Zeitschrift: Entomologica Basiliensia
Herausgeber: Naturhistorisches Museum Basel, Entomologische Sammlungen
Band: 9 (1984)

Artikel: Phenology of Diptera Sciomyzidae in a mediterranean forestry biotop
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DOI: https://doi.org/10.5169/seals-980521

Phenology of Diptera Sciomyzidae in a mediterranean forestry biotop

by **J. C. Vala***

Abstract: In the oak grove of Rochefort du Gard, sited in the South of France, six species of Sciomyzidae can be found. They are: *Trypetoptera punctulata* (Scopoli), *Coremacera marginata* (Fabricius), *Euthycera cribrata* (Rondani), *E. leclercqi* Vala and Reidenbach, *Dichetophora obliterata* (Fabricius) and *Pherbellia cinerella* (Fallen). Occasionally *E. alaris* Vala, *Salticella fasciata* (Meigen) and *Sepedon sphegeus* (Fabricius) can also be captured.

This study enables to precise: the seasonal variations of the species; the synchronism between breeding of 3 species and the one of their mollusk-prey; the phenological periods of species is determined by the presence of larvae instars, pupae, adults and preoviposition period.

Sciomyzidae dipterae, whose larvae feed on mollusks, are commonly called marsh flies. Depending on the biotop of mollusks attacked, species are mentioned as terrestrial or aquatic. In this study, we followed the development of species found in strictly terrestrial surroundings. The chosen area is the oak-grove of Rochefort du Gard.

The oak-grove of Rochefort du Gard, situated in the south of France, in the surroundings of Avignon, mainly consists of white oaks (*Quercus pubescens* Willdenow) and green oaks (*Q. ilex* L.). The very diversified cover presents in some parts homogeneous clumps of graminae, of *Lithospernum officinale* L. of *Osyris alba* L. Altitude does not exceed 100 m and climatic conditions are mediterranean.

Samples of adult Sciomyzidae were taken by sweeping for a period of 30 minutes each time over herbaceous vegetation in many stations or directly over the ground after rain. Once we had determined species, sex and the number of captured flies, we released most of them, although a few specimens were held in captivity for the study of the different larval stages. All larvae were reared by feeding them with the terrestrial snails found at the place, these are: *Pomatia elegans* (Müller), *Clausilia nigricans* (Pult.), *Abida secale*, *Helix aspersa* Müller, *H.*

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* This work was presented on the 17th International Congress of Entomology of Hamburg, 20–26 august 1984.

memoralis L., *Fruticola hispida* (L.), *Lauria cylindracea* (Da costa), *Vitrina major* de Ferussac and two species of slugs, *Agriolimax reticulata* Müller and *Agriolimax* sp.

Species and seasonal variations

Six species of Sciomyzidae have been collected in this forest: *Coremacera marginata* (Fabricius, 1775), *Dichetophora obliterata*

