

National Centre of Competence
in Research (NCCR)

*Plant Survival in Natural and
Agricultural Ecosystems*



Second Phase Results
2005-2009

Foreword

The second phase of the NCCR Plant Survival (April 2005 – March 2009) has generated a new set of remarkable results. We are proud to present the work of our research groups on the interactions of plants with their environment.

Plants are the primary producers of organic matter. Their survival and performance are therefore of fundamental importance for both the preservation of biodiversity and sustainable agriculture. Maize and grapevine have been at the centre of numerous successes related to defence against pests or diseases. The methods tested mostly deal with the enhancement of natural strategies and resistance mechanisms. For this purpose, scientists have explored interactions among plants as well as between plants, insects and pathogens on a scale ranging from the molecule to the ecosystem.

On a more fundamental level, studies on plant nutrition and light capture through photosynthesis have made significant progress. Inside the plant cell, the role of chloroplasts in processes such as energy transformation, protein storage, starch metabolism or chlorophyll degradation gave rise to many scientific contributions in highly renowned publications.

Studies on the spread and impact of invasive plants consist in refining and extending the investigations on the causes of invasiveness. The focus on a single species and comparison of its development between the native and introduced ranges sets a basis for predictive modelling of invasiveness. Last but not least, novel statistics and modelling methods are specifically being developed in order to support many of our research groups. We wish you a pleasant reading.

The Management and Coordination Unit
NCCR Plant Survival, April 2010

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Notice

Since the highlights expressed here represent only a small selection of the research carried out within this national network, we extend our apologies to those scientists whose work could not be shown in this document, due to a lack of space.

Maize defence

An odorous signal restored

Ivan Hiltbold,
Ted Turlings (UniNE)

A natural defence mechanism that no longer existed in certain American maize varieties was reinstated by genetic engineering. Research groups at the University of Neuchâtel and the Max Planck Institute (MPI) for Chemical Ecology in Jena (Germany) had previously identified the volatile molecule in maize responsible for this odorous signal: (E)- β -caryophyllene.

Belowground, the Western Corn Rootworm *Diabrotica virgifera virgifera* causes economic losses of about one billion USD per year in North America. When present, the odorous root signal attracts nematodes – tiny parasitic worms – that kill the destructive larvae. By inserting a specific gene, the researchers



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were able to restore the signal in one of the American varieties. In fields planted with the “repaired” maize, Ivan Hiltbold found significantly less root damage and a 60% decrease in the emergence of adult *Diabrotica* compared to fields with non-modified maize. The enhanced killing power of the nematodes is comparable to that of synthetic pesticides commonly used against *Diabrotica*.



Diabrotica larvae attacked by nematodes (tiny parasitic worms)



Field trials measuring the efficiency of plants emitting caryophyllene to attract nematodes

Bt maize: no harm to beneficial insects

Michael Meissle, Nora Lawo, Yunhe Li,
Roger Konrad, **Jörg Romeis** (ART Reckenholz)

Novel *Bt* maize varieties express the Cry3Bb1 protein to control larvae of the Western Corn Rootworm (WCR) (*Diabrotica virgifera virgifera*). However, the toxin released might also cause adverse effects on non-targeted arthropods that fulfil important ecological functions in the maize agroecosystem, such as biological control.

No detrimental effect was found on the development and reproduction of the ladybird *Stethorus punctillum* when fed with *Bt* maize-reared spider mites. Interestingly however, female beetles were found to have a shorter pre-oviposition period, an increased daily fecundity and egg viability in the *Bt* treatment.

In order to assess a possible effect of *Bt* protein on adult green lacewings, two groups of *Chrysoperla carnea* were fed pollen from two varieties of transgenic maize. The first one contained the insecticidal Cry1Ab protein meant to eliminate lepidopteran pests such as the European corn borer *Ostrinia nubilalis*. The second one produces the Cry3Bb1 protein



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that acts on WCR. No difference was detected in a number of life-history parameters between *Bt* maize pollen-fed insects and those that were fed pollen from the corresponding non-transgenic varieties.

