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Evaluation of traps for collecting propolis by honeybees

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INTRODUCTION

Propolis (bee glue) is the resinous substance produced by the honeybees after the collection and enzymatic processing of plant resins and gums. It is considered a valuable beekeeping product due to its antibacterial, antifungal, antiviral and antioxidant activity. Raw propolis consists of about 50% plant resins and gums, 30% beeswax, 10% essential and aromatic oils, 5 % pollen and 5% other organic compounds, although its exact chemical composition may vary significantly depending on the plant origin of resins and gums. There are commercial **traps** for collecting propolis by beehives but there is a lack of evaluation studies about the quantitative collection and the qualitative composition of the collected propolis by alternative type of traps.

The **aim** of the current study was the quantitative and qualitative comparison of propolis collected by two low-cost, alternative traps applied on **Langstroth beehives** in comparison with a commercial trap.

MATERIALS AND METHODS

Three different types of **propolis collection traps** were applied on Langstroth beehives, a **commercial** one and two hand-cut screens with smaller squared openings (**4 x 4 mm** and **1 x 1 mm**). Each trap was applied on three beehive colonies, equal in adult and brood population, at the same apiary. The experiment took place in **two different apiaries**, in the apiary of the Laboratory of Sericulture and Apiculture of Agricultural University of Athens and in a productive apiary in Evia island, during the spring and fall of 2024.

The applied traps were compared for their quantity and quality of the collected propolis. All the screens were placed on the beehives at the same day and were removed when one of them was filled with propolis. The **quantity** of the collected propolis was determined by freezing the screens (-18ºC for 24h), flexing them above a clean paper sheet and **weighing the removed propolis**. The **quality** of propolis samples was evaluated by performing several **spectrophotometric tests** in the Laboratory of Food Chemistry and Biochemistry of Aristotle University of Thessaloniki. Total phenolics were determined using the Folin-Ciocalteu method, and in vitro antioxidant activity was evaluated using the DPPH, CUPRAC, and ABTS methods.

For the statistical analysis, **ANOVA analysis** was performed with a percentage of significance **a=0.05** using Tukey-Kramer HSD after logarithmic transformation of the data (JMP software).

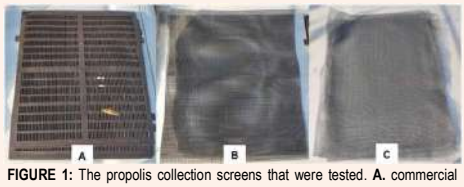

FIGURE 1: The propolis collection screens that were tested. **A.** commercial screen **B.** hand-cut screen with 4 x 4 mm openings **C.** hand-cut screen with 1 x 1 mm openings

FIGURE 2: Screens in Langstroth beehives during filling with propolis. **A.** commercial screen **B.** hand-cut screen with 4 x 4 mm openings **C.** hand-cut screen with 1 x 1 mm openings

RESULTS

Statistical analysis showed **significant differences in the amount of collected propolis** between the tested traps. Hand-cut screens with **1 x 1 mm** openings proved **more efficient** in collecting propolis (average **26.12 gr**) than the one with 4 x 4 mm openings (average 14.13 gr) (p-value = 0.0401 < 0.05), both having no significant differences with the commercial screen (average 21.13 gr) (p-value = 0.8722 and 0.0984 > 0.05, respectively).

Regarding the **quality** of the collected propolis, **no statistically significant difference** was detected between the traps tested.

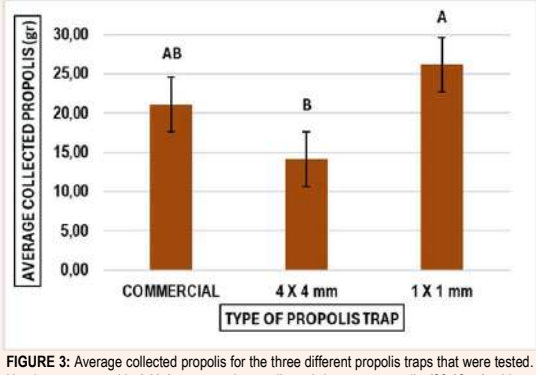

FIGURE 3: Average collected propolis for the three different propolis traps that were tested. Hand-cut screen with 1 X 1 mm openings collected the most propolis (26.12 gr) without statistically significant differences from the commercial one (21.13 gr).

DISCUSSION AND CONCLUSIONS

The study highlights the necessity of improving the existing commercial traps to optimize the amount of propolis collected.

The efficacy of the **hand-cut screen with 1 x 1 mm openings** indicates its successful use as an **alternative trap** for collecting propolis from beehives, having the **same results in the amount and quality of the collected propolis** as the commercial trap but **with decreased production cost** for the beekeepers. The results agree with the study of Tsagkarakis *et al.* (2017), in which top screens with 1 X 1 mm were more effective than the ones with larger openings. Lebedev (1979) refers that honeybees tend to fill smaller cracks than the larger ones and this is probably why 1 X 1 mm screens were also filled faster.

Due to the gap in the research related to the propolis collection traps, more alternative traps should be studied for optimizing the amount of the collected propolis.

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Propolis is the resinous product that honeybees produce after the collection of plant resins and their enzymatic processing. It has antibacterial, antifungal and antioxidant activity, among others. It is considered a very important beekeeping product but many aspects of it, such as composition, plant origin, optimization of collection methods, remain understudied. Although there are commercial traps for collecting propolis by beehives, there are very few evaluation studies about the quantitative collection and the qualitative composition of the collected propolis by alternative, low-cost traps. Three different types of propolis collection traps were applied on Langstroth beehives, a commercial one and 2 hand-cut screens with smaller square openings (1 x 1 mm and 4 x 4 mm). When one of the traps was filled with propolis, all the screens were removed, frozen and the collected propolis was removed and weighted. The quality of propolis samples was evaluated by performing several spectrophotometric tests. Total phenolics were determined using the Folin-Ciocalteu method, and in vitro antioxidant activity was evaluated using the DPPH, CUPRAC, and ABTS methods. For the results, ANOVA analysis was performed with a percentage of significance a=0.05. Results showed that the hand-cut screen with 1 x 1 mm openings had statistically significant differences with the one with 4 x 4 mm openings for the quantity of the collected propolis (p-value=0.0401<0.05). The commercial trap had not statistically significant differences with both the hand-cut screen 1 x 1 mm and 4 x 4 mm (p-value=0.8722 and 0.0984, respectively). In respect of the quality, there were not statistically significant differences between the traps tested. The current study highlights an important gap in the research related to the propolis collection traps and the possibility of improving existing commercial traps to optimize the amount of propolis collected. From a practical point of view, there is a proven cheaper and more efficient alternative for collecting propolis for beekeepers. As a result, production costs of propolis are reduced while production increases. These kinds of traps can be either commercially available or home-made by the beekeepers, which reduces costs even more.