

Journal of Environmental Chemistry and Ecotoxicology

Volume 8 Number 4 April 2016

ISSN 2141-226X



*Academic
Journals*

ABOUT JECE

The **Journal of Environmental Chemistry and Ecotoxicology (JECE)** is published bi-monthly (one volume per year) by Academic Journals.

Journal of Environmental Chemistry and Ecotoxicology (JECE) is an open access journal that provides rapid publication (bi-monthly) of articles in all areas of the subject such as ocean acidification, pesticides use and regulation, arsenic induced genotoxicity by curcumin, heavy metals and its environmental effect etc. The Journal welcomes the submission of manuscripts that meet the general criteria of significance and scientific excellence. Papers will be published shortly after acceptance. All articles published in JECE are peer-reviewed.

Contact Us

Editorial Office:

jece@academicjournals.org

Help Desk:

helpdesk@academicjournals.org

Website:

<http://www.academicjournals.org/journal/JECE>

Submit manuscript online

<http://ms.academicjournals.me/>

Editors

Prof. Peter Massanyi

*Slovak University of Agriculture, Faculty of
Biotechnology and Food Sciences, Department of
Animal Physiology,
Management,
Tr. A. Hlinku 2, SK-949 76 Nitra, Slovak Republic,
Slovak Republic.*

Prof. Mostafa El-Sheekh

*Faculty of Science, Tanta University,
Tanta 31527,
Egypt.*

China

Prof. Minghua Zhou

*Nankai University,
No. 94, Road Weijin,*

*Nankai District,
Tianjin 300071,
China.*

Prof. Muhammad Abdul Rauf

*United Arab Emirates University,
United Arab Emirates.*

Prof. Shao Hongbo

*Qingdao University of Science Technology,
Zhengzhou Road 53, Qingdao266042, China ,
China.*

Prof. Ghasem D. Najafpour

*Oshirvani University of Technology
Babol, Iran
Iran.*

Prof. Toyin Ayodele Arowolo

*Department of Environmental Management &
Toxicology,
College of Environmental Resources*

*University of Agriculture,
P.M.B. 2240,
Abeokuta 110001,
Ogun State,
Nigeria.*

Dr. Xue Song Wang

*Department of Chemical Engineering,
Huaihai Institute of Technology,
CangWu Road 59#, Lianyungang, Jiangsu, PR.*

Dr. Mohamed Nageeb Rashed

*Aswan Faculty of Science, South Valley University,

Aswan,
Egypt.*

Prof. Hamayun Khan

*Department of Chemistry
Islamia College University
Peshawar-25120,
Pakistan.*

Editorial Board

Dr. Mohammad Al-Hwaiti

*Al-Hussein Bin Talal University
Environmental Engineering Department
O. Box (20) Ma'an-Jordan
Jordan.*

Prof. Ajai Kumar Srivastav

*DDU Gorakhpur University
Department of Zoology, DDU Gorakhpur University,
Gorakhpur,
INDIA.*

Nathaniel C. Añasco

*University of the Philippines Visayas
Miagao, Iloilo 5023 Philippines
Philippines.*

Prof. El-Refaie Kenawy

*King Saud University,
Faculty of Science,
Department of Chemistry,
Petrochemicals Research Chair,
B.O.Box 2455 Riyadh 11451 ,Saudi Arabia
Saudi Arabia.*

Dr. K. Senthil Kumar

*TÜV SÜD South Asia Pvt. Ltd.,
No: A-151, 2nd C Main, 2nd Stage, Peenya Industrial
Estate,
Bangalore 560058, Karnataka State, INDIA
India.*

Dr. Omotayo Sarafadeen Amuda

*Ladoke Akintola University of Technology
Ilorin Road, Ogbomoso,
Nigeria.*

Dr. Jitendra Pandey

*Banaras Hindu university
Environmental Science Division, Department of Botany,
Banaras Hindu university, Varanasi - 221005,
India.*

Dr. Soumya Chatterjey

*Defence Research Laboratory, Tezpur (DRDO)
Post Bag No. 2, Tezpur 784001, Assam,
India.*

