Bulletin de veille du Réseau des Ecotoxicologues de l'INRA, N°4

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Edito

Après une période de silence et les congés d'été, voici notre quatrième bulletin. Il est essentiellement consacré au suivi des productions des membres du réseau.

Plusieurs thèmes nouveaux de veille sont à l'étude. Ils seront, ainsi que les thèmes plus anciens, repris dans le prochain bulletin à paraitre en octobre prochain.

N'hésitez pas à nous faire part de vos remarques et suggestions sur la forme et le contenu de ce bulletin, sur des propositions de thèmes à mettre en veille, ou sur votre souhait de prendre en charge la veille sur une thématique précise. Contact : christian.mougin@versailles.inra.fr.

Bonne lecture !

L'équipe de veille

Sommaire

Publications des membres du réseau Ecotox

Fate of 14C-organic pollutant residues in composted sludge after application to soil

Haudin, C. S.; Zhang YuHai; Dumeny, V.; Lashermes, G.; Bergheaud, V.; Barriuso, E.; Houot, S.

Chemosphere, 92 (10):1280-1285; 2013

Abstract: Organic micropollutants may be present in biosolids, leading to soil contamination when they are recycled in agriculture. A sludge spiked with 14C-labelled glyphosate (GLY), sodium linear dodecylbenzene sulphonate (LAS), fluoranthene (FLT) or 4-n-nonylphenol (NP) was composted with green waste and the fate of the 14C-micropollutant residues remaining after composting was assessed after the compost application to the soil. 14C-residues were mineralised in the soil and represented after 140 d 20-32% of the initial activity for LAS, 16-25% for GLY, 6-9% for FLT and 4-7% for NP. The 14C-residues at the end of composting that could not be extracted with methanol or ammonia were minimally remobilised or even increased for FLT. After 140 d, non-extractable residues represented 38-52% of all of the 14C-residues remaining in the soil for FLT, 50-67% for GLY, 91-92% for NP and 94-97% for LAS and in most cases, less than 1% of the 14C-residues were water soluble, suggesting a low direct availability for leaching and microbial or plant assimilation. FLT was identified as the main compound among the methanol-extractable 14C-residues that may be potentially available. The fate of the 14C-organic pollutant residues in composts after application to soil could be assessed through a sequential chemical extraction scheme and depended on the chemical nature of the pollutant.

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Earthworms highly increase ciprofloxacin mineralization in soils

Mougin, C.; Cheviron, N.; Repincay, C.; Hedde, M.; Hernandez-Raquet, G.

Environmental Chemistry Letters, 11 (2):127-133; 2013

Abstract: This report shows that earthworms increase up to eight times the mineralization of the antibiotic

ciprofloxacin in soils. Antibiotics are extensively used and disseminated in environmental compartments. Antibiotics may enter food chains and thus induce resistance in environmental and human commensal bacteria. The antibiotic ciprofloxacin is suspected to induce significant adverse effects on soil microbial processes, with possible consequences on soil functions. Nevertheless, little is known concerning the fate of ciprofloxacin in soils. Here, we studied the mineralization and distribution of the [2-14C]-ciprofloxacin in soil-plant-water systems where ciprofloxacin was applied by amendment of spiked pig slurry. Results show that a very weak microbial mineralization of the antibiotic, lower than 0.01%, occurred after 84 days of incubation. By contrast, the addition of earthworms increased from 5 to 8 times ciprofloxacin mineralization during the following 84 days incubation. In addition, earthworm activity induced the transfer of 40% of radioactive compounds from the upper to the lower layer of soil, modifying the distribution of the antibiotic within the soil profile. We conclude that earthworms can be used efficiently to mineralize ciprofloxacin and modify its distribution in soils. As a consequence, earthworms change the exposure of soil organisms to ciprofloxacin, and, in turn, the eco-toxicological impact of the antibiotic.

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Inability of Near Infrared Reflectance Spectroscopy (NIRS) to identify belowground earthworm casts in no-tillage soil

Bottinelli, N.; Capowiez, Y.; Hallaire, V.; Ranger, J.; Jouquet, P.

Applied Soil Ecology, 70 57-61; 2013

Abstract: Several studies have emphasised the ability of Near Infrared Reflectance Spectroscopy (NIRS) to identify surface earthworm casts in the field. However, less is known about casts deposited within the soil, which usually represent the majority found in the field. This study tested the ability of NIRS to identify belowground casts in agricultural systems. Casts and surrounding soils were sampled at depths of 20-30 cm in a loamy soil under no tillage for 12 years. To distinguish different types of cast, sizes and orientations relative to the horizontal plane were measured. NIRS analyses and analyses of carbon and nitrogen content were also performed to compare casts to surrounding soils. Casts were classified into 4 size classes, with no preferential orientation. Cast carbon and nitrogen content were not influenced by their size and did not differ from surrounding soils. PCAs performed on the NIRS data did not allow casts to be differentiated from surrounding soils, regardless of size class. However, soil aggregates were clearly differentiated probably due to their spatial distribution in the soil. Although this study did not identify specific NIRS signatures for casts, it shows the utility of this method to investigate the origin of the soil consumed by earthworms. In our case, NIRS analyses suggest that the high bulk density of the soil (1.42 g cm -3) forced ingestion by endogeic earthworms, simply to move around, without preferential selection for organic matter. Consequently, their casts were deposited a few mm from where they had ingested soil with similar organic matter quality.

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Can body condition and somatic indices be used to evaluate metal-induced stress in wild small mammals?

Tete, N.; Fritsch, C.; Afonso, E.; Coeurdassier, M.; Lambert, J. C.; Giraudoux, P.; Scheifler, R.

PLoS ONE, 8 (6):e66399; 2013

Abstract: Wildlife is exposed to natural (e.g., food availability and quality, parasitism) and anthropogenic stressors (e.g., habitat fragmentation, toxicants). Individual variables (e.g., age, gender) affect behaviour and physiology of animals. Together, these parameters can create both great inter-individual variations in health indicators and interpretation difficulties. We investigated the relevance of body condition and somatic indices (liver, kidneys) as indicators of health status in wood mice (*Apodemus sylvaticus*, n=560) captured along a metal pollution gradient in four landscape types (30 sampling squares 500-m sided). The indices were calculated using a recently proposed standard major axis regression instead of an ordinary least square regression. After considering age and gender for the body condition index, no landscape type influence was detected in the indices. However, important index variability was observed between sampling squares; this effect was included as a random effect in linear models. After integrating all individual and environmental variables that may affect the indices, cadmium (Cd) concentrations in both the liver and kidneys were negatively related to body condition and liver indices only for individuals from highly contaminated sites. Lead in the liver was negatively related to the liver index, and Cd in kidneys was positively linked to the kidney index, potentially suggesting metal-induced stress. However, interpretation of these indices as a wildlife ecotoxicology tool should be performed with caution due to the sensitivity of potentially confounding variables (e.g., individual factors and environmental parameters).

