Carbofurans

Title	Effects of Carbofuran on Lantana camara and its biocontrol agent, Teleonemia scrupulosa
Author Name	Naweji Katembo, Ed T.F. Witkowski & Marcus J. Byrne
Journal Name	Biocontrol Science and Technology
Year	2019
Volume and Issue	VOL. 29, NO. 8
Pages	Pages 746-756
Abstracts	This laboratory-based study sought to determine the efficacy of using carbofuran in an exclusion experiment aimed at assessing the impacts of biocontrol agents on Lantana camara L. (sensu lato) (Verbenaceae). Two separate experiments were conducted, the first one on insect-free plants, to determine the effects of carbofuran solely on plant growth; and the second one, on Teleonemia scrupulosa Stål (Hemiptera: Tingidae) infested plants, with the objective of determining the impact of carbofuran on this biocontrol agent, as well as its impacts on plant growth. Carbofuran granules (10% a.i.) were applied at 7 g/m^2 a.i. to the potting medium. It was found that carbofuran did not have a significant effect on plant growth. Total removal of T. scrupulosa from exclusion plants (carbofuran-treated plants) was not achieved; however the low level of leaf feeding lesions on those plants indicated that carbofuran had considerably reduced the insect's population density. Results from a bioassay showed 100% and 40% T. scrupulosa mortality on leaves collected from carbofuran-treated and control plants, respectively, within three weeks of exposure. Analysis of chemical residue levels in the leaf material revealed that carbofuran potency only persisted for about three weeks, and was detectable at trace levels.
Keywords	Carbofuran; insecticide residue; insect survival; persistence; plant growth; Teleonemia scrupulosa

Title	**Sorption of 14C-carbofuran in Austrian soils: evaluation of fate and transport of carbofuran in temperate regions**
Author Name	Tanya Cáceres, Britt Maestroni, Marivil Islam2 & Andrew Cannavan
Journal Name	Environmental Science and Pollution Research
Year	2019
Volume and Issue	26
Pages	Pages 986-990
Abstracts	Carbofuran is an anticholinesterase carbamate commonly used as an insecticide, nematicide and acaricide in agricultural practice throughout the world. However, data on its sorption in temperate soils from Europe is limited. Laboratory studies were conducted to determine the adsorption of carbofuran on three distinct Austrian soils using batch experiments and radiometric techniques. Carbofuran adsorption capacity of the soils was found to be low in the three soils tested and showed to be related to the soils clay and organic carbon contents. The pesticide presented linear adsorption isotherms in all of the three soils. Due to the low sorption of carbofuran in the soils tested and to its high water solubility, there is a risk of migration to water bodies through run off and consequent negative effects on aquatic organisms and soil biota.
Keywords	Carbofuran; Temperate soils; Sorption; Risk assessment; Carbamates pesticides fate

Title	**Production and characterization of extracellular polymeric substances (EPS) generated by a carbofuran degrading strain Cupriavidus sp. ISTL7**
Author Name	Juhi Gupta, Rashmi Rathour, Rashmi Singh, Indu ShekharThakur
Journal Name	Bioresource Technology
Year	2019
Volume and Issue	282
Pages	Pages 417-424
Abstracts	The present study demonstrates EPS production by Cupriavidus sp. ISTL7 along with its capability to remediate a toxic carbamate pesticide, carbofuran. The strain ISTL7 efficiently degraded approximately 98% of carbofuran (400 ppm) within 96 h. GC–MS analysis showed catabolic metabolites of degradation which included carbofuran-7-phenol, methylamine, 2-hydroxy-3-(3-methylpropan-2-ol)benzene-N-methyl-carbamate etc. EPS production from the mineral medium supplemented with carbofuran was observed to be 3.112 ± 0.3682 g L^{-1}. FTIR confirmed its carbohydrate composition and the monomeric sugars: glucose, xylose, sorbitol and fructose were identified by GC–MS analysis. The toxic potential of degradation experiment and the produced EPS was evaluated on HepG2 (mammalian liver cell line). The cytotoxicity of carbofuran was reduced upon bacterial degradation and the formed EPS was found to be non-toxic as inferred from percentage cell viability. The present research can possibly influence the development strategies of biological remediation.
Keywords	Carbofuran; Extracellular polymeric substances (EPS); Cupriavidus sp.; Microbial degradation Toxicity

