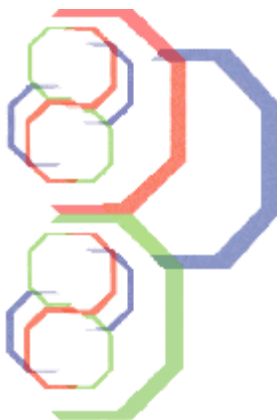


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1st International e-Conference on
Biomedical, Environmental and
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(IeCBEN 2008)

Book of Abstracts

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Foreword

The International e-Conference on Biomedical, Environmental and Nutritional Health Sciences 2008 (leCBEN 2008) held from October 6 - 20, 2008 is unique in that participants exhibit their presentations and interact entirely electronically, i.e. on the Internet. The major reason behind the conception of the e-conference is a desire to reduce the costs of participation, and thereby increase the number of participants from developing countries. Participants incur no expenses for transportation, hotel accommodation, per diem, visa, etc since the conference can be attended from the office, home or any other place with Internet access.

The 1st e-Conference has been received very positively with numerous high quality presentations being entered from all continents. In addition to publishing the abstracts online, participants have an opportunity to publish full papers in the *Journal of Applied Biosciences* (ISSN 1997-5902).

This publication comprises of the **Book of Abstracts** submitted for the 1st e-Conference (leCBEN 2008). All full papers will be published in a special volume of the *Journal of Applied Biosciences* to be issued in November to December 2008. Links to all outputs of this e-conference can be accessed at <http://www.e-conference.elewa.org/biomedical>.

F.A.C.T BioSciences Unit based at Nairobi, Kenya, has coordinated this event and is committed to supporting it annually for the foreseeable future. We hope it will stimulate and provide a suitable outlet for scientists in developing countries to participate more and contribute to shaping the global development agenda. We gratefully acknowledge the support of all participants and members of the scientific committee who have reviewed the abstracts and the full papers.

Maina Mwangi, PhD

Biosciences Communications and Publications Unit, F.a.C.T. BioSciences



Impact of Sesame Leaves Diet on the Renal Histomorphometric and Biochemical Studies of Adult Male Sprague Dawley Rats

Shittu Lukeman A. J ^{1*}, Shittu Remilekun K ², Olayode J.A.
³, Tayo A.O ⁴

¹Department of Anatomy, University of Abuja, College of Health Sciences, Gwagwalada, Abuja, Nigeria; ²Medical Microbiology Unit, Bolomedics Laboratories, Egbeda, Lagos, Nigeria; ³Department of Anatomy, Ladoke Akintola University, Ogbomosho, Oshun State, Nigeria; ⁴Department of Obstetrics and Gynaecology, Lagos State University College of Medicine/ Lagos State University Teaching Hospital, Ikeja, Lagos Nigeria.

*Corresponding author e-mail: drlukemanjoseph@yahoo.com; Tel: +234-804-7235.

ABSTRACT

Objective: Sesame diet, which is rich in phytoestrogenic lignans, is one of the key staple foods in West African especially Togo and Nigeria (South West and Middle-belt). However, concern has been expressed over the last few decades about the potential effect of estrogenic endocrine disruptors (EED) on human health, especially kidney diseases and their treatment. Moreover, recent studies have shown that certain types of estrogen can lower the risk of heart attacks and stroke in people with previous history of cardiovascular



disease. However, due to paucity of knowledge on the renal impact of consuming sesame leaves regularly we therefore aim to investigate the protective role played by sesame leaves consumption on the biochemical parameters and histomorphometric studies of adult male Sprague Dawley.

Methodology and results: Thirty adult male rats were divided into three groups of 10 rats each. The treated groups received oral garvage of 28.0mg/kg bwt/day and 14.0 mg/kg bwt/day of aqueous extract of sesame leaves respectively for 6 weeks. The control group received equal volume of 0.9% normal saline per day. Biochemical and histomorphometric studies were carried out on H & E stained kidney tissues processed using standard procedure. Data were analysed using SPSS software and $P < 0.05$ was considered statistically significant.

There was significant ($P < 0.05$) evidence of dose dependent increased in both the raw body weight of all the animals treated and the relative kidney weight per 100g body weights (wt/100g) in the treated groups when compared to the control group. No evidence of chronic toxicity was seen in the glomeruli and tubules except for very mild vascular congestion in the treated groups, which was probably due to observed low albumin level. However, there were also mild significant decreased in both serum proteins and albumin of the treated groups when compared to the control group animals in a dose dependent manner. Although, serum globulin concomitantly increased in the treated groups when compared to control, which implied that sesame played a protective role in the body immune system.

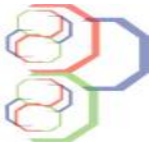
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Conclusion and application of findings Consumption of Sesame leaves is safe and improves the kidney profile especially in certain disease condition.

Key words: Phytoestrogens, *Sesame radiatum*, Sprague dawley rats, kidney.



Pulsed High Voltage Discharge Technology for Killing Hepatitis C virus (HCV)

G.M.El-Aragi

Plasma Physics and Nuclear Fusion Dept., Nuclear Research
Center, AEA, P.O. Box 13759 Inshas, Cairo, Egypt

Corresponding author email: elaragi@gmail.com

ABSTRACT

Objective: Pulsed high voltage discharge technology is a newly developed method for knocking out viruses in blood using various electrohydraulic discharge reactors. The aim of this study was to investigate the effect of an electrohydraulic discharge treatment system on Hepatitis C virus (HCV).

Methodology and results: The electrohydraulic discharge (EHD) reactor consists of a high voltage point discharge electrode above the blood surface and a cylindrical ground copper electrode containing the blood (at the same time acts as the vessel reactor). The EHD can produce both arc discharge in gas and liquid phases. The high energy plasma arc produces a pressure shock wave, electromagnetic radiations, ozone and free radicals.

Virus assay has shown that the number of survivor viruses after treatment at 5.1 msec pulse discharge (N) = 620

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Copy/ml versus the initial number of viable viruses in the control sample before treatment (N_0) = 2000 Copy/ml which translates to log reduction of about 0.51. The decimal reduction time or time required for a 1-log cycle reduction in the virus load is about 10 msec.

Conclusion and application of findings: Pulsed non-thermal plasma technology is a newly developed method for effectively kill blood-borne viral diseases. By irradiating a patient blood outside the body cleaning it of infection, and then reintroducing it back to the patient, mortality associated with diseases like hepatitis C can be greatly reduced. This technology is environmentally friendly, as it does not involve the introduction of toxic chemicals into the blood. Also, this method capable of treating large volumes of blood under static regime. Many of the process considered have not been examined in detail. Generally plasma and plasmaochemical processes accompanying electric discharge in the blood have received little study to date.

Key words: electrohydraulic, discharge, shock wave, plasma, free radicals, reactor



Histomorphometric Evidence of Hepatoprotective Impact of Aqueous *Sesamum Radiatum* (Schum & Thonn.) Leaves on Carbon Tetrachloride Induced Hepatotoxicity in Adult Sprague Dawley Rats

Shittu Lukeman A. J. ^{1*}, Shittu Remilekun K. ², Olayode
J.A. ³, Tayo A.O. ⁴

¹Department of Anatomy, University of Abuja, College of Health Sciences, Gwagwalada, Abuja, Nigeria; ²Medical Microbiology Unit, Bolomedics Laboratories, Egbeda, Lagos, Nigeria; ³Department of Anatomy, Ladoke Akintola University, Ogbomosho, Oshun State, Nigeria; ⁴Department of Obstetrics and Gynaecology, Lagos State University College of Medicine/ Lagos State University Teaching Hospital, Ikeja, Lagos Nigeria.