Spiders are generalist predators and feed on various prey organisms. In a Cry3Bb1-transgenic maize field, plant-expressed *Bt* proteins are ingested by herbivores and passed on to their predators. By combining the data on exposure and hazard (toxicity) collected over 3 years, the researchers concluded that the risk of the spider *Theridion impressum* being affected by *Bt* maize is negligible.



The Western Corn Rootworm is causing huge damages in North America



The spider *Theridion impressum* attacking an adult WCR

Pollination and reproduction

A single gene for pollinator preference

Maria Elena Hoballah, Alexandre dell'Olivo, **Cris Kuhlemeier** (UniBE)

Petunia relies on insect pollinators to ensure their reproduction – either diurnal bumblebees or nocturnal hawkmoths. Researchers have found that modifying a single gene is sufficient to change the capacity to attract one pollinator over another.



When the “bee version” of the AN2 gene is introduced into *Petunia axillaris*, pollinator preference changes from moths to bees



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They demonstrated that a gene involved in determining petal colour (AN2) plays a major role in attracting pollinators. The expression of the AN2 gene is responsible for the production of anthocyanin pigmentation. The anthocyanins give the *Petunia integrifolia* flower its red-violet colour, to which the bumblebee *Bombus terrestris* is particularly attracted. On the other hand, when the AN2 is not expressed, the flower does not produce anthocyanins and remains white. It will then be visited by nocturnal butterflies such as the hawkmoth *Manduca sexta*. Therefore, changing the expression of one single gene creates a major shift in the pollinator preference from one flower species to another.

Wheat genes go wild

Nils Arrigo, Roberto Guadagnuolo, Sylvain Lappe, **François Felber** (UniNE)

This study detected a significant introgression of wheat genes into natural populations of *Aegilops*, the European wild wheat relatives. Gene flow was prevalent at short distances of wheat fields, with the majority of introgressants occurring within 50 meters from cultivation. Nevertheless, a few introgressed individuals were reported at several kilometers from wheat fields, suggesting long distance dispersal. Two species were especially affected by this phenomenon: *Ae. triuncialis* and *Ae. neglecta*. Both are common in the Mediterranean



TG2

area. In addition, *Ae. triuncialis* represents a major concern since it occasionally acts as a weed. For instance, this species is considered to be a serious weed in California (US), where it spread as an adventive organism. Another part of the study showed that durum wheat (*Triticum turgidum*) is the most likely source of wheat genes, which is consistent with its regional abundance. These results were confirmed by a second study conducted in Andalusia (Spain) during the 2008 growing season.



Plants are wrapped in special paper bags in order to avoid accidental pollen flow

Ineffective crypsis in a crab spider

Rolf Brechbühl, **Sven Bacher** (UniFR)

The crab spider *Misumena vatia* can adapt her body colour to white or yellow depending on the colour of the flower she is hunting on. For over a century, this phenomenon has been used as a textbook example of camouflage that helps spiders hide more effectively from the eyes of their prey – mostly pollinators – and to improve their capture rate. A study carried out at the Universities of Bern, Fribourg and Tours (France) under the supervision of Sven Bacher has shown otherwise: colour-matched crab spiders do not catch more prey than unmatched conspecifics. They also do not seem to be protected from their own enemies.



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With the help of ten cameras, PhD student Rolf Brechbühl recorded more than 8.000 visits and the capture of 78 insects. Presently, it is not clear why spiders switch colours, but apparently camouflage is not the reason.



