Detoxification of the Fusarium mycotoxin zearalenone is an important trait of Clonostachys rosea in biocontrol of Fusarium foot rot of barley.

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Abstract: The sensitivity of *Trichoderma atroviride* and *T. hamatum* biocontrol agents to a range of common soil fungi and actinomycetes was tested in co-culture on agar medium, sterile and non-sterile soil. Six test fungi (*Alternaria alternata, Aspergillus niger*, *Chaetomium globosum*, *Metarhizium anisopliae*, *Paecilomyces lilacinus*, and *Daldinia eschscholzii)* inhibited both *Trichoderma* species to varying degrees. In general, *T. atroviride* was more sensitive than *T. hamatum* and inhibition observed in agar culture and sterile soil was greater than that observed in non-sterile soil. Our results suggest that *Trichoderma* populations would be maintained in the soil when exposed to field levels of these test microbes and that biocontrol activity would not be compromised.

Abstract: The efficacy of the biocontrol agents (BCAs) Serenade, Prestop, Trianum P and Boniprotect Forte, applied as 4 or 5 spray programmes starting pre-flowering or at first flower for control of *Botrytis cinerea* fruit rot on blackcurrant cultivars Ben Hope and Ben Tirran was compared to a standard fungicide programme at similar timings and an untreated control. Programmes based on fungicides for the first 3 sprays followed by one, two or no sprays of Serenade were also included. The incidence of *B. cinerea* was assessed on green fruit samples on paraquat agar and on harvested fruit following 7 days damp incubation. The incidence of *B. cinerea* fruit rot pre-harvest on bushes was negligible. The incidence of *B. cinerea* in green fruit samples varied from 0-100% *B. cinerea* and in post-harvest tests varied from 0-70%. For Ben Tirran the incidence of *Botrytis* in post-harvest in untreated fruit was around 12%. All treatments, including the BCAs, significantly reduced the incidence of *B. cinerea* rot compared to the untreated. Best control was achieved by treatment 2 (4 x fungicide treatments) and 7 (3 early fungicides + 2 late Serenade). Replacing the fourth fungicide with two treatments with the BCA Serenade appeared to have some benefit in *B. cinerea* control. *B. cinerea* rot incidence was more variable on fruit from Ben Hope most likely due to the drier weather and hence lower botrytis risk, when this cultivar was flowering. This made the data more difficult to interpret. The lowest incidence of botrytis in the post-harvest tests was recorded in fruit from treatment 2 (4 x fungicide treatments).

Abstract: The soil-borne pathogen *Rhizoctonia solani* Kühn is responsible for serious damages on a wide range of important crops worldwide. Efficient control strategies against *R. solani* are urgently required. Application of individual biocontrol strains has often resulted in inconsistent

performance in the field. Consequently biocontrol activity was assessed by combining biocontrol strains with different modes of action to overcome this problem. The bacterial antagonist *Pseudomonas jessenii* and the mycoparasite *Trichoderma viride* were selected as promising control agents against *R. solani* the causal agent of bottom rot on lettuce. Growth chamber experiments were performed to investigate the biocontrol efficacy of individual and co-inoculation treatments of these biocontrol agents in the presence and absence of *R. solani* on lettuce. Additionally, the impact of the inoculants on compositions of bacterial and fungal communities in the rhizosphere of lettuce was studied by analyzing with 16S rRNA and ITS-based fingerprinting methods. Biocontrol efficacy was improved in co-inoculants treatment of *P. jessenii* and *T. viride* compared to individual inoculant application. DGGE analysis revealed a more pronounced effect on the bacterial and fungal community in the treatment with both inoculants compared to individual bacterial and fungal inoculant application. In summary, the applied cultivation-independent methods provided insights into the complex interaction in response to the pathogen presence and to biocontrol strains inoculation.

Abstract only

Abstract: A Colombian strain of *Pseudomonas fluorescens* Ps06 was formulated as a powder which stabilized cells viability during six months at 8°C ± 2. This formulation significantly reduced ($P < 0.05$) incidence and severity of first symptoms of tomato crown rot in 86% and 50%, respectively. Developed biopesticide could be a useful tool to control *F. oxysporum* in tomato crop.

Abstract: Examination of the dynamics of the phylloplane yeast populations revealed immature fruits showed significantly larger populations than mature fruits or leaves. The dominant yeasts belong to the genera *Cryptococcus*, *Rhodotorula*, as well as *Sporobolomyces* and showed resistance to the two major fungicides applied to strawberry cultures. This suggests potential use of phylloplane yeasts in the integrated control of fungal diseases in strawberry.