*Corresponding author e-mail: dlukemanjoseph@yahoo.com

ABSTRACT

Objective: Lipid peroxidation and generation of reactive oxygen species in a living organism is associated with tissue/cell injury especially of the liver cells which appear to be the main sites for most bio-degradation processes in the body. Increasing concern about oxidative tissue damage has brought about the need to create a dietary adjunct with a novel natural antioxidant and additional therapeutic effects on the liver. In this study, we evaluated the hepatoprotective effect of sesame leaves



phytoestrogenic-lignans against hepatotoxicity induced by carbon tetrachloride in rats using histopathological evidence. The study also sort to confirm folkloric claims regarding the effects of consuming sesame leaves.

Methodology and results: Thirty adult male SD rats were divided into three groups of 10 animals each. The control group received equal volume of normal saline. The treated groups received 28.0mg/kg bw/day and 14.0 mg /kg bw /day of aqueous sesame leaves extract via gastric gavage for six weeks after exposure to carbon tetrachloride. H & E stained of processed paraffin embedded liver tissues was carried out. Statistical analysis of data was done using SPSS software and $P < 0.05$ considered statistically significant.

The result showed evidence of significant ($P < 0.05$) body weight gain in all the treated animals. However, we observed that there was percentage relative body weight loss of 78% and 57% in the high and low dose groups respectively when compared to the weights of the control animals. There was a significant ($P < 0.05$) increase in raw liver weights and decrease ($P < 0.05$) in the relative liver weight per 100g bwt weight in the treated groups compared to the control. However, the weight loss was more in the high dose than the low dose group in a dose dependent manner when compared to the control.

Conclusion and application of findings: Animals treated with sesame extracts and exposed to carbon tetrachloride induced hepatotoxicity have similar morphology to animals in the control healthy group. These findings demonstrate that Sesame leaves extract is safe for consumption as a natural antioxidant.

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Key words: *S. radiatum*, antioxidant, carbon tetrachloride, rats.



Study of digital and palmar dermatoglyphic patterns of Nigerian women with malignant mammary neoplasm

Oladipo Gabriel S^{*}, Paul C. W. and Iboroma Adeleke D.
Department of Anatomy, Faculty of Basic Medical Sciences,
University of Port Harcourt, Nigeria.

*Corresponding author email: oladipogabriel@yahoo.com; Tel.
+234805610377

ABSTRACT

Objective: To examine the relationship between malignant mammary neoplasm and dermatoglyphic patterns of hands.

Methodology and results: Palmar and digital prints from 20 women with histologically proven malignant mammary neoplasm (case group) were compared to palmar and digital prints from 25 women with no history of any malignant diseases (control group) to establish a relationship with dermatoglyphic patterns of hands. Of the patterns analyzed, ulnar loop showed a statistically significant association with malignant mammary neoplasm in 8 out of 10 digits, which has the highest mean percentage frequency of digital pattern followed by whorls, arch and lastly the radial loop. Women with malignant mammary neoplasm showed significantly high mean DAT angle (62.70 ± 2.85 and 61.66 ± 2.56) for right and left hand, respectively, and a reduced total ridge count (12.61 ± 2.21).

Conclusion and application of findings: the results demonstrate that dermatoglyphic patterns and values could be used as

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noninvasive anatomical markers of malignant mammary neoplasm. However, further studies are needed to confirm these findings for Nigerians, possibly using larger populations.
Key words: Malignant mammary neoplasm, dermatoglyphics, DAT angle.



Endocrine Disruptive Potential of Sesame Phytoestrogenic Lignans on Adult Male Sprague Dawley Rats Blood Cells Profiles- Myth or Reality?

Shittu Lukeman A. J. ^{1*}, Shittu Remilekun K. ², Olayode
J.A. ³, Tayo A.O. ⁴

¹Department of Anatomy, University of Abuja, College of Health Sciences, Gwagwalada, Abuja, Nigeria; ²Medical Microbiology Unit, Bolomedics Laboratories, Egbeda, Lagos, Nigeria; ³Department of Anatomy, Ladoké Akintola University, Ogbomosho, Oshun State, Nigeria; ⁴Department of Obstetrics and Gynaecology, Lagos State University College of Medicine/ Lagos State University Teaching Hospital, Ikeja, Lagos Nigeria.

*Corresponding author e-mail: drlukemanjoseph@yahoo.com

ABSTRACT

Objective: Sesame has constituted one of the staple foods in the diet of West Africans especially in Togo and Nigeria since ancient times. Over the past few decades, concern has been expressed about the potential effects of estrogenic endocrine disruptors (EEDs) on human health. However, little attention has been paid on the haematological impact of sesame leaves consumption. Hence, we aim to investigate the role of sesame diet (phytoestrogens) on haematological parameters of adult male Sprague dawley rats and



to confirm the folkloric claim of sesame leaves nutritive/blood supplementary effects.

Methodology and results: Thirty adult male SD rats randomly divided into 3 groups of 10 rats each. The treated groups I and II received oral garvage of 28.0 mg /kg bw/day and 14.0 mg/ kg bw/day of aqueous extract of sesame leaves, respectively. The control group received equal volume of 0.9% normal saline per day for 6 weeks. Blood was collected from the animals in heparinized bottles for haematological profiles analysis using the Coulter counter analyzer. Statistical analysis of data was done using SPSS software and $P < 0.05$ considered statistically significant.

There was evidence of significant ($P < 0.05$) increased in red cells indices and white cells profiles. In addition, significant reduction in platelets indices with exception of the mean platelet volume (MPV) observed in both treated groups in a dose related manner when compared to the control. However, all these parameters were within the normal range expected for the normal physiological state of rats. No evidence of toxicity was observed arising from interaction of sesame's active nutritive ingredients with the respective blood cells parameters.

Conclusion and application of findings: Consuming sesame can help in prevention of anaemia of nutritional origin. In addition, our results show that consuming sesame prevents platelet aggregation thereby enhancing improvement in the cardiovascular status and reducing complications from anaemia. Sesame leaves extract is safe for consumption and it improves the haematological profiles.

Key words: *Sesamum radiatum* leaves, blood cells indices, Sprague Dawley rats



Effect of Electrohydraulic Discharge (EHD) on Viscosity of Human Blood

G.M.El-Aragi

Plasma Physics and Nuclear Fusion Dept., Nuclear Research
Center, AEA, P.O. Box 13759 Inshas, Cairo, Egypt

Corresponding author email: elaragi@gmail.com

ABSTRACT

Objective: The electrohydraulic discharge reactor consists of a high voltage point discharge electrode above blood surface and cylindrical ground copper electrode containing the blood (at the same time acts as the vessel reactor). The discharge could produce both arc discharges in gas and liquid phases. The plasma arc produces a pressure shock wave, electromagnetic radiations, ozone and free radicals. The aim of this work was to examine the use of electrohydraulic discharge (EHD) system and the effect of pulsed plasma arc discharge directly on viscosity of the human blood.

