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Drosophilidae (Diptera) species of a *Juniperus thurifera* L. forest of Los Monegros region (Zaragoza, Spain)

Gerhard Bächli & Javier Blasco-Zumeta

Abstract

A survey of the Drosophilidae of a *Juniperus thurifera* L. forest of Los Monegros region (Zaragoza, Spain) was carried out between 1989 and 1994. In total, 2,419 specimens belonging to 18 species and 5 genera were collected. Some facts are given on the ecology of the family in the area and traps efficiency. The first record of *Amiota semivirgo* Máca, 1970 for Spain is included.

Key words: Diptera, Drosophilidae, phenology, traps efficiency, faunistic records, Los Monegros, Spain.

Resumen

Un muestreo de la familia Drosophilidae en un bosque de *Juniperus thurifera* L. en la comarca de Los Monegros (Zaragoza, España) ha tenido lugar entre los años 1989 a 1994, colectándose un total de 2.419 ejemplares pertenecientes a 18 especies y 5 géneros diferentes. Se proporcionan datos sobre la ecología de la familia en la zona así como de efectividad de trampeo. Se cita por primera vez para España a *Amiota semivirgo* Máca, 1970.

Palabras clave: Diptera, Drosophilidae, fenología, eficiencia de trampeo, faunística, Los Monegros, España.

INTRODUCTION

In Spain, large-scale surveys of the drosophilid fauna have rarely been made. It was therefore an excellent opportunity to analyze the drosophilid flies collected during the years 1989 to 1994 by different trapping methods. In addition, faunistical and ecological investigations of the Monegros region, well-known for its high ecological and scenic importance, could furnish good arguments to enforce the efforts made for its permanent conservation.

MATERIAL AND METHODS

Study area

The Monegros region lies in the central part of the Ebro valley, east of Zaragoza. This area's extreme climatic conditions have produced a vegetation similar to that of the North-African steppes (BRAUN-BLANQUET & BOLOS, 1957). OCHOA (1982) summarizes its climate as follows: large annual range of minimum and maximum temperatures, which go from -10 °C to above 40 °C; frequent Spring frosts; prevailing winds from the NW and the SE (cold and warm, respectively), both with great desiccating power; low annual rainfall (200-400 mm); water deficit over 300 mm.

These climatic conditions are connected with a climax vegetation of *Juniperus thurifera* L. forests of the *Juniperetum phoeniceo-thuriferae* (Braun-Blanquet & Bolos) Rivas-Martínez

community (RIVAS-MARTINEZ, 1987), a species-poor plant community characterized by the presence of *Juniperus thurifera* L., *Rhamnus lycioides* L., *Ephedra nebrodensis* Tineo ex Guss. and *Asparagus acutifolius* L. It is a clear forest or a steppe with trees, associated with various shrub layers whose composition depends on microclimatic (altitude, exposure, and soil) conditions (BRAUN-BLANQUET & BOLOS, 1957).

Material and Methods

Specimens have been collected from 1989 to 1994 in an area near the locality Pina de Ebro (Zaragoza province) called «Retuerta de Pina» (UTM grid square 30T YL29). The mean altitude is 360 m Soils (QUIRANTES, 1978) are mostly gypsum, with some marl and clay. It is the last well-preserved *Juniperus thurifera* L. forest in the Monegros region.

The following collecting methods have been used:

Moericke trap. A metal container, yellow inside and green outside, sized 60 x 60 x 10 cm, on a 70 cm high stand, filled with slightly soapy water. Both samples and water were removed once a week and grouped by fortnights. It was working from May 1990 to December 1991, with two breaks, August-September 1990 and July-September 1991.

Coloured dishes. 25 plastic trays (9 yellow, 8 blue, 8 white), sized 26 x 16 x 4 cm, were used, filled with soapy water. They were in use from February 1990 to December 1991, set once in a fortnight in 1991, and left in operation for 24 hours on each occasion. The specimens were grouped by fortnights.

Malaise trap. Two traps 180 cm long, 121 cm wide and 206 cm to 183 cm high were used. The collecting liquid was 70 % alcohol. They were in use from September 1990 till December 1991, emptied once a week; the material was grouped by fortnights.

Light trap. It consists of two 20W/10S lamps (a blacklight and a daylight lamp) operating on a 12V battery. The specimens were taken off the lamps by means of a pooter. It was used regularly from January to December in 1993, and the collected material was grouped by fortnights. More samples were taken previously to 1993, but they were not sampled regularly.

Pitfall trap. 12 plastic bottles, 14 cm high and 8 cm wide, with a 5 cm wide opening were used, containing beer (1991) or vinegar (1992) as bait, and buried just below the surface, with the lids off. They were placed 10 m apart from each other.

Sweeping from plants. An insect net was swept once by fortnight during 1992 and from January to December 1993 on 21 plant species: el *Agropyro-Lygeion* Br.-Bl. & Bolós (a vegetal community composed mainly by perennial steppic grasses), *Artemisia herba-alba* Asso, *Atriplex halimus* L., *Ephedra nebrodensis* Tineo ex Guss., *Genista scorpius* (L.) DC., *Gypsophila struthium* L. ssp. *hispanica* (Willk.) G. López, *Helianthemum squamatum* (L.) Pers., *Juniperus phoenicea* L., *Juniperus thurifera* L., *Lithodora fruticosa* (L.) Griseb (from April to September only), *Ononis tridentata* L., *Osyris alba* L., *Pinus halepensis* Miller, *Quercus coccifera* L., *Retama sphaerocarpa* (L.) Boiss, *Rhamnus lycioides* L., *Rosmarinus officinalis* L., *Salsola vermiculata* L., *Santolina chamaecyparissus* L., *Suaeda vera* J.F. Gmelin y *Tamarix canariensis* Willd. During 1994, the following plants were swept with the same frequency: *Asparagus acutifolius* L., *Frankenia thymifolia* Desf., *Lepidium subulatum* L., *Peganum harmala* L., *Salvia lavandulifolia* Vahl. and *Thymus vulgaris* L. More samples were taken before and after those years but without regularity on the same and other plant species.

