

***Pseudonapomyza atratula* Zlobin, 2002 (Diptera: Agromyzidae): First Record on the European Continent (Spain) with Observations on Hosts Plants and Phenology¹**

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Abstract Malaise traps were operated for 3 yrs (2004 - 2007) at 2 locations in Spain. Agromyzid adults were collected from plant material that was periodically removed from one of those locations. From these sampling efforts, *Pseudonapomyza atratula* Zlobin, 2002 (Diptera: Agromyzidae), a species previously reported only from Tunisia, is reported for the first time in Europe (Spain). Specimens were collected from the host plants, *Avena barbata* Pott ex Link and *A. fatua* L., which are first records as hosts of this leaf-miner. Males were captured from late-September or the beginning of October continuously through the end of May with 8 to 10 generations annually. Population peaks appeared when average temperatures were in a range of approx. 10 - 20°C. *Pseudonapomyza atratula* is closely related to *P. atra* (Meigen); morphological criteria (male genitalia) are provided for taxonomic separation of the two species.

Key Words Diptera, Agromyzidae, *Pseudonapomyza atratula*, first record, Spain, Europe, host-plants, phenology

The genus *Pseudonapomyza* Hendel, 1920 (Diptera: Agromyzidae) is composed exclusively on the European continent of miners on monocotyledon plants (Poaceae). *Pseudonapomyza* is theorized to have emerged from the genus *Phytomyza* which includes 28.5% of the Palaearctic Agromyzidae species. Within *Pseudonapomyza*, there is a group of species that mines plants within the families Acanthaceae, Amaranthaceae and Asteraceae, whereas another group occurs within temperate zones and mines exclusively on Poaceae (Spencer 1990).

Pseudonapomyza is widely distributed on the European continent. Martinez (2004) listed 19 species that occur on only 3 known host plant species in Europe (Benavent-Corai et al. 2005). Those 19 species represent 43.2% of the known Palaearctic species (44 total species). Worldwide, 92 species are known to occur in most regions except in South America (Zlobin 2002). The predominant worldwide distribution of *Pseudonapomyza* is Afrotropical, Oriental and Australian (Cerny 1992).

The morphological diagnostic characteristics of the genus *Pseudonapomyza* are summarized by Dempewolf (2004). The wing costa extends only to generate $R_4 + 5$, and the 2nd costal section is conspicuously short being less than 1.5 times the length of 4th (Spencer 1986). The 2nd cross vein is missing, and the 3rd antennal segment is

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angulate (only known for species feeding on Poaceae). The mesonotum and the abdominal tergites often present a bluish shine. The epandrium is long, the surstyli is fused, and the hypandrium is rather short with a broad frame. The aedeagal apodeme is often long. The tip of aedeagus is in most strongly pigmented, with well visible appendages of distiphallus. The larval mandibles normally each have 2 alternating mouth hooks. There are one or more rows of conspicuous setae on each body segment. The pupation often takes place in the mine, but not always.

Pseudonapomyza atratula was discovered in Tunisia and described by Zlobin (2002). Since then, this was the only known citation of the occurrence of this species in the world. The type material (all from Tunisia) studied by Zlobin is deposited in the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (ZIN) and the collection of the Zoological Museum of the Lund University, Sweden (ZMLU), without a citation of known host plant(s).

Pseudonapomyza atratula belongs to the *atra*-group of the genus with 72 known species in the world, all exclusive miners on Poaceae. Morphological similarities among species make identification to species possible only by examination of the genitalia (Figs. 1 - 2). *Pseudonapomyza atratula* is closely related to *P. atra*, the differing in shape of aedeagus and spermathecae. Zlobin (2002) noted that the *P. atratula* basiphallus has a central part that is desclerotized or hyaline. The mesophallus lacks a prominent ventral projection typical of *atra*-group. The distiphallus is similar to *P. atra*, but the apical sclerite is very slender and the ventral projections are longer. The ejaculatory apodeme has a long narrow base with an entirely membraneous pump. The spermathecae are subequal in size and shape, more or less oval, and with truncated base. The duct at the base is broad.

Eight species of *Pseudonapomyza* are reported from Spain: *P. atra*, *P. hispanica*, *P. insularis*, *P. lacteipennis*, *P. spinosa*, *P. strobliana*, *P. vota* (Martínez and Báez 2002), and *P. europaea* (Cerny 2004). Only *P. atra* and *P. spinosa* are considered of economic importance (Benavent-Corai et al. 2004).