Methodology and results: Before experiments were started, human blood was drawn from healthy donors and was anticoagulated with ethylene diamine tetra-acetic acid (EDTA). All experiments used whole blood. At least three 5 cm samples of blood were used for each exposure condition. The data demonstrate that the whole



blood viscosity was increased with extended duration of exposure. It was found that the ratio of the blood viscosity under the influence magnetic field η_{mag} to the viscosity in the absence of magnetic field η is directly proportional to the applied magnetic field H .

Conclusion and application of findings: Plasma viscosity is used as a marker for different diseases in humans such as coronary artery disease, lupus erythematosus and rheumatoid arthritis. The voltage pulsation introduces electric field and temperature jump at the same time leads to hemolysis of the blood cells. The hemolysis occur because of the osmotic imbalance generated by the leakage of ions and small molecules.

The blood exhibits magnetization and also holds the property of an electrically conducting fluid. Most of the biofluids due to the existing ions in the body may be influenced by the magnetic field only due to their electrical conductivity.

Key words: electrohydraulic, shock wave, viscosity, blood, electromagnetic radiations



Chemical composition and hypotensive
effects of essential oil of *Monodora myristica*
Gaertn

¹J.Koudou, ²A.W. Etou Ossibi, ³K.Aklikokou, ²A.A. Abena,
³M.Gbeassor and ⁴J.M.Bessiere

¹Cerphametra, Université de Bangui, BP1450 Bangui, RCA ;
²Laboratoire de biochimie et pharmacologie, Université Marien
Nguabi, BP69 Brazzaville, Congo, abena_cg@yahoo.fr;
³Département de physiologie animale, Université de Lomé, BP 1515
Lomé, Togo, gbeassor@tg.refer.org ; ⁴Laboratoire de phytochimie,
Ecole Nationale Supérieure de Chimie, 34296 Montpellier, France,
bessiere@enscm.fr

Corresponding author email: jean_koudou@yahoo.fr

ABSTRACT

Introduction and objective: *Monodora myristica* Gaertn (Annonaceae) is a perennial tree growing in the tropical rainforest from Liberia to Angola. It is one of the heavily exploited wild plants for food and medicinal products. In Central African Republic the seeds of the plant are used as condiment and drug in the treatment of headache and hypertension. The present study investigated essential oil composition in the seeds with the aim of evaluating their antihypertensive activity.



Methodology and results: The fruit seeds of *Monodora myristica* were collected in September 2006 from the forest of Lobaye (130km near the city of Bangui). 500g of seeds were reduced in powder and hydrodistilled for 4h using a Clevenger-type apparatus. The oil was dried after decantation over anhydrous sodium sulphate. The oil was studied by capillary gas chromatography. Effects of the essential oils on the cardiovascular system were studied by recording the frequency of the isolated frog heart contractions and by recording arterial blood pressure variations of guinea pig. Quantitative assessment of antihypertensive activity was conducted in October 2006. Statistical significance was set at $p < 0.05$ (Student's t-test). The oil yield from the seeds was 1.2% (w/w). The main components of oil were monoterpenoids (93.2%) out of which 77.4% are monoterpene hydrocarbons and some sesquiterpenoids (5.8%). The major constituents were α -phellandrene (34.4%) and p-cymene (22.2%). At the dose of 40, 80, 120 $\mu\text{l.kg}^{-1}$ the essential oil induced a hypotensive effect on the blood pressure and at the dose of 0.01-0.05% it significantly reduced the cardiac contractions of the isolated heart. At 0.06% essential oil totally stopped the cardiac contractions.

Conclusion and potential application of Findings: The results show that essential oils from *M. myristica* have a hypotensive effect on blood pressure and can significantly reduce the cardiac contractions of isolated heart. These effects indicate that these essential oils could be exploited as a potential natural anti hypertensive agents.



Evaluation of Antibacterial Properties of Flavonoids in stem bark extract of *Antiaris africana* (Engl)

Aderotimi Banso and Abdullahi Mann

Department of Science Laboratory Technology, The Federal
Polytechnic, Bida, Niger State, Nigeria

Corresponding author email: abdumann@yahoo.com

ABSTRACT

Objective: To investigate the antibacterial properties of flavonoids in stem bark extract of *Antiaris africana*, a plant that is used ethnobotanically in Nigeria to relieve rheumatic, respiratory and stomachic pains.

Methodology and results: The stem bark of *Antiaris africana* and clinical isolates of *Bacillus subtilis*, *Streptococcus pyogenes* and *Escherichia coli* were used in this study. The extract from *A. africana* was screened for phytochemical properties using standard methods. The flavonoid fraction in the extracts was assayed using the agar diffusion method to determine the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC). The MIC of the flavonoid fraction of *A. africana* against *B. subtilis*, *S. pyogenes* and *E. coli* were 0.04, 0.050 and 0.050mg/ml, respectively. The



lowest MBC of 0.045mg/ml was recorded against *B. subtilis* while a higher MBC of 0.050mg/ml was recorded against *S. pyogenes* and *E.coli*.

Conclusions and application of findings: The phytochemical screening of the stem bark extract of *Antiaris africana* was found to contain flavonoids. The large size of inhibition zones against the test organisms is indicative of the potency of the flavonoid fraction from *A. africana*. The results of this study show that the flavonoid fraction from *A. africana* has antibacterial activity, though organisms vary in the degree of susceptibility to the antibacterial agents. The findings justify the continued ethnobotanical use of stem bark extract of *Antiaris africana* to relieve respiratory and stomach pains. The flavonoid fraction from *A. africana* stem bark should be explored further as a potential source of antibacterial agents.

Key words: *Antiaris africana*, antibacterial properties, flavonoids, inhibition, ethnobotanical use



Evaluation of the anti-stress and anticonvulsant activity of leaf extract of *Alchornea cordifolia* in mice

Solomon Umukoro¹ and Chinedu Onwuchekwa²

¹Department of Pharmacology and Therapeutics, University of Ibadan, Ibadan, Nigeria; ²Department of Physiology, Usman Danfodio University, Sokoto, Nigeria and Department of Physiology, University of Ibadan, Ibadan, Nigeria

Corresponding author e-mail: Solomon.umukoro@mail.ui.edu.ng;
umusolo@yahoo.com

ABSTRACT

Introduction and objective: The leaves of *Alchornea cordifolia* (AC) have been shown to possess active principles, e.g. alchornine, alchorneinone, gentistic acid and yohimbine. This plant is extensively used in tropical regions of Africa as a herbal remedy for ulcers, rheumatic pains, febrile convulsions and for enhancing physical performance. This study was carried out to assess the anti-stress and anticonvulsant effects of an aqueous leaf extract of AC in mice.

Methodology and Results: The anti-stress activity was assessed based on the ability of the extract to alter the duration of immobility, in the forced swimming endurance test in mice whilst a picrotoxin-treated animal was employed as the model for convulsive seizures. The extract (50-200 mg/kg) given orally, was found to significantly ($p < 0.05$) reduce the



duration of immobility, which suggests presence of an antistress/ anti-fatigue property. However, AC when tested at doses between 100 - 400 mg/kg, p.o. did not prevent convulsions induced by picrotoxin (10 mg/kg, i.p.) in mice. The acute toxicity study carried out in mice revealed that the extract, when administered orally, was well tolerated by the animals, as no death was observed at the dose-range of 0.05 – 0.4 g/kg. *Conclusions and application of findings:* The results of this preliminary study suggest that *A.cordifolia* possesses phytochemically active compounds that might be useful against stress or fatigue.

