Physiologia Plantarum
An International Journal for Plant Biology

Physiologia Plantarum 165: 169–182. 2019

Time-course analysis of salicylic acid effects on ROS regulation and antioxidant defense in roots of hulled and hulless barley under combined stress of drought, heat and salinity

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Received 8 May 2018;
revised 2 July 2018

doi:10.1111/ppl.12798

Greater crop losses can result from simultaneous exposure to a combination of drought, heat and salinity in the field. Salicylic acid (SA), a phenolic phytohormone, can affect a range of physiological and biochemical processes in plants and significantly impacts their resistance to these abiotic stresses. Despite numerous reports involving the positive effects of SA by applying each abiotic stress separately, the mechanism of SA-mediated adaptation to combined stresses remains elusive. This study, via a time-course analysis, investigated the role of SA on the roots of hulled and hulless (naked) barley (*Hordeum vulgare* L. 'Tarm' and 'Özen', respectively), which differed in salt tolerance, under the combined stress of drought, heat and salt. The combined stress caused marked reductions in root length and increases in proline content in both genotypes; however, Tarm exhibited better adaptation to the triple stress. Under the first 24 h of stress, superoxide dismutase (SOD; EC.1.15.1.1) and peroxidase (POX; EC.1.11.1.7) activity in the Tarm roots increased remarkably, while decreasing in the Özen roots. Furthermore, the Tarm roots showed higher catalase (CAT; EC 1.11.1.6), ascorbate peroxidase (APX; EC 1.11.1.11) and glutathione reductase (GR; EC 1.6.4.2) activity than the Özen during the combined stresses. The sensitivity of hulless barley roots may be related to decreasing SOD, POX, CAT and GR activity under stress. Over 72 h of stress, the SA pretreatment improved the APX and GR activity in Tarm and that of POX and CAT in Özen, demonstrating that exogenously applied SA regulates antioxidant defense enzymes in order to detoxify reactive oxygen species. The results of this study suggest that SA treatment may improve the triple-stress combination tolerance in hulled and hulless barley cultivars by increasing the level of antioxidant enzyme activity and promoting the accumulation of proline. Thus, SA alleviated the damaging effects of the triple stress by improving the antioxidant system, although these effects differed depending on characteristic of the hull of the grain.

Abbreviations – APX, ascorbate peroxidase; CAT, catalase; GR, glutathione reductase; GSSG, oxidized glutathione; NBT, nitro blue tetrazolium; POX, peroxidase; ROS, reactive oxygen species; SA, salicylic acid; SOD, superoxide dismutase; TBARS, thiobarbituric acid reactive substances.

INTERNATIONAL JOURNAL OF ENVIRONMENTAL ANALYTICAL CHEMISTRY
2019, VOL. 99, NO. 15, 1575–1585
https://doi.org/10.1080/03067319.2019.1625345

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ARTICLE

A novel vortex-assisted liquid phase microextraction method for parabens in cosmetic oil products using deep eutectic solvent

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ABSTRACT

The parabens, which are harmful to our bodies, are primarily utilized as preservatives in medicine, personal care products and cosmetics. A novel, more efficient, fast and cheap vortex-assisted liquid phase microextraction method based on deep eutectic solvents (DESs) was developed for the determination of parabens. The microextraction conditions were optimized using these solvents and the analytical parameters of the method were determined under optimal microextraction conditions. After extraction, the chromatographic separation of parabens was undertaken using high-performance liquid chromatography-UV detection. Experimental parameters, such as DES type, DES volume, dilution solvent volume and vortex extraction time were optimized. DES6 [ChCl-Ethylene glycol (1/2)] was the most suitable DES to work in this study. Detection limits for this method of 0.053 μg mL^{-1} for methylparaben, 0.061 μg mL^{-1} for ethylparaben, 0.049 μg mL^{-1} for propylparaben and 0.052 μg mL^{-1} for butylparaben were obtained. Correlation coefficients (R^2) for a concentration range of 0.1–100 μg mL^{-1} were higher than 0.9992 and relative standard deviation (RSD) values below 2.91% at parabens concentration of 2.5 μg mL^{-1} were obtained. The results of spike/recovery values of real samples were greater than 84%. When compared with other methods, the main advantages include lower LOD, short extraction time, rapidity, repeatability and simplicity.

ARTICLE HISTORY
Received 6 May 2019
Accepted 23 May 2019

KEYWORDS
Parabens; deep eutectic solvents; vortex-assisted liquid phase microextraction; cosmetic oils

1. Introduction

In order to prevent aging and deterioration, many preservatives and additives are widely utilized in food, medicine and cosmetic products and thus extend shelf life [1,2]. Consumers are exposed to many chemicals through the ingestion of processed food and pharmaceutical products, or the application of personal care products and cosmetics. However, the tendency to allergic stimulation of these protectors may be harmful to consumers [3–5].

The parabens are p-hydroxybenzoates or alkyl esters of parahydroxybenzoic acid. This class of chemical includes methylparaben (MP), ethylparaben (EP), propylparaben (PP), butylparaben (BP), isobutylparaben, isopropylparaben and benzylparaben and their sodium salts [1,6]. Parabens are widely used as antifungal and antimicrobial agents in over 13,200 kinds of beverages, cosmetics and pharmaceuticals, because of their ability

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Anaerobic treatability and residual biogas potential of the effluent stream of anaerobic digestion processes

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Received 14 November 2018; Revised 14 November 2018; Accepted 7 December 2018

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Published online 28 January 2019 in Wiley Online Library (wileyonlinelibrary.com)

DOI: 10.1002/wer.1048

Abstract

Although anaerobic digestion is a well-established technology, the treatment and disposal of the digestate still presents a challenge due to lack of viable methods for processing. The residual organic matter in digestates also creates a significant residual biogas potential. This fact indicates that the digestates need further processing not only to reduce their organic content for disposal, but also to capture the biogas associated with this residual organic content. This study investigated anaerobic treatment and residual biogas potential of digestates obtained from five full-scale farm-based digesters. The results indicated that it was possible to reduce the total chemical oxygen demand (COD_t) of the digestates with an efficiency of 21%–84%. The corresponding biogas yields of digestates ranged between 0.078 and 0.326 $L_{biogas}/g\ VS_{added}$. This level of biogas production is comparable to the biogas production potential of several commonly used raw substrates. © 2019 Water Environment Federation

Practitioner points

- Significant CODt reduction and biogas capture can be attained by AD of digestates.
- The digestates subjected to anaerobic treatment yielded up to 82% CODt removal.
- Residual biogas yields of digestates ranged between 0.078–0.326 Lbiogas/g VSadded.
- Biogas yields obtained were comparable to many raw feedstocks of biogas plants.