The crab spider *Misumena vatia* can adapt her body colour to white or yellow



GBIF, Per de Place Björn

Plants and light

Maximizing the photosynthetic potential

Matthieu de Carbonnel,
Christian Fankhauser (Unil)

Plants use photosynthesis to transform solar energy into chemical energy, which is typically stored in the form of complex carbohydrates such as starch. The existence of most organisms, including humans, depends on this reaction, which is constantly optimized in plants depending on the light conditions. The phototropin photoreceptors largely contribute to this optimization by controlling a number of adaptive responses such as positioning and flattening of the leaves, which maximizes light captured by the plant's solar panels (the leaves). How the phototropins control these developmental responses is poorly



TG6

understood. A recent study identifies members of the PKS family of plant specific proteins as regulators of these important growth responses. The importance of PKS2 in particular is demonstrated by showing that this protein is required to allow the plant to accumulate maximum amounts of biomass reflecting the efficiency with which plants transform light into chemical energy.



Leaves of an *Arabidopsis* mutant lacking PKS2 protein (left) compared to a normal plant (right)

Dynamics of photosynthetic complexes

Jean-David Rochaix (UniGE)

For an optimal growth, photosynthetic organisms need to constantly adapt to changing light conditions. One of these adjustments consists of maintaining a balance between the light excitation energy absorbed by photosystem II and photosystem I, which are connected through the electron transport chain. A key



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component in this process is an enzyme found in the chloroplast: Stt7/STN7 protein kinase. The group of Jean-David Rochaix has described in detail the mode of action of Stt7, and its dynamic association with large protein-chlorophyll complexes in the photosynthetic membranes.

Chlorophyll degradation

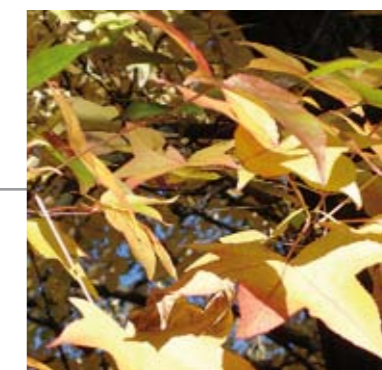
Stefan Hörtensteiner (UniZH)

Senescence is the final phase of leaf development leading to a change in colour and eventual death. This process is accompanied by chlorophyll break-down. The loss of green colour is catalyzed by the joint action of two enzymes, pheophorbide a oxygenase (PAO) and red chlorophyll catabolite reductase. For a long time it was considered that PAO activity was regulated by a protein termed "staygreen" (SGR), because mutants where SGR was not expressed



TG6

stayed continuously green and, compared to the wild type, had reduced PAO activity. However, this group recently showed that SGR functions independently and upstream of PAO in the chlorophyll breakdown pathway. In addition, they were able to show that the "green cotyledon" variety of pea, used by Mendel to establish the laws of genetics, is also deficient in SGR.



The expression of SGR protein is responsible for the change of colour of leaves from green to yellow

Inside the plant cell

The pharmaceutical promises of plastoglobules

Pierre-Alexandre Vidi, Claire Bréhélin, **Felix Kessler** (UniNE)

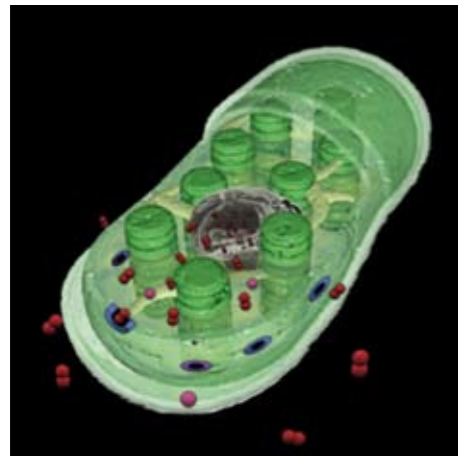
Plastoglobules are low density lipid droplets inside the chloroplast and contain many types of lipids including Vitamin E and K. For a long time the plastoglobules were believed to only store these lipids. Surprisingly, this research now suggests that plastoglobules actively participate in the production of some of these lipids: as an example, the VTE1



TG6

(tocopherol cyclase) enzyme is found at the surface of plastoglobules where it completes an important step of Vitamin E synthesis.