Key words: *Alchornea cordifolia*, extracts, anti-stress, anticonvulsant



Volatile constituents, antioxidant and antibacterial properties of essential oils of *Daniella Klainei* Pierre ex A. Chev.

Jean Koudou¹, Louis-Clément Obame^{2, 3}, Prosper Edou³,
Ismael Bassolé², Gilles Figueredo⁴ and Alfred S. Traore²

¹Université de Bangui, BP1450, Bangui République Centrafricaine ;
²Université de Ouagadougou 03 BP7131 Ouagadougou Burkina
Faso.hbassole@hotmail.com; ³Ecole Normale Supérieure, BP7131
Libreville, Gabon; louis_obame@univ-ouaga.bf;
edouengonga@yahoo.fr; gillesfigueredo@yahoo.fr; astraore@univ-ouaga.bf.

Corresponding author email: jean_koudou@yahoo.fr

ABSTRACT

Introduction and objective: *Daniella klainei* Pierre ex A.Chev (Cesalpiniaceae) has for long been used in traditional medicine in Gabon. It is a perennial tree that reaches about 45m height and widely distributed in the tropical rain forest (Aubreville, 1970). The resin of this plant is used to heal sores and against microbial infections. The traditional use of this plant suggests it has antioxidant and antibacterial effects. Recently, there has been growing interest in substances exhibiting antioxidant and antibacterial properties as sources of specific pharmaceuticals for human or animal use. It is well-known that essential oils



have antibacterial activities (Özer *et al.*, 2007). This study aimed to determine the chemical composition, antioxidant and antibacterial properties of *D. klainei*.

Methodology and results: *D. klainei* resin was collected in March 2007 from Sebang Herbarium of IPHAMETRA, Libreville, Gabon. The essential oil was extracted from the resin (500g) by hydrodistillation in a Clavenger-type apparatus for 4h. The oil was dried after decantation over anhydrous sodium sulphate. Nine reference strains and three clinical bacterial strains were used to test the antioxidant effect of resin using DPPH radical scavenging activity and the β -carotene bleaching test.

The resin oil was analyzed by GC and GC/MS on a Hewlett-Packard HP 6890 and a Hewlett-Packard 5973/6890 system, respectively, operating in EI mode (70eV) using the same parameters (Koudou *et al.*, 2008). The free radical scavenging activity of essential oil was determined as described by Burits and Bucar (2000) while the antioxidant ability was determined as described by Dakpevicus *et al.* (1998). A broth microdilution method (Bassole *et al.*, 2003) was used to determine the minimum inhibitory concentration (MIC) and the minimum bactericidal concentration (MBC). All tests were performed in Mueller-Hinton Broth (Becton Dickinson, USA).

The hydrodistillation of the resin of *Daniella klainei* produced 3.85% (w/w) essential oil. The major constituent of the resin essential oil is myrcene (55.42%), α -pinene (5.39%), α -humulène (8.09%) and Germacrene-D (6.06%). Monoterpenoids were predominant (71.91%) while oxygenated compounds accounted for 5.89%. The essential oil possessed



antioxidant and DPPH radical scavenging activities and it inhibited lipid peroxidation. These activities can be attributed to the presence of some components that have antioxidant activity, i.e. 1, 8 cineol, α -pinene, β -pinene (Houghton, 2004), terpinen-4-ol (Lee & Shibamoto, 2001).

MICs and MBCs varied from 0.50 to 8% for all bacterial strains tested. The essential oil was bactericidal to *Escherichia coli* CIP NCTC11602, *Staphylococcus aureus* ATCC9244, *Staphylococcus camorum* LMG13567 and *Staphylococcus aureus*. This antibacterial action might be due to the different constituents of the essential oil of this plant such as 1,8-cineol, terpinen-4-ol and α -terpineol. Although the proportions of these components were relatively low in this oil possible synergistic and antagonistic effects of compounds in the oil should be taken into consideration.

Conclusion and application of findings: The findings of this work are very important. Our results showed that the essential oil of *D. klainei* has antioxidant and bactericidal activities; it might be used as a potential and natural agent against degenerative diseases, bacterial infections and used for food conservation.



Nitric oxide generation by two *Capsicum*
annuum varieties with varying sensitivity to
Phytophthora capsici

¹REQUENA Maria Emilia, ¹EZZIYYANI Mohammed,
²GILABERT Catalina Egea, ³HAMDACHE Ahlem, ³LAMARTI
Ahmed and ¹CANDELA Maria Emilia

¹Department of Plant Biology, Faculty of Biology, University of
Murcia, Campus de Espinardo, 30100 Espinardo (Murcia), Spain.

²Department of Science and Agrarian Technology. ETS Ingeniería
Agronómica. University Polytechnic of Cartagena. Paseo Alfonso
XIII, 48. 30203 Cartagena, Spain; ³Faculté des Sciences,
Département de Biologie, Equipe de Biotechnologies Végétales.
M'hannech II, BP. 2121. 93002 Tétouan (Maroc).

Corresponding author email: mcandela@um.es

ABSTRACT

Objective

To investigate the presence of an NO generation system (NO and NOS) in two pepper varieties showing different degrees of sensitivity to *P. capsici*. In a comparison of resistant and sensitive varieties, we attempted to ascertain the involvement of NO in triggering the defensive reactions and any correlation with the spread of the mould. We discuss the role played by NO in arresting mouldy growth in the resistant variety, and



analyse the possible production of NO by NOS in pepper plants.

Methodology and results

The resistant *C. annuum* L. var. Serrano Criollo de Morelos (SCM) and the susceptible var. Americano (AM) were grown in a Fison chamber with a 16 h photoperiod at 25°C and 75–80% RH. *P. capsici* Leon, isolate 17, was maintained in the dark on potato dextrose agar (PDA) medium at 24°C. Ten plants of both varieties were infected when they had five to six true leaves by cutting off the tops of the stems and infecting with plugs of actively growing *P. capsici* mycelium. The control stems were inoculated using only PDA medium without mycelium. To measure the hypersensitive response, the necrotic part of the plants was analysed 3, 6 and 9 days after infection, while penetration of the water mould and the NO–NOS system were evaluated in the intermediate part of the stems (immediately below the necrotic part) 3 and 6 days after infection. Bio-imaging of nitric oxide (NO) *in vivo* was carried out using diaminofluorescein diacetate (DAF-2DA) in conjunction with confocal laser scanning microscopy. Both pepper varieties developed a hypersensitive reaction and generated NO as a defence reaction. However, only SCM was able to overcome the infection by inhibiting the pathogen's growth, while AM succumbed to the disease. NO-induced fluorescence was always higher in SCM than in AM tissues, and was also detected at trace level in decapitated non-infected control plants as a result of wounding. In var. SCM, the highest intensity of NO production (23 pixels) was detected 3 days after infection in the first four sections following the necrosis zone, which corresponded to the mould

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invasion zone. In AM, extensive necrosis was followed by general invasion of the hyphae, accompanied by minimal NO production.

Conclusion and application of findings

These findings suggest that NO is involved in the resistance reaction against this water mould and that it is induced by the isoenzyme, nitric oxide synthase (NOS), whose activity is qualitatively greater in the tissues of var. SCM. This is the first time that the involvement of NO and NOS has been reported in the defensive signalling reaction between pepper plants and *P. capsici*.

