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Laboratory Assessment of Three Bait Molluscicides Against the White Garden Snail, *Theba pisana* Müller (Pulmonata: Parmacillidae)

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ABSTRACT

A Laboratory test method, simulating natural conditions, was developed to assess the efficiency of three bait molluscicides against the white garden snail, *Theba pisana* Müller and to find out the ideal concentration which would produce a sublethal effect on this animal pest. Metaldehyde compounds were not equal in their effectiveness and more effective than mercaptodimethur. The daily average of percentage kill for metaldehyde (Metaldene®), metaldehyde (Lumacrusk$_5$®) and mercaptodimethur ranged from 73.90–83.23, 74.65–81.19 and 57.75–63.76, respectively. Higher mortalities in snails have resulted when these bait molluscicides were used at relatively lower concentrations (7.4 kg a.i./ha.) than when applied at the recommended ones (14.8 kg a.i./ha.).

INTRODUCTION

During the last few years in Libya, the white garden snail, *Theba pisana* Müller has become a potential pest of a wide variety of field and horticultural crops. To control this pest various bait molluscicides can be used.

The main purpose of this study is to assess the efficiency of three bait molluscicides, which are commonly recommended for the control of the white garden snail, by a laboratory testing method, simulating natural conditions, and to search for the ideal concentration which would produce a sublethal dose on this animal pest.

MATERIALS AND METHODS

The species used in the tests was the white garden snail, *T. pisana*, which occurs mainly in the coastal or semicoastal areas of Libya, where high to moderate humid conditions exist. This kind of land gastropod is the most common and probably the most destructive species to a wide variety of plants, including vegetables, forage crops, tree fruits, shrubs, flowers, ground cover and lawn grasses. Since the susceptibility of land gastropods to molluscicides depends on their weight rather than on their age (3), enough test animals were collected from the field, and samples of *T. pisana* of similar weight (0.93 ∓ 0.1 g/snail) were used throughout the experiments.

Snails are very susceptible to desiccation and tend to lose water at relative humidities less than 100% (4). The relative humidity may also affect the toxicity of some poisons in the field (2,6) and drying conditions enhance the effect of metaldehyde (1,5).

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A laboratory technique which overcomes these problems and simulates natural conditions has been developed for testing bait molluscicides. Plastic boxes (10 × 12.5 × 17.5 cm), furnished with 305 g wet peat moss (10 cm high), were used and the peat moss was regularly irrigated. Moisture was enough to keep the snails active and prevent adverse effects of moist or drying conditions on both snails and bait molluscicides. Twenty-five snails were placed in each box. After treatment with each particular bait molluscicide, the boxes were covered with polythene sheets having holes pierced with a pin about one cm apart. The cover kept the air saturated with moisture and prevented the snails from escape.

The three bait molluscicides tested were mercaptodimethur (a product of snail pellets known commercially as Mesurol, manufactured by Bayer AG, Leverkusen, West Germany, containing 4% of 3,5-dimethyl-4-(methylthio) phenol methyl carbamate), metaldehyde (a product of snail granules known commercially as Metaldene, manufactured by Visplant, Bologna, Italy, containing 5% of metacetaldehyde) and another metaldehyde (a product of snail granules known commercially as Lumacrusk$_5$, manufactured by Sariaf, Fienza, Italy, containing 5% of metacetaldehyde). Each particular molluscicide was tested for efficiency against the white garden snail at the rates of 7.4, 14.8 and 29.6 kg a.i./ha. (i.e. doses equivalent to half the recommended concentration, the recommended concentration and twice as much as the recommended concentration, respectively). Untreated snails were also included in the tests. There were three boxes for each concentration representing three replicates.

Animals failing to respond to a tactile stimulus by probing with a dissecting needle were considered dead. Deaths were counted every 24 hours and dead snails were removed. Since all of the molluscicides tested do not cause rapid death of the snails, trials extended over a 5-day period. The average percentage of mortality at each particular day was calculated by dividing the number of snails which died from the start of the experiment until that day over the total number of snails used for each test. Also, the efficiency of the different molluscicides at different concentrations was compared.

