

SPECIES OF TACHINIDS (DIPTERA: TACHINIDAE) THAT PARASITIZE
THE GRAPE-LEAF MOTH
SPARGANOTHIS PILLERIANA (DENIS & SCHIFFERMÜLER, 1775)
(LEPIDOPTERA: TORTRICIDAE)
IN SOUTHERN VINEYARDS OF ROMANIA

DANIELA BĂRBUCEANU

University of Pitești, Faculty of Sciences, Department of Biology, Târgul din Vale St. 1, 110040, Pitești, Romania
E-mail: daniela_barbuceanu@yahoo.com

Abstract

Two species of tachinids – *Nemorilla maculosa* (Meigen, 1824) and *Pseudoperichaeta nigrolineata* (Walker, 1853) – were obtained as a result of the rearing of *Sparganothis pilleriana* (Denis & Schiffermüller, 1775) larvae and chrysalids. The observations were carried out from 2000-2003 in two vineyards of southern Romania: Ștefănești-Argeș, which has a small population of *S. pilleriana*, and Dăbuleni-Dolj (near the Danube) where the host has a large population. The two species are mentioned as parasitoids of *S. pilleriana* for the first time in Romania. The role played by the two species of tachinidae in reducing the population of *S. pilleriana* is rather small (3.08%); *N. maculosa* is more significant than *P. nigrolineata* (2.74/0.34%). In the Ștefănești vineyard, *N. maculosa* parasitized the host by 4.2% and at the Dăbuleni vineyard by 1.64%. In turn, two species of hyperparasitoids, *Pediobius* sp. and *Catolaccus ater* (Ratzeburg, 1852), parasitized *N. maculosa*, reducing its activity.

KEY WORDS: grape-leaf moth, vineyard, parasitoids, *Nemorilla maculosa*

Introduction

Nemorilla maculosa (Meigen, 1824) and *Pseudoperichaeta nigrolineata* (Walker, 1853) are polyphagous diptera that parasitized numerous species of microlepidoptera. *Nemorilla maculosa* is noted by THOMPSON (1954) as a frequent parasitoid of the species *Sparganothis pilleriana* (Denis & Schiffermüller, 1775) in Europe. PŶKHOVA (1968) finds that a kindred species, *Nemorilla floralis* (Fallen, 1810) is one of the main parasitoids of that microlepidopteran in Ukraine, and PREDESCU (1971) obtains the same species, *N. floralis*, starting from pupae of *S. pilleriana* collected in vineyards located in western Romania. As a matter of fact, *N.*

floralis probably has a host spectrum similar to that of the species *N. maculosa*, with which it was often mistaken in the past. *Pseudoperichaeta nigrolineata* parasitizes microlepidoptera, especially in the Tortricidae and Pyralidae families, but also in the Oecophoridae and Hyponomeutidae families (RAHAL *et al.*, 1995). MARTINEZ & REYMONET (1991) obtained it from *Homoeosoma nebulella* (Denis & Schiffermüller 1775), *Lobesia botrana* (Denis & Schiffermüller, 1775), and *Cnephasia alticolana* (Herrich-Schäffer, 1851). In Romania, it has also been obtained from *Ostrinia nubilalis* (Hübner, 1796) (IONESCU *et al.* 1964) and *Archips rosana* (Linnaeus, 1758) (DIACONU & TSCHORSNIG, 1999).

Material and Methods

The observations were carried out in two vineyards in southern Romania, Ștefănești and Dăbuleni. The vineyards of Ștefănești, located in the central southern region of the Wallachian hills and characterized over the observation period by a rather wet and cool climate, present a small *Sparganothis pilleriana* population. Although the Ștefănești vineyards cover an area of several scores of hectares where numerous grape varieties are cultivated (e.g. Fetească regală, Fetească albă, Aligote, Chasselas Doré etc.), *S. pilleriana* was identified and observed in a vineyard of ca 3 hectares where the Fetească regală variety of grape is grown, and the attack occurred within an area of ca 1 hectare. Up to the year 2000, intensive chemical treatments were conducted there. Dăbuleni is located in southern Oltenia region, near the Danube, so the climate is characterized by Mediterranean influences. Here several grape varieties are cultivated including Sangiovese, Rkatsiteli, Grand noir de la Calmette, and Roșioară, but *S. pilleriana* was observed only on the Roșioară variety, in a vineyard of ca 2 hectares.