The group of Felix Kessler has also demonstrated the advantage of using plastoglobules as compared to other places of the chloroplasts for storing proteins. Plants can be genetically modified to synthesize "medical" proteins (such as insulin) that will then accumulate at the surface of plastoglobules. Then – and here lies the strong point of this technology – the low density plastoglobules together with the medical proteins can easily be isolated by phase separation, which looks like skimming cream off the top of fresh milk.



Starch breakdown to maltose happens in the chloroplast

The regulation of starch breakdown

Samuel C. Zeeman (ETHZ)

Starch degradation by the enzyme β -amylase is a key process in plant metabolism at night that results in the production of a sugar (maltose), an essential energy resource. In *Arabidopsis*, evidence was obtained that some β -amylase-like proteins have lost their catalytic capacity and obtained new biological roles. One is still required for starch breakdown and proposed to be a regulatory protein. Two others are localized in



TG6

the cell nucleus and are capable of influencing gene transcription. The Zeeman laboratory has also identified a novel phosphatase involved in the regulation of starch breakdown. It is a glucan phosphatase, which means that this enzyme removes covalently-linked phosphates from the glucan chains which comprise starch. This discovery gave rise to a new model for the regulation of starch degradation.

Fatty acids and stress in plants

Ted Farmer (UniL)

Plants react to severe biotic and abiotic stresses by producing reactive oxygen species (ROS). These can damage cells and organelles, such as chloroplasts. When damaged by these natural by-products, chloroplast fatty acids are broken down to release malondialdehyde (MDA). To ensure their survival, plants have developed strategies aimed at reducing the overproduction of toxic ROS. The researchers showed that MDA, resulting from omega-3 trienoic fatty acid (TFA) fragmentation, act as a sink for these



TG1

ROS. This hypothesis runs counter to the prevailing idea that nonenzymatic oxidation is always harmful. Furthermore, plants lacking TFAs were more susceptible to a fungal pathogen than wild-type plants.

Malondialdehyde accumulation (shown in green) in *Arabidopsis* mutant seedlings



The model plant *Arabidopsis thaliana*

Mycorrhizal fungi

The hidden allies of plants

Enrico Martinoia (UniZH)

More than 80% of plants improve their growth and development through a symbiotic association with mycorrhizal fungi. On the one hand, plants transfer carbon to the fungus and on the other hand, the mycorrhizae, considered as an extension of the root network, facilitate the uptake of nutrients from the soil to the plant.

In order to establish mycorrhizal associations, plants and fungi have to communicate. Plant secondary



TG7

products such as terpenoids and phenolics play an important role in this process. The group of Enrico Martinoia is investigating how plants excrete metabolites to the soil in order that the fungus can sense that a partner is in proximity and ready to be mycorrhized. They recently have identified a membrane protein which is involved in the release of such a signaling compound from the plant root.

With the help of earthworms

Roxane Milleret,
Jean-Michel Gobat (UniNE)

This group was interested in the combined role played by AMF and earthworms in the belowground zone of leeks. The soil stability, which reflects soil fertility, appears to be greatly improved by the combination of roots and AMF. Concerning plant growth, the earthworms and AMF had divergent effects on root



TG7

biomass. The largest root mass was achieved with the presence of AMF only, followed by the combination of AMF and earthworms. A further decrease in biomass occurred when only earthworms were present and the worst case was measured in pots without any AMF and earthworms.