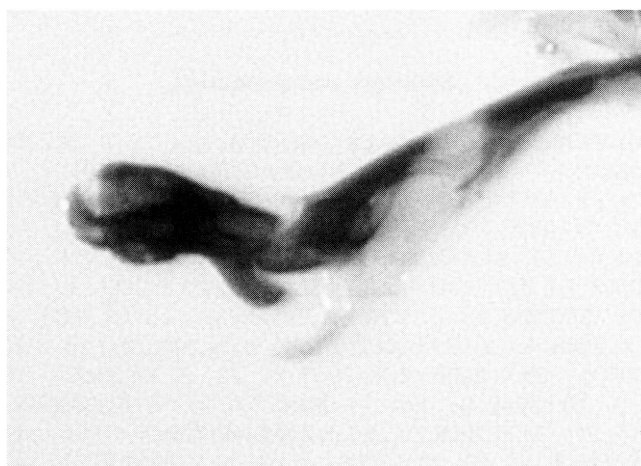


Fig. 1. *Pseudonapomyza atratula* aedeagus in lateral view.

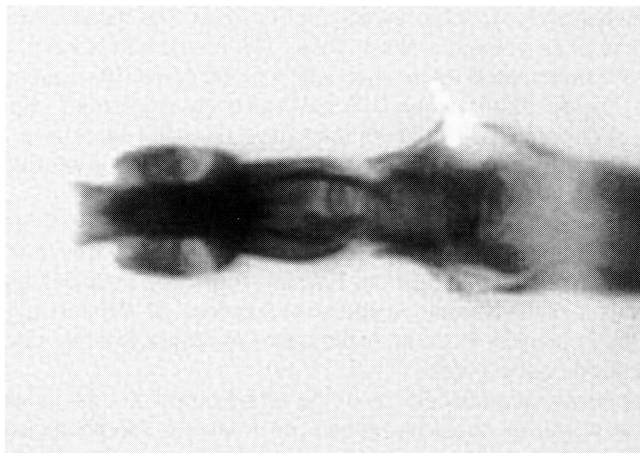


Fig. 2. *Pseudonapomyza atratula* aedeagus in ventral view.

Studies conducted by our research team in Spain have confirmed the presence of *P. atra* in Pina de Ebro (Zaragoza), in Tinença de Benifassà (Castellón) (TN), and in Alfarara (Alicante); *P. spinosa* is also cited in Las Saladas (Teruel), and Porta-coeli (Valencia); *P. hispanica* in Villareal (Castellón) and *P. strobliana* in TN (Francés 1994 and Echevarría 1996). Recent studies we have conducted in the Natural Parks of Lagunas de La Mata-Torrevieja (Alicante) (TRV), Font Roja (Alicante) (FR), and TN by trapping with Malaise traps have confirmed the presence of those species while also adding *P. atratula* (FR, TRV), *P. europeae* (TN), *P. spinosa* (FR, TRV) and *P. vota* (TN, TRV). Five new species have been discovered in Spain during these studies. The lack of work conducted shows few studies of the Agromyzidae family at the level of biodiversity in Spain, being extended to most areas of Europe, North Africa, and Asia (Cerny and Merz 2006).

Materials and Methods

Material examined. Lagunas de La Mata-Torrevieja: 3♂, 27.IV.2004 - 4.V.2004; 5♂, 4 - 11.V.2004; 1♂, 18 - 25.V.2004; 1♂, 25.V.2004 - 1.VI.2006; 2♂, 3.VIII.2004 - 10.VIII.2004; 1♂, 5 - 12.X.2004; 1♂, 26.X.2004 - 2.XI.2004; 1♂, 2 - 9.XI.2004; 3♂, 9 - 16.XI.2004; 5♂, 16 - 23.XI.2004; 7♂, 23 - 30.XI.2004; 3♂, 30.XI.2004 - 7.XII.2004; 2♂, 7 - 14.XII.2004; 8♂, 14 - 21.XII.2004; 4♂, 21.XII.2004 - 18.I.2005; 1♂, 18 - 26.I.2005; 2♂, 8 - 15.II.2005; 1♂, 22.II.2005 - 1.III.2005; 1♂, 22 - 29.III.2005; 3♂, 19 - 26.IV.2005; 1♂, 26.IV.2005 - 3.V.2005; 1♂, 31.V.2005 - 7.VI.2005; 2♂, 27.IX.2005 - 4.X.2005; 6♂, 4.X.2005 - 1.XI.2005; 4♂, 1 - 8.XI.2005; 2♂, 8 - 15.XI.2005; 2♂, 15 - 22.XI.2005; 1♂, 22 - 29.XI.2005; 4♂, 29.XI.2005 - 6.XII.2005; 1♂, 20 - 27.XII.2005; 1♂, 27.XII.2005 - 3.I.2006; 2♂, 3 - 10.I.2006; 3♂, 24 - 31.I.2006; 1♂, 14 - 21.II.2006; 8♂, 28.II.2006 - 14.III.2006; 8♂, 21 - 28.III.2006; 5♂, 28.III.2006 - 4.IV.2006; 1♂, 4 - 11.IV.2006; 1♂, 11.IV.2006 - 2.V.2006; 1♂, 16 - 23.V.2006; 1♂, 24 - 31.X.2006; 2♂, 7 - 14.XI.2006; 1♂, 14 - 21.XI.2006; 8♂, 21 - 28.XI.2006; 4♂, 28.XI.2006 - 5.XII.2006; 1♂, 5 - 12.XII.2006; 3♂, 19 - 26.XII.2006; 1♂, 26.XII.2006 - 2.I.2007; 1♂, 2 - 24.I.2007; 2♂, 6 - 13.II.2007;

