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EFFECTS OF ALTERNATIVE PRODUCTS ON COFFEE LEAF MINER OVIPOSITION

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Abstract: This study, aimed to evaluate the influence of alternative products on the oviposition of *Leucoptera coffeella*. The tests were performed in a lab on seedlings of coffee IAPAR-59 which were eight months of age and had at least four pairs of leaves. The treatments were: control without application, distilled water, propolis extract, lime sulphur, silicate clay, neem oil, pyroligneous extract with pepper and garlic, kaolin, and kaolin + neem oil. The treatments were sprayed with a pressure of 2 bar. We evaluated the effect of pesticides on *L. coffeella* oviposition on treated leaves. The evaluation results of the test oviposition leaf miner no choice were subjected to analysis of variance, using the non-parametric Kruskal-Wallis test followed by Dunn's test of multiple comparisons at 0.5 %. The propolis extract, neem oil, neem oil + kaolin, and pyroligneous extract with pepper and garlic repelled oviposition of *L. coffeella*. Thus, although still to be evaluated under field conditions, it is possible that the application of these products can reduce coffee plant colonization by *L. coffeella*, thus avoiding high pest populations.

Introduction: The coffee leaf miner *Leucoptera coffeella* (Guérin-Mèneville & Perrottet, 1842) (Lepidoptera: Lyonetiidae), is one of the most important pests in coffee cultivation, causing serious damage and productivity reduction, owing to the premature leaf fall it causes.

Chemical control has been continually used, which induces resistance and leads to less effective control over the years. Alternative control has been sought, and some of them have been implemented in agriculture settings.

An alternative control to this pest could be the use of a phytoprotecting mixture and insecticidal plant extract. Treatment with sulfocalcic mixtures, silicate stone dust, and pyroligneous acid have demonstrated adverse effects on insects, such as repelling, oviposition, feeding inhibition, and death. Neem extract (azadirachtin) also showed similar results (AZEVEDO

et al., 2005). The effect of these products on the coffee leaf miner requires further research. Thus, the objective of this study was to evaluate the effect of phytoprotecting mixtures and plant extracts on *L. coffeella* oviposition.

Material and methods:

The coffee leaf miner *Leucoptera coffeella* (Guérin-Mèneville & Perrottet, 1842) (Lepidoptera: Lyonetiidae), is one of the most important pests in coffee cultivation, causing serious damage and productivity reduction, owing to the premature leaf fall it causes.

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MATERIAL AND METHODS

The experiments were conducted during the months of March and June of 2010, at the entomology laboratory of the Agricultural Research Institute of Paraná (IAPAR) in Londrina, State of Paraná, Brazil. The tests were conducted in an acclimatised chamber, with temperature, relative humidity, and photophase of 25 ± 1 °C, 70 ± 10 %, and 14 h, respectively. The products and applied doses are presented in Table 1. The controls were treated with distilled water and no treatment at all.

TABLE 1– *Products and their doses sprayed on the cultivar IAPAR-59 seedlings to control Leucoptera coffeella. Londrina, State of Paraná, 2010.*

Treatments	Dose in 100 ml of water
Propolisextract	1 ml
Pyroligneous extractwith pepper and garlic	2 ml
Silicate clay	2 g
Kaolin	5 g
Neemoil	1 ml
Sulfocalcicmixture	2 ml
Kaolin + Neemoil	5 g + 1 ml
Control (distilledwater)	100 ml
Control (no aplication)	-

Tubes (120 cm^3 volume) containing cultivar IAPAR 59 seedlings, that were eight months of age and had more than four pairs of fully expanded leaves, received a spray application using the YAMAR® SW 776 professional sprayer, at 2 bar pressure, depositing thin droplets on the adaxial leaf surface. The seedlings were kept in cages (80 × 60 × 60 cm) composed of *voile* fabric inside the acclimatised chamber.

The seedlings received three applications in seven-day intervals to stimulate resistance induction or create a physical barrier on the leaves. Treatments were:

- ethanolic propolis extract (15 %), using 300 g of propolis and 2 L of alcohol 92.8 %, filtered 48 h after preparation.
- Pyroligneous acid used pepper and garlic with 300 g of *Capsicum frutescens* and 100 g of *Allium sativum* within 2 L of pyroligneous acid.
- commercial rock dust Rocksil® with composition: Al_2O3, SiO_2, S, CaO, TiO_2, MgO, Fe_2O_3, and P_2O_5, and its proportions were 20.56 %, 17.43 %, 9.82 %, 1.31 %, 0.34 %, 0.18 %, 0.16 %, and 0.10 %, respectively.
- kaolin ($Al_2Si_2O_5(OH)_4$), commercial name Protesyl®, with SiO_2 (46.6 %), Al_2O_3 (39.5 %), and H_2O (13.9 %).
- sulfocalcic mixture with S_2, CaO, H_2O and azadirachtin at 10 $g^{-1}L$.

