

# Susceptibility of *Aphelinus mali* (Haldeman) to different products used in apple orchards in Trentino (Northern Italy)

Sara Zanoni<sup>1</sup>, Cristina Tomasi<sup>1</sup>, Emanuela Coller<sup>1</sup>, Serena Giorgia Chiesa<sup>1</sup>,  
<sup>1</sup> Technology Transfer Centre, Fondazione Edmund Mach, via E. Mach 1, 38098 San Michele all'Adige (Italy)

## INTRODUCTION

*Aphelinus mali* (Haldeman) is the most important biological control agent of woolly apple aphid (WAA) *Eriosoma lanigerum* (Hausmann), a serious pest of apple. The first adults of *A. mali* emerge only when the WAA has already gone through one generation, and its innate capacity to increase is considerably lower than its host. In fact, the rate of parasitism reaches high levels (80-90%) in late summer. Furthermore, some plant protection products commonly used in apple orchards could compromise the effectiveness of *A. mali* on biological control. In Trentino region (Italy), the first flight peak of *A. mali* usually occurs in the post-flowering period. Afterwards, an exponential flight increases and the consequent culmination of the parasitisation ratio in summer is observed, generally at the end of July. To understand the possible effects of different active substances on *A. mali* activity, we tested several plant protection products commonly used in integrated and organic pest management programs on parasitized mummies.