Key words

anaerobic; digestate; residual biogas; treatment

Introduction

Anaerobic digestion (AD) process is widely applied for the stabilization and the treatment of high-strength organic wastes and simultaneously for the production of renewable energy via biogas generation. Organic wastes such as animal manures, sewage sludges, municipal solid wastes, and agricultural and food residues are anaerobically stabilized with significant amounts of biogas production (Braun, 2007; Zupančič & Grilc, 2012). On the other hand, AD of organic wastes creates another waste stream known as digestate which is the slurry effluent of AD processes.

Digestates leaving anaerobic digesters still contain considerable amounts of undigested organic matter (Gioelli, Dinuccio, & Balsari, 2011; Menardo, Gioelli, & Balsari, 2011; Rico, Rico, Tejero, Muñoz, & Gómez, 2011). The organic matter content of digestate in terms of volatile solids can be up to 70% of its total solids content (Drosg, Fuchs, Seadi, Madsen, & Linke, 2015). Operating conditions of anaerobic digesters such as high organic loading rate (OLR) and low hydraulic retention time (HRT; Menardo et al., 2011; Rico et al., 2011) as well as short circuiting within digester (Angelidaki, Boe, & Ellegaard, 2005) and partial degradation of recalcitrant organic matters in anaerobic digesters (Thygesen, Sommer, Shin, & Triolo, 2014) were pointed out as the reasons for the presence of undigested organics in digestates.

Even though AD is a well-established technology, the treatment and disposal of digestate still presents a challenge. Digestate processing options developed with the aim of nutrient recovery or treatment either require chemical addition or high energy

BIOFUELS
https://doi.org/10.1080/17597269.2019.1667658

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Combustion, performance, vibration and noise characteristics of cottonseed methyl ester–diesel blends fuelled engine

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ABSTRACT

An experimental study was conducted to evaluate the impacts of using cottonseed methyl ester as an additive into neat diesel fuel on the combustion, performance, vibration and noise characteristics of a single-cylinder, direct injection diesel engine at a constant engine speed (1500 rpm) and under different engine loads (2.5, 5, 7.5 and 10 Nm). B_{10}, B_{20} and B_{50} fuel blends were prepared as the working fuels and compared to B_0 reference fuel (neat diesel fuel) in the study. The results indicated that the lowest average vibration value was also obtained in B_{20} type fuel. It was observed that cottonseed methyl ester due to the high oxygen content improved the quality of combustion process. Additionally, the high viscosity value of the used biodiesel increased the ignition delay by adversely affecting the atomisation, evaporation and mixing ratio of the fuels. On the other hand, BSFC increased with the increment of the biodiesel ratio in the blends i.e. the maximum BSFC was observed in B50 fuel type. In all fuel blends except for B_{50} type, IP_{max} values were achieved higher than B_0 for each engine load. In conclusion, the experimental results clearly reported that the presence of cottonseed methyl ester in the blends can alternatively be substituted for the neat diesel fuel without any modifications in diesel engines.

ARTICLE HISTORY
Received 24 April 2019
Accepted 4 September 2019

KEYWORDS
Cottonseed methyl ester; combustion; performance; vibration; noise

Nomenclature

ACP_{max}	Angle of maximum cylinder pressure
AIPmax	Angle of maximum pressure increase
B_0	Reference fuel - neat diesel
B_{10}	10% biodisel + 90% diesel (v/v)
B_{20}	20% biodisel + 80% diesel (v/v)
B_{25}	25% biodisel + 75% diesel (v/v)
B_{50}	50% biodisel + 50% diesel (v/v)
B_{75}	75% biodisel + 25% diesel (v/v)
B_{100}	Biodiesel
BSFC	Brake specific fuel consumption
BTE	Brake thermal efficiency
CD	Combustion duration
CO	Carbon monoxide
CP_{max}	Maximum cylinder pressure
CSME	Cottonseed methyl ester
EGT	Exhaust gas temperature
FFT	Fast Fourier transform
HC	Hydrocarbon
HRR	Heat release rate
HRR_{max}	Maximum heat release rate
ICEs	Internal combustion engines
ID	Ignition delay
IP_{max}	Maximum pressure increase
k	Polytrophic constant
m_f	Mass flow rate
NaOH	Sodium hydroxide
NOx	Nitrogen oxide
PI_{max}	Maximum pressure increase
P_e	Brake power
R	Uncertainty function
RMS	Root mean square
SOC	Start of combustion
SOI	Start od injection
T	Torque
TDC	Top dead centre
w_n	Uncertainty in the independent variables.
wt. %	Weight percent
W_R	Total uncertainty
v/v	Volumetric ratio
Ø or °CA	Crank angle
∂ P	Change in-cylinder pressure
∂ V	Change in cylinder volume
ω	Angular velocity

Introduction

Throughout history, energy is one of the most essential needs to sustain any activity in daily life. However, the rapidly growing population has caused an enormous increase in energy demand and consumption. Comparing to the year 2016, the primary energy consumption of the world increased by 2.2% in the year 2017. Moreover, fossil fuels are the most dominant energy source by the rate of 85% [1]. This rate has not changed over the last century and could persist for a few decades more. With the burning of fossil fuels, many harmful gases have been released into the atmosphere and they have seriously threatened the environment and human health [2]. Additionally, another important disadvantage is that the known-reserves of fossil fuels have a finite. In other word, they are not a renewable energy source. It is projected that these reserves of fossil fuels will be completely run out in the next century [3]. These adversities have accelerated the shift towards alternative and renewable energy sources that can be used instead of fossil fuels. Over recent years, some steps have been, therefore, taken to reduce the high dependence on fossil fuels worldwide. Among these steps, the tendency to biomass is one of the most promising solutions, particularly

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Environmental Science and Pollution Research (2019) 26:1323–1335
https://doi.org/10.1007/s11356-018-3700-9

RESEARCH ARTICLE

Determination of histological, immunohistochemical and biochemical effects of acute and chronic grayanotoxin III administration in different doses in rats

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Received: 16 May 2018 / Accepted: 6 November 2018 / Published online: 13 November 2018