The seedlings treated with distilled water, neem oil, and kaolin + neem oil received only one application. The interval between the applications and the plants exposed to the leaf miners oviposition was four h.

In each cage, 200 *L. coffeella* adults that were three days post-emergence, were released for 24 h to allow oviposition. The number of eggs was counted using a stereoscopic microscope. A non-parametric test was applied, Kruskal-Wallis test, followed by Dunn's test of multiple comparisons at 5 % significance.

Results: The coffee seedlings sprayed with propolis extract, pyroligneous extract with pepper and garlic, neem oil, and kaolin + neem oil, resulted in 1.1, 2.7, 3.6, and 2.7 eggs per plant, respectively. Compared to the control seedlings with and without water, which had 38.0 and 35.2 eggs per plant, respectively. These products resulted in a decrease of more than 89 % in *L. coffeella* egg number. However, about 60 % of the plants treated with kaolin and sulfocalcic mixture resulted in 12.9 eggs per plant, differing from the water sprayed plants (Table 2).

The cages containing seedlings treated with propolis extract had a repellent effect on the moths, as they remained on the walls with little to no movement. The other treatments had different results, as the moths flew around the leaves and rested on the abaxial leaf face.

Table 2 –Number (mean ± standard error) of *L. coffeella* eggs per coffee seedling treated before oviposition.IAPAR, Londrina, State of Paraná, 2010.

Treatments	Eggs/seedling		
Propolis extract	1.1	± 0.6	d [1]
Pyrolignousacid with pepper and garlic	2.7	± 0.9	cd
Silicate clay	21.9	± 3.5	ab
Kaolin	12.9	± 3.0	bc
Neem oil	3.6	± 1.1	cd
Sulfocalcicmixture	12.9	± 3.1	bc
Kaolin + neem oil	2.7	± 0.9	cd
Control (distilled water)	38.0	± 2.5	a
Control (no aplication)	35.2	± 5.8	ab
p-value	< 0,01		

Means followed by the same letter in the columns do not differ, tested by Kruskal-Wallis followed by Dunn at 5% significance.

Discussion: The reduction in oviposition observed in the propolis extract treatment could be a result of its composition of alcohols, phenols, and esters, and the mechanical effect of the propolis' sticky wax and resin, which probably deterred or repelled *L. coffeella* oviposition. The moth's diminished movement in the cage treated with the propolis could have contributed to the lower oviposition. The anaesthetic effect of the propolis was also observed by GAREDEW *et al.,* (2002), who verified a reduction in the movement and feeding of larvae and adults of *Tenebriomolitor* L. (Coleoptera: Tenebrionidae). DAMIANI *et al.,* (2010) also observed an anaesthetic and lethal effect on the *Varroa destructor* mite (Acari: Varroidae).

Leaves treated with the pyroligneous extract with pepper and garlic reduced the oviposition of the coffee leaf miner. AZEVEDO *et al*., (2005) observed that a single dose of pyroligneous extract had a repellent effect on *Bemisia tabaci* biotype B (Hemiptera: Aleyrodidae) in melon plants. The neem oil treatment affected the oviposition behaviour of leaf miners, possibly owing to the capacity of the Lepidoptera to detect deleterious allelochemicals, such as azadirachtin, through tarsal chemical receptors, used to decide on oviposition sites, shown as leaf miner adults traverse the leaf surface before egg laying. The neem oil at different concentrations reduced the oviposition of many Lepidoptera species such as *Spodoptera littoralis* (Boisduval) (Lepidoptera: Noctuidae) (MARTINEZ & VAN EMDEN, 2001).

The mixture of kaolin + neem oil reduced the *L. coffeella* oviposition, primarily due to the neem oil effect, since kaolin alone did not differ from the control.

Leaves treated with neem oil, kaolin + neem oil, propolis extract, and pyroligneous acid with pepper and garlic reduced *L. coffeella* oviposition.

Keywords: Leucoptera coffeella, organic coffee, clay silicate, propolis extract, plant extracts.