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Effect of Carbamate Molluscicide on African Giant Land Snail *Limicolaria Aurora*

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ABSTRACT: The effect of 50, 100, 200 , 300 , 400 and 500 mg/ml of carbamate molluscicide on the behavioural and macroscopic changes of *Limicolaria aurora* were investigated in the laboratory using *Carica papaya* as bait for 120 h. The data showed that 48 h after dosing the organism with furadan, 60% mortality was recorded. Above 200 mg/ml deters snails from feeding and becomes sub-lethal. @JASEM

Carbamate pesticides may have either insecticidal (N-methyl - carbamates: fenobucarb, propoxur, promecarbs, benediocarbs, carbofuran, methiocarb, carbyl and 3, 4, 5 - trimetocarb) or herbicidal properties (N-arylcarbamates: carbendazim, propham, swep, chloropropham and phenmedipham), Faber and Scholer (1993).

Terrestrial gastropods poisoned by carbamates become immobilized as the muscle tonus is lost (Godan, 1983). Barley et al (1989) claimed that methiocarb shorten meal by interfering with the neural control of feeding. Carbamate molluscicides are with the neural control of feeding. Carbamate molluscicides are known to act as nerve toxins by inhibition of cholinesterase (Wilkinson, 1976; Young and Wilkins, 1989). Cytological effects induced by carbamates have been recorded (Triebskorn, 1989; Triebskorn and Kunast, 1990; Triebskorn *et al* 1996). The escape of snails from breeding enclosures where they are reared for human consumption and their potential impact on agricultural crops, which will affect farm incomes in areas concerned have been recorded in Nigeria. Damage is characteristically localized (Egonmwan, 1991; Imevbore and Ajayi, 1993). The importance of terrestrial gastropods as crop pests has greatly increased, and in the process demands for effective controls has outstripped the development of chemical control measures. Most of our knowledge of carbamate is restricted either to vertebrates or to insects and there is little information on terrestrial gastropods (Henderson and Triebskorn, 2002). A literature survey indicated no previous study of carbamate effect on African giant land snails. The purpose of this study was to investigate the toxicity of carbamate pesticide furadan, on *Limicolaria aurora.*

MATERIALS AND METHODS

Live adult L. aurora 12±0.05g were obtained locally from a snail breeder in Uyo, Nigeria, where snail consumption is not a taboo (Ebenso, 2002 a & b). This is within the wetland ecosystem of guinea forest of southeastern, Nigeria, with 1500 mm rainfall and 90% relative humidity. Snails were quarantined for 3 days as described by Thompson and Cheney (1996) before commencement of the study. The experiments were carried out in the laboratory in plastic boxes 12 x 12 x 60cm^3 with lids perforated for ventilation, under constant conditions with a temperature cycle of 27^0 for 12 h (day) and 20^0C for 12 h (night), with a photo period of 12L : 12D imitating temperature and light conditions within the ecosystem. Moistened loam soil (to maintain humidity) up to 3cm deep, oven dried at 60^0C for 48 h, was used as substrate. Powdered oyster shell spread on the soil provided snails with calcium (Ebenso, 2003 a & b). Five *L. aurora* in plastic boxes were randomly allotted to each of six treatments. A single oral application of furadan was presented to snails at concentrations of 50 , 100 , 200 , 300 , 400 and 500 mg/ml (ppm). Following the methods of Ebenso and Okafor (2002) chopped green pawpaw (*Carica papaya*) fruits, rolled in solution of furadan was used as bait (which was intended to act as both an attractant and feeding stimulant). Untreated *C. papaya* was offered for ingestion at 2% of the snail's body weight according to Ejidike (2001) for five days. Snails were fed at 1700 h and watered at 1600 h each day. Physical observations of behavioural and macroscopic changes using defined criterial of head retraction into shell, swelling, excessive mucus secretion, mortality (lack of response to mechanical stimulus), actively feeding and crawling (normal) cessation of feeding and cessation of crawling as described by Ebenso

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(2004). These changes were observed at 20 00h to 22 00h.

RESULTS AND DISCUSSION

The responses of *L. aurora* snails exposed to different concentrations of furadan are recorded in Table 1. At 48 h after a single oral application of furadan, most snails ceased feeding. This observation agrees with Bailey (2002), that the carbamates are also feeding inhibitors. Ingesting molluscicides has shown to cause immediate inhibition of feeding in slug *Deroceras reticulatum* (Wedgwood and Bailey, 1988) and in various helicid species (Coupland, 1996). Neurotoxic effects may result in alteration of feeding behaviour (Wright and Williams 1980; Wedgwood and Bailey 1986; Bourne *et al* 1988; Bailey 1989; Bailey *et al* 1989), which is of particular significance when attempting to deliver the chemical in baits (Henderson and Triebskorn 2002). At concentration of 50 mg/ml within 24 h one snail extruded excess mucus. Increased mucus production followed by increased mucus secretion is one of the first reactions of gastropods to many stressors, including mechanical stimuli or chemical irritation caused by molluscicidal chemical (Godan 1983; Triebskorn and Ebert 1989; Triebskorn et al 1998).

TABLE 1: Response* of *Limicolaria aurora*, after single oral application of furadan

	0-24 h		48 h		72 h		96 h		120 h	
Concentration (mg/ml)	n	Response	n	Response	n	Response	n	Response	n	Response
50	1 1	excess mucus died	1	ceased crawling	1	ceased feeding	2	ceased feeding	1	Swollen
100	1	died	1 1	died ceased crawling	1	ceased crawling	1	ceased crawling	2	ceased feeding
200	1	died	2 1	died ceased feeding	2	head retracted	1	ceased feeding	2	ceased feeding
300	1	ceased crawling	2	ceased crawling	2	ceased crawling	1	ceased crawling	2	ceased crawling
400	1	swollen	1 3	ceased feeding ceased crawling	1	head retracted	1	ceased crawling	1	swollen
500	1	swollen	1 3	ceased feeding ceased crawling	1	head retracted	1	ceased crawling	1	ceased crawling

**number of snails that fed and moved normally are not indicated in the table*
n = number of snails

One effect of the extruded mucus is to form a protective barrier preventing direct contact between the toxin and the epithelia of the skin or disgestive tract, so reducing the toxicity of the chemicals (Port and port 1986; Triebskorn and Ebert 1989). Within the first 24 h, snails in this study fed higher concentrations of 400 and 500 mg/ml began to swell around the anterior region. This agrees with Triebshorn (1989) that by 30 min after ingestion of carbamate, the *D. reticulatum* show violent muscle convulsion, the anterior body began to swell while the posterior flattens. Most snails in this study that ingested contaminated baits ceased feeding and ceased crawling. Working with methiocarbs, Coupland (1996) emphasized the need to avoid a concentration of active ingredient that was too low and thus sub-lethal, or too high, deterring the gastropods from eating it and thus, again, sub-lethal. According to Triebskorn *et al* (1996), in the environment, chronic exposure conditions could have a significant effect on an entire ecosystem, since in order to compensate for a condition of permanent chemical stress, many organisms may have to keep repair and defence mechanism continually in activities, and invest a large amount of energy into limiting cell damage, with little or no energy left for other activities.

Conclusion: Furadan is effective against *L. aurora*, however at concentration of above 200 mg/ml, it deters snails from eating and is thus sub-lethal.

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