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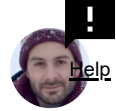
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Open Access Article

Assessment of Four Plant-Derived Extracts as Potential Control Agents Against *Varroa destructor* with Safety Evaluation in Honey Bees (*Apis mellifera*)

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by  **MDPI** (1)

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This study evaluated the acaricidal efficacy of extracts from *Salvia officinalis* (SO), *Origanum vulgare* (MV), *Ruta graveolens* (RG), and *Opuntia ficus-indica* (OFI) against *Varroa destructor*, together with their acute toxicity to *Apis mellifera*. The extracts were characterized for their phenolic content and antioxidant activity. Honey bee toxicity was assessed at 0.5, 1, and 2 mg/mL using three application methods, while acaricidal activity was determined by the drip method. Survival data were analyzed using Kaplan–Meier, the log-rank test, and Abbott's correction. The extracts differed markedly in their phenolic composition, with RG showing the highest total phenolic content, whereas all extracts exhibited strong antioxidant activity. Toxicity assays revealed significant differences among plant species. SO was the most toxic to honey bees, particularly following drip application, whereas MV and OFI caused minimal mortality. RG showed moderate toxicity that varied with the application method. In contrast, all extracts achieved complete mortality of *V. destructor* within 4 h, with corrected efficacy exceeding 89%. MV and OFI exhibited the lowest LC₅₀ values, indicating the greatest acaricidal potency. Overall, MV and OFI emerged as the most promising candidates, combining high efficacy against *V. destructor* with low toxicity to honey bees. However, further validation under field conditions is required.

Keywords: botanical acaricide (/search?q=botanical+acaricide); *Apis mellifera* (/search?q=Apis+mellifera); plant extracts (/search?q=plant+extracts); selective toxicity (/search?q=selective+toxicity); *Varroa destructor* (/search?q=Varroa+destructor)

1. Introduction

Beekeeping production in Africa represents a strategic sector that contributes significantly to economic development, food security, environmental sustainability, and social well-being [1]. It encompasses the systematic management and husbandry of honey bee colonies for the purposes of crop pollination and the production of honey and other apicultural products [2]. In Algeria, where apiculture has been practiced since antiquity, it constitutes a longstanding component of the national agricultural heritage. The transmission of traditional knowledge across generations has contributed to the preservation of diverse apicultural practices adapted to various ecological zones. Furthermore, the country's significant potential in this sector offers a strategic avenue for local economic development and the attainment of honey self-sufficiency. In 2010, Algeria's apicultural sector comprised approximately 1.2 million colonies and 20,000 beekeepers. Although honey production increased significantly between 2002 and 2010, colony productivity remained low, averaging less than 4kg per hive [3].

In the past decade, evidence from scientific observations has indicated abnormal weakening and elevated mortality rates in honeybee colonies worldwide [4]. Global honeybee colony losses are acknowledged to be influenced by a combination of environmental, biological, and anthropogenic factors. As highlighted in previous reviews, honey bees are susceptible to a wide range of pests and pathogens, including parasitic mites, diverse viral agents, microsporidia, bacterial infections, and fungal species [5]. Honey bee colonies harbor diverse mite taxa (*Acar*), notably *Varroa destructor* Anderson and Trueman (Mesostigmata: Varroidae), *Acarapis woodi* Rennie (Trombidiformes: Tarsonemidae), *Varroa jacobsoni* Oudemans (Mesostigmata: Varroidae), and *Tropilaelaps clareae* Delfinado and Baker (Mesostigmata: Laelapidae), which are major economic pests capable of severely impairing colony survival and productivity [6]. *Varroa destructor* represents the most serious global threat to honey bee colonies, as an obligate ectoparasite capable of infesting all developmental stages and castes of *Apis mellifera* Linnaeus, 1758 (Hymenoptera: Apidae) [7]. *Varroa destructor* feeds primarily on the fat body tissue of adult bees [8]. In drones, infestation reduces body weight, flight capacity, and sperm production, while in foragers it impairs orientation and homing ability [9], often delaying or preventing their return to the colony [10]. Conventional control of *V. destructor* relies on fluvalinate-impregnated strips, a synthetic pyrethroid, applied in hives during periods without honey production. However, the intensive use of these strips has resulted in resistance to pyrethroid insecticides, as previously reported [11]. For these reasons, several studies have explored biological control approaches as safer, reasonably effective, and economically feasible alternatives for managing *V. destructor* infestations in honey bee colonies. Plant-derived compounds are regarded as promising natural alternatives and have been documented to exert bioactive effects against *V. destructor* infestations in apicultural systems [12,13,14].

Several plant extracts, recognized for their potent natural biological activity, may hold potential in the prevention and treatment of different insect and mite pests [15]. Notable examples include *Salvia officinalis* L. (Lamiales, Lamiaceae), *Marrubium vulgare* L. (Lamiales, Lamiaceae), *Ruta graveolens* L. (Sapindales, Rutaceae), and *Opuntia ficus-indica* (L.) Mill. (Caryophyllales, Cactaceae) which have been extensively studied for their bioactive properties and potential health benefits. Numerous studies have reported that these plants are rich in diverse bioactive compounds, including polyphenols, steroids, flavonoids, and other phytochemicals [16,17,18,19]. Plant bioactive compounds exhibit antimicrobial, antioxidant, and anti-inflammatory activities, contributing to the prevention and management of various diseases [16,19,20,21,22,23]. Moreover, numerous studies have confirmed the in vitro antiparasitic activities of the aforementioned plants [24,25,26,27,28]. To the best of our knowledge, the antiviral activity of these plants has not yet been documented in the scientific literature. Thus, the objective of the present study was to investigate the effect of *S. officinalis* (SO), *M. vulgare* (MV), *R. graveolens* (RG), and *O. ficus-indica* (OFI) extracts against the parasitic mite *Varroa destructor* and safety for honey bees.

2. Materials and Methods

2.1. Study Period

The present study was conducted at the Laboratory of Animal Biology, Faculty of Natural and Life Sciences, University of Bejaia (Algeria; 36°43' N, 5°04' E), during the spring season, from March to May 2025. During the experimental period, the mean maximum temperature reached 22.1 °C, while the mean minimum temperature decreased to 12.2 °C. In addition, rainfall, average relative humidity, and wind speed were 55.8 mm, 68.8%, and 10.9 km/day, respectively. For the purpose of the bioassays, *V. destructor* mites and honeybees (*Apis mellifera*) used in this study were collected from privately managed apiaries located in the Bejaia region.

2.2. Plant Collection and Extraction

Leaves of SO, MV, and RG, as well as flowers of OFI, were obtained in May 2023 from Talendjast (36.6° N, 5.1° E), located in the Bejaia department in northern Algeria. The OFI flowers were harvested at the post-flowering stage, manually sorted, and thoroughly cleaned using a soft brush to remove spines and adhering dust particles. The plant materials were first dried at 40 °C for 24 h in a ventilated drying oven. The dried materials were subsequently ground and sieved, and the grinding and sieving process was repeated to ensure uniform particle size and homogeneity. The resulting powder was stored in airtight containers at 4 °C until further analysis.

Extraction with ethanol as the solvent was carried out according to Cacique et al. [29] using the maceration technique. Briefly, 1 g of homogeneous plant powder was mixed with 20 mL of 50% ethanol at 50 °C. The mixture was allowed to macerate for 30 min and then filtered. Immediately after extraction, the suspension was rapidly cooled in an ice-water bath. The solvent was removed using a rotary evaporator.

2.3. Determination of Total Phenolic Content (TPC)

The total phenolic content was determined according to the method described by Velioglu et al. [30]. Briefly, 0.5 mL of extract was mixed with 1.5 mL of diluted Folin–Ciocalteu reagent (Merck KGaA, Darmstadt, Germany). After 5 min, 1.5 mL of sodium carbonate (6%) was added to the reaction mixture. The reaction mixture was incubated for 1 h at room temperature in complete darkness and the absorbance was measured at 750 nm compared to a blank (Uvline 9400, Secomam, Alès, France). Gallic acid was used as the standard for the calibration curve. The total phenolic content is expressed as milligrams of gallic acid equivalents (GAE) per 100 g of dry weight (DW).

2.4. DPPH Radical Scavenging Activity

The antioxidant activity of the plant extracts was evaluated using the free radical scavenger 1,1-diphenyl-2-picrylhydrazyl (DPPH), following the method previously described by Molyneux [31]. An aliquot (200 µL) of the extract was mixed with 1 mL of a 60 M

methanolic DPPH solution. After 30 min, the decolorizing process was recorded at a wavelength of 515 nm. The results were expressed as a percentage of inhibition (%).

2.5. Honey Bee Collection and Toxicity Assessment

Prior to the experiments, the beehives were treated with an organic acaricide based on oxalic acid. Adult worker bees were subsequently collected from colonies originating from hives confirmed to be free of *Varroa* mites following hive inspections. After opening the hive, two to three frames heavily covered with bees were removed and shaken into a large plastic container. Honey bees were lightly sprayed with water to inhibit flight and subsequently mixed. The collected bees were immediately transported to the laboratory for further processing. Collected bees were maintained under controlled laboratory conditions (25 °C and 65% relative humidity) parasitologically and 50% sucrose solution until the initiation of the bioassay.

The plant extracts from leaves of SO, MV, and RG, as well as flowers of OFI were assessed using paper, drip, and spraying methods, with 0.5 mL of solution applied for each concentration. For each plant extract, the experiment was conducted using two independent replicates, with 10 bees per replicate, resulting in a total of 20 bees. Treatments were conducted in plastic boxes (10 cm × 10 cm × 10 cm) containing 10 bees each. Each plant extract was diluted in distilled water to the desired concentration including 0.5 mg/mL, 1 mg/mL, and 2 mg/mL. Three control treatments were included: a commercial anti-*Varroa* cream as a positive control applied in small quantities to the side of the boxes; distilled water as a negative control; and a 50% ethanol solution as a solvent control. The toxicity of the extracts on bees was then assessed at 1, 2, 24, and 48 h post-exposure. Mortality of bees was assessed by visual observation and confirmed by gently stimulating apparently immobile bees with forceps. Bees that showed no movement of their legs, antennae, or other body parts following stimulation were considered dead.

2.6. Mite Collect and Toxicity Assessment

Varroa destructor mites were collected from honey bee colonies that were maintained under conditions favoring high mite infestation, as no chemical treatments were applied to reduce mite populations. In the colonies examined in this study, *Varroa destructor* was the only mite species detected and was identified based on its diagnostic morphological characteristics; no other mite taxa were observed. Prior to the experiment, colony infestation was assessed through direct inspection of adult bees, examination of capped brood cells, and inspection of hive bottom boards for fallen mites. Colonies exhibiting natural *V. destructor* infestation were selected for mite collection. Mites were collected from adult bees, capped brood cells, and hive bottom boards and subsequently used in the experimental assays. In the present study, two methods were employed for the sampling of *V. destructor* mites. Mites were carefully collected using a fine-bristled brush and immediately transferred to their respective treatment groups. In addition, capped brood cells were carefully opened with

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foreeops to collect mites present within the cells or attached to the developing bees. A total of 280 *V. destructor* mites were collected and transported to the laboratory for subsequent use in the bioassays. The movement and behavior of the mites were observed under a magnifying glass.

Additionally, mite collection from bee samples was carried out using the icing sugar wash method. About 300 bees were placed in a graduated container with 15 g of icing sugar, closed with a mesh lid, gently rolled for one minute, and then inverted over a plastic bag to recover dislodged *V. destructor* mites. The procedure was repeated with 5 g of icing sugar, mixed for 30 s to ensure complete recovery of mites, and a few drops of water were subsequently added to dissolve the sugar, facilitating the collection of any remaining *V. destructor* mites. The bees were subsequently released.

As the drip treatment with the four plant extracts resulted in low mortality in bees, this method was subsequently applied to assess their effects on the parasite. Each plant extract was tested with 0.5 mL of solution applied for each concentration. Following the introduction of mites, sealed Petri dishes containing five *Varroa* mites each were incubated in darkness at 34 °C and 65% relative humidity. Temperature and humidity were set to mimic the conditions usually observed in the brood area of the hive. The concentrations of the plant extracts used were 0.5, 1, and 2 mg/mL. Two standard compounds, gallic acid and quercetin, were included as reference controls. Two additional control treatments were applied: a commercial anti-*Varroa* cream as a positive control, administered in small amounts to the sides of the boxes, and distilled water as a negative control. The effects of the extracts on *Varroa* mites were evaluated at 1, 2, 3, and 4 h following exposure. This is due to the sensitivity of mites to artificial conditions when maintained outside their natural habitat for more than 4 h, which can result in starvation and dehydration [32]. After each exposure period, the parasites were transferred from the tubes to a Petri dish and examined under a stereoscopic microscope. Mites that showed no movement when gently stimulated with a fine paintbrush were considered dead, while those that moved one or more legs were classified as inactive.

2.7. Statistical Analysis

All survival analyses were performed using GraphPad Prism software (GraphPad Software, Version 8.0.1, San Diego, CA, USA). Survival data of *V. destructor* and *A. mellifera* were analyzed using the Kaplan–Meier survival estimator to calculate survival probabilities over time for each treatment group. Differences in survival distributions between treatments, concentrations (0.5, 1, and 2 mg/mL), and application methods (paper, drip, and spraying) were assessed using the log-rank (Mantel–Cox) test. All experiments were conducted in duplicate to ensure reproducibility. Survival data were recorded over the entire observation period until the end point of each assay. Statistical significance was defined at $p < 0.05$.

3. Results

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The total phenolic content (TPC) of the leaves of SO, MV, and RG, as well as the flowers of OFI, was determined to be 606.80 ± 3.25 , 408.70 ± 11.03 , 3501.78 ± 10.32 , and 1081.61 ± 9.65 mg GAE/g DW, respectively. In addition, the DPPH radical scavenging activity of SO, MV, and RG leaves and OFI flowers ranged from 60.77% to 73.48%.

Figure 1 illustrates the survival rates of *A. mellifera* workers exposed to SO extracts at 0.5, 1, and 2 mg/mL via paper contact, drip, and spraying over 48 h. The most severe toxicity was observed with the drip method, where survival fell to 10% at 1 mg/mL and 50% at both 0.5 and 2 mg/mL at 48 h. The paper method produced comparable lethality at 1 mg/mL (15% survival), while the 2 mg/mL group reached 55% survival; the 0.5 mg/mL group remained unaffected (100%). In the spraying method, mortality was initiated as early as 1 h at 2 mg/mL, with final survival rates of 50%, 80%, and 60% at 2, 1, and 0.5 mg/mL, respectively. All controls maintained survival above 95% throughout the experiment. Across all application methods, survival curves differed significantly among treatments (paper: $\chi^2 = 37.38$, $df = 5$, $p < 0.0001$; drip: $\chi^2 = 33.90$, $df = 5$, $p < 0.0001$; spraying: $\chi^2 = 33.78$, $df = 5$, $p < 0.0001$), indicating a consistent and robust treatment effect of SO extracts on honey bee survival. A significant dose-dependent trend was detected in all cases, with the strongest trend observed in the drip and spraying methods (paper: $p = 0.0143$; drip: $p < 0.0001$; spraying: $p = 0.0002$). The Gehan–Breslow–Wilcoxon test confirmed significant early differences in survival distributions for all application methods (paper: $\chi^2 = 38.40$, $df = 5$, $p < 0.0001$; drip: $\chi^2 = 32.69$, $df = 5$, $p < 0.0001$; spraying: $\chi^2 = 26.46$, $df = 5$, $p < 0.0001$).