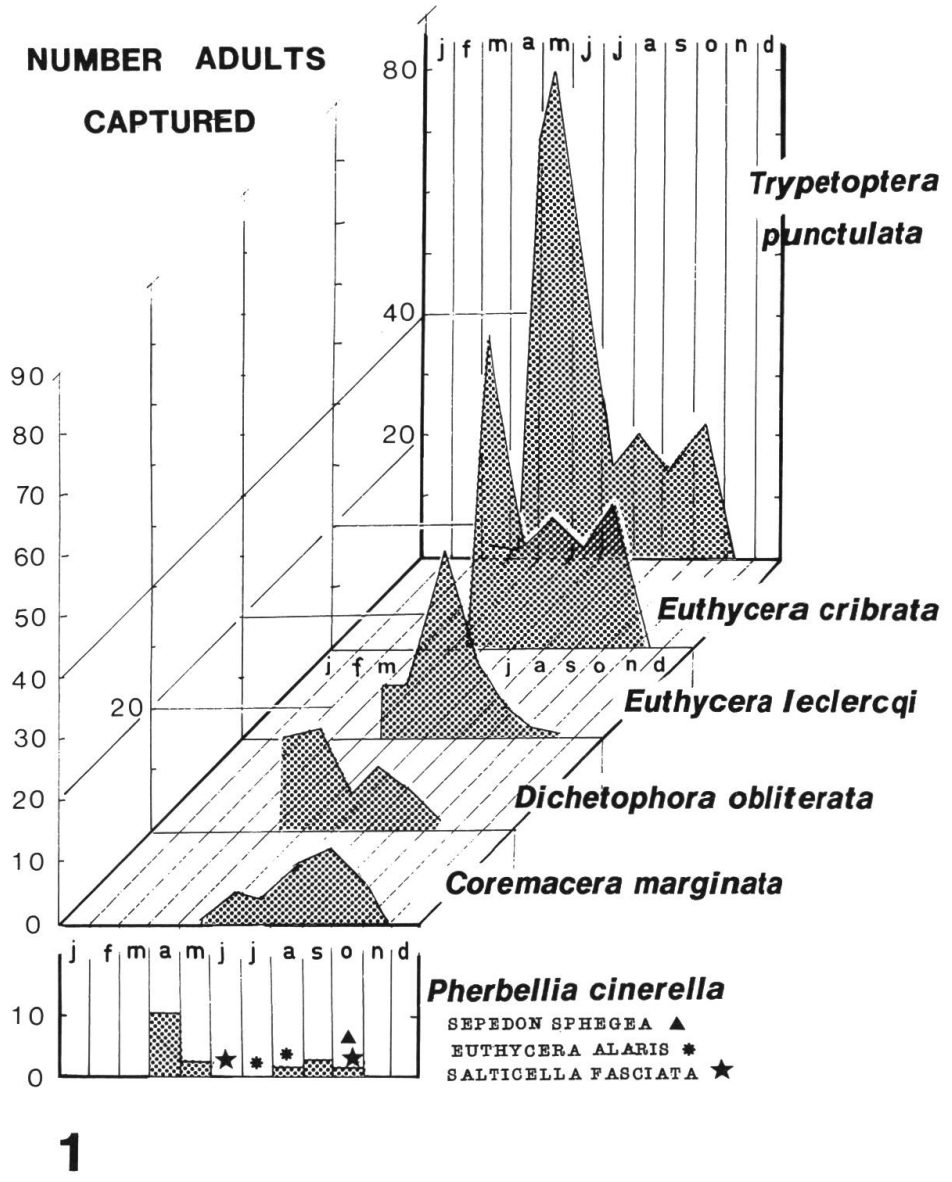


Fig. 1: Seasonal variations in Sciomyzidae populations in the forest of Rochefort du Gard.

(Fabricius, 1805), *Euthycera cribrata* (Rondani, 1867), *E. leclercqi* Vala et Reidenbach, 1982, *Trypetoptera punctulata* (Scopoli) *and Pherbellia cinerella* (Fallen, 1820), *Euthycera alaris* Vala which is very unusual and very localized. (Fig. 1).

In five years of capturing (1979–1984), we exceptionally found 2 *Salticella fasciata* ♂ and 12 *Sepedon sphegea* Fabricius, whose presence can probably be explained by the action of a strong local wind, called «Mistral». We also occasionally found *Euthycera alaris* Vala, 1983; only 2 samples have been captured during the period of study.

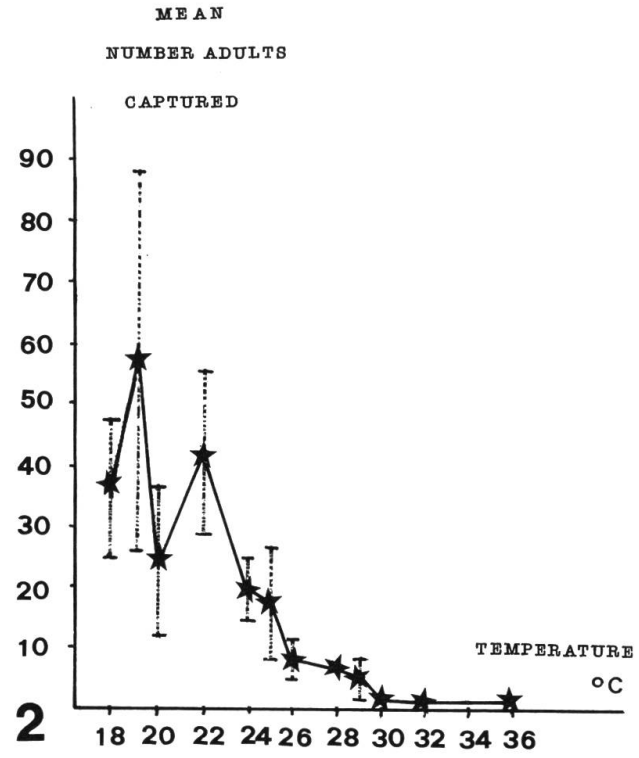
Pherbellia cinerella is only a marginal species in this forestry biotop. It is localized in the outskirts of clearings or of forestry tracks. To compare with the uncovered herbaceous biotop which represents its usual habitat, the number of captures is very low, around 2–5%.

