THE EFFECT OF ALTERNATIVE TREATMENT METHODS ON THE POPULATION EVOLUTION OF *ARANEAE* IN GOOSEBERRY CULTURE

EFECTELE METODELOR ALTERNATIVE DE TRATAMENT ASUPRA EVOLUȚIEI POPULAȚIEI DE *ARANEAE* ÎN CULTURA DE AGRIȘ

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Abstract.
This paper presents the effects of alternative treatment methods on the population dynamics of spiders in three gooseberry varieties: Invicta, Captivator, and Hinnonmaki Red. The presence of entomophagous spiders is influenced by factors such as prey availability, plant odor, the phenophase of the host plant, climatic conditions, and the type of treatment applied. The treatments were carried out using infusions of Urtica dioica, Mentha piperita, Thymus serpyllum, and Mentha pulegium. The effects of these treatments on the population of entomophagous spiders were studied and compared. Differences were noted based on both the treatment's influence on prey and the odor of the plants used.
Key words: enthomophgous spiders, *Ribes* spp., *Thymus serpyllum, Urtica dioica, Mentha spp.*

Rezumat.
În lucrare sunt prezentate efectele metodelor alternative de tratament asupra evolutiei populației de păianjăni, în cazul a trei soiuri de agriș: Invicta, Captivator și Hinnonmaki roșu. Studiile au fost efectuate în perioada 2023-2024. Prezența păianjănilor entomofagi este influențată de: prezența prăzii, mirosul plantelor, fenofaza plantei-gazdă, condițiile climatice și tipul de tratament aplicat. Tratamentele efectuate au fost făcute cu infuzii de: Urtica dioica, Mentha piperita, Thymus serpyllum și Mentha pulegium. S-au studiat și s-a comparat efectele tratamentelor asupra populației de păianjăni entomofagi. Diferența a fost făcută atât de influența tratamentului asupra prăzii cât și de mirosul plantelor utilizate.
Cuvinte cheie: *Mentha spp*., păianjăni entomofagi, *Ribes* spp., *Thymus serpyllum, Urtica dioica*

INTRODUCTION

Predatory arthropods keep pest populations under control [Michalko *et al.*, 2019]. Among arthropods, spiders play a significant role both in terms of their

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numbers and the diversity of species they feed on [Nadeem *et al.*, 2023]. They appear in crops before other beneficial arthropods, often in sufficient abundance to control pests [Schmidt-Jeffris *et al.*, 2022].

Araneae is the largest order of arachnids, comprising 113 families, 4033 genera, and 46499 species [Selden, 2017]. The architectural and mechanical properties of spider webs are specific to each species [Su *et al.*, 2021]. Spiders migrate from the edge of the crop field towards the center. The effort involved in constructing a web hinders a spider's easy migration and the creation of a new web [Markó *et al.*, 2009].

Globally, research and actions have been undertaken regarding the conservation of predatory spider species. Surveys among experts from different regions of the world have highlighted factors significantly contributing to the decline and extinction of predatory spider species: agriculture, climate change, urbanization, and pollution [Branco Vasco & Cardoso, 2020].

Climate change influences the growth and development time of spiders, their longevity and adult size, and their reproductive capacity [Li & Jackson, 1996]. High temperatures hinder egg hatching - e.g., temperatures above 35 °C affect *Misumenops tricuspidatus* from the *Thomisidae* family. The quality of food also impacts spiders [Li, 2002].

Measures necessary for the conservation of predatory spider species include integrated management practices and highlighting the importance of predatory spiders in controlling harmful entomofauna through education and awareness [Branco, 2020].

Studies conducted by Nelson *et al.* [2021] have demonstrated that:

- spiders without webs feed on a wider range of insect genera than web-weaving spiders.
- in addition to the presence of pests, the spider population is influenced by the odor of plants.