From the stocks that exhibited the attacks, the samplings were done randomly over the period of activity of the host, i.e. May to July, in 1998, and 2000-2003. With the exception of 2001, the years were characterized by thermal values exceeding the average. The larvae and pupae of *S. pilleriana* were reared in laboratory conditions, after being isolated in glass containers in order to retain the possible parasitoids. The larvae were fed daily with vine leaves. Of the 36 larvae and pupae of *S. pilleriana* parasitized by the tachinids, four adults of *P. nigrolineata* were obtained, as well as 26 adults of *N. maculosa*; six puparies, probably belonging to *N. maculosa*, failed to complete their evolution as two of them were hyperparasitized.

Results and Discussion

The role played by the tachinids (Diptera) in limiting the host populations of *S. pilleriana* in the two regions is rather small compared to that of another systematic group of parasitoids (Hymenoptera). If the whole complex of parasitoids contributes to limiting the *S. pilleriana* populations by 20.77%, the tachinids claim a percentage of only 3.08%.

The data about the recorded parasitoids have been arranged in the following order: locality / stage of host / stage of emerging / collecting date / date of emergence / individuals (♀ and ♂) obtained.

Nemorilla maculosa (Meigen, 1824)

It was obtained as a larval or larvo-pupal solitary, primary endoparasitoid in:

Ștefănești - mature larva / pupa / 09.06.2000 / 29.06.2000 / 1♂; mature larva / pupa / 09.06.2000 / 05.07.2000 / 1♀, 1♂; mature larva / mature larva / 29.06.2001 / 13.07.2001 / 1♀; mature larva / pupa / 04.06.2002 / 11.07.2002 / 1♂; mature larva / pupa / 13.06.2002 / 03.07.2002 / 1♀; mature larva / pupa / 28.06.2002 / 12.07.2002 / 1♂; mature larva / pupa / 28.06.2002 / 12.07.2002 / 1♂; mature larva / pupa / 28.06.2002 / 14.07.2002 / 1♂; pupa / pupa / 28.06.2002 / 15.07.2002 / 1♀; pupa / pupa / 12.06.2003 / 04.07.2003 / 1♂; pupa / pupa / 12.06.2003 / 04.07.2003 / 1♂; pupa / pupa / 12.06.2003 / 04.07.2003 / 1♀; mature larva / mature larva / 17.06.2003 / 06.07.2003 / 1♂; pupa / pupa / 17.06.2003 / 02.07.2003 / 1♀; pupa / pupa / 17.06.2003 / 04.07.2003 / 1♂; pupa / pupa / 17.06.2003 / 05.07.2003 / 1♀; pupa / pupa / 17.06.2003 / 05.07.2003 / 1♂.

Dăbuleni - mature larva / pupa / 27.06.2000 / 20.06.2000 / 1♂; mature larva / pupa / 29.05.2001 / 15.06.2001 / 1♀; immature larva / mature larva / 29.05.2001 / 02.07.2001 / 1♂; pupa / pupa / 20.06.2001 / 05.07.2001 / 1♂; mature larva / pupa / 20.06.2001 / 12.07.2001 / 1♂; mature larva / mature larva / 17.06.2002 / 07.07.2002 / 1♀; mature larva / mature larva / 17.06.2002 / 30.06.2002 / 2♀♀; mature larva / pupa / 17.06.2002 / 08.07.2002 / 1♂.

Over the study period, it was found that the parasitoid lays the eggs on the front part of the host's body, in a dorsal position, often on the cephalic capsule and the prothorax plate, but also on its thorax segments, and seldom on the abdominal ones. There was only one case when the egg was situated in a ventral position, in the thorax area. When two or three eggs are laid on the host's body, of the larvae which penetrate into the host only one reaches complete maturity. There are, however, exceptions: out of a larva collected on May 17th, 2002 in Dăbuleni which had two spots of necrosis on the thorax segments, two females of *N. maculosa* hatched on June 30th, within a few hours of each other. This was the only case noticed throughout the four years of study. Similarly, there were cases when the larvae collected exhibited spots of necrosis on the surface of their bodies, yet, for various reasons, the parasitoid larva failed to continue its evolution. The parasitoid generally attacks larvae having reached full development, rarely attacks smaller larvae, a situation emphasised during the observations.

The mature larvae which are parasitized keep their mobility and behave normally; they turn into chrysalids, without betraying in any way the presence of the internal parasitoid. The larva of the parasitoid develops in the fore part of the host (in the larval or pupal stage).

