EUROCORES Programme
European Collaborative Research

Networking / Dissemination Activity
Scientific Report Form

Form (Word or PDF file) to be completed and uploaded via the online system within two months of the completion of the event for the following activities: working group meetings, seminars, workshops, symposia, conferences, summer schools, training programmes and specialised courses (graduate-level and continuing education), EUROCORES programme invited sessions at larger conferences, working group meetings (e.g. publication meetings).

a) Summary

Plants are the primary producers that form the basis of most food webs and as such plants are the dominating and – after insects – the most diverse multi-cellular organisms on earth. They cover most of the terrestrial parts of our planet despite the actions of numerous insect herbivores. The relationship between insects and plants is not only antagonistic; many insects provide reproductive assistance as pollinators or protection as predators of herbivores. The exceedingly important role of plants for ecosystem functioning, as well as their value as a food source for humans and life-stock, make it evident that a good understanding of insect-plant interactions is of utmost importance. Recent advances in molecular and chemical methodologies have allowed scientists worldwide to make great progress in generating such knowledge.

Initiated in 1958, the International Symposium on Insect-Plant Relationships (SIP) is held every three or four years at different places in Europe. After 1995, the SIP was hosted for a second time in Switzerland. The event took place at the University of Neuchâtel from August 17 to 22, 2014 (see: http://www2.unine.ch/sip15), the last day of the meeting was dedicated to the EuroVOL final meeting. The conference was attended by 202 scientists that are active in the field of insect-plant interactions. It was a great opportunity to bring these scientists together in Neuchâtel and present them an important part of the research that was conducted in the context of EuroVol.. During the symposium they exchanged information and presented their ideas on how to use the latest research progress to preserve and enhance biodiversity, as well as to help improve crop performance and protection.

At the meeting, EuroVOL scientists presented their work in oral presentations or posters. In particular young scientists were offered the opportunity to present their work and to discuss it with renowned experts in the field. The meeting was organized in seven sessions, each of which had two invited speakers. The invited scientists presented a 20-minute talk and the other talks were 15-minutes each. Contributing of the speakers are provided to present their work in a peer-reviewed article for the Symposium Proceedings, i.e. a special issue of the respectable journal Entomologia Experimentalis et Applicata. The members of the organizing committee serve as editors of this special issue.

The SIP 15 meeting was a wonderful occasion for EuroVOL scientists to discuss their results and make the final debriefing of this outstanding program. For the junior scientists of the EuroVOL

program it was an ideal opportunity to showcase their work and to network with plant-insects specialists, enhancing their changes for a career in science.

b) Final programme of the event

Sunday, 17 August 2014

10:00 –20:00	Arrival of participants free visit **Botanical Garden**	
13:00 –17:00	Registration (SIP 15 conference site) Setting up of posters	
PLENARY LECTURE		
16:00	***Betty Benrey*** ***Ted Turlings***	Welcome
16:15	***Sharon Strauss***	Apparency revisited
17:00	Welcome reception	

Monday, 18 August 2014

8:50	information	
Chair:	***Gwen Shlichta***	***MULTITROPHIC INTERACTIONS 1***
9:00	***Martin Heil***	Successful teamwork: Cooperation as a strategy in plant defence
9:20	***Enric Frago***	Insect symbionts: a hidden trophic level in insect-plant interactions
9:35	***Tobias Lortzing***	Paid in blood – Ant-attracting wound secretions of *Solanum dulcamara* provide indirect defense against herbivory
9:50	***Andrew Gherlenda***	Is the response of insect herbivores to elevated CO2 and temperature universally predictable for different host tree species?
10:05	***Andrew George Stephenson***	Impact of *Solanum carolinense* trichomes on larval growth, integrity of the peritrophic membrane, and the immune system of *Manduca sexta*
10:20	tea/coffee break	
10:50	***Fanny Vogelweith***	Which processes shape grapevine moth immune response against parasitism?
11:05	***Johan A. Stenberg***	Sex-biased predation in dioecious willow: the long reach of plant genes
11:20	***Yin-Quan Liu***	Effects of a begomovirus on the tritrophic interaction of tomato, whitefly *Bemisia tabaci* and its parasitoid *Eretmocerus hayati*
11:35	***Karen Muller***	Male larval nutrition on different grape varieties affects adult reproductive success in wild European grapevine moth (*Lobesia botrana*)
11:50	***Arjen Biere***	Effects of plant microbial symbionts on aboveground plant-insect interactions in *Plantago lanceolata*
12:05	lunch at Le Romarin / dessert and coffee at the conference site	
13:30	Poster session	
Chair:	***Christophe Praz***	***POLLINATION***
15:30	***Florian Schiestl****	Floral signals in the context of pollination and herbivory
15:50	***Daniel Gervasi***	Impact of changing pollinator environments on the evolution of plants
16:05	***Angela Köhler***	'Toxic nectar': harmful and beneficial effects of nicotine on an important pollinator, the African honey bee
16:20	***Mascha Bischoff***	No pollinator is an island – the role of context and previous experience in floral reproductive isolation