The spider population is also influenced by the phenophase of the host plant [Saksongmuang *et al.*, 2024]. The application of pesticides directly affects predatory spiders—impacting their viability and reproductive capacity—and indirectly by eradicating prey. The abundance of harmful insects promotes the proliferation of spider populations [Markó *et al.*, 2009; Marc *et al.*, 1999].

Web-less spiders are more sensitive to pesticides than web-weaving spiders [Bostanian *et al.*, 2012]. Pesticides affect the nervous system of spiders and, consequently, their sensory system [Barth, 2002].

International Organization for Biological Control (IOBC) rarely includes spiders in testing the non-target effects of pesticides, and only one species is tested per report [Schmidt-Jeffris *et al.*, 2022].

Spiders are indicators of environmental pollution. Based on spider population composition, several European countries have methods for ecological classification of natural habitats [Marc *et al.*, 1999].

MATERIAL AND METHOD

The research was conducted in the experimental field in Domnești commune, Ilfov County. The coordinates of the location are: latitude 44°24'18.4"N, longitude 25°55'45.5"E. The altitude above sea level is approximately 90 meters. The experimental field was established in 2021 in an area where there are no longer gooseberry crops.

The planting distances were 2 meters between rows and 1 meter between rows. The rows were mulched with Geotextile fabric, and the space between rows was mowed.

The experiment was conducted with five variants, each with three replicates, and each replicate had three gooseberry plants (Invicta, Captivator, and Hinnonmaki Red). The treatments used were: infusion of *Urtica dioica*, infusion of *Mentha piperita*, infusion of *Thymus serpyllum*, and infusion of *Mentha pulegium*. The study was conducted in 2023-2024. Treatments were applied monthly, from April to July. One row served as the control.

The technical materials used were: the camera of the Huawei P30 Lite phone and the Olympus OM-D camera with the Olympus ED MSC macro lens.

To achieve the proposed aims and objectives, the following general methods were used: documentary study on the level of knowledge of the research topic, data and biological material analysis and synthesis, field observations, spider and pest identification, preparation of infusions, comparison, and experimentation.

RESULTS AND DISCUSSIONS

In the experimental field, spiders were identified on the ground, stems, and foliage of the gooseberries, which do not spin webs.

Spiders that do not spin webs are harder to observe due to the dense foliage of the gooseberries. Spider webs, regardless of their type, are easier to observe.

Analyzing potential prey was difficult due to the abundance of gooseberry foliage, which made observations possible only on visible spider specimens. The study was conducted without affecting the webs and without analyzing the prey under a microscope.

Various genera of aphids were observed in the spider webs. The difference between the appearance of green aphids, the first spider web, and non-web-spinning spiders is about one week in April.

One month after the appearance of spiders, the first foam of *Philaenus spumarius* **larvae was observed.**

Larvae and adult specimens of *Philaenus spumarius* **were identified in the spider webs.**

In 2023, spider webs were observed on all gooseberry varieties as follows:

a) for the Invicta variety:

- on the control variant, no spider webs were present.

- on the repetition treated with *Urtica dioica* - 2 out of 3 bushes had one web each on each gooseberry.
- on the repetition treated with *Mentha piperita* - a single spider web on one gooseberry.
- on the repetition treated with *Thymus serpyllum* - 3 spider webs on one bush.
- spider specimens do not prefer plants treated with *Mentha pulegium*.

b) for the Captivator variety:

- on the control variant, no spider webs were present.
- on the repetition treated with *Urtica dioica* - all bushes had one spider web each on each gooseberry.
- on the repetition treated with *Mentha piperita* - 2 spider webs on one gooseberry.
- on the repetition treated with *Thymus serpyllum* - 2 spider webs on one gooseberry.
- *the treatment with Mentha pulegium did not positively influence the presence of spiders.*

c) For the Hinnonmaki Red variety:

- on the control variant, spider webs were present on 2 bushes.
- on the repetition treated with *Urtica dioica* - none were observed.
- on the repetition treated with *Mentha piperita* - 1 spider web on a single gooseberry.
- on the repetition treated with *Thymus serpyllum* - 1 spider web on a single gooseberry.
- *the treatment with Mentha pulegium did not positively influence the presence of spiders.*

The presence of spider webs on plants of the Invicta, Captivator and Hinnonmaki Red variety, in 2023 is show in fig.1.