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Responses of soil macroinvertebrate communities to Miscanthus cropping in different trace metal contaminated soils

Hedde, M.; Oort, F. van; Boudon, E.; Abonnel, F.; Lamy, I.

Biomass and Bioenergy, 55 122-129; 2013

Abstract: Nowadays, the influence of biomass plantations in polluted soils as a remediation strategy has mainly been considered in the view of phytoextraction, but little of soil biodiversity. Our objective was to assess the impact of *Miscanthus giganteus* plantations on soil macroinvertebrates in trace metal contaminated soils. We hypothesized (1) that miscanthus plantations host more numerous and diverse communities than comparable annual crop soils and (2) that functional traits permit to decrypt the biological strategies underlying invertebrate community response. We selected fields on sandy and loamy-clay soils contaminated either by urban wastewater or atmospheric deposition, respectively. Our results showed that in comparison to annual cropping systems, miscanthus plantation enhanced higher densities and diversity of soil invertebrates but not of ground-dwelling invertebrates. Miscanthus cropping led to an increase in the proportion of resident, detritivores and rhizophages species, and a trend was revealed for larger invertebrates. Thus, the use of a trait-based approach provided fine opportunities to elucidate invertebrate responses to land use changes in contaminated areas.

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Improving the MicroResp TM substrate-induced respiration method by a more complete description of CO_2 behavior in closed incubation wells

Renault, P.; Ben-Sassi, M.; Berard, A.

Geoderma, 207/208 82-91; 2013

Abstract: The MicroResp TM method allows soil respiration and microbial community physiological profiles to be determined colorimetrically in microplates. This method, however, neglects CO2 storage in the agar gel carrying the colorimetric indicator, and calcite dissolution associated with CO2-induced change in soil solution pH. Our objective was to improve the method by taking into account CO2 in the gel in the calculation of microbial respiration, describing the effect of microbial CO2 on the pH of the soil solution and calcite dissolution, and checking whether CO2 distribution among calcite, soil solution, air and gel is near equilibrium after incubation. We propose a thermodynamic equilibrium model describing (a) distribution of CO2 among calcite, soil solution, gel and air, (b) dissociations of water, carbonic acid, cresol red, and substrates in the gel and soil solution, (c) exchange of adsorbed cations with H3O+ in the gel, and (d) calcite dissolution in soil. In-gel experiments were designed to calibrate the model, quantify the rate of CO2 exchange with air, and compare conservation procedures. On-soil experiments were designed to check whether calcite dissolution is near equilibrium and whether the model predicts the effect of CO2 on the pH of the solution. In-microplate experiments were designed to assess the effects of incubation period and soil quantity on estimated microbial respiration. The model can describe the distribution and speciation of CO2 in the gel, the soil solution and the air space of each microplate well. Initial properties of the gel vary with storage: soda lime partly extracts CO2 supplied as NaHCO3, and dries out the gel, which can skew the calibration. When incubation is over, the proportion of microbial CO2 in the gel is higher at lower microbial respiration. Incubations shorter than 4 h underestimate microbial respiration due to the slow diffusion of CO2 in the gel. CO2 in the soil solution cannot be overlooked; it decreases the soil pH and may promote calcite dissolution in calcareous soil. It is important to precisely estimate initial CO2 air fraction and to control temperature, which affects both thermodynamic constants and microorganisms.

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Reproductive impacts of tributyltin (TBT) and triphenyltin (TPT) in the hermaphroditic freshwater gastropod *Lymnaea stagnalis*

Giusti, A.; Barsi, A.; Dugue, M.; Collinet, M.; Thome, J. P.; Joaquim-Justo, C.; Roig, B.; Lagadic, L.; Ducrot, V.

Environmental Toxicology and Chemistry, 32 (7):1552-1560; 2013

Abstract: Tributyltin (TBT) and triphenyltin (TPT) are emblematic endocrine disruptors, which have been mostly studied in gonochoric prosobranchs. Although both compounds can simultaneously occur in the environment, they have mainly been tested separately for their effects on snail reproduction. Because large discrepancies in experimental conditions occurred in these tests, the present study aimed to compare the relative toxicity of TBT and TPT under similar laboratory conditions in the range of 0ng Sn/L to 600ng Sn/L. Tests were performed on the simultaneous hermaphrodite *Lymnaea stagnalis*, a freshwater snail in which effects of TPT were unknown. Survival, shell length, and reproduction were monitored in a 21-d semistatic test. Frequency of abnormal eggs was assessed as an additional endpoint. Triphenyltin hampered survival while TBT did not. Major effects on shell solidity and reproduction were observed for both compounds, reproductive outputs being more severely

hampered by TBT than by TPT. Considering the frequency of abnormal eggs allowed increasing test sensitivity, because snail responses to TBT could be detected at concentrations as low as 19ng Sn/L. However, the putative mode of action of the 2 compounds could not be deduced from the structure of the molecules or from the response of apical endpoints. Sensitivity of *L. stagnalis* to TBT and TPT was compared with the sensitivity of prosobranch mollusks with different habitats and different reproductive strategies.

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Long-term impact of hydrological regime on structure and functions of microbial communities in riverine wetland sediments

Foulquier, A.; Volat, B.; Neyra, M.; Bornette, G.; Montuelle, B.

FEMS Microbiology Ecology, 85 (2):211-226; 2013

Abstract: In a context of global change, alterations in the water cycle may impact the structure and function of terrestrial and aquatic ecosystems. Wetlands are particularly at risk because hydrological regime has a major influence on microbially mediated biogeochemical processes in sediments. While the influence of water availability on wetland biogeochemical processes has been comprehensively studied, the influence of hydrological regime on microbial community structure has been overlooked. We tested for the effect of hydrological regime on the structure and functions of microbial communities by comparing sediments collected at multiple sites in the Ain departement (Eastern France). Each site consisted of two plots, one permanently and one seasonally inundated. At the time of sampling, all plots were continuously inundated for more than 6 months but still harboured distinct bacterial communities. This change in community structure was not associated with marked modifications in the rates of microbial activities involved in the C and N cycles. These results suggest that the observed structural change could be related to bacterial taxa responding to the environmental variations associated with different hydrological regimes, but not strongly associated with the biogeochemical processes monitored here.

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UV-induced Nucleotide Excision Repair (NER) and Photoreactivation Repair (PER) in two trout fish cell lines used in ecotoxicological assessment studies

Kienzler, Aude; Tronchere, Xavier; Devaux, Alain; Bony, Sylvie

Journal of photochemistry and photobiology. B, Biology, 125 51-5; 2013-Aug-5

Abstract: A better knowledge of DNA repair capacities in permanent fish cell lines would contribute to establish their interest in genotoxicity testing for environmental risk assessment studies including the effects of an increase in solar UV radiations on aquatic organisms. NER (Nucleotide Excision Repair) and PER (Photoreactivation Repair) are the two repair pathways of choice for UV-induced photo-lesions. In the present paper, these repair processes were characterized in the two rainbow trout cell lines, RTGill-W1 and RTL-W1 (liver), by means of a T4-modified comet assay which allowed to follow the cyclobutane pyrimidine dimers repair kinetics specifically. Both repair processes have been found in the cell lines, PER repairing much faster UV lesions than NER, and NER being slightly more efficient in the gill cell line than in the liver one. Copyright 2013 Elsevier B.V. All rights reserved.