Abstract

Grayanotoxin (GTX)-III is a Na-channel neurotoxin. Grayanotoxins can be found in the nectar, pollen, and other plant parts of the Rhododendron genus plants from the Ericaceae family. It is widely believed that honey produced from these plants, which are concentrated in the Black Sea region, is traditionally characterized as enhancing sexual performance. It is thought that the effective factor is dose for this compound, which has both beneficial and toxic effects reported. Therefore, it is aimed to evaluate the histological, immunohistochemical, and biochemical effects of acute and chronic impact of GTX-III in different doses on testes tissue in this study. For this purpose, 100 Sprague-Dawley male rats were divided into 5 separate groups for acute and chronic research. While dose groups were (control, 0.1, 0.2, 0.4, ve 0.8 μg/kg/bw) for experimental groups, a single dose (i.p.) was administered for acute impact whereas the same doses were administered daily for 3 weeks to assess chronic effect. At the end of the experiment, Johnsen testicular biopsy scoring was performed on testicular tissue samples, seminiferous tubule diameters were measured, and apoptotic cells were evaluated by TUNEL method. Testosterone, LH, and FSH levels were measured by ELISA method in serum and tissue specimens. It was found that Johnsen score of acute doses was significantly lower than the control group, and the diameter of the seminiferous tubules decreased significantly in acute and chronic dose-administered groups compared to the control. Hemorrhage, epithelial shedding, irregularity in seminiferous epithelium, and vacuolization were observed in acute and chronic dose-administered groups, and increase in apoptotic cells was determined. Hormone levels varied depending on the dose. In conclusion, it was found that dose-dependent acute and chronic effects of GTX-III are different, and this factor should be taken into account in studies to be carried out due to the adverse effects of high doses.

Keywords Grayanotoxin · Ericaceae · Sexual hormone · Histology

Introduction

Grayanotoxin is a water and lipid soluble toxin that enhances channel activity by binding to the group II receptor site of voltage-dependent sodium channels. The main toxic isomer in Rhododendron plant species is grayanotoxin III (GTX-III); grayanotoxin I (GTX-I) and grayanotoxin II (GTX-II) are less toxic. However, there are 18 different grayanotoxins mentioned in the literature that are less toxic (Wong et al. 2002). The toxic effects of GTX on the cell are on Na channels. They enhance the permeability of sodium ions in excitable membranes and facilitate the entry of calcium into the cell. The toxin binds to voltage-dependent channels in the opening phase of these channels, the channels are modified, and inactivation is inhibited. The activation potential of modified Na channels leads to hyperpolarization of the channel. In this

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International Journal of Environmental Science and Technology (2019) 16:4083–4090
https://doi.org/10.1007/s13762-018-02202-5

ORIGINAL PAPER

Effect of disinfection processes and anthropogenic pollutants on comparative formation of trihalomethanes and *N*-nitrosodimethylamine

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Received: 8 October 2018 / Revised: 3 December 2018 / Accepted: 31 December 2018 / Published online: 9 January 2019

Abstract
Chloramination and chlorination contribute to the formation of *N*-nitrosodimethylamine and trihalomethanes, respectively, both of which are defined as disinfection by-products. To be able to select the most appropriate water treatment scheme, it is important to comparatively evaluate the formation of both of these disinfection by-products during the application of different disinfection methods. In this study, chlorination, chloramination and stepwise chloramination methods have been applied to surface water samples that have been spiked with known *N*-nitrosodimethylamine precursors. Experimental results showed that ranitidine can be an effective *N*-nitrosodimethylamine precursor in distilled water, when chloraminated with high concentrations (140 mg/L) for a long time (10 days), resulting in approximately 450 ng/L of *N*-nitrosodimethylamine. However, neither dimethylamine nor ranitidine leads to significant trihalomethanes or *N*-nitrosodimethylamine formation in lake water when chloramination is conducted with low concentration (2 mg/L) for 2 h. These results suggest that *N*-nitrosodimethylamine concentration measured in the effluent of the drinking water treatment plant may underestimate the *N*-nitrosodimethylamine concentration that will reach the consumers since chloramination reactions will continue in the distribution system. On the other hand, when only *N*-nitrosodimethylamine formation potential is used, it will overestimate the *N*-nitrosodimethylamine that might form in the distribution system due to high disinfectant concentration, high contact time and adjusted pH values used in the *N*-nitrosodimethylamine formation potential test.

Keywords Chlorination · Chloramination · Dimethylamine · Disinfection by-products · Ranitidine · Water quality

Introduction

Although disinfection of drinking water is necessary for public health, adverse human health effects such as pregnancy abnormalities, bladder cancer, colorectal cancer and other diseases related to disinfection by-products (DBPs) require the concentration of DBPs to be kept below certain limits (Yang and Zhang 2016). Trihalomethanes (THM) usually form during chlorination where chloramination contributes mainly to the formation of *N*-nitrosodimethylamine (NDMA).

THM are the most widely regulated DBP in drinking water in the world with maximum allowable concentration (MAC) of 80 µg/L and 100 µg/L in the USA and Europe, respectively. THM concentrations in the effluent of the water treatment plant can be decreased either by removing the THM precursors prior to chlorination or by removing the THM that formed. In addition, instead of chlorination, chloramination can be used since chloramines are less potent than chlorine in THM formation. However, switching from chlorination to chloramination may lead to the formation of NDMA (Zhang et al. 2016). NDMA is not a widely regulated DBP in the world even though the presence of NDMA has been observed up to 30 ng/L in chlorinated (Valentine et al. 2006) and 50 ng/L in chloraminated water (Russell et al. 2012) which are well above the concentration associated with $1/10^6$ cancer risk (CEPA 2006; USEPA 1993). After the

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Journal of Water Process Engineering 31 (2019) 100877

Contents lists available at ScienceDirect

Journal of Water Process Engineering

journal homepage: www.elsevier.com/locate/jwpe

Electrocoagulation/electroflotation as a combined process for the laundry wastewater purification and reuse

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ARTICLE INFO

Keywords:
Laundry wasterwater
Electrocoagulation
Electroflotation

ABSTRACT

The purpose of this work is to purify wastewater from industrial laundries and return them to the washing process. By means of the methods of electrocoagulation and electroflotation, laboratory and pilot studies on the wastewater treatment were carried out using aluminium electrodes. The process of wastewater treatment has been studied in dependence on treatment time, temperature, pH and current density. The effectiveness of the cleaning process under different values of operating parameters of the reactor was estimated as the percentage of color, turbidity and surfactant removal from the wastewater. As a result of laboratory studies, the optimum values of the operating parameters of the reactor at 90% removal of contamination were the following: current density value as 5.26 mA/cm^2, pH as 5.5 and 5 min processing time. The consumption of electrical energy in this case amounted to 1.25 kW h/ m^3. The quality control of the purified water was carried out according to such additional parameters as total suspended solids, chemical oxygen demand, total organic carbon, and the content of metal ions and phosphate and nitrate anions in the water. The study of the wastewater treatment in a pilot plant with laboratory values of operating parameters showed the reproducibility of the purification results for the controlled parameters of water quality and suitability of the water for reuse. The washing performed with purified water was estimated by the whiteness index for bed linen and was not inferior to the traditional washing with water from a source of water supply.