16:35	***Paulo Milet-Pinheiro***	Sexual deception or rendezvous attraction? Deconstructing the floral mimicry of *Cephalanthera rubra* (Orchidaceae)
16:50	tea/coffee break	
17:20	***Martine Hossaert***	Lord of the dance: chemical mediators and specific pollination interactions
17:40	***Vincent Trunz***	Pollen secondary metabolites influence bee-flower relationships
17:55	***Holly Summers***	Nitrogenous aldoximes produced by a night-blooming flower influence hawkmoth feeding behavior
18:10	***Dani Lucas-Barbosa****	Integrating Plant-Pollinator and Plant-Herbivore Interactions
18:25	***Rayko Halitschke***	Herbivore-pollinator interactions in wild *Solanum*

**** EuroVOL participant***

Tuesday, 19 August 2014

8:50	information	
Chair:	***Ted Turlings***	***BELOWGROUND INTERACTIONS***
9:00	***Roxina Soler***	Plant-mediated interactions between insects across above-belowground domains: ecology, mechanisms and utilization
9:20	***Scott Johnson***	The missing half: can we predict how climate change will affect belowground insect-plant interactions?
9:35	***Ivan Hiltpold***	Induced fitness cost: a consequence of root indirect defences in western corn rootworm population showing resistance to Bt-toxins
9:50	***Christelle Robert***	Plant secondary metabolite hijacking by a specialist root herbivore
10:10	***Meret Huber***	Root herbivory drives the evolution of defensive latex secondary metabolites in nature
10:25	tea/coffee break	
10:55	***Michael Rostás***	Aboveground endophyte affects root volatile emission and host plant selection of a belowground insect
11:10	***Shai Morin***	Inoculation of tomato plants with rhizobacteria enhances the performance of the phloem-feeding insect *Bemisia tabaci*
Chair:	***Betty Benrey***	***PLANT DOMESTICATION AND APPLICATION***
11:25	***Yolanda Chen***	Crop domestication and naturally selected species interactions
11:45	***Kirsten Leiss***	Host plant resistance to Western flower thrips in cultivated, biofortified and wild carrots
12:00	***Gwen Shlichta***	Contrasting effects of plant domestication on herbivore interactions: The case of wild and cultivated lima beans
12:15	lunch at Le Romarin / dessert and coffee at the conference site	
13:30	Poster session	
15:30	***Toby Bruce***	The call of the wild: tracking an indirect defence trait in maize
15:50	***Martín Aluja***	Costs of extreme apple domestication and the value of old cultivars under global climate change
16:05	***Karen Kloth***	High-throughput phenotyping of plant resistance to aphids by automated video tracking
Chair:	***Ivan Hiltpold***	***PLANT VOLATILES***
16:20	***Eric Schmelz***	Plant volatiles: getting a biochemical grasp on specificity
16:40	***Feng Zhu***	Plant volatile mediated interactions in food webs up to the fourth trophic level
16:55	tea/coffee break	
17:25	***Sergio Rasmann***	The effect of ecological gradients on plant volatile emissions
17:40	***Peter Anderson****	Effect of experience to plant cues on host plant choice of a moth
18:00	***Tuuli-Marjaana***	Volatile organic compounds from insect-defoliated trees as

	Koski	possible foraging cues for insectivorous birds
18:15	***Foteini Paschalidou****	Effects of insect herbivore eggs on interactions of plants with their insect community
18:30	***Sara Hermann***	Prey perception of predation risk: volatile chemical cues mediate non-consumptive effects of a predator on a herbivorous insect