When the host parasitizing takes place in the immature larval stage or at the beginning of its mature stage, the departure from the host's body by the parasitoid is done when the latter is in the larval stage, because the parasitoid will complete its development inside the host (5 cases out of 26); only the tegument will remain outside. If the parasitizing happens at a later period, the quitting of the host and the formation of the puparium occur a few days after the host turns into a pupa.

The puparium protrudes from the remains of the larva or the chrysalis at the level of the thorax, ventrally. In only two cases did the formation of the puparium occur outside the host-pupa, as the completely developed larva of the parasitoid leaves the pupa through a narrow opening, made either at the front end of the pupa, or between the first two abdominal segments.

The duration of the development varies according to the environment conditions. A larva collected on June 17th, 2003 in Ștefănești had two eggs on its second and fifth segment; on June 26th, 2003, at the level of the eggs two scars appeared. At an average temperature of about 23°C, under laboratory conditions, the incubation of the eggs lasted for about 10 days. The literature in the field suggests that larval development is brief – about 5 to 7 days. Similarly, from a puparium whose formation was completed on June 29th, 2003 at about 12 o'clock a.m. a male hatched on July 6th: under the same laboratory conditions, nymphosis lasted 6 and half days.

The activity of the parasitoid varies in keeping with the local and annual climatic conditions. In the climatic conditions in Dăbuleni, parasitizing begins in the last ten-day period of the month of May, continuing in June as long as the larvae are present in the vineyard. In Ștefănești, where the average annual temperature is lower, parasitizing occurs in early June, and lasts throughout the month.

The influence of high temperatures on the development of the host and the parasitoid was better noticed in the climatic conditions of 2003, in Ștefănești. The year 2003 was an outstanding year in terms of thermic regimen, as the unusually high temperatures in May and June determined an accelerated development of the host, *Sparganothis pilleriana*, and of the parasitoid *Nemorilla maculosa* (Meig) as well. Of the mature larvae and the pupae collected during that period, the eclosion dates of the moths of *S. pilleriana* were unusually close together, from June 16th, 2003 to July 14th, 2003; the flight of the adults of *N. maculosa* also occurred early, and developed during a short interval: 2.07. – 6.07. (Fig. 1). Which of the two sexes hatches first cannot be said precisely, as both males and females were present throughout the duration of the flight.

The adults reared under laboratory conditions and fed on sugar syrup survived 5 to 12 days, extreme values being present for both males and females.

Over the four years of samplings, of the puparia that completed their development more males (15) than females (11) were obtained, the sex-ratio having a supra-unit value, i.e. 1.36.

The role of the parasitoid in limiting the populations of *S. pilleriana* was 2.74% (Tab. I).

In Ștefănești, the species *N. maculosa* achieved a parasitizing percentage of 4.2%. In Fig. 2 it can be seen that at Ștefănești the importance of the parasitoid increases, as a result of the cessation of the chemical treatments, and the increase in the host population. An exception is evident in 2001, with a parasitizing percentage of 1.62%; the lower temperatures recorded in that year and the parasitoid's preference for a warm and dry climate account for this exception.

In Dăbuleni, the species *N. maculosa* achieved a parasitizing percentage of 1.64%. Although the climatic conditions are favourable to the development of the species, the parasitizing percentages are smaller than those recorded at Ștefănești, probably due to a disadvantageous competition with other species of parasitoids, or an insufficient number of samples taken.

Table I. Role of tachinids in limiting of the *S. pilleriana* (Den. & Schiff.) populations.

| Places | Year | No. of individ. (larvae and pupae) | Individuals parasitized | | | | Tachinidae | | | |
|------------|------|---------------------------------------|-------------------------|-------|-----|------|--------------------|------|------------------------|------|
| | | | | | | | <i>N. maculosa</i> | | <i>P. nigrolineata</i> | |
| | | | No. | % | No. | % | No. | % | No. | % |
| Ștefănești | 1998 | 27 | 5 | 18.51 | - | - | - | - | - | - |
| | 2000 | 64 | 12 | 18.75 | 2 | 3.13 | 2 | 3.13 | - | - |
| | 2001 | 124 | 18 | 14.52 | 2 | 1.62 | 2 | 1.62 | - | - |
| | 2002 | 164 | 30 | 18.29 | 8 | 4.87 | 7 | 4.27 | 1 | 0.61 |
| | 2003 | 122 | 34 | 27.87 | 11 | 9.02 | 10 | 8.20 | 1 | 0.82 |
| Subtotal | | 501 | 99 | 19.76 | 23 | 4.59 | 21 | 4.20 | 2 | 0.4 |
| Dăbuleni | 2000 | 215 | 61 | 28.37 | 3 | 1.4 | 3 | 1.4 | - | - |
| | 2001 | 308 | 67 | 21.75 | 6 | 1.95 | 5 | 1.62 | 1 | 0.32 |
| | 2002 | 146 | 16 | 10.96 | 4 | 2.74 | 3 | 2.05 | 1 | 0.68 |
| Subtotal | | 669 | 144 | 21.52 | 13 | 1.94 | 11 | 1.64 | 2 | 0.3 |
| Total | | 1170 | 243 | 20.77 | 36 | 3.08 | 32 | 2.74 | 4 | 0.34 |

