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CO-OCCURRENCE AND SHORT-TERM POPULATION DYNAMICS OF MAJOR PHYTOPHAGOUS ARTHROPODS IN PROTECTED CUCUMBER CULTIVATION

Authors

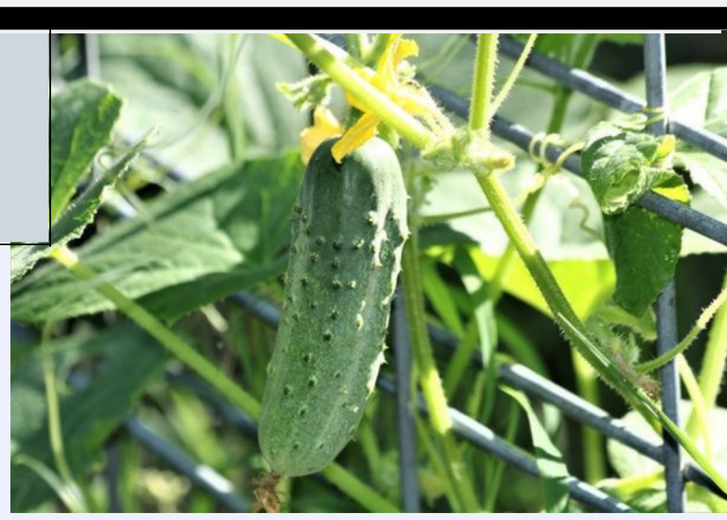
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Aphis gossypii - colony, alate and apterous

Tetranychus urticae mobile stage

Introduction

- Protected environment and key cucumber pests: Protected cultivation (such as polytunnels) creates elevated temperatures that shorten pest development cycles, with thrips (Frankliniella occidentalis), aphids (Aphis gossypii), and spider mites (Tetranychus urticae) being the primary pests affecting cucumber crops, including in Romania.
- Ecological dynamics and co-occurrence: Although these three species differ in their feeding habits and reproductive strategies, they exploit the same host plant and form a recurrent pest complex whose population dynamics fluctuate over time based on microclimate, planting date, season, and management practices.
- Study objective: The study aims to characterize the short-term population dynamics and concurrent co-occurrence of these three major pests in a polytunnel cucumber crop in western Romania using a unified sampling method.



Frankliniella occidentalis - adult and larvae

Sampling design:

Sampling design: Pest populations (*F. occidentalis, A. gossypii, and T. urticae*) were directly monitored via leaf sampling across seven dates (every ~5 days, June 25 – July 25, 2026), sampling ten randomly selected plants alternating between canopy strata (lower, middle, upper) to account for vertical pest distribution, with date-level means (n = 7) used for statistical analysis to address non-independence.



Material and method

The study was conducted in a commercial polytunnel located in Giarmata, Timiș County, western Romania (45°50'00.0"N 21°18'50.6"E). The polyethylene-covered structure measured 10 × 6 m (60 m^2) and was naturally ventilated through its front doors.

Pest management: No insecticides or acaricides were applied during the monitoring period; a single chemical treatment (Milbeknock 1% EC) was applied to the entire polytunnel only after the final sampling date when pest density peaked.

Result & Discussion

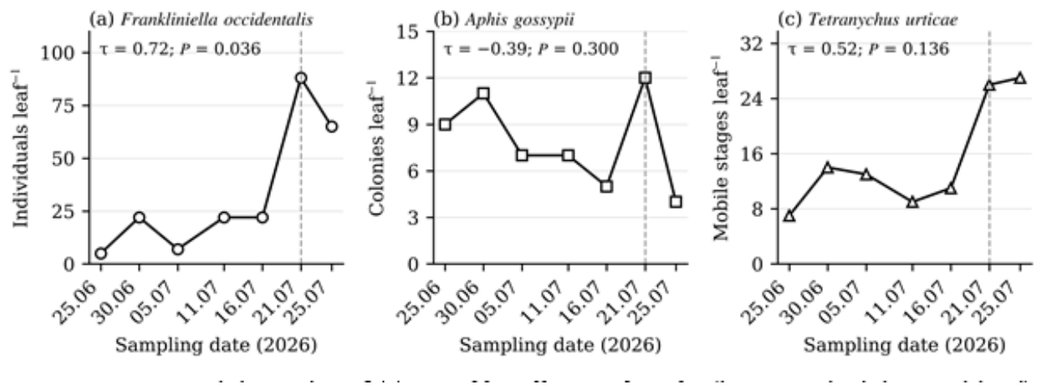


Figure 1. Temporal dynamics of (a) Frankliniella occidentalis (larvae and adults combined), (b) Aphis gossypii, and (c) Tetranychus urticae on protected cucumber, Giarmata, 2026. Values are means per leaf (n = 10 leaves per sampling date). Kendall's τ and exact permutation P-values refer to the monotonic trend over time. The dashed line marks 21 July, the date of maximum concurrent abundance.