Prof. Bechan Sharma

*University of Allahabad
Department of Biochemistry,
Allahabad-211002,
India.*

Dr. Ghousia Begum

*Indian Institute of Chemical Technology,
Hyderabad 500 007, A.P; India
Prof. Gang Yang
Key Laboratory of Forest Plant Ecology, Ministry of
Education,
Northeast Forestry University
26 Hexing Road, Harbin
China.*

Dr. Anindita Bhattacharyya

*Indian Statistical Institute
203, B. T. Road, Kolkata 700108, West Bengal,
India.*

Dr. Onome Davies

*Rivers State University of Science & Technology, Port
Harcourt, Rivers State
Dept. of Fisheries & Aquatic Environment, P.M.B. 5080,
Port Harcourt,
Nigeria.*

Dr. B. Stephen Inbaraj

*Fu Jen University
Department of Nutrition & food science,
Taipei 242, Taiwan
Environmental Chemistry & Analytical Chemistry
Taiwan.*

Dr. Hala A. Awney

*Institute of Graduate Studies and Research,
Alexandria University,
Egypt.*

Dr. Suhel Parvez

*Leibniz Institute for Neurobiology
Brennekestr. 6, Magdeburg 39118,
Germany.*

Dr. Mayalagu Rajkumar

*Institute of Oceanology, Chinese Academy of Sciences
7 Nanhai Road, Qingdao, 266071
China.*

Dr. Eldon Raj Rene

*University of La Coruna
Department of Chemical Engineering, Spain*

Vyacheslav Khavrus

*L. V. Pizarzhevskii Institute of physical chemistry of
NAS of the Ukraine (permanent position)
Ukraine.*

Journal of Environmental Chemistry and Ecotoxicology

Table of Content: Volume 8 Number 4 April, 2016

ARTICLES

- Effect of Dichlorvos on Reproductive Performance of Laying hens** 34
Ethelbert Uchechukwu Ezeji, Angela Chika Udebuani, Josephath Okereke, Sylvia Anyadoh-Nwadike, Ikechukwu N. E. Onwurah and Kalu Obasi

Full Length Research Paper

Effect of Dichlorvos on Reproductive Performance of Laying hens

Ethelbert Uchekwue Ezeji^{1*}, Angela Chika Udebuani¹, Josephath Okereke¹, Sylvia Anyadoh-Nwadike¹, Ikechukwu N. E. Onwurah² and Kalu Obasi³

¹Department of Biotechnology, Federal University of Technology, P.M.B. 1526 Owerri, Imo State, Nigeria.

²Pollution Control and Biotechnology Unit, Department of Biochemistry, University of Nigeria, Nsukka, Enugu State, Nigeria.

³Department of Biological Science, Federal University of Technology, Owerri, Imo State, Nigeria.

Received 21 May 2015; Accepted 22 December, 2015

The effect of dichlorvos on reproductive performance of laying hens was studied. Seven weeks old pullets with an average weight of 557.5 ± 9.5 g were divided into four groups and fed *ad libitum* with commercial poultry feeds contaminated with 0.01, 0.02 and 0.04% dichlorvos (w/v). The group without dichlorvos served as the control. Exposure to dichlorvos was continued until nine weeks after the hens started laying eggs. There was a significant reduction ($p < 0.05$) in feed intake between the control group and those exposed to dichlorvos. Egg laying was delayed in the hens exposed to the pesticide by as much as eighteen weeks. The ages of the hens at first egg lay were 18 weeks for the control, 23 weeks for hens fed on 0.01 and 0.02% contaminated diet and 36 weeks for those fed on 0.04% contaminated diet. The average daily egg production was reduced from 5 eggs in the control group to 1 egg in 0.04% contaminated group. The protein contents of the egg (yolk and egg-white) and cholesterol level of the egg yolk were lowered in birds exposed to dichlorvos. There was no significant difference in the weight of eggs between the control and those exposed to pesticide. Results of this study suggest that exposure of laying hens to dichlorvos could affect their reproductive success.

Key words: Dichlorvos, reproductive success, sexual maturity, egg laying hens.