## MATERIALS AND METHODS

### Parasitized mummies treatment

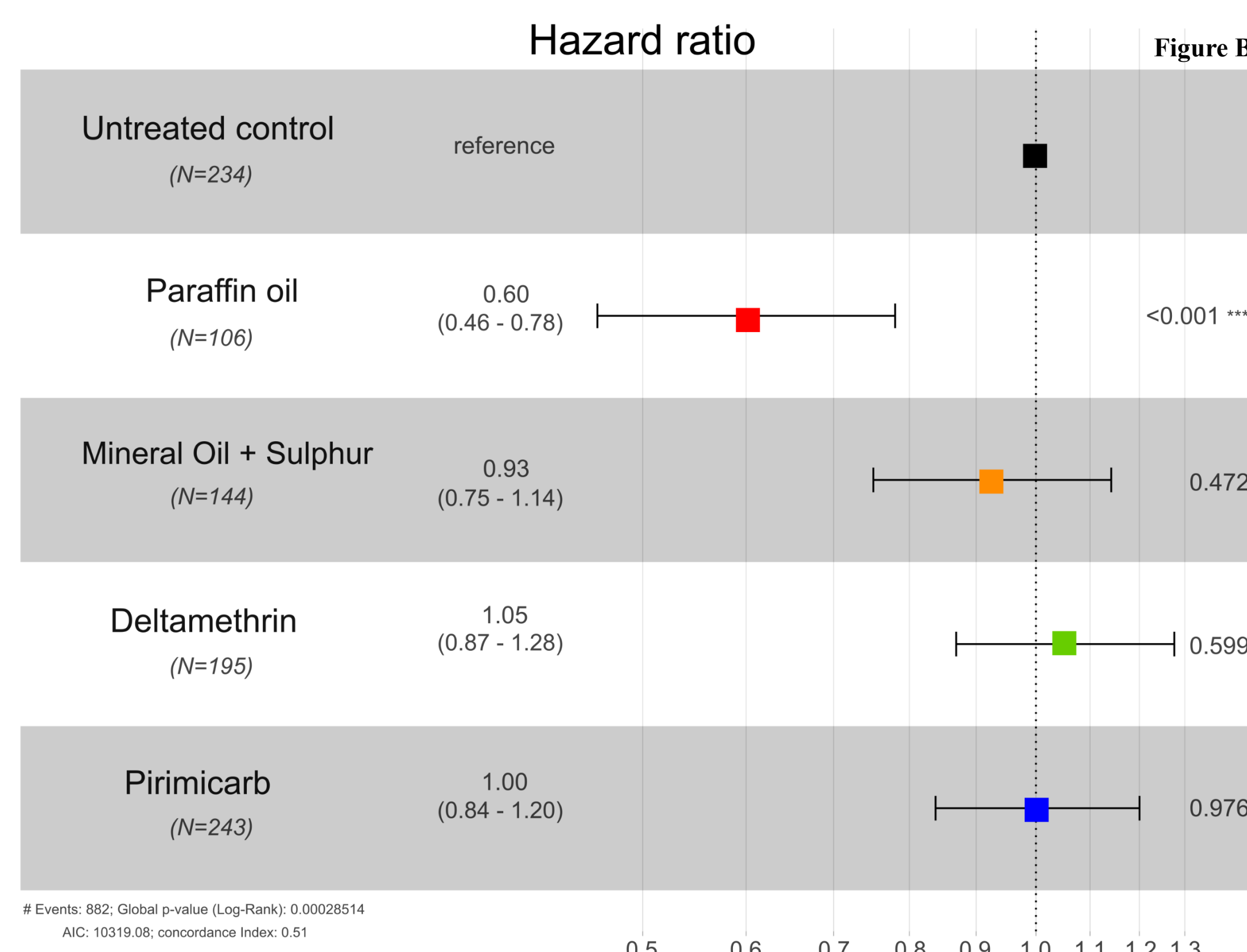
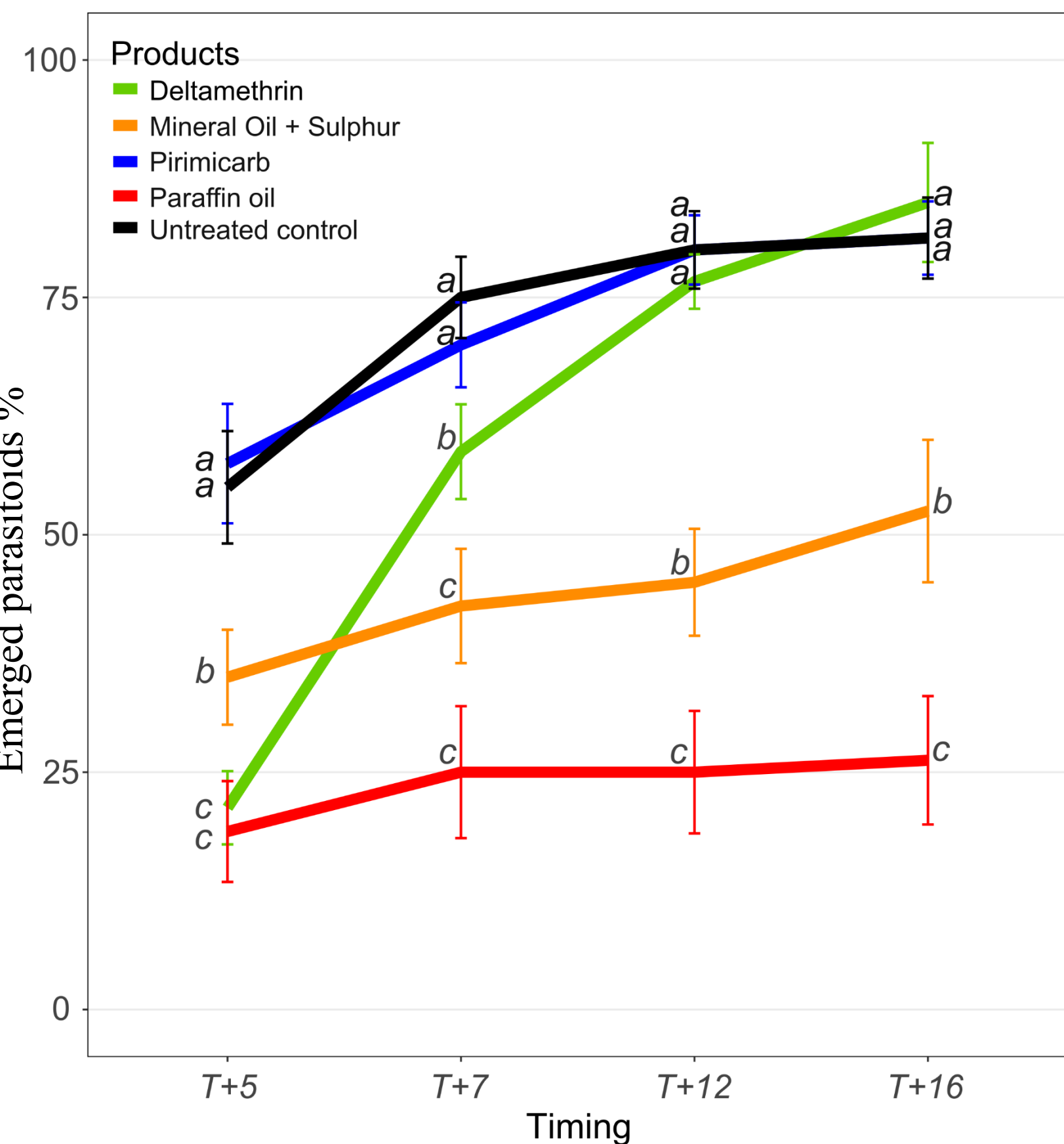
### Direct treatment in Potter's Tower