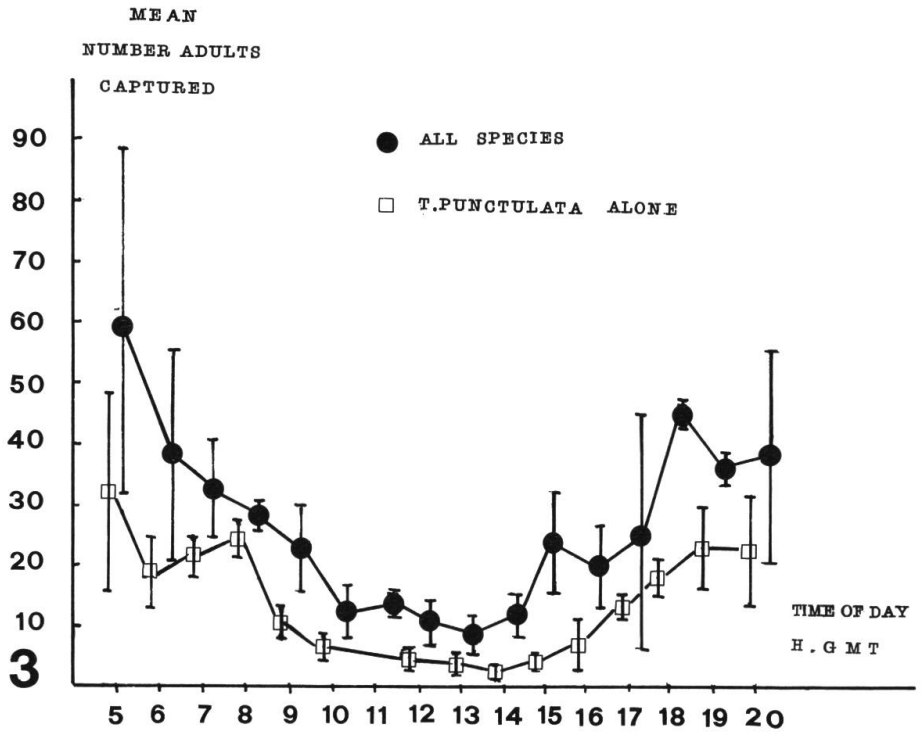
For all the other Sciomyzidae, monthly collectings, figure 1, clearly show that the species live in the biotop during the most temperate period of the year. *Trypetoptera punctulata,* the earlier one, can be seen from the beginning of may and the other ones from the end of may until the beginning of june. Every species appears suddenly and massively, there is only one annual emergence peak at the beginning of the flying period. Then, particularly under the predatory action of the spiders and the Asilidae, the density of every population decreases. The last captures take place during the first fortnight of november.

The effects of temperature

In this kind of biotop, the number of captured insects significantly varies according to ambient temperature (Fig. 2) and consequently according to the time of capture (Fig. 3). The experiences, carried out from may 28th to june 9th 1981, which is a period of high density and abundance for all the species, show distinct differences in the number of captured insects. The most favourable temperatures are 18–25°C. These conditions can be fulfilled in the morning and in the evening.

Therefore, the captured number, quite high in the morning, is decreasing as temperature is increasing, then it gradually gets higher with the coming of dusk. On the one hand, these differences may be due to direct sunshine on some parts of the biotop then deserted by most of the flies which take refuge in shady areas. On the other hand, and correlatively, the increase of ambient temperature brings about a secondary





Figs 2–3: 2. Relationship between number of captured Sciomyzidae and temperature.
3. Relationship between number of captured Sciomyzidae and time.

spreading of the flies which set themselves up at the base of the shaded vegetation.

