A survey of a bioinsecticide for controlling insect pests under laboratory conditions

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ABSTRACT: The purpose of this study was to evaluate the efficiency of the mycoinsecticide Naturalis® (BioIntrachem, Italy) against field-collected adults of the grey maize weevil, *Tanymecus dilaticollis*, the cereal leaf beetle, *Oulema melanopus,* and the multicolored Asian lady beetle, *Harmonia axyridis*. Naturalis® was tested in six concentrations (2.3×10^2 - 2.3×10^7 conidia/ml) in glass Petri dishes. The median lethal concentration (LC_{50}) after ten days of fungal treatment ranged from 2.0×10^3 conidia/ml to 2.1×10^6 conidia/ml for the different species. Naturalis® was most efficient against *T. dilaticollis* adults causing significantly higher mortality at all concentrations tested compared to the control treatment (water). The possibility of using mycoinsecticide to control coleopteran pests in Bulgaria is discussed.

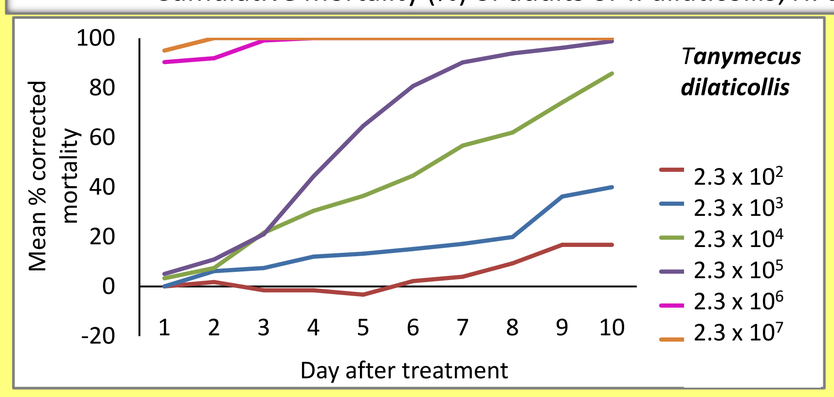
A bioassay method for evaluating Naturalis® (*Beauveria bassiana* strain ATCC 74040) effectiveness

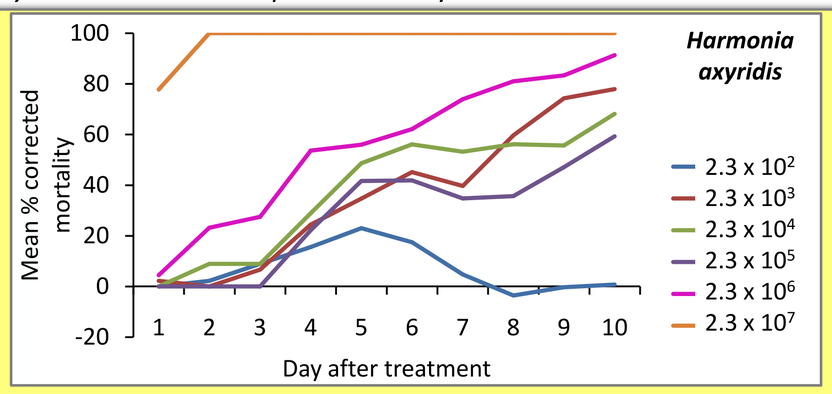
- Adults of *T. dilaticollis*, *Oulema melanopus* and *Harmonia axyridis* were collected from a maize field belonging to the Maize Research Institute, Knezha, Bulgaria (43°28'48.85"N; 24°3'22.03"E)
- Naturalis® was tested at six concentrations: 2.3×10^2 - 2.3×10^7 conidia/ml.
- 1 ml from each concentration was applied separately on the white filter paper disc covering the bottom of a Petri dish.
- Adults in control variants were treated with 1 ml of distilled water.
- The experiments were replicated ⇨ 3 times for each species.
- Insect mortality was recorded at 24-h intervals during 10 days after treatment.
- The mortality data were corrected using Schneider-Orelli's formula, where corrected mortality (%) = (a – b/100 – b) × 100 (where a = percentage mortality data from the treated group and b = percentage mortality from the control group)
- Probit analysis was used to estimate the median lethal concentration (LC_{50}) (time necessary to kill 50% of the tested indviduals)and lethal concentration 90 (LC_{90}),the lethal time LT_{50} and the 95% confidence intervals of these features.