INTRODUCTION

Use of pesticides in agriculture and domestic purposes may have adverse effects on humans and non-target animals. Dichlorvos is widely used as an insecticide to control household pests, in public health, protecting stored product from insects and control of parasites in livestock. As an organophosphate pesticide, dichlorvos

works by inhibiting the activity of the enzyme, acetylcholinesterase (Yair et al., 2008). The excessive use of organophosphorus pesticides in agriculture has originated serious problems in the environment (Singh and Walker, 2006). Many environmental pollutants are known to cause reproductive toxicity and have resulted

*Corresponding author. E-mail: ucheezeji@yahoo.com. Tel: +234-8033429193.

Table 1. Effect of DDVP exposure on body weight, feed intake and egg production of domestic fowl.

Experimental group	Control	0.01% DDVP	0.02% DDVP	0.04% DDVP
Body weight gain (%)	126.50	68.75	65.10	28.10
Feed intake (g)	924.59	723.98	686.76	600.32
Age at 1st egg (days)	126	161	161	252
Weight of 1st egg (g)	35.27	41.54	42.02	45.60
Egg production (%)	52.75	22.42	23.34	1.47

in a decrease in fertility level of human population (Whorton et al., 1972). The world-wide deaths and chronic diseases due to pesticide poisoning is about 1 million per year (Environews Forum, 1999). Environmental contaminants such as agricultural chemicals and industrial wastes have been reported to have adverse effect on the reproduction of birds exposed to them (Fry, 1995). Exposure to pesticides has been reported to cause decrease in egg production and embryo viability in birds (EPA, 2006). Sauter and Steelo (1972) have suggested pesticide residues as a major cause of declining population of several wild species of birds. Poultry may be exposed to pesticides either by ingestion of contaminated feed or through use of pesticides in poultry house (Foster, 1974). This study evaluates the effect of dichlorvos on the reproductive performance of egg laying hens.

MATERIALS AND METHODS

Forty (40) day old black pullets were obtained from Zartec Farms, Ibadan, Nigeria. The birds were brooded under appropriate conditions until they were seven weeks old. The seven weeks old pullets (with an average weight of 557.5 ± 9.5 g) were then divided into four different groups containing ten birds each and housed in poultry pens at the livestock unit of the Department of Animal Science Technology, Federal University of Technology, Owerri. The four groups were fed *ad libitum* with commercial poultry feeds contaminated with 0.00, 0.01, 0.02 and 0.04% dichlorvos (w/v). The contamination was done by measuring out graded volumes of the pesticide and mixing it with the feed. Three different types of feeds were given to the birds during the period of the experiment. Starter feeds were given from day 1 to the 8th week; growers mash was given from the 8th week to first egg drop after which layers mash was given till the end of the experiment. The birds were maintained in a clean environment that ensures 12 h of light and 12 h of darkness. The control group had no pesticide added to their feed. The pesticide exposure was continued until nine weeks after the first lay of eggs. The birds were weighed before and at the end of the exposure while the feed intake was also recorded. Eggs were collected daily and weighed. Total proteins of the eggs were estimated by the method of Lowry et al., (1951). Egg yolk cholesterol was determined as described by Shen et al., (1982). The results were statistically analyzed using a one way analysis of variance (ANOVA).

RESULTS

It was observed that exposure to dichlorvos affected the

weight of the birds. The body weight of the control birds were significantly higher ($p < 0.05$) than those exposed to the pesticide. The percentage gain in weight is shown in Table 1. For the control, the percentage gain in body weight was 126.5% as against 68.75, 65.10 and 28.10% gain in weight recorded for 0.01, 0.02 and 0.04% contaminated diets, respectively.

There was a significant reduction ($p < 0.05$) in feed intake in the birds fed on pesticide contaminated diet. The control group recorded an average feed intake of 924.59 ± 11.1 g while those fed on 0.04% DDVP recorded an average feed intake of 600.32 ± 8.99 g throughout the period of the experiment (Table 1).