Characteristics of the larval life

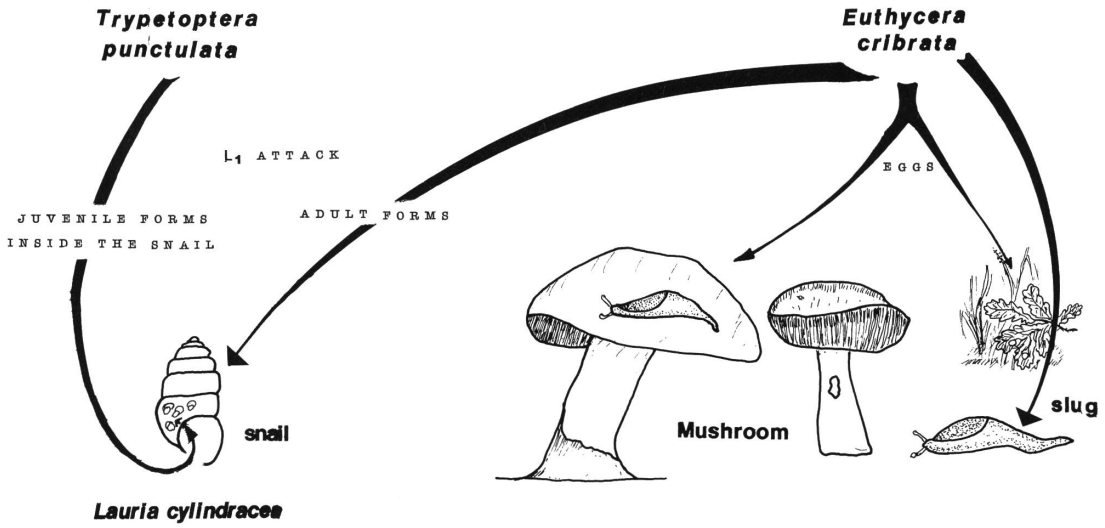
Experimental larval developments which are already known for forest species (Table 1) point out two main characteristics. Firstly, all the species present a preoviposition period which is lengthened for 2 or 3 months, and even 5 months in the case of *T. punctulata*. Secondly, the larval development as well as the puparium stage takes place in autumn (and during winter), until may. This explains the fact that there is only one annual generation for each species.

Table 1

Species	Preoviposition	Incubation	L_{1-3}	Pupae	Authors
Coremacera marginata	81	11	22–97	47–124	Knutson 1973
Euthycera cribrata	60–75	12–38	51–110	49–120	Vala & al. 1982
Euthycera leclercqi	55–65	12–23	47–79	39–109	Vala & Caillet (in press)
Trypetoptera punctulata	90–150	12–16	70–82	60–90	Vala (in press)
Dichetophora obliterata	90 or + ?	71–90			Vala (unpublished)
Pherbellia cinerella	multivoltine species				Bratt & al. 1966

Comparative time of development for immature stages of concerned species according to various authors.

Sciomyzidae larvae are malacophagous. Their eggs are deposited on low vegetation in august and september. First instar larvae hatch 15, 30, or even 90 days *(D. obliterata)* later. In the same time, the biotop contains many juvenile forms of Helicidae, Limacidae, ... In the course of our experimental researches (Vala, in press), we noticed that the young *Lauria cylindracea* incubated inside the palleal cavity of their parents, and they were then eaten by first instar larvae of *T. punctulata*. On



4 Fig. 4: Likely autumn predator-prey relationships between 2 species of Sciomyzidae and their mollusk hosts in nature.

the contrary, the *Euthycera* larva directly eats the adult *Lauria* (Fig. 4). Moreover, in the end of summer and beginning of autumn, rains are quite frequent and morning dews always abundant; so that the forest abounds in mushrooms, which then attract slugs, and *E. cribrata*, whose larvae also eat slugs (VALA & al., 1983), is often seen on a variety of mushrooms.

Therefore, in the Rochefort du Gard Forest (Fig. 5), the development of *E. cribrata* and perhaps *E. leclercqi* seems to synchronise with that of the Helicidae and the slugs. The reproduction of *Trypetoptera punctulata* appears to be in accordance with the one of *Lauria cylindracea*, at least for first and second instar larvae. In the literature on Sciomyzidae, the only case of synchronous reproduction between flies and molluscs-preys concerned the *Antichaeta* species: «Gravid females of *Antichaeta* retain their eggs until they find snail egg masses and oviposit only on them.» (BERG & KNUTSON, 1978).