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Decontamination of a polychlorinated biphenyls-contaminated soil by phytoremediation-assisted bioaugmentation

Secher, C.; Lollier, M.; Jezequel, K.; Cornu, J. Y.; Amalric, L.; Lebeau, T.

Biodegradation, 24 (4):549-562; 2013

Conference: Soil science for the benefit of mankind and environment. 4th International Conference of the European Confederations of Soil Science Societies, Bari, Italy, 2-6 July 2012.

Abstract: A 70 day pot experiment was conducted for the cleaning-up of a PCBs-contaminated soil (104 mg kg -1 soil DW) using bioaugmentation with *Burkholderia xenovorans* LB400 (LB400) assisted or not by the use of tall fescue (*Festuca arundinacea*). The total cultivable bacteria of the soil were higher with the presence of plants. Real-time PCR showed that LB400 (targeting 16S-23S rRNA ITS) survived with abundance related to total bacteria (targeting 16S rRNA) being higher with fescue (up to a factor of three). Bioaugmentation had a positive effect on fescue biomass and more specifically on roots (by a factor of three). PCB dissipation (sum of congeners 28, 52, 101, 118, 153, 180) averaged 13% (bioaugmented-planted) up to 32% (non bioaugmented-planted), without any significant difference between treatments. Basically our results demonstrated that indigenous bacteria were able to dissipate PCBs (26.2% dissipation). PCB dissipation was not related to the abundance of LB400 or to the total

bacterial counts. Bioaugmentation or fescue altered the structure of the bacterial community of the soil, not the combination of both. Principal component analysis showed that bioaugmentation tended to improve the control of the process (lower variability in PCB dissipation). Opposite to that bioaugmentation increased the variability of the structure of the bacterial community.

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Special issue on long-term ecotoxicological effects: an introduction

Coutellec, Marie-Agnes; Barata, Carlos

Ecotoxicology (London, England), 22 (5):763-6; 2013

Début de l'article : Two years after the Special Issue published in Journal Ecotoxicology on Evolutionary Process in Ecotoxicology (vol 20 (3); see Coutellec and Barata 2011), the present issue proposes a timely update on long-term biological impacts of pollutants, including delayed, trans-generational, and evolutionary effects. The number of articles contributed in the present issue confirms that this question is gaining ground in the field of ecotoxicology. Despite the awareness of the scientific community that evolutionary change can occur rapidly (e.g., Carroll et al. 2007), and that addressing the long term ecotoxicological impact is relevant to improve the significance of ecological risk assessment of chemicals (e.g., Bickham 2011), this research field has been poorly explored until recent time…

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Parental exposure to methyl methane sulfonate of three-spined stickleback: contribution of DNA damage in male and female germ cells to further development impairment in progeny

Santos, R; Palos-Ladeiro, M; Besnard, A; Reggio, J; Vulliet, E; Porcher, J M; Bony, S; Sanchez, W; Devaux, A

Ecotoxicology (London, England), 22 (5):815-24; 2013

Abstract: Data regarding the link between DNA integrity of germ cells and the quality of progeny in fish exposed to genotoxicant are scarce although such information is of value to understand genotoxic effects of contaminants in aquatic fauna. This work aimed at studying the consequences of a parental exposure during the breeding season on offspring quality in three-spined stickleback. After in vivo exposure of adult fish to methyl methane sulfonate, a model alkylating compound, a clear increase in DNA damage was observed in erythrocytes of both genders, here used as a biomarker of exposure. MMS exposure significantly affected sperm DNA integrity but neither female fecundity nor fertilization success. In order to understand the contribution of each sex to potential deleterious effects in progeny due to parental exposure, mating of males and females exposed or not to MMS, was carried out. Exposure of both males and females or of males alone led to a significant increase in both mortali! ty during embryo-larval stages and abnormality rate at hatching that appeared to be sensitive stages. Thus, in accordance with recent studies carried out in other freshwater fish species, such development defects in progeny were clearly driven by male genome, known to be devoid of DNA repair capacity in spermatozoa. The next step will be to investigate the link between DNA damage in stickleback sperm and reproductive impairment in natural populations exposed to complex mixture of genotoxicants.

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Population genetics of *Lymnaea stagnalis* experimentally exposed to cocktails of pesticides

Coutellec, Marie-Agnes; Besnard, Anne-Laure; Caquet, Thierry

Ecotoxicology (London, England), 22 (5):879-88; 2013

Abstract: Freshwater invertebrates may be regularly exposed to pesticides in agricultural landscapes, as water bodies such as ditches and ponds are the final recipient of many chemicals, through various transfer pathways. Local evolutionary impacts may hence be expected on populations, especially for species with a completely aquatic life cycle. We tested the hypothesis that exposure to combinations of pesticides used in crop protection programmes could increase the effect of random genetic drift in a non-target species, via demographic impacts. To do so, experimental populations of the freshwater snail *Lymnaea stagnalis* were created from a common genetic pool and exposed for three successive generations to treatments corresponding to two different crop protection plans (conventional and low pesticide input). Population genetic parameters were estimated in each generation on the basis of ten polymorphic microsatellite loci. Effects consistent with increased random genetic drift were observed for one sampling campaign performed in the third generation, i.e., decreased genetic variability and increased population differentiation in the group of populations exposed to the treatment programme whose demographic impact was the most effective on *L. stagnalis*. Otherwise, no clear pattern emerged and even opposed effects could be observed. All populations were found significantly inbred, mostly due to biparental inbreeding. Conversely, selfing was generally not significant, and did not express preferentially under high pesticide pressure. We conclude from this study that

population genetics should be used very cautiously in the context of ecological risk assessment, especially when applied to natural populations.

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Testosterone levels and fecundity in the hermaphroditic aquatic snail *Lymnaea stagnalis* exposed to testosterone and endocrine disruptors

Giusti, Arnaud; Ducrot, Virginie; Joaquim-Justo, Celia; Lagadic, Laurent

Environmental toxicology and chemistry / SETAC, 32 (8):1740-5; 2013

Abstract: Endocrine disruptors are known to alter endogenous free and esterified levels of androgenic and estrogenic steroid hormones in aquatic mollusks. The origin of steroids in these animals, however, remains controversial. In the present study, free and esterified testosterone concentrations were measured in the hermaphroditic aquatic gastropod *Lymnaea stagnalis* exposed to molecules known for their androgenic (testosterone and tributyltin), anti-androgenic (cyproterone-acetate), and estrogenic (chlordecone) properties, by reference to their mode of action in vertebrates. In parallel, snail oviposition and fecundity were followed over a 21-d exposure period. Testosterone exposure resulted in increased esterified testosterone levels, whereas free testosterone concentrations remained stable. In contrast, cyproterone-acetate significantly increased the free form of testosterone with no changes in the esterified form, whereas chlordecone showed a tendency to reduce (though not significantly) esterified testosterone concentrations without changing free testosterone levels. Finally, tributyltin did not alter testosterone homeostasis. The production of egg clutches and eggs was significantly reduced only in the snails exposed to the highest concentrations of chlordecone (19.6g/L) and tributyltin (94.2ng Sn/L). Overall, the present study demonstrates that uptake of testosterone from the exposure medium occurs in *L. stagnalis*. Moreover, it shows that cyproterone-acetate and, to a lesser extent, chlordecone can alter endogenous testosterone levels in this freshwater snail. However, the relationship between hormonal changes and snail reproduction has not been established.