Abstract: An alkaline protease gene was amplified and characterized from genomic DNA and cDNA of *Aureobasidium pullulans* PL5. Expression of ALP5 in *Escherichia coli* BL21 (DE3) yielded an homogeneous recombinant ALP5 which hydrolysed the substrate casein and inhibited the mycelial growth of the pathogens. This study provided the direct evidence that extracellular proteases secreted by the antagonist *A. pullulans* PL5 played a role in the biocontrol activities against some postharvest pathogens of apple and peach.

Abstract: Plants were inoculated with the endophytic *Penicillium* sp. and then appeared to be over sensitive to phytopathogens, which is quite original in terms of biocontrol. In this case the inoculated plants displayed stronger symptoms than the control. On the other hand an extraction of the growth medium was found to be active and provided protection to plants against

pathogens. It is likely that the benefit coming from the described endophyte will not be due to introduction of the endophyte into the plant rather using its secondary metabolites as "natural pesticides".

Abstract: Plants have evolved the ability to enhance their basal resistance after perception of specific stimuli, such as root colonization by selective rhizobacteria or derived microbial-associated molecular patterns. In this study, we examined the differences and similarities in term of the effectiveness of various bacteria with different origins to trigger ISR and to induce or prime some defence responses in grapevine. We especially focused on oxidative burst in grapevine cell suspensions and systemic production of stilbenic phytoalexins, trans-resveratrol and its dehydrodimer ε-viniferin in plants.

Abstract: With the climate change, the temperature is going to play a key role in the effectiveness of microbial biocontrol agents. The influence of this environmental factor on the ecology and biocontrol activity of *Bacillus amyloliquefaciens* strain S499 has been investigated in this work. On this purpose, the effect of temperature on the ability to move onto solid surface, to form biofilm, to persist onto plant rhizosphere and to induce systemic resistance in plants have been evaluated *in vitro* and *in vivo*.

Abstract: The activity of a biological control agent, strain LL, previously identified as *Aureobasidium pullulans*, was tested for the first time on peach, apple and orange artificially inoculated with *Monilinia laxa*, *M. fructicola*, *M. fructigena* (peach) and *Botrytis cinerea*, *Colletotrichum acutatum*, *Penicillium expansum* (apple) and *P. digitatum*, *P. italicum* (orange). The washed cells of the antagonist were effective against all eight pathogens, inhibiting decay by over 94%; in particular the antagonist completely controlled *M. laxa, M. fructicola*, *C. acutatum, P. digitatum* and *P. italicum*. To our knowledge this is the first study considering the biocontrol of eight postharvest fruit pathogens with an *A. pullulans* strain in the same experimental conditions. Under postharvest conditions, in peaches inoculated with *Monilinia* spp., treated with the antagonist and stored at 0°C for 21 days plus 7 days of shelf-life, the antagonist was able to completely inhibit *M. laxa* and *M. fructicola*. In the same way, blue mould caused by *P. expansum* was significantly reduced on apple, after 120 days at 0°C, plus 7 days at 20°C. In *in vitro* trials, the VOCs released by the antagonist significantly inhibited the growth of all seven tested pathogens compared to the control, although with a different rate depending on the pathogen. These preliminary data, showing the efficacy of the *A. pullulans* LL strain in the control of the main postharvest fruit diseases, are promising for the development of a biofungicide for postharvest applications on a wide range of species and pathogens.

Abstract: Main pathogens isolated from symptomatic Forelle pears were *Botrytis cinerea*, *Penicillium expansum* and *Alternaria* spp. Iprodione and pyrimethanil significantly reduced total decay in 2010. In 2011 fludioxonil, iprodione, pyrimethanil and pyrimethanil plus imazalil were also efficient. These fungicides decreased *Penicillium expansum*, *Alternaria* spp. effects and secondary decay caused by *Botrytis cinerea*. The biological control agent *Cryptococcus albidus*

powerful tools for monitoring both active and non-active forms of *T. harzianum* in pure cultures and nursery substrates. Moreover, proper isolates of *T. harzianum* have been screened and selected according to the highest biocontrol potential and effectiveness against the target disease. To enhance the biocontrol effect of *T. harzianum*, enrichment with chitin-rich wastes has been successfully applied, decreasing the incidence of the pathogen.