1. Introduction

The widespread use of synthetic surfactants (SS) as washing, stabilizing and foaming agents, determines their presence in most types of industrial and domestic wastewater. The recent studies show a significant effect of synthetic surfactants on all living organisms, plants and humans [1,2]. When interacting with other contaminants, surfactants contribute to the emulsification and stabilization of liquid and solid dispersed types of contaminants. Therefore, wastewater containing SS are characterized by a complex chemical and phase-dispersed composition, which makes it possible to treat them as a special type of sewage [3–7].

The analysis of existing technological solutions shows that the creation of circulating water supply systems in industrial enterprises is quite a difficult, but solvable task. At the same time, the creation of closed cycle of water consumption can be hampered only by economic reasons. The choice of purification technology is being carried out, based on the specific operating conditions and features of the cleaning equipment. The main criteria that ensure the selection of an appropriate cleaning method should be sufficient wastewater treatment (WWT) efficiency, as well as low operational cost of the cleaning equipment, its simplicity and reliability.

This article discusses the electrocoagulation (EC) and electroflotation (EF) as methods that can be applied to the treatment of wastewater from industrial laundries with the purpose of their reuse. Combined use of these methods has shown their efficiency and cost-effectiveness in solving various problems related to the environment protection [8–13]. Over the past 20 years there is no such industry, whose model wastewater would not have been investigated in the laboratories by electrochemical methods in general and by EC, in particular.

There was an attempt to treat and reuse laundry wastewater (LWW) by taking various configurations of hybrid systems based on the biological treatment followed by oxidation and membrane separation [14–18]. It should be noted that processes of the surfactants oxidation can be accompanied by the release of more toxic products of destruction. It is shown that the Photo-Fenton process proved to be toxicologically safe, in comparison with the initial solution [19]. Removal of sodium dodecyl sulfate (SDS) from model solutions of wastewater by

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https://doi.org/10.1016/j.jwpe.2019.100877
Received 26 December 2018; Received in revised form 28 April 2019; Accepted 11 June 2019
Available online 17 June 2019

Ecotoxicology and Environmental Safety 181 (2019) 49–59

Contents lists available at ScienceDirect

Ecotoxicology and Environmental Safety

journal homepage: www.elsevier.com/locate/ecoenv

Exogenous N-Acetylcysteine alleviates heavy metal stress by promoting phenolic acids to support antioxidant defence systems in wheat roots

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ARTICLE INFO

Keywords:
Wheat
Triticum aestivum
Heavy metal
N-acetylcysteine
Antioxidant
Phenolic acid

ABSTRACT

N-acetylcysteine (N-Acetyl L-cysteine, NAC) is a thiol compound derived from the addition of the acetyl group to cysteine amino acid. NAC has been used as an antioxidant, free radical scavenger, and chelating agent for reducing the deleterious effects on plants of biotic and abiotic environmental stresses. It can also relieve heavy metal (HM) toxicity, although its alleviating mechanism remains unknown. In this study, we compared HM-stressed (Cu, Hg, Cd and Pb, 100 μM each) wheat seedlings without NAC treatment and in combination with NAC (1 mM). In comparison to HMs alone, NAC treatment in combination with HMs (Cu, Cd, Hg and Pb, respectively) stimulated root growth (1.1-, 1.5-, 10.5- and 1.9-fold), and significantly increased fresh (1.3-, 1.5-, 4.3- and 1.4-fold) and dry (1.2-, 1.5-, 2.5- and 1.2-fold) mass. Combination treatment also led to significant reductions in HM concentrations (1.3-, 1.4-, 4- and 1.1-fold, respectively). GSH (1.1 – 1.8-fold), TBARS (1.4 – 2.7-fold) and H_2O_2 (1.6 – 1.8-fold) contents in treatment with HMs alone were significantly mitigated by the NAC combination. Some of the antioxidant enzyme activities increased or reduced by some HM treatments alone were stimulated by a combination of NAC with HMs, or remained unchanged or changed only insignificantly, supported by the phenolic pool of the plant. Ferulic, *p*-comaric and syringic acids were the major phenolic acids (PAs) in the roots in free, ester, glycoside and ester-bound forms, and their concentrations were increased by HM treatments alone, in comparison to the control seedlings, while PAs concentrations were relatively reduced by NAC in combination with HMs. These results indicate that NAC can alleviate HM toxicity and improve the growth of HM-stressed wheat seedlings by coordinated induction of the phenolic pool and the antioxidant defence system.

1. Introduction

Urban and peri-urban agricultural lands are frequently contaminated by the accumulation of heavy metals (HMs) and metalloids. HMs are released into the biosphere both from natural sources, including volcanic eruptions, and as a result of anthropogenic activities, including mining, and the use of fossil fuels, dyes, animal debris, sewage sludge, pesticides, fertilizers, etc. (Nagajyoti et al., 2010). Low concentrations of HMs in agricultural land can rise to toxic levels by accumulating in soil in the event of repeated use of any one or more of the above agents. The most common essential or non-essential HMs in polluted areas are lead (Pb), chromium (Cr), arsenic (As), zinc (Zn), cadmium (Cd), copper (Cu), mercury (Hg) and nickel (Ni). Due to their high solubility in water, plants frequently and easily absorb HMs from soil through their roots, the first organ exposed to the effect of HMs, before these are transported and accumulated in the aerial parts of the plant (Nagajyoti et al., 2010; Gill, 2014).