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Genotoxic effects of exposure to waterborne uranium, dietary methylmercury and hyperoxia in zebrafish assessed by the quantitative RAPD-PCR method

Lerebours, Adelaide; Cambier, Sebastien; Hislop, Lindsay; Adam-Guillermin, Christelle; Bourdineaud, Jean-Paul

Mutation research, 755 (1):55-60; 2013

Abstract: Release of chemicals and fluctuation in oxygen content in the aquatic environment represent hazards for fish health. The present study aims at assessing the genotoxic impact of low concentration exposures to waterborne uranium (U), dietary methyl mercury (MeHg) and hyperoxia in zebrafish by using the RAPD-PCR quantitative method. A significant increase of the number hybridization sites was observed in fish exposed to 30mugU/L and 100mugU/L and hyperoxia. In fish exposed to MeHg (13.5mug Hg/g, dry weight) no change in the number of hybridization sites were found, however, the frequency of PCR products showed significant variation. The mechanisms of toxicity leading to DNA damage in fish exposed to waterborne uranium, mercury and hyperoxia are discussed and the results from the literature given by the comet assay, micronucleus test and RAPD-PCR method compared. The study provides new data regarding the genotoxic effects of MeHg, hyperoxia and low U concentrations (30mugU/L) in! fish. The present work highlights the use of the RAPD-PCR as a sensitive method in the assessment of chemically-induced DNA damage in animals.

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DNA repair activity in fish and interest in ecotoxicology: a review

Kienzler, A.; Bony, S.; Devaux, A.

Aquatic Toxicology, 134/135 47-56; 2013

Abstract: The knowledge of DNA repair in a target species is of first importance as it is the primary line of defense against genotoxicants, and a better knowledge of DNA repair capacity in fish could help to interpret genotoxicity data and/or assist in the choice of target species, developmental stage and tissues to focus on, both for environmental biomonitoring studies and DNA repair testing. This review focuses in a first part on what is presently known on a mechanistic basis, about the various DNA repair systems in fish, in vivo and in established cell lines. Data on base excision repair (BER), direct reversal with O,6-alkylguanine transferase and double strand breaks repair, although rather scarce, are being reviewed, as well as nucleotide excision repair (NER) and photoreactivation repair (PER), which are by far the most studied repair mechanisms in fish. Most of these repair mechanisms seem to be strongly species and tissue

dependent; they also depend on the developmental stage of the organisms. BER is efficient in vivo, although no data has been found on in vitro models. NER activity is quite low or even inexistent depending on the studies; however this lack is partly compensated by a strong PER activity, especially in early developmental stage. In a second part, a survey of the ecotoxicological studies integrating DNA repair as a parameter responding to single or mixture of contaminant is realized. Three main approaches are being used: the measurement of DNA repair gene expression after exposure, although it has not yet been clearly established whether gene expression is indicative of repair capacity; the monitoring of DNA damage removal by following DNA repair kinetics; and the modulation of DNA repair activity following exposure in situ, in order to assess the impact of exposure history on DNA repair capacity. Since all DNA repair processes are possible targets for environmental pollutants, we can also wonder at which extent such a modulation of repair capacities in fish could be the base for the development of new biomarkers of genotoxicity. Knowing the importance of the germ cell DNA integrity in the reproductive success of aquatic organisms, the DNA repair capacity of such cells deserve to be more studied, as well as DNA repair capacities of established fish cell lines. The limited amount of available data, which shows low/slow DNA repair capacities of fish cell lines compared with mammalian cell lines, concerned mainly the NER system; thus this point merits to be explored more deeply. Additionally, since some of the DNA repair systems appear more efficient in embryo larval stages, it would be of interest to consider embryonic cell lineages more closely.

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The use of antioxidant enzymes in freshwater biofilms: temporal variability vs. toxicological responses

Bonnineau, C.; Tlili, A.; Faggiano, L.; Montuelle, B.; Guasch, H.

Aquatic Toxicology, 136/137 60-71; 2013

Abstract: This study aims to investigate the potential of antioxidant enzyme activities (AEA) as biomarkers of oxidative stress in freshwater biofilms. Therefore, biofilms were grown in channels for 38 days and then exposed to different concentrations (0-150 g L -1) of the herbicide oxyfluorfen for 5 more weeks. Under control conditions, the AEA of biofilms were found to change throughout time with a significant increase in ascorbate peroxidase (APX) activity during the exponential growth and a more important role of catalase (CAT) and glutathione reductase (GR) activities during the slow growth phase. Chronic exposure to oxyfluorfen led to slight variations in AEA, however, the ranges of variability of AEA in controls and exposed communities were similar, highlighting the difficulty of a direct interpretation of AEA values. After 5 weeks of exposure to oxyfluorfen, no clear effects were observed on chl- a concentration or on the composition of other pigments suggesting that algal group composition was not affected. Eukaryotic communities were structured clearly by toxicant concentration and both eukaryotic and bacterial richness were reduced in communities exposed to the highest concentration. In addition, during acute exposure tests performed at the end of the chronic exposure, biofilms chronically exposed to 75 and 150 g L -1 oxyfluorfen showed a higher CAT activity than controls. Chronic exposure to oxyfluorfen provoked then structural changes but also functional changes in the capacity of biofilm CAT activity to respond to a sudden increase in concentration, suggesting a selection of species with higher antioxidant capacity. This study highlighted the difficulty of interpretation of AEA values due to their temporal variation and to the absence of absolute threshold value indicative of oxidative stress induced by contaminants. Nevertheless, the determination of AEA pattern throughout acute exposure test is of high interest to compare oxidative stress levels undergone by different biofilm communities and thus determine their antioxidant capacity.

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Translocation of 125I, 75Se and 36Cl to wheat edible parts following wet foliar contamination under field conditions

Hurtevent, P.; Thiry, Y.; Levchuk, S.; Yoschenko, V.; Henner, P.; Madoz-Escande, C.; Leclerc, E.; Colle, C.; Kashparov, V.

Journal of Environmental Radioactivity, 121 43-54; 2013

Conference: Selected papers from the 2011 International Conference on Radioecology and Environmental Radioactivity (ICRER), Hamilton, Canada, 18-24 June 2011.