**** EuroVOL participant***

Wednesday, 20 August 2014

8:50	information	
Chair:	***Matthias Erb***	***METABOLOMICS AND MOLECULAR MECHANISMS***
9:00	***Gaétan Glauser***	Metabolomics for studying plant-insect interactions: help or hype?
9:20	***Caroline Müller***	Specificity of metabolic plant responses to salicylic and jasmonic acid and impacts on chewing and sucking herbivores
9:35	***Christelle Bonnet****	Impact of (a)biotic pretreatments on *Pieris brassicae* feeding responses in *Brassica nigra*
9:50	***Duy Nguyen***	Water stresses affect herbivore-induced defense responses in *Solanum dulcamara*
10:05	***Peter Klinkhamer***	Metabolomics of different leaf cell types and interacting effects of secondary metabolites on toxicity to *Spodoptera*
10:20	tea/coffee break	
10:50	***Philippe Reymond****	Role of Arabidopsis bHLH transcription factors MYC2, MYC3 and MYC4 in defense against herbivory
11:10	***Suzanne Kos***	Unravelling host plant resistance in chrysanthemum using NMR
11:25	***Vinzenz Handrick***	Benzoxazinoids: Biosynthesis and function of major defense compounds in maize
11:40	***Osnat Malka***	Disarming the glucosinolate-myrosinase complex by sulfatase in *Bemisia tabaci*
11:55	***Michele Bandoly***	Insect eggs predict future attack and prime induced plant defence
12:10	business meeting	
12:40	packet lunch	
	FREE AFTERNOON	

**** EuroVOL participant***

Thursday, 21 August 2014

8:50	information	
Chair:	***Sergio Rasmann***	***PHYLOGENETICS AND COEVOLUTION***
9:00	***Nadir Alvarez***	Processes from patterns – can co-evolutionary diversification be tested in a phylogenetic framework?
9:20	***Tobias Züst***	Prevalence of growth-defense trade-offs in two major defense traits of the common milkweed *Asclepias syriaca* L.
9:35	***Martin Steinbauer***	An Australian contribution to the coevolution of red leaf colour hypothesis – courtesy of eucalypts and eucalypt-feeding psylloids
9:50	***Georg Petschenka***	Evolution of cardenolide resistance and sequestration in milkweed butterflies (Lepidoptera, Danaini)
10:05	***Jared Gregory Ali***	Aphids suck and monarchs rule: asymmetry of plant-mediated interactions between specialist aphids and caterpillars on two milkweeds
10:20	tea/coffee break	
10:50	***Susanne Dobler***	Convergent adaptive evolution – how insects master the challenge of cardenolide-containing host plants

11:10	***Jeffrey Ahern***	Macroevolutionary patterns of plant phenolic metabolites in the Onagraceae
11:25	***Franziska Beran***	*Phyllotreta* flea beetles utilize host plant defense compounds to create their own glucosinolate-myrosinase system
11:40	***Nina Fatouros****	Synergism between direct and indirect defence controls herbivore eggs on a wild crucifer
11:55	***Corinna Krempl***	Adaptation of generalist herbivores to Gossypol, a cotton secondary metabolite
12:10	***Thure Pavlo Hauser***	Constraints to the evolution of both insect and pathogen resistance in two chemotypes of a wild crucifer
12:25	lunch at Le Romarin / desert and coffee at the conference site	
13:30	Poster session	
Chair:	***Angela Köhler***	***MULTITROPHIC INTERACTIONS 2***
15:30	***Erik Poelman****	Multi species multi trophic interactions
15:50	***Aino Kalske***	Inbreeding in a plant-herbivore interaction: effects on herbivore performance, preference and third-trophic level interactions
16:05	***Jeltje Stam***	Order of arrival of early season herbivores affect the subsequent insect community
16:20	***Grit Kunert***	What does the aphid feeding behaviour tells us about plant factors important for pea aphid host race maintenance?
16:35	tea/coffee	
17:05	***Ilka Vosteen***	The role of hoverfly – plant species interaction in maintenance of pea aphid host races
17:20	***Tiantian Lin***	The EICA and SDH hypothesis revisited: A competition experiment between invasive and native *Jacobaea vulgaris* under specialist or generalist herbivore attack
17:35	***Paul Ode***	Parasitism increases plant investment in chemical defences against herbivores
17:50	***Stefan Pentzold***	Insect counter-adaptations to plant cyanogenic glucosides
18:45 –24:00	Boat tour, Gala dinner, poster awards and Jazz band *Cocinando*	