Exposure to dichlorvos affected the layer performance of the birds. The birds fed on normal diet (control group) laid their first egg when they were 18 weeks old (126 days), while those fed on 0.01 and 0.02% contaminated diets laid their first egg when they were 23 weeks old (161 days). Egg laying was further delayed in the birds exposed to 0.04% dichlorvos laying their first egg in the 36th week. There was also a reduction in egg production in the birds fed on pesticide contaminated diet. A total of 544 eggs were laid by the birds over a period of nine weeks. Out of these, 52.75% were laid by the birds fed on normal diet (control) while the remaining 47.25% were laid by those fed on pesticide contaminated diet.

Analysis of the eggs from the birds exposed to different concentrations of dichlorvos showed that there was no significant effect on the weight of the eggs. There were also no significant differences ($p > 0.05$) in the weight of the egg shells between the control and those exposed to pesticide (Table 2). However, the highest egg shell weight (5.13 ± 0.36 g) was recorded in the group exposed to 0.04% pesticide. There was a slight reduction in the weight of egg white from 31.42 ± 0.45 g in the control to 29.35 ± 0.73 g in the birds exposed to pesticide (Table 2). This difference was also not statistically significant ($p > 0.05$). The differences in egg yolk weight was also not significant ($p > 0.05$), although the highest weight (14.59 ± 1.15 g) was recorded in the birds fed on 0.02% pesticide contaminated diet.

The protein content of the egg yolk was significantly ($p < 0.05$) reduced from 161.54 ± 5.71 mg protein/g yolk in the control to 139.73 ± 3.42 mg protein/g yolk in the birds exposed to 0.04% pesticide (Table 3). There was also a significant ($p < 0.05$) reduction in the protein

Table 2. Effect of DDVP exposure on egg quality of domestic fowl.

Experimental group	Control	0.01% DDVP	0.02% DDVP	0.04% DDVP
Weight of egg (g)	52.85 ± 0.06	49.20 ± 1.48	51.70 ± 2.09	57.50 ± 0.03
Shell weight(g)	4.88 ± 0.08	4.67 ± 0.01	4.82 ± 0.32	5.13 ± 0.36
Wt. of egg white (g)	31.42 ± 0.01	29.35 ± 0.01	29.32 ± 0.73	30.60 ± 0.87
Wt. of egg yolk (g)	13.46 ± 0.01	12.93 ± 0.00	14.59 ± 1.15	12.77 ± 4.0

Table 3. Egg yolk protein, egg white protein and yolk cholesterol of domestic fowl exposed to DDVP.

Experimental group	Egg yolk protein (mgProtein/g yolk)	Egg white protein (mgProtein/gEW)	Yolk cholesterol (mg/gYolk)
Control	12.51 ± 0.14	157.5 ± 5.71	120.34 ± 10.28
0.01% DDVP	12.40 ± 0.36	150.23 ± 4.56	115.5 ± 3.43
0.02% DDVP	12.21 ± 0.21	143.76 ± 4.68	107.42 ± 7.99
0.04% DDVP	11.92 ± 0.29	139.73 ± 3.43	100.15 ± 6.85

content of egg white with increase in percentage pesticide contamination. A similar trend was also observed in the cholesterol content of the egg yolk (Table 3). The differences in cholesterol content of the egg yolk from the different groups were not significant ($p > 0.05$).

DISCUSSION

It has been reported that environmental contamination by agricultural chemicals (including pesticides) have adverse effects on the reproduction of exposed birds (Fry, 1995). There was a reduction in feed intake in birds exposed to dichlorvos. This is in line with the work of Pym et al., (1984). Our results showed that dichlorvos have negative effects on the reproductive performance of poultry birds. Sexual maturity was delayed in the birds fed on pesticide contaminated diet. This is reflected in the delay in egg laying time by as much as 18 weeks in the hens fed on 0.04% pesticide contaminated diet when compared with the control. The birds exposed to 0.01 and 0.02% pesticide, respectively, laid their first eggs on the same day (23rd week) while those fed on 0.04% contaminated diet laid their first egg on the 36th week. Under normal circumstances, commercial egg layers will lay their first egg between 15-19 weeks.