Example of two-sided devices using *Petunia hybrida*

Towards a fertilizer alternative

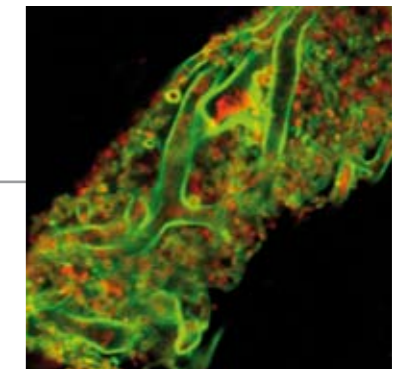
Uta Paszkowski (UniL)

Host plants of AM fungi acquire phosphate either directly from the soil or indirectly via the association with arbuscular mycorrhizal (AM) fungi. In



Paddy fields in Vietnam

Cells of the root cortex with a highly branched arbuscule (in green), which serves for nutrient exchange between the fungus and the plant



TG7

mycorrhizal plants the symbiotic uptake pathway typically dominates the direct route, delivering more phosphate to the plant than the roots acquire themselves. Uta Paszkowski's team (UniL) studies symbiotic phosphate nutrition in cereals to ultimately estimate the potential of the AM symbiosis as a fertilizer alternative to modern but sustainable crop production. They found that symbiotic phosphate uptake in cereals is mediated via different sets of related phosphate transporter proteins. In addition they discovered that in rice each of the two transporter proteins is required for the establishment and functioning of the AM symbiosis.

Plants get the initiative

Florence Breuillin,
Didier Reinhardt (UniFR)

This group has succeeded in showing, by genetic means, that the symbiosis is initiated by the plant and not by the fungus. By studying the symbiosis in petunia roots, they discovered a gene that promotes



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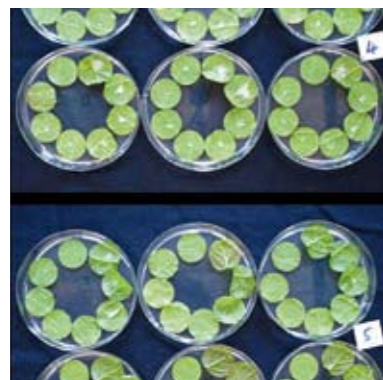
hyphal penetration in the roots. When this gene is absent, the colonisation of the roots by the mycorrhizal fungus is significantly reduced and nutrient supply to the plant is compromised.

Grapevine protection

Site and soil management

Barbara Thürig,
Lucius Tamm (FiBL, Frick)

The effect of site and soil management on the susceptibility of grapevine to *Plasmopara viticola* is one of the main topics of this project. Researchers have demonstrated that site ("terroir") is a key determinant for susceptibility of Chasselas and Pinot noir to *P. viticola*. Grapevines with identical genetic back-



Grapevine coming from different sites differed in their susceptibility to downy mildew



TG4

ground grown at three sites in the region of Lake Neuchâtel differed significantly and consistently in their susceptibility to *P. viticola* in a five year study.

By using new methods developed at the NCCR, the differences in susceptibility were also mirrored in the constitutive expression pattern of four defence-related genes. Furthermore, it was evaluated whether site-specific resistance can be modulated by agronomic practices such as the application of organic amendments.

Resistance to fungal diseases

Sylvain Schnee, Sophie Godard,
 Olivier Viret, **Katia Gindro** (ACW Changins)

Powdery mildew, caused by the obligate biotrophic pathogen *Erysiphe necator*, is one of the most important fungal diseases of cultivated grapevine (*Vitis vinifera*). Wild grapevine species appear, however, to be quite resistant to this pathogen. This fungal pathogen produces specialised infection structures in the host epidermal cells to take up nutrients. In the Bronner cultivar, the researchers identified several genes controlling the resistance to powdery mildew.



TG4

Regarding downy mildew (*Plasmopara viticola*), the ability of *Rheum palmatum* root extract and *Frangula alnus* bark extract to protect grapevine leaves was evaluated. Chemical analysis showed that these two natural extracts contain many phenolic compounds belonging to the anthraquinone family. Emodin alone is able to impair *P. viticola* development and to stimulate viniferins and the accumulation of pterostilbene, substances known for their protective properties.