**** EuroVOL participant***

Friday, 22 August 2014

8:45 Meeting point at Quai Léopold-Robert (Close to Hotel Beaulac)
9:00 Bus departure to Grand-Vy for a hike at le Creux du Van to the Farm Soliat
11:00 Final overview of the EuroVOL projects

- **MOMEVIP** Jörg-Peter Schnitzler, Helmholtz Zentrum München

"Plants under environmental stress - potential functions of volatile isoprenoids"

- **A-BIO-VOC** Camille Ponzio, Wageningen University

"Exploring VOC-mediated parasitoid foraging in a multiple attack scenario"

- **InvaVOL** Gaylord Desurmont, University of Neuchâtel

"Alien interference: disruption of infochemical networks by invasive insect herbivores."

13:00 Lunch
14:30 Departure to the chocolate factory Jacot
15:00 Visit of the chocolate factory- chocolate & wine Tasting
17:00 Departure, back to Neuchâtel (arrival at about 17h30-17h45).

c) Description of the scientific content of the event (abstracts can be provided)

The SIP 15 meeting was divided in seven scientific sessions:

- Multitrophic interactions
- Pollination
- Plant volatiles
- Belowground interactions
- Plant domestication and application
- Metabolomics and Molecular mechanisms
- Phylogenetics and co-evolution

All the abstracts are available in the abstract book on the SIP 15 website.
The last day of the meeting (Friday, August 22nd) was dedicated to the final EuroVOL meeting. This meeting was attended by 30 scientists of the three CRPs. One scientist of each CRPs gave a presentation that summarized the results obtained during the EuroVOL program. After each talk, there was a discussion. Although we when ran out of time at the end, overall this debriefing session was positively evaluated by the participants.

Abstracts of the presentations from Friday, August 22nd, EuroVOL final meeting.

Plants under environmental stress –potential functions of volatile isoprenoids

Jörg-Peter Schnitzler[1], Francesco Loreto[2], Wilhelm Gruissem[3], Harro Bouwmeester[4], Han Asard[5], Jenny Renaut[6], Armin Hansel[7], Thomas D. Sharkey[8]

[1]Helmholtz Zentrum München, Neuherberg, Germany
[2]Consiglio Nazionale delle Ricerche, Florence, Italy
[3]ETH Zürich, Switzerland
[4]Wageningen University, Wageningen, The Netherlands
[5]Universiteit Antwerpen, Antwerpen, Belgium
[6]The "Centre de Recherche Public – Gabriel Lippmann"
[7]Universität Innsbruck, Innsbruck, Austria
[8]Michigan State University, East landing, USA

The presention summarizes actual results from the Collaborative Resarch Project (CRP) "Molecular and metabolic bases of volatile isoprenoid-induced resistance to stresses" which was performed in the frame of the ESF Eurocore Programme EuroVOl (2009-2014).
Specifically we aimed testing current mechanistic hypotheses on the function roles of volatile isoprenoids (VIPs) against the use of novel molecular and technological tools and unravelling cross-links between isoprenoid biosynthesis and other biochemical pathways, which may lead to changes in plant resistance to abiotic stressors and in plant primary productivity.
Using mutants of model systems Arabidosis, poplar and tobacco we analysed whether VIPs make cell membranes more resistant to denaturation under heat or oxidative stresses; and tested whether these compounds reduced oxidative pressure in membranes by avoiding reactive oxygen species (ROS) formation, or by interacting with ROS, or by indirectly priming a general activation of antioxidant defenses.
Based on joint climate chamber experiments we also identified carbon sources for VIP biosynthesis, and possible cross-talks between biochemical pathways, especially when primary carbon sources are inhibited and VIP biosynthesis is stimulated by stress.
Omic (transcriptome and proteome) approaches helped to clarify whether induction of VIP feedbacks on primary metabolism, altering long-term allocation of resources and photosynthates, and above- and below-ground plant growth and productivity.
For more details visit: http://www.esf.org/coordinating-research/eurocores/running-programmes/eurovol/collaborative-research-projects-crps/molecular-and-metabolic-bases-of-volatile-isoprenoid-induced-resistance-to-stresses-momevip.html.

