

**RESEARCH ON THE BIOLOGY OF THE SPECIES
LASPEYRESIA POMONELLA L. IN THE NORTH-EAST
AREA OF ROMANIA**

**CERCETĂRI PRIVIND BIOLOGIA SPECIEI LASPEYRESIA
POMONELLA L. ÎN ZONA DE NORD EST A ROMÂNIEI**

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Abstract.

The research was carried out at the Research Station for Fruit Growing Iași, during 2021–2022, with the objective of correlating climatic conditions with the biological dynamics of pests of the Laspeyresia Pomonella L. species in apple orchards. The year 2021 was characterized by an average annual temperature of 10.1°C (below the multiannual average of 11.0°C) and a precipitation amount of 563.6 mm, close to normal, but with an uneven distribution. In contrast, the year 2022 was more hostile, with an average temperature of 11.3°C, a maximum of 37.0°C and only 379.0 mm of precipitation, marking a deficit of -182.6 mm and causing severe water stress. Late spring frosts (down to -6.0°C in April 2022) affected the phenophases of apple and influenced the evolution of insect populations. Based on the accumulation of thermal degrees, two complete generations of pests were confirmed in both years. The first generation was triggered in April, with the emergence of adults, followed by egg laying and larval hatching in May ($\Sigma \approx 200\text{--}270^\circ\text{C}$), pupation in June ($\Sigma \approx 600\text{--}660^\circ\text{C}$) and adult maturation. The second generation took place in July–August ($\Sigma \approx 1400\text{--}1500^\circ\text{C}$), and the mature larvae entered diapause in September–October ($\Sigma \approx 1700^\circ\text{C}$). In conclusion, the data show that climatic variations (late frosts, droughts and excessively hot summers) influenced both the phenology of the trees and the synchronization of the biological stages of the pests, highlighting the need for ecological control strategies adapted to climate change.

Key words: fruit pests, phenology, biological stages, climate change, population dynamics.

Rezumat.

Cercetările au fost realizate la Stațiunea de Cercetare-Dezvoltare pentru Pomicultură Iași, în perioada 2021–2022, având ca obiectiv corelarea condițiilor climatice cu dinamica biologică a dăunătorilor speciei

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Laspeyresia pomonella L. din livezile de măr. Anul 2021 s-a caracterizat printr-o temperatură medie anuală de 10,1°C (sub media multianuală de 11,0°C) și o cantitate de precipitații de 563,6 mm, apropiată de normal, dar cu distribuție neuniformă. În schimb, anul 2022 a fost mai ostil, cu o temperatură medie de 11,3°C, un maxim de 37,0°C și doar 379,0 mm precipitații, marcând un deficit de -182,6 mm și determinând stres hidric accentuat. Înghețurile târzii de primăvară (până la -6,0°C în aprilie 2022) au afectat fenofazele mărului și au influențat evoluția populațiilor de insecte. Pe baza acumulării gradelor termice, în ambii ani s-au confirmat două generații complete de dăunători. Prima generație s-a declanșat în aprilie, cu apariția adulților, urmată de depunerea ouălor și ecloziunea larvelor în mai ($\Sigma \approx 200-270^\circ\text{C}$), puparea în iunie ($\Sigma \approx 600-660^\circ\text{C}$) și maturizarea adulților. A doua generație s-a desfășurat în iulie-august ($\Sigma \approx 1400-1500^\circ\text{C}$), iar larvele mature au intrat în diapauză în septembrie-octombrie ($\Sigma \approx 1700^\circ\text{C}$). În concluzie, datele arată că variațiile climatice (înghețuri târzii, secete și veri excesiv de calde) au influențat atât fenologia pomilor, cât și sincronizarea stadiilor biologice ale dăunătorilor, evidențiind necesitatea unor strategii de combatere ecologică adaptate schimbărilor climatice.