Pseudoperichaeta nigrolineata (Walker, 1853)

It was obtained as a larval or larvo-pupal solitary, primary endoparasitoid in:

Ștefănești - mature larva / pupa / 28.06.2002 / 12.07.2002 / 1♀; mature larva / pupa / 01.06.2003 / 15.06.2003 / 1♂.

Dăbuleni - mature larva / pupa / 19.06.2001 / 12.07.2001 / 1♀; immature larva / mature larva / 27.05.2002 / 26.06.2002 / 1♂.

The adults fly from early May till the middle of September.

The small number of specimens obtained did not allow any pertinent observations regarding the biology of this parasitoid.

The larvae of the host were parasitized earlier than those from which the adults of *N. maculosa* appeared. *Pseudoperichaeta nigrolineata*, no less than the former species, also parasitizes the larvae of *S. pilleriana* in immature stages, a situation where the appearance of the parasitoid occurs when the host is in the stage of the mature larva.

The role of that species in reducing the host populations is only minor: 0.34% (Tab. I).

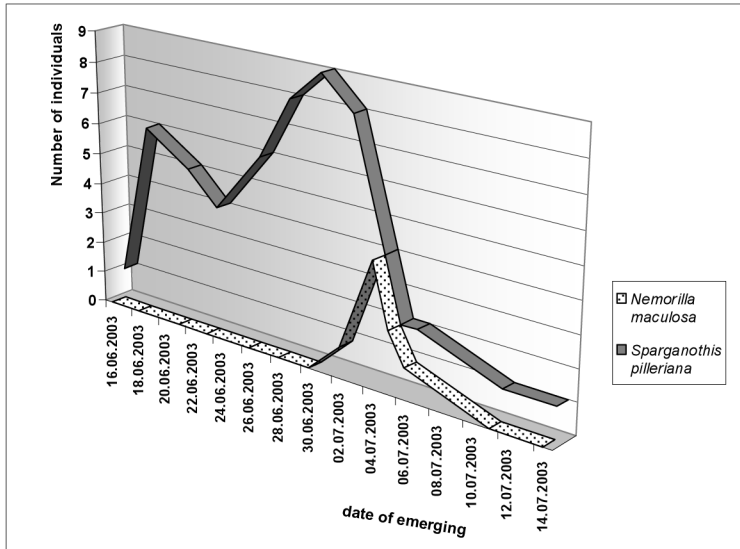


Figure 1. The dynamics of the appearance of the adults of *Nemorilla maculosa* (Meig.) and *Sparganothis pilleriana* (Den. & Schiff.) in Ștefănești, in the year 2003.

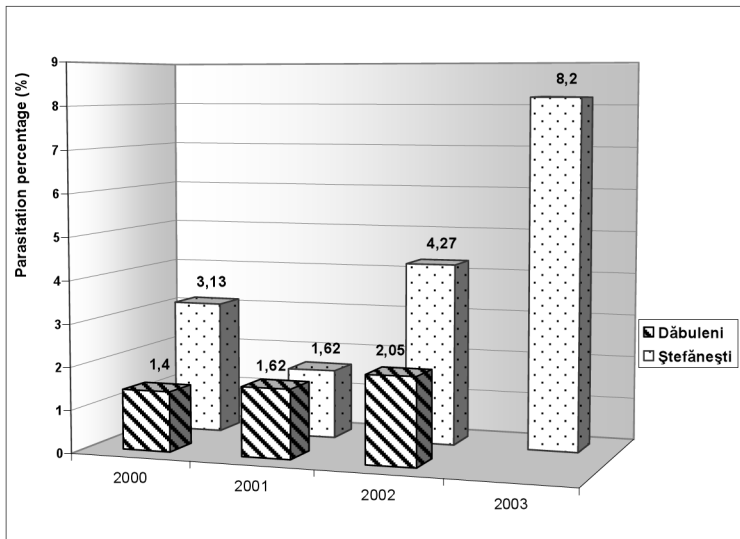


Figure 2. The parasitization percentages for *Nemorilla maculosa* (Meig.) on *Sparganothis pilleriana* (Den. & Schiff.)

