population size of <i>Ceutorhynchus assimilis</i> (Payk.) (Coleoptera: Curculionidae) on winter oilseed rape
48	Potential effect of a changing climate on phoma stem canker and light leaf spot of oilseed rape
49	Fungicide persistence, application timing and control of sclerotinia stem rot in England in 2007 and 2008
50	Search for promising entomopathogenic fungal isolates for use against pollen beetles
51	Phenotypic distortions of winter rapeseed in successive generations after primary infection with phytoplasmas
52	Effect of Bean pod mottle virus time of infection on soybean seed quality (mottling, oil content and protein content).
53	Testing of compounds eliciting defence response and resistance in oilseed rape against <i>Leptosphaeria maculans</i>
54	Occurrence of Phoma lingam pathotypes on oilseed rape cultivars with different resistance gene background