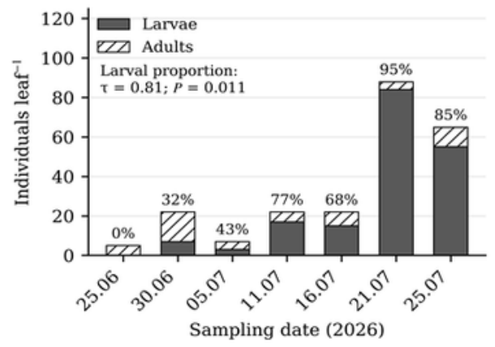


Figure 2. Stage structure of the Frankliniella occidentalis population on protected cucumber leaves, Giarmata, 2026. Bars show the mean number of larvae and adults per leaf (n = 10 leaves per sampling date); percentages above the bars indicate the proportion of larvae in the total thrips population. Kendall's τ and the exact permutation P-value refer to the monotonic trend in larval proportion over time.

Species/stage	Mean leaf⁻¹	Range	CV (%)	Cumulative pest-days	Sen's slope (day⁻¹)	τ_b	*P*
F. occidentalis (total)	33.0	5–88	95	918	2.00	0.72	**0.036**
– larvae	25.9	0–84	122	708	1.83	0.71	**0.030**
– adults	7.1	4–15	57	210	0.00	0.05	1.000
A. gossypii (colonies)	7.9	4–12	38	242	−0.17	−0.39	0.300
T. urticae (mobile stages)	15.3	7–27	52	434	0.57	0.52	0.136

(b) Spearman's rank correlation coefficients (r_s) between species

	A. gossypii	*T. urticae*
F. occidentalis	0.04 (*P* = 0.931)	**0.78 (*P* = 0.045)**
A. gossypii	–	−0.04 (*P* = 0.952)

Note: Cumulative pest-days were calculated as the area under the abundance curve using the actual intervals between sampling dates (for *A. gossypii*, expressed as colony-days); being expressed in species-specific units, they are not directly comparable among species. τ_b, Kendall's tau-b (Mann–Kendall trend test). All *P*-values were obtained by exact permutation and are unadjusted for multiple comparisons. Values in bold are significant at $P < 0.05$.

Data analysis

- Abundance metrics and co-occurrence: Pest abundance was measured as mean individuals per leaf (F. occidentalis and T. urticae) or mean colonies per leaf (A. gossypii), with cumulative pest pressure calculated as cumulative pest-days (area under the curve) across the 7 sampling dates.
- Analytical approach: Due to the small sample size (n = 7), exact permutation tests in Python were used to calculate P-values, and results were interpreted strictly as exploratory without adjustments for multiple comparisons.



TheCore Points for the Discussion

Distinct dynamics: Microclimate drives each pest differently - *F. occidentalis* surges through active larval reproduction, *A. gossypii* is suppressed by midsummer heat (>30°C), and *T. urticae* rises steadily as a thermophilic species.

Concurrent risk window: Their overlapping peak in late July creates a sudden, critical threat to the crop.

Practical application: Monitoring and management must focus on the entire pest complex rather than tracking single species in isolation.

CONCLUSION

***Frankliniella occidentalis*, *Aphis gossypii*, and *Tetranychus urticae* co-occurred within the crop throughout the monitoring period but followed distinct short-term trajectories. *F. occidentalis* exhibited a pronounced population increase, primarily driven by the progressive predominance of larval stages, suggesting active reproduction within the crop. *T. urticae* increased mainly towards the end of the survey, whereas *A. gossypii* showed no consistent trend. The convergence of elevated densities in late July suggests that pest pressure in protected cucumber may intensify within a short interval. Although exploratory and limited to a single 30-day period, these results support concurrent monitoring of the pest complex at approximately five-day intervals during midsummer, with separate recording of thrips larvae as an early indicator of in-crop reproduction. Studies covering complete production cycles, with microclimate recording and assessment of natural enemies, are needed to confirm these patterns.**

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