Triticum aestivum L. is one of the most important cereals as a human food source, and requires approximately 520 mm of water per year. Irrigation is mainly performed with waste water in developing countries (Durán–Álvarez and Jiménez–Cisneros, 2014). However, toxic HMs in waste water can accumulate at high rates in wheat crops (e.g. grains), and toxic HMs may thus be consumed by humans (Jaramillo and Restrepo, 2017; Rizwan et al., 2016). HMs accumulated in tissues exert direct or indirect deleterious effects on seedling growth, photosynthesis, respiration, protein metabolism, antioxidant systems, etc. through various different mechanisms. Increased levels of reactive oxygen species (ROS) including hydroxyl radical ($^{\bullet}OH$), superoxide anion ($O_2^{\bullet-}$), hydrogen peroxide (H_2O_2), and alkoxyl ($RO^{\bullet}$) and the development of oxidative stress are the best-known indirect effects. In addition, HMs exhibit a direct effect by blocking functional groups of proteins and enzymes by binding to sulfhydryl groups in particular and

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https://doi.org/10.1016/j.ecoenv.2019.05.052
Received 21 February 2019; Received in revised form 29 April 2019; Accepted 15 May 2019
Available online 03 June 2019
0147-6513/

Journal of Plant Pathology (2020) 102:537
https://doi.org/10.1007/s42161-019-00429-w

DISEASE NOTE

First report of fruit rot caused by *Botryosphaeria dothidea* on olive in Turkey

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Received: 18 July 2019 / Accepted: 9 October 2019 / Published online: 2 December 2019

Keywords *Botryosphaeria dothidea* · Fruit rot · Olive

During the years 2012 and 2013, in the Aegean region (Western Turkey), fruit rot symptoms occurred on olive (*Olea europea* L.) cvs Gemlik, Memecik and Ayvalık with an infection incidence 50%. Infected olives showed an initial brown color and then fruits increase in size and the lesions are fused until they become completely desiccated and mummified. Infected fruit parts were disinfected with 1% sodium hypochloride for 2 min, rinsed in sterile distilled water twice and dried in sterilised filter paper. The infected fruit parts were placed on potato dextrose agar (PDA) and incubated at 25 °C in darkness for 5 days. Fungal cultures showed fusiform, hyaline, aseptate conidia typical of the genus *Fusicoccum*, dark walled, ovoid, elipsoid or fusiform and other conidia types were different that had 1–2 septate averaging 22.7 × 5.3 μm (Philips et al. 2005). Nucleotide sequence of the internal transcribed spacer region (primer pair ITS1/ITS4) of ribosomal DNA and part of translation elongation factor 1-alpha (EF1-α; EF1-688F/EF1-986R) were amplified. The sequences, obtained from three different samples from the same fungus, were deposited in GenBank under accession Nos. MG598525, MG753998 and KX898358 for the ITS region and MG816210, MG816211, MG816213 for the EF1-α region. The gene homology analyses showed that the three ITS sequences were 99- 100% identical to *Botryosphaeria dothidea* (EF638755). Similar results were obtained for the three samples of the EF1-α sequences, all showing 100% gene homology to *B. dothidea* (EF638732) (Lazzizera et al. 2008). Pathogenicity was conducted by placing a 5 mm disk of PDA colonized with *B. dothidea* on selected two branches each with 25 fruits of native olive cultivar Gemlik. As a control, fruits were inoculated with uncolonized discs on selected third branch (25 fruits) (Delen and Saribay 1972). Branches were covered with plastic bags after the application to provide high humidity. After 10 days of incubation, the pathogen was successfully re-isolated from the fruit surface to fulfill Koch's postulates. Previously, drupe rot caused by *B. dothidea* has been reported on olive in Greece (Philips et al. 2005). To the best of our knowledge, this study is the first report of *B. dothidea* causing olive fruit rot from Turkey.

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s42161-019-00429-w) contains supplementary material, which is available to authorized users.

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Phytoparasitica (2019) 47:89–97
https://doi.org/10.1007/s12600-018-00708-9

Determination of pathogenicity of *Bursaphelenchus* species on different pine species under natural conditions in Düzce

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Received: 16 August 2018 / Accepted: 6 December 2018 / Published online: 19 December 2018

Abstract The pinewood nematode, *Bursaphelenchus xylophilus* is a pathogen of conifer forest trees. This pest is characterized by the sudden death of infected pine trees. In this study, pathogenicity tests of six native *Bursaphelenchus* species (*B. mucronatus*, *B. sexdentati*, *B. anamurius*, *B. vallesianus*, *B. andrassyi* and *B. hellenicus*) on three pine species (*Pinus pinaster, P. nigra and P. sylvestris*) using two inoculum doses under natural conditions were conducted. For each treatment, 8 trees of each species were inoculated. For each tree species 8 trees were used as control groups. Inoculated trees were monitored for a year after inoculation. Monthly oleoresin flow measurements were carried out and external symptoms (foliage coloration) observed. Nematode inoculated trees did not die at the end of the study. The amount of oleoresin flow differed significantly among tree species. Inoculated *Bursaphelenchus* species did not cause any significant difference in the oleoresin flow between inoculated and uninoculated trees. We concluded that *Bursaphelenchus* species used in this study were not pathogenic to pine trees growing under natural forest stand conditions.

Keywords *Bursaphelenchus* · Oleoresin flow · Pathogenicity · *Pinus* spp.

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Introduction

The pinewood nematode, *Bursaphelenchus xylophilus* (Steiner and Buhrer 1934) Nickle 1970 (Nematoda: Parasitaphelenchidae) is a tree pathogen of conifer forests. This pathogen, known as the causal agent of pine wilt disease, is characterized by the sudden death of infected pine trees (Mamiya 1983; Kishi 1995). This species causes considerable losses in eastern Asian countries such as Japan, China, and South Korea (Mamiya 1988). In 1999 and 2008, it was detected in the forest lands of Portugal and Spain respectively (Mota et al. 1999; Abelleira et al. 2011). Recently, detection of the nematode in *Pinus nigra* J. F. Arnold trees (Inacio et al. 2015), in addition to *Pinus pinaster* Aiton in Portugal indicates that the nematode increased both its distribution and host ranges.

Increasing international trade of goods and human movements has been threatening forest ecosystems of countries via invasion of exotic forest pest species (Liebhold et al. 1995). The geographical location of Turkey increases the possibility of invasion of exotic pests in forest ecosystems. The invasion potential of *B. xylophilus* into Turkey is very high due to the considerable amount of wood importation from different countries, suitable climatic conditions, presence of vector insect species (*Monochamus galloprovincialis* Olivier) and large number of susceptible pine trees.

For the reasons stated above, studies on pine wilt disease and its components in Turkey were initiated in 2003 (Akbulut et al. 2006). So far, *B. xylophilus* has not been found, but the presence of different *Bursaphelenchus* species was reported (Akbulut et al. 2006, 2007a, b; 2008).