ACTIVE INGREDIENT	CONC. INGREDIENT	FORM.	FIELD RATE (g or mL/hL)
Paraffin oil	400 g/L	EW	5 L
Mineral oil	800g/L	EW	2500 g
Sulphur	825 g/L	SC	500 g
Pirimicarb	500 g/L	WDG	50 g
Delthametrin	25 g/L	EW	50 mL

### Field treatment

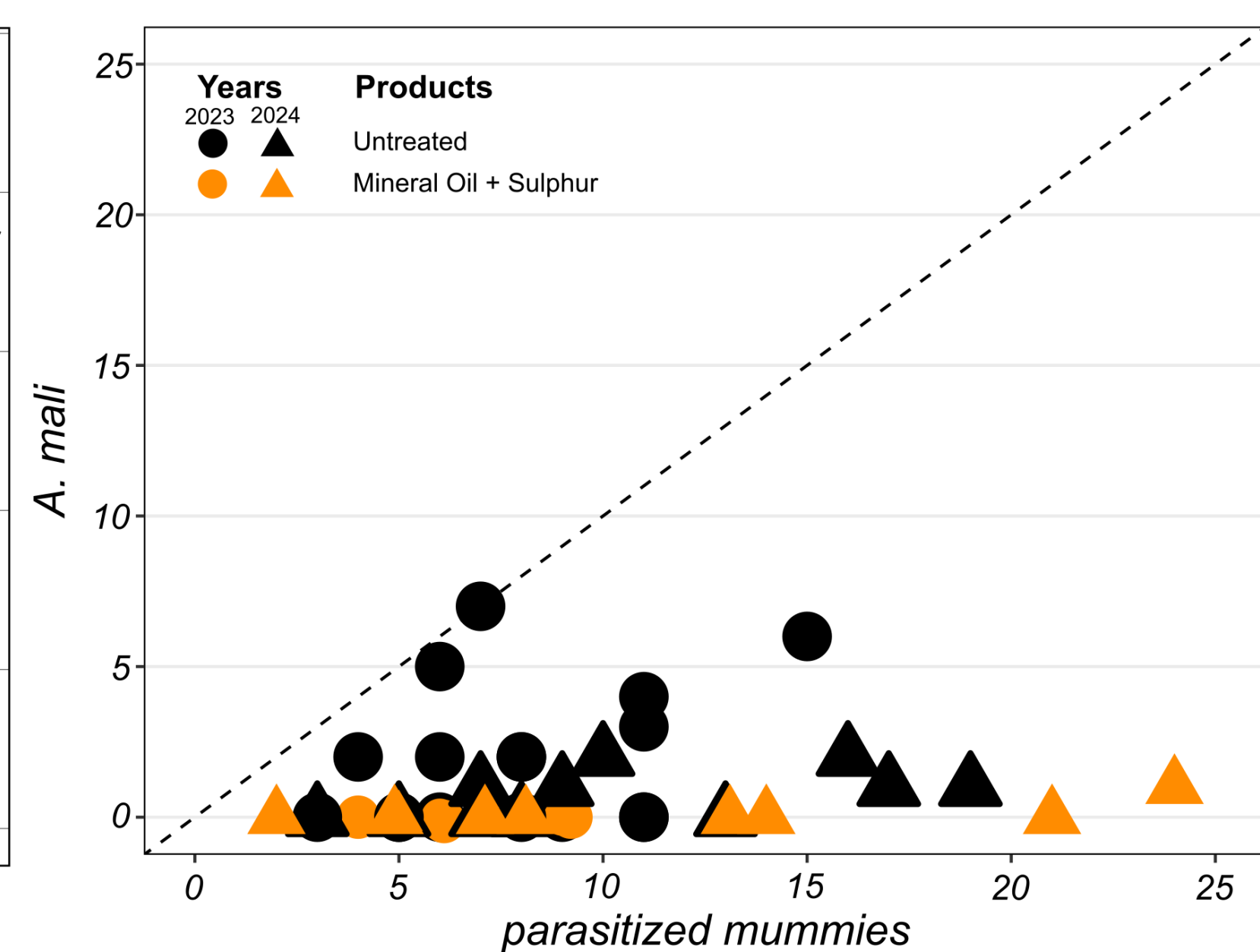
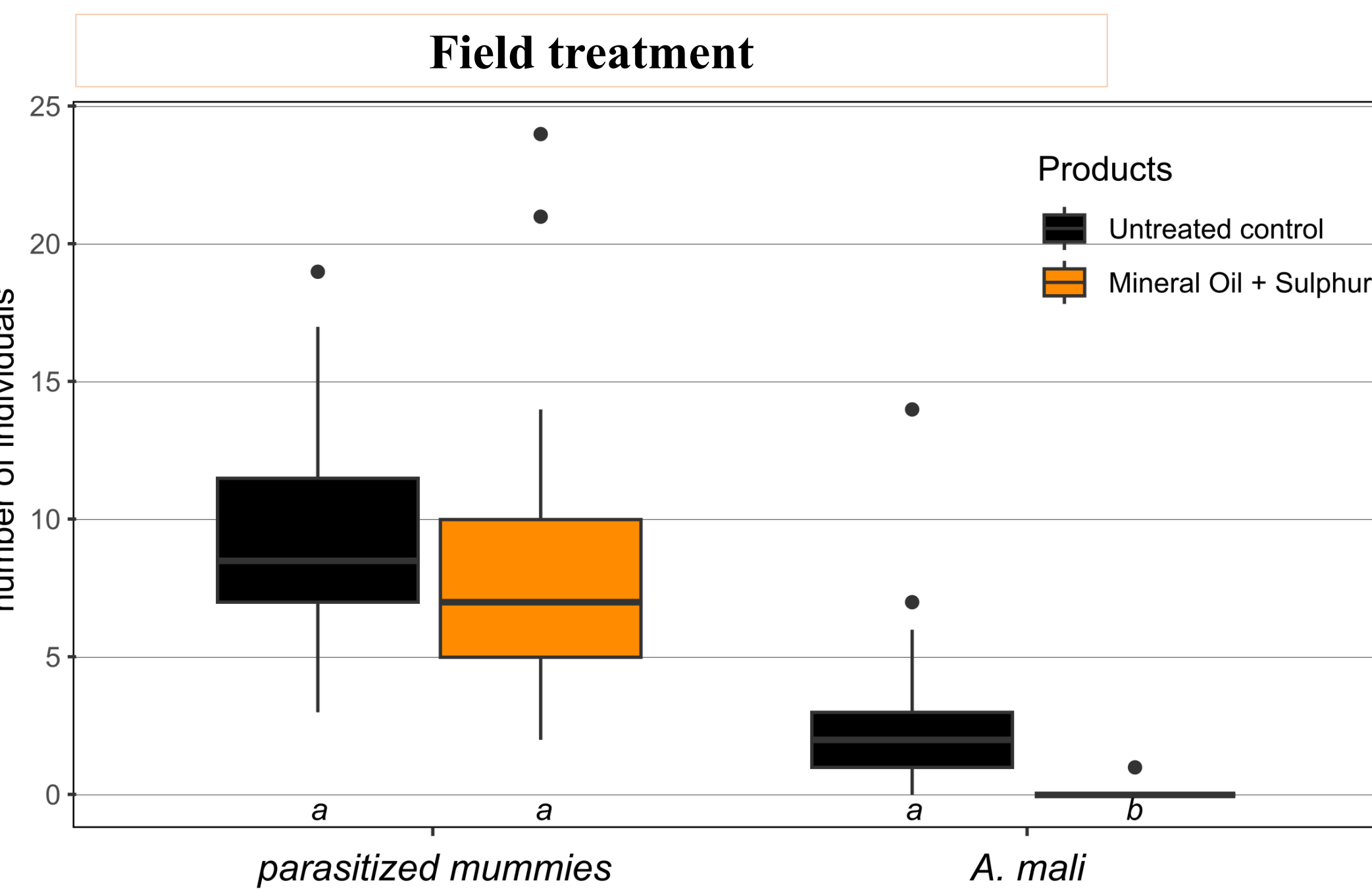
PRODUCT	ACTIVE INGREDIENT	FIELD RATE (g/hL)
Vernoil	Mineral oil	2500 g
Thiopron®	Sulphur	500 g

