International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

IJFBS
International Journal of Fauna And Biological Studies

ISSN 2347-2677
IJFBS 2018; 5(1): 228-230
Received: 06-11-2017
Accepted: 07-12-2017

Ankita Thakur
Ph.D. Scholar, Punjab Agricultural University, Ludhiana, Punjab, India

Dr. Harjit Kaur
Retired Professor, Department of Zoology, Punjab Agricultural University, Ludhiana, Punjab, India

Correspondence
Ankita Thakur
Ph.D. Scholar, Punjab Agricultural University, Ludhiana, Punjab, India

Influence of lead pollution on survival and growth of slug, *Filicaulis alte* and snail, *Macrochlamys indica* Godwin-Austen

Ankita Thakur and Dr. Harjit Kaur

Abstract
Slug, *Filicaulis alte* and snail, *Macrochlamys indica* were fed on an artificial diet contaminated with different concentrations of Pb (50, 100, 200, 400, 800 µg/g). Snails were tolerant of all levels of lead contamination with no mortalities but at highest concentration (800 µg/g), Pb was detrimental to snail shell. Slug, *F. alte* was found to be sensitive towards highest concentration of Pb (800 µg/g), showed adverse morphological effects on their body along with mortality. Thus both slug and snail could be used as bioindicators to monitor adverse effects of environmental Pb pollution.

Keywords: *Filicaulis alte, Macrochlamys indica,* Lead contamination, bioindicators

Introduction
Lead pollution occurs as a consequence of combustion of petrol additives in automobiles and reaches soil by means of atmospheric precipitation (Amusan *et al* 2002) [1]. It has been substantiated that invertebrates tend to concentrate lead more than other aquatic organism. To reveal the presence of pollutants in the environment and to measure their toxic effects biological indicators can be used. Molluscs are sturdy enough to survive in laboratory and field conditions and tolerant to environmental alterations, and various contaminants. In the laboratory studies, mostly an artificial type of food was used Contaminants are taken up by snails through diet (Ebenso and Ologhobo 2009). Elevated metal concentrations in the food can directly influence consumption, growth, reproduction and survival. Swaileh and Ezzughayyar (2000, 2001) also found significant reduction in food consumption with increase in concentration of heavy metals in diet of snail. Slugs and snails are ideal species for environmental monitoring, because of their abundance, wide geographical distribution, relative longer life span, size, weight, easy identification and collection. They are suitable for hazard and risk assessment (Gupta and Singh 2011) [7]. Present study was conducted to study the effect of inorganic lead contaminated diet on survival and growth of both adults and juveniles of slug, *F. alte* and snail, *M. indica* under laboratory conditions.

Materials and Methods
Slugs and snails were acclimatized for a week in plastic trays (each 18 x 15 x 4 cm) covered by moist muslin cloth on top. Soil was kept moist throughout the experiment by sprinkling water. Feeding and mortality experiment using different concentrations of lead (50, 100, 200, 400 and 800 µg/g of lead as Pb $(NO_3)_2$ mixed in wheat bran were conducted in plastic trays using 5 slugs (3-6 g body weight) and 5 snails (1.5- 2 g body weight) in each tray. Each treatment was replicated 3 times. Control experiment was run along with each test using 5 slugs and snails per tray (three replicates) and were offered 5g wheat bran daily per tray. Daily observations were made for their mortality during test period. After four days test period, they were offered plain wheat bran.

Statistical analysis: One way analysis of variance (ANNOVA) was used to determine increase or decrease in mean body weight of both slug and snail in treated set by comparing with that of untreated sets.

Results and Discussion
Feeding responses and mortality of slug, *F. alte* and snail, *M. indica* fed on lead mixed wheat bran bait.