Wilkening trap. Four traps built according the model of WILKENING *et al.* (1981) were used, sized 32 cm high and 11 cm wide. They were placed into the branches of *J. phoenicea, J. thurifera* and *P. halepensis*, between brushes of *R. officinalis*, and inside an old building for sheeps. They were working from January to December 1992. Samples were removed once a week and grouped by fortnights.

Carrion trap. One carrion trap, containing mainly pig's liver as a bait, was working during 1991. Salt water was used for conservation. Samples were removed once a week and grouped by fortnights.

Traps inside rabbit's burrows. Twelve traps were used inside six different rabbit's burrows intercepting the arthropod fauna. Six traps caught incoming fauna and the other six the outgoing one. They were working during 1994, and 3 % formol was used for preserving. Samples were removed once a week and grouped by fortnights.

For the statistical tratment of the data we have excluded both the material collected by means of those techniques which were not operating a whole calendar year and, in the case of those techniques which were operational over periods longer than a calendar year, the material collected outside the calendar year.

RESULTS AND DISCUSION

Faunistical account

Steganinae

Amiota (Phortica) semivirgo Máca, 1977

Distribution: Europe; not previously recorded in Spain.

Examined material: Pitfall trap: with vinegar: 8.VII.92, 1 ♂1 ♀. Total: 1 ♂ 1 ♀.

Gitona distigma Meigen, 1830

Distribution: Palaearctic; already recorded in Spain by CZERNY & STROBL (1909) and ARIAS ENCOBET (1912).

Examined material: Malaise trap: 7.V.91, 1 ♀. Pitfall trap: with beer: 28.XI.90, 1 ♀; with vinegar: 10.IV.92, 2 ♂♂ 2 ♀♀; 25.IV.92, 1 ♂ 4 ♀♀. Total: 3 ♂♂ 8 ♀♀.

Leucophenga maculata (Dufour, 1839)

Distribution: Palaearctic; already recorded in Spain by HACKMAN (1969).

Examined material: Malaise trap: 10.9.91, 1 ♀. Total: 1 ♀.

Drosophilinae

Drosophila (Dorsilopha) busckii Coquillett, 1901

Distribution: Worldwide; domestic species, already recorded in Spain by HADORN *et al.* (1952), RODERO FRANGANILLO (1957, 1959), MONCLÚS (1964), ORTIZ (1968), OCHANDO (1978, 1980), MONCLÚS & PREVOSTI (1979), GARCIA VAZQUEZ *et al.* (1985) and ALCORTA-AZCUE *et al.* (1986).

Examined material: Coloured dishes: 7.V.91, 1 ♀. Malaise trap: 23.XI.90, 1 ♀. Pitfall trap: with beer: 10.V.91, 1 ♀; with vinegar: 25.III.92, 1 ♀; 10.IV.92, 1 ♀. By swept: on *T. canariensis*: 28.V.92, 1 ♂ 1 ♀. Wilkening trap: inside a building: 10.VI.92, 1 ♀, 28.VI.92, 4 ♂♂. Total: 5 ♂♂ 7 ♀♀.

Drosophila (Drosophila) cameraria Haliday, 1833

Distribution: Palaearctic & Macronesia; already recorded in Spain (and several times named *D. pallida*) by DUDA (1934/35), HADORN *et al.* (1952), MONCLÚS (1964), ORTIZ (1968), OCHANDO (1978, 1980), MONCLÚS & PREVOSTI (1979) and NÁJERA (1985).

Examined material: Moericke trap: 7.I.91, 1 ♀; 20.II.91, 1 ♂; 25.III.91, 1 ♀. Coloured dishes: 9.III.91, 1 ♂ 4 ♀♀; 9.IV.91, 1 ♀; 25.IV.91, 1 ♀; 7.V.91, 1 ♀. Pitfall trap: with beer: 16.I.91, 2 ♀♀; 3.X.91, 1 ♂ 1 ♀; 15.XII.91, 2 ♂♂ 1 ♀; with vinegar: 25.III.92, 1 ♀; 25.IV.92, 1 ♀. Total: 5 ♂♂ 15 ♀♀.

Drosophila (Drosophila) funebris (Fabricius, 1787)

Distribution: Worldwide excl. Oriental Region; domestic species, already recorded in Spain by CUNÍ Y MARTORELL (1888, 1897), ARIAS ENCOBET (1912), FUENTE & MORALES (1926), HADORN *et al.* (1952), RODERO FRANGANILLO (1957, 1959), MONCLÚS (1964), ORTIZ (1968), HACKMAN (1969),

OCHANDO (1978, 1980), MONCLÚS & PREVOSTI (1979), GARCIA VAZQUEZ *et al.* (1985) and ALCORTA-AZCUE *et al.* (1986).

Examined material: Pitfall trap: with beer: 19.IV.91, 1 ♂; with vinegar: 15.II.92, 1 ♀; 25.III.92, 1 ♀; 10.IV.92, 1 ♂ 1 ♀; 25.IV.92, 2 ♀♀; 25.V.92, 1 ♀. Total: 2 ♂♂ 6 ♀♀.

Drosophila (Drosophila) hydei Sturtevant, 1921

Distribution: Worldwide; domestic species, already recorded in Spain by RODERO FRANGANILLO (1957, 1959), MONCLÚS (1964), ORTIZ (1968), HACKMAN (1969), OCHANDO (1978, 1980), MONCLÚS & PREVOSTI (1979), GARCIA VAZQUEZ *et al.* (1985) and ALCORTA-AZCUE *et al.* (1986).

Examined material: Coloured dishes: 20.X.89, 1 ♂ 2 ♀♀; 16.XII.89, 1 ♀. Malaise trap: 9.X.91, 1 ♀; 9.XI.91, 3 ♀♀. Light trap: 14.X.90, 1 ♂. Pitfall trap: with beer: 28.XI.90, 4 ♂♂ 13 ♀♀; 22.XII.90, 1 ♀; 15.XII.91, 2 ♂♂. with vinegar: 10.III.92, 2 ♂♂ 1 ♀; 25.III.92, 2 ♂♂; 10.IV.92, 1 ♀. By swept: on *Diplotaxis erucoides* L. (DC): 20.XII.92, 1 ♀. Carrion trap: 20.X.91, 1 ♂ 1 ♀. Total: 13 ♂♂ 24 ♀♀.