## RESULTS



**Figure A.** The percentage of emerged parasitoid from mummies (mean ± standard error) in different timing. The colors represent the different treatments. Different italic letters mean significant statistical differences in the percentage of emerged parasitoid among timing in the same treatment (the Wilcoxon test - with the Benjamini-Yekutieli correction).

**Figure B.** The Hazard Ratio test (HR) of individuals flickers in the different treatments compared to those in the control group (untreated control). The number of emerged parasitoids is given in parentheses under the name of the treatment. The figure shows the mean HR test value, with the maximum and minimum values in parentheses. On the right, there is the p-value for the comparison with the untreated group (significant comparison p value ≤ 0.05). The HR values should be interpreted as follows: HR = 1 no significant difference compared to the reference HR < 1 the treatment increases the hazard ratio of the event (dead). Minor number of *A. mali* flickers compared to the control. HR > 1 the treatment decreases the hazard ratio of the event (dead). Major number of *A. mali* flickers compared to the control.



	Untreated control	Mineral Oil+Sulphur
Nr of parasitized mummies	9,8±0,95	8,68±1,34
Nr of <i>A. mali</i>	2,62±0,72 a	0,05±0,05 b
Ratio ( <i>A. mali</i> /parasitized mummies)	0,24±0,06 a	0,00±0,00 b

	Untreated control	Mineral Oil+Sulphur
2023	38%	0%
2024	27%	1%

% of emerged parasitoids from mummies in 2023 and 2024

## CONCLUSIONS

The results of direct effect trial in Potter's Tower showed that the Paraffin oil caused a lower *A. mali* flicker rate than the other products. The HR test was used to compare subjects exposed to different products with subjects in the untreated group. The HR < 1 was of Mineral Oil + Sulphur and the Paraffin oil, but only the paraffin oil caused a significantly lower ejection rate than the control. The preliminary field results showed a lower percentage of emerged parasitoid from mummies from the plot subjected to the winter treatment. Further studies are necessary to understand if insecticides and fungicides can influence the first peak of *A. mali* flight in the post-flowering period and the consequent parasitisation ratio in summer.