Priming for resistance

Ana Slaughter, Jean-Marc Neuhaus,
Brigitte Mauch-Mani (UniNE)

Beta-Aminobutyric acid (BABA) was used to prime for resistance in grapevine (*Vitis vinifera*) against downy mildew (*Plasmopara viticola*). The researchers compared the increased reaction of the resistant cultivar Solaris and the susceptible cultivar Chasselas. Specific stilbenes active against *P. viticola* (particularly *trans*-pterostilbene) were produced in both BABA-primed cultivars upon infection by the pathogen. Infection also induced several genes encoding enzymes involved in the synthesis of these stilbenes.

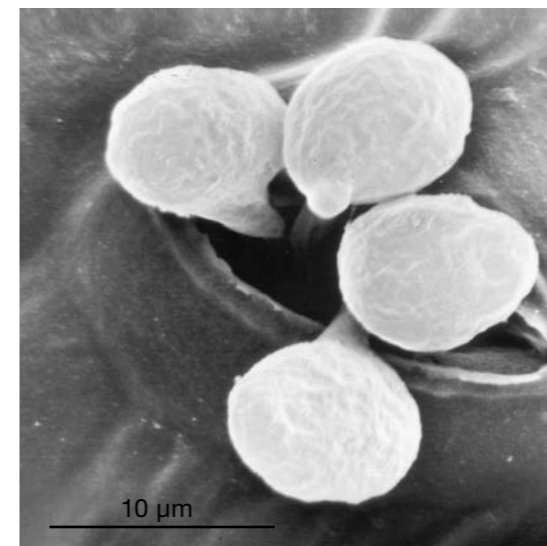


TG4

Thanks to new genetic tools developed at the University of Verona, the NCCR team could compare gene expression in Chasselas at various times after infection, with or without BABA-priming treatment. Apart from many expected plant defence genes, yet unknown genes were also found to be induced, particularly in primed plants. So far 23 primed genes have been confirmed, including defence-related genes.



Comparison between grapevine susceptible to *P. viticola* (left) and treated with BABA (right)



Spores of downy mildew penetrating through the stomatal aperture of a leaf



Variety of grapevine (Gamay) susceptible to downy mildew

Grapevine protection

Swiss Vitis Microsatellite Database (SVMD)

José Vouillamoz,
Claire Arnold (UniNE)



TG4

The Swiss Vitis Microsatellite Database's (SVMD) goal is to set up an online database containing the genotypes of all grape cultivars, rootstocks and wild grapevines growing in Switzerland, in collaboration with Agroscope ACW and the Computer science department (IIUN) of the University of Neuchâtel. Switzerland is one of the countries with the highest density of cultivars in the world (> 100 varieties for 15'000 Ha).

In addition to the genotypes, the SVMD reports the source where the sample comes from, the berries' colour, the species within the genus *Vitis*, the pedigree, the area of cultivation in Switzerland and the most common synonyms. The SVMD showed applications for the harmonisation of grape collections, the selection of material in research against pathogens or other biotic or abiotic stress, and for breeding programmes.

www.unine.ch/nccr/svmd



The SVMD database collected the genotypes of grapevine varieties grown in Switzerland

Tourisme neuchâtelois

A love flavour for grapevine moths

Daniela Schmidt-Büsser,
Martin von Arx, Patrick Guerin (UniNE)



TG5

The moths *Lobesia botrana* and *Eupoecilia ambiguella* are among the most important grapevine insect pests in Europe. One biotechnical control method, already used in half of all Swiss vineyards, consists of preventing male moths from reaching females using mating disruption. With this approach, dispensers placed in vineyards release synthetic sex pheromones

that imitate females and attract males, so preventing the moths from mating and reproducing.

The researchers have shown that when volatile compounds emitted from the grapevine are added to the synthetic sex pheromones, the combined signal's capacity to attract males is increased considerably. The plant signals apparently serve to increase the likelihood of females in the proximity of the host plant being detected by males. Both laboratory and field experiments that exploit the phenomenon for the purpose of improving pheromone disruption were successful.