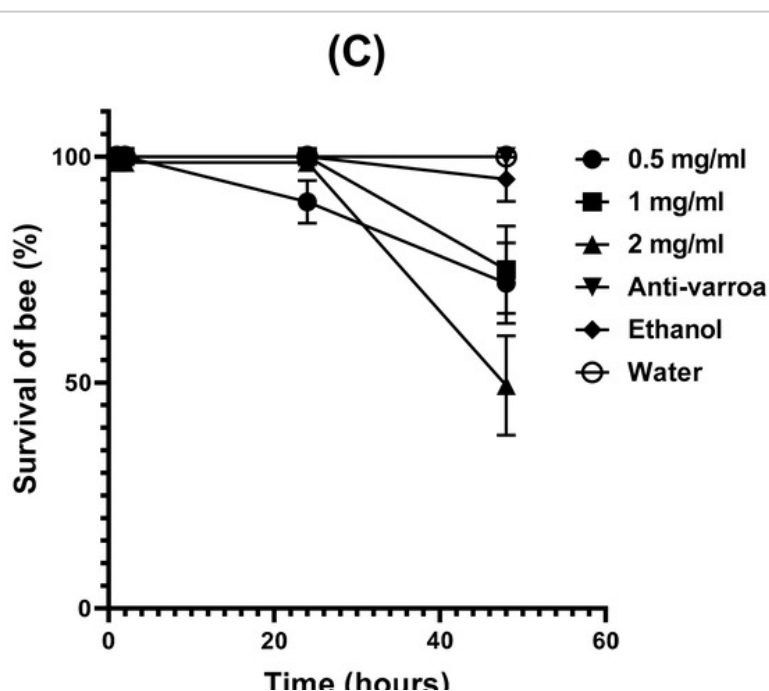
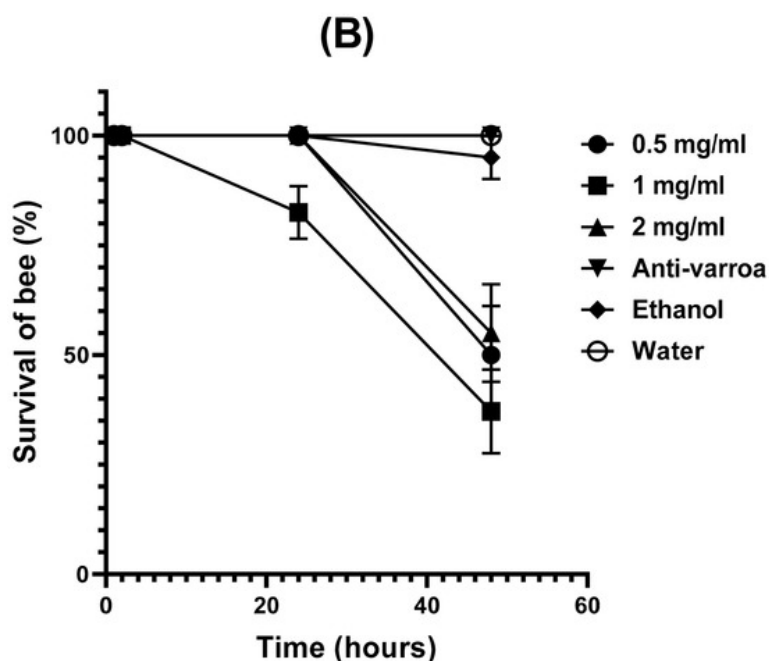
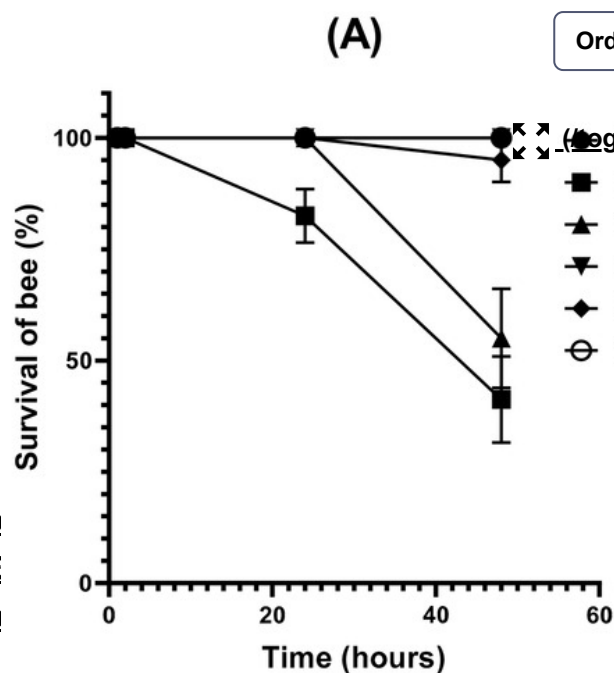
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Figure 1. Survival rates of honey bees (*Apis mellifera*) after treatment with *Salvia miltiorrhiza* extracts at 0.5 mg/mL, 1 mg/mL, and 2 mg/mL by the paper (A), drip (B), and spraying (C) methods. Data are presented as mean $\pm$ standard error of the mean (SEM).

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Across all methods, honey bee survival following exposure to MV extracts remained high, with no mortality recorded during the first 2 h of exposure (**Figure 2**). Only isolated mortality events were observed at 24 and 48 h, with no consistent concentration-dependent pattern. The drip application resulted in complete survival of bees exposed to all extract concentrations throughout the experiment, whereas the paper and spraying methods showed only sporadic mortality events. Survival analysis using the Kaplan–Meier method revealed no significant effects of MV extracts on the survival of *Apis mellifera* regardless of the application method. For the paper, drip, and spraying treatments, the log-rank (Mantel–Cox) test showed no significant differences among survival curves (paper: $\chi^2 = 3.017$, $df = 5$, $p = 0.6974$; drip: $\chi^2 = 5.000$, $df = 5$, $p = 0.4159$; spraying: $\chi^2 = 4.000$, $df = 5$, $p = 0.5494$). Likewise, the log-rank test for trend indicated no significant dose-dependent effect for any application method (paper: $p = 0.6111$; drip: $p = 0.3798$; spraying: $p = 0.6788$). These findings were further confirmed by the Gehan–Breslow–Wilcoxon test, which detected no significant differences in survival distributions among treatments and controls (paper: $p = 0.6473$; drip: $p = 0.4159$; spraying: $p = 0.5210$).



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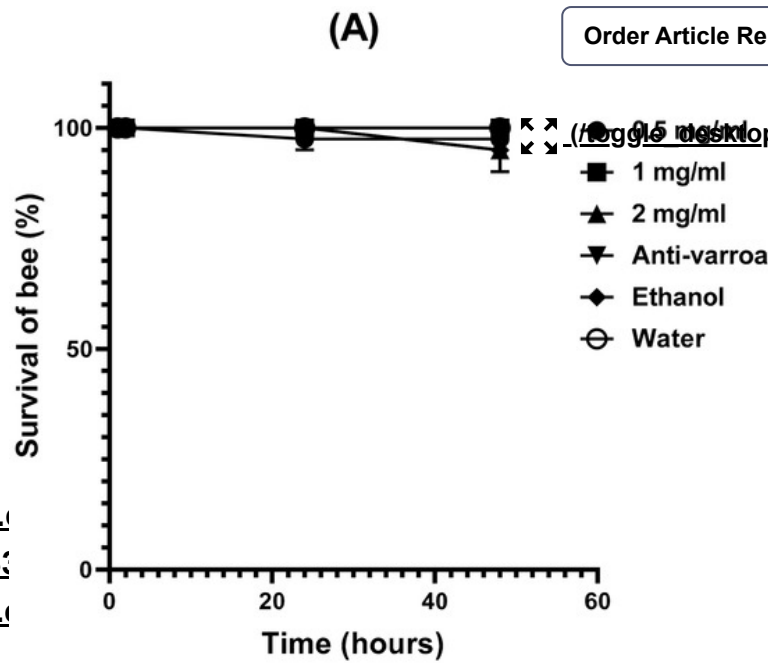


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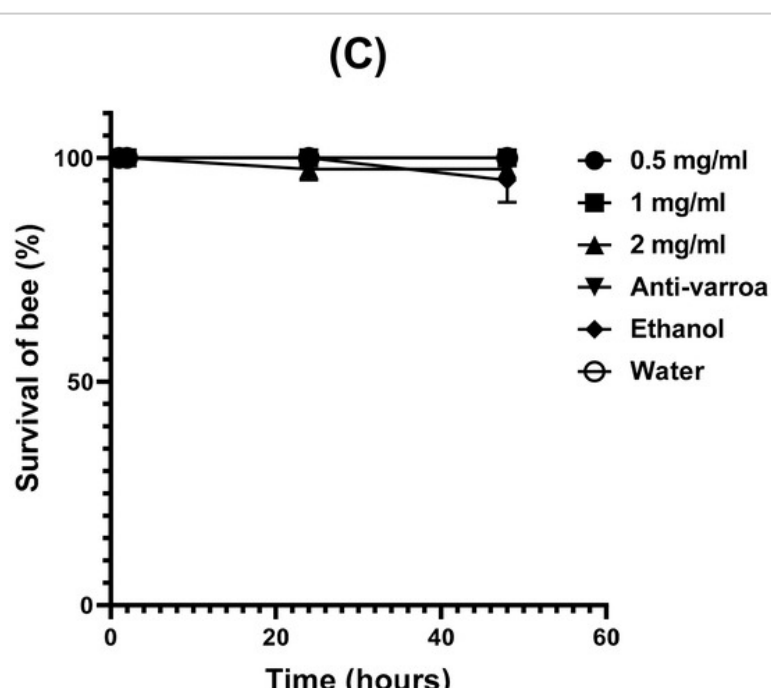
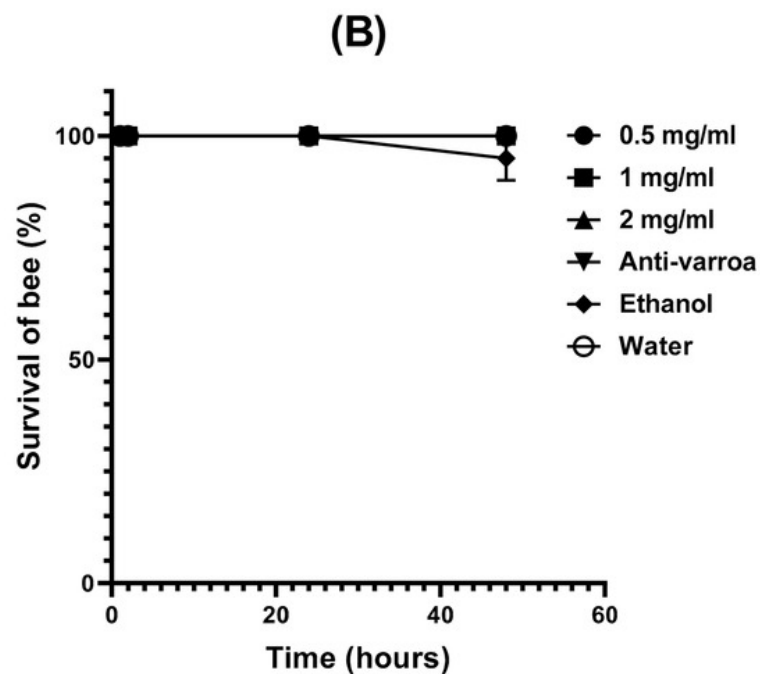
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Figure 2. Survival rates of honey bees (*Apis mellifera*) after treatment with *Marrubium* extracts at 0.5 mg/mL, 1 mg/mL, and 2 mg/mL by the paper (A), drip (B), and spraying (C) methods. Data are presented as mean $\pm$ standard error of the mean (SEM).

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Figure 3 presents the survival rates of *A. mellifera* exposed to RG extracts at three concentrations (0.5, 1, and 2 mg/mL) via paper, drip, and spraying methods over 48 h. No mortality was recorded in any group at 1 and 2 h post-treatment across all three methods, indicating no immediate acute toxicity. Divergences emerged from 24 h onward and groups/public/10.3390/parasitology60500512. The drip method produced the lowest mortality, with survival rates remaining above 50% at all time points, comparable to control groups, suggesting minimal risk via this route. The paper method induced moderate but paradoxical mortality, with survival declining to 50% and 65% at 0.5 and 1 mg/mL respectively by 24 h, while the 2 mg/mL concentration remained non-lethal throughout. The spraying method was the most toxic, with the 1 mg/mL concentration causing complete mortality by 48 h (0% survival), followed by 50% and 40% mortality at 0.5 and 2 mg/mL respectively. Across all methods, control groups (anti-varroa, ethanol, and distilled water) maintained survival rates at or above 95%. The recurrent non-linear dose-response pattern, whereby intermediate concentrations exhibited greater lethality than the highest tested dose. Statistical analysis revealed that paper and spraying both produced highly significant differences in bee survival across concentrations (log-rank: $\chi^2 = 73.08$ and 131.6, respectively; $df = 5$; $p < 0.0001$), accompanied by strong dose-dependent trends ($\chi^2 = 50.80$ and 51.64; $p < 0.0001$), and confirmed by the Gehan–Breslow–Wilcoxon test ($\chi^2 = 65.50$ and 111.0; $p < 0.0001$). Notably, the spraying method yielded the strongest effect with the highest chi-square value observed across all figures ($\chi^2 = 131.6$). By contrast, the drip method produced no significant differences in survival curves (log-rank: $\chi^2 = 3.47$, $p = 0.63$; Gehan–Breslow–Wilcoxon: $\chi^2 = 3.04$, $p = 0.69$) and no dose-response trend ($\chi^2 = 2.12$, $p = 0.15$), suggesting negligible bee toxicity when applied by this route.



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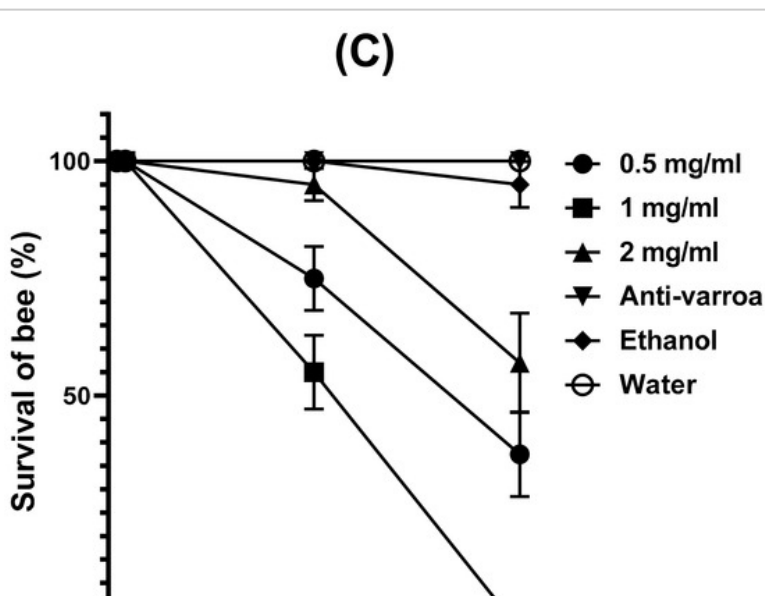
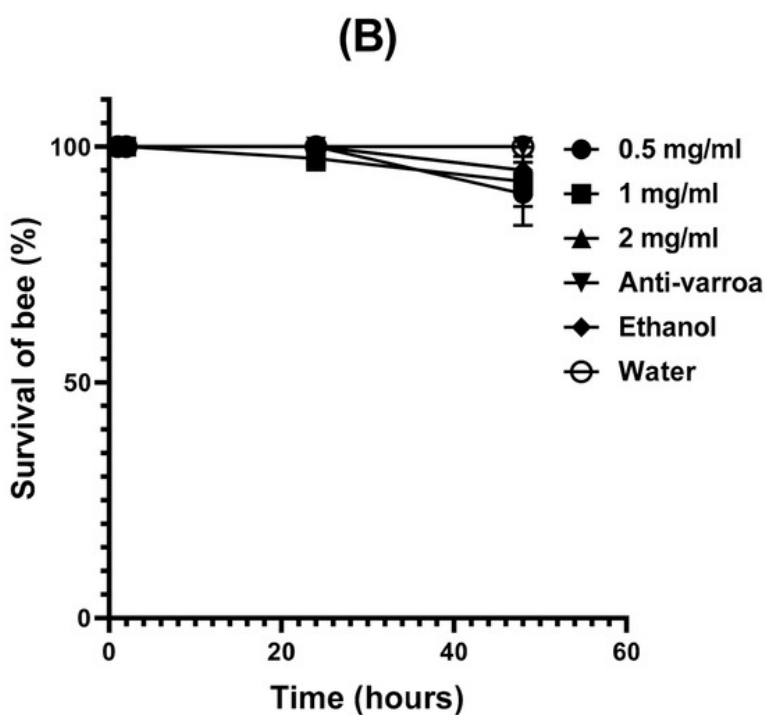
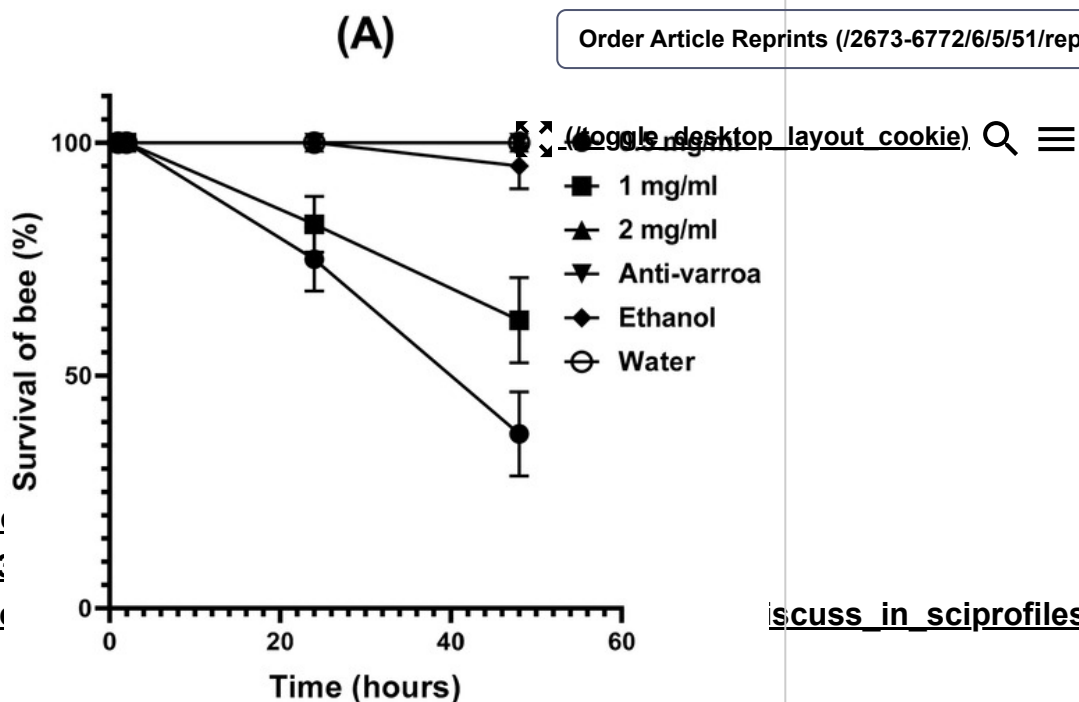


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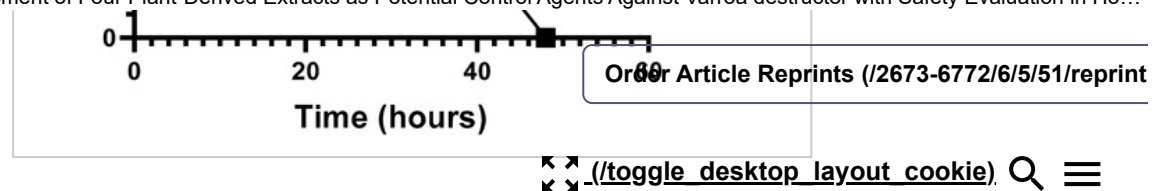
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Figure 3. Survival rates of honey bees (*Apis mellifera*) after treatment with *Ruta graveolens* extracts at 0.5 mg/mL, 1 mg/mL, and 2 mg/mL by the paper (A), drip (B), and spraying (C) methods. Data are presented as mean $\pm$ standard error of the mean (SEM).

