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Assessment of Liveability and Genotoxic Response of Edible Snail, *Pachymelania aurita* on Exposure to an Endocrine Disrupting Chemical

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Abstract
Two hundred edible snails, Pachymelania *aurita* (Isam) were exposed to graded levels (1, 5, 25 and 100 µg/L; A, B, C and D respectively) of bisphenol A (BPA), an endocrine-disrupting chemical (EDC) and its effect on liveability (ability to crawl and mortality) and genotoxicity (presence or absence of high molecular weight DNA) at days 7, 14 and 21 of exposure determined. Decreases in snails activity were observed in A, B and C groups by day-14 today-21. No significant weight change was recorded. Group D snails recorded 8 dead snails during the second week,and 5 snails each during the first and third week. Gel electrophoresis of DNA extracted from group D snails showed faint bands at 7 and 14 days, indicating degradation of the genomic DNA but not at 21, indicating an adaptation of snails to the high level of the chemical. There is the need to monitor levels of EDC in Nigerian freshwater bodies in order to conserve its food organisms.

Keywords: Snail,Pachymelania *aurita,*bisphenol A,fresh water bodies

Introduction

An array of chemicals discharged into the environment from industrial activities can mimic or antagonise the action of hormones in animals and therefore can interact with physiological systems to alter development, growth and reproduction in wildlife exposed to them (Tetreault, 2011). A recent study by Nwajiobi (2017) showed that one of these endocrine disrupting chemicals (EDC), bisphenol A (BPA) is present in Nigerian waters and therefore can affect the physiology of freshwater fish and snails that play important role in the food chain and livelihood of riverine communities in Nigeria. Information on the effects of BPA on fresh water edible snails of Nigeria is however lacking.

The objective of this study is therefore to assess the liveability and genotoxic response of the edible snail, *Pachymelania aurita* (Isam) to graded levels of BPA exposure.

Materials and Methods

Two hundred *Pachymelania aurita* of approximately similar sizes (35 – 45 mm long and 5.0 - 7.9 g by weight) gathered by fishermen from the estuaries of the Cross River were procured from mongers at the Marina market, Calabar, Cross River State. They were acclimatized for two weeks by feeding sediments/mud from their natural habitat in an aquarium. Thereafter, they were divided into five groups of 40 snails each and exposed to different concentrations (1, 5, 25 and 100 µg/L) of BPA, an EDC associated with anthropogenic activities and present in Nigerian waters (Nwajiobi, 2017). A sixth group exposed to absolute ethanol solution only served as control. All analysis was performed in triplicate.

The snails were observed for liveability (ability to crawl and mortality) on daily bases and results pooled for 7, 14 and 21 days intervals. At the same intervals, snails were sacrificed and analysed for the genotoxicity of the BPA using the Sokolov (2000) protocol. Briefly, DNA was extracted from 50 mg of snail foot muscle and the quality of extracted genomic DNA determined by Agarosegel electrophoresis and scoring for either presence or absence of high molecular weight DNA.

Results and Discussion

Liveability changes in *Pachymelania aurita* exposed to BPA: Table 1 showed that at the end three weeks, the control snails remained active (in terms of crawling). However, decreases in activity wereobserved in the snails in tests A, B and C exposed to BPA at different concentrations from day-14 to day-21. Specifically, decrease in liveability of group D (100 µg/L) snails started from day-7 and continued to day-21. No significant change in weight of snails were observed with values remaining within the initial weight range of 5.0 - 7.0 g. Figure I showed that the control group recorded the least mortality of 1-3 snails across the study period. The group D snails (100 µg/L), recorded a peak of 8 dead snails during the second week of exposure to BPA, while equal mortality of 5 snails each was recorded during the first and third week.