The hyperparasitoids of the species *Nemorilla maculosa* (Meigen, 1824)

Two species of hyperparasitoids were obtained out of the puparia of *N. maculosa*.

Catolaccus ater (Ratzeburg 1852) was obtained as a solitary pupal secondary endoparasitoid in:

Ștefănești – puparium / 11.07.2003 / 17.07.2003 / 1♀.

It was also obtained out of cocoons of *Apanteles* and other Ichneumonoidea (TRJAPIȚĂN, 1978). In Romania it was obtained from cocoons of *Apanteles glomeratus* (Linnaeus, 1758), in the complex of parasitoids of *Pieris brassicae* (Linnaeus, 1758), (ANDRIESCU *et al.*, 1975). In the puparium from which that species hatched there were no observations of cocoon remains of Ichneumonidae or Braconidae, known hosts of that species. This host-parasitoid relationship is new to science.

Pediobius sp. was obtained as a gregarious pupal secondary endoparasitoid in:

Ștefănești – puparium / 17.06.2003 / 17.07.2003 / 8♀♀.

The species of *Pediobius* are known as primary and secondary parasitoids of a number of species of Coleoptera, Diptera, Lepidoptera, Hymenoptera and Hemiptera. (BOUCEK, 1965). This host-parasitoid relationship is new to science.

Conclusions

In the vineyards of southern Romania, the populations of *Sparganothis pilleriana* (Denis & Schiffemüller) are controlled by two species of tachinids, *Nemorilla maculosa* (Meigen, 1824) and *Pseudoperichaeta nigrolineata* (Walker). The two species are mentioned for the first time as parasitoids of the grape-leaf moth in Romania.

The parasitization of the host usually takes place in the stage where the larva reaches complete development, and less often when it is immature. The activity of the parasitoid *Nemorilla maculosa* (Meig.) begins earlier in the vineyard of Dăbuleni than in the Ștefănești vineyard (in the last ten days of May), on account of the warmer climate. The males are more numerous than the females, so the sex-ratio has a supra-unit value, i.e. 1.36.

With a parasitizing percentage of 2.74%, the species *Nemorilla maculosa* (Meig.) has a greater importance in limiting the host population than the *Pseudoperichaeta nigrolineata* (Walk.) which ensures a reduction of only 0.34%. In the vineyards at Ștefănești, *Nemorilla maculosa* (Meig.) reduced the host population by 4.2%, while the parasitizing at Dăbuleni was only 1.64%. *Nemorilla maculosa* (Meig.) was hyperparasitized by two species, *Catolaccus ater* (Ratzeburg) and *Pediobius* sp., whose role is insignificant.

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ВРСТЕ ТАХИНИДА (DIPTERA: TACHINIDAE) КОЈЕ ПАРАЗИТИРАЈУ
НА ГРОЗДОВОМ СМОТАВЦУ
SPARGANOTHIS PILLERIANA (DENIS & SCHIFFERMÜLER, 1775)
(LEPIDOPTERA: TORTRICIDAE),
У ВИНОГРАДИМА ЈУЖНЕ РУМУНИЈЕ

ДАНИЈЕЛА БАРБУЦЕАНУ

Извод

Две врсте тахинида - *Nemorilla maculosa* (Meigen) и *Pseudoperichaeta nigrolineata* (Walker) забележене су у процесу гајења ларви *Sparganothis pilleriana* (Denis & Schiffermüller) и хризалида, сакупљених у виноградима јужне Румуније. Посматрања су вршена у два винограда – Штефанешти-Аргеш у којем је популација *S. pilleriana* била мала, и Дабулени-Дољ, у близини Дунава, у којем је популација ове врсте била врло бројна. Улога две врсте из породице Tachinidae у редуковању величине популација *Sparganothis pilleriana* је прилично мала (3,08%), при чему је улога *N. maculosa* значајно већа од улоге *P. nigrolineata* (2,74% односно 0,34%, респективно). Ово је први пут да су *N. maculosa* и *P. nigrolineata* забележене као паразитоиди *S. pilleriana* у Румунији. Поред тога, у овом истраживању је констатовано да је *N. maculosa* била домаћин двома врстама хиперпаразитоида - *Pediobius* sp. и *Catolaccus ater* (Ratzeburg).

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