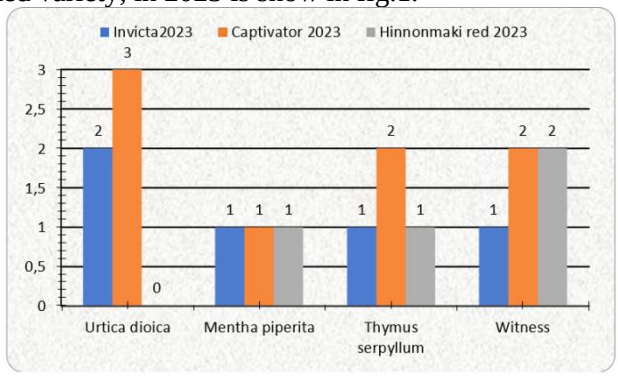

Fig. 1. Presence of spider webs on plants of the Invicta, Captivator and Hinnonmaki Red variety, in 2023

In 2024, spider webs were observed on all gooseberry varieties as follows:

a) for the Invicta variety:

- on the control variant, 2 spider webs on a repetition.
- on the repetition treated with *Urtica dioica* - 4 spider webs on 2 plants.
- on the repetition treated with *Mentha piperita* - 1 spider web on each of 2 bushes.
- on the repetition treated with *Thymus serpyllum* - 5 spider webs in total on all 3 plants.
- spider specimens do not prefer plants treated with *Mentha pulegium*.

b) for the Captivator variety:

- on the control variant, 2 spider webs on a single plant.
- on the repetition treated with *Urtica dioica* - 4 spider webs on 2 gooseberries.
- on the repetition treated with *Mentha piperita* - 6 spider webs on 3 gooseberries.
- on the repetition treated with *Thymus serpyllum* - 2 spider webs on a single gooseberry.
- *the treatment with Mentha pulegium did not positively influence the presence of spiders.*

c) for the Hinnonmaki Red variety:

- on the control variant, no spider webs were observed.
- on the repetition treated with *Urtica dioica* – 4 spider webs on 2 gooseberries.
- on the plants treated with *Mentha piperita* – 10 spider webs on 3 gooseberries.
- on the plants treated with *Thymus serpyllum* – 6 spider webs on 3 gooseberries.
- *the treatment with Mentha pulegium did not positively influence the presence of spiders*.

The presence of spider webs on plants of the Invicta, Captivator and Hinnonmaki Red variety, in 2024 is show in fig.2.

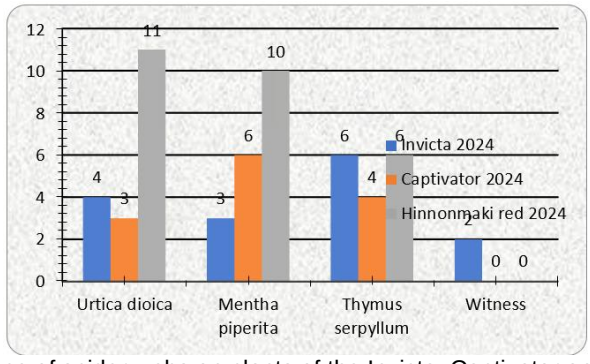

Fig. 2. Presence of spider webs on plants of the Invicta, Captivator and Hinnonmaki Red variety, in 2024

The overall view of the variants and repetitions for the period 2023-2024 is as follows - fig.3 for the Invicta variety, fig.4 for the Captivator variety, fig.5 for the Hinnonmaki red variety :