Table 1: Livability changes observed in the *P. aurita*

Days/Concentration	Control	A (1µg/L)	B (5µg/L)	C (25µg/L)	D (100µg/L)
Day 7	++++	++++	++++	++++	+++
Day 14	++++	+++	+++	++	++
Day 21	+++	++	++	++	+

Key: ++++ = Very Active; +++ = Active; ++ = Moderately Active; + = Less Active

Agarose gel electrophoresis of genomic DNA of *P. aurita* exposed to BPA: Plate 1a, showed that A_1, A_2 and A_3 bands equivalent to 1, 5 and 25 µg/L exposure rates of BPA respectively had similar intensity as the control band M_1, unlike band A_4 (100 µg/L) which was very faint, and attributed to effects of high BPA content. Plate 1b showed that at 2nd week of exposure B_1, B_2 and B_3 were not visibly different in intensity from the control band, M_2. Band B_4 (100 µg/L) however, reflected an intensity in the region of low molecular weight DNA, probably due to further degradation of the genomic DNA by thehigh level of BPA. At 3rd week of exposure (Plate 1c), visible decrease in band intensity was noted for all exposed samples compared to the control band M_3. Band C_4 (100 µg/L) intensity was however comparable to the control, probably due to the adaptation of the organism to the high BPA concentration.

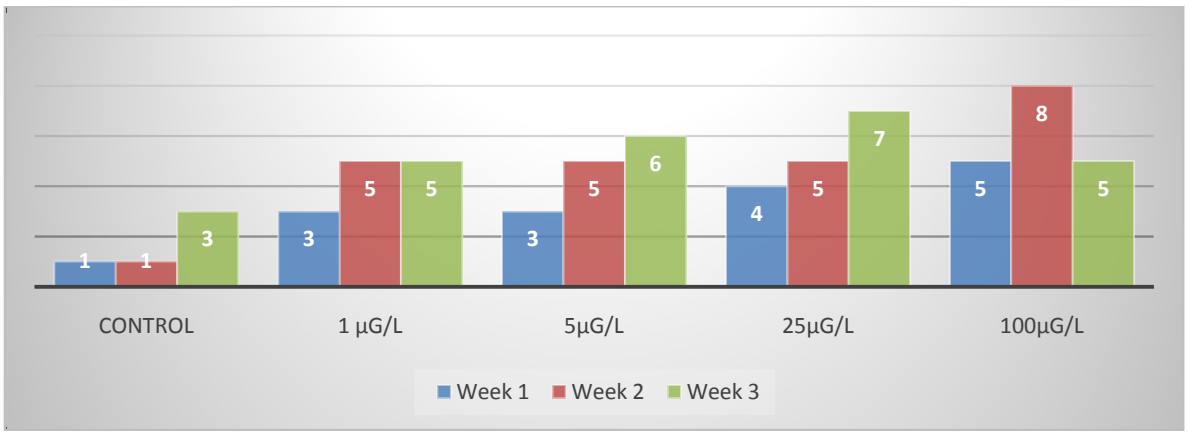

Fig. I: Mortality of exposed *P. aurita*

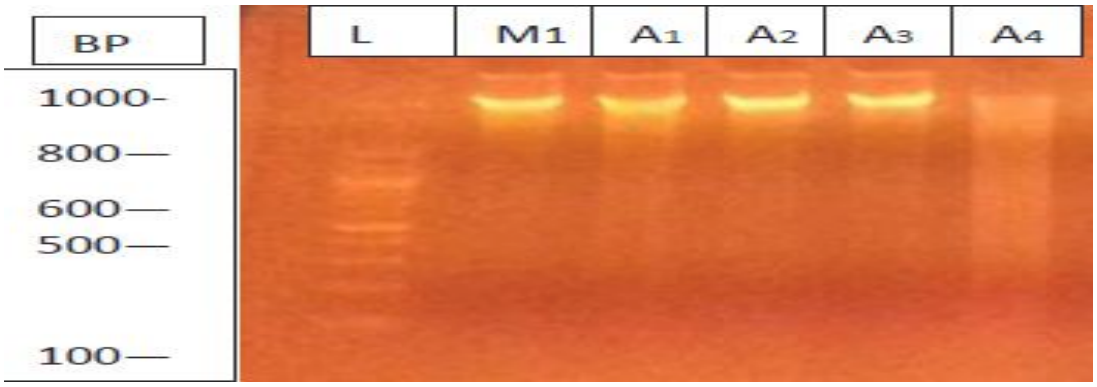

Plate 1a: Ist week exposure

Key: L=1kb DNA ladder; M_1, M_2 and M_3=Control 1st, 2nd and 3rd week; A= 1st week, B=2nd week, C=3rd week of exposure; 1,2,3 and 4=1µg/L, 5µg/L, 25µg/L and 100µg/L respectively.