Drosophila (Drosophila) immigrans Sturtevant, 1921

Distribution: Worlwide; domestic species, already recorded in Spain by RODERO FRANGANILLO (1957, 1959), MONCLÚS (1964), ORTIZ (1968), HACKMAN (1969), MONCLÚS & PREVOSTI (1979), GARCIA VAZQUEZ *et al.* (1985) and ALCORTA-AZCUE *et al.* (1986).

Examined material: Moericke trap: 17.X.90, 2 ♀♀; 9.XI.91, 2 ♂♂ 1 ♀. Coloured dishes: 14.X.90, 2 ♀♀; 20.X.90, 1 ♀; 3.XI.90, 1 ♀; 26.X.91, 1 ♀. Malaise trap: 17.X.90, 1 ♀. Light trap: 14.X.90, 1 ♀; 9.XI.90, 1 ♀. Pitfall trap: with beer: 28.XI.90, 6 ♂♂ 7 ♀♀; 3.X.91, 1 ♀; 14.X.91, 1 ♀; 15.XII.91, 3 ♀♀. with vinegar: 25.III.92, 1 ♀; 9.VII.92, 4 ♀♀; 25.VII.92, 1 ♀. By swept: on *P. halepensis*: 20.XII.92, 1 ♀. Carrion trap: 20.X.91, 2 ♂♂ 17 ♀♀. Total: 10 ♂♂ 47 ♀♀.

Drosophila (Drosophila) phalerata Meigen, 1830

Distribution: West Palaearctic; already recorded in Spain by ARIAS ENCOBET (1912), HADORN *et al.* (1952), MONCLÚS (1964), ORTIZ (1968), HACKMAN (1969), OCHANDO (1978, 1980), MONCLÚS & PREVOSTI (1979), GARCIA VAZQUEZ *et al.* (1985) and ALCORTA-AZCUE *et al.* (1986).

Examined material: Pitfall trap: with beer: 28.XI.90, 1 ♂. Carrion trap: 20.X.91, 1 ♀. Total: 1 ♂ 1 ♀.

Drosophila (Drosophila) repleta Wollaston, 1858

Distribution: Pantropical; domestic species, already recorded in Spain by ARIAS ENCOBET (1912), RODERO FRANGANILLO (1957, 1959), MONCLÚS (1964), ORTIZ (1968), OCHANDO (1978, 1980) and MONCLÚS & PREVOSTI (1979).

Examined material: Coloured dishes: 18.VI.91, 1 ♂. Pitfall trap: with vinegar: 9.VII.92, 1 ♂. Carrion trap: 29.VII.91, 1 ♂ 1 ♀; 25.VIII.91, 1 ♂. Total: 4 ♂♂ 1 ♀.

Drosophila (Lordiphosa) andalusiaca Strobl, 1906

Distribution: West Palaearctic & Macronesia; already recorded in Spain by STROBL (1906), ARIAS ENCOBET (1912), BASDEN (1961), HACKMAN (1969) and LASTOVKA & MÁCA, 1978).

Examined material: Moericke trap: 17.X.90, 1 ♂; 7.I.91, 1 ♂. Coloured dishes: 18.VI.91, 1 ♂ 1 ♀. Light trap: 21.VI.90, 1 ♂ 1 ♀; 14.IX.90, 1 ♀; 25.VI.93, 1 ♂. By swept: on *G. struthium*: 20.V.89, 1 ♀. Total: 4 ♂♂ 4 ♀♀.

Drosophila (Sophophora) ambigua Pomini, 1940

Distribution: West Palaerctic & Macronesia; already recorded in Spain by HADORN *et al.* (1952), MONCLÚS (1964) and MONCLÚS & PREVOSTI (1979).

Examined material: Moericke trap: 2.VI.90, 1 ♀. Pitfall trap: with beer: 15.XII.91, 1 ♂. with vinegar: 25.III.92, 1 ♀; 10.IV.92, 1 ♀; 10.V.92, 3 ♀♀; 25.V.92, 1 ♀. Wilkening trap: on *J. thurifera*: 10.III.92, 1 ♀. Carrion trap: 28.VI.92, 1 ♀; 25.VII.92, 1 ♂. Total: 2 ♂♂ 9 ♀♀.

Drosophila (Sophophora) melanogaster Meigen, 1830

Distribution: Worldwide; domestic species, used for various laboratory investigations, already recorded in Spain by several authors.

Examined material: Moericke trap: 2.VI.90, 2 ♀♀; 29.X.90, 1 ♀; 11.XI.90, 2 ♀♀. Coloured dishes: 5.V.90, 1 ♀; 14.X.90, 1 ♀; 10.XI.91, 1 ♂ 3 ♀♀. Malaise trap: 25.VIII.91, 1 ♀. Light trap: 14.IX.90, 2 ♂♂; 26.IX.90, 1 ♀; 10.X.93, 1 ♂; 20.XII.93, 1 ♂. Pitfall trap: with beer: 28.VI.90, 2 ♂♂ 2 ♀♀; 28.XI.90, 6 ♂♂ 17 ♀♀; 22.XII.90, 3 ♂♂ 3 ♀♀; 16.I.91, 1 ♂; 7.VI.91, 1 ♂; 5.IX.91, 1 ♂; 15.IX.91, 2 ♀♀; 14.X.91, 1 ♂ 1 ♀; 15.XII.91, 1 ♀. with vinegar: 25.V.92, 1 ♀; 25.VII.92, 2 ♂♂ 1 ♀. By swept: on *F. thymifolia*: 26.XII.94, 1 ♀. Wilkening trap: on P. HALEPENSIS: 13.VIII.92, 1 ♀. Carrion trap: 25.VIII.91, 2 ♂♂; 10.X.91, 1 ♂ 1 ♀; 20.X.91, 1 ♂ 1 ♀. Traps in burrows: 10.X.94, 1 ♀; 25.X.94, 1 ♀; 20.XII.94, 1 ♂. Total: 27 ♂♂ 46 ♀♀.