Exploring volatile-mediated parasitoid foraging in a multiple attack scenario

Camille Ponzio, Pasquale Cascone, Antonino Cusumano, Berhane Weldegergis, Nina Fatouros , Emilio Guerrieri, Marcel Dicke, Rieta Gols
Wageningen University

In this aspect of the A-BIO-VOC subproject of EuroVol, we investigated the effects of multiple attack on the volatile blends emitted by plant and on wasp foraging behavior. In a first approach, we first compared the effects on different secondary attackers on the foraging behavior of *Cotesia glomerata* parasitoid wasps, parasitizing *Pieris brassicae* caterpillars. We found that neither aphid (*Brevicoryne brassicae*) nor egg (*P. brassicae*) infestation, nor infection by the plant pathogen *Xanthomonas campestris* affected the ability of the wasps to locate their caterpillar hosts. Headspace analysis showed that caterpillar or dually infested plants emitted similar blends, which correlates with the observed behavior. In a second approach, we then looked at the effects of one specific dual infestation scenario (aphids and *P. brassicae* eggs or larvae) under different densities of aphid infestation, and looked at the effects on three parasitoid wasps species: an aphid parasitoid (*Diaeretiella rapae*), an egg parasitoid (*Trichogramma brassicae*) and larval parasitoid (*C. glomerata*). Here we found that aphid density had a strong linear effect on foraging behavior for all three species, while in the emitted volatiles we found non-linear effects, and no specific volatile characteristics were found to support the behavior. Our findings demonstrate that when scaling up the complexity of the studied interactions, limited knowledge on the exact volatile cues used by the parasitoids limits our ability to link differences in volatile profiles to foraging behavior.

Alien interference: disruption of infochemical networks by invasive insect herbivores

Gaylord Desurmont and Ted Turlings
University of Neuchatel

Exotic herbivores invading new environments can pose a threat to the functioning of foodwebs and interfere with native insect-plant interactions. In the context of the EUROVOL project InvaVol, six European laboratories worked in collaboration to investigate the disruptive effects of invasions by exotic insect herbivores on insect-plant interactions mediated by plant volatiles, for native insects belonging to different trophic levels: insect herbivores, natural enemies of herbivores, and pollinators.
Results showed that the native herbivore *Mamestra brassicae* does not suffer from competition by the exotic *Spodoptera littoralis* but, because the main parasitoid of *M. brassicae* is not attracted by plants infested by *S. littoralis*, oviposition preferences toward *S. littoralis*-infested plants may translate in reduced parasitism for *M. brassicae*. Results with natural enemies showed that, in general, parasitoids are extremely efficient at innately distinguishing plants infested by their host from plants infested by a non-host herbivore, independently of the origin of the non-host. However, in case of double infestation (host and non-host herbivore feeding on the same plant), plants doubly infested with an exotic non-host became less attractive to parasitoids. This result was consistent for a range of 17 non-host herbivores, showing a general effect of exotic herbivores possibly leading to reduced fitness for native parasitoids. Results of experiments with pollinators showed contrasting, system-dependent, results: with *Brassica rapa* plants pollinated by bumblebees, herbivory lead to reduced attraction of pollinators and a decrease in plant fitness correlates. In the case of *Silene latifolia* plants pollinated by a nursery herbivore, herbivory by *S. littoralis* resulted in increased production of floral volatiles, higher pollination, and increased fitness. Overall, the chemical changes in plant volatiles behind such disturbance effects were well-elucidated in the case of the exotic herbivore *S. littoralis*, and were also showed to be very species-specific and to vary tremendously depending on infestation timing and feeding guild of the invader (i.e. leaf chewer or root-feeder). In summary, the InvaVol project revealed that exotic herbivores can impact infochemical networks and that these effects can escalate through the food chain to affect many native organisms involved in chemically mediated insect-plant interactions.

d) Assessment of the results and impact of the event on the EUROCORES programme.