Lobesia botrana
grapevine moth



Eupoecilia ambiguella
European grape berry moth

Invasive plants

Predicting the invasiveness

Olivier Broennimann,
Antoine Guisan (UniL)

A preliminary study on spotted knapweed (*Centaurea stoebe*) showed that invasive species may change their realised climatic niche between the native and the invaded ranges. This change can hamper



Centaurea stoebe showed changes in its realized climatic niche between the native and invaded ranges



TG3

predictions of species' distribution and spread in the new range. To solve this problem, a novel modelling approach combining data from the two ranges was illustrated using the spotted knapweed.

As a second step, niche similarity and niche equivalency in both environmental and geographic spaces were tested on 43 species. These plants were native from Europe or North America and invasive in the other range as well as in Australia. The results showed that if niche equivalency was rejected in most cases – hampering accurate predictions in the invaded ranges –, niche similarity was not rejected for a majority of species, confirming a tendency for niche conservatism across ranges.

Successful tetraploids

Patrik Mraz, Martin Henery, Urs Treier,
Heinz Müller-Schärer (UniFR)

The lower specific leaf area and thicker leaves in tetraploid as compared to diploid *Centaurea stoebe* plants fit well with the fact that in North America invasive tetraploids occupy a drier climatic niche. Compared to European tetraploids, there is also evidence of a shift towards a more strictly polycarpic life-cycle, less leaf dissection and greater carbon investment per leaf, indicating that post-introduction evolutionary change may have further contributed to the invasion's success.



TG3

Molecular marker studies based on more than 1000 plants show a clear reduction in haplotype diversity (i.e. the set of genes on the same chromosome) in the introduced range compared to the native one. They indicate several introductions from Eastern Europe, with fast and successful range expansion by one haplotype especially.



Tetraploidy may partly explain the success of *Centaurea stoebe* in North America

Disentangling invasiveness and invasibility

Aurélié Thébault, François Gillet,
Alexandre Buttler (EPFL)

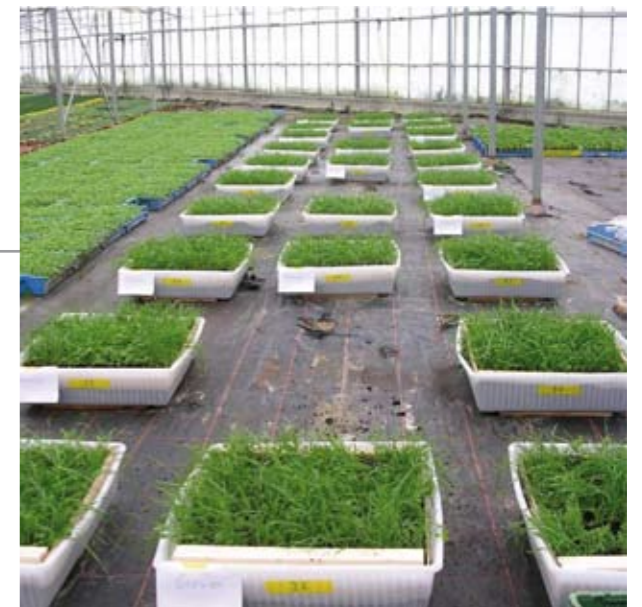
Experiments were conducted on two species. *Centaurea stoebe* is native from Europe and invasive in North America, whereas *Senecio inaequidens* – native from South Africa – is invasive in Europe, where it threatens biodiversity and forage production. Although these two Asteraceae species occupy similar ecological niches, they present distinct growth strategies leading to different invasion mechanisms. The large investment in seed production explains the invasive success of *S. inaequidens* through its high pressure on the surrounding vegetation, whereas *C. stoebe* takes advantage of the interactions with belowground microbial communities. Consequently, environmental factors limiting invasion success into a plant community depend on the invader's strategy.