Abstract: Hyphae of *Ustilago nuda* and *U. tritici* were observed to invade the shoot apical meristem and leaf primordia of barley and wheat respectively, already during the first days after the onset of germination. In a screening performed *in vitro,* a number of microorganisms and plant extracts inhibited the germination of teliospores of *U. nuda*. However, in field experiments with barley and wheat sufficient and reliable control of loose smut by seed treatment with selected agents was not obtained. On oat, seed treatment with ethanol (70%) provided a level of 75-80% control.

Abstract: Biocontrol control effect of *Pseudomonas* CMR12a, a rhizospheric bacteria which is able to produce phenazines and biosurfactants, was investigated in different soil-sand combinations. According to statistics, disease suppressive capacity of phenazines and biosurfactants was substrate-dependent and disease severity increased with the proportion of sand. In substrate containing 50% or 75% of potting soil, the presence of either phenazines or biosurfactants was sufficient to suppress bean root rot. However, in substrate containing 25% of potting soil, the involvement of both compounds was required to achieve successful biocontrol activities.

Extended abstract

Abstract: Two native isolates of rhizobacteria (*Pseudomonas migulae* Pf014 and *Bacillus amyloliquefaciens* Bs006), were selected for their effectiveness as plant growth promoters and biocontrol against *Fusarium oxysporum* in cape gooseberry in nursery, while *T. koningiopsis* Th003 only expressed biocontrol activity. However, when they were formulated and applied in field, Th003 was the most efficient biocontrol agent (5% incidence, compared to 20% in the untreated control), although rhizobacteria increased yield up to 48%.

Abstract: Fusarium Head Blight (FHB) is one of the most economically devasting disease of wheat, causing losses in yield and quality due to the presence of *Fusarium* damaged kernels and their associated mycotoxins such as the trichothecene deoxynivalenol (DON). Biological control, including treatment of crop residues with antagonists, alone or in combination in a multitrophic approach, to reduce pathogen inoculum of FHB, holds considerable promise. *Trichoderma gamsii* 6085 has been selected for its ability to grow in presence of DON and to reduce "*in vitro*" growth and mycotoxin production by *F. graminearum* and *F. culmorum*. *Pythium* sp. SC1-14a has been investigated for its antagonistic and competitive ability against FHB causal agents. When tested in a field trial as biocontrol agents on wheat, either as soil or spikelets inoculant, both antagonists

Abstract: Due to the reduction of peat in ornamental substrates, great attention is focusing on setting up new and innovative substrates for this market. In the present work, *Trichoderma* spp. isolates were selected for endophytism and plant growth promotion in *Limonium sinuatum*, *Cupressus sempervirens* and *Camelia sinensis*. Ten isolates (out of 162) for Limonium, 9 (out of 162) for Cupressus and 8 (out of 202) for Camelia resulted endophytic in roots. From a successive round of inoculation three *Trichoderma* isolates, among which T2046 was in common for all the tested species, confirmed the best endophytic performance and improved growth. In addition, the antagonistic activity of selected strains against fungal plant pathogens such as *Botrytis cinerea*, *Colletotrichum gloeosporioides* and *Rhizoctonia solani* have been evaluated. The three *Trichoderma* isolates, and first of all T2046, could be taken into account as inoculants for innovative substrates for ornamental plants.

Abstract: *Penicillium simplicissimum* GP17-2, was evaluated for its ability to induce resistance against *Cucumber mosaic virus* (CMV) and *Pseudomonas syringae* pv. *tomato* DC3000 (Pst) in *Arabidopsis thaliana* and tobacco plants. All plants treated with BGI of GP17-2 or its culture filtrate showed a significant reduction in disease severity compared control plants. RT-PCR results showed that multiple defence pathways were involved in GP17-2-mediated resistance to CMV and Pst.

Abstract: *Trichoderma harzianum* 6776 has shown a biological control activity against *Rhizoctonia solani* on radish under two different inoculation procedures. When tested on tomato seedlings, it is able to stimulate plant growth under greenhouse condition. In addition, biocontrol activity against soil-borne pathogens (*R. solani, Fusarium oxysporum* f. sp. *lycopersici* and *F. oxysporum* f. sp. *radicis-lycopersici*) has been evaluated on tomato, showing positive results and suggesting a future employment of this strain as biopesticide.

conidia suspension or liquid culture. In the first type of soil only liquid culture seed treatment significantly increased the percentage of healthy plantlets, irrespective to biofumigation, suggesting a role for the metabolites produced during *T. harzianum in vitro* growth. These results were substantially confirmed also with the second type of soil.

