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APHIDICIDAL AND REPELLENT ACTIVITIES OF *PISTACIA TEREBINTHUS* ESSENTIAL OILS AGAINST THE ROSY APPLE APHID, *DYSAPHIS PLANTAGINEA* PASSERINI, 1860

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Abstract

The rosy apple aphid, *Dysaphis plantaginea*, is a serious pest of apple. Essential oils of *Pistacia terebinthus* were examined against this species through toxicity and repellency assays. The results demonstrated moderate aphidicidal activity and weak repellent effects of the tested essential oils.

KEYWORDS: *Pistacia terebinthus*, insect control, toxicity test, bio-aphicide

Introduction

Dysaphis plantaginea Passerini, 1860 (Homoptera: Aphididae) is a major aphid pest of apple worldwide. Infestation can cause severe leaf curling and fruit malformation, while large aphid populations may produce substantial amounts of honeydew, which promotes the growth of sooty mold fungi and can adversely affect the quality of the harvested fruit (Angeli & Simoni, 2006).

Given the essential role of pesticides in enhancing agricultural production, their use has increased substantially in recent years, from 2,846,866 tons in 2010 to 3,526,746 tons in 2022 (Rodríguez-Seijo *et al.*, 2025). However, the extensive use of synthetic pesticides in agriculture is a growing concern because of their potential adverse effects on human health and the environment (Al Shamsi, 2024).

Owing to the limitations associated with synthetic pesticides, biopesticides offer effective and safer alternatives for pest management (Belhamra *et al.*, 2025). Botanical pesticides derived from plants may be preferable to synthetic chemicals because they are generally more environmentally friendly and exhibit lower toxicity (Al Shamsi, 2024).

Algeria's diversified geography and varied climate provide an ideal setting for the development of numerous plant species with diverse chemical profiles (Belhamra *et al.*, 2025). *Pistacia terebinthus* L., a typical representative of the Mediterranean flora, belongs to the family Anacardiaceae and is a dioecious tree (Couladis *et al.*, 2003).

Nonetheless, no published data are currently available on the insecticidal potential of *P. terebinthus*. Therefore, the aim of the present study was to evaluate the aphidicidal and repellent activities of the essential oils obtained from this plant species.

Materials and Methods

Pistacia terebinthus was collected in September 2024 from the region of Rouached (Mila Province, eastern Algeria; 36°26'42.0"N 5°59'00.2"E, 750 m a.s.l.), and the essential oils (EOs) were extracted from their galls by hydrodistillation. Five EO concentrations were subsequently prepared for the bioassays.

Leaves of apple, *Malus domestica* Borkh (Golden Delicious variety), and a colony of rosy apple aphid, *Dysaphis plantaginea*, were used in the bioassays. Both were collected in April 2025 from an orchard in the Khenchela region (eastern Algeria).

The toxicity test was performed under laboratory conditions. Three replicates were prepared for each treatment. In total, seven solutions were tested, including five concentrations of the plant extract, a negative control, and a positive control (the biopesticide Vegex Crisflor®, a broad-spectrum bioinsecticide based on natural pyrethrins). Leaf disks were dipped in each concentration for 2-5 s. Subsequently, 15 wingless *D. plantaginea* aphids were placed on each treated leaf disk, with each leaf disk representing a replicate. Mortality was recorded 24 h after treatment. Percent mortality was corrected using Abbott's formula (1925).

To assess the repellency effect, six Petri dishes were prepared using the 10,000 ppm concentration. Each dish was divided into two equal parts, and two aphid-free leaf disks were placed in the dish: one disk was dipped in the treatment solution for 2-5 s and placed in one section, while the untreated disk was placed in the other side. Ten aphids were placed in the center of each Petri dish. After 24 h, the number of aphids present in each section was recorded, and the repellency percentage (RP) was calculated.

Aphid mortality data were analyzed using analysis of variance (ANOVA), followed by Student-Newman-Keuls (SNK) post hoc tests, with SPSS software. The median lethal concentration 50 (LC₅₀) was estimated using probit analysis.

Results

The toxicity assay showed that the highest aphid mortality was observed at a concentration of 1,000 ppm (52.85%) and with the biopesticide (85.69%), whereas the lowest mortality was recorded for apple leaves treated with 5,000 ppm (16.67%) (Table I).

The LC₅₀ of the tested essential oil was estimated at 161 ppm.

Table I. Corrected mortality percentages of *D. plantaginea* following exposure to the tested solutions

Solutions	Corrected mortality (M ± SE)
100 ppm	47.33±23.78 ab
500 ppm	44.13±8.49 ab
1,000 ppm	52.85±4.09 ab
5,000 ppm	16.67±12.55 a
10,000 ppm	30.52±12.14 ab
Biopesticide	85.69±9.91 b

Significant at P< 0.05

Regarding the repellency test, the RP was 33.33%. According to the classification proposed by McDonald *et al.* (1970), the tested EOs exhibited a class II response, corresponding to a slightly repellent effect on *D. plantaginea*. Similarly, previous studies have demonstrated the efficacy of various plant-derived extracts against *D. plantaginea*, including neem (*Azadirachta indica*) formulations at 133 g/hl (Lob, 2000) and *Pistacia lentiscus* EOs at a concentration of 10,000 ppm (Lebbal *et al.*, 2023). The insecticidal effect of *P. terebinthus* observed in the present study may be attributed to the secondary metabolites present in its essential oils. Several groups of phytochemicals, including alkaloids, terpenoids, phenolics, and essential oils from more than 2,000 plant species, have been reported to exhibit insecticidal activities (Roy *et al.*, 2016).

In conclusion, given the moderate aphidicidal activity exhibited by *P. terebinthus* EOs, future studies should focus on characterizing the chemical composition of local biotypes and elucidating the mechanisms of action of these extracts against insect pests.

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ТОКСИЧНО И ОДБОЈНО ДЕЛОВАЊЕ ЕТАРСКИХ УЉА *PISTACIA TEREBINTHUS* НА ПЕПЕЉАСТУ ВАШ ЈАБУКЕ *DYSAPHIS PLANTAGINEA* PASSERINI, 1860.

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Извод

Пепељаста ваш јабуке, *Dysaphis plantaginea*, представља значајну штеточину јабуке. Етарска уља врсте *Pistacia terebinthus* испитивана су у односу на ову врсту применом тестова токсичности и репелентног дејства. Резултати су показали умерену афидицидну активност и слабо репелентно дејство испитиваних етарских уља.

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