RESULTS AND DISCUSSION

The comparative toxicities of the three bait molluscicides tested against the white garden snail are shown in Table 1. All of the tested molluscicides gave satisfactory to good control results, since the daily average percentage of mortality caused by each

Table 1 The comparative effectiveness of three bait molluscicides against the white garden snail.

Molluscicide	Bait conc. in kg a.i./ha	Mean percentage of mortality after indicated days								Average percentage mortality per day[1]
		1	2	3	4	5	6	7	8	
Mercaptodimethur (Mesurol®)	7.4	12.43	21.80	51.80	70.40	91.76	98.39	100.00		63.76
	14.8	26.89	31.32	55.52	75.00	100.00				57.75
	29.6	12.43	18.08	52.08	74.64	98.48	100.00			59.29
Metaldehyde (Metaldene®)	7.4	39.40	76.20	81.96	88.88	91.92	91.96	95.44	100.00	83.23
	14.8	38.40	42.00	62.20	75.40	84.00	94.00	96.96	98.28	73.90
	29.6	38.40	62.2	79.16	90.20	91.88	94.12	97.08	100.00	81.83
Metaldehyde (Lumacrusk$_5$®)	7.4	44.45	60.76	72.20	80.56	80.96	86.24	94.64	94.64	76.81
	14.8	43.43	59.60	73.56	79.16	84.52	85.64	85.64	85.64	74.65
	29.9	43.43	66.28	79.20	86.40	91.88	94.12	94.12	94.12	81.19

[1]Average based on 75 snails involved in each test (3 replications of 25 snails/testing box).

molluscicide at the three different concentrations exceeded 55%. However, both metaldehyde compounds were subequal in their toxicities and more effective than mercaptodimethur. The average percentage of kill for metaldehyde (Metaldene®), metaldehyde (Lumacrusk$_5$®) and mercaptodimethure ranged from 73.90–83.23, 74.65–81.19 and 57.75–63.76, respectively.

Bait molluscicides containing metaldehyde as the active ingredient produced marked paralysis in test animals, whereas mercaptodimethur (a carbamate molluscicide) produced loss of muscle tone without inducing excessive mucous secretions. Death usually took place within a week.

Results shown in Table 1 indicate the concentration which would produce a sublethal dose and that which would be repellent. Higher mortalities have resulted from all molluscicides tested when applied at lower concentrations (7.4 kg a.i./ha.) than at medium concentrations (14.8 kg a.i./ha.). However, high mortalities caused at higher concentrations (29.6 kg a.i./ha.) is hard to explain and may be due to the lethal toxicities of these high doses. These results are in full agreement with those obtained by Crowell (2), who found that mercaptodimethur and metaldehyde were more effective and caused higher mortalities in the snail *Helix aspersa* Müller when applied at 2% than at 4%. More studies needed to be made on field control of the white garden snail to ascertain the effectiveness of these bait molluscicides at low concentrations.

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تقييم ثلاثة مبيدات قواقع معمليا لمكافحة قوقع الحديقة الأبيض

نعيم شرف

مستخلص

أجريت تجربة معملية لمعرفة مدى كفاءة ثلاثة مبيدات قواقع لمكافحة قوقع الحديقة الأبيض ولتحديد التركيز الملائم منها لهذا الغرض . وقد أدت النتائج الى أن مركبات الميتالديهايد كانت متساوية فى مدى كفاءتها لمكافحة هذا القوقع ، كما أنها كانت أكثر فعالية من المبيد الكرباماتى ميركابتود ايميثور ، حيث تراوحت نسب الموت اليومية ما بين ٧٣ر٩ – ٨٣ر٢٣ ، ٧٤ر٦٥ – ٨١ر١٩ و ٥٧ر٧٥ – ٦٣ر٦٧ لكل من المبيدات متيالد يهايد (ميتالدينا) ، ميتالديهايد (لوماكروسك) وميركابتود ايميثور ، على التوالى .

كما دلت النتائج على أن استعمال المبيدات الثلاثة بالتركيزات المنخفضة (٧ر٤ كغم مادة فعالة / هكتار) قد أعطى نسب موت أعلى مما لو تم استعمالها بالنسب المنصوح بها (١٤ر٨ كغم مادة فعالة / هكتار) .