Drosophila (Sophophora) simulans Sturtevant, 1919

Distribution: Worldwide; domestic species, already recorded in Spain by RODERO FRANGANILLO (1957, 1959), MONCLÚS (1964), ORTIZ (1968), OCHANDO (1978, 1980), MONCLÚS & PREVOSTI (1979), PEREZ (1981), NÁJERA (1985) and GARCIA VAZQUEZ *et al.* (1985).

Examined material: Moericke trap: 17.X.90, 1 ♂ 2 ♀♀; 29.X.90, 1 ♂ 2 ♀♀; 11.XI.90, 1 ♀; 20.X.91, 2 ♀♀; 9.XI.91, 1 ♂ 2 ♀♀. Coloured dishes: 20.X.89, 1 ♀; 16.XII.89, 1 ♂ 3 ♀♀; 22.VIII.90, 1 ♂; 6.X.90, 1 ♀; 14.X.90, 4 ♂♂ 5 ♀♀; 17.XI.90, 1 ♀; 18.VI.91, 1 ♀; 9.X.91, 1 ♂; 10.XI.91, 17 ♂♂ 20 ♀♀. Malaise trap: 17.X.90, 1 ♀; 23.XI.90, 1 ♀. Light trap: 13.VIII.89, 2 ♂♂ 1 ♀; 19.VIII.90, 1 ♂; 28.VIII.90, 10 ♂♂ 9 ♀♀; 14.IX.90, 13 ♂♂ 9 ♀♀; 20.IX.90, 1 ♂ 1 ♀; 26.IX.90, 1 ♂; 12.X.90, 5 ♂♂ 8 ♀♀; 20.X.90, 1 ♂ 2 ♀♀; 30.X.90, 1 ♀; 9.XI.90, 5 ♂♂ 1 ♀; 5.IX.91, 2 ♂♂ 1 ♀; 26.X.91, 3 ♂♂ 1 ♀; 1.XI.91, 4 ♂♂ 3 ♀♀; 18.IX.92, 1 ♂ 3 ♀♀; 20.VII.93, 1 ♀; 10.VIII.93, 1 ♀; 20.VIII.93, 3 ♂♂; 10.IX.93, 1 ♂ 4 ♀♀; 20.IX.93, 2 ♂♂ 1 ♀; 10.X.93, 1 ♂; 20.X.93, 1 ♂ 4 ♀♀. Pitfall trap: with beer: 28.VI.90, 2 ♀♀; 15.IX.90, 11 ♀♀ 17 ♀♀; 28.XI.90, 17 ♂♂ 34 ♀♀; 22.XII.90, 1 ♂ 3 ♀♀; 5.IX.91, 1 ♂ 4 ♀♀; 3.X.91, 32 ♂♂ 29 ♀♀; 14.X.91, 3 ♂♂ 5 ♀♀; with vinegar: 15.XII.91, 4 ♂♂ 7 ♀♀; 9.VII.92, 2 ♀♀; 25.VII.92, 6 ♂♂ 13 ♀♀; 13.VIII.92, 3 ♂♂ 9 ♀♀; 28.VIII.92, 8 ♂♂ 18 ♀♀. By swept: on *G. struthium*: 20.V.89, 1 ♂; on *S. vermiculata*: 11.I.92, 1 ♀. Wilkening trap: on *J. phoenicea*: 13.VIII.92, 1 ♂ 5 ♀♀; 28.VIII.92, 3 ♀♀; on *J. thurifera*: 25.VII.92, 1 ♀; 10.IX.92, 1 ♀; on *P. halepensis*: 25.VII.92, 1 ♂; 13.VIII.92, 4 ♀♀; 9.XI.92, 8 ♂♂ 17 ♀♀; inside a building for sheep: 25.VII.92, 1 ♀; 13.VIII.92, 1 ♂. Carrion trap: 29.VII.91, 4 ♂♂ 10 ♀♀; 25.VIII.91, 22 ♂♂ 12 ♀♀; 5.IX.91, 4 ♂♂ 2 ♀♀; 22.IX.91, 3 ♂♂; 10.X.91, 9 ♂♂ 21 ♀♀; 8.VII.92, 1 ♀; 25.VII.92, 5 ♂♂ 9 ♀♀; 28.VIII.92, 10 ♂♂ 17 ♀♀. Traps in burrows: 15.X.94, 3 ♀♀. Total: 241 ♂♂ 343 ♀♀.

Drosophila (Sophophora) subobscura Collin *in* Gordon, 1936

Distribution: West Palaearctic & Macronesia; used for laboratory investigations, already recorded in Spain by various authors.