As shown in **Figure 4**, adults of *Apis mellifera* exhibited high survival rates following exposure to OFI extracts at 0.5, 1, and 2 mg/mL, regardless of the application method. Under paper and drip treatments, no mortality was recorded during the first 24 h, and only limited mortality was observed after 48 h, resulting in survival rates ranging from 80 to 100%. Similarly, the spraying method produced only minor reductions in survival, with occasional mortality detected at 24 and 48 h in the 1 and 2 mg/mL treatments. Survival curve analyses revealed contrasting patterns among the three application methods. For the paper contact assay, the log-rank (Mantel–Cox) test indicated a significant difference among treatment groups ($\chi^2 = 35.55$, $df = 5$, $p < 0.0001$), which was confirmed by the Gehan–Breslow–Wilcoxon test ($\chi^2 = 24.25$, $df = 5$, $p = 0.0002$), although no significant dose-dependent trend was detected ($\chi^2 = 1.681$, $df = 1$, $p = 0.1947$). In the drip assay, significant differences among survival curves were also observed (log-rank: $\chi^2 = 13.94$, $df = 5$, $p = 0.0160$; Gehan–Breslow–Wilcoxon: $\chi^2 = 13.94$, $df = 5$, $p = 0.0160$), together with a significant concentration–response trend ($\chi^2 = 4.503$, $df = 1$, $p = 0.0338$). In contrast, the spraying assay showed no statistically significant differences among treatments (log-rank: $\chi^2 = 9.526$, $df = 5$, $p = 0.0898$; Gehan–Breslow–Wilcoxon: $\chi^2 = 9.142$, $df = 5$, $p = 0.1035$), and no significant trend was detected ($\chi^2 = 1.017$, $df = 1$, $p = 0.3131$). Overall, these results indicate that only the drip application exhibited a significant dose-dependent effect on survival, while paper contact showed group differences without a clear trend, and spraying had no significant impact on honey bee survival.



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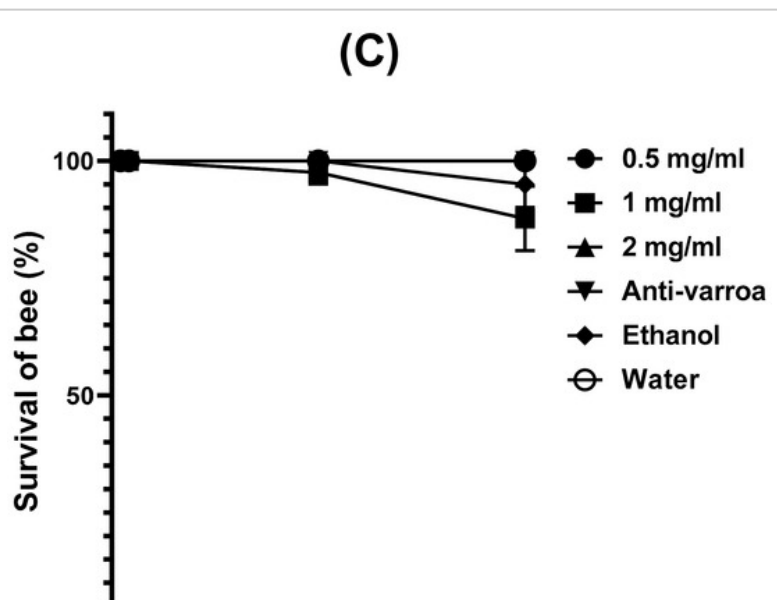
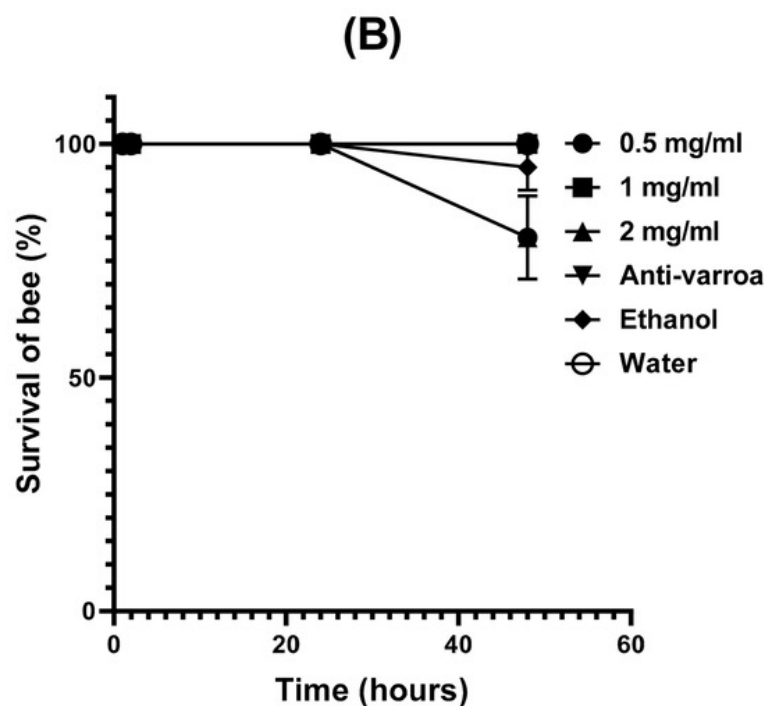
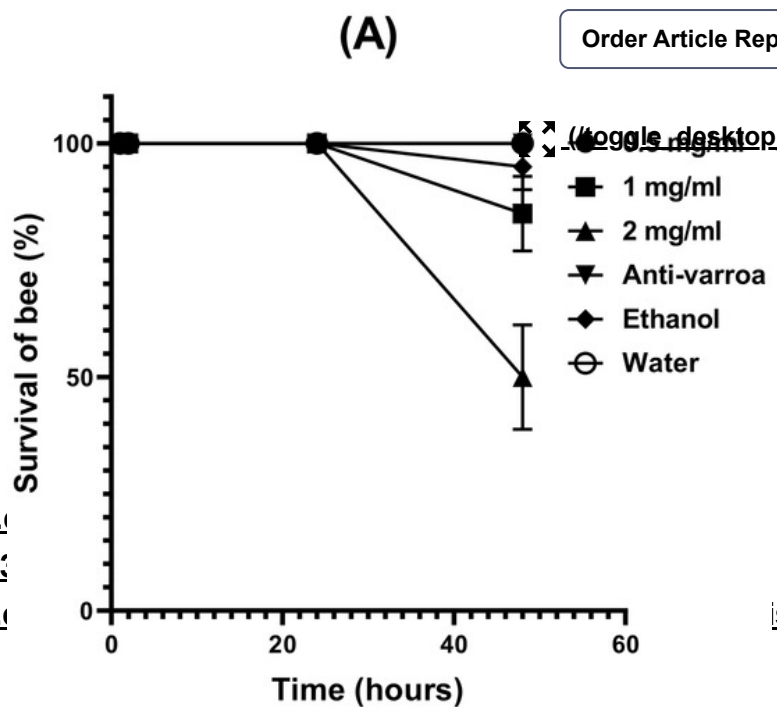
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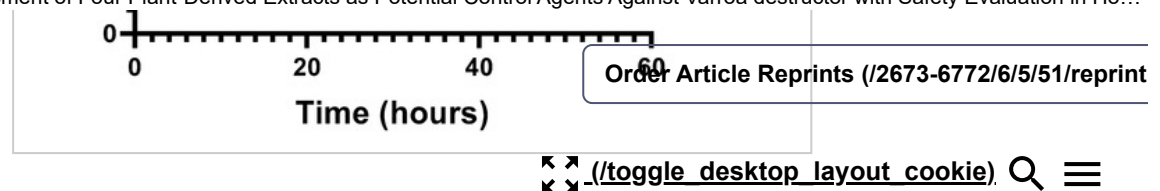


Figure 4. Survival rates of honey bees (*Apis mellifera*) after treatment with *Opuntia ficus-indica* extracts at 0.5 mg/mL, 1 mg/mL, and 2 mg/mL by the paper (A), drip (B), and spraying (C) methods. Data are presented as mean $\pm$ standard error of the mean (SEM).

Figure 5 shows the survival curves of *V. destructor* mites following treatment with plant extracts from SO, MV, RG, and OFI applied at 0.5, 1, and 2 mg/mL using the drip method. Survival was estimated by the Kaplan–Meier method. Four hours after topical exposure, the leaves of SO, MV, and RG, together with the flowers of OFI extracts, demonstrated strong acaricidal efficacy against *V. destructor*. All tested 0.5, 1, and 2 mg/mL concentrations resulted in 100% mite mortality. All four extracts produced highly significant differences in mite survival across concentration groups, as confirmed by both the log-rank (Mantel–Cox) test (SO: $\chi^2 = 68.31$; MV: $\chi^2 = 60.34$; RG: $\chi^2 = 71.28$; OFI: $\chi^2 = 61.64$; $df = 6$; $p < 0.0001$ for all) and the Gehan–Breslow–Wilcoxon test ($\chi^2 = 50.07, 42.18, 52.51$, and 41.93 , respectively; $p < 0.0001$). Regarding concentration-dependent trends, no significant dose–response effect was detected for *S. officinalis* ($\chi^2 = 0.47$, $p = 0.49$) or *R. graveolens* ($\chi^2 = 1.63$, $p = 0.20$), suggesting a relatively uniform acaricidal effect across tested concentrations. In contrast, a significant positive trend was observed for *M. vulgare* ($\chi^2 = 4.39$, $p = 0.036$) and, most markedly, for *O. ficus-indica* ($\chi^2 = 16.30$, $p < 0.0001$), indicating a clear dose-dependent increase in mite mortality with rising extract concentration. In addition, quercetin and gallic acid, used as standard compounds and tested at different concentrations (0.5, 1, and 2 mg/mL), resulted in a 100% reduction in the number of *V. destructor* mites after 4 h of treatment. A significantly low number of *V. destructor* mites ($p < 0.05$) was observed following treatment with the tested concentrations of anti-varroa. The *V. destructor* mites treated with distilled water (negative control) exhibited significantly higher values ($p \leq 0.0001$) compared with those obtained for the different concentrations of the four tested extracts and the reference compounds.



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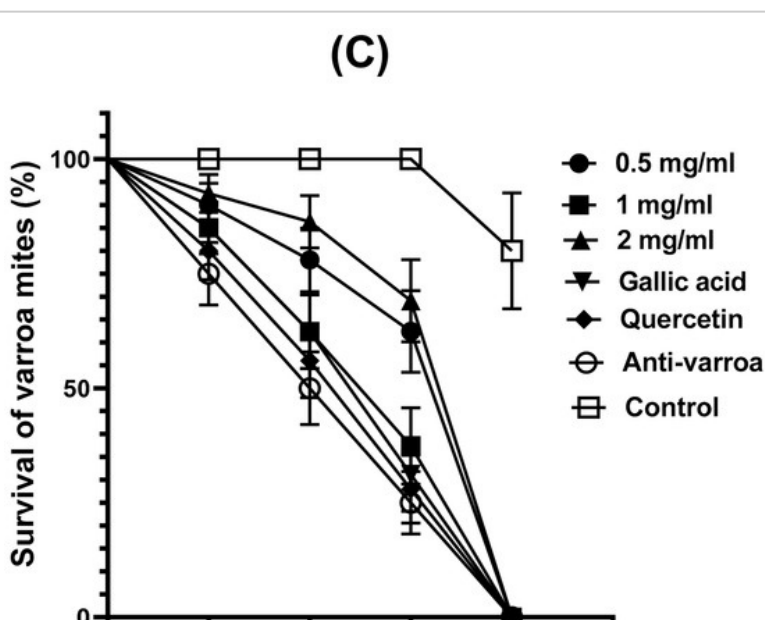
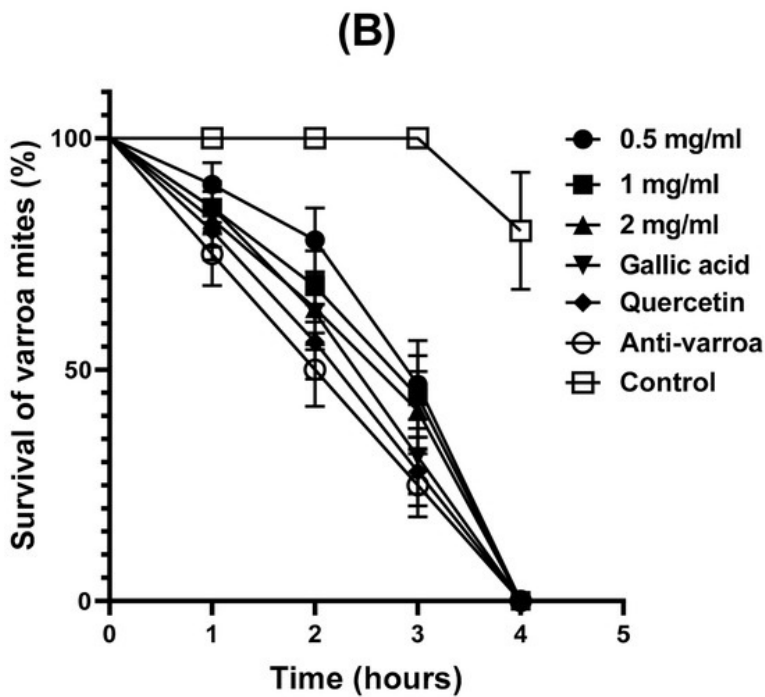
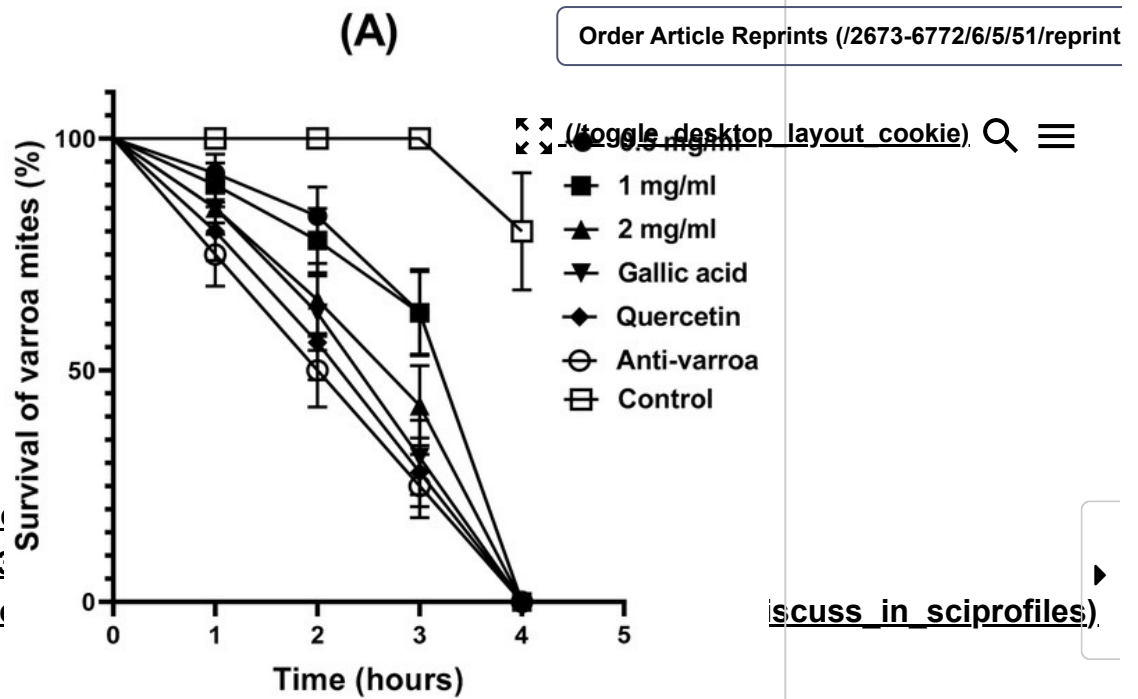
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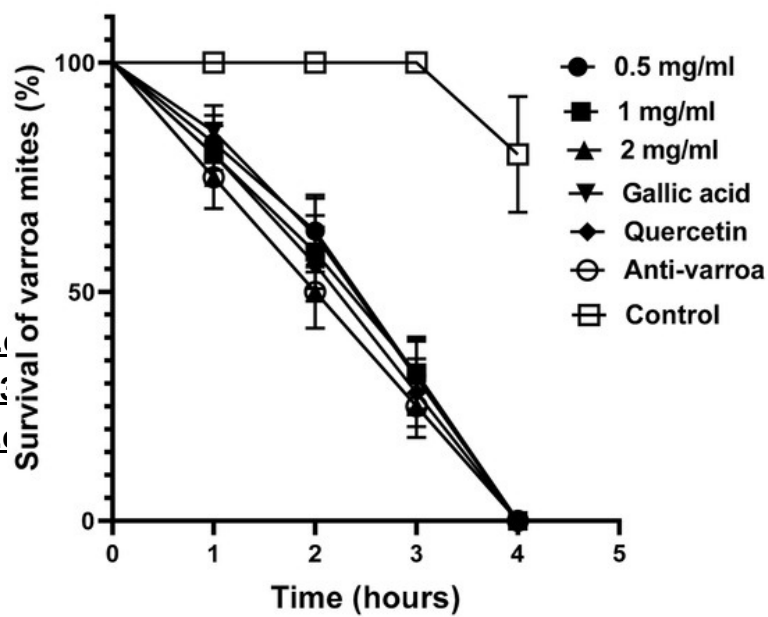
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Figure 5. Survival rates of *V. destructor* after treatment with the four different plant extracts from *Salvia officinalis* (**A**), *Marrubium vulgare* (**B**), *Ruta graveolens* (**C**), and *Opuntia ficus-indica* (**D**), at three concentrations of 0.5 mg/mL, 1 mg/mL, and 2 mg/mL by the drip method. Data are presented as mean $\pm$ standard error of the mean (SEM).