Cuvinte cheie: dăunători pomicoli, fenologie, stadii biologice, schimbări climatice, dinamică populațională.

INTRODUCTION

The flight period of adults usually begins at the end of May and extends until September, and determining the biofix moment is essential for the application of phytosanitary treatments [Turcu *et al.*, 2021].

The biological cycle of the species includes one to three generations per year, depending on the average temperature and the rainfall regime specific [Ungureanu *et al.*, 2005] to the region of Moldova.

The distribution of the *Laspeyresia pomonella* L. species is high in the northeastern area of Romania, where climatic conditions favor the development of populations in apple and pear orchards [Emil *et al.*, 2010, Mihaela Sumedrea *et al.*, 2015].

Recent climate changes, characterized by higher temperatures and dry periods, have favored the expansion of the third generation [Grant *et al.*, 2017; <https://ipm.ucanr.edu/agriculture>].

MATERIAL AND METHOD

In 2021, a moderate thermal deficit (-0.9°C compared to the multiannual average) and a normal amount of precipitation (563.6 mm) were recorded (Figure 1), with an uneven distribution and late cold episodes that negatively affected the phenology of fruit species.

By contrast, 2022 was warmer (+0.3°C compared to the multiannual average) and pronouncedly drier (379.0 mm, deficit of -182.6 mm), being marked by extreme climatic phenomena – late frosts, prolonged drought and high thermal maxima – which

amplified the physiological stress of the plantations. The comparison of the phenological stages highlights a temporal gap of 4–12 days between 2021 and 2022, determined by contrasting climatic conditions. In 2022, the vegetative dormancy (BBCH 01–03) and bud development (BBCH 03–09) phases began on March 20 and 24, compared to March 16 and 20 in 2021, marking a slightly delayed start. However, bud break and leaf development (BBCH 10–19) occurred 12 days earlier (March 28 compared to April 9), indicating an acceleration of the vegetative rhythm. Inflorescence emergence (BBCH 51–59) and flowering (BBCH 60–69) phases occurred almost simultaneously in the two years (April 25–27 in 2021 and April 28–May 1 in 2022, respectively). Fruit development (BBCH 71–79) occurred on May 11 in 2022, compared to May 10 in 2021, and fruit maturity (BBCH 81–89) was reached 6 days earlier (August 24 compared to August 30). Similarly, vegetative dormancy (BBCH 91–99) began on October 2, 2022, three days earlier than in 2021.

In conclusion, 2022 presented a general acceleration of phenophases and a shortening of the vegetative cycle by 5–10 days, correlated with higher average temperatures (+0.3°C compared to the multiannual average) and a pronounced rainfall deficit (–182.6 mm), while 2021 was distinguished by a more balanced phenological dynamics, in line with the more moderate thermal regime (–0.9°C compared to normal).

