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ROBBER FLIES (DIPTERA, ASILIDAE) OF A *JUNIPERUS THURIFERA* L. FOREST OF LOS MONEGROS REGION (ZARAGOZA, SPAIN)

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ABSTRACT.— A survey of the Asilidae of a *Juniperus thurifera* L. forest of Los Monegros region (Zaragoza, Spain) was carried out between 1989 and 1994. In all, 569 specimens belonging to 35 species and 23 genera were collected. Some facts are given on the ecology of the family in the area and trap efficiency. The first record of *Loewinella virescens* (Loew, 1871), *Rhadinus megalonyx* Loew, 1856, *Holopogon siculus* (Macquart, 1834), *H. venustus* (Rossi, 1790), *Leptogaster gracilis* Loew, 1847, *Acanthopleura naxia* (Macquart, 1838) and *Dysmachus stylifer* (Loew, 1854, 1871) for Spain are included.

RESUMEN.— *Asílidos (Diptera, Asilidae) de un bosque de* Juniperus thurifera *L. de la comarca de Los Monegros (Zaragoza, España)*. Entre los años 1989 y 1994 se llevó a cabo un estudio sobre los Asilidae en un bosque de *Juniperus thurifera* L. de la región de Los Monegros (Zaragoza, España). En total, se colectaron 569 ejemplares, correspondientes a 35 especies y 23 géneros. Se aportan algunos datos relacionados con la ecología de la familia en la zona y a la eficacia de las trampas. Se incluyen las primeras citas aparecidas en España de *Loewinella virescens* (Loew, 1871), *Rhadinus megalonyx* Loew, 1856, *Holopogon siculus* (Macquart, 1834), *H. venustus*

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(Rossi, 1790), *Leptogaster gracilis* Loew, 1847, *Acanthopleura naxia* (Macquart, 1838) y *Dysmachus stylifer* (Loew, 1854, 1871).

KEY WORDS.— Diptera, Asilidae, phenology, faunistics, new records, Los Monegros, Spain.

INTRODUCTION

An intensive inventory of the taxa of Los Monegros region took place during 1989-1994, as a means of evaluating its natural values in order to campaign for legal protection, and the various trapping techniques used produced the species of Asilidae dealt with in this paper.

According to the *Catalogue of Palaearctic Diptera* (LEHR, 1988), 140 species had been recorded from Spain up to now. Papers dealing with specific areas of Spain are also few (GAYUBO *et al*., 1987; OLDROYD, 1972; PÉREZ & PORTILLO, 1991; SÉGUY, 1934; WEINBERG & TSACAS, 1975; WEINBERG & BÁEZ, 1992). This paper is an attempt at filling the gap in our knowledge of the Asilidae that inhabit one of Spain's most characteristic areas, thus contributing to a better understanding of these Diptera in the Iberian Peninsula.

STUDY AREA

Los 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 & BOLÒS, 1957). OCHOA (1982) summarizes its climate as follows: large annual range of minimum and maximum temperatures, which go from –10 ºC to above 40 ºC; 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 & BOLÒS, 1957) Rivas-Martínez community (RIVAS-MARTÍNEZ, 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 & BOLÒS, 1957).

MATERIAL AND METHODS

The specimens have been collected in Retuerta de Pina, an area near the locality of Pina de Ebro (Zaragoza province) (UTM grid square 30T YL29). All the collecting methods used are described in BÄCHLI & BLASCO-ZUMETA (1995) with only the following ones being successful for Asilidae:

Sweeping from plants. An insect net was swept once every fortnight during 1992 and from January to December 1993 on 21 plant species: *Agropyro-Lygeion* Br.-Bl. & Bolòs (a plant community composed mainly of 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 and *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.

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 every 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.

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 in opera-

tion from May 1990 to December 1991, with two breaks, August-September 1990 and July-September 1991.

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.

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

The list of species is arranged following the *Catalogue of Palaearctic Diptera* (LEHR, 1988). Identifications have been made by the first author using the works by ENGEL (1930), HULL (1962), SÉGUY (1927), THEODOR (1980), TSACAS (1968) and WEINBERG & TSACAS (1975, 1976). The grouping of genera in subfamilies follows LEHR's (1988) treatment.

The species are listed alphabetically within each genus. For every species the means of capture, date and number of specimens by sex are given.