Effect of community diversity and spatial arrangement on invasive success of two species: *Centaurea maculosa* and *Senecio inaequidens*



TG3

For both species, polyploidisation in the native range is linked to a specialisation towards higher competitive ability. Establishment and spread in the new range are related to a loss of specialisation that facilitates adaptation to different environments. Therefore, and as shown by our experiments, for a given invasive species, factors involved in community resistance change according to the invasion stage.



Invasive plants

Enhanced biological control

Urs Schaffner (CABI-Switzerland)

The ragwort *Jacobaea vulgaris* originating from Europe is an invasive weed in North America. The caterpillar *Longitarsus jacobaeae* is a specialist biological control agent of this plant. The researchers assessed plant performance and herbivore defence traits of populations originating from two regions of the introduced range, i.e. New Zealand and North America, that were either exposed or not to biological control management by *L. jacobaeae*. Opposite to predictions, populations which had been previously exposed to this biocontrol agent showed less resistance to *L. jacobaeae*. However, no significant



TG3

differences were found between populations with and without biological control history in terms of specific chemical defense traits or plant growth.

These results indicate that the invasive plants have not evolved increased resistance against the biological control agent, and that the successful biological control of tansy ragwort in western North America will persist.



The caterpillar *Longitarsus jacobaeae* is known as a biological control agent of *Jacobaea vulgaris*

Causes of invasiveness

Mark van Kleunen, Markus Fischer (UniBE)



TG3

In a larger garden experiment, European plant species were grown under different environmental conditions (shaded, unshaded, fertilized, unfertilized). It appeared that the plants that produced a high biomass were more likely to become invasive upon introduction into other continents than related species producing

a low biomass and experiencing the same condition. Plants responded to shading by increasing the biomass allocation to light-capturing structures, but these plastic shade-avoidance responses did not differ between invasive and non-invasive species. The researchers conclude that high biomass production across different environments pre-adapts species to become invasive. This pre-adaptation is more likely to be mediated by trait values that allow for high light capture in different light environments rather than by phenotypic plasticity of these traits.



Trifolium medium
Non-invasive



Campanula patula
Non-invasive



Trifolium repens
Invasive



Campanula rapunculoides
Invasive

Modelling interactions

Guided by odours

Ingrid Ricard,
Anthony C. Davison (EPFL)

The stochastic modelling of insect behaviour, stimulated by data from Ted Turlings' team (TG1), has possible implications for bio-control of herbivore pests. Olfactometer experiments are used to determine the effect of odours on the behaviour of organisms such as insects or nematodes. They typically result in data comprising many groups of small counts, overdispersed relative to the multinomial distribution. Different models describe the influence of olfactory cues, visual cues, or simple overdispersion due to environmental effects on the behaviour of wasps in an olfactometer.

Parasitic wasps are the natural enemies of herbivore caterpillars



TG9

Such models help in comparing the factors that affect the choices made by organisms in an olfactometer, make quantitative comparisons of the reactions to the different treatments more precise, and can help experimenters to devise more efficient ways to obtain their data.



War around the thistle

Thomas Clerc,
Louis-Félix Bersier (UniFR)

This study focused on the predator-prey interactions in the surrounding of the creeping thistle. The aim was to develop a new approach to study predator-prey dynamics based on stochastic modelling, rather than on traditional differential equations. The advantage of such an approach is that it perfectly reflects the discrete nature of predation (a prey is eaten or not), which is decisive to explore the stability of systems. To illustrate the method, the researchers applied their model to the data of Sven



TG9

Bacher's group (TG1) who observed the depletion of the thistle shield beetle (*Cassida rubiginosa*) due to its exclusive predator, the paper wasp *Polistes dominulus*. While corroborating the main conclusions resulting from this work, the new stochastic approach highlighted a significant difference between the two years for which data were available, and suggested improvements to the design of future experiments by finding the optimal observation interval for this system.



The study focused on predator-prey dynamics around the creeping thistle

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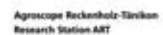


PLANT SURVIVAL

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