The acaricidal efficacy of four plant extracts—SO, MV, RG, and OFI—against *V. destructor* was assessed in vitro using the drip method at three concentrations (0.5, 1, and 2 mg/mL) over a 4-h exposure period, with Abbott's formula applied to correct for natural

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4. Discussion

The present study evaluated the acaricidal efficacy of four plant extracts—SO, MV, RG, and OFI—against *V. destructor*, and their safety toward adult *A. mellifera* workers through three treatment methods (paper, drip and spraying). Plant-derived products are increasingly considered promising alternatives to synthetic varroacides because of their biodegradability, lower environmental persistence, and diverse bioactive compounds [33,34]. However, their potential for sustainable *Varroa destructor* management should be assessed not only in terms of acaricidal efficacy but also regarding their safety to honey bees and compatibility with apicultural practices [35]. Therefore, evaluating both mite control and host safety is essential for identifying effective and environmentally sustainable botanical treatments.

Total phenolic content (TPC) varied markedly across the studied species, reflecting significant species-specific differences in the capacity for secondary metabolite accumulation. RG leaves exhibited the highest TPC, indicating a superior capacity for phenolic biosynthesis relative to the other species. Phenolic compounds, key plant secondary metabolites, are widely recognized for their roles in defense mechanisms, stress adaptation, and antioxidant protection [36]. Across all tested extracts, important DPPH radical scavenging activity was recorded, lending support to their exploitation as natural antioxidant resources. This antiradical potential is predominantly governed by polyphenolic constituents, which serve as proficient electron or hydrogen atom donors capable of neutralizing reactive oxygen species (ROS) and consequently reducing oxidative injury [37]. The absence of a strict

correspondence between DPPH radical scavenging activity and TPC across the studied extracts points to the likely involvement of synergistic interactions among phenolics and co-occurring phytochemicals, such as carotenoids, terpenoids, vitamins, and other reductants. The synergistic effects, increasingly documented in the literature, are now regarded as critical modulators of the global antioxidant response in plant matrices, thereby explaining the recurrently observed inadequacy of TPC as a standalone biomarker of antioxidant efficacy [36]. The remarkable antioxidant potential demonstrated by the investigated species substantiates the increasing scientific interest in phenolic-rich plant-derived resources as promising natural alternatives for integration into nutraceutical and pharmaceutical formulations aimed at alleviating oxidative stress-related disorders [38].

The results revealed pronounced differences among the tested extracts and application methods, demonstrating that both concentration and exposure route are critical factors influencing the efficacy and toxicity of botanical products used for *Varroa* control. Among the tested extracts, SO extract exhibited the highest toxicity. Significant mortality was observed across all application methods, particularly following drip application, where survival rates declined sharply within 48 h. The significant dose-dependent trends detected in all exposure routes indicate that toxicity increased with concentration. These findings are consistent with previous reports demonstrating the toxicity of certain botanical aqueous infusions to honey bees. For instance, the incorporation of tansy (*Tanacetum vulgare* L.), greater celandine (*Chelidonium majus* L.), and coriander (*Coriandrum sativum* L.) infusions into the diet of honey bees resulted in a significant reduction in survival rate compared with the control group ($p < 0.05$), highlighting the potential adverse effects of plant-derived preparations on bee longevity [39]. The higher mortality observed in the drip assay suggests that plant bioactive compounds penetrate the cuticle more efficiently, resulting in greater physiological disruption [40,41].

In contrast, MV extract exhibited a notably benign safety profile. Honey bee survival consistently exceeded 95% across all tested concentrations and exposure routes, and neither survival analyses nor trend-based statistical tests revealed any significant treatment-related effects. These results indicate that the bioactive constituents of MV are either inherently non-toxic to honey bees or are effectively detoxified through their endogenous metabolic and detoxification pathways. Honey bees possess detoxification pathways involving cytochrome P450 monooxygenases, glutathione-S-transferases, and other enzymatic systems that contribute to the neutralization of plant secondary metabolites [42]. Previous studies have demonstrated that certain botanical extracts can be administered to honey bees without inducing measurable effects on adult survival, provided that exposure levels remain within biologically relevant thresholds [40]. Accordingly, MV extract emerges as a promising candidate for further investigation and potential development as a bee-compatible botanical product.

The toxicity profile of the RG extract exhibited a more complex pattern. Although no mortality was observed during the initial hours post-exposure, marked mortality

24–48 h, particularly under the spraying application. Notably, the highest mortality was recorded at the intermediate concentration (1 mg/mL), which resulted in complete mortality at 48 h, whereas the highest tested concentration induced comparatively lower mortality levels. The non-monotonic dose–response relationships observed in RG extract could be attributed to hormetic responses or antagonistic interactions among phytochemicals [43]. In addition, plant extracts represent complex mixtures of bioactive compounds whose interactions may alter toxicity at different concentrations, resulting in nonlinear biological responses.

OFI displayed comparatively weak toxic activity, as evidenced by high survival rates (80–100%) across all treatments and minimal mortality even at the maximum tested concentration. Although significant differences among groups were detected in the paper and drip assays, the absence of a clear concentration–response relationship in the paper treatment suggests that the observed effects may reflect minor biological variability rather than substantial toxicological impacts. These findings are consistent with previous studies reporting that certain plant-derived products can induce statistically significant responses without causing biologically meaningful reductions in honey bee survival [44], suggesting that OFI extract poses a relatively low acute risk to adult honey bees under laboratory conditions.

The present study demonstrates strong acaricidal activity of the four plant extracts against *V. destructor*, with 100% mortality achieved at all tested concentrations (0.5, 1, and 2 mg/mL) within 4 h using the drip application method. These findings support the growing evidence highlighting plant-derived compounds as promising alternatives to synthetic acaricides in apicultural pest management [13,45]. Kaplan–Meier survival analysis, using the log-rank (Mantel–Cox) and Gehan–Breslow–Wilcoxon tests, was used to assess the effects of extract concentration on *V. destructor* survival. The concordance between these complementary tests highlights the rapid and pronounced acaricidal activity of the investigated plant extracts. The consistency of the results obtained with both tests reinforces the statistical robustness of the mortality response.

A particularly significant observation was the distinct dose–response profiles exhibited by the evaluated plant extracts. In the cases of SO and RG, no statistically significant concentration-dependent effect was detected. This absence of a measurable dose–response relationship suggests that the lowest tested concentration (0.5 mg/mL) was already sufficient to achieve maximal biological efficacy, likely surpassing the lethal threshold for *V. destructor* across all concentrations investigated. Such a response pattern is consistent with a saturation or ceiling effect, whereby further increases in concentration do not result in enhanced biological activity. Similar phenomena have been reported for essential oil constituents such as thujone and camphor, major bioactive compounds of *S. officinalis*, are known to affect nervous system function through neuroactive mechanisms, including acetylcholinesterase inhibition, thereby contributing to their acaricidal activity [46,47]. In contrast, MV displayed a modest but statistically significant concentration-dependent response, indicating that increases in extract concentration contributed to enhanced acaricidal activity. A stronger dose–response relationship was observed for OFI, which exhibited the highest

dependency among all tested extracts. The pronounced gradient in efficacy recorded for OFI extract suggests that its active constituents may possess lower intrinsic toxicity toward *V. destructor* compared with those present in the other botanical extracts. Consequently, higher concentrations appear necessary to achieve comparable mortality levels, resulting in a more clearly defined dose-dependent response. This pattern may also reflect differences in the abundance, potency, or bioavailability of the bioactive compounds responsible for the observed acaricidal effects. This observation is mechanistically plausible, as OFI flowers are characterized by a predominance of flavonoid glycosides and betalains [48]. The hydrophilic nature of these metabolites may constrain their diffusion across the lipophilic cuticular barrier of arthropods, resulting in reduced uptake at lower doses and necessitating higher concentrations to achieve optimal acaricidal activity [49].

The inclusion of quercetin and gallic acid as reference phytochemicals—both inducing 100% mite mortality across all tested concentrations within 4 h—provides important mechanistic insight into the observed acaricidal activity. Quercetin, a widely distributed flavonol occurring in numerous plant taxa, has been reported the accumulation of reactive oxygen species (ROS) in neural tissue, specifically in the nerve ring and ventral nerve cord in several nematode species [50]. Similarly, gallic acid, a phenolic acid recognized for its pro-oxidant properties under biological conditions, induced marked tegumental damage in *Schistosoma mansoni* [51]. These antiparasitic effects, including oxidative stress induction, activation of apoptotic pathways, and impairment of membrane integrity, are particularly pertinent to *Varroa destructor*, as this mite depends on similar structural and metabolic mechanisms to maintain cellular homeostasis and ensure survival [52]. The ability of both compounds to reproduce the 100% mortality observed with the crude extracts provides strong evidence that the acaricidal activity of SO, MV, RG, and OFI is, at least in part, attributable to their phenolic fraction. This interpretation is consistent with the well-documented phytochemical composition of these species, which are characterized by richness in bioactive phenolic compounds with known pro-oxidant properties.

Study Limitations

Although the present study provides valuable insights into the acaricidal potential of selected plant extracts against *V. destructor* and their acute toxicity toward *Apis mellifera*, several limitations should be acknowledged. First, all experiments were conducted under controlled laboratory conditions, which may not fully reproduce the complex environmental and behavioral interactions occurring within honey bee colonies. Consequently, the efficacy and safety observed in vitro may differ under field conditions. Second, the assessment of bee toxicity was limited to short-term survival over a 48-h period. Potential sublethal effects on bee physiology, behavior, learning ability, foraging activity, brood development, and colony performance were not investigated. Such effects could influence colony health even in the absence of significant mortality. Third, although the extracts exhibited strong acaricidal activity, the specific bioactive compounds responsible for these effects were not identified.

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Further phytochemical characterization and bioassay-guided fractionation are required to determine the compounds involved and to elucidate their mechanisms of action. Finally, only a limited range of concentrations and application methods were evaluated. Additional studies involving broader dose ranges, repeated exposures, and colony-level assessments are necessary to optimize treatment protocols and establish the practical applicability of these botanical extracts in integrated varroosis management programs.

5. Conclusions

This study demonstrated that extracts of SO, MV, RG, and OFI possess strong acaricidal activity against *V. destructor*, achieving complete mite mortality within 4 h at all tested concentrations. However, significant differences were observed in their effects on *Apis mellifera*. While SO and MV exhibited a lesser impact, RG extract showed notable toxicity depending on the application method, MV and OFI extract exhibited high acaricidal efficacy combined with low toxicity toward honey bees. These findings highlight MV and OFI extracts as promising candidates for the development of sustainable botanical alternatives for varroosis control. Further field studies are needed to confirm their efficacy and safety under colony conditions and to identify the compounds responsible for their biological activity.

Author Contributions

A.A. designed, supervised the experimental study, participated in parasitological in vitro and wrote the manuscript. E.-H.B. provided technical assistance during the experimental work and reviewed the manuscript. K.I. contributed in technical assistance. M.A.-A. carried out the plant extraction and antioxidant activity. M.A. and A.M. participated in parasitological in vitro. N.B.D. participated in statistical analysis and reviewed the manuscript. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

Not applicable. Bioethical approval was not required for the use of invertebrate animal groups considered in this study.

Informed Consent Statement

Not applicable.

Data Availability Statement

The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author. [Order Article Reprints \(/2673-6772/6/5/51/reprint\)](#) [\(https://toggle_desktop_layout_cookie\)](#) [Q](#) [≡](#)

Conflicts of Interest

The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

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SO *Salvia officinalis*
 MV *Marrubium vulgare*
 RG *Ruta graveolens*
 OFI *Opuntia ficus-indica*
 TPC Determination of Total Phenolic Content
 GAE gallic acid equivalents
 DW dry weight
 DPPH 1,1-diphenyl-2-picrylhydrazyl
 TPC total phenolic content
 ROS reactive oxygen species

References

1. Terefe, T. Practices and challenges of beekeeping in Chiro District of West Hararghe Zone, Eastern Oromia, Ethiopia. *East Afr. J. Sci.* **2018**, *12*, 127–136. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Practices+and+challenges+of+beekeeping+in+Chiro+District+of+West+Har+arghe+Zone,+Eastern+Oromia,+Ethiopia&author=Terefe,+T.&publication_year=2018&journal=East+Afr.+J.+Sci.&volume=12&pages=127%E2%80%93136)]
2. Fikadu, Z. The contribution of managed honey bees to crop pollination, food security, and economic stability: Case of Ethiopia. *Open Agric. J.* **2019**, *13*, 175–181. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=The+contribution+of+managed+honey+bees+to+crop+pollination,+food+se+curity,+and+economic+stability:+Case+of+Ethiopia&author=Fikadu,+Z.&publicat+ion_year=2019&journal=Open+Agric.+J.&volume=13&pages=175%E2%80%93181&doi=10.2174/1874331501913010175)] [CrossRef] (<https://doi.org/10.2174/1874331501913010175>)] [Scilit] (<https://www.scilit.com/publications/f9898e7d0fb676ff7b3601aabeaa51dc>)]



Adilane, N.; Doumandji, S.E.; Haddad, N. Situation de l'apiculture en Algérie: Facteurs menaçant la survie des colonies d'abeilles locales *Apis mellifera intermissa*. *Cah. Agric.* **2012**, *21*, 235–241. [Google Scholar]

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[80%93241\)\]](https://scholar.google.com/scholar_lookup?title=Situation+de+l%E2%80%99apiculture+en+Alg%C3%A9rie:+Facteurs+mena%C3%A7ant+la+survie+des+colonies+d%E2%80%99abeilles+locales+Apis+mellifera+intermissa&author=Adilane,+N.&author=Doumandji,+S.E.&author=Haddad,+N.&publication_year=2012&journal=Cah.+Agric.&volume=21&pages=235%E2%80%93241)

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SciProfiles

4. Potts, S.G.; Roberts, S.P.; Dean, R.; Marris, G.; Brown, M.A.; Jones, R.; Neumann, P.; Settele, J. Declines of managed honey bees and beekeepers in Europe. *J. Apic. Res.* **2010**, *49*, 15–22. [Google Scholar] ([https://scholar.google.com/scholar_lookup?](https://scholar.google.com/scholar_lookup?title=Declines+of+managed+honey+bees+and+beekeepers+in+Europe&author=Potts,+S.G.&author=Roberts,+S.P.&author=Dean,+R.&author=Marris,+G.&author=Brown,+M.A.&author=Jones,+R.&author=Neumann,+P.&author=Settele,+J.&publication_year=2010&journal=J.+Apic.+Res.&volume=49&pages=15%E2%80%9322&doi=10.3896/ibra.1.49.1.02)

[title=Declines+of+managed+honey+bees+and+beekeepers+in+Europe&author=P](https://scholar.google.com/scholar_lookup?title=Declines+of+managed+honey+bees+and+beekeepers+in+Europe&author=Potts,+S.G.&author=Roberts,+S.P.&author=Dean,+R.&author=Marris,+G.&author=Brown,+M.A.&author=Jones,+R.&author=Neumann,+P.&author=Settele,+J.&publication_year=2010&journal=J.+Apic.+Res.&volume=49&pages=15%E2%80%9322&doi=10.3896/ibra.1.49.1.02)

[otts,+S.G.&author=Roberts,+S.P.&author=Dean,+R.&author=Marris,+G.&author=](https://scholar.google.com/scholar_lookup?title=Declines+of+managed+honey+bees+and+beekeepers+in+Europe&author=Potts,+S.G.&author=Roberts,+S.P.&author=Dean,+R.&author=Marris,+G.&author=Brown,+M.A.&author=Jones,+R.&author=Neumann,+P.&author=Settele,+J.&publication_year=2010&journal=J.+Apic.+Res.&volume=49&pages=15%E2%80%9322&doi=10.3896/ibra.1.49.1.02)