There was significant time dependent decrease in mean daily intake (MDI) of Pb contaminated bait as compared to uncontaminated one, resulted in reduction in mean body weight of snail, *M. indica* (Table 1). Swaileh and Ezzughayyar (2001) reported that 'Pb' contaminated diet significantly reduced growth and feeding rates of *Helix engaddensis.* The growth can also be effected due to heavy metal stress, which further leads to change in activity of an organism resulting in utilisation of their biochemical energy to counteract the toxic stress, hence metabolic rate increases which affect growth (Mahajan and Zambare 2013) [9]. The faecal matter was dark orange in colour in Pb treated snails when compared with the untreated ones, whose faecal matter was white in colour which might indicate that Pb is excreted through the body of snail through detoxification process. Pb is excreted rapidly by snail, *Cepaea hortensis* (Martin 2012) [8]. Accumulation and detoxification of metals within tissues generally results in additional energy utilization thus reducing growth rate (Notten *et al* 2006) [11]. It was observed that in snails exposed to highest concentration of Pb (800 µg/g), there was thinning of shell near the operculum which indicate that highest concentration of Pb is detrimental to snail shell as showed in Fig. 1 a. Adaptation to heavy metal stressors may involves modification of existing metabolic pathways and sequestering of toxic substances in shell or exoskeleton, significant changes in shell characteristics were recorded in *Helix aspersa* exposed to lead contamination (Beeby and Richmond 2011). Besides, in the land snails, *H. aspersa*, the shell was a site of Pb deposition (Ebenso and Ologhobo 2010). So, snails were found to be tolerant to Pb with no mortalities.

Similar observations were recorded in case of slug, *F alte* i.e. they also showed significant time dependent decrease in mean daily intake (MDI) of Pb contaminated bait as compared to uncontaminated one, resulted in reduction in overall mean body weight as shown in table 2; however they were found to be more sensitive than snails, showed mortality with adverse morphological effects i.e. thinning of skin from ventral surface of body of one of the slug was noticed at highest Pb concentration (800µg/g) (Fig 1. b). Similar findings were reported by Marigomez *et al* (2002) [10] the thinning may be due to the induction of cellular lysis in the epithelium as a result of detoxification process and the general body response to stress. Orange coloured faecal matter might indicate that slugs also have the capability to detoxify excess metal concentration from their body.

Table 1: Effect of different concentrations of Pb in wheat bran on feeding responses of the snail, *Macrochlamys indica* (n = 5 snails/ replicate) in no-choice laboratory feeding tests

Treatment	Body weight of snail (g)		Percent Increase (+)/ decrease (-) in body weight	Overall bait intake (g/10g body weight)
	Before treatment	After treatment		
UT_1	1.29±0.33	1.36±0.03	5.14 (+)	1.11±0.1*
T_1-50ppm	1.41±0.36	1.28±0.09	9.2 (-)	0.48±0.05
UT_2	1.17±0.30	1.53±0.08	23.5 (+)	1.27±0.06*
T_2-100ppm	1.54±0.21	1.52±0.39	1.29 (-)	0.65±0.08
UT_3	1.23±0.3	1.57±0.03	21.65 (+)	1.24±0.05*
T_3-200ppm	1.72±0.44	1.49±0.14	13.3 (-)	0.49±0.06
UT_4	1.72±0.44	1.76±0.06	2.27 (+)	1.09±0.12*
T_4-400ppm	1.84±0.25	1.66±0.43	9.78 (-)	0.25±0.07
UT_5	1.47±0.09	1.72±0.06	14.53 (+)	1.21±0.10*
T_5-800ppm	1.65±0.07	1.49±0.06	9.69 (-)	0.49±0.04

Values are, Mean±S.E

%(+) – increase in body weight, %(-) - decrease in body weight,

UT – Untreated, T- Treated

* Differences between consumption of untreated and treated baits significant at $p \geq 0.05$

Table 2: Feeding responses of slug, *Filicaulis alte* towards different concentrations of lead in wheat bran bait in no choice laboratory feeding tests