Abstract: Endophytic *Streptomyces* sp. strain MBCN152-1 which was isolated from cabbage greatly reduced disease severity on plug-seedlings of cabbage after spray-inoculation with *Alternaria brassicicola*. Furthermore, amendment of growing medium with MBCN152-1 strongly inhibited the incidence of damping-off of cabbage seedlings raised from seeds artificially infested with *A. brassicicola*. Microscopic observation revealed that hyperparasitism is one of the modes of action of strain MBCN152-1. These results indicated that strain MBCN152-1 is a suitable candidate for the biological control of *A. brassicicola*. Endophytic actinomycetes, isolated from strawberry plants, were tested for inhibition of anthracnose, caused by *Glomerella cingulata*, on detached leaflets and plug seedlings of strawberry. *Streptomyces* sp. strain MBFA-172 strongly inhibited symptom development on the detached leaflets and significantly reduced disease incidence on strawberry plug seedlings. Strain MBFA-172 provided higher level of protection than a commercial biofungicide (*Talaromyces flavus*) and comparable level with a chemical fungicide (propineb) under greenhouse conditions. A spontaneous thiostrepton-resistant mutant of MBFA-172 colonized aboveground parts of strawberry plants at mean population densities of 3.2×10^3 to 7.2×10^5 cfu/g (fresh weight) even after 21 days of foliar application. These results indicated that MBFA-172 has a great potential as a biocontrol agent for strawberry anthracnose.

Abstract: Spot blotch caused by *Bipolaris sorokiniana* (teleomorph *Cochliobolus sativus*) is a serious disease of barley in Libya. A small-scale field experiment was carried out in the UK to test the effectiveness of *Trichoderma harzianum* T-22 for controlling spot blotch in two Libyan barley cultivars, Nibola and Rehan. Nibola was significantly more resistant to spot blotch than Rehan. Two methods of applying T-22, foliar spray and seed coating, were tested individually and in combination. There was some reduction in disease severity with all three application methods, but the combined treatment most consistently reduced disease severity and increased yields of both cultivars. The results provide evidence that combining disease resistance with biological control may be beneficial for spot blotch management.

Abstract: The sugar beet endophyte *Pseudomonas poae* RE*1-1-14 is a component of an antagonistic cocktail developed to control root rot diseases in sugar beet. Based on an extended screening process the microbial compilation also includes the rhizobacteria *P. fluorescens* L13-6-12 and *Serratia plymuthica* 3Re4-18. To assess cell numbers during the seed treatment procedure, subsequent storage of the inoculated seeds and, finally, in course of plant development, a quantitative real-time PCR method was established for the model strain *P. poae* RE*1-1-14. For cultivation-independent monitoring of the population dynamics of the strain, we developed a pair of SCAR (Sequence Characterized Amplified Regions) primer for a specific 580 bp fragment derived from a comparative U-PCR approach. In combination with a strain-specific probe, the primer set was suitable to be employed in a TaqMan® real-time PCR assay. The described system allows the accurate detection and quantification of the antagonist in sugar beet seed coatings and *ad planta* under greenhouse conditions.

Extended abstract

Abstract: *Aspergillus flavus* is a major pathogen of groundnut in many countries, including Nigeria. Infection can result in contamination of groundnut seed with the mycotoxin, aflatoxin, which poses a potent threat to the health of individually consuming infected nuts. In preliminary experiments twelve plant oils were screened for inhibition of *A. flavus* on amended PDA plates. Only four extacts; clove, camphor, garlic, and galangal oils showed high inhibitory effects. Clove oil and camphor oil also significantly suppressed infection of groundnuts by *A. flavus* in amended compost, when applied as seed treatments. Biological control based on use of *Trichoderma* spp. (*T. harzianum, T. viride and T. asperellum*), *Bacillus amyloliquifaciens* (isolates MBI 600, 62P and 66P) and *Pseudomonas chlorophis* was also evaluated. *In vitro* assays on agar plates showed the *Trichoderma* spp. and *Bacillus* isolates 62P and 66P were the most active. These same organisms were also effective in improving emergence when applied as a seed amendment to seed sown in *Aspergillus*-inoculated compost. When applied as a preventative treatment to groundnut pods, the *Trichoderma* spp. were also effective in suppressing infection, when the pods were subsequently inoculated with *A. flavus*. A strategy may be therefore be possible which provides control of *A. flavus* on groundnut, using BCAs and plant extracts, applied alone or in combination.