Title	**Degradation of carbofuran in contaminated soil by plant-microorganism combined technology**
Author Name	Wang Xin, Li Zhaoxing, Yao Mengqin, Bao Jia, Zhang Huiwen
Journal Name	Journal of the Serbian Chemical Society
Year	2019
Volume and Issue	84
Pages	Pages 1-12
Abstracts	With the development of modern agriculture, the pollution caused by the use of chemical fertilizers and pesticides has become a serious problem, posing a threat to human health and the living environment. Bioremediation technology is receiving more and more attention due to the safety of contaminated soil, non-secondary pollution, and low cost. In this study, white rot fungi were immobilized by adsorption method, and the functional plants suitable for reducing carbofuran were screened by pot experiment. Based on the previous study, a combined remediation technique was established. The results showed that after 30 days, compared to the single bioremediation of carbofuran-contaminated soil, the degradation rate increased by 19 % through the corn-white rot fungi combined remediation, and by 17 % using the sorghum-white rot fungi combined remediation. The effect of pesticide content in soil on the combined remediation is mainly reflected in the significant difference in the number of microorganisms ($p<0.05$). Combined bioreme¬diation may be a better alternative to mitigate the impact of high pollution on microorganisms at different pollutant concentrations compared to single microbial bioremediation or phytoremediation.
Keywords	Fertilizers; carbofuran; fungi, pesticide; microorganisms; phytoremediation

Title	**Influence of phorate and carbofuran insecticides on nitrogen availability and their residues in soil and rice**
Author Name	VS Borkar, NB Gokhale, NH Khobragade, SS More and RV Dhopavkar
Journal Name	International Journal of Chemical Studies
Year	2018
Volume and Issue	6,1
Pages	Pages 09-14
Abstracts	An experiment was conducted in with two insecticides, phorate and carbofuran at rates of 10.0 and 16.5 kg ha^{-1} respectively, to investigate its effect on the availability of nitrogen in rhizosphere soils of rice (Oryzasativa L., variety IR-50). Application of the insecticides stimulated the availability of nitrogen in the rhizosphere soils, and the stimulation was more pronounced with phorate as compared to carbofuran. The residue of Carbofuron and phorate was detected below maximum residue limit of 0.1 mg kg^{-1} in grain after harvest.
Keywords	Carbofuran insecticides; nitrogen availability; soil and rice

Title	Biochemical changes in rice plant due to application of carbofuran
Author Name	A Nayak, PK Mahapatra and KS Behera
Journal Name	Journal of Entomology and Zoology Studies
Year	2017
Volume and Issue	5,2
Pages	1177-1180
Abstracts	Carbofuran is a widely used insecticide for the control of a number of major rice-pests and caused a resurgence of rice leaf folder. An investigation was undertaken to study the effect of carbofuran application on different biochemical activities of the rice plant. Results indicated that gross weight of all the plant tissues (root, stem, and leaf) observed were more 21 days after treatment of carbofuran and highly pronounced in stem followed by leaf at 28 days after treatment. The average gross weight of the whole plant on 28 days after treatment was 55.7 gm in the untreated control compared with 122.8 gm in the treated plants. As regards soluble amino acids and chlorophyll, an increase of both the parameters in treated plants compared to the control plants was observed from 14 days after application of carbofuran. The difference in chlorophyll content was more on 14 days after treatment 3.55 and 5.40 mg/gm of fresh tissue in control and treated plants, respectively; whereas the difference in total soluble amino acid content was more on 28 days after treatment. The activity of acid phosphatase was more only in the root and leaf in treated plants than in control.
Keywords	Carbofuran; rice plant; biochemical analysis; acid phosphatase

Title	**Fungal bioaugmentation of two rice husk-based biomixtures for the removal of carbofuran in on-farm biopurification systems**
Author Name	Kattia Madrigal-Zúñiga, Karla Ruiz-Hidalgo, Juan Salvador Chin-Pampillo, Mario Masís-Mora, Víctor Castro-Gutiérre, Carlos E. Rodríguez-Rodríguez
Journal Name	Biology and Fertility of Soils
Year	2016
Volume and Issue	52,2
Pages	Pages 243-250
Abstracts	The ligninolytic fungus Trametes versicolor was employed in the bioaugmentation of compost- (GCS) and peat-based (GTS) biomixtures for the removal of the insecticide-nematicide carbofuran (CFN). Among several lignocellulosic substrates, fungal colonization was best supported in rice husk, and this pre-colonized substrate was used to prepare the biomixtures. Estimated half-lives for CFN were 3.4 and 8.1 days in the GTS and GCS biomixtures, respectively. The CFN transformation products 3-hydroxycarbofuran and 3-ketocarbofuran were detected at the moment of CFN application, but their concentration continuously decreased to complete removal in both biomixtures. Mineralization of 14C-radiolabeled CFN was faster in GTS (k = 0.00248 day−1) than in GCS (k = 0.00188 day−1). Complete elimination of the toxicity in the matrices was demonstrated after 48 days. Overall data suggest that the bioaugmentation improved the performance of the GTS rather than the GCS biomixture.
Keywords	Biopurification system; Bioaugmentation; Degradation; Pesticides; Fungi Toxicity