Examined material: Moericke trap: 2.VI.90, 6 ♂♂ 10 ♀♀; 8.IX.90, 1 ♀; 7.I.91, 31 ♂♂ 17 ♀♀; 9.II.91, 1 ♂; 20.II.91, 5 ♂♂ 7 ♀♀; 25.III.91, 1 ♀; 25.IV.91, 2 ♀♀; 7.V.91, 1 ♂; 20.V.91, 2 ♂♂ 2 ♀♀; 20.X.91, 1 ♀. Coloured dishes: 10.II.90, 1 ♀; 14.IV.90, 1 ♀; 5.V.90, 12 ♀♀; 6.X.90, 1 ♀; 17.XI.90, 1 ♀; 9.II.91, 1 ♀; 9.IV.91, 1 ♀; 18.VI.91, 3 ♂♂. Malaise trap: 17.X.90, 1 ♀; 11.XI.90, 1 ♀; 23.XI.90, 1 ♂; 22.XII.90, 2 ♂♂ 1 ♀; 19.II.91, 3 ♀♀; 7.V.91, 1 ♀; 24.V.91, 1 ♂ 1 ♀; 7.VI.91, 1 ♂; 20.VI.91, 1 ♀; 10.IX.91, 1 ♀; 9.X.91, 1 ♀. Light trap: 25.VIII.90, 2 ♂♂ 2 ♀♀; 20.X.90, 1♂; 5.IX.91, 1 ♀; 26.X.91, 2 ♂♂ 1 ♀; 10.VI.93, 1 ♂; 25.VI.93, 2 ♀♀; 10.VIII.93, 2 ♀♀; 20.VIII.93, 3 ♀♀; 10.IX.93, 1 ♀. Pitfall trap: with beer: 28.XI.90, 23 ♂♂ 45 ♀♀; 22.XII.90, 7 ♂♂ 8 ♀♀; 16.I.91, 56 ♂♂ 32 ♀♀; 19.II.91, 10 ♂♂ 7 ♀♀; 26.III.91, 44 ♂♂ 80 ♀♀; 19.IV.91, 1♂ 5 ♀♀; 10.V.91, 15 ♂♂ 26 ♀♀; 7.VI.91, 1 ♀; 25.VIII.91, 1 ♂ 1 ♀; 5.IX.91, 1 ♂; 15.IX.91, 10 ♀♀; 3.X.91, 4 ♂♂ 10 ♀♀; 14.X.91, 1 ♂ 4 ♀♀; 15.XII.91, 45 ♂♂ 32 ♀♀; with vinegar: 20.II.92, 19 ♂♂ 23 ♀♀; 10.III.92, 36 ♂♂ 14 ♀♀; 25.III.92, 26 ♂♂ 23 ♀♀; 10.IV.92, 4 ♂♂ 5 ♀♀; 25.IV.92, 16 ♂♂ 27 ♀♀; 10.V.92, 14 ♂♂ 13 ♀♀; 25.V.92, 1 ♀; 9.VII.92, 10 ♂♂ 5 ♀♀; 25.VII.92, 4 ♂♂ 5 ♀♀; 28.VIII.92, 3 ♂♂ 4 ♀♀. By swept: on *A. herba-alba*: 7.XI.92, 1 ♂; on *Carduus bourgeanus* Boiss. & Reut.: 20.V.89, 2 ♀♀, on *Onopordum nervosum* Boiss.: 26.V.91, 1 ♀; on *R. lycioides*, 12.XII.92, 1 ♀; on *T. canariensis*: 28.V.92, 1 ♀. Wilkening trap: on *J. thurifera*: 25.I.92,

1 ♀; 25.IV.92, 1 ♀; 10.V.92, 2 ♂♂ 3 ♀♀; 25.V.92, 1 ♂ 2 ♀♀; 10.IX.92, 1 ♀; on *P. halepensis*, 25.II.92, 1 ♂ 1 ♀; 25.V.92, 1 ♀; 9.XI.92, 1 ♂. Carrion trap: 29.VII.91, 1 ♀; 25.VIII.91, 2 ♀♀; 10.X.91, 1 ♀; 20.X.91, 8 ♂♂ 7 ♀♀; 10.XI.91, 1 ♂; 20.III.92, 1 ♀; 25.IV.92, 2 ♂♂ 3 ♀♀; 10.V.92, 9 ♂♂ 5 ♀♀; 28.VI.92, 1 ♂ 1 ♀. Total: 428 ♂♂ 559 ♀♀.

Scaptomyza (Parascaptomyza) pallida (Zetterstedt, 1847)

Distribution: Worldwide; already recorded in Spain by various authors.