Application of Electrostatic Powder Coating on Wood Composite Panels Using a Cooling Method. Part 1: Investigation of Water Intake, Abrasion, Scratch Resistance, and Adhesion Strength

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Powder coating is environmentally friendly and safe in terms of human health and is used especially on home appliances and in the automotive sector. Because of these advantages, recent studies have expanded work on the application of powder coating on non-conductive surfaces. Within the scope of this research, low temperature curing (120 °C to 130 °C) was applied on wood-based composite panels of medium-density fiberboard (MDF), particleboard, and plywood to facilitate conductivity. Epoxy, polyester, and hybrid (epoxy-polyester) types of powder paint and water-based liquid paint (control group) were applied to the surface of materials. Panels coated with the powder coatings were compared to the panels coated with the water-soluble acrylic resin coating. The prepared samples were analyzed for performance properties. The best results for thickness swelling, water absorption, adhesive strength, abrasion, and scratch resistance were found for the plywood coated with water-based liquid paint, MDF coated with polyester-based powder paint, plywood coated with hybrid powder paint, particleboard coated with hybrid powder paint, and plywood coated with epoxy powder paint, respectively.

Keywords: Electrostatic powder coatings; Wood-based panels; Water-based coating

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INTRODUCTION

Great care must be taken with solvent-based paints that are used during the production of furniture. Both the coating operation and the dust that is released during the sanding process are harmful to the health of the workers. Solvent-based coatings cause serious damage to the lungs when inhaled, and these toxic substances can cause asthma, bronchitis, and even lung cancer. Solvents pose a hazard, as they are flammable, volatile, evaporate easily, and are prone to form explosive mixtures. Consequently, solvents can be the cause of fires and explosions in painting plants. During their application, 30% to 50% of solvent-based paints go to waste, and these are classified as hazardous wastes having toxic effects that substantially threaten human health and the environment (Akkuş 2018).

Due to solvent emission rules and increased ecological awareness of consumers and producers, the use of economic and ecologically sound coatings is becoming increasingly popular (Prieto and Kiene 2007). Coatings that do not harm the environment or human health have started to replace acid-based or double-component polyurethane-based paints containing high amounts of solvent-based nitrocellulose. Recently, powder paints, water-based paint systems, and UV-based paints have become the preferred coatings for medium-

Effects of Moisture Content on Mechanical Properties of Micro-size Oak Wood

Ogün Korkmaz and Ümit Büyüksarı *

Effects of moisture content (MC) were investigated for the mechanical properties of oak wood (*Quercus petraea* Liebl.) using micro-size test specimens. The micro-size specimens for bending, tensile, and compression tests were prepared and divided into five groups. Each group was conditioned at a different relative humidity and temperature to achieve MC values of 8%, 12%, 16%, 20%, and above-fiber-saturation-point MCs. After conditioning, the bending strength, modulus of elasticity (MOE) in bending, tensile strength, and compression strength values were determined. The results showed that MC had statistically significant effects on all the measured mechanical properties in the micro-size oak wood samples. The greatest decrease was observed for the compression strength, while the lowest decrease was observed for the tensile strength, when MC increased. The changing rates induced by 1% MC were calculated as 3% for bending strength, 2.5% for the MOE, 2.0% for the tensile strength, and 3.1% for the compression strength.

Keywords: Size effect; Moisture content; Changing rate; Flexural properties; Tension; Compression; Strength

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INTRODUCTION

Structural-size, standard-size (small and clear), micro-size, and cellular-size specimens have all been used to determine the mechanical properties of wood. Sample dimensions and volume have important effects on the mechanical properties of wood. This is called "size effect" or "weakest link theory" (Weibull 1951). According to this theory, the strength is dependent on the size of the highly stressed volume. The basis for this theory is that there is a greater probability that a region of low strength will occur in a sample of large volume than in a sample of small volume. This region of low strength is assumed to cause complete failure of the sample (Weibull 1951).

In recent years, the use of the micro-size specimens to determine the mechanical properties of wood is gaining prominence. Micro-size samples have some advantages in determining the mechanical properties of wood (Büyüksarı *et al*. 2016). Additionally, identification of wood's micro-scale behavior provides inputs to finite element models and predictions of the mechanical properties of composite materials based on the individual particle, strand, and fiber properties (Jeong 2008). Several previous studies have used micro-size specimens to evaluate the mechanical properties of earlywood and latewood sections, wood strands, and fibers (Plagemann 1982; Hunt *et al*. 1989; Deomano 2001; Deomano and Zink-Sharp 2004; Wu *et al*. 2005; Zink-Sharp and Price 2006; Cai *et al*. 2007; Hindman and Lee 2007; Jeong 2008; Jeong *et al*. 2009; Roszyk *et al*. 2016). Recently, studies have focused on comparisons of the micro-size and standard-size

Peripherally substituted soluble Nickel phthalocyanines: Synthesis, characterization, aggregation behavior and antioxidant properties

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ABSTRACT: Tetra zwitterionic substituted nickel(II) phthalocyanine derivatives were newly synthesized starting from nonionic 2(3), 9(10), 16(17), 23(24)-Tetrakis-[2-(N-((3-dimethylamino)propyl)carbamate)oxyethyl)phthalocyaninato nickel (II). The novel compounds have been characterized by the combination of UV-Vis, FT-IR, mass spectroscopies and elemental analysis. The critical micelle concentrations of the prepared compounds were measured, and the antioxidant activities were analyzed with radical scavenging ability of 1,1-diphenyl-2-picrylhydrazyl (DPPH) and 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt (ABTS), as well. It is found that the zwitterionic molecules showed aggregated spectra in UV-Vis spectrum and they might be good surfactant candidates for detergent industry with their appropriate critical micelle concentration (CMC) properties in water. The compounds exhibited ABTS radical scavenging activity thus they have antioxidant activity.

KEYWORDS: soluble phthalocyanines, zwitterionic substituted phthalocyanines, antioxidant properties, ABTS, critical micelle concentration.