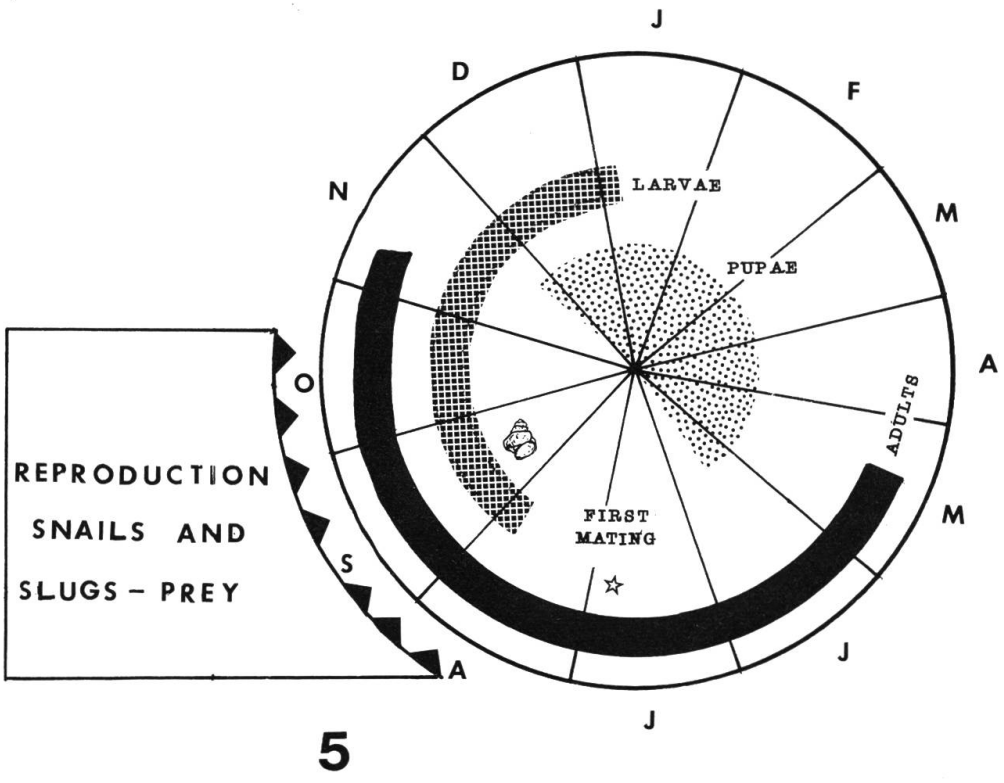


Fig. 5: Phenological model of Sciomyzidae in a terrestrial biotop, example of the oak grove of Rochefort du Gard.

Phenology

The synthesis between the different biological aspects of adults and larvae, and the observations directly made in the field, enables to be distinguished in the overall phenology of the Sciomyzidae found in the Rochefort du Gard forest the following phases: (Fig. 5):

– presence of adults from may to november
– long period of pre-reproduction
– presence of larvae from september to january
– presence of puparia which are in diapause from December to May.

This phenological aspect allows the Sciomyzidae found in the forest of Rochefort du Gard to be placed in the type 5 described by Berg & al. (1982). This one includes all the univoltine species which spend wintertime in the form of pupae. However, concerning the presence of this stage in nature, our opinion is quite different. According to these authors, pupae can be found at all times of the year. In the case of our species, *E. cribrata, E. leclercqi, C. marginata* and *T. punctulata,* pupae can only be found during 6 months of the year, from december until may. But on the other hand, the other phenological phases described by Berg and al. do not last as long as ours. For example, the adult flying-period only extends from may to august and the larval period from may to the beginning of september.

We notice that the species considered by Berg & al. are all nearctic, holarctic or nord-palearctic, but ours are south-palearctic and even mediterranean. Adaptations to variations in climatic conditions might explain these differences. We therefore think that 2 subdivisions should be distinguished, according to latitude, within type 5 of Berg & al. (1982). The first one, type 5a, would correspond to the initial description of the authors and include the nearctic and nord-palearctic species. The second one, type 5b, whose development characteristics would scarcely differ from the cycles of the species found in the forest of Rochefort du Gard, would embrace more southern and south-palearctic species.

Finally, *P. cinerella* is a multivoltine and ubiquitous species which occupies various types of biotop. Its phenology is characterized by the imaginal diapause during the winter (2 ♂ captured on the 28.XII.1979 when the ground was covered with 40 cm of snow). The species might be put in type 2, according to Berg & al. (1982).

Acknowledgements

I thank Martine Fargier (Laboratory of Animal Biology, Avignon) for kindly translating the original text of this article and Dr J. C. Deeming (National Museum of Wales, Cardiff) for giving further corrections to the final manuscript.

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