Examined material: Moericke trap: 25.IX.90, 1 ♀ 28.X.90, 11 ♀♀; 11.XI.90, 3 ♂♂ 6 ♀♀; 7.I.91, 1 ♂; 20.II.91, 1 ♂ 3 ♀♀; 9.IV.91, 1 ♀; 25.IV.91, 2 ♂♂ 1 ♀; 7.V.91, 6 ♂♂ 7 ♀♀; 20.V.91, 1 ♂; 20.X.91, 3 ♂♂ 1 ♀; 9.XI.91, 7 ♂♂ 1 ♀; 20.XI.91, 1 ♂ 3 ♀♀; 20.XII.91, 3 ♂♂ 1 ♀. Coloured dishes: 20.X.89, 1 ♂; 16.XII.89, 3 ♂♂ 1 ♀; 10.II.90, 1 ♂;14.IV.90, 1 ♂; 29.IV.90, 1 ♀; 5.V.90, 2 ♂♂ 4 ♀♀; 6.VII.90, 1 ♂; 6.X.90, 1 ♂ 3 ♀♀; 14.X.90, 2 ♂♂ 2 ♀; 17.XI.90, 1 ♀; 12.I.91, 3 ♂♂ 2 ♀♀; 9.II.91, 2 ♂♂ 4 ♀♀; 20.II.91, 1 ♂; 9.III.91, 1 ♀; 7.V.91, 1 ♂ 3 ♀♀; 9.X.91, 1 ♂ 5 ♀♀; 20.X.91, 11 ♂ 8 ♀♀; 10.XI.91, 1 ♂ 2 ♀♀; 9.XII.91, 3 ♂♂ 1 ♀. Malaise trap: 19.IX.90, 1 ♂; 17.X.90, 9 ♂♂ 12 ♀♀; 11.XI.90, 4 ♂♂ 4 ♀♀; 23.XI.90, 1 ♂ 2 ♀; 22.XII.90, 1 ♂; 7.I.91, 1 ♀; 20.I.91, 1 ♀; 9.II.91, 2 ♀♀; 7.V.91, 1 ♀; 24.V.91, 2 ♂♂ 2 ♀♀; 7.VI.91, 1 ♀; 20.VI.91, 1 ♀; 20.X.91, 1 ♂; 25.I.92, 1 ♂ 1 ♀. Light trap: 13.IX.89, 1 ♀; 19.VIII.90, 1 ♂; 25.VIII.90, 1 ♀; 14.IX.90, 1 ♂ 2 ♀; 9.III.91, 2 ♂♂; 12.IX.91, 1 ♀; 26.X.91, 1 ♀; 10.IV.93, 2 ♀♀; 10.VII.93, 1 ♀; 20.VII.93, 1 ♂; 20.VIII.93, 1 ♂ 2 ♀♀; 10.IX.93, 4 ♂♂ 3 ♀♀; 20.IX.93, 1 ♀; 10.X.93, 1 ♂ 1 ♀; 10.XI.93, 2 ♀♀. Pitfall trap:with vinegar: 25.IV.92, 1 ♂ 3 ♀♀; 10.V.92, 2 ♀♀. By swept: on the *Agropyro-Lygeion*: 10.XI.91, 1 ♂ 2 ♀; 14.XI.92, 4 ♂♂ 16 ♀♀; 28.XI.92, 1 ♂; 20.XII.92, 2 ♂♂ 4 ♀♀; on *A. herba-alba*: 11.X.92, 23 ♂♂ 26 ♀♀; 24.X.92, 4 ♂♂ 16 ♀♀; 7.XI.92, 15 ♂♂ 41 ♀♀; 14.XI.92, 11 ♂♂ 32 ♀♀; 21.XI.92, 7 ♂♂ 16 ♀♀; 5.XII.92, 1 ♂ 1 ♀; 20.XII.92, 7 ♂♂ 12 ♀♀; 9.I.93, 2 ♂♂ 5 ♀♀; on *A. halimus*: 11.X.92, 2 ♀♀; 24.X.92, 3 ♂♂ 8 ♀♀; 9.I.93, 1 ♀; on *Diplotaxis erucoides* (L.) DC: 20.XII.92, 1 ♂ 2 ♀♀; on *E. nebrodensis*: 26.I.92, 1 ♂; 20.IV.92, 2 ♂♂; on *F. thymifolia*: 4.II.94, 1 ♂; 26.XI.94, 2 ♂♂; on *G. struthium*: 20.V.89, 1 ♀; 28.XI.92, 1 ♂ 2 ♀♀; on *H. squamatum*: 9.I.93, 1 ♀; on *J. phoenicea*: 9.III.92, 1 ♂; 14.X.92, 1 ♂ 1 ♀; on *J. thurifera*: 4.I.91, 1 ♀; 5.XII.92, 1 ♂ 1 ♀; 20.XII.92, 1 ♂ 1 ♀; on *P. halepensis*: 9.III.92, 1 ♂; 14.X.92, 1 ♀; on *Q. coccifera*: 5.XII.92, 1 ♀; on *R. lycioides*: 14.X.92, 1 ♀; on *R. officinalis*: 14.X.92, 1 ♂ 2 ♀♀; 24.X.92, 1 ♂ 2 ♀♀; 28.XI.92, 3 ♂♂ 3 ♀♀; on *S. vermiculata*: 11.X.92, 6 ♂♂ 4 ♀♀; 24.X.92, 1 ♀; 7.XI.92, 3 ♂♂ 15 ♀♀; 20.XII.92, 1 ♀; on *S. chamaecyparissus*: 14.X.92, 1 ♀; 24.X.92, 1 ♀; on *Sisymbrium runcinatum* Lag. ex DC: 23.IV.91, 1 ♀; 11.IV.92, 1 ♂; on *S. vera*: 11.X.90, 2 ♀♀; 14.XI.92, 2 ♂♂ 3 ♀♀; on *T. canariensis*: 9.VI.91, 2 ♂; 9.V.94, 1 ♀; on a wheat field: 20.VI.92, 1 ♂ 1 ♀. Wilkening trap: on *J. phoenicea*: 10.V.92, 1 ♂; on *J. thurifera*: 6.VII.92, 1 ♂; on *P. halepensis*: 25.II.92, 1 ♀; 25.V.92, 1 ♀; on *R. officinalis*: 10.VI.92, 1 ♀. Traps in burrows: 10.IV.94, 1 ♂. Total: 231 ♂♂ 360 ♀♀.

Scaptomyza (Scaptomyza) flava (Fallén, 1823)

Distribution: Holarctic & Macronesia; already recorded in Spain by Arias Encobet (1912) and Hackman (1969).

Examined material: Pitfall trap: with vinegar: 25.IV.92, 1 ♀. Total: 1 ♀.

Scaptomyza graminum (Fallén, 1823)

Distribution: Holarctic & Macronesia; already recorded in Spain by Arias Encobet (1912), Fuente & Morales (1926) and Hackman (1969).

Examined material: Moericke trap: 9.III.91, 1 ♂; 7.V.91, 1 ♂. Coloured dishes: 22.IV.90, 1 ♀; 9.II.91, 1 ♂ 2 ♀♀; 25.III.91, 1 ♀; 7.V.91, 1 ♀. Malaise trap: 7.I.91, 1 ♂. Total: 4 ♂♂ 5 ♀♀.

General overview

The total number of species recorded, 18, is relatively high: Monclús (1964) listed 25 species for Catalonia, at various collection sites, including domestic habitats, however. Three species, *D. subobscura, S. pallida*, and *D. simulans*, were very abundant, followed by *D. immigrans* and *D. melanogaster*.

In the Mediterranean, *D. melanogaster* may be dominant among the *melanogaster/simulans* complex, but a dominance of *D. simulans*, depending from season, altitude and probably

Tab. 1. Number of flies collected by different methods. Abbreviations: DS=coloured dishes; ML=Malaise trap; LT=light trap; PTB=pitfall trap with beer; PTV= pitfall trap with vinegar; SW=swept on plants; WK=Wilkening trap; CR=carrion trap; BR= traps in burrows.

Número de ejemplares colectados mediante diferentes métodos. Abreviaturas: DS=platos de colores; ML=trampa Malaise; LT=trampa luminosa; PTB=trampa de caida con cerveza; PTV= trampa de caida con vinagre; SW=barrido sobre plantas; WK=trampa Wilkening; CR=trampa con carroña; BR=trampa en madrigueras.