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HortScience 54(5):873–879. 2019. https://doi.org/10.21273/HORTSCI13749-18

Sumatran Fleabane (*Conyza sumatrensis*) Resistance to Glyphosate in Peach Orchards in Turkey

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Additional index words. glyphosate isopropyl amin, glyphosate potassium, chlorsulfuron, metribuzin, *Conyza sumatrensis* (Retz.) E. H. Walker, *Prunus persica* Batsch, herbicide resistance, dose response

Abstract. **Glyphosate has been widely used to control annual, perennial, and biennial weeds including *Conyza* species. *Conyza sumatrensis* (Sumatran fleabane) is considered a highly invasive and troublesome weed worldwide, including in European and Mediterranean regions. In Turkey, the use of glyphosate in orchards has recently increased; however, extensive use of glyphosate has resulted in poor control of *C. sumatrensis* in several peach orchards. The objectives of this research were to determine if *C. sumatrensis* is resistant to glyphosate and identify alternative herbicides with different modes of action that can be used instead of glyphosate. Two dose response studies were conducted in the greenhouse to evaluate the response of four *C. sumatrensis* populations to glyphosate, chlorsulfuron, and metribuzin. Glyphosate isopropyl amine and glyphosate potassium was applied at 0, 0.25, 0.5, 1, 2, 4, and 8 times the use rate of 1080 g a.e./ha (a.e. indicates acid equivalent) when the plants were at rosette (5–6 true leaves) and vegetative (20–22 cm tall) stages. Effects of both glyphosate formulations were combined. The resistant populations showed higher resistance 3.8 to 6.6 and 5.3 to 7.8 times at rosette stage and vegetative stage, respectively, compared with the susceptible population. Furthermore, glyphosate-resistant populations were treated with chlorsulfuron and metribuzin at 0, 0.25, 0.5, 1, 2, 4, and 8 times use rate of 7.5 and 350 g a.i./ha, respectively at the rosette stage. The glyphosate-resistant populations exhibited 2.4 to 3.8 times more resistance to chlorsulfuron, but were adequately controlled with metribuzin.**

Glyphosate [N-(phosphonomethyl)-glycine] is a systemic, nonselective, postemergence herbicide that controls more weed species than any other herbicide (Duke, 2018; Heap and Duke, 2018). It has been used to control annual, perennial, and biennial species of grasses, sedges, and broadleaf weeds (Dinelli et al., 2006). Glyphosate inhibits the enzyme 5-enolpyruvlshikimate-3-phosphate synthase (EPSPS), which catalyzes the reaction of shikimate-3-phosphate and phosphoenolpyruvate to form 5-enolpyruvil-shikimate-3-phosphate (Fernandez et al., 2015; González-Torralva et al., 2012). Inhibition of EPSPS prevents the biosynthesis of phenylalanine, tryptophan, tyrosine, and other aromatic compounds in sensitive plants (Amaro-Blanco et al., 2018; Tahmasebi et al., 2018). In Turkey, glyphosate is the most widely used herbicide and is registered on more than 70 crops, including peach (Torun, 2017). In the past 5 years, the total amount of glyphosate sold in Turkey was ≈1.1 million kg of acid equivalent (Ministry of Agriculture and Forestry, 2018).

The application of glyphosate in crop and noncrop areas has resulted in decreased efficacy on several populations of three widespread species of the genus *Conyza* (Amaro-Blanco et al., 2018). These species include *C. bonariensis* (hairy fleabane), *C. canadensis* (horseweed), and *C. sumatrensis* [Sumatran fleabane (Syn. *C. albida*)]; there are at least 13 hairy fleabane, 42 horseweed, and 8 Sumatran fleabane cases of resistance reported in field crops, orchards, forests, pastures, urban areas, and nurseries around the world (Heap, 2018; Mylonas et al., 2014). Several glyphosate-resistant *Conyza* species have been reported in European and Mediterranean countries including France (Fernandez et al., 2015), Spain (Amaro-Blanco et al., 2018), Greece (Margaritopoulou et al., 2018), and Israel (Matzrafi et al., 2015). These species are native to the Americas (Amaro-Blanco et al., 2018) and considered as invasive and troublesome species in many parts of the world (Matzrafi et al., 2015). They are common weeds in orchards, row crops, roadsides, abandoned fields, and wasteland (Amaro-Blanco et al., 2018; Sansom et al., 2013) and occur in more than 70 countries (Holm et al., 1997). Currently, these *Conyza* species have become established in new territories including the Mediterranean basin (Amaro-Blanco et al., 2018) and are invading a variety of cropping systems (Tahmasebi et al., 2018).

In 2015, peach growers in Çanakkale Province of Turkey complained about a lack of glyphosate control of *Conyza* species. To date the only report of poor *Conyza* species control with glyphosate in Turkey was reported in citrus orchards in Adana, Mersin, and Hatay of Mediterranean region (Dogan et al., 2016). No research has been conducted to confirm and determine the level of resistance in these populations.

There are ≈56,000 ha of cherry, apple, pear, peach, and nectarine orchards in the Çanakkale Province in northwestern Turkey, which is considered one of the most important fruit and vegetable production areas in Turkey (TUIK, 2018). Currently, *C. sumatrensis* is considered as the most common troublesome weed in these orchards. Because of the poor control of *C. sumatrensis* with glyphosate, the objectives of this study were to confirm and identify the level of glyphosate resistance in *C. sumatrensis* and to determine the effect of chlorsulfuron (an acetolactate inhibitor) and metribuzin (a photosynthetic inhibitor) on glyphosate-resistant populations, which some farmers use to solve the problem despite their not being registered for use in orchards.

Materials and Methods

Plant material. Conyza seeds were collected from peach orchards where farmers reported a lack of control with glyphosate and from noncrop areas in the Çanakkale Province in northwestern Turkey. Herbicide application records were obtained from farmers (Table 1). Seeds were collected from three peach orchards that had been established for at least 10 years and from noncrop areas where glyphosate was not used at Çanakkale. Before the experiments commenced, plant species were identified by the Düzce University Herbarium (Table 1). The populations EYSAL-1, EYSAL-2, and EYYAP-3 were selected for this study because they were under the highest glyphosate selection pressure according to growers' records and herbicide use history. The susceptible population, KEPKO-1 was taken from a noncrop area with no recorded glyphosate use.

Received for publication 16 Nov. 2018. Accepted for publication 2 Feb. 2019.
We thank the Plant Sciences Department of University of California, Davis for their support.
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Journal of Molecular Structure 1195 (2019) 877–882

Contents lists available at ScienceDirect

Journal of Molecular Structure

journal homepage: http://www.elsevier.com/locate/molstruc

Synthesis, antimicrobial and antimutagenic effects of novel polymeric-Schiff bases including indol

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ARTICLE INFO

Article history:
Received 6 February 2019
Received in revised form
17 April 2019
Accepted 11 June 2019
Available online 14 June 2019

Keywords:
polymeric-schiff bases
Indol compounds
Antimicrobial activity
Antimutagenic effect

ABSTRACT

Herein, the synthesis and characterization of three new polymeric-Schiff bases including indol (L_1, L_2, L_3) were reported. The antibacterial and antifungal activity of all compounds were investigated by the well-diffusion method against some selected microorganisms as potential antimicrobial agents. In addition, the anti-genotoxic properties of these polymeric-Schiff bases were examined against sodium azide in human lymphocyte cells by micronuclei (MN) and sister chromatid exchange (SCE) tests.