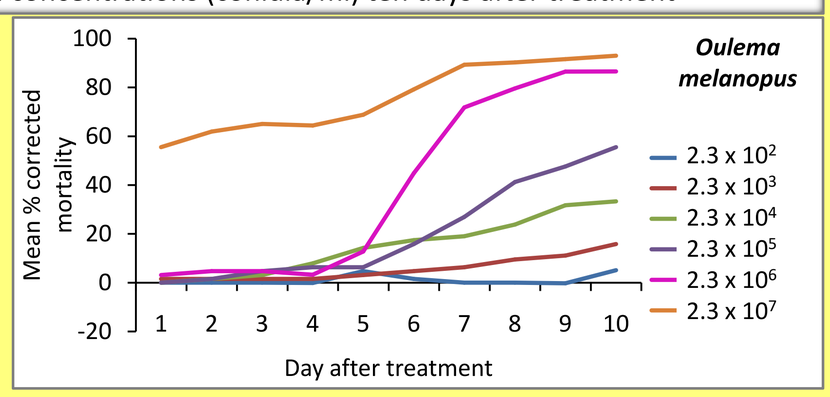
LC_{50} and LC_{90} of different concentrations of Naturalis® against the adults of the three coleopteran species under laboratory conditions.

Species	LC_{50} conidia/ ml	Confidence intervals		LC_{90} conidia/ ml	Confidence intervals	
		Lower bound	Upper bound		Lower bound	Upper bound
T. dilaticollis	2.0×10^3	8.7×10^2	5.8×10^3	5.2×10^4	1.6×10^4	5.8×10^5
H. axyridis	1.4×10^4	1.6×10^3	6.5×10^5	5.0×10^5	2.7×10^4	1.0×10^8
O. melanopus	2.2×10^5	2.8×10^4	5.2×10^6	1.7×10^6	8.9×10^3	4.9×10^5

Cumulative mortality (%) of adults of *T. dilaticollis*, *H. axyridis* and *O. melanopus* caused by Naturalis® at different conidial concentrations (conidia/ml) ten days after treatment







Mycosis of *O. melanopus* aduls caused by the fungus *Beauveria bassiana*, 2.3×10^5 - 2.3×10^7 conidia/ml.

Median lethal time (LT_{50}) in days at the highest concentrations of Naturalis® for the adults of *T. dilaticollis*, *H. axyridis* and *O. melanopus* under laboratory conditions.

Concentration conidia/ml	LT_{50} (lower and upper confidence intervals), days		
	Tanymecus dilaticollis	*Harmonia axyridis*	*Oulema melanopus*
2.3×10^4	5.75 (5.07 - 6.70)	9.51 (5.16 - 36.06)	74.13 (35.40 - 229.09)
2.3×10^5	3.53 (3.16 - 4.04)	6.62 (5.32 - 8.79)	15.18 (10.23 - 29.51)
2.3×10^6	0.25 (0.19 - 0.30)	3.85 (3.27 - 4.75)	6.17 (4.47 - 10.07)
2.3×10^7	0.01 (0.001 - 0.02)	0.09 (0.03 - 0.16)	1.30 (1.24 - 1.39)

- To our knowledge these are the first results on the susceptibility of the adults of *T. dilaticollis*, *H. axyridis* and *O. melanopus* to Naturalis® (BioIntrachem, Italy).
- lt was established that the adults of the grey maize weevil were most sensitive test-insects to the mycoinsecticide under laboratory conditions.
- For *T. dilaticollis*, the mycoinsecticide caused 100 % corrected mortality of exposed weevils when tested at concentrations over 2.3×10^5 conidia/ml. There was no significant difference in mortality between treatments with concentrations above 2.3×10^4 conidia/ml.
- For *H. axyridis*, the highest concentrations tested evoked 91-100 % mortality.
- For *O. melanopus*, the effectiveness of Naturalis® was relatively low – the highest mortality was in the range of 87-93 % for the concentations of 2.3×10^6 – 2.3×10^7 conidia/ml . received at the end of the bioassay.
- Results showed potential of this mycoinsecticide for its use for microbial control of *T. dilaticollis* adults.

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