RESULTS

FAUNISTICAL ACCOUNT

SUBFAMILY ATOMOSINAE

Loewinella virescens (Loew, 1871)

Distribution: Southern Europe and Asia: Iran, Mongolia, China. Not previously recorded from Spain.

Material examined: 1 ♀. Coloured dishes: 9.X.91: 1 ♀.

SUBFAMILY LAPHYSTIINAE

Glyphotriclis ornatus (Schiner, 1868)

Distribution: Spain, France, Israel and North Africa.

Material examined: 1 ♀. Coloured dishes: 8.VII.91: 1 ♀.

Psilocurus Loew, 1874 sp. nov.

The genus *Psilocurus* is distributed through Asia and Southern Europe (Caucasus). 8 specimens were collected.

SUBFAMILY STENOPOGONINAE

Dioctria gagates (Meigen, 1820)

Distribution: Great Britain, Spain, Portugal, Greece, Italy and North Africa.

Material examined: 2 ♂♂ 48 ♀♀. Sweeping: on *Carduus bourgeanus* Boiss. et Reut., 20.V.91: 1 ♀; on *T. canariensis*, 9.VI.91: 2 ♀♀. Coloured dishes: 7.VI.91: 1 ♀. Malaise trap: 24.V.91: 2 ♀♀; 7.VI.91: 19 ♀♀; 20.VI.91: 13 ♀♀; 6.VII.91: 1 ♀. Moericke trap: 20.V.91: 1 ♀.

Lasiopogon cinctus (Fabricius, 1781)

Distribution: Europe, recorded from Spain by LEHR (1988).

Material examined: 46 ♂♂ 15 ♀♀. Coloured dishes: 24.II.90: 1 ♂; 14.IV.90: 1 ♂; 22.IV.90: 11 ♂♂; 25.III.91: 1 ♂ 1 ♀; 9.IV.91: 29 ♂♂ 12 ♀♀; 25.IV.91: 2 ♂♂. Malaise trap: 9.IV.91: 1 ♀; 20.IV.91: 1 ♂; 25.V.91: 1 ♀.

Rhadinus megalonyx Loew, 1856

Distribution: Transcaucasus, Asia, Syria, Israel, Irak, Iran, North Africa (Tunisia, Lybia, Egypt) and also in the Afrotropical region (south Yemen, Sudan). New record for Spain.

Material examined: 21 ♂♂ 7 ♀♀. Sweeping: on *Artemisia herba-alba*, 12.IX.92: 1 ♂; on *Suaeda vera*, 22.VIII.91: 1 ♂; on ground, 6.IX.90: 1 ♀; 8.IX.90: 1 ♀. Coloured dishes: 27.VII.90: 1♂; 22.VIII.90: 6 ♂♂; 3.IX.90: 8 ♂♂ 3 ♀♀; 21.VII.91: 2 ♂♂; 9.IX.91: 1 ♂ 1 ♀. Malaise trap: 25.VIII.91: 1 ♂ 1 ♀.

Habropogon appendiculatus Schiner, 1867

Distribution: France, Greece, Italy, former Yugoslavia, Southern and Central Russia, Israel, Morocco and Egypt. Recorded from Spain by GAYUBO *et al*. (1987).

Material examined: 8 ♂♂ 4 ♀♀. Sweeping: on *Salsola vermiculata*, 20.VI.91: 1 ♂ 2 ♀♀; on ground, 9.VI.90: 3 ♂♂. Coloured dishes: 7.VI.91: 2 ♂♂ 1 ♀. Malaise trap: 24.V.91: 1 ♂ 1 ♂. Moericke trap: 11.VII.90: 1 ♂.

Heteropogon manicatus (Meigen, 1820)

Distribution: France, Spain, Turkey, Morocco and Algeria.

Material examined: 4 ♂♂ 2 ♀♀. Sweeping: on *Juniperus thurifera*, 25.VI.89: 1 ♀; on *Rosmarinus officinalis*, 30.V.89: 1 ♂; 9.VI.90: 1 ♂; 6.VII.90: 1 ♂; 25.VI.92: 1 ♀. Malaise trap: 20.VI.91: 1 ♂.

Holopogon flavotibialis Strobl, 1909

Distribution: Recorded only from Spain.