[Brown,+M.A.&author=Jones,+R.&author=Neumann,+P.&author=Settele,+J.&publi](https://scholar.google.com/scholar_lookup?title=Declines+of+managed+honey+bees+and+beekeepers+in+Europe&author=Potts,+S.G.&author=Roberts,+S.P.&author=Dean,+R.&author=Marris,+G.&author=Brown,+M.A.&author=Jones,+R.&author=Neumann,+P.&author=Settele,+J.&publication_year=2010&journal=J.+Apic.+Res.&volume=49&pages=15%E2%80%9322&doi=10.3896/ibra.1.49.1.02)

[cation_year=2010&journal=J.+Apic.+Res.&volume=49&pages=15%E2%80%9322](https://scholar.google.com/scholar_lookup?title=Declines+of+managed+honey+bees+and+beekeepers+in+Europe&author=Potts,+S.G.&author=Roberts,+S.P.&author=Dean,+R.&author=Marris,+G.&author=Brown,+M.A.&author=Jones,+R.&author=Neumann,+P.&author=Settele,+J.&publication_year=2010&journal=J.+Apic.+Res.&volume=49&pages=15%E2%80%9322&doi=10.3896/ibra.1.49.1.02)

[&doi=10.3896/ibra.1.49.1.02\)\] \[CrossRef \(<https://doi.org/10.3896/ibra.1.49.1.02>\)\]](https://scholar.google.com/scholar_lookup?title=Declines+of+managed+honey+bees+and+beekeepers+in+Europe&author=Potts,+S.G.&author=Roberts,+S.P.&author=Dean,+R.&author=Marris,+G.&author=Brown,+M.A.&author=Jones,+R.&author=Neumann,+P.&author=Settele,+J.&publication_year=2010&journal=J.+Apic.+Res.&volume=49&pages=15%E2%80%9322&doi=10.3896/ibra.1.49.1.02)

[\[Scilit \(<https://www.scilit.com/publications/8311136c90e6905f41784a23ca922c69>\)\]](https://scholar.google.com/scholar_lookup?title=Declines+of+managed+honey+bees+and+beekeepers+in+Europe&author=Potts,+S.G.&author=Roberts,+S.P.&author=Dean,+R.&author=Marris,+G.&author=Brown,+M.A.&author=Jones,+R.&author=Neumann,+P.&author=Settele,+J.&publication_year=2010&journal=J.+Apic.+Res.&volume=49&pages=15%E2%80%9322&doi=10.3896/ibra.1.49.1.02)

5. Hristov, P.; Shumkova, R.; Palova, N.; Neov, B. Factors associated with honey bee colony losses: A mini-review. *Vet. Sci.* **2020**, *7*, 166. [Google Scholar] ([https://scholar.google.com/scholar_lookup?](https://scholar.google.com/scholar_lookup?title=Factors+associated+with+honey+bee+colony+losses:+A+mini-review&author=Hristov,+P.&author=Shumkova,+R.&author=Palova,+N.&author=Neov,+B.&publication_year=2020&journal=Vet.+Sci.&volume=7&pages=166&doi=10.3390/vetsci7040166&pmid=33143134)

[title=Factors+associated+with+honey+bee+colony+losses:+A+mini-](https://scholar.google.com/scholar_lookup?title=Factors+associated+with+honey+bee+colony+losses:+A+mini-review&author=Hristov,+P.&author=Shumkova,+R.&author=Palova,+N.&author=Neov,+B.&publication_year=2020&journal=Vet.+Sci.&volume=7&pages=166&doi=10.3390/vetsci7040166&pmid=33143134)

[review&author=Hristov,+P.&author=Shumkova,+R.&author=Palova,+N.&author=](https://scholar.google.com/scholar_lookup?title=Factors+associated+with+honey+bee+colony+losses:+A+mini-review&author=Hristov,+P.&author=Shumkova,+R.&author=Palova,+N.&author=Neov,+B.&publication_year=2020&journal=Vet.+Sci.&volume=7&pages=166&doi=10.3390/vetsci7040166&pmid=33143134)

[Neov,+B.&publication_year=2020&journal=Vet.+Sci.&volume=7&pages=166&doi](https://scholar.google.com/scholar_lookup?title=Factors+associated+with+honey+bee+colony+losses:+A+mini-review&author=Hristov,+P.&author=Shumkova,+R.&author=Palova,+N.&author=Neov,+B.&publication_year=2020&journal=Vet.+Sci.&volume=7&pages=166&doi=10.3390/vetsci7040166&pmid=33143134)

[=10.3390/vetsci7040166&pmid=33143134\)\] \[CrossRef](https://scholar.google.com/scholar_lookup?title=Factors+associated+with+honey+bee+colony+losses:+A+mini-review&author=Hristov,+P.&author=Shumkova,+R.&author=Palova,+N.&author=Neov,+B.&publication_year=2020&journal=Vet.+Sci.&volume=7&pages=166&doi=10.3390/vetsci7040166&pmid=33143134)

[\(https://doi.org/10.3390/vetsci7040166\)\] \[Scilit](https://scholar.google.com/scholar_lookup?title=Factors+associated+with+honey+bee+colony+losses:+A+mini-review&author=Hristov,+P.&author=Shumkova,+R.&author=Palova,+N.&author=Neov,+B.&publication_year=2020&journal=Vet.+Sci.&volume=7&pages=166&doi=10.3390/vetsci7040166&pmid=33143134)

[\(https://www.scilit.com/publications/c1fdea8c360ac97434d317cdcbe1d943\)\]](https://scholar.google.com/scholar_lookup?title=Factors+associated+with+honey+bee+colony+losses:+A+mini-review&author=Hristov,+P.&author=Shumkova,+R.&author=Palova,+N.&author=Neov,+B.&publication_year=2020&journal=Vet.+Sci.&volume=7&pages=166&doi=10.3390/vetsci7040166&pmid=33143134)

[\[PubMed \(<https://www.ncbi.nlm.nih.gov/pubmed/33143134>\)\]](https://scholar.google.com/scholar_lookup?title=Factors+associated+with+honey+bee+colony+losses:+A+mini-review&author=Hristov,+P.&author=Shumkova,+R.&author=Palova,+N.&author=Neov,+B.&publication_year=2020&journal=Vet.+Sci.&volume=7&pages=166&doi=10.3390/vetsci7040166&pmid=33143134)

6. Sammataro, D.; Gerson, U.; Needham, G. Parasitic mites of honey bees: Life history, implications, and impact. *Annu. Rev. Entomol.* **2000**, *45*, 519–548. [Google Scholar] ([https://scholar.google.com/scholar_lookup?](https://scholar.google.com/scholar_lookup?title=Parasitic+mites+of+honey+bees:+Life+history,+implications,+and+impact&author=Sammataro,+D.&author=Gerson,+U.&author=Needham,+G.&publication_year=2000&journal=Annu.+Rev.+Entomol.&volume=45&pages=519%E2%80%93548&doi=10.1146/annurev.ento.45.1.519&pmid=10761588)

[title=Parasitic+mites+of+honey+bees:+Life+history,+implications,+and+impact&](https://scholar.google.com/scholar_lookup?title=Parasitic+mites+of+honey+bees:+Life+history,+implications,+and+impact&author=Sammataro,+D.&author=Gerson,+U.&author=Needham,+G.&publication_year=2000&journal=Annu.+Rev.+Entomol.&volume=45&pages=519%E2%80%93548&doi=10.1146/annurev.ento.45.1.519&pmid=10761588)

[author=Sammataro,+D.&author=Gerson,+U.&author=Needham,+G.&publication_](https://scholar.google.com/scholar_lookup?title=Parasitic+mites+of+honey+bees:+Life+history,+implications,+and+impact&author=Sammataro,+D.&author=Gerson,+U.&author=Needham,+G.&publication_year=2000&journal=Annu.+Rev.+Entomol.&volume=45&pages=519%E2%80%93548&doi=10.1146/annurev.ento.45.1.519&pmid=10761588)

[year=2000&journal=Annu.+Rev.+Entomol.&volume=45&pages=519%E2%80%93548](https://scholar.google.com/scholar_lookup?title=Parasitic+mites+of+honey+bees:+Life+history,+implications,+and+impact&author=Sammataro,+D.&author=Gerson,+U.&author=Needham,+G.&publication_year=2000&journal=Annu.+Rev.+Entomol.&volume=45&pages=519%E2%80%93548&doi=10.1146/annurev.ento.45.1.519&pmid=10761588)

[&doi=10.1146/annurev.ento.45.1.519&pmid=10761588\)\] \[CrossRef](https://scholar.google.com/scholar_lookup?title=Parasitic+mites+of+honey+bees:+Life+history,+implications,+and+impact&author=Sammataro,+D.&author=Gerson,+U.&author=Needham,+G.&publication_year=2000&journal=Annu.+Rev.+Entomol.&volume=45&pages=519%E2%80%93548&doi=10.1146/annurev.ento.45.1.519&pmid=10761588)

[\(https://doi.org/10.1146/annurev.ento.45.1.519\)\] \[Scilit](https://scholar.google.com/scholar_lookup?title=Parasitic+mites+of+honey+bees:+Life+history,+implications,+and+impact&author=Sammataro,+D.&author=Gerson,+U.&author=Needham,+G.&publication_year=2000&journal=Annu.+Rev.+Entomol.&volume=45&pages=519%E2%80%93548&doi=10.1146/annurev.ento.45.1.519&pmid=10761588)

[\(https://www.scilit.com/publications/1791dab392af93296a8184055b75f8b3\)\]](https://scholar.google.com/scholar_lookup?title=Parasitic+mites+of+honey+bees:+Life+history,+implications,+and+impact&author=Sammataro,+D.&author=Gerson,+U.&author=Needham,+G.&publication_year=2000&journal=Annu.+Rev.+Entomol.&volume=45&pages=519%E2%80%93548&doi=10.1146/annurev.ento.45.1.519&pmid=10761588)

[\[PubMed \(<https://www.ncbi.nlm.nih.gov/pubmed/10761588>\)\]](https://scholar.google.com/scholar_lookup?title=Parasitic+mites+of+honey+bees:+Life+history,+implications,+and+impact&author=Sammataro,+D.&author=Gerson,+U.&author=Needham,+G.&publication_year=2000&journal=Annu.+Rev.+Entomol.&volume=45&pages=519%E2%80%93548&doi=10.1146/annurev.ento.45.1.519&pmid=10761588)



Nazzi, F.; Le Conte, Y. Ecology of *Varroa destructor*, the major ectoparasite of the western honey bee, *Apis mellifera*. *Annu. Rev. Entomol.* **2016**, *61*, 417–432. [Google

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oney+bee,+Apis+mellifera&author=Nazzi,+F.&author=Le+Conte,+Y.&publication_

■ ■

year=2016&journal=Annu.+Rev.+Entomol.&volume=61&pages=417%E2%80%934

Cite

32&doi=10.1146/annurev-ento-010715-023731&pmid=26667378)] [CrossRef

.(https://doi.org/10.1146/annurev-ento-010715-023731)] [Scilit

(<https://www.scilit.com/publications/c6e23389a9c0440eec316dd7156b0415>)]

SciProfiles

PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/26667378>)

(<https://sciprofiles.com/discussion->

8. Ramsey, S.D.; Ochoa, R.; Bauchner, H.; Gulbranson, C.; Mowery, J.D.; Cohen, A.; Lim, groups/public/10.3390/parasitologia6050051?&open_access=1

utm_source=mpd.com&utm_medium=publication&utm_campaign=discuss+primarily+on+science+by

bee fat body tissue and not hemolymph. *Proc. Natl. Acad. Sci. USA* **2019**, *116*, 1792–

1801. [Google Scholar (https://scholar.google.com/scholar_lookup?

title=Varroa+destructor+feeds+primarily+on+honey+bee+fat+body+tissue+and+

not+hemolymph&author=Ramsey,+S.D.&author=Ochoa,+R.&author=Bauchan,+G

.&author=Gulbronson,+C.&author=Mowery,+J.D.&author=Cohen,+A.&author=Li

m,+D.&author=Joklik,+J.&author=Cicero,+J.M.&author=Ellis,+J.D.&author=et+al.

&publication_year=2019&journal=Proc.+Natl.+Acad.+Sci.+USA&volume=116&pa

ges=1792%E2%80%93931801&doi=10.1073/pnas.1818371116&pmid=30647116)]

[CrossRef] (<https://doi.org/10.1073/pnas.1818371116>) [Scilit]

(<https://www.scilit.com/publications/b0dfca8cf7f4238279533baadf8c860b>)

[PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/30647116>)]

9. Rinkevich, F.D.; Danka, R.G.; Healy, K.B. Influence of *Varroa* mite (*Varroa destructor*) management practices on insecticide sensitivity in the honey bee (*Apis mellifera*). *Insects* **2017**, *8*, 9. [Google Scholar ([https://scholar.google.com/scholar_lookup?title=Influence+of+Varroa+mite+\(Varroa+destructor\)+management+practices+on+insecticide+sensitivity+in+the+honey+bee+\(Apis+mellifera\)&author=Rinkevich,+F.D.&author=Danka,+R.G.&author=Healy,+K.B.&publication_year=2017&journal=Insects&volume=8&pages=9&doi=10.3390/insects8010009&pmid=28085045](https://scholar.google.com/scholar_lookup?title=Influence+of+Varroa+mite+(Varroa+destructor)+management+practices+on+insecticide+sensitivity+in+the+honey+bee+(Apis+mellifera)&author=Rinkevich,+F.D.&author=Danka,+R.G.&author=Healy,+K.B.&publication_year=2017&journal=Insects&volume=8&pages=9&doi=10.3390/insects8010009&pmid=28085045))] [CrossRef (<https://doi.org/10.3390/insects8010009>)] [Scilit (<https://www.scilit.com/publications/4c929abd3d1d127a4410137095794014>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/28085045>)]



Peck, D.T.; Smith, M.L.; Seeley, T.D. *Varroa destructor* mites can nimbly climb from flowers onto foraging honey bees. *PLoS ONE* **2016**, *11*, e0167798. [Google Scholar]

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(https://scholar.google.com/scholar_lookup?title=Varroa+destructor+mites+can+nimbly+climb+from+flowers+onto+foraging+honey+bees&author=Peck,+D.T.&author=Smith,+M.L.&author=Seeley,+T.D.&publication_year=2016&journal=PLoS+ONE&volume=11&pages=e0167798&doi=10.1371/journal.pone.0167798&pmid=27942015) [CrossRef]

(<https://doi.org/10.1371/journal.pone.0167798>) [Scilit]

(<https://www.scilit.com/publications/84273736b5eb985a18adbb61cf29e079>)

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PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/27942015>)

([https://sciprofiles.com/discussion-](https://sciprofiles.com/discussion-groups/public/10.3390/parasitologia60500519)

<https://sciprofiles.com/discussion-groups/public/10.3390/parasitologia60500519>

11. Lester, P.J. Integrated resistance management for acaricide use on *Varroa destructor*. *Front. Bee. Sci.* **2023**, *1*, 1297326. [Google Scholar]

(https://scholar.google.com/scholar_lookup?title=Integrated+resistance+management+for+acaricide+use+on+Varroa+destructor&author=Lester,+P.J.&publication_year=2023&journal=Front.+Bee+Sci.&volume=1&pages=1297326&doi=10.3389/frbee.2023.1297326) [CrossRef]

(<https://doi.org/10.3389/frbee.2023.1297326>) [Scilit]

(<https://www.scilit.com/publications/cef0ed9bad48c7e3ca54cf6ebe7b29e1>)

12. Ojagh, S.; Malekifard, F.; Yakhchali, M. In vitro study on the efficacy of *Ziziphus vulgaris* L. and *Camellia sinensis* (L.) Kuntze extracts for controlling *Varroa destructor* (Acari: Varroidae) in *Apis mellifera* (Hym.: Apidae). *Vet. Med. Sci.* **2025**, *11*, e70612.