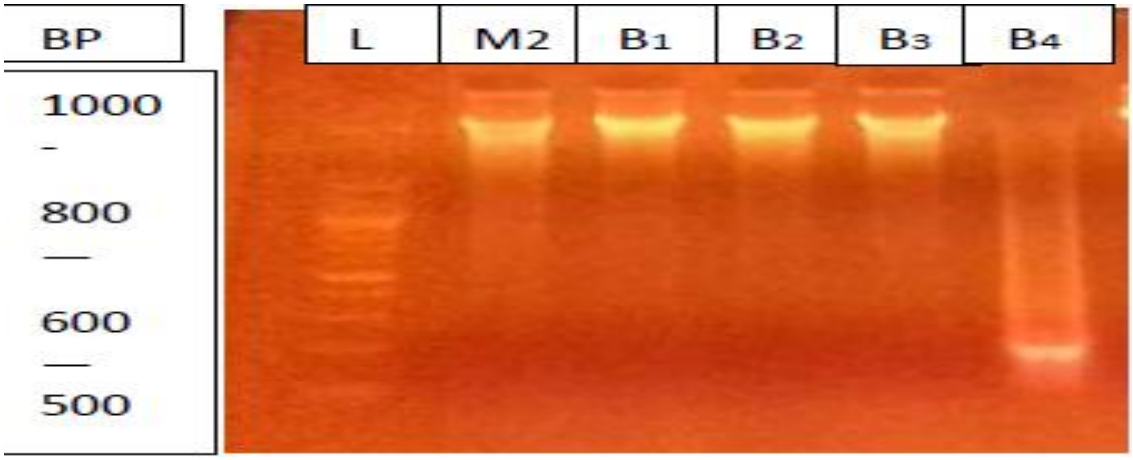

Plate 1b: 2nd week exposure

Key: L=1kb DNA ladder; M_1, M_2 and M_3=Control 1st, 2nd and 3rd week; A= 1st week, B=2nd week, C=3rd week of exposure; 1,2,3 and 4=1µg/L, 5µg/L, 25µg/L and 100µg/L respectively.

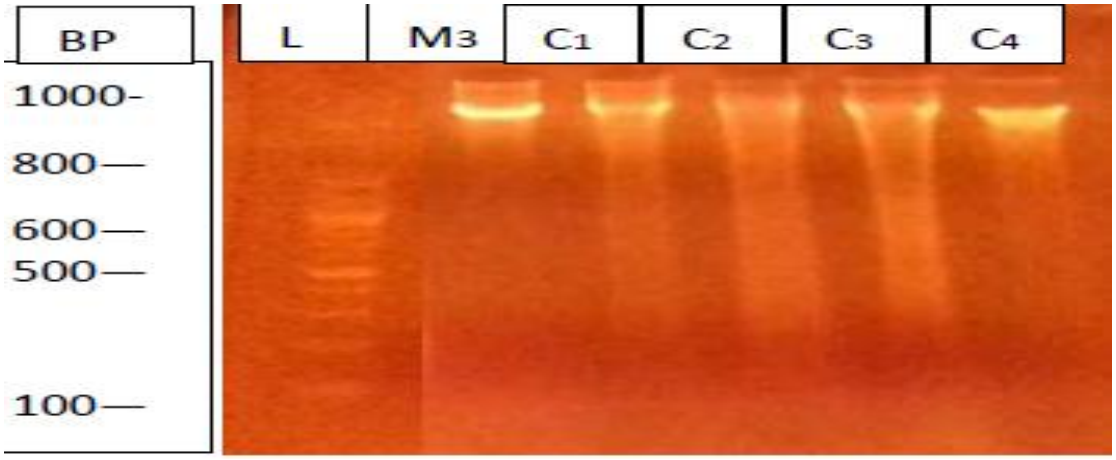

Plate 1c: 3rd week exposure

Key: L=1kb DNA ladder; M_1, M_2 and M_3=Control 1st, 2nd and 3rd week; A= 1st week, B=2nd week, C=3rd week of exposure; 1,2,3 and 4=1µg/L, 5µg/L, 25µg/L and 100µg/L respectively.

Conclusion

Exposure of the edible snail, *Pachymelania aurita*to 100 µg/L of bisphenol A up to 14 days has deleterious effects on both the liveability and genomic DNA of the organism. There is the need to monitor levels of endocrine disrupting chemicals in Nigerian freshwater bodies in order to conserve their food organisms.

References

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