As this meeting was the last one concerning the EuroVOL program, it was a great occasion for all the members to discuss their final results. Future collaborations were also discussed.
The EuroVOL program induced a lot of interactions between the senior scientists and probably most importantly between junior scientists that participated to the program. They will definitely keep these collaborations running in their future career. Exchanges and collaboration will continue between the three CRPs. The quality of the science that came out from the projects is excellent and is internationally recognized. The SIP 15 meeting was again the occasion for the EuroVOL scientists to present their results. Dani Barbosa won a poster prize, which indicates the excellence of the work done within the EuroVOL program.
As mentioned above, the SIP 15 collaborates with Entomologia Experimentalis and Applicata, a special issue will come out soon.

e) List of speakers and participants

List of invited speakers:

Plenary Speaker
- Sharon Strauss, University of California Davis, USA

Multitrophic Interactions
- Erik Poelman, Wageningen UR, NL
- Martin Heil, CINVESTAV Guanajuato, MEX

Belowground Interactions
- Christelle Robert, MPI CE Jena, GER
- Roxina Soler, NIOO-KNAW Wageningen, NL

Pollination
- Florian Schiestl, University of Zurich, CH
- Martine Hossaert, CEFE/CNRS Montpellier, FR

Plant Domestication and Application
- Yolanda Chen, Unversity of Vermont, USA
- Toby Bruce, Rothamsted Research, UK

Plant Volatiles
- Eric Schmelz, USDA-ARS Gainesville, USA
- Peter Anderson, SLU Alnarp, SWE

Metabolomics and Molecular Mechanisms
- Gaétan Glauser, University of Neuchâtel, CH
- Philippe Reymond, University of Lausanne, CH

Phylogenetics and Co-Evolution
- Nadir Alvarez, University of Lausanne, CH
- Susanne Dobler, University of Hamburg, GER

EuroVOL final meeting
- Camille Ponzio, wageningen University, NL
- Jörg-Peter Schnitzler, Helmholtz Zentrum München, GER
- Gaylord Desurmont, University of Neuchâtel, CH

List of EuroVOL participants:

Dr	Guerrieri	Emilio	Institute for Plant Protection, National Research Council of Italy
MSc	Lucas-Barbosa	Dani	Wageningen University
PhD	CUSUMANO	ANTONINO	UNIVERSITY OF PALERMO
Ms	Bonnet	Christelle	University of Lausanne

PhD	Cascone	Pasquale	CNR Consiglio Nazionale delle Ricerche, Istituto per la Protezione delle Piante
Prof.	Dicke	Marcel	Laboratory of Entomology - Wageningen University
MSc	Ponzio	Camille	Wageningen University
MSc	Paschalidou	Foteini	Entomology, Wageningen UR
Dr	Blande	James	University of Eastern Finland
Prof.	Schiestl	Florian	University of Zürich
Prof.	Poelman	Erik	Wageningen University
Prof.	Reymond	Philippe	University of Lausanne
Mr	Khaling	Eliezer	University of Eastern Finland
PhD student	Papazian	Stefano	Umeå Plant Science Centre
Dr	Gols	Rieta	Laboratory of Entomology, Wageningen Univesity
Dr.	Senning	Melanie	ETH Zurich
Dr.	Fatouros	Nina	Wageningen University, Laboratory of Entomology
Professor	Anderson	Peter	Chemical Ecology, Swedish University of Agricultural Sciences
Dr	van Dam	Nicole	German Centre of Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig
Herr	Danner	Holger	Radboud University, IWWR
Dr.	Cristescu	Simona	Radboud University
Pr.	Schnitzler	Jörg-Peter	Helmholtz Zentrum München Research Unit Environmental Simulation
Prof.	Noureddine	Yassaa	
Dr	Benedicte	Albrectsen	Umeå Universitet
Prof.	Helmig	Detlev	
Mrs.	Litto	Maria	University of Naples Federico II
Dr	Weldegergis	Berhane	Wageningen University
Dr.	Desurmont	Gaylord	University of Neuchatel
Prof.	Turlings	Ted	University of Neuchatel
Dr.	Gouinguené	Sandrine	University of Neuchatel

A list of all participants to the SIP 15 is available in the abstract book.