[Google Scholar ([https://scholar.google.com/scholar_lookup?title=In+vitro+study+on+the+efficacy+of+Ziziphus+vulgaris+L.+and+Camellia+sinensis+\(L.\)+Kuntze+extracts+for+controlling+Varroa+destructor+\(Acari:+Varroidae\)+in+Apis+mellifera+\(Hym.:+Apidae\)&author=Ojagh,+S.&author=Malekifard,+F.&author=Yakhchali,+M.&publication_year=2025&journal=Vet.+Med.+Sci.&volume=11&pages=e70612&doi=10.1002/vms3.70612&pmid=40944947](https://scholar.google.com/scholar_lookup?title=In+vitro+study+on+the+efficacy+of+Ziziphus+vulgaris+L.+and+Camellia+sinensis+(L.)+Kuntze+extracts+for+controlling+Varroa+destructor+(Acari:+Varroidae)+in+Apis+mellifera+(Hym.:+Apidae)&author=Ojagh,+S.&author=Malekifard,+F.&author=Yakhchali,+M.&publication_year=2025&journal=Vet.+Med.+Sci.&volume=11&pages=e70612&doi=10.1002/vms3.70612&pmid=40944947))]

[CrossRef] (<https://doi.org/10.1002/vms3.70612>) [Scilit]

(<https://www.scilit.com/publications/361acc92d39489f79b1c985f15db9a80>)

[PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/40944947>)]

(<https://www.scilit.com/publications/361acc92d39489f79b1c985f15db9a80>)

[PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/40944947>)]

MDPI (2)
Korený, L.; Hillayová, M.K.; Škvarenina, J. Efficacy of plant-based remedies for *Varroa destructor* control in honey bee colonies: A preliminary study. *Vet. Parasitol.* **2025**, *338*, 110629. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Efficacy+of+plant-based+remedies+for+Varroa+destructor+control+in+honey+bee+colonies:+A+preliminary+study&author=Koren%C3%BD,+%C4%BD.&author=Hillayov%C3%A1,+M.K.&author=%C5%A0kvarenina,+J.&publication_year=2025&journal=Vet.+Parasitol.&volume=338&pages=110629&doi=10.1016/j.vetpar.2025.110629&pmid=41101186)] [CrossRef (<https://doi.org/10.1016/j.vetpar.2025.110629>)] [Scilit (<https://www.scilit.com/publications/9bcd60104961f58228f3cddbde76d09b8>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/41101186>)] [groups/public/10.3390/parasitologia6050051?utm_source=mdpi.com&utm_medium=publication&utm_campaign=discuss_id=Stratigakis, N.C.; Ghanotakis, D.; Katerinopoulos, H.E. From nature to synthesis and vice versa: Costic acid analogs with acaricidal activity against the bee parasite *Varroa destructor*. *Plants* **2026**, *15*, 310. [Google Scholar (https://scholar.google.com/scholar_lookup?title=From+nature+to+synthesis+and+vice+versa:+Costic+acid+analog+with+acaricidal+activity+against+the+bee+parasite+Varroa+destructor&author=Papastefanaki,+E.&author=Spyros,+A.&author=Isaakidis,+D.&author=Kallivretaki,+M.&author=Moraiti,+D.&author=Stratigakis,+N.C.&author=Ghanotakis,+D.&author=Katerinopoulos,+H.E.&publication_year=2026&journal=Plants&volume=15&pages=310&doi=10.3390/plants15020310&pmid=41600117)] [CrossRef (<https://doi.org/10.3390/plants15020310>)] [Scilit (<https://www.scilit.com/publications/4704337657d164dbc85fc53cc91a1763>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/41600117>)]

14. Papastefanaki, E.; Spyros, A.; Isaakidis, D.; Kallivretaki, M.; Moraiti, D.; Stratigakis, N.C.; Ghanotakis, D.; Katerinopoulos, H.E. From nature to synthesis and vice versa: Costic acid analogs with acaricidal activity against the bee parasite *Varroa destructor*. *Plants* **2026**, *15*, 310. [Google Scholar (https://scholar.google.com/scholar_lookup?title=From+nature+to+synthesis+and+vice+versa:+Costic+acid+analog+with+acaricidal+activity+against+the+bee+parasite+Varroa+destructor&author=Papastefanaki,+E.&author=Spyros,+A.&author=Isaakidis,+D.&author=Kallivretaki,+M.&author=Moraiti,+D.&author=Stratigakis,+N.C.&author=Ghanotakis,+D.&author=Katerinopoulos,+H.E.&publication_year=2026&journal=Plants&volume=15&pages=310&doi=10.3390/plants15020310&pmid=41600117)] [CrossRef (<https://doi.org/10.3390/plants15020310>)] [Scilit (<https://www.scilit.com/publications/4704337657d164dbc85fc53cc91a1763>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/41600117>)]

15. De Giosa, M.; Dale, A.G.; Wu, X.; Revynthi, A.M. Potential of commercial biorational and conventional pesticides to manage the *Ruelliaerinose* mite in ornamental landscapes. *Insects* **2025**, *16*, 801. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Potential+of+commercial+biorational+and+conventional+pesticides+to+manage+the+Ruelliaerinose+mite+in+ornamental+landscapes&author=De+Giosa,+M.&author=Dale,+A.G.&author=Wu,+X.&author=Revynthi,+A.M.&publication_year=2025&journal=Insects&volume=16&pages=801&doi=10.3390/insects16080801&pmid=40870602)] [CrossRef (<https://doi.org/10.3390/insects16080801>)] [Scilit (<https://www.scilit.com/publications/e647aa766e36e2c685adfe44fbcaba11>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/40870602>)]

16. De Giosa, M.; Dale, A.G.; Wu, X.; Revynthi, A.M. Potential of commercial biorational and conventional pesticides to manage the *Ruelliaerinose* mite in ornamental landscapes. *Insects* **2025**, *16*, 801. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Potential+of+commercial+biorational+and+conventional+pesticides+to+manage+the+Ruelliaerinose+mite+in+ornamental+landscapes&author=De+Giosa,+M.&author=Dale,+A.G.&author=Wu,+X.&author=Revynthi,+A.M.&publication_year=2025&journal=Insects&volume=16&pages=801&doi=10.3390/insects16080801&pmid=40870602)] [CrossRef (<https://doi.org/10.3390/insects16080801>)] [Scilit (<https://www.scilit.com/publications/e647aa766e36e2c685adfe44fbcaba11>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/40870602>)]

16. Bouaouich, A.; Bouguerche, F.; Mahiaoui, H.; Peron, G.; Bendif, H. Phytochemical elucidation and antioxidant activity of seeds from three prickly pear (*Opuntia ficus-indica* L.) cultivars from Algeria. *Appl. Sci.* **2023**, *13*, 1444. [Google Scholar] ([https://scholar.google.com/scholar_lookup?title=Phytochemical+elucidation+and+antioxidant+activity+of+seeds+from+three+prickly+pear+\(Opuntia+ficus-indica+L.\)+cultivars+from+Algeria&author=Bouaouich,+A.&author=Bouguerche,+F.&author=Mahiaoui,+H.&author=Peron,+G.&author=Bendif,+H.&publication_year=2023&journal=Appl.+Sci.&volume=13&pages=1444&doi=10.3390/app13031444](https://scholar.google.com/scholar_lookup?title=Phytochemical+elucidation+and+antioxidant+activity+of+seeds+from+three+prickly+pear+(Opuntia+ficus-indica+L.)+cultivars+from+Algeria&author=Bouaouich,+A.&author=Bouguerche,+F.&author=Mahiaoui,+H.&author=Peron,+G.&author=Bendif,+H.&publication_year=2023&journal=Appl.+Sci.&volume=13&pages=1444&doi=10.3390/app13031444)) [CrossRef] (<https://doi.org/10.3390/app13031444>) [Scilit] ([https://sciprofiles.com/discussion-\(https://www.scilit.com/publications/c7fdd84dd296807654da675c0ce5652f\)groups/public/10.3390/parasitologia6050051?utm_source=mdpi.com&utm_medium=publication&utm_campaign=discussion-compromis](https://sciprofiles.com/discussion-(https://www.scilit.com/publications/c7fdd84dd296807654da675c0ce5652f)groups/public/10.3390/parasitologia6050051?utm_source=mdpi.com&utm_medium=publication&utm_campaign=discussion-compromis))
17. Boufadi, M.Y.; Keddari, S.; Moulaï-Hacene, F.; Chaa, S. Chemical composition, antioxidant and anti-inflammatory properties of *Salvia officinalis* extract from Algeria. *Pharmacogn. J.* **2021**, *13*, 506–515. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Chemical+composition,+antioxidant+and+anti-inflammatory+properties+of+Salvia+officinalis+extract+from+Algeria&author=Boufadi,+M.Y.&author=Keddari,+S.&author=Moulaï-Hacene,+F.&author=Chaa,+S.&publication_year=2021&journal=Pharmacogn.+J.&volume=13&pages=506%E2%80%93515&doi=10.5530/pj.2021.13.64) [CrossRef] (<https://doi.org/10.5530/pj.2021.13.64>) [Scilit] (<https://www.scilit.com/publications/bf0f032572032bc62d15db4e1e686822>)
18. Rached, S.; Imtara, H.; Habsaoui, A.; Mzioud, K.; Haida, S.; Saleh, A.; El Fartah, S.; Al Kamaly, O.; Alahdab, A.; Parvez, M.K.; et al. Characterization, chemical compounds and biological activities of *Marrubium vulgare* L. essential oil. *Processes* **2022**, *10*, 2110. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Characterization,+chemical+compounds+and+biological+activities+of+Marrubium+vulgare+L.+essential+oil&author=Rached,+S.&author=Imtara,+H.&author=Habsaoui,+A.&author=Mzioud,+K.&author=Haida,+S.&author=Saleh,+A.&author=El+Fartah,+S.&author=Al+Kamaly,+O.&author=Alahdab,+A.&author=Parvez,+M.K.&author=et+al.&publication_year=2022&journal=Processes&volume=10&pages=2110&doi=10.3390/pr10102110) [CrossRef] (<https://doi.org/10.3390/pr10102110>) [Scilit] (<https://www.scilit.com/publications/fdcfbfcd7c21d6be8612c37f400fafa3>)

Mokhtar, M.; Youcefi, F.; Keddari, S.; Saimi, Y.; Otsmane-Elhaou, S.; Cacciola, F. Phenolic content and in vitro antioxidant, anti-inflammatory and antimicrobial evaluation of Algerian *Ruta graveolens* L. *Chem. Biodivers.* **2022**, *19*, e202200545. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Phenolic+content+and+in+vitro+antioxidant,+anti-inflammatory+and+antimicrobial+evaluation+of+Algerian+Ruta+graveolens+L.&author=Mokhtar,+M.&author=Youcefi,+F.&author=Keddari,+S.&author=Saimi,+Y.&author=Otsmane+Elhaou,+S.&author=Cacciola,+F.&publication_year=2022&journal=Chem.+Biodivers.&volume=19&pages=e202200545&doi=10.1002/cbdv.202200545&pmid=35866461)] [CrossRef (https://doi.org/10.1002/cbdv.202200545)] [Scilit (https://sciprofiles.com/discussion-groups/public/10.3390/parasitologia6050051?utm_source=mpdi.com&utm_medium=publication&utm_campaign=discuss_in_sciprofiles)] [PubMed (https://www.ncbi.nlm.nih.gov/pubmed/35866461)]

20. Abbad, S.; Aissaoui, N.; Gana, F.Z. *Marrubium vulgare* leaf extract-assisted green synthesis of silver nanoparticles: Optimization, characterization and in vitro exploration of their antimicrobial, antioxidant and anti-inflammatory potential. *Pharmacogn. J.* **2025**, *17*, 7–21. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Marrubium+vulgare+leaf+extract-assisted+green+synthesis+of+silver+nanoparticles:+Optimization,+characterization+and+in+vitro+exploration+of+their+antimicrobial,+antioxidant+and+anti-inflammatory+potential&author=Abbad,+S.&author=Aissaoui,+N.&author=Gana,+F.Z.&publication_year=2025&journal=Pharmacogn.+J.&volume=17&pages=7%E2%80%9321&doi=10.5530/pj.2025.17.2)] [CrossRef (https://doi.org/10.5530/pj.2025.17.2)] [Scilit (https://www.scilit.com/publications/36f17350075f78b89796784f9850d66e)]
21. Benramdane, E.; Chougui, N.; Ramos, P.A.; Makhloufi, N.; Tamendjari, A.; Silvestre, A.J.D.; Santos, S.A.O. Lipophilic compounds and antibacterial activity of *Opuntia ficus-indica* root extracts from Algeria. *Int. J. Mol. Sci.* **2022**, *23*, 11161. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Lipophilic+compounds+and+antibacterial+activity+of+Opuntia+ficus-indica+root+extracts+from+Algeria&author=Benramdane,+E.&author=Chougui,+N.&author=Ramos,+P.A.&author=Makhloufi,+N.&author=Tamendjari,+A.&author=Silvestre,+A.J.D.&author=Santos,+S.A.O.&publication_year=2022&journal=Int.+J.+Mol.+Sci.&volume=23&pages=11161&doi=10.3390/ijms231911161&pmid=36232458)] [CrossRef (https://doi.org/10.3390/ijms231911161)] [Scilit (https://www.scilit.com/publications/084764a55fcb308ef6016f9613706d62)] [PubMed (https://www.ncbi.nlm.nih.gov/pubmed/36232458)]

- MDPI (Open Access) Ammam, A.; Zemour, H.; Kaid, M.H.; Villemin, D.; Soufan, W.; Belhouadjeb, F.A. Assessment of the anti-inflammatory and analgesic effects of *Opuntia ficus-indica* L. cladodes extract. *Libyan J. Med.* **2023**, *18*, 2275417. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Assessment+of+the+anti-inflammatory+and+analgesic+effects+of+Opuntia+ficus-indica+L.+cladodes+extract&author=Ammam,+A.&author=Zemour,+H.&author=Kaid,+M.H.&author=Villemin,+D.&author=Soufan,+W.&author=Belhouadjeb,+F.A.&publication_year=2023&journal=Libyan+J.+Med.&volume=18&pages=2275417&doi=10.1080/19932820.2023.2275417&pmid=37905304)] [CrossRef] (<https://doi.org/10.1080/19932820.2023.2275417>)] [Scilit] ([https://sciprofiles.com/discussion-\(https://www.scilit.com/publications/ab2e8f866202582a393ef834e990ce31\)groups/public/10.3390/parasitologia6050051?utm_source=mpdf.com&utm_medium=publication&utm_campaign=discuss_in_sciprofiles\)](https://sciprofiles.com/discussion-(https://www.scilit.com/publications/ab2e8f866202582a393ef834e990ce31)groups/public/10.3390/parasitologia6050051?utm_source=mpdf.com&utm_medium=publication&utm_campaign=discuss_in_sciprofiles)))] PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/37905304>)]
23. Ladjel-Mendil, A.; Laraba-Djebari, F. Antioxidant and anti-inflammatory properties of essential oils of *Salvia officinalis* on immunopathological effects induced by scorpion envenomation. *Alger. J. Health Sci.* **2020**, *2*, 15–24. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Antioxidant+and+anti-inflammatory+properties+of+essential+oils+of+Salvia+officinalis+on+immunopathological+effects+induced+by+scorpion+envenomation&author=Ladjel-Mendil,+A.&author=Laraba-Djebari,+F.&publication_year=2020&journal=Alger.+J.+Health+Sci.&volume=2&pages=15%E2%80%9324)]
24. Moussouni, L.; Benhanifia, M.; Ayad, A. In vitro anthelmintic effects of aqueous and ethanolic extracts of *Marrubium vulgare* leaves against bovine digestive strongyles. *Turk. Parazitol. Derg.* **2018**, *42*, 262–266. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=In+vitro+anthelmintic+effects+of+aqueous+and+ethanolic+extracts+of+Marrubium+vulgare+leaves+against+bovine+digestive+strongyles&author=Moussouni,+L.&author=Benhanifia,+M.&author=Ayad,+A.&publication_year=2018&journal=Turk.+Parazitol.+Derg.&volume=42&pages=262%E2%80%93266&doi=10.5152/tpd.2018.5972&pmid=30604687)] [CrossRef] (<https://doi.org/10.5152/tpd.2018.5972>)] [Scilit] (<https://www.scilit.com/publications/ff3c4fed4945a8cfda0e656702f04295>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/30604687>)]

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26. Amrane-Abider, M.; Imre, M.; Herman, V.; Debbou-louknane, N.; Zemouri-Alioui, S.; Khaled, S.; Ayad, A. Bioactive compounds and in vitro antioxidant and anticoccidial activities of *Opuntia ficus-indica* flower extracts. *Biomedicines* **2023**, *11*, 2173. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Bioactive+compounds+and+in+vitro+antioxidant+and+anticoccidial+activities+of+Opuntia+ficus-indica+flower+extracts&author=Amrane-Abider,+M.&author=Imre,+M.&author=Herman,+V.&author=Debbou-louknane,+N.&author=Zemouri-Alioui,+S.&author=Khaled,+S.&author=Ayad,+A.&publication_year=2023&journal=Biomedicines&volume=11&pages=2173&doi=10.3390/biomedicines11082173&pmid=37626669)] [CrossRef (https://doi.org/10.3390/biomedicines11082173)] [Scilit (https://www.scilit.com/publications/76ae0ffb0043036e474c67245aa65630)] [PubMed (https://www.ncbi.nlm.nih.gov/pubmed/37626669)]



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(<https://www.scilit.com/publications/7ccc46e47dd872ce9213ebe7f254ce0f>)]

[PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/40499255>)]

28. de Carvalho, A.V.; Lübeck, I.; da Rocha, M.B.; Güez, C.M.; Machado, M.M.; de Oliveira, L.F.S. Evaluation of the tickcide, genotoxic, and mutagenic effects of *Ruta graveolens* L. (Rutaceae). *Acta Sci. Biol. Sci.* **2015**, *37*, 491–497. [Google Scholar ([https://scholar.google.com/scholar_lookup?](https://scholar.google.com/scholar_lookup?title=Evaluation+of+the+tickcide,+genotoxic,+and+mutagenic+effects+of+Ruta+graveolens+L.+(Rutaceae)&author=de+Carvalho,+A.V.&author=L%C3%BCbeck,+I.&author=da+Rocha,+M.B.&author=G%C3%BCez,+C.M.&author=Machado,+M.M.&author=de+Oliveira,+L.F.S.&publication_year=2015&journal=Acta+Sci.+Biol.+Sci.&volume=37&pages=491%E2%80%93497&doi=10.4025/actascibiols.v37i4.27576)

[title=Evaluation+of+the+tickcide,+genotoxic,+and+mutagenic+effects+of+Ruta+graveolens+L.+](https://scholar.google.com/scholar_lookup?title=Evaluation+of+the+tickcide,+genotoxic,+and+mutagenic+effects+of+Ruta+graveolens+L.+(Rutaceae)&author=de+Carvalho,+A.V.&author=L%C3%BCbeck,+I.&author=da+Rocha,+M.B.&author=G%C3%BCez,+C.M.&author=Machado,+M.M.&author=de+Oliveira,+L.F.S.&publication_year=2015&journal=Acta+Sci.+Biol.+Sci.&volume=37&pages=491%E2%80%93497&doi=10.4025/actascibiols.v37i4.27576)