Key words: *Capsicum annuum*, resistance, Nitric oxide, *Phytophthora capsici*

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Nutritional Status of Fermented Maize Meal Fortified with Bambara Nut

Theodore I. Mbata*¹, M.J. Ikenebomeh² and I. Ahonkhai³

Department of Microbiology, Federal Polytechnic Nekede, PMB
1036, Owerri, Nigeria.

Corresponding author email: theoiyke@yahoo.com

ABSTRACT

Objective: To develop an appropriate household/small scale enterprise level technique for the production of fermented maize dough or meal fortified with bambara -nut.

Methodology and results: The effect of fortifying maize based traditional foods with legume protein (bambara- nut) at 0, 10 and 20% replacement levels on the rate of fermentation and organoleptic product quality were investigated. Sensory characteristics, amino acid pattern, proximate composition (moisture, protein, fat, ash, carbohydrate) pH, titratable acidity and rheological properties (pasting temperature, peak viscosity, viscosity at 95 and at 50°C) were used as the indicators of quality.

The results showed that addition of Bambara nut caused only minimal changes in the proximate composition with the exception of protein content, which increased

remarkably from 10.1 to 16.4% and 10.1 to 16.2% with 20% bambara nut addition, respectively, for boiled and raw bambara nut fortified fermented maize dough. The product pH decreased with concomitant increase in moisture, fat, ash and titratable acidity as the amount of bambara- nut added increased. A significant improvement was also achieved in the lysine and tryptophan content of the fortified dough compared to the unfortified lot. Boiling bambara-nut for 20 min before incorporation into the maize for milling and fermentation imparted a good flavour. Little or no changes occurred in the pasting viscosity characteristics of raw bambara-nut fortified fermented maize dough. Organoleptic evaluation revealed that the foods were well accepted.

Conclusion and application of findings: Based on the findings of the study, using Bambara nut in fortification to traditional foods would be a viable option towards promoting the nutritional quality of African maize – based traditional foods with improved rheological and cooking qualities. The results show that the most appropriate technique for fortifying maize dough with bambara protein should involve incorporation of boiled whole bambara-nut in soaked maize before milling and fermentation. This improves the sensory characteristics, enhances nutritive value and other functional properties.

Key words: Fermented maize meal, bambara- nut, fortification, protein quality, rheology



Biological control of *Phytophthora capsici*
root rot of pepper (*Capsicum annuum*) using
Burkholderia cepacia and *Trichoderma harzianum*

¹EZZIYYANI Mohammed, ¹REQUENA Maria Emilia, ²GILABERT Catalina Egea, ³HAMDACHE Ahlem, ³LAMARTI Ahmed and ¹CANDELA Maria Emilia

¹Department of Plant Biology, Faculty of Biology, University of Murcia, Campus de Espinardo, 30100 Espinardo (Murcia), Spain. mcandela@um.es; ²Department of Science and Agrarian Technology. ETS Ingeniería Agronómica. Université Polytechnique de Cartagena. Paseo Alfonso XIII, 48. 30203 Cartagena, Spain; ³Faculté des Sciences, Département de Biologie, Equipe de Biotechnologies Végétales. M'hannech II, BP. 2121. 93002 Tétouan (Maroc).

Corresponding author email: mcandela@um.es

ABSTRACT

Objective: To control *P. capsici* using a combination of two independently effective and compatible microorganisms, *Trichoderma harzianum* and *Burkholderia cepacia*.

Methodology and results: A combination of two compatible microorganisms, *Trichoderma harzianum* and *Burkholderia cepacia*, both antagonistic to the pathogen *Phytophthora capsici*, was used to control root rot in pepper. The population of the pathogen in soil was



reduced by 71% as a result. Vegetative growth of the mycelium of *P. capsici* was inhibited in vitro on the second day after *P. capsici* and *T. harzianum* were placed on the opposite sides of the same Petri plate. *T. harzianum* was capable of not only arresting the spread of the pathogen from a distance but also, after invading the whole surface of the pathogen colony, sporulating over it. Scanning electron microscopy showed the hyphae of *P. capsici* surrounded by those of *T. harzianum*, their subsequent disintegration, and the eventual suppression of the pathogen's growth. *Burkholderia cepacia* produced a zone of inhibition, from which was obtained a compound with anti-oomycete property secreted by the bacteria. When purified by high-pressure liquid chromatography, this compound was identified as pyrrolnitrin which seems to be one of the principal compounds involved in the antagonism. Finally, a strategy was tested for increasing the level of the hydrolytic enzyme β -1,3-glucanase and chitinase in the antagonism test of *P. capsici* versus *T. harzianum* on PDA medium enriched with laminarin: glucose (3:1, v/v). Chitinolytic activity was evaluated using culture filtrates from isolates grown on chitin and the *Agaricus bisporus* mushroom as the release of p-nitrophenol from p-nitrophenyl N, N'-diacetylchitobiose and as the formation of clearing zones on chitin agar. A formulation was prepared that maintained the compound's capacity to inhibit growth of the pathogen for up to two years when stored at room temperature in the laboratory on a mixture of plantation soil and vermiculite. The two antagonists, added as a compound formulation, were effective at pH from 3.5 to 5.6 at 23 to 30 °C. The optimal dose of the antagonists in the compound formulation was 3.5×10^8 spores/ml of *T. harzianum* and 10^9 cfu/ml of *Burkholderia cepacia*.

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Conclusion and application: This is the first report of a compound biocontrol formulation of these two antagonists with a potential to control root rot caused by *P. capsici*.

Key words: Biocontrol, *Capsicum annum*, *Phytophthora capsici*, *Burkholderia cepacia*, *Trichoderma harzianum*



In vitro screening of selected plant
Extracts for fungicidal properties against fungal
dry rot of yam tubers (*Dioscorea rotundata*) in Kogi
State, Nigeria

†Taiga A. and Olufolaji D. B.

Department of Biological Sciences, Kogi State University, Anyigba,
Nigeria

Corresponding author e-mail: akpotaiga@yahoo.com

ABSTRACT

Objective: To screen leaf extracts of various plants as potential; sources of compounds with effect against dry rot fungal pathogens of yam.

Methodology and results: Leaf extracts of eight plants, i.e. *Azadirachta indica*, *Tridax precumbens*, *Carica papaya*, *Nicotiana tabacum*, *Aloe vera*, *Psidium guajava*, *Magnifera indica* and *Phragmanthera incane* were screened for fungicidal properties against dry rot pathogens of yam tubers. Four fungal pathogens, i.e. *Fusarium oxysporium*, *Aspergillus niger*, *Rhizopus stolonifer* and *Penicilium oxalicum* were isolated from the rotted yam tubers. Four concentration levels of leaf extracts 10, 20, 30 and 40% were used for the tests.

A. indica, *T. precumbens*, *C. papaya*, *N. tabacum* and *A. vera* were found to posses fungicidal properties, while



Phragmanthera incane, *Magnifera indica* and *Psidium guajava* were not fungicidal. Hot or cold extracts of *A. indica*, *N. tabacum* and *A. vera* completely inhibited fungal mycelia growth at different concentrations. Only the hot extract of *N. tabacum* completely inhibited all the isolated fungal pathogens using all concentration levels tested.

Conclusion and application of findings: Hot extract of *N. tabacum* is recommended as the most effective compound with antifungal effects against *Fusarium oxysporium*, *Aspergillus niger*, *Rhizopus stolonifer* and *Penicillium oxalicum*.