Abstract: Apart from radiocaesium and radiostrontium, there have been few studies on the foliar transfer of radionuclides in plants. Consequently, specific translocation factor (ftr) values for 129I, 79Se and 36Cl are still missing from the IAEA reference databases. The translocation of short-lived isotopes, 125I and 75Se, and of 36Cl to wheat grain were measured under field conditions following acute and chronic wet foliar contamination at various plant growth stages in the absence of leaching caused by rain. The translocation factors ranged from 0.02% to 1.1% for 125I (a value similar to Sr), from 0.1% to 16.5% for 75Se, and from 1% to 14.9% for 36Cl. Both 36Cl and 75Se were as mobile as Cs. The phenomenological analysis showed that each element displayed a specific behavior. Iodide showed the lowest apparent mobility because of its preferential fixation in or on the leaves and a significant amount probably volatilized. Selenite internal transfer was significant and possibly utilized the sulphur metabolic pathway. However bio-methylation of selenite may have led to increased

volatilization. Chloride was very mobile and quickly diffused throughout the plant. In addition, the analysis underlined the importance of plant growth responses to annual variations in weather conditions that can affect open field experiments because plant growth stage played a major role in ftr values dispersion. The chronic contamination results suggested that a series of acute contamination events had an additive effect on translocated elements. The highest translocation value obtained for an acute contamination event was shown to be a good conservative assessment of chronic contamination if data on chronic contamination translocation are lacking. The absence of rain leaching during the experiment meant that this investigation avoided potential radionuclide transfer by the roots, which also meant that radionuclide retention on or in the leaves was maximized. This study was therefore able to obtain accurate translocation factors, which are probably among the highest that could be recorded.

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Assessing ecotoxicity and uptake of metals and metalloids in relation to two different earthworm species (*Eiseina hortensis* and *Lumbricus terrestris*)

Leveque, T.; Capowiez, Y.; Schreck, E.; Mazzia, C.; Auffan, M.; Foucault, Y.; Austruy, A.; Dumat, C.

Environmental Pollution, 179 232-241; 2013

Abstract: Due to diffuse atmospheric fallouts of process particles enriched by metals and metalloids, polluted soils concern large areas at the global scale. Useful tools to assess ecotoxicity induced by these polluted soils are therefore needed. Earthworms are currently used as biotest, however the influence of specie and earthworm behaviour, soil characteristics are poorly highlighted. Our aim was therefore to assess the toxicity of various polluted soils with process particles enriches by metals and metalloids (Pb, Cd, Cu, Zn, As and Sb) collected from a lead recycling facility on two earthworm species belonging to different ecological types and thus likely to have contrasted behavioural responses (*Eiseina hortensis* and *Lumbricus terrestris*). The combination of behavioural factors measurements (cast production and biomass) and physico-chemical parameters such as metal absorption, bioaccumulation by earthworms and their localization in invertebrate tissues provided a valuable indication of pollutant bioavailability and ecotoxicity. Soil characteristics influenced ecotoxicity and metal uptake by earthworms, as well as their soil bioturbation.

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Accès au document

Environment Exploration and Colonization Behavior of the Pea Aphid Associated with the Expression of the foraging Gene

Tares, Sophie; Arthaud, Laury; Amichot, Marcel; Robichon, Alain

PloS one, 8 (5):e65104; 2013

Abstract: Aphids respond to specific environmental cues by producing alternative morphs, a phenomenon called polyphenism, but also by modulating their individual behavior even within the same morph. This complex plasticity allows a rapid adaptation of individuals to fluctuating environmental conditions, but the underlying genetic and molecular mechanisms remain largely unknown. The foraging gene is known to be associated with behavior in various species and has been shown to mediate the behavioral shift induced by environmental changes in some insects. In this study, we investigated the function of this gene in the clonal forms of the pea aphid *Acyrthosiphon pisum* by identifying and cloning cDNA variants, as well as analyzing their expression levels in developmental morphs and behavioral variants. Our results indicate that the expression of foraging changes at key steps of the aphid development. This gene is also highly expressed in sedentary wingless adult morphs reared under crowded conditions, probably just before they start walking and foraging. The cGMP-dependent protein kinase (PKG) enzyme activity measured in the behavioral variants correlates with the level of foraging expression. Altogether, our results suggest that foraging could act to promote the shift from a sedentary to an exploratory behavior, being thus involved in the behavioral plasticity of the pea aphid.

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Accès au document

Transfer of Rare Earth Elements (REE) from natural soil to plant systems: implications for the environmental availability of anthropogenic REE

Brioschi, L.; Steinmann, M.; Lucot, E.; Pierret, M. C.; Stille, P.; Prunier, J.; Badot, P. M.

Plant and Soil, 366 (1/2):143-163; 2013

Abstract: Background and aims: Rare Earth Elements (REE) are widely used to trace natural geochemical processes. They are also increasingly used by man (electronics industry, medicine, agriculture) and therefore considered as emerging pollutants. The present study documents REE mobility in non-polluted natural soil-plant systems in order to characterize their environmental availability for future anthropogenic pollution. Methods: The study is based on a field approach in non-polluted

natural sites with contrasting geological environments (limestone, granite, and carbonatite) and highly variable REE contents. Results: REE concentrations in soils do not directly reflect bedrock concentrations, but depend largely on pedogenetic processes and on the mineralogy of bedrock and soil. The soils of all sites are with respect to bedrock enriched in heavy REE. The REE uptake by plants is not primarily controlled by the plant itself, but depends on the concentration and the speciation in the soil and the adsorbed soil water pool. Conclusions: REE uptake by plant roots are linked with those of Fe. Roots absorb preferentially the light REE. Before translocation, REE are retained by the Casparian strip leading to much lower concentrations in the aerial parts. The transport of the REE within the xylem is associated with the general nutrient flux.

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Accès au document

Structure of earthworm burrows related to organic matter of a constructed Technosol

Pey, B.; Cortet, J.; Watteau, F.; Cheynier, K.; Schwartz, C.

Geoderma, 202/203 103-111; 2013

Abstract: Literature considering earthworms as a biological agent of Technosol functioning, especially those constructed in order to reclaim degraded areas (e.g. industrial wasteland), is scarce. The main objectives of the following work is: (i) to describe the structure of burrows produced by two different eco-morphological groups of earthworms in a constructed Technosol and (ii) to link their burrowing activity to Technosol organic matter transfers and carbon content in one-species and two-species combinations. For these purposes, the contributions of *Lumbricus terrestris* as an epi-anecic earthworm and *Aporrectodea caliginosa* as an endogeic one to such functioning aspects of a constructed Technosol, resulting from soil engineering processes (e.g. choice of proportions, parent materials) were assessed using laboratory microcosm experiments. The Technosol studied was composed of green waste compost, treated industrial soil and paper mill sludge. Earthworms were inoculated separately and together in the constructed Technosol over a period of 75 days. Ultra-structural analysis of randomly selected burrows of the one-species treatments and the soil of the control treatment were sampled to describe their structure. Functional consequences on the organic matter in the Technosol were assessed by studying remaining surface litter mass, transfer of surface organic matter to depth and by measuring soil carbon content. At the ultrastructural scale, the burrowing activity of the two eco-morphological groups of earthworms locally modified the organo-mineral associations of the Technosol. Burrows presented a similar structure for both species, with a looser internal cutan including some organic elements and microbial activity tracks (closed to the lumen) and a compacted external mineral cutan (distant from the lumen)…

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Accès au document

Application of X-ray tomography to evaluate liming impact on earthworm burrowing activity in an acidic forest soil under laboratory conditions

Auclerc, A.; Capowiez, Y.; Guerold, F.; Nahmani, J.