[\(Rutaceae\)&author=de+Carvalho,+A.V.&author=L%C3%BCbeck,+I.&author=da+Rocha,+M.B.&author=G%C3%BCez,+C.M.&author=Machado,+M.M.&author=de+Oliveira,+L.F.S.&publication_year=2015&journal=Acta+Sci.+Biol.+Sci.&volume=37&pages=491%E2%80%93497&doi=10.4025/actascibiols.v37i4.27576\)\]](https://scholar.google.com/scholar_lookup?title=Evaluation+of+the+tickcide,+genotoxic,+and+mutagenic+effects+of+Ruta+graveolens+L.+(Rutaceae)&author=de+Carvalho,+A.V.&author=L%C3%BCbeck,+I.&author=da+Rocha,+M.B.&author=G%C3%BCez,+C.M.&author=Machado,+M.M.&author=de+Oliveira,+L.F.S.&publication_year=2015&journal=Acta+Sci.+Biol.+Sci.&volume=37&pages=491%E2%80%93497&doi=10.4025/actascibiols.v37i4.27576) [CrossRef

(<https://doi.org/10.4025/actascibiols.v37i4.27576>)] [Scilit

(<https://www.scilit.com/publications/a029980169183a900489675f72abd79e>)]

29. Cacique, A.P.; Barbosa, E.S.; Pinho, G.P.D.; Silvério, F.O. Maceration extraction conditions for determining the phenolic compounds and the antioxidant activity of *Catharanthus roseus* (L.) G. Don. *Cienc. Agrotecnol.* **2020**, *44*, e017420. [Google Scholar ([https://scholar.google.com/scholar_lookup?](https://scholar.google.com/scholar_lookup?title=Maceration+extraction+conditions+for+determining+the+phenolic+compounds+and+the+antioxidant+activity+of+Catharanthus+roseus+(L.)+G.+Don&author=Cacique,+A.P.&author=Barbosa,+E.S.&author=Pinho,+G.P.D.&author=Silv%C3%A9rio,+F.O.&publication_year=2020&journal=Cienc.+Agrotecnol.&volume=44&pages=e017420&doi=10.1590/1413-7054202044017420)

[title=Maceration+extraction+conditions+for+determining+the+phenolic+compounds+and+the+antioxidant+activity+of+Catharanthus+roseus+](https://scholar.google.com/scholar_lookup?title=Maceration+extraction+conditions+for+determining+the+phenolic+compounds+and+the+antioxidant+activity+of+Catharanthus+roseus+(L.)+G.+Don&author=Cacique,+A.P.&author=Barbosa,+E.S.&author=Pinho,+G.P.D.&author=Silv%C3%A9rio,+F.O.&publication_year=2020&journal=Cienc.+Agrotecnol.&volume=44&pages=e017420&doi=10.1590/1413-7054202044017420)

[\(L.\)+G.+Don&author=Cacique,+A.P.&author=Barbosa,+E.S.&author=Pinho,+G.P.D.&author=Silv%C3%A9rio,+F.O.&publication_year=2020&journal=Cienc.+Agrotecnol.&volume=44&pages=e017420&doi=10.1590/1413-7054202044017420\)\]](https://scholar.google.com/scholar_lookup?title=Maceration+extraction+conditions+for+determining+the+phenolic+compounds+and+the+antioxidant+activity+of+Catharanthus+roseus+(L.)+G.+Don&author=Cacique,+A.P.&author=Barbosa,+E.S.&author=Pinho,+G.P.D.&author=Silv%C3%A9rio,+F.O.&publication_year=2020&journal=Cienc.+Agrotecnol.&volume=44&pages=e017420&doi=10.1590/1413-7054202044017420)

[CrossRef (<https://doi.org/10.1590/1413-7054202044017420>)] [Scilit

(<https://www.scilit.com/publications/4753fe6a58db1373ce44536084d091a6>)]

30. Velioğlu, Y.; Mazza, G.; Gao, L.; Oomah, B. Antioxidant activity and total phenolics in selected fruits, vegetables, and grain products. *J. Agric. Food Chem.* **1998**, *46*, 4113–4117. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Antioxidant+activity+and+total+phenolics+in+selected+fruits,+vegetables,+and+grain+products&author=Velioğlu,+Y.&author=Mazza,+G.&author=Gao,+L.&author=Oomah,+B.&publication_year=1998&journal=J.+Agric.+Food+Chem.&volume=46&pages=4113%E2%80%934117&doi=10.1021/jf9801973)] [CrossRef (<https://doi.org/10.1021/jf9801973>)] [Scilit (<https://www.scilit.com/publications/aa1d5b40bee85ce5a55b281e79818bc3>)]
31. Molyneux, P. The use of the stable free radical diphenylpicrylhydrazyl (DPPH) for estimating antioxidant activity. *Songklanakarin J. Sci. Technol.* **2004**, *26*, 211–219. [Google Scholar ([https://scholar.google.com/scholar_lookup?title=The+use+of+the+stable+free+radical+diphenylpicrylhydrazyl+\(DPPH\)+for+estimating+antioxidant+activity&author=Molyneux,+P.&publication_year=2004&journal=Songklanakarin+J.+Sci.+Technol.&volume=26&pages=211%E2%80%93219](https://scholar.google.com/scholar_lookup?title=The+use+of+the+stable+free+radical+diphenylpicrylhydrazyl+(DPPH)+for+estimating+antioxidant+activity&author=Molyneux,+P.&publication_year=2004&journal=Songklanakarin+J.+Sci.+Technol.&volume=26&pages=211%E2%80%93219))]
32. Milani, N. Activity of oxalic and citric acids on the mite *Varroa destructor* in laboratory assays. *Apidologie* **2001**, *32*, 127–138. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Activity+of+oxalic+and+citric+acids+on+the+mite+Varroa+destructor+in+laboratory+assays&author=Milani,+N.&publication_year=2001&journal=Apidologie&volume=32&pages=127%E2%80%93138&doi=10.1051/apido:2001118)] [CrossRef (<https://doi.org/10.1051/apido:2001118>)] [Scilit (<https://www.scilit.com/publications/a24a5d10e0b22831176d0d8438c01f12>)]
33. Kosch, Y.; Mülling, C.; Emmerich, I.U. Resistance of *Varroa destructor* against oxalic acid treatment: A systematic review. *Vet. Sci.* **2024**, *11*, 393. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Resistance+of+Varroa+destructor+against+oxalic+acid+treatment:+A+systematic+review&author=Kosch,+Y.&author=M%C3%BClling,+C.&author=Emmerich,+I.U.&publication_year=2024&journal=Vet.+Sci.&volume=11&pages=393&doi=10.3390/vetsci11090393&pmid=39330772)] [CrossRef (<https://doi.org/10.3390/vetsci11090393>)] [Scilit (<https://www.scilit.com/publications/c694f8bc06cfa2f7ff0a221840a0687f>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/39330772>)]



Ntalli, N.; Samara, M.; Stathakis, T.; Barda, M.; Kapaxidi, E.; Manea-Karga, E.; Gounari, S.; Goras, G.; Kasiotis, K.; Karamaouna, F. The acaricidal activity of essential

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oil vapors and its effect on the Varroa mite *Varroa destructor*. *Agriculture* **2025**, *15*,

1379. [Google Scholar ([https://scholar.google.com/scholar_lookup?](https://scholar.google.com/scholar_lookup?title=The+acaricidal+activity+of+essential+oil+vapors+and+its+effect+on+the+Va)

[title=The+acaricidal+activity+of+essential+oil+vapors+and+its+effect+on+the+Va](https://scholar.google.com/scholar_lookup?title=The+acaricidal+activity+of+essential+oil+vapors+and+its+effect+on+the+Va)

[rroa+mite+Varroa+destructor&author=Ntalli,+N.&author=Samara,+M.&author=St](https://scholar.google.com/scholar_lookup?title=The+acaricidal+activity+of+essential+oil+vapors+and+its+effect+on+the+Va)

[athakis,+T.&author=Barda,+M.&author=Kapaxidi,+E.&author=Manea-](https://scholar.google.com/scholar_lookup?title=The+acaricidal+activity+of+essential+oil+vapors+and+its+effect+on+the+Va)

[Karga,+E.&author=Gounari,+S.&author=Goras,+G.&author=Kasiotis,+K.&author](https://scholar.google.com/scholar_lookup?title=The+acaricidal+activity+of+essential+oil+vapors+and+its+effect+on+the+Va)

[=Karamaouna,+F.&publication_year=2025&journal=Agriculture&volume=15&pag](https://scholar.google.com/scholar_lookup?title=The+acaricidal+activity+of+essential+oil+vapors+and+its+effect+on+the+Va)

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[groups/public/10.3390/parasitologia6050051?](https://doi.org/10.3390/agriculture15131379)))

[\(<https://www.scilit.com/publications/a008e2a4c1687f393928646468813a61>\)\]](https://doi.org/10.3390/agriculture15131379)))

[utm_source=mpdi.com&utm_medium=publication&utm_campaign=discuss_in_sciprofiles](https://www.scilit.com/publications/a008e2a4c1687f393928646468813a61)).

35. Zaborowska, M.; Borsuk, G.; Burmańczuk, A.; Tomaszewska, E. *Varroa destructor* and varroosis control in *Apis mellifera* L.: Current strategies, resistance, residues, and future challenges. *Agriculture* **2026**, *16*, 1448. [Google Scholar ([https://scholar.google.com/scholar_lookup?](https://scholar.google.com/scholar_lookup?title=Varroa+destructor+and+varroosis+control+in+Apis+mellifera+L.:+Current+strategies,+resistance,+residues,+and+future+challenges&author=Zaborowska,+M.&author=Borsuk,+G.&author=Burma%C5%84czuk,+A.&author=Tomaszewska,+E.&publication_year=2026&journal=Agriculture&volume=16&pages=1448&doi=10.3390/agriculture16131448)

[title=Varroa+destructor+and+varroosis+control+in+Apis+mellifera+L.:+Current+strategies,+resistance,+residues,+and+future+challenges&author=Zaborowska,+M.&author=Borsuk,+G.&author=Burma%C5%84czuk,+A.&author=Tomaszewska,+E.&publication_year=2026&journal=Agriculture&volume=16&pages=1448&doi=10.3390/agriculture16131448](https://scholar.google.com/scholar_lookup?title=Varroa+destructor+and+varroosis+control+in+Apis+mellifera+L.:+Current+strategies,+resistance,+residues,+and+future+challenges&author=Zaborowska,+M.&author=Borsuk,+G.&author=Burma%C5%84czuk,+A.&author=Tomaszewska,+E.&publication_year=2026&journal=Agriculture&volume=16&pages=1448&doi=10.3390/agriculture16131448))]

[\(<https://doi.org/10.3390/agriculture16131448>\)\]](https://doi.org/10.3390/agriculture16131448)

[\(<https://www.scilit.com/publications/c50f5622842f944b480fbc57f23980a3>\)\]](https://www.scilit.com/publications/c50f5622842f944b480fbc57f23980a3)

36. Shi, L.; Zhao, W.; Yang, Z.; Subbiah, V.; Suleria, H.A.R. Extraction and characterization of phenolic compounds and their potential antioxidant activities. *Environ. Sci. Pollut. Res.* **2022**, *29*, 81112–81129. [Google Scholar ([https://scholar.google.com/scholar_lookup?](https://scholar.google.com/scholar_lookup?title=Extraction+and+characterization+of+phenolic+compounds+and+their+pote)

[title=Extraction+and+characterization+of+phenolic+compounds+and+their+pote](https://scholar.google.com/scholar_lookup?title=Extraction+and+characterization+of+phenolic+compounds+and+their+pote)

[ntial+antioxidant+activities&author=Shi,+L.&author=Zhao,+W.&author=Yang,+Z.](https://scholar.google.com/scholar_lookup?title=Extraction+and+characterization+of+phenolic+compounds+and+their+pote)

[&author=Subbiah,+V.&author=Suleria,+H.A.R.&publication_year=2022&journal=Environ.+Sci.+Pollut.+Res.&volume=29&pages=81112%E2%80%9381129&doi=10.1007/s11356-022-23337-6&pmid=36201076](https://scholar.google.com/scholar_lookup?title=Extraction+and+characterization+of+phenolic+compounds+and+their+pote))]

[\[PubMed \(<https://www.ncbi.nlm.nih.gov/pubmed/36201076>\)\]](https://scholar.google.com/scholar_lookup?title=Extraction+and+characterization+of+phenolic+compounds+and+their+pote)



Kruk, J.; Aboul-Enein, B.H.; Duchnik, E.; Marchlewicz, M. Antioxidative properties of phenolic compounds and their effect on oxidative stress induced by severe physical exercise. *J. Physiol. Sci.* **2022**, *72*, 19. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Antioxidative+properties+of+phenolic+compounds+and+their+effect+on+oxidative+stress+induced+by+severe+physical+exercise&author=Kruk,+J.&author=Aboul-Enein,+B.H.&author=Duchnik,+E.&author=Marchlewicz,+M.&publication_year=2022&journal=J.+Physiol.+Sci.&volume=72&pages=19&doi=10.1186/s12576-022-00845-1&pmid=35931969)] [CrossRef (https://doi.org/10.1186/s12576-022-00845-1)] [Scilit (https://www.scilit.com/publications/d847d96cfd70d78d5eedf8a6f6484b75)] [PubMed (https://www.ncbi.nlm.nih.gov/pubmed/35931969)]

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groups/public/10.3390/parasitologia6050051?utm_source=mpdi.com&utm_medium=publication&utm_campaign=discuss_in_sciprofiles)] [PubMed (https://www.ncbi.nlm.nih.gov/pubmed/35931969)]

38. Nardini, M. Phenolic compounds in food: Characterization and health benefits. *Molecules* **2022**, *27*, 783. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Phenolic+compounds+in+food:+Characterization+and+health+benefits&author=Nardini,+M.&publication_year=2022&journal=Molecules&volume=27&pages=783&doi=10.3390/molecules27030783&pmid=35164044)] [CrossRef (https://doi.org/10.3390/molecules27030783)] [Scilit (https://www.scilit.com/publications/94edb5b8f8e20454c8040db9bbd98fdb)] [PubMed (https://www.ncbi.nlm.nih.gov/pubmed/35164044)]

39. Cappa, F.; Baracchi, D.; Cervo, R. Biopesticides and insect pollinators: Detrimental effects, outdated guidelines, and future directions. *Sci. Total Environ.* **2022**, *837*, 155714. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Biopesticides+and+insect+pollinators:+Detrimental+effects,+outdated+guidelines,+and+future+directions&author=Cappa,+F.&author=Baracchi,+D.&author=Cervo,+R.&publication_year=2022&journal=Sci.+Total+Environ.&volume=837&pages=155714&doi=10.1016/j.scitotenv.2022.155714&pmid=35525339)] [CrossRef (https://doi.org/10.1016/j.scitotenv.2022.155714)] [Scilit (https://www.scilit.com/publications/06ea5e838e5ecdddf5d3c5e5f549f77c)] [PubMed (https://www.ncbi.nlm.nih.gov/pubmed/35525339)]

40. Caren, J.; Zhu, Y.C.; Read, Q.D.; Du, Y. Risk assessment of effects of essential oils on honey bees (*Apis mellifera* L.). *Insects* **2025**, *16*, 303. [Google Scholar] ([https://scholar.google.com/scholar_lookup?title=Risk+assessment+of+effects+of+essential+oils+on+honey+bees+\(Apis+mellifera+L.\)&author=Caren,+J.&author=Zhu,+Y.C.&author=Read,+Q.D.&author=Du,+Y.&publication_year=2025&journal=Insects&volume=16&pages=303&doi=10.3390/insects16030303&pmid=40266795](https://scholar.google.com/scholar_lookup?title=Risk+assessment+of+effects+of+essential+oils+on+honey+bees+(Apis+mellifera+L.)&author=Caren,+J.&author=Zhu,+Y.C.&author=Read,+Q.D.&author=Du,+Y.&publication_year=2025&journal=Insects&volume=16&pages=303&doi=10.3390/insects16030303&pmid=40266795)) [CrossRef] (<https://doi.org/10.3390/insects16030303>) [Scilit] (<https://www.scilit.com/publications/e7f7887a53f0cdb40c19cdb90db227bc>) [PubMed] (<https://www.ncbi.nlm.nih.gov/pubmed/40266795>)] (<https://sciprofiles.com/discussion-groups/public/10.3390/parasitology16050051>)
41. Abuagla, M.I.B.; Iqbal, J.; Raweh, H.S.A.; Alqarni, A.S. Insight into olfactory learning, memory and mortality of *Apis mellifera jemenitica* after exposure to acetamiprid insecticide. *Insects* **2024**, *15*, 473. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Insight+into+olfactory+learning,+memory,+and+mortality+of+Apis+mellifera+jemenitica+after+exposure+to+acetamiprid+insecticide&author=Abuagla,+M.I.B.&author=Iqbal,+J.&author=Raweh,+H.S.A.&author=Alqarni,+A.S.&publication_year=2024&journal=Insects&volume=15&pages=473&doi=10.3390/insects15070473&pmid=39057206) [CrossRef] (<https://doi.org/10.3390/insects15070473>) [Scilit] (<https://www.scilit.com/publications/708ee00c62362406c45e349d64cf6da1>) [PubMed] (<https://www.ncbi.nlm.nih.gov/pubmed/39057206>)]
42. Maiwald, F.; Haas, J.; Hertlein, G.; Lueke, B.; Roesner, J.; Nauen, R. Expression profile of the entire detoxification gene inventory of the western honey bee, *Apis mellifera*, across life stages. *Pestic. Biochem. Physiol.* **2023**, *192*, 105410. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Expression+profile+of+the+entire+detoxification+gene+inventory+of+the+western+honey+bee,+Apis+mellifera,+across+life+stages&author=Maiwald,+F.&author=Haas,+J.&author=Hertlein,+G.&author=Lueke,+B.&author=Roesner,+J.&author=Nauen,+R.&publication_year=2023&journal=Pestic.+Biochem.+Physiol.&volume=192&pages=105410&doi=10.1016/j.pestbp.2023.105410&pmid=37105637) [CrossRef] (<https://doi.org/10.1016/j.pestbp.2023.105410>) [Scilit] (<https://www.scilit.com/publications/9559f4521fa48050299f72494ffab0e3>) [PubMed] (<https://www.ncbi.nlm.nih.gov/pubmed/37105637>)]