Material examined: 3 ♂♂ 1 ♀. Sweeping: at the *Agropyro-Lygeion*, 25.V.92: 1 ♂. Coloured dishes: 7.VI.91, 1 ♂. Malaise trap: 7.V.91: 1 ♂; 24.V.91: 1 ♀.

Holopogon siculus (Macquart, 1834)

Distribution: Known only from Sicily. New record for Spain.

Material examined: 1 ♂ 1 ♀. Malaise trap: 7.VI.91: 1 ♂ 1 ♀.

Holopogon venustus (Rossi, 1790)

Distribution: Austria, Germany, France and Italy. New record for Spain.

Material examined: 10 ♂♂ 10 ♀♀. Coloured dishes: 22.VIII.90: 1 ♂. Malaise trap: 20.VI.91: 4 ♂♂ 1 ♀; 7.VI.91: 1 ♀; 6.VII.91: 2 ♂♂ 3 ♀♀; 25.VII.91: 1 ♀; 7.VIII.91: 2 ♂♂ 1 ♀; 25.VIII.91: 1 ♂ 1 ♀. Wilkening trap: in *Juniperus thurifera*, 14.VII.92: 1 ♀; 13.VIII.92: 1 ♀.

Stenopogon brevipennis (Meigen, 1820)

Distribution: Spain, Portugal and Tunisia.

Material examined: 3 ♂♂ 4 ♀♀. Malaise trap: 6.VII.91: 1 ♂; 7.VIII.91: 2 ♀♀; 25.VIII.91: 2 ♂♂ 2 ♀♀.

Stenopogon junceus (Meigen, 1820)

Distribution: Spain, France, Greece, Turkey, Caucasus, Iran and North Africa.

Material examined: 3 ♂♂. Sweeping: on *Rosmarinus officinalis*, 2.VII.93: 1 ♂. Malaise trap: 25.VII.91: 1 ♂. Moericke trap: 11.VII.90: 1 ♂.

SUBFAMILY DASYPOGONIDAE

Dasypogon diadema (Fabricius, 1781)

Distribution: Europe, previously recorded from Spain (LEHR, 1988).

Material examined: 4 ♂♂ 4 ♀♀. Sweeping: at the *Agropyro-Lygeion*, 14.VI.92: 1 ♂; 25.VI.92: 1 ♀; on *Gypsophila struthium*, 7.VI.90: 1 ♂; on *Ononis tridentata*, 2.VII.93: 1 ♀; on *Rosmarinus officinalis*, 12.VI.90: 1 ♂ 1 ♀; 20.VI.91: 1 ♀. Coloured dishes: 7.VI.91: 1 ♂.

Saropogon obesulus Loew, 1869

Distribution: Recorded only from Spain.

Material examined: 50 ♂♂ 12 ♀♀. Sweeping: on *Salsola vermiculata*, 14.V.91: 1 ♀. Coloured dishes: 14.IV.90: 2 ♂♂ 1 ♀; 22.IV.90: 3 ♂♂; 29.IV.90: 9 ♂♂; 25.IV.91: 2 ♂♂; 7.V.91: 4 ♀♀; 7.VI.91: 1 ♂ 1 ♀. Malaise trap: 7.V.91: 8 ♂♂; 24.V.91: 12 ♂♂ 3 ♀♀; 7.VI.91: 2 ♂♂ 2 ♀♀.

SUBFAMILY LEPTOGASTRINAE

Leptogaster cylindrica (De Geer, 1776)

Distribution: A Palaearctic species, previously recorded from Spain (LEHR, 1988).

Material examined: 3 ♂♂ 3 ♀♀. Sweeping: on *Suaeda vera*, 20.VII.92: 1 ♀. Malaise trap: 6.VII.91: 2 ♂♂ 1 ♀. Light trap: 23.V.92: 1 ♂; 10.VI.93: 1 ♀.

Leptogaster gracilis Loew, 1847

Distribution: Roumania, Turkey, Israel, Iran and Mongolia. New record for Spain.

Material examined: 3 ♂♂. Sweeping: on *Rosmarinus officinalis*, 2.VII.93: 1 ♂. Coloured dishes: 6.VII.90: 1 ♂. Moericke trap: 11.VII.90: 1 ♂.

Leptogaster subtilis Loew, 1847

Distribution: Central Europe, previously recorded from Spain (LEHR, 1988).