Geoderma, 202/203 45-50; 2013

Abstract: This study investigated the burrowing activity responses of two earthworm species (*Aporrectodea caliginos*a and *Aporrectodea giardi*) with contrasting ecological strategies to lime application under laboratory conditions. The impact of liming on earthworm burrowing activity was measured in 25-cm, repacked soil cores sampled from an acidic forest of the Vosges Mountains (North-eastern, France). Soil treatments included: (i) a non-limed field soil (OH horizon, 0-5 cm, pH=3.8; A horizon, 5-25 cm, pH=4.5) that had received decades of atmospheric acidic deposition, (ii) an in situ limed soil (OH, 0-5 cm, pH=4.1; A horizon, 5-25 cm, pH=4.7) that had been limed at 2.5 t ha -1 six years prior to sampling for this experiment and (iii) an in vitro non-limed field OH horizon limed in the laboratory to 2.5 t ha -1 equivalence over a non-limed A horizon (OH, 0-5 cm of core, pH=5.4; A horizon, 5-25 cm, pH=4.5). After 9 weeks of incubation, X-ray computed tomography was used to characterize the burrow system of the two earthworm species for each of the three soil treatments. Soil pH, amount of surface casts, and earthworm biomass were also measured. All earthworms were alive at the end of the experiment. *A. giardi* lost significantly less weight and produced more surface casts than *A. caliginosa*. The in vitro liming increased total burrow volume and length of A. giardi. Liming had no effect on *A. caliginosa* biomass, surface cast production or total burrow system volume and length. However, in vitro liming significantly enhanced *A. caliginosa* burrowing activity in the OH horizon. Finally, for both species, the burrowing activity was not improved into the in situ limed treatment.

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Accès au document

Next-generation sequencing to inventory taxonomic diversity in eukaryotic communities: a test for freshwater diatoms

Kermarrec L., Franc A., Rimet F., Chaumeil P.. Humbert J.-F. and Bouchez A.

Molecular Ecology Resources, 13:607–619, 2013

Abstract: The recent emergence of barcoding approaches coupled to those of next-generation sequencing (NGS) has raised new perspectives for studying environmental communities. In this framework, we tested the possibility to derive accurate inventories of diatom communities from pyrosequencing outputs with an available DNA reference library. We used three molecular markers targeting the nuclear, chloroplast and mitochondrial genomes (SSU rDNA, rbcL and cox1) and three samples of a mock community composed of 30 known diatom strains belonging to 21 species. In the goal to detect methodological biases, one sample was constituted directly from pooled cultures, whereas the others consisted of pooled PCR products. The NGS reads obtained by pyrosequencing (Roche 454) were compared first to a DNA reference library including the sequences of all the species used to constitute the mock community, and second to a complete DNA reference library with a larger taxonomic coverage. A stringent taxonomic assignation gave inventories that were compared to the real one. We detected biases due to DNA extraction and PCR amplification that resulted in false-negative detection. Conversely, pyrosequencing errors appeared to generate false positives, especially in case of closely allied species. The taxonomic coverage of DNA reference libraries appears to be the most crucial factor, together with marker polymorphism which is essential to identify taxa at the species level. RbcL offers a high resolving power together with a large DNA reference library. Although needing further optimization, pyrosequencing is suitable for identifying diatom assemblages and may find applications in the field of freshwater biomonitoring.

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Accès au document

Avoidance behaviour response and esterase inhibition in the earthworm, *Lumbricus terrestris*, after exposure to chlorpyrifos

Martinez Morcillo, S.; Yela, J. L.; Capowiez, Y.; Mazzia, C.; Rault, M.; Sanchez-Hernandez, J. C.

Ecotoxicology, 22 (4):597-607; 2013

Abstract: The avoidance response of earthworms to polluted soils has been standardised using a simple and low-cost test, which facilitates soil toxicity screening. In this study, the avoidance response of *Lumbricus terrestris* was quantified in chlorpyrifos-spiked soils, depending on the pesticide concentration and exposure duration. The inhibition of acetylcholinesterase (AChE) and carboxylesterase (CbE) activities was also determined as indirect measures of pesticide bioavailability. The effects of different chlorpyrifos concentrations were examined in a standardised test (two-chamber system) with 0.6, 3 and 15 mg/kg chlorpyrifos. A modification of the test involved a pre-exposure step (24, 48 or 72 h) in soils spiked with 15 mg/kg. In both protocols, earthworms were unable to avoid the contaminated soils. However, the esterase activities showed that all earthworms were exposed to chlorpyrifos. Acetylcholinesterase activity did not change in earthworms in the standardised behavioural test (0.580.20 U/mg protein, meanSD; n=72), whereas the CbE activity was significantly inhibited (62-87% inhibition) in earthworms exposed to 3 and 15 mg/kg. In the modified test, earthworms had greatly inhibited AChE activity (0.0880.034 U/mg protein, n=72), which was supported by reactivation of the inhibited enzyme activity in the presence of pralidoxime (2-PAM). Similarly, the CbE activity was significantly inhibited in earthworms with all treatments. This study suggests that the avoidance behaviour test for organophosphorus-contaminated soils could be supported by specific biomarkers to facilitate a better understanding of pesticide exposure and toxicity during this test.

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Accès au document

Dynamics of soil fauna after plantation of perennial energy crops on polluted soils

Hedde, M.; Oort, F. van; Renouf, E.; Thenard, J.; Lamy, I.

Applied Soil Ecology, 66 29-39; 2013

Abstract: Growing demand for alternative energy sources has led to an increased production of biomass crops. In order to limit the use of fertile agricultural land for producing bioenergy, low quality agricultural land, as well as degraded or drastically disturbed soils have been proposed for the cropping of bioenergy cultivars. Our work aimed at assessing the dynamics of soil invertebrate diversity after plantation of perennial energy crops on metal polluted soils. The results were compared with invertebrate diversity dynamics in soils of other plots, representative either for the dominant land occupancies in the study area, or for unpolluted soil situations. We investigated taxonomic, compositional and functional dimensions of diversity in soil- and surface-dwelling communities. Changes in land use from annual crops to perennial energy crops led to a higher number of individuals in soil. No or few changes in taxonomic richness were recorded with an increasing age of energy cropping. Regarding functional diversity, the proportions of resident invertebrates tended to vary with the age of energy cropping, but neither the trophic composition nor the body spectra were modified. Our findings highlighted an increase of soil carrying capacity after perennial

energy crop plantation on metal polluted soils, but effects on invertebrate diversity were limited

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Standard methods for artificial rearing of *Apis mellifera* larvae

Crailsheim, K.; Brodschneider, R.; Aupinel, P.; Behrens, D.; Genersch, E.; Vollmann, J.; Riessberger-Galle, U.