Abstract: This study aimed at evaluating the potential of fish hydrolyzed (FH), fish emulsion (FE), shrimp peel powder (SP), *Sargassum* seaweed powder (SW) and mussel shell powder (MS) to induce suppressiveness against *Cylindrocladium spathiphylli* in container media. In the container media, naturally infested, FH and FE at concentrations of 0, 5, 10, 15, 20 and 25% (v/v) of the volume of water required to reach the water retention capacity of the container media, and SP, SW and MS at concentrations of 0, 1, 2, 3, 4 and 5% (v/v) were incorporated. The mixtures were incubated for 10 days at room temperature. Afterwards, the mixtures were transferred to plastic pots of 300 ml, followed by the planting of one plug of *Spathiphyllum* 'Opal'/pot. When planting, at 90 and 180 days of cultivation, microbial respiration, carbon microbial biomass (MBC), and fluorescein diacetate hydrolysis (FDA) were determined. The incidence was

cultivars planted in individual pots: *Vitis vinifera* cv. Alphonse Lavallée grafted onto110 Richter and *V. vinifera* cv Muscat de Hambourd grafted onto 161-149 Couderc. In 2011 the product efficacies expressed by the attack frequencies and intensities of *P. viticola*, showed that the solutions of *F. alnus, E. arvense* and of D-fructose associated with copper 100g/ha, were as effective as copper hydroxide 600g/ha. They significantly reduced attack rates versus the untreated control. *A. vulgaris* extract had no visible effects. Further experiments will be conducted in 2012 to corroborate these interesting data.

Abstract: A biopesticide prototype based on a strain of *Rhodotorula glutinis* Lv316 that exhibit a high biocontrol activity against *Botrytis cinerea* was formulated as a concentrate suspension. A culture medium was developed to reach a yield of 6×10^9 cell/ml in batch fermenter for both 13-l. Two biopesticide prototypes were developed, one of them was supplemented with an optical brighteners which conferred a high UV-B protection (62%). Both presented high biocontrol activity since their efficacy ranged from 55 to 65% in a blackberry commercial crop, compared with 45 and 26% disease reduction using a chemical treatment difenoconazol and carbendazim, respectively.

Abstract: *Streptomyces anulatus* S37 is an actinomycete able to colonize grapevine *in-vitro* plants and inhibit the growth of *Botrytis cinerea*. This strain has also a great potential to produce antifungal metabolites. These results indicate the potential of developing effective actinomycetes from Moroccan habitats for the biological control of *B. cinerea*. Further studies are ongoing to better understand the activity of each of the purified molecules.

Abstract only

Abstract: Human activities are altering the concentrations of ozone in the troposphere and hence in the incidence of ultraviolet-B (UV-B) on Earth's surface. Although representing only five percent of UV-B radiation striking the Earth's surface, this radiation has the potential to cause effects on biologically active molecules. Sensitivity to UV-B radiation is one of the limitations of biological control of plant pathogens in the field. The objectives of this work were to evaluate the effects of UV-B on several isolates of *Clonostachys rosea*, and the ability of an isolate of *C. rosea*, previously selected for its tolerant to UV-B radiation, to control *Botrytis cinerea* on strawberry leaves in controlled conditions (strawberry leaf discs). The germination of *C. rosea* conidia was inversely proportional to the irradiance. The most tolerant strain (LQC62) had relative germination of about 60% after irradiation of 4.2kJ/m^2, and this strain was selected to be used in the subsequent studies. The data showed that even with exposure to UV-B radiation, *C. rosea* LQC62 controlled the pathogen. Conidial concentrations of strain LQC62 above 10^5 conidia/ml showed higher tolerance to UV-B radiation and increased ability to control more than 75% of the *B. cinerea* even with exposure to radiation. According to our results, in addition to

with a soil-less drip-irrigation system. Differential nitrogen nutrition was applied for the last four weeks prior to pruning, treatment of wounds with the biocontrol agents and inoculation with two strains of *B. cinerea*. They were then incubated in conditions conducive to disease development. Plant fertilization had a highly significant effect on disease development for both strains tested and it significantly influenced the efficacy of both biocontrol agents. High nitrogen fertilization generally decreased disease severity and also enhanced the efficacy biocontrol.