	DS	ML	LT	PT	PTV	SW	WK	CR	BR	total
A. semivirgo	0	0	0	0	2	0	0	0	0	2
G. distigma	0	1	0	0	9	0	0	0	0	10
L. maculata	0	1	0	0	0	0	0	0	0	1
D. busckii	1	0	0	1	2	2	5	0	0	11
D. cameraria	8	0	0	7	2	0	0	0	0	17
D. funebris	0	0	0	1	7	0	0	0	0	8
D. hydei	0	4	0	2	6	0	0	2	0	14
D. immigrans	0	1	0	5	6	1	0	19	0	32
D. phalerata	0	0	0	0	0	0	0	1	0	1
D. repleta	1	0	0	0	1	0	0	3	0	5
D. andalusiaca	2	0	1	0	0	0	0	0	0	3
D. ambigua	0	0	0	1	6	0	1	0	0	8
D. melanogaster	4	1	2	8	4	1	1	6	3	30
D. simulans	39	0	19	74	59	1	43	87	3	325
D. subobscura	5	10	9	386	252	3	15	20	0	700
S. pallida	49	10	19	0	6	322	5	0	1	412
S. flava	0	0	0	0	1	0	0	0	0	1
S. graminum	5	1	0	0	0	0	0	0	0	6
total flies	114	29	50	485	363	330	70	138	7	1.586
total species	9	8	5	9	14	6	6	7	3	18
diversity H'	0.63	0.69	0.54	0.31	0.50	0.07	0.49	0.50	0.51	0.64

some local conditions, has been found by MONCLÚS (1968), OCHANDO (1978, 1980), GARCIA VAZQUEZ *et al.* (1985), NÁJERA (1985) and ALCORTA-AZCUE *et al.* (1986) as well; in very few cases, however, the ratio was as high as 10:1.

Several species already recorded in Spain are missing, mainly domestic and/or recently introduced cosmopolitan ones. Considering the extreme ecological conditions of the Monegros area, we could have expected only few additional species, such as *D. obscura, D. testacea,* and *D. transversa.* Except of *D. simulans*, the domestic species found (*D. busckii, D. funebris, D. immigrans, D. repleta*, and *D. melanogaster*) were relatively rare, which proves the high ecological importance of the area surveyed.

The results by trapping methods are listed in Tab. 1, as far as they have been operated during comparable periods. In Spain, drosophilid flies have not been collected by using

Tab. 2. Number of flies collected during the four seasons. Spring: March to May; Summer: June to August; Autumn: September to November; Winter: December to February.

Número de ejemplares colectados durante las cuatro estaciones. Primavera: de Marzo a Mayo; Verano: de Junio a Agosto; Otoño: de Septiembre a Noviembre; Invierno: de Diciembre a Febrero.

	Spring	Summer	Autumn	Winter	total
A. semivirgo	0	2	0	0	2
D. distigma	10	0	0	0	10
L. maculata	0	0	1	0	1
D. busckii	6	5	0	0	11
D. cameraria	4	0	2	11	17
D. funebris	7	0	0	1	8
D. hydei	6	0	6	2	14
D. immigrans	1	5	22	4	32
D. phalerata	0	0	1	0	1
D. repleta	0	5	0	0	5
D. andalusiaca	0	3	0	0	3
D. ambigua	7	0	0	1	8
D. melanogaster	1	8	16	5	30
D. simulans	0	130	194	1	325
D. subobscura	365	50	53	232	700
S. pallida	25	9	323	55	412
S. flava	0	1	0	0	1
S. graminum	2	0	0	4	6
TOTAL	435	217	618	316	1.586

various methods of collecting till now. Usually, the standard method with fermenting fruit baits is the most effective one. In part, our collection data of the pitfall traps, supplied with beer or vinegar, probably having the same attraction as fruit baits, are therefore comparable with those of MONCLÚS (1964), OCHANDO (1978, 1980), GARCIA VAZQUEZ *et al.* (1985) and ALCORTA-AZCUE *et al.*, (1986) –all using fermenting fruit baits– who in general yielded fewer species (in shorter collection periods, however). The pitfall traps were especially rich on *D. subobscura* and *D. simulans*. Both were dominant or very abundant in at least three other traps.

The other trapping methods used were less effective, except for the coloured dishes and the Malaise trap, which both showed a relatively high diversity; the latter, however, with lower efficiency.

By net sweeping, a very large number of *S. pallida* was collected, as expected. This species is extremely abundant in the herbs layer, but rarely attracted to baits. In the swepts, other drosophilid species were more or less missing, and the diversity was very small.

With a few exceptions, males were more abundant than females even in so-called non-selective traps. We suppose that males are more vagile than females and/or have a greater catchability.

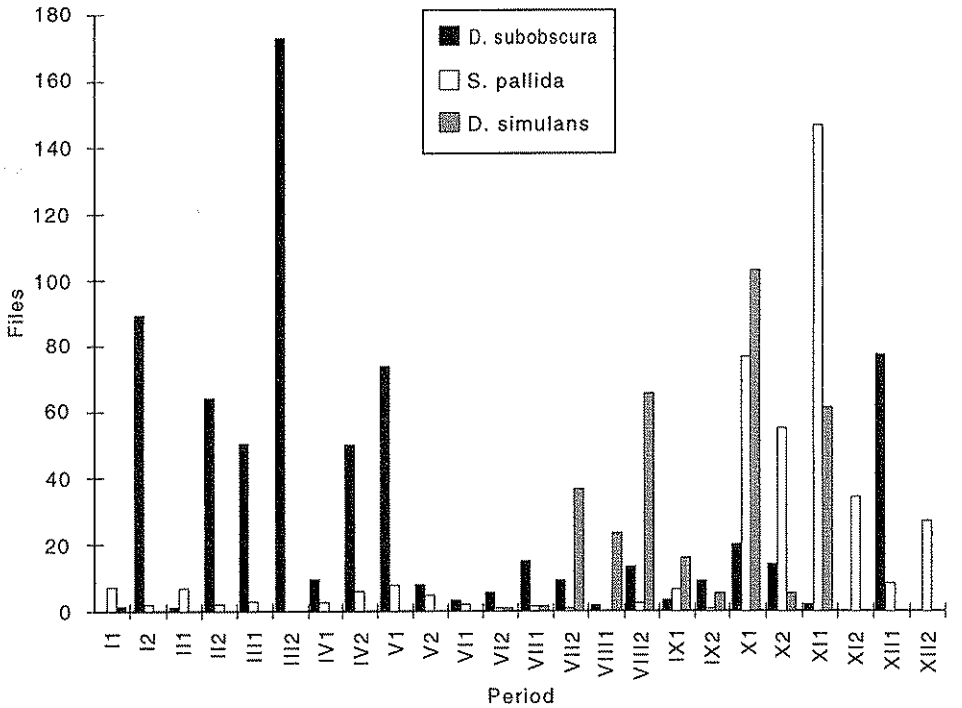

Fig. 1. Number of flies of the three most abundant species, by fortnight periods. Roman numbers: months; arabic numbers: first/second half of the month.