Journal of Apicultural Research, 52 (1):spcial issue; 2013

Abstract: Originally, a method to rear worker honey bee larvae in vitro was introduced into the field of bee biology to analyse honey bee physiology and caste development. Recently, it has become an increasingly important method in bee pathology and toxicology. The in vitro method of rearing larvae is complex and can be developed as an art by itself, especially if the aim is to obtain queens or worker bees which, for example, can be re-introduced into the colony as able members. However, a more pragmatic approach to in vitro rearing of larvae is also possible and justified if the aim is to focus on certain pathogens or compounds to be tested. It is up to the researcher(s) to decide on the appropriate experimental establishment and design. This paper will help with this decision and provide guidelines on how to adjust the method of in vitro rearing according to the specific needs of the scientific project.

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Accès au document

Are cyanobacterial blooms trophic dead ends?

Perga, Marie-Elodie; Domaizon, Isabelle; Guillard, Jean; Hamelet, Valerie; Anneville, Orlane

Oecologia, 172 (2):551-62; 2013

Abstract: Cyanobacterial blooms induce significant costs that are expected to increase in the near future. Cyanobacterial resistance to zooplankton grazing is one factor thought to promote bloom events. Yet, numerous studies on zooplankton ability to graze upon cyanobacteria have been producing contradictory results and such a puzzle might arise from the lack of direct observations in situ. Our objective was to track, using fatty acid (FA) and fatty acid stable isotope analyses (FA-SIA), the fate of cyanobacterial organic matter in the food web of a lake subjected to summer blooms of *Planktothrix rubescens*. A metalimnetic bloom of *P. rubescens* occurred in Lake Bourget (France) during the study period (May-November 2009). The bloom was especially rich in alpha-linolenic acid, 18:3(n-3), but none of the considered zooplankton taxa exhibited spiking content in this particular FA. FA-SIA revealed, however, that over a quarter of 18:3(n-3) in small zooplankton (500mum) did not benefit from it. P. rubescens 18:3(n-3) could be tracked up to perch (*Perca fluviatilis*) young of the year (YOY) to which it contributed to ~15% of total 18:3(n-3). Although transferred with a much lower efficiency than micro-algal organic matter, the *P. rubescens* bloom supported a significant share of the pelagic secondary production and did not constitute, sensu stricto, a 'trophic dead end'. The cyanobacterial bloom also provided perch YOY with components of high nutritional values at a season when these are critical for their recruitment. This cyanobacterial bloom might thus be regarded as a significant dietary bonus for juvenile fish.

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Accès au document

Environment: Overhaul pesticide testing on bees

Decourtye, Axel; Henry, Mickael; Desneux, Nicolas

Nature, 497 (7448):188; 2013

Début du texte : Political action is needed to address the adverse side effects of systemic pesticides on bees (Nature 496, 408; 2013) by revising procedures for pesticide registration. The current risk-assessment process for these chemicals is outdated and does not incorporate important developments from the past 30 years.

To register a new pesticide in industrialized countries, the substance must be assessed for toxicity to the honeybee (*Apis mellifera*), which was originally chosen as a representative model of the Apoidea superfamily of some 20,000 bee species. However, the life histories of different bee species vary considerably. Unlike honeybees, most bee species are solitary, so individuals killed by pesticides are not easily replaced. There are 42 studies (source: Web of Science) reporting side effects of registered pesticides on other bee species, even though these passed risk assessment for honeybees. Tests need to be much more sensitive if they are to pick up all pesticide-related effects for bees as a whole…

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Accès au document

Assessment of base-excision repair activity in fish cell lines: Toward a new biomarker of exposure to environmental contaminants?

Kienzler, Aude; Bony, Sylvie; Tronchere, Xavier; Devaux, Alain

Mutation research, 753 (2):107-13; 2013

Abstract: Amongst DNA-repair processes, base-excision repair (BER) is the major mechanism for removal of DNA-base lesions caused by environmental genotoxicants. BER has been proven to exist in fish but has not been investigated in fish cell-lines, although these constitute increasingly important tools in eco-toxicological assessment. The present study aims at highlighting BER capacity of RTL-W1 and RTG-W1, two trout cell lines used in eco-genotoxicity studies. This is realized by following the kinetics of strand-break repair after a short exposure to model genotoxicants-leading predominantly to BER-specific lesions-by means of the standard alkaline and Fpg-modified comet assays. Results show that both cell lines efficiently repair single-strand breaks and base-alkylation damages within 4h and 24h, respectively. Then, the study shows that after minor modifications of the protocol, the cell extract-based BERc assay can be used to evaluate the base-incision capacity of the cell lines and! its variation after exposure of the cells to a model inhibitor of BER (3-aminobenzamide) and to environmental contaminants such as cadmium and tributyltin. This work provides a basis for the further development of DNA-repair activity in fish cell-lines as a new biomarker of genotoxicity. Copyright 2013 Elsevier B.V. All rights reserved.

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Accès au document

First evidence of large-scale PAH trends in French soils

Villanneau, E. J.; Saby, N. P. A.; Orton, T. G.; Jolivet, C. C.; Boulonne, L.; Caria, G.; Barriuso, E.;

Environmental Chemistry Letters, 11 (1):99-104; 2013

Abstract: Polycyclic aromatic hydrocarbons (PAHs) are widespread organic pollutants. Soils are a reservoir of PAHs because some soil constituents favour PAH accumulation. Therefore, soil is a key indicator of the degree of contamination. So far, studies mapping soil PAH levels over large territories are very rare. Here, we report the first nation-wide maps of soil PAHs in France. Results were obtained within the French National Soil Monitoring Network, which is the first European network monitoring systematically soil PAHs. We used advanced geostatistics to map PAH distribution over the whole French territory. Our results show clear trends of PAH levels at the nation scale. For instance, the highest PAH levels are found in Northern and Eastern France. This high contamination is explained by the intense industrial activity of these regions during the last century. High levels of PAH are also found near some coastlines. This observation could be explained by long-range atmospheric transportation. In addition, we found that light PAHs are rarely found in French topsoils.