Egg production was also affected by exposure to dichlorvos. The percentage egg production was significantly lowered ($p < 0.05$) in the hens fed on pesticide contaminated diet when compared with the control. A number of factors affect the reproductive capacity of domestic fowl. These include quantity and quality of feeds, availability of clean water, proper lighting and cleanliness of the pens, among others. Exposure to environmental pollutants have been

reported to have some adverse effects on fertility and reproductive capacity of laying hens. Summer et al., (1996) reported significant decreases in egg production, weight and fertility of adult hens exposed to halogenated hydrocarbons. Pribilincová et al. (1996) also reported a negative effect on the reproductive performance of laying hens exposed to phenyl mercury.

Conclusion

Results of this study suggest that exposure of poultry birds to dichlorvos could affect their reproductive success as well as the quality of eggs laid.

ACKNOWLEDGEMENTS

The authors are grateful to the Head of the Department of Animal Science Technology, Federal University of Technology, Owerri, Nigeria, for making their poultry pens available for this research.

Conflict of interests

The authors have not declared any conflict of interests.

REFERENCES

- Environews Forum (1999) Killer environment. Environ. Health Perspect. 107:A62.
- Environmental Protection Agency (2006). Decision documents for atrazine. Available at: <https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/PB2006114876.xhtml>
- Foster TS (1974). Physiological and biological effects of pesticide

- residues in poultry. *Rev. Environ. Contam. Toxicol.* 51:69-121
- Fry DM (1995). Reproductive Effects in Birds Exposed to Pesticides and Industrial Chemicals. *Environ. Health Perspect.* 103(7):165-171.
- Lowry OH, Rosenbrough NJ, Fair AL, Randall, RJ (1951). Protein measurement with the Folin – Phenol reagent. *J Biol. Chem.* 193:265-270.
- Pribilincova J, Maretova E, Kosutoka J, Maretta M (1996). The effect mercury on reproductive performance of layer hens. *Acta Vet. Hung.* 44:377-387.
- Pym RAE, Singh G, Gilbert WS, Armstrong JP, McCleary BV (1984). Effects of dichlorvos, maldison and pirimiphos-methyl on food consumption, egg production, egg and tissue residue and plasma acetylcholinesterase inhibition in layer strain hens. *Aust. J. Exp. Agric. Anim. Husb.* 24: 83-92.
- Sauter EA, Steele EE (1972) . The effect of low level pesticide feeding on the fertility and Hatchability of chicken eggs. *Poult. Sci.* 51: 71-76.
- Shen CS, Chen IS, Sheppard AJ (1982). Enzymatic determination of cholesterol in egg yolk. *J. Assoc. Off. Anal. Chem.* 65(5):1222-1224.
- Singh BK, Walker A (2006). Microbial Degradation of Organophosphorus Compounds, *FEMS Microbiol. Rev.* 30(3):428-471.
- Summer CL, Giesy JP, Bursian SJ, Render JA, Kubiak TJ, Jones PD, Verbrugge DA, Aulerich RJ (1996). Effects induced by feeding organochlorine-contaminated carp from Saginaw Bay, Lake Huron, to laying White Leghorn hens. I. Effects on health of adult hens, egg production, and fertility. *J. Toxicol. Environ. Health* 49(4):389-407.
- Whorton D, Krauss RM, Marshall S, Milby TH (1972). Infertility in male pesticide workers, *Lancet* 2:1259-1261.
- Yair S, Ofer B, Arik E, Shai, S, Yossi R, Tzvika D, Amir K (2008). Organophosphate Degrading Microorganisms and Enzymes as Biocatalysts in Environmental and Personal Decontamination, *Appl. Crit. Rev. Biotechnol.* 28:265-275.

Journal of Environmental Chemistry and Ecotoxicology

Related Journals Published by Academic Journals

- *African Journal of Pure and Applied Chemistry*
- *International Journal of Physical Sciences*
- *Journal of Geology and Mining Research*
- *African Journal of Mathematics and Computer Science Research*
- *Journal of Internet and Information Systems*
- *Journal of Oceanography and Marine Science*
- *Journal of Petroleum Technology and Alternative Fuels*

academicJournals