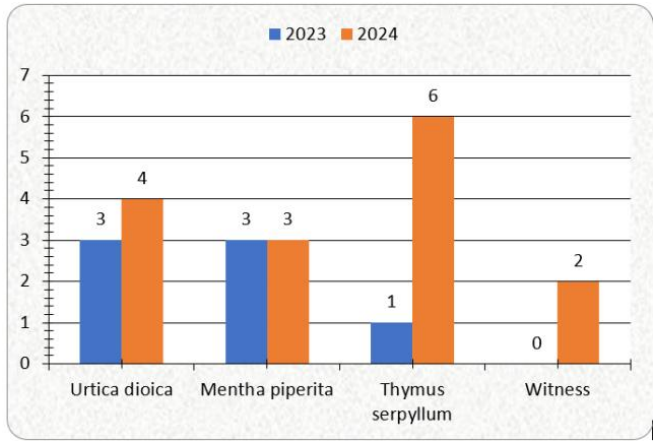

Fig. 3. Situation of spider webs in 2023 and 2024 for the Invicta variety

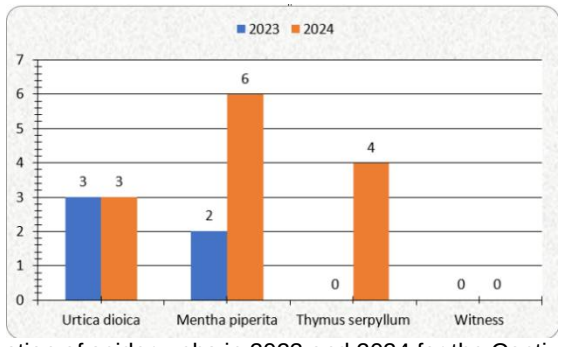

Fig. 4. Situation of spider webs in 2023 and 2024 for the Captivator variety

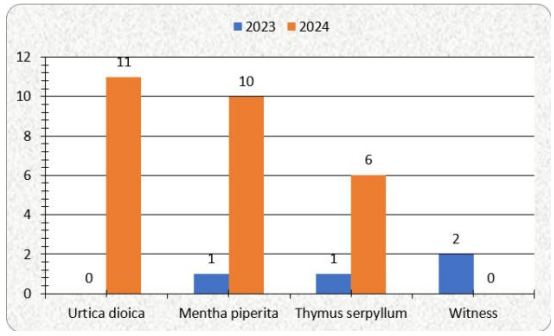

Fig. 5. Situation of spider webs in 2023 and 2024 for the Hinnonmaki Red variety

CONCLUSIONS

Chemical products for plant protection used in conventional treatments for gooseberries are not approved for such crops. Under these conditions, the period of residue in fruits is unknown. Global studies highlight the adverse effects of active chemical substances on humans and beneficial anthropofauna.

The plants used in the alternative treatment methods covered in this study (*Urtica dioica, Mentha piperita, Thymus serpyllum and Mentha pulegium*) have beneficial effects on humans.

Urtica dioica, Mentha piperita, Thymus serpyllum and Mentha pulegium – have different odors and effects on prey and host plants. They have differently influenced the spider population.

It was observed that the spider population was higher in the host plants treated with Urtica dioica, Mentha piperita, and Thymus serpyllum compared to the control plants. The treatment with Mentha pulegium did not positively influence the presence of spiders. Gooseberries treated with Urtica dioica and Mentha piperita had a higher spider population than the untreated variant. The active substances in these treatments did not achieve maximum efficacy against gooseberry pests. In this case, the spiders' prey also included harmful insects.

It was noted that although the treatment with *Thymus serpyllum* was maximally effective against gooseberry pests, the spider population was greater than in the untreated variant. This suggests that:

- the spiders' prey could included insects that do not affect gooseberries.
- the higher spider population in plants treated with *Thymus serpyllum* compared to untreated plants could provide better protection against potential pests.

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