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Accès au document

Adsorption and desorption behavior of selected pesticides as influenced by decomposition of maize mulch

Aslam, Sohaib; Garnier, Patricia; Rumpel, Cornelia; Parent, Serge E; Benoit, Pierre

Chemosphere, 91 (11):1447-55; 2013

Abstract: Assessing pesticide fate in conservation agricultural systems requires a detailed understanding of their interaction with decomposing surface crop residues (mulch). Adsorption and desorption behavior of glyphosate, s-metolachlor and epoxiconazole was investigated on maize mulch residues decomposed under laboratory and field conditions. Our conceptual approach included characterization of chemical composition and hydrophobicity of mulch residues in order to generate parameters to predict sorption behavior. Adsorption of s-metolachlor and epoxiconazole greatly increased with mulch decomposition, whereas glyphosate adsorption was less affected but its desorption was increased. Mulch characteristics including aromaticity, hydrophobicity and polarity indices were strongly correlated to Koc of the non-ionic pesticides. A predictive model based on compositional data (CoDa) analysis revealed that the sorption capacity of decomposing mulch can be predicted from descriptors such as ar! omatic and alkyl C corresponding respectively to lignin and NDF biochemical fractions. The decomposition degree of mulch residues should be taken into account while predicting the fate of pesticides. Copyright 2012 Elsevier Ltd. All rights reserved.

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Flow cytometry detection of lysosomal presence and lysosomal membrane integrity in the three-spined stickleback (*Gasterosteus aculeatus* L.) immune cells: applications in environmental aquatic immunotoxicology

Bado-Nilles, Anne; Betoulle, Stephane; Geffard, Alain; Porcher, Jean-Marc; Gagnaire, Beatrice; Sanchez, Wilfried

Environmental science and pollution research international, 20 (5):2692-704; 2013

Abstract: The neutral red retention assay has been proposed to determine the lysosomal membrane stability in immune cells. Nevertheless, this assay implies many examinations under a microscope at short time intervals and therefore the analysis of few samples. The present study proposes two more rapid, efficient, and sensitive

sample analyses using flow cytometry method. Lysosomal presence and lysosomal membrane integrity (LMI) were evaluated on the three-spined stickleback, *Gasterosteus aculeatus* (L.), a well-described model fish species for aquatic ecotoxicology studies. After development of the two biomarkers, they were validated by ex vivo contamination with endosulfan and copper and by in situ sampling. These immunomarkers were clearly modulated by pollutants and their variations seemed to be correlated with leucocyte mortality. Thus, from a practical point of view, lysosomal presence and LMI may provide novel and efficient means of evaluating immune capacities and indicating the toxic effects of environmental pollution.

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Accès au document

Metal contamination disturbs biochemical and microbial properties of calcareous agricultural soils of the Mediterranean area

Santiago-Martin, A. de; Cheviron, N.; Quintana, J. R.; Gonzalez, C.; Lafuente, A. L.; Mougin, C.

Archives of Environmental Contamination and Toxicology, 64 (3):388-398; 2013

Abstract: Mediterranean climate characteristics and carbonate are key factors governing soil heavy-metal accumulation, and low organic matter (OM) content could limit the ability of microbial populations to cope with resulting stress. We studied the effects of metal contamination on a combination of biological parameters in soils having these characteristics. With this aim, soils were spiked with a mixture of cadmium, copper, lead, and zinc, at the two limit values proposed by current European legislation, and incubated for ≤12 months. Then we measured biochemical (phosphatase, urease, beta-galactosidase, arylsulfatase, and dehydrogenase activities) and microbial (fungal and bacterial DNA concentration by quantitative polymerase chain reaction) parameters. All of the enzyme activities were strongly affected by metal contamination and showed the following inhibition sequence: phosphatase (30-64%) < arylsulfatase (38-97%) ≤ urease (1-100%) ≤ beta-galactosidase (30-100%) < dehydrogenase (69-100%). The high variability among soils was attributed to the different proportion of fine mineral fraction, OM, crystalline iron oxides, and divalent cations in soil solution. The decrease of fungal DNA concentration in metal-spiked soils was negligible, whereas the decrease of bacterial DNA was ~1-54% at the lowest level and 2-69% at the highest level of contamination. The lowest bacterial DNA decrease occurred in soils with the highest OM, clay, and carbonate contents. Finally, regarding the strong inhibition of the biological parameters measured and the alteration of the fungal/bacterial DNA ratio, we provide strong evidence that disturbance on the system, even within the limiting values of contamination proposed by the current European Directive, could alter key soil processes. These limiting values should be established according to soil characteristics and/or revised when contamination is produced by a mixture of heavy metals.

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Colloques

Appel à contribution / Brussel 16-17 oct 2013, 8th SETAC Europe Special Science Symposium

Le 8ème colloque Européen SETAC aura pour thème : Plant protection products and pollinators: testing methodologies, risk assessment and risk management La date limite pour l'appel à contributions est le 30 Août 2013.

Le comité organisateur est composé des personnes suivantes :

-Guy Smagghe, chair (Gent University, Belgium)

-Marco Candolfi (IES Ltd, Switzerland)

-Roel Evens (SETAC Europe, Belgium)

-Mark Miles (Dow AgroSciences, UK)

-Jens Pistorius (JKI, Germany)

-Veronique Poulsen (ANSES, France)

-Cynthia Scott-Dupree (University of Guelph, Canada)

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Call for session proposals for SETAC Basel 2014

Date limite de réponse : 15 Aout 2013

SETAC Europe 24th Annual Meeting Basel, Switzerland, 11-15 May 2014

The meeting organisers are soliciting proposals for parallel and special sessions to address 10 conference tracks. For guidelines and submission instructions, please visit the SETAC Basel 2014 website.

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Conférence environnementale pour la transition écologique. 20-21 septembre 2013

La prochaine conférence environnementale, aura lieu les 20 et 21 septembre 2013 au Conseil économique, social et environnemental.

Elle donnera lieu au bilan des actions engagées au titre de la feuille de route pour la transition écologique de septembre 2012.

Elle permettra également d'avancer sur cinq nouveaux chantiers : l'économie circulaire qui doit conduire à développer le recyclage et la valorisation des déchets mais aussi favoriser les circuits territorialisés ; les emplois de la transition écologique ; la politique de l'eau, la biodiversité marine, la mer et les océans dans la perspective de renforcer les connaissances et la protection de l'environnement marin en métropole et en outre-mer ; l'éducation à l'environnement et au développement durable.

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Veille sociétale

L'Institut de Recherche Microbiologique créé une nouvelle activité

Article de l'Usine nouvelle 21/06/2013

L'Institut de Recherche Microbiologique (IRM) a inauguré, vendredi 14 juin à Mitry-Mory (Seine-et-Marne), une extension de ses laboratoires spécialement dédiée à une activité nouvelle **: l'écotoxicologie aquatique.** Cette compétence concerne, notamment, tous les acteurs du secteur de la chimie ou hospitaliers. Elle complète le panel des services de l'IRM créé en 1989 et spécialisé dans la recherche et les analyses d'efficacité des agents antimicrobiens. 500 000 euros ont été investis pour la réalisation de cet équipement.

Filiale du groupe familial EVA, également propriétaire de la société Prodene Klint spécialisée dans les produits cosmétiques et antiseptiques, l'Institut de recherche microbiologique emploie 17 salariés pour un chiffre d'affaires de 1,5 million d'euros.

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