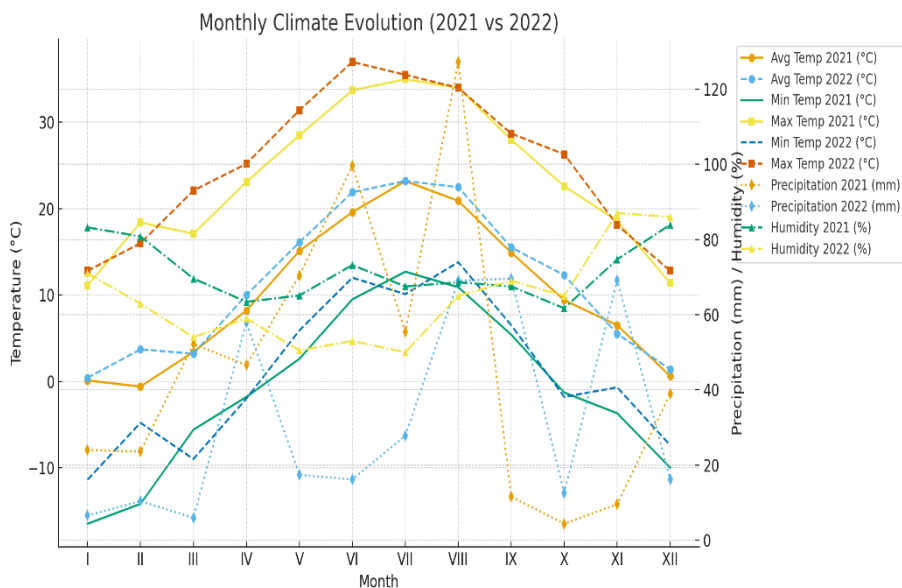


Fig. 1. The climatic situation of the area in 2021-2022

RESULTS AND DISCUSSIONS

Clear difference in the population development rate between 2021 and 2022, determined by seasonal thermal variations (figure 3) and the dynamics of degree-day accumulation ($\Sigma(t_n - t_0)$).

In both cases, the January–March period was characterized by larval diapause (L5 stage), without biological activity, because the average temperature

was below the biological developmental threshold (9°C). Metabolic activity resumed in April, but with different intensities: in 2021 only 6°C were accumulated, compared to 36°C in 2022, which denotes an earlier and more intense start of activity in 2022, favored by a higher average monthly temperature (10.2°C compared to 8.2°C).

In May, thermal accumulations increased significantly, reaching 198.2°C in 2021 and 271.6°C in 2022, values that exceed the biological threshold of 80°C required for hatching of larvae from eggs. This difference of approximately 73°C determined an earlier hatching of the first generation larvae and an anticipated installation of the first active generation in 2022.

In June and July, cumulative values reached 956.3°C (2021) and 1097.8°C (2022), confirming the achievement of the 610°C threshold, corresponding to the emergence of adults (Figure 2) and the onset of flight II. Thus, in 2022, biological activity was accelerated by approximately 10–14 days, and the second generation cycle took place in a shorter interval.

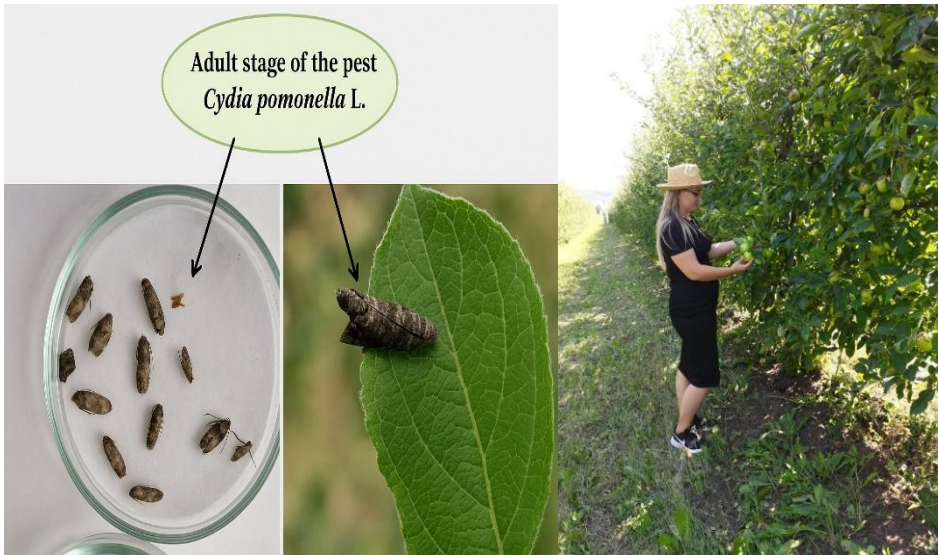


Fig. 2. Field aspects

In August, accumulations increased to 1326.2°C (2021) and 1516.3°C (2022), confirming an advancement of the second generation and a faster completion of the larval and pupal stages. In September, the biological threshold of $\approx 1.711^\circ\text{C}$, associated with the initiation of diapause, was reached only in 2022, while in 2021 it was reached only in October.