10♂, 20.II.2007 - 6.III.2007; 8♂, 6 - 13.III.2007; 3♂, 13 - 20.III.2007; 5♂, 20 - 27.III.2007; 1♂, 27.III.2007 - 3.IV.2007; 1♂, 3 - 10.IV.2007; 5♂, 17 - 24.IV.2007; 1♂, 24.IV.2007 - 1.V.2007; 10♂, 1 - 8.V.2007; 2♂, 8 - 16.V.2007. Font Roja: 1♂, 19 - 26.VI.2006.

Trapping/collection. From April 2004 through April 2007, male *P. atratula* were captured and monitored with Malaise trapping in Lagunas de La Mata-Torre Vieja (GPS location N38°01'48.8" / W00°42'00.1" Altitude: 5 m) and in the Font Roja Natural Park (GPS location N38°39'43.1" / W00°31'04.0" Altitude: 1076 m). In a related study, we collected mined plant material from the same location as the Malaise traps in the Natural Park of the Lagunas de La Mata-Torre Vieja. This material was returned to the laboratory where it was maintained at 25 - 26°C and 65 - 70% RH. As adults emerged, specimens were placed in 70% ethyl alcohol and later identified using morphology of the genitalia.

Results and Discussion

Malaise trap collection data from Lagunas de La Mata-Torre Vieja are shown in Fig. 3. A significant seasonality occurred with the numbers of males captured in response to temperature changes. Population peaks appeared when average temperatures were in a range of approx. 10 - 20°C. Males were captured from late-September or the beginning of October continuously through the end of May with 8 to 10 generations annually. The largest catches occurred in the winter and spring and were estimated at approx. 10 males per wk when an average temperature of 15.5 - 20.5°C was observed. Most winters in the Lagunas de La Mata are mild with high average temperatures (>25°C) occurring usually in early May. One specimen was captured in the Malaise trap in the Font Roja Natural Park at the end June when average temperatures were 21.2°C.

Pseudonapomyza atratula adults emerged from mines in the host plants *Avena barbata* Pott ex Link ([2♀] sampled (s).30.iv.2007, 1♀ emerged (e).18.v.2007 and 1♀ e.31.v.2007, GPS coordinates of sampling N38°01'35.6"/W00°41'21.1") and *Avena*

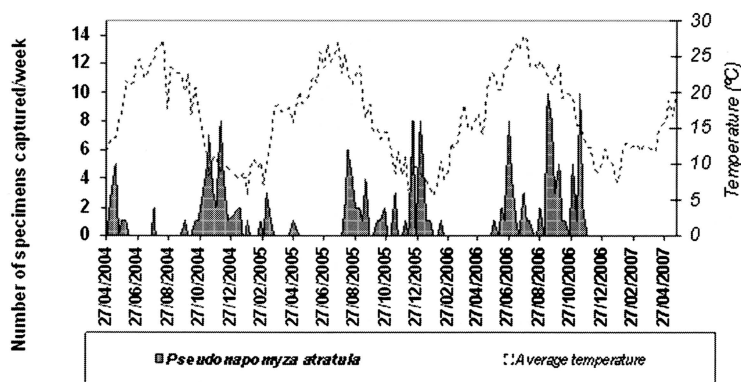


Fig. 3. Seasonal phenology of *Pseudonapomyza atratula* males in the Lagunas de La Mata-Torre Vieja Natural Park, Spain.

fatua L. ([1♂] s.30.iv.2007, e.26.v.2007, GPS coordinates of sampling N38°01'19.7"/W00°40'54.2"). These collections represent the first reports of these host plants being attacked by *P. atratula*. Benavent-Corai et al. (2005) reported that *P. atra* was found as a miner of plants in the *Avena* genus. The morphological similarities of *P. atra* and *P. atratula* suggest that these 2 species are closely related, which is corroborated by both being found mining *Avena* spp. *Pseudonapomyza atra* mines other genera such as *Apera*, *Holcus*, *Hordeum*, *Lolium*, *Phalaris*, *Poa*, *Secale* and *Triticum*, from which *P. atratula* has not been reported; however, these species should be considered as potentially susceptible to *P. atratula*. Subsequent studies should be conducted to characterize *P. atratula* female behavior and phenology and to use molecular techniques corroborate morphological differences among species in this genus.

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