Abstract: The plant growth promoting fungus (PGPF) *Penicillium simplicissimum* GP17-2 induces systemic resistance against fungal and bacterial pathogens. The induced systemic resistance (ISR) signalling involves multiple plant hormone mediated paths, including salicylic acid, jasmonic acid, and ethylene. In this study, we investigated the signal transduction of GP17-2-mediated ISR by microarray and comprehensive *cis*-regulatory elements prediction. The prediction provided the candidates of various putative ISR and also plant hormone-responsive elements. Signalling cross-talk among GP17-2 and plant hormone responses including salicylic acid, hydrogen peroxide and abscisic acid were detected by comparative microarray analysis and *cis*-regulatory elements prediction. These results provide that new knowledge of transcriptional network of GP17-2-mediated ISR and plant hormone signalling.

Extended abstract

Abstract: The mycoparasite *Ampelomyces quisqualis* strain ITA3 is a biocontrol agent of powdery mildew disease but the mycelium and conidia production of the fungus still needs to be developed. The objective of this research is to find out the optimum conditions for high mycelium and conidia production of the strain ITA3. At submerged-fermentation stage (vegetative growth), the nutrition factors (carbon source, nitrogen source and C/N ratio) were optimized whereas at solid surface-fermentation stage (sporulation) culture nutrient medium was optimized for lower cost. The results showed that, out of three kinds of carbon source, sucrose (jaggery) gave the highest mycelia growth compared to dextrose and glucose. The organic nitrogen sources (i.e. potato extract, yeast extract, malt extract, urea) gave a better significant growth for *A. quisqualis* strain ITA3 ($P < 0.001$) compared with the inorganic nitrogen source (sodium nitrate, ammonium chloride). The C/N ratio and agitation speed were also optimized for higher mycelium growth of the fungus. It was observed that the harvested mycelium from stationary growth phase of ITA3 (6 days) transferred into a solid potato extract agar plate gave higher sporulation (4 days) in comparison to transferring it into solid jaggery and potato dextrose agar plates. At this optimum condition the strain ITA3 produced an average of 5×10^8 conidia per g of mycelium after 96 hours. These outcomes indicate that the higher mycelium and spore production of *A. quisqualis* strain ITA3 can be achieved with a two-step fermentation system by the short period with cheaper culture medium.

Abstract: Dry mycelium and culture filtrate from 3 isolates (PW1, PW2 and KKU) of luminescent mushroom (*Neonothopanus nambi*) were extracted in order to obtain bioactive compounds. Extraction using dry mycelium derived bioactive compound powder more than using culture filtrate with extraction efficiency of 8.7-12.9%. The effect of bioactive compound was investigated on infectious larvae (J2) of root-knot nematode (*Meloidogyne incognita*) in laboratory. The result showed that bioactive compound at concentration 500mg/l caused 100% mortality of J2 in 1 min. Concentrations of 100 and 50mg/l affected J2 causing significantly mortalities of 100% in 30 min and 48h, respectively. Effect of this bioactive compound on J2 was also confirmed in screened house experiment and found that concentrations of 100 and 500mg/l suppressed evidently J2 without root-knot symptom on tomato plants. Root-knot score 1 was detectable on tomato plants treated with the compound of 10 and 50mg/l. However, it was significantly ($P < 0.05$) from control treatment, which exhibited root-knot score 4. The mushroom spawn was also tested on control of root-knot nematode with chili plant under green-house condition. Spawn of 10, 20, 30, 40 and 40g/plant were infested in chili plants grown in pots. Galling percentage was evaluated on 30 days after treated with spawn. The result indicated that all rate of spawn suppressed root galling. In particular, the treatment of 10g/plant reduced significantly ($P < 0.05$) 85% (galling index 12%). While in control and chemical treatments, galling indexes were 75 and 60%, respectively. This study suggests the efficiency and potential of the application of bioactive compound from *N. nambi* for control root-knot nematode.

Abstract: An *in vitro* method enabling to inoculate tomato roots with Fusarium oxysporum 47 and 48h later with *Fusarium oxysporum* f. sp. *lycopersici* 8 was developed. Results show that colonization of tomato roots by Fo47 is able to induce a primed state of roots, which results in a higher expression level of defence-related genes (*GluA*, *Chi3*, *PR1a*) upon pathogenic *F. oxysporum* attack.

Abstract: Elicitors of animal origin were tested on wheat as inducers of resistance to powdery mildew. Their effect was compared with the inducer of chemical origin benzothiadiazole and with inducers of plant origin. Effect of animal- and plant-origin elicitors on disease severity differed in two years of experiments under field conditions. Inducers of animal origin could be potential sources of plant- induced resistance to diseases.