Key words: Plant extracts, fungal dry rot, *D. rotundata* tuber.



Pepper morphological traits related to resistance to *Phytophthora capsici*

¹REQUENA Maria Emilia, ¹EZZIYYANI Mohammed,
²GILABERT Catalina Egea, ³HAMDACHE Ahlem,
³LAMARTI Ahmed and ¹CANDELA Maria Emilia

¹Department of Plant Biology, Faculty of Biology, University of Murcia, Campus de Espinardo, 30100 Espinardo (Murcia), Spain. mcandela@um.es; ²Department of Science and Agrarian Technology. ETS Ingeniería Agronómica. University Polytechnic of Cartagena. Paseo Alfonso XIII, 48. 30203 Cartagena, Spain; ³Faculté des Sciences, Département de Biologie, Equipe de Biotechnologies Végétales. M'hannech II, BP. 2121. 93002 Tétouan (Maroc).

Corresponding author email: mcandela@um.es

ABSTRACT

Objective: An improvement programme to obtain pepper cultivars for paprika production with a sufficient degree of hardiness to be cultivated in calcareous soils and little available water, which produce an intensely red fruit and which are resistant to *Phytophthora capsici*.



Methodology and results: Inheritance of 10 morphological and quantitative traits related to plant and fruit development and resistance to the pathogen *Phytophthora capsici* was studied in an intra-specific cross between a non-pungent, susceptible *Capsicum annuum* parent (cv. Americano) and a wild, pungent and resistant line (Serrano Criollo de Morelos-334). Crossing was by bud pollination of emasculated flowers. The main raceme of individual F₁ plants was self pollinated to obtain F₂ seed. Data were obtained from the segregation of 166 F₂ plants and 50 F₃ plants in four years. Three of the traits analyzed (necrosis length, leaf width and leaf length) exhibited a transgress segregation. A multiple linear regression analysis was applied in order to establish a relationship between necrosis length and some of the morphological traits measured such as length and width of leaf; length, diameter and weight of fruit; capsaicin levels in fruit; and presence of hair on leaves and stems. The results identified a linear dependence between necrosis length (as an inverse measurement of resistance) and leaf width, fruit diameter and hair presence in the stem. Pungency was not related with resistance.

Conclusion and application of findings: The most probable model which can be proposed establishes a polygenic and probably multicomponent inheritance. We propose a theoretical correlation to predict resistance to the pathogen *P. capsici* in pepper plants based on the measure of morphological traits.

Key words: *Capsicum annuum*, pungency, necrosis length, breeding program

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Environmental impacts of crop diseases

Maina Mwangi

Biosciences Unit, FaCT Ltd., P.O. Box 967-00217, Kenya.

Corresponding author email: maina@biosciences.elewa.org

ABSTRACT

Introduction and objective: Agriculture is the main livelihood activity for millions of inhabitants globally, but most importantly in developing countries. Through direct impacts on livelihoods of farming communities, pests and pathogens that destroy crops also affect the environment. The adverse effects can occur through loss of crop cover, thus exposing soil to erosion, change of crop varieties or farming systems leading to net negative environmental effects or abandonment of farming activities, with accompanying collapse of activities that protect the environment. Some of the negative consequences of crop pathogens that have been observed in diverse farming systems in across east and west Africa are presented below.

Methodology and results: Between 2003 and 2007 numerous extensive surveys were carried out on fungal tuber rot diseases of cassava and yams in Nigeria, Cameroon and the Democratic Republic of Congo, and on *Xanthomonas* bacterial wilt of banana in the Great Lakes region of East and Central



Africa. The surveys aimed to identify the pathogens causing these crop diseases, estimate the yield losses realized, document farmer responses and explore various measures to combat the diseases. In addition to the above, negative consequences of crop diseases on the environment were noted.

In the humid forests of central and west Africa, major environmental destruction was noted through destruction of forest cover as farmers practice shifting cultivation. Although this practice partly aims to exploit variations in soil fertility between forested and non-forested soils, farmers also aimed to move their crops to soils that had been fallowed for longer periods and thus were assured to be pathogen free. In areas with dense populations, annual establishment of new plantations from existing forests leads to extensive loss of plant cover, thus exposing soil to degradation and also loss of forest biomass that is crucial as CO₂ sink.





Photo 1: Cassava tuberous roots extensively rotted after attack by fungal pathogens.



Photo 2: Cassava tuberous roots heavily attacked by root and tuber scales.





Photo 3: Destruction of forest land to create new farming area where soils are more fertile and without pests and diseases.

In areas where banana plantations were destroyed by *Xanthomonas* wilt, massive erosion was observed especially where farms are established on steep hillsides. Although exposure of soil upon plant death in itself leads to erosion, there were situations where the erosion appeared to be aggravated by farmers' intervention to manually uproot the diseased plants thus disturbing the soil, making it loose and thus much easier to wash away.



Photo 4: A banana bunch (left) and plants (right) destroyed after infection by *Xanthomonas* wilt.



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Photo 5: Banana plants uprooted after attack by *Xanthomonas* wilt leaving soil on the hillsides exposed to erosion. Alternative crops, e.g. sweet potato seen on the right are not as effective in preventing erosion.

In some countries, due to loss of means to earn a livelihood, some farmers turned to cultivation of other crops, especially those that have high market value and demand, e.g. vegetables and fruits. Most of the alternative production occurred on wetlands in valleys, where water is easily accessible for year round production. In the absence of crop diseases that disrupt normal agricultural productivity, such wetlands would otherwise be conserved. These wetlands are important for sustaining ecosystems, and their loss through economic exploitation eventually leads to loss of biodiversity.

In other areas, alternative economic activity involves cutting down trees to harvest timber or charcoal, which is associated with extensive destruction of trees. In east D.R. Congo, an increase in households that own large saws for cutting trees has been observed, with a proportional increase in the number of trees being cut down annually.

Loss of banana has also been associated with changes to alternative crops, e.g. sorghum for income or Colocassiae for food. These crops are not as well suited to the steep and often hilly landscapes that require protective measures against erosion. Sorghum or Colocassiae lack the strong root systems or canopy cover provided by banana plants to protect soil from runoff effects. Increased cultivation of these crops thus leads to increased soil erosion.



Photo 6: Trees harvested for timber in areas where bananas have been destroyed by *Xanthomonas* wilt in DR Congo.



Photo 7: Collocasiae and sorghum (background) plants on hillsides where banana plantations were previously destroyed by *Xanthomonas* wilt.

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Conclusion and application: Although it is often not well appreciated, crop diseases adversely affect the environment in numerous ways. Therefore, measures to address crop pathogens and pests should not only aim to address food security or economic losses felt by farmers, but should also consider ways and means of mitigating negative impacts on the environment.



*Study of the nematocidal properties of
the culture filtrate of Paecilomyces lilacinus
containing Titanium (IV) chloride and its effect on
pepper fruit quality*

¹EZZIYANI Mohammed, ¹REQUENA Maria Emilia,
²HAMDACHE Ahlem, ²LAMARTI Ahmed and ¹CANDELA
Maria Emilia

¹Department of Plant Biology, Faculty of Biology, University
of Murcia, Campus de Espinardo, 30100 Espinardo (Murcia), Spain;

²Team of Plant Biotechnology, Department of Biology, Faculty of
Sciences, University of Abdelmalek Essaâdi, B.P.2121, M'hanech,
Tetoun- Morocco.