Treatment	Body weight of slug (g)		Percent Increase (+)/ decrease (-) in body weight	Overall bait intake (g/10g body weight)
	Before treatment	After treatment		
UT_1	3.76±0.97	4.17±0.33	10.9 (+)	1.54±0.08*
T_1-50ppm	4.36±0.19	4.19±1.08	3.89 (-)	0.78±0.10
UT_2	4.0±1.04	4.23±0.09	5.43 (+)	1.31±0.07*
T_2-100ppm	5.19±0.09	4.06±1.04	21.7 (-)	0.53±0.46
UT_3	4.50±1.41	4.87±0.16	7.59 (+)	1.45±0.06*
T_3-200ppm	5.58±0.16	5.49±1.4	1.61 (-)	0.39±0.12
UT_4	5.05±1.30	5.34±0.58	5.61 (+)	1.36±0.07*
T_4-400ppm	6.16±0.14	5.90±1.05	4.22 (-)	0.42±0.11
UT_5	6.33±0.24	6.47±0.23	2.16 (+)	1.16±0.21*
T_5-800ppm	7.06±0.23	6.38±0.24	9.63 (-)	0.19±0.04

Values are Mean±S.E

%(+) – increase in body weight, %(-) - decrease in body weight, UT – Untreated, T- Treated

* Differences between consumption of untreated and treated baits significant at $p \geq 0.05$

a) Damage to snail shell

b) Damage to slug skin (thinning of skin)

Fig 1: Damage caused to snail and slug when fed with higher concentration of lead

Conclusion

Thus the findings of our study revealed that slugs and snails could be used as bioindicators of environmental Pb pollution.

Acknowledgement

The authors are thankful to the Head of Department of Zoology, Punjab Agricultural University, Ludhiana, India for providing necessary facilities

References

1. Amusan A AS, Anyaele OO, Lasisi AA. Effects of Copper and Lead on growth, feeding and mortality of terrestrial gastropod *Limicolaria flammea* African Journal of Biomedical Research. 2002; 5:47-50.
2. Beeby A, Richmond L. Magnesium and the deposition of lead in the shell of three populations of the garden snail *Cantareus asperses*, Enviromental pollution 2011; 159(6):1667-72.
3. Ebenso IE, Ologhobo AD. Effects of Lead Pollution at Industrial Contaminated Sites on Sentinel Juvenile, *Achatina achatina Bulletin of* Environmental Contamination and Toxicology 2009; 85:106-10.
4. Ebenso IE, Ologhob AD. Evaluation of environmental lead exposure in snails from four contaminated sites at abandoned battery factory in Niger Delta Nigeria, Journal of Animal Production. 2010; 37(2):258-63.
5. Gomot A, Vaufleury D. Standardized Growth toxicity testing (Cu, Zn, Pb, Pentachlorophenol) with *Helix aspera* Ecotoxicology and Environonment Safety 2000; 46:41-50.
6. Gomot-de Vaufleury A, Kerhoas I. Methods for toxicity assessment of contaminated soil by oral or dermal uptake in land snails: sublethal effects on growth Environment Science and Technology 2011; 34:1865-70.
7. Gupta S, Singh J. Evaluation of mollusc as sensitive indicator of heavy metal pollution in aquatic system The IIOAB Journal. 2011; 2:49-57.
8. Martin MH. Biological Monitoring of Heavy Metal Pollution: Land and Air Oecologia (Berl) 2012; 30:265-72.
9. Mahajan PR, Zambare SP. Caffeine, the remedy for the heavy metal induced toxicosis with respect to ascorbic acid in a model *Bellamya bengalensis*, World Journal of Pharmaceutical Research. 2013; 1:16-18.
10. Marigomez I, Soto M, Miren PC, Angulo E, Giamberini L. Cellular and subcellular distribution of metals in molluscs Microscopy Research and Technique. 2002; 56:358-92.
11. Notten MJM, Oosthoek AJP, Rozema J, Aerts R. Heavy metal pollution affects consumption and reproduction of the landsnail *Cepaea nemoralis* fed on naturally polluted *Urtica dioica* leaves Ecotoxicology 2006; 15:295-304.
12. Swaileh K, Hussein R, Halaweh N. Metal accumulation from contaminated food and its effect on growth of juvenile land snail *Helix engaddensis* Journal of Environmental Science and Health (B). 2002; 37(2):151-9.
13. Walker EH, Hopkin SP, Sibly RM, Peakall DB. Principles of ecotoxicology, 2nd edn. Taylor and Francis, London, 2011.