1. Introduction

Schiff base polymers having azomethine have received increasing attention because of their useful properties such as conductivity, catalytic activity, thermal and chemical stability, luminescence and magnetism properties [1–4]. Polymer-bonded Schiff bases also have electrochemical, mechanical and enzymatic properties and have the potential to be used in sensors [5,6]. Immobilization of enzymes onto these type polymeric supports are improved the performance of storage stability and reusability [7,8]. The increase in resistance to antimicrobials attracts the attention of medical chemists as the new antimicrobial materials due to the pharmacological activities, antioxidant and antimicrobial properties of the polymeric-Schiff bases [9–11].

Recently, studies on mutagenic agents have been increased due of there has been an increase in mutation-related disease [12]. Therefore the discovery of new antimutagens has been became important. Mutagenic substances cause permanent base changes in genetic material (DNA) [13]. Antimutagen is a biological term for the compound that eliminates mutation process. The antimutagens are remarkable due to prospects of their practical use for the prevention of negative effects of induced mutagens in human, the main of which are highly associated with hereditary diseases and cancer [14]. The antimutagenic effect is that mutation can be prevented on genes or is the inactivation of the mutagenic agent. One of the mutagenic substances is sodium azide (NaN_3). It is widely used in industry, agriculture and medicine but it is a highly toxic substance [15–17]. If sodium azide find in the intracellular milieu, azide ions bind Fe^{3+} in hemoglobin and inhibit the respiratory chain of metabolism [18].

Indoles are an important class of organic heterocyclic compounds. Indole derivatives have antioxidant, anticancer, antibacterial, antifungal, anti-inflammatory, antiviral properties, anticonvulsant and antihypertensive activity [19,20]. They have also good thermal stability, high redox activity and selectivity [21]. Novel potential drug candidates are usually screened for their possible toxicity and mutagenic, antimutagenic and biological activities in many systems [22].

In this research, we report the synthesis and characterization of

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https://doi.org/10.1016/j.molstruc.2019.06.042
0022-2860/

https://doi.org/10.1590/0004-282X20190064

ARTICLE

The effect of vortioxetine on penicillin-induced epileptiform activity in rats

O efeito da vortioxetina sobre a atividade epileptiforme induzida pela penicilina em ratos

Muhammed Nur ÖGÜN[1], Ayhan ÇETİNKAYA[2], Ersin BEYAZÇİÇEK[3]

ABSTRACT

Vortioxetine is a multimodal antidepressant agent that modulates 5-HT receptors and inhibits the serotonin transporter. It is indicated especially in cases of major depressive disorder related to cognitive dysfunction. There are many studies investigating the effects of antidepressants on the seizure threshold and short-term epileptic activity. However, the effect of vortioxetine on epileptic seizures is not exactly known. Our aim was to investigate the effects of vortioxetine on penicillin-induced epileptiform activity. Twenty-seven Wistar rats were divided into three groups: sham-control group, positive control group (diazepam), and vortioxetine group. After a penicillin-induced epilepsy model was formed in each of the three groups of animals, 0.1 ml of saline was administered to the control group, 0.1 ml (10 mg/kg) vortioxetine was administered in the vortioxetine group, and 0.1 mL (5 mg/kg) of diazepam was administered in the positive control group, intraperitoneally. The epileptic activity records were obtained for 120 minutes after the onset of seizure. There was no significant difference in spike wave activity between the vortioxetine and diazepam groups, whereas this was significantly reduced in the vortioxetine group compared with the controls. The administration of vortioxetine at a dose of 10 mg/kg immediately after the seizure induction significantly decreased the spike frequencies of epileptiform activity compared with the control group. No significant difference was found between the vortioxetine and positive controls. This study showed that vortioxetine reduces the number of acutely-induced epileptic discharges. Vortioxetine may be an important alternative for epileptic patients with major depressive disorder-related cognitive dysfunction.

Keywords: Epilepsy; penicillins; vortioxetine, rats.

RESUMO

A vortioxetina é um agente antidepressivo multimodal que modula os receptores 5HT e inibe o transportador de serotonina. Está indicada, principalmente nos casos de transtorno depressivo maior (TDM), relacionado à disfunção cognitiva. Existem muitos estudos que investigam os efeitos dos antidepressivos no limiar convulsivo e na atividade epiléptica de curto prazo. No entanto, o efeito da vortioxetina nas crises epilépticas não é exatamente conhecido. Nosso objetivo é investigar os efeitos da vortioxetina sobre a atividade epileptiforme induzida pela penicilina. Vinte e sete ratos Wistar foram divididos em três grupos, grupo controle-sham, grupo controle positivo (Diazepam) e grupo vortioxetina. Depois, 0,1 mg (10 mg / kg) de vortioxetina foi administrado no grupo vortioxetina, e 0,1 ml (5 mg / kg) / kg) de diazepam foi administrado no grupo de controle positivo intraperitonealmente. Os registros de atividade epiléptica foram obtidos durante 120 minutos após o início da convulsão. Não houve diferença significativa na atividade de pico entre o grupo de voritoxetina e diazepam, embora tenha sido significativamente reduzida no grupo de vortioxetina em comparação com os controles. A administração de vortioxetina na dose de 10 mg / kg imediatamente após a indução das convulsões diminuiu significativamente as frequências de espícula da atividade epileptiforme em comparação com o grupo controle. Nenhuma diferença significativa foi encontrada entre a vortioxetina e controles positivos. Este estudo mostrou que a vortioxetina reduz o número de descargas epilépticas agudamente induzidas. A vortioxetina pode ser uma alternativa importante para pacientes epilépticos com disfunção cognitiva relacionada à TDM.

Palavras-chave: Epilepsia; penicilinas; vortioxetina, ratos.

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Ethical approval: All animal experiments were carried out in accordance with the ethical guidelines of the Ethics Committee of the Abant Izzet Baysal University, and the NIH Guiding Principles in the Care and Use of Animals.

Conflict of interest: There is no conflict of interest to declare.

Received 03 January 2019; Received in final form 02 February 2019; Accepted 18 February 2019.