Corresponding author e-mail: ezzim@um.es

ABSTRACT

Introduction and objective: *Meloidogyne incognita* and
Heterodera avenae are a parasite that infects the roots and
attacks a great number of plants worldwide, causing



significant economic damages, especially where agriculture is of intensive, e.g. in greenhouses. Traditionally, application of chemical pesticides has been effective in managing and control of crop pests and pathogens. However, with the prohibition of the most effective nematicide (methyl bromide), the remaining compounds are not effective and do not give the required results. This has made it necessary to develop other strategies that are effective against soil borne pathogens, and which do not damage the environment and human health. The objective of this study was to test for increasing the level of the toxin in the antagonism test *in vivo* of *M. incognita* and *H. avenae* versus *P. lilacinus* on PDB medium enriched with Titanium.

Methodology and results: *Capsicum annum* L. plants (cv. California wonder) were treated with Titanium (IV) chloride (Ti) in combination with culture filtrates of *Paecilomyces lilacinus*, all applied via soil. Discs 3 mm in diameter cut from the edge of a colony of *P. lilacinus* actively growing on PDA were added to 500-ml Erlenmeyer flasks containing 250 ml of sterilized Malt broth by adding oats extract, phosphite and Ti. The fungi mycelia thus obtained was separated from the medium and culture filtrates transferred to 1000-ml Erlenmeyer flasks containing n-octanol. All flasks were incubated at 21 °C for 3 weeks with the cultures being shaken at 120 rpm. The culture filtrates of nematophagous fungus *P. lilacinus* grown on different liquid media and under various conditions showed inconsistent effects on the *Heteroderidae* family (*Meloidogyne*, *Heterodera*). When tested on four mediums, the best nematocidal activity and effect on pepper fruit quality was

obtained on Ezziyyani medium [salts+ oats extract + phosphite +Ti + n-octanol, (pH 5.5)] with motionless aerated cultures. Light had no effect on toxin production de *P. lilacinus* but it affected Ti. Although it was only generated at pH 5.5, the toxin had an activity dependent relationship to the pH (the low pH with time of incubation: when the fungi mycelia of *P. lilacinus* were separated from the medium and the pH of culture filtrates is 4.5. the pH drops has 4.5. Before the treatments one must adjust the pH 5.5. The activity of the toxic metabolite was very specific and was only efficient against *M. incognita* and *H. avenae*.

On the pepper plant, Titanium stimulated biomass production, nutrient absorption, several enzymatic system activities (catalase, peroxidase, lipoygenase and nitrate reductase), malic acid, leaf chlorophyll, fruit carotenoids and ascorbic acid contents, but caused a decrease in plant starch concentration. In addition to these effects, it has been demonstrated that Ti mainly accumulates in the cytoplasm and chloroplasts of the leaf cells of treated plants, and that increases the concentrations of Fe²⁺ in leaves, fruits, leaf chloroplasts and fruit chromoplasts. The increase in iron is probably responsible for the stimulatory effects observed with Ti applications. The oats contain flavonoids which have been reported to have nematocidal activity.

Conclusion and application of findings: *Addition of culture filtrates of P. lilacinus enriched with Titanium has double effect because Ti is a beneficial element which enhances both growth and the red colour of pepper plant and, culture filtrates of the fungus has a high nematocidal effect.*

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Key words: Pepper, Titanium (IV) chloride, nematode, culture filtrates, *Paecilomyces lilacinus*.



Phytotoxicity and remediation of heavy metals by fibrous root grass (sorghum)

Chhotu D. Jadia and M. H. Fulekar*

Environmental Biotechnology Laboratory, Department of Life Sciences, University of Mumbai, Santacruz (E), Mumbai -400 098, Mumbai, India.

*Corresponding author email: mhfulekar@yahoo.com; Tel: +91 -22 26528847; Fax: +91 -22 26526053.

ABSTRACT

Objectives: To determine the uptake and effects of heavy metals (Cd, Cu, Ni, Pb and Zn) on seed germination, growth of fibrous roots, root/shoot growth and biomass of grass (sorghum) grown in soil - vermicompost media (3:1).

Methodology and results: Vermicompost developed using vermiculture biotechnology from vegetable market waste was characterized and found to have high concentrations of the nutrient elements Ca, Zn, Cu, Mg, Fe and Mn. The vermicompost was used as a natural fertilizer for phytoremediation studies of heavy metals. The selected heavy metals were dosed at concentrations from 0, 5, 10, 20, 40 and 50 ppm separately in the soil - vermicompost media (3:1) in pot experiments. The phytotoxic effect of heavy metals on the



growth of sorghum and physicochemical parameters of soil-vermicompost media were measured. The uptake of heavy metals in plant samples were analyzed by atomic absorption spectrophotometer. Plant growth was adversely affected by heavy metals at the higher concentration of 40 and 50 ppm, while lower concentrations (5 to 20 ppm) stimulated shoot growth and increased plant biomass. Heavy metals were efficiently taken up mainly by roots of sorghum plant at all the evaluated concentrations of 5, 10, 20, 40 and 50 ppm.

Conclusions and application of findings: Vermicompost from vegetable waste has high nutrient contents and therefore it can be used as a natural fertilizer to increase growth of plants that play a role in phytoremediation. Although heavy metals at 40 and 50 ppm reduced seed germination, plants germinated and grew efficiently when Zn was available. Vermicompost application as a natural fertilizer or soil amendment would enhance sorghum plant growth and enhance phytoremediation of heavy metals from contaminated environments.

Key words: heavy metals, sorghum, phytoremediation, vermicompost.



Evaluation of selected rat liver enzyme activities following consumption of diet contaminated with crude oil

*Taofik Olatunde SUNMONU and Oyelola Bukoye

OLOYEDE

Department of Biochemistry, University of Ilorin, Ilorin, Nigeria

*Corresponding author email: taosun77@yahoo.com

Tel.: +2348033939464

ABSTRACT

Objective: To study liver enzyme profiles of rats fed on catfish that were artificially exposed to crude oil contamination.

Methodology and results: Changes in selected liver enzymes of albino rats fed on diet formulated with catfish that were exposed to water polluted with crude oil for 30 days were studied. Catfish (*Clarias gariepinus*) (n = 120) were divided into 6 groups of 20 catfish each and held for 30 hours in 5 different treatments of water that was artificially polluted with crude oil at 0.1, 0.25, 0.5, 0.75 and 1% v/v. Catfish in the control group were kept in borehole water. At the expiration of 30 hours, the catfish were harvested and used to formulate diet. Albino rats (n = 60) in 6 groups of 10 rats each were fed on the formulated diet for a period of 30 days, each group being consistently fed on a diet of catfish exposed to one level of crude oil pollution. The control rats were fed on diet containing catfish cultured in borehole water. In comparison with the control, the results



revealed a significant reduction ($p < 0.05$) in the activities of aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP) and gamma glutamyl transferase (GGT) in the liver of rats as the concentration of crude oil in the diet increased. Conversely, the activities of these enzymes in the serum of albino rats increased significantly ($p < 0.05$) when compared with the control.