Title	**Ecotoxicological analysis during the removal of carbofuran in fungal bioaugmented matrices**
Author Name	Karla Ruíz-Hidalgo,Mario Masís-Mora,Edison Barbieri, Elizabeth Carazo-Rojas, Carlos E. Rodríguez-Rodríguez
Journal Name	Chemosphere
Year	2016
Volume and Issue	144
Pages	864-871
Abstracts	Biomixtures are used for the removal of pesticides from agricultural wastewater. As biomixtures employ high content of lignocellulosic substrates, their bioaugmentation with ligninolytic fungi represents a novel approach for their enhancement. Nonetheless, the decrease in the concentration of the pesticide may result in sublethal concentrations that still affect ecosystems. Two matrices, a microcosm of rice husk (lignocellulosic substrate) bioaugmented with the fungus Trametes versicolor and a biomixture that contained fungally colonized rice husk were used in the degradation of the insecticide/nematicide carbofuran (CFN). Elutriates simulating lixiviates from these matrices were used to assay the ecotoxicological effects at sublethal level over Daphnia magna (Straus) and the fish Oreochromis aureus (Steindachner) and Oncorhynchus mykiss (Walbaum). Elutriates obtained after 30 d of treatment in the rice husk microcosms at dilutions over 2.5% increased the offspring of D. magna as a trade-off stress response, and produced mortality of neonates at dilutions over 5%. Elutriates (dilution 1:200) obtained during a 30 d period did not produce alterations on the oxygen consumption and ammonium excretion of O. mykiss, however these physiological parameters were affected in O. aureus at every time point of treatment, irrespective of the decrease in CFN concentration. When the fungally colonized rice husk was used to prepare a biomixture, where more accelerated degradation is expected, similar alterations on the responses by O. aureus were achieved. Results suggest that despite the good removal of the pesticide, it is necessary to optimize biomixtures to minimize their residual toxicity and potential chronic effects on aquatic life.
Keywords	Carbofuran; Degradation; Physiological responses in fish; Chronic toxicity; Biopurification system; Bioaugmentation

Title	Optimization of a Fungally Bioaugmented Biomixture for Carbofuran Removal in On-Farm Biopurification Systems
Author Name	Karla Ruiz-Hidalgo, Juan Salvador Chin-Pampillo, Mario Masís-Mora, Elizabeth Carazo-Rojas & Carlos E. Rodríguez-Rodríguez
Journal Name	Water Air Soil Pollutants
Year	2016
Volume and Issue	227,3
Pages	864-871
Abstracts	Biomixtures comprise the active part of biopurification systems (BPS) for the removal of pesticide-containing wastewater from agricultural origin. Considering that biomixtures contain an important amount of lignocellulosic substrates, their bioaugmentation with degrading ligninolytic fungi represents apromising way to improve BPS. The fungus Trametes versicolor was employed for the bioaugmentation of rice husk-compost-soil (GCS) biomixtures in order to optimize the removal of the highly toxic insecticide/nematicide carbofuran (CFN). Composition ofbiomixtures has not been optimized before, and usually,a volumetric composition of 50:25:25 (lignocellulosicsubstrate:humic component:soil) is employed.Optimization of the biomixture composition was per-formed with a central composite design, using the vol-umetric content of rice husk (pre-colonized by thefungus) and the volumetric ratio compost/soil as designvariables. Performance of biomixtures was comprehen-sively assayed considering CFN removal, the produc-tion of toxic transformation products (3-hydroxycarbofuran/3-ketocarbofuran), the ability tomineralize [14C]carbofuran, and the residual toxicity inthe matrix. According to the models, the optimal volu-metric composition of the GCS biomixture is 30:43:27,which maximizes removal and mineralization rate, andminimizes the accumulation of transformation products.Results support the value of assessing new biomixtureformulations according to the target pesticide in order toobtain their optimal performance, before their use in BPS.
Keywords	Biopurification system; Pesticides; Bioaugmentation; Fungi; Toxicity; Degradation

Title	**Monitoring and dietary exposure assessment of pesticide residues in cowpea (*Vigna unguiculata L. Walp*) in Hainan, China**
Author Name	Yun Duan , Ni Guan, Pingping Li, Jianguo Li, Jinhui Luo
Journal Name	Food Control
Year	2016
Volume and Issue	59
Pages	250-255
Abstracts	To monitor pesticide residues in cowpea and assess the potential public health risk, 433 fresh cowpea samples from Hainan province (2012 and 2013) were collected and the presence of 20 organophosphoate, carbamate and pyrethroid was determined. A screening analysis consisting of a dietary exposure assessment of pesticide residue was performed using a deterministic approach-point estimate of exposure. The results indicated the most important residues were triazophos, carbofuran, isocarbophos, phoxim and omethoate. The estimated daily intakes (EDIs) of those pesticides were 72.89%, 27.45%, 12.35%, 12.19% and 9.15% of Acceptable Daily Intake (ADI) respectively. Then a probabilistic approach applied on the residues of concern demonstrated that exposure from triazophos exceeded the ADI at P99.9. A relative potency factors method was employed to ascertain that exposure to triazophos is a cause for concern.
Keywords	Pesticide residue; Vigan unguiculata L. Walp; Exposure assessment