Finally, the cumulative values were 1506.6°C in 2021 and 1810.5°C in 2022, highlighting an annual thermal surplus of +304°C in favor of 2022. This surplus

avored an intensification of biological activity, with the possibility of completing two complete biological generations and an earlier entry into larval diapause.

Month	Days	tn medium (°C)	Temperature (tn - 9, 0) × zile	Σ(tn-10) cumulative	Estimated biological stage	Phenological observations	Month	Days	tn medium (°C)	Temperature (tn - 9, 0) × zile	Σ(tn-10) cumulative	Estimated biological stage	Phenological observations
January-March	-	-	0	0	Diapause (L5) – larvae at rest	In the cocoon under the bark	January-March	-	-	0	0	Diapause (L5) – larvae at rest	In the cocoon under the bark
April	30	8.2	(0.2 × 30) = 6	6	Pre-pupation → pupa → adult emergence	At the end of the month; threshold for flight 1 confirmed	April	30	10.2	(1.2 × 30) = 36	36	Pre-pupation → pupa → adult emergence	At the end of the month; threshold for flight 1 confirmed
May	31	15.2	(6.2 × 31) = 192.2	198.2	Egg → hatching larva Gen I	Hatching after ~80 °C, now 198.2 °C → larvae in fruit	May	31	16.6	(7.6 × 31) = 235.6	271.6	Egg → hatching larva Gen I	Hatching after ~80 °C, now 198.2 °C → larvae in fruit
June	30	19.7	(10.7 × 30) = 321	519.2	Larva → pupa gen I	Mature larvae; adult emergence	June	30	21.9	(12.9 × 30) = 387	658.6	Larva → pupa gen I	Mature larvae; adult emergence
July	31	23.1	(14.1 × 31) = 437.1	956.3	Adult II → egg II → larva II	Intense activity; biofix stress II (~590 °C) has been reached	July	31	23.20	(14.2 × 31) = 439.2	1 097.8	Adult II → egg II → larva II	Intense activity; biofix stress II (~590 °C) has been reached
August	31	20.9	(11.9 × 31) = 369.9	1 326.2	Larva II → pupa II	Advanced Generation II approx. in 1400-1600 °C	August	31	22.5	(13.5 × 31) = 418.5	1 516.3	Larva II → pupa II	Advanced Generation II approx. in 1400-1600 °C
September	30	14.6	(5.6 × 30) = 168	1 494.2	Mature II/III larva → seeking refuge	Mature larvae – approaching diapause (~1711 °C)	September	30	15.5	(6.5 × 30) = 195	1 711.3	Mature II/III larva → seeking refuge	Mature larvae – approaching diapause (~1711 °C)
October	31	9.4	(0.4 × 31) = 12.4	1 506.6	Larval diapause L5	Enters rest; threshold confirmed (>1711 °C)	October	31	12.2	(3.2 × 31) = 99.2	1 810.5	Larval diapause L5	Enters rest; threshold confirmed (>1711 °C)
November-December	-	-	0	1 506.6	Larval diapause L5	No biological activity until next spring	November-December	-	-	0	1 810.5	Larval diapause L5	No biological activity until next spring

Fig. 3. Development stages of the *Laspeyresia pomonella* L. species in 2021-2022

CONCLUSIONS

The species *Laspeyresia pomonella* L. shows high ecological plasticity, adapting quickly to climatic variations in the northeastern area of Romania. Its biological activity is influenced by temperature and humidity, factors that determine the number of annual generations.

Pheromonal monitoring is an essential method for integrated pest management, and the correct application of treatments, combined with biological control measures, can keep populations below the economic damage threshold.

The results support the need for the continuous application of the principles of integrated control and the adaptation of phenological models to the current climatic conditions in northeastern Romania.

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