Conclusion and application of findings: The data obtained indicate potential adverse effects of crude oil on albino rats which is manifested by changes in activity of enzymes in the liver. This study has shown that crude oil portends serious damaging effects on the hepatocytes as evidenced by reduced activities of GGT, AST, ALT and ALP in the liver of rat fed on crude oil contaminated catfish. Hence, hepatic functions may be impaired. Therefore, it is advisable that people should avoid consuming fish from water that is potentially contaminated with crude oil especially at concentrations above 0.25% v/v.

Key words: crude oil, enzymes, pollution, serum, liver, catfish



***Evaluation of a Portable Blood Lead
Analyzer as an Alternative to Graphite Furnace
Atomic Absorption Spectrophotometer***

Tom M. Olewe^{1*}; Mutuku A. Mwanthi²; Joseph K.
Wang'ombe² and Jeffrey K. Griffiths³

¹ Vision Integrity & Passion to Serve (VIPS) Health Services at
Woodley, P. O BOX 8238 – 00200, Nairobi, Kenya; ² Department of
Community Health, School of Medicine, University of Nairobi, Kenya;
³ Department of Public Health and Family Medicine, Tufts University,
Boston, MA, USA

*Corresponding author email: tolewe@vipkenya.or.ke or
amuaa_leo@yahoo.com

ABSTRACT

Objective: To evaluate LeadCare II analyzer, a portable
electro-analytical instrument used to rapidly analyze blood lead
levels (BLL) in children, and compare it to gold standard,
graphite furnace atomic absorption spectrometry (GFAAS)

Methodology and results: Twenty-two (22) duplicate fresh
capillary blood samples were tested using both LeadCare II kits
and GFAAS. There was a strong, positive correlation ($r =$
 0.787 , $r^2 = 0.62$) between the BLL determined by LeadCare II
and GFAAS. In this study, LeadCare II analyzer scored 57%
sensitivity, 80% specificity and positive predictive value (PPV) of 0.8.

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However, like all screening tests, its predictive value depends on prevalence of disease and the number of individuals.

Conclusion and application of findings: LeadCare II offers an opportunity to cost effectively screen for childhood lead poisoning in Kenya. It has potential to improve patient care by providing instant results so that in one visit to a health center, information on lead poisoning can be provided and immediate treatment initiated if necessary.

Key words: Blood lead levels, Kenya, GFAAS, LeadCare II analyzer



Determination of Trace Metal Levels in Drinking Water and Fruit Juice in Benin City, Nigeria

Okeri H.A.*, Mmeremikwu A.C. and Ifeadi A.N.

Department of Pharmaceutical Chemistry, Faculty of Pharmacy,
University of Benin, Benin-City, Nigeria.

Corresponding author email: hokeri1@yahoo.com; hokeri@uniben.edu;
Tel: +234 8023112394

ABSTRACT

Objective: Trace elements are important for the normal functions of the body when their concentrations are within allowable limits but can cause health hazards when they exceed such limits. This study investigated levels of the trace metals Chromium (Cr), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn) and Zinc (Zn) in water and juice consumed in Benin City.

Methodology and results: Trace metal levels were determined in fifteen drinking water and ten fruit juice samples using Atomic Absorption Spectrophotometry (AAS). The drinking water is packaged water samples and the fruit juice were obtained from commercial (small-scale) sources. The metallic elements measured are Cr, Cu, Fe, Pb, Mn and Zn. The results



show that Fe was present in all the samples, Cu was present only in the drinking water samples, Mn and Zn were found in all drinking water samples and only three fruit juice samples. Pb and Cr were below the detection limits in all the samples. Except in one of the fruit juice sample, the trace metal levels in all the samples were below the allowable limits set by the National Research Council (NRC) and WHO (1996). The exception sample had 5.696 mg/L Zn which is above the beneficial limit and therefore unsafe for human consumption.

Conclusion and application of findings: Erah et al had reported that the water source (ground water and rivers) as raw material for the manufacture of fruit juices and preparation of drinking water in Benin-City are contaminated with abnormal levels of lead (Pb) and Zinc (Zn), and other studies in different parts of Nigeria has shown the need to properly process water meant for drinking and use for manufacture of consumables. Although, the water obtained from bore-holes and rivers are subjected to various treatment by different manufacturing companies before they are packaged for consumption or use for other manufacturing processes, it is recommended that regular surveillance should be carried out to ensure that drinking water and other products are safe for human consumption in terms of their metallic content.

Key words: Trace metals, fruit juice, drinking water, Atomic Absorption Spectrophotometry (AAS).



Potential negative impacts of vegetable production in polluted ecosystems

M. Mwangi & S. Maina

Biosciences Unit, FaCT Ltd., P.O. Box 967-00217, Kenya.

Corresponding author email: maina@biosciences.elewa.org

ABSTRACT

Vegetables are important for nutrition, food security and they constitute a major economic activity in rural and urban agricultural systems in developing countries. As land and water resources become scarce within urban areas, and the demand for vegetable products in urban markets increases, there has been increased utilization of marginal areas, e.g. rehabilitated garbage dump sites, road reserves, waste water ways, for vegetable production. Many farmers in urban areas utilize water flowing from sewers or other waste disposal systems to irrigate vegetable gardens. Here a few of the potential hazards that could emanate from these practices are presented.

One of the key dangers of producing vegetables on polluted soils is the potential uptake and accumulation of toxic heavy metals. Depending on variety, some crops are known to take up large quantities of heavy metals and store them within their tissues. Although this trait may be desirable and could be exploited for phytoremediation of polluted environments, consumption of such plants could lead to toxicity when the



metals are transferred from the vegetables into human body tissues.

Depending on the type of waste that is released into the polluted environments, there is also a risk of encountering lethal pathogens, which could cling onto the surfaces of harvested vegetable produce and be subsequently consumed. The risk of pathogen spread is particularly significant when polluted waste waters, e.g. from hospitals or places with large human populations are used to irrigate vegetables. Potential pathogens include especially colliforms, e.g. *Escheria coli*.



Photo 1: Vegetables produced in a small scale garden in urban areas. Although aesthetically appealing, such produce could be loaded with toxic metals or harbor microbial pathogens that can affect consumers.



Although washing of vegetables would reduce or eliminate pathogen loads, increasing water scarcity and costs in urban areas make it even more difficult to clean produce to the required degree.

Furthermore, urban families that keep livestock also use vegetable produce, or remnants, as fodder. Since this fodder is unlikely to be cleaned before feeding to the livestock there is a risk of pathogens passing through livestock products to human body tissues. It is possible that some microorganisms could be transmitted through milk, eggs or meat. In addition, animals fed on plant materials that contain heavy doses of toxic metals, could also accumulate the metals or other pollutants in their tissues, and these can be passed on to humans through consumed animal products.

Besides the danger of product contamination, farmers who work in polluted environments are exposed to increased risk of being directly infected by pathogens that are in such environments. Poor farmers are unlikely to have access to adequately protective working clothes. Thus, even minor wounds could turn into major avenues of infection by a host of microorganisms in water or soil.

Additional adverse impact of growing vegetables in polluted environments would be experienced in markets that have well defined standards for produce. Vegetables from areas associated with presence of polluting substances or practices are unlikely to be accepted and if accepted, it would be at much lower prices.

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Considering the importance of vegetables in livelihoods for food and income security, it is necessary to increase awareness of producers, especially in urban areas on the need to observe good production practices. One measure would be to ensure no vegetables are produced in polluted environments or using inputs that could expose consumers to negative health consequences.