Número de ejemplares de las tres especies más abundantes, agrupados por quincenas. Números romanos: los meses; números árabes: primera/segunda quincena del mes.

Ecological aspects

Flies were collected continuously during at least one year, but in different years, depending of the trap type. The appropriate data, pooled per season, are shown in Tab. 2. Obviously, several species show peaks in certain seasons: *D. subobscura* during winter and spring, *D. simulans* (as well as, but less distinctive, *D. melanogaster* and *D. immigrans*) during summer and autumn, as already mentioned by OCHANDO (1978, 1980). Most of the domestic species showed this behaviour. On the other hand, *S. pallida* was abundant mainly during autumn. All specimens of *G. distigma* were found in Spring, probably during the flowering time of *Sonchus* species thistles they are associated with.

For the three most abundant species, a more detailed analysis of the annual distribution of flies is shown in Fig. 1. Besides some fluctuations, *D. subobscura* is present during all months, but very rare from June to October. In the Mediterranean, this was observed by several authors (e.g. OCHANDO, 1978, 1980). For *S. pallida*, more or less continuously present as well, a rather short period of high abundance was found, covering the months October to December. This species has never before been assessed during a whole year and many details of its ecology are therefore not known well enough; the ecological situation during the mentioned period might allow the establishment of high densities of flies.

D. simulans was nearly completely missing from December to June. A more or less analogous but less uniform result was achieved by OCHANDO (1978, 1980). This species, probably better adapted to warm climate and/or more able to produce high densities under favourable conditions than *D. melanogaster*, and then overflowing the latter, might invade the area from adjacent habitats every year again.

As a conclusion, the drosophilids collected in the Monegros region show various ecological properties, some of them obviously typical for the area studied.

SUMARIO

En España, la fauna de drosifílidos no ha venido estudiándose con intensidad. Es por ello que se han aprovechado los resultados del inventario de la biocenosis asociada a un bosque de *Juniperus thurifera* L. en la comarca de Los Monegros, para obtener datos sobre la efectividad de diversos sistemas de trampeo y la ecología de esta familia.

Se han colectado un total de 2.419 ejemplares, pertenecientes a cinco géneros y 18 especies diferentes, todas ellas con una amplia distribución global. Excepto *D. simulans*, las especies domésticas como *D. busckii, D. funebris, D. immigrans, D. repleta* y *D. melanogaster* están escasamente representadas, lo que indica un hábitat con poca influencia antrópica. Se cita a *A. semivirgo* por primera vez para la península.

Se han utilizado una serie de técnicas recolectoras de invertebrados: **trampa Moericke** (amarilla por dentro y verde por fuera, con unas dimensiones de 60 x 60 x 10 cm, colocada a una altura de 70 cm y llenada con agua jabonosa); **platos de colores** (platos de plástico de color amarillo, azul o blanco, con unas dimensiones de 26 x 16 x 4 cm y colocados sobre el suelo); dos **trampas Malaise**; 12 **trampas de caída** (con cerveza o vinagre como cebo); **barrido** sobre plantas; cuatro **trampas Wilkening** (con unas dimensiones de 32 cm de alto x 11 de ancho); **trampas de carroña** (conteniendo hígado de cerdo, principalmente) y **trampas en el interior de madrigueras de conejo**. En orden al tratamiento estadístico de los datos, se ha excluido el material colectado por las técnicas de trampeo que no han sido utilizadas durante un año calendario completo y aquellas citas que, para los demás sistemas, sobrepasaban ese periodo.

El método de trampeo más efectivo han sido las trampas de caída cebadas con cerveza o vinagre (ver tab. 1), con unos resultados comparables a los obtenidos por otros autores que utilizaron fruta fermentada como cebo, el sistema más habitual de colectar este tipo de dípteros. De los demás métodos, sólo los platos de colores y la trampa Malaise muestran cierta efectividad para colectar drosofílidos. El barrido sobre plantas ha sido efectivo sólo para *S. pallida*, como era de esperar en una especie que no es atraída por los cebos y se muestra abundante entre la vegetación.

La tabla 2 muestra la fenología de la familia por estaciones. Varias especies muestran picos, como *D. subobscura* en invierno y primavera, *D. simulans* (y aunque menos nítidamente *D. melanogaster* y *D. immigrans*) durante el verano y el otoño.

Se muestra un análisis detallado de la fenología anual de las tres especies más abundantes (fig. 1). Así, *D. subobscura* está presente durante todo el año, siendo más rara de Junio a Octubre; lo mismo ocurre con *S. pallida*, que se muestra especialemente abundante de Octubre a Diciembre. Finalmente, *D. simulans* desaparece desde Diciembre a Junio: este comportamiento parece indicar una alta capacidad de reproducción bajo condiciones favorables que permiten ocupar la zona cada año desde hábitats cercanos.

Como conclusión, la fauna de drosofílidos de Los Monegros muestra una serie de adaptaciones a las condiciones ecológicas del área estudiada.

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Gerhard Bächli
Zoological Museum. University of Zürich
CH-8057 ZÜRICH - Switzerland (Suiza)

Javier Blasco-Zumeta
C/ Hispanidad, 8
E-50750 PINA DE EBRO - Zaragoza, Spain (España)