43. Erofeeva, E.A. Plant hormesis: The energy aspect of low and high-dose stresses. *Plant Stress* 2024, 14, 100628. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Plant+hormesis:+The+energy+aspect+of+low+and+high-dose+stresses&author=Erofeeva,+E.A.&publication_year=2024&journal=Plant+Stress&volume=14&pages=100628&doi=10.1016/j.stress.2024.100628)] [CrossRef] (https://doi.org/10.1016/j.stress.2024.100628)] [Scilit] (https://www.scilit.com/publications/b0e58dd3db80efcf15a4b85cfc54e744)]
44. Alkassab, A.T.; Erler, S.; Steinert, M.; Pistorius, J. Exposure of honey bees to mixtures of microbial biopesticides and their effects on bee survival under laboratory conditions. *Environ. Sci. Pollut. Res.* 2024, 31, 26618–26627. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Exposure+of+honey+bees+to+mixtures+of+microbial+biopesticides+and+their+effects+on+bee+survival+under+laboratory+conditions&author=Alkassab,+A.T.&author=Erler,+S.&author=Steinert,+M.&author=Pistorius,+J.&publication_year=2024&journal=Environ.+Sci.+Pollut.+Res.&volume=31&pages=26618%E2%80%9326627&doi=10.1007/s11356-024-32753-9&pmid=38453759)] [CrossRef] (https://doi.org/10.1007/s11356-024-32753-9)] [Scilit] (https://www.scilit.com/publications/7a0b3042386e72950ba704c111592267)] [PubMed (https://www.ncbi.nlm.nih.gov/pubmed/38453759)]
45. Manzo, R.M.; Iglesias, A.E.; Guajardo, J.J.; Amaturi, C.A.; Freeman, B.D.; López de Armentia, J.; Rizzuto, S.; Maggi, M.D. Bioactivity of essential oils from Patagonian wild plants: Acaricidal and insecticidal effects on *Varroa destructor* and *Apis mellifera*. *Plants* 2025, 14, 2484. [Google Scholar] (https://scholar.google.com/scholar_lookup?title=Bioactivity+of+essential+oils+from+Patagonian+wild+plants:+Acaricidal+and+insecticidal+effects+on+Varroa+destructor+and+Apis+mellifera&author=Manzo,+R.M.&author=Iglesias,+A.E.&author=Guajardo,+J.J.&author=Amaturi,+C.A.&author=Freeman,+B.D.&author=L%C3%B3pez+de+Armentia,+J.&author=Rizzuto,+S.&author=Maggi,+M.D.&publication_year=2025&journal=Plants&volume=14&pages=2484&doi=10.3390/plants14162484&pmid=40872107)] [CrossRef] (https://doi.org/10.3390/plants14162484)] [Scilit] (https://www.scilit.com/publications/d6d2cc678bc21f3fa7fdc9d5c0f9ac32)] [PubMed (https://www.ncbi.nlm.nih.gov/pubmed/40872107)]

46. Gharehbagh, H.J.; Ebrahimi, M.; Dabaghian, F.; Mojtavavi, S.; Hariri, R.; Saeedi, M.; Khanavi, M.; Faramarzi, M.A.; Khanavi, M. Chemical composition, cholinesterase, and α -glucosidase inhibitory activity of the essential oils of some Iranian native *Salvia* species. *BMC Complement. Med. Ther.* **2023**, *23*, 184. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Chemical+composition,+cholinesterase,+and+%CE%B1-glucosidase+inhibitory+activity+of+the+essential+oils+of+some+Iranian+native+Salvia+species&author=Gharehbagh,+H.J.&author=Ebrahimi,+M.&author=Dabaghian,+F.&author=Mojtabavi,+S.&author=Hariri,+R.&author=Saeedi,+M.&author=Khanavi,+M.&author=Faramarzi,+M.A.&author=Khanavi,+M.&publication_year=2023&journal=BMC+Complement.+Med.+Ther.&volume=23&pages=184&doi=10.1186/s12906-023-04004-w&pmid=37270541)] [CrossRef (https://doi.org/10.1186/s12906-023-04004-w)] [Scilit (https://www.scilit.com/publications/7725ec9c18b1879188daa65e9eaa03b1)] [PubMed (https://www.ncbi.nlm.nih.gov/pubmed/37270541)]

47. Kačániová, M.; Galovičová, L.; Valková, V.; Ďuranová, H.; Borotová, P.; Štefániková, J.; Grinshpan, D.; Vukovic, N.L.; Vukic, M.; Kunová, S.; et al. Chemical composition and biological activity of *Salvia officinalis* essential oil. *Acta Hort. Regiotect.* **2021**, *24*, 81–88. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Chemical+composition+and+biological+activity+of+Salvia+officinalis+essential+oil&author=Ka%C4%8D%C3%A1niov%C3%A1,+M.&author=Galovi%C4%8Dov%C3%A1,+L.&author=Valkov%C3%A1,+V.&author=%C4%8Euranov%C3%A1,+H.&author=Borotov%C3%A1,+P.&author=%C5%A0tef%C3%A1nikov%C3%A1,+J.&author=Grinshpan,+D.&author=Vukovic,+N.L.&author=Vukic,+M.&author=Kunov%C3%A1,+S.&author=et+al.&publication_year=2021&journal=Acta+Hortic.+Regiotect.&volume=24&pages=81%E2%80%9388&doi=10.2478/ahr-2021-0028)] [CrossRef (https://doi.org/10.2478/ahr-2021-0028)] [Scilit (https://www.scilit.com/publications/3a2887e54c701a5fe899900fd24eaff3)]
48. Giraldo-Silva, L.; Ferreira, B.; Rosa, E.; Dias, A.C. *Opuntia ficus-indica* fruit: A systematic review of its phytochemicals and pharmacological activities. *Plants* **2023**, *12*, 543. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Opuntia+ficus-indica+fruit:+A+systematic+review+of+its+phytochemicals+and+pharmacological+activities&author=Giraldo-Silva,+L.&author=Ferreira,+B.&author=Rosa,+E.&author=Dias,+A.C.&publication_year=2023&journal=Plants&volume=12&pages=543&doi=10.3390/plants12030543&pmid=36771630)] [CrossRef (https://doi.org/10.3390/plants12030543)] [Scilit (https://www.scilit.com/publications/4d14c8e27d0a1e2da09385049168bb0e)] [PubMed (https://www.ncbi.nlm.nih.gov/pubmed/36771630)]

MDPI (L) Ren, Y.; Li, Y.; Ju, Y.; Zhang, W.; Wang, Y. Insect cuticle and insecticide development. *Arch. Insect Biochem. Physiol.* **2023**, *114*, e22057. [Google Scholar] Order Article Reprints (/2673-6772/6/5/51/reprint)

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([https://sciprofiles.com/discussion-](https://sciprofiles.com/discussion-groups/public/10.3390/parasitologia6050051)

50. Goel, V.; Sharma, S.; Chakraborty, N.K.; Singla, L.D.; Choudhury, D. Targeting the nervous system of the parasitic worm *Haemonchus contortus* with quercetin. *Heliyon* **2023**, *9*, e13699. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Targeting+the+nervous+system+of+the+parasitic+worm,+Haemonchus+contortus,+with+quercetin&author=Goel,+V.&author=Sharma,+S.&author=Chakraborty,+N.K.&author=Singla,+L.D.&author=Choudhury,+D.&publication_year=2023&journal=Heliyon&volume=9&pages=e13699&doi=10.1016/j.heliyon.2023.e13699&pmid=36852031)] [CrossRef (<https://doi.org/10.1016/j.heliyon.2023.e13699>)] [Scilit (<https://www.scilit.com/publications/cfe47596c2b417e9b8e8c7af80026c4d>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/36852031>)]

51. Sharaf-El-Deen, S.; Soliman, S.; Brakat, R. Evaluation of the antiparasitic and antifibrotic effects of gallic acid on experimental hepatic *Schistosoma mansoni* infection. *J. Helminthol.* **2024**, *98*, e3. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Evaluation+of+the+antiparasitic+and+antifibrotic+effects+of+gallic+acid+on+experimental+hepatic+Schistosoma+mansoni+infection&author=Sharaf-El-Deen,+S.&author=Soliman,+S.&author=Brakat,+R.&publication_year=2024&journal=J.+Helminthol.&volume=98&pages=e3&doi=10.1017/s0022149x23000937&pmid=38167243)] [CrossRef (<https://doi.org/10.1017/s0022149x23000937>)] [Scilit (<https://www.scilit.com/publications/295d64710c1b0de03f87b6ee49e6f406>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/38167243>)]

51. Sharaf-El-Deen, S.; Soliman, S.; Brakat, R. Evaluation of the antiparasitic and antifibrotic effects of gallic acid on experimental hepatic *Schistosoma mansoni* infection. *J. Helminthol.* **2024**, *98*, e3. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Evaluation+of+the+antiparasitic+and+antifibrotic+effects+of+gallic+acid+on+experimental+hepatic+Schistosoma+mansoni+infection&author=Sharaf-El-Deen,+S.&author=Soliman,+S.&author=Brakat,+R.&publication_year=2024&journal=J.+Helminthol.&volume=98&pages=e3&doi=10.1017/s0022149x23000937&pmid=38167243)] [CrossRef (<https://doi.org/10.1017/s0022149x23000937>)] [Scilit (<https://www.scilit.com/publications/295d64710c1b0de03f87b6ee49e6f406>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/38167243>)]



Tawfeek, G.M.; Fahmy, H.M.; Faried, E.S.; Ammar, A.M. Genotoxic and protoscolicidal effects of gallic acid and its nanoformulation against *Echinococcus granulosus* protoscoleces: In vitro and ex vivo insights from Egypt. *Vet. Parasitol.* **2026**, *343*, 110731. [Google Scholar (https://scholar.google.com/scholar_lookup?title=Genotoxic+and+protoscolicidal+effects+of+gallic+acid+and+its+nanoformulation+against+Echinococcus+granulosus+protoscoleces:+In+vitro+and+ex+vivo+insights+from+Egypt&author=Tawfeek,+G.M.+author=Fahmy,+H.M.+author=Faried,+E.S.+author=Ammar,+A.M.+publication_year=2026&journal=Vet.+Parasitol.+&volume=343&pages=110731&doi=10.1016/j.vetpar.2026.110731&pmid=4177499)] [CrossRef (<https://doi.org/10.1016/j.vetpar.2026.110731>)] [Scilit (<https://sciprofiles.com/discussion-https://www.scilit.com/publications/032fe20171ba292a45469bd85e69205e>)] [PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/41774999>)] (<https://www.mdpi.com/4065706%3A%0A%0AAssessment%20of%20Four%20Plant-Derived%20Extracts%20as%20Potential%20Control%20Agents%20Against%20Varroa%20destructor%20with%20Safety%20Evaluation%20in%20Honey%20Bees%20%28Apis%20mellifera%29%0A%0AAbstract%3A%20This%20study%20evaluated%20the%20acaricidal%20efficacy%20of%20extracts%20from%20Salvia%20officinalis%20%28SO%29%2C%20Marrubium%20vulgare%20%28MV%29%2C%20Ruta%20graveolens%20%28RG%29%2C%20and%20Opuntia%20ficus-indica%20%28OFI%29%20against%20Varroa%20destructor%2C%20together%20with%20their%20acute%20toxicity%20to%20Apis%20mellifera.%20The%20extracts%20were%20characterized%20for%20their%20phenolic%20content%20and%20antioxidant%20activity.%20Honey%20bee%20toxicity%20was%20assessed%20at%200.5%2C%201%2C>)] (<https://www.mdpi.com/4065706%3A%0A%0AAssessment%20of%20Four%20Plant-Derived%20Extracts%20as%20Potential%20Control%20Agents%20Against%20Varroa%20destructor%20with%20Safety%20Evaluation%20in%20Honey%20Bees%20%28Apis%20mellifera%29%0A%0AAbstract%3A%20This%20study%20evaluated%20the%20acaricidal%20efficacy%20of%20extracts%20from%20Salvia%20officinalis%20%28SO%29%2C%20Marrubium%20vulgare%20%28MV%29%2C%20Ruta%20graveolens%20%28RG%29%2C%20and%20Opuntia%20ficus-indica%20%28OFI%29%20against%20Varroa%20destructor%2C%20together%20with%20their%20acute%20toxicity%20to%20Apis%20mellifera.%20The%20extracts%20were%20characterized%20for%20their%20phenolic%20content%20and%20antioxidant%20activity.%20Honey%20bee%20toxicity%20was%20assessed%20at%200.5%2C%201%2C>)]

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Ayad A., Balla E-H, Ichalal K, Amrane-Abider M, Ayad M, Mozaoui A, Dergal NB. Assessment of Four Plant-Derived Extracts as Potential Control Agents Against *Varroa destructor* with Safety Evaluation in Honey Bees (*Apis mellifera*). *Parasitologia*. 2026; 6(5):51. <https://doi.org/10.3390/parasitologia6050051>

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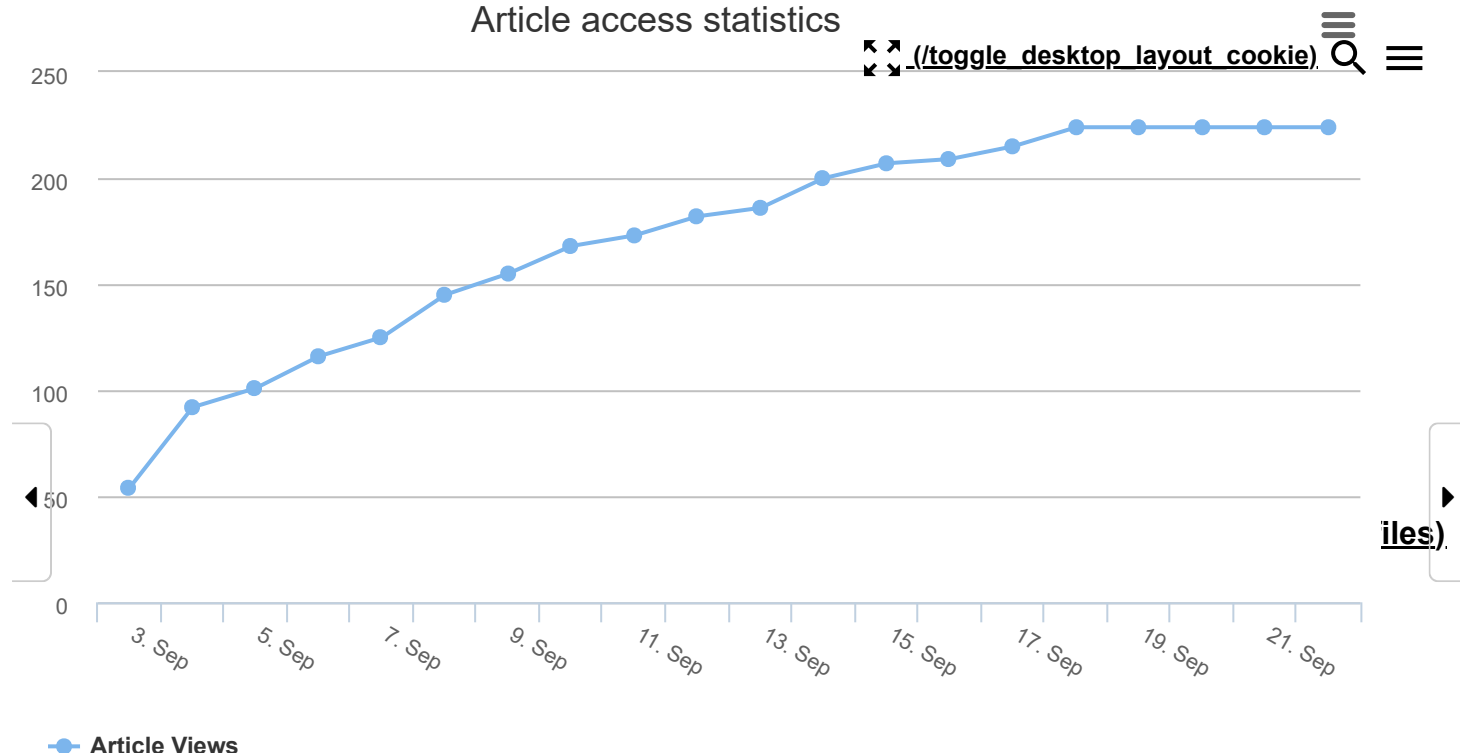
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