Material examined: 1 ♂ 1 ex. Malaise trap: 20.VII.91: 1 ex. Wilkening trap: in *Juniperus thurifera*, 10.VI.94: 1 ♂.

SUBFAMILY ASILINAE

Acanthopleura naxia (Macquart, 1838)

Distribution: Austria, Greece and Turkey. First record for Spain.

Material examined: 2 ♂♂. Sweeping: on the *Agropyro-Lygeion*, 14.VI.92: 1 ♂. Malaise trap: 6.VII.91: 1 ♂.

Antiphrisson trifarius (Loew, 1849)

Distribution: Europe, Syria, Israel, Tunisia and Egypt. Previously recorded from Spain by LEHR (1988).

Material examined: 10 ♂♂ 8 ♀♀. Sweeping: on ground, 26.V.90: 1 ♂; 2.VI.90: 1 ♀; 9.VI.90: 1 ♂. Coloured dishes: 7.VI.91: 1 ♀; 9.X.91: 1 ♀. Malaise trap: 24.V.91: 8 ♂♂ 5 ♀♀.

Asilus barbarus Linnaeus, 1758

Distribution: Spain, France, Italy, Mongolia, China. Morocco, Algeria, Tunisia.

Material examined: 3 ♂♂ 3 ♀♀. Sweeping: on ground, 1.IX.89: 1 ♂; 25.VII.90: 1 ♀; 6.X.93: 1 ♂. Coloured dishes: 8.VII.91: 1 ♂; 9.IX.91: 1 ♀. Moericke trap: 25.IX.90: 1 ♀.

Cerdistus melleus (Macquart, 1838)

Distribution: Southern Europe (SÉGUY, 1927).

Material examined: 1 ♀. Moericke trap: 9.VII.90: 1 ♀.

Dysmachus stylifer (Loew, 1854)

Distribution: Europe. New record for Spain.

Material examined: 6 ♂♂ 11 ♀♀. Sweeping: on *Salsola vermiculata*, 14.V.91: 2 ♀♀. Coloured dishes: 14.IV.90: 1 ♂; 7.V.91: 5 ♂♂ 4 ♀♀; 7.VI.91: 4 ♀♀. Malaise trap: 24.V.91: 1 ♀.

Dysmachus trigonus (Meigen, 1804)

Distribution: Europe, Algeria and Tunisia. Recorded from Spain by LEHR (1988).

Material examined: 1 ♂ 2 ♀♀. Sweeping: on *Salsola vermiculata*, 14.V.91: 1 ♂. Malaise trap: 24.V.91: 1 ♂ 1 ♀.

Eccoptopus longitarsis (Macquart, 1838)

Distribution: In Europe recorded only from Spain; Asia: Irak, Israel, Iran; North Africa: Morocco, Algeria, Tunisia.

Material examined: 1 ♂. Sweeping: on the *Agropyro-Lygeion*, 22.VIII.94: 1 ♂.

Epitriptus cingulatus (Fabricius, 1781)

Distribution: Europe, Turkey and Iran. Recorded from Spain by PÉREZ & PORTILLO (1991).

Material examined: 1 ♂. Sweeping: on ground, 12.VI.90: 1 ♂.

Epitriptus inconstans (Meigen, 1820)

Distribution: Europe and North Africa. Previously recorded from Spain by LEHR (1988).

Material examined: 1 ♂ 6 ♀♀. Sweeping: at the *Agropyro-Lygeion*, 11.X.92: 1 ♂; on ground, 8.IX.90: 1 ♀. Coloured dishes: 14.X.90: 2 ♀♀. Malaise trap: 18.IX.90: 1 ♀. Light trap: 18.IX.92: 1 ♀; 25.VI.93: 1 ♀.

Machimus Loew, 1849 sp. nov.

The genus *Machimus* is distributed throughout the Palaearctic. 17 specimens were collected.

Machimus chrysitis (Meigen, 1820)

Distribution: Europe, previously recorded from Spain by LEHR (1988).

Material examined: 43 ♂♂ 19 ♀♀. Sweeping: on *Juniperus thurifera*, 21.VII.89: 1 ♂; on *Salsola vermiculata*, 14.V.91: 1 ♀; on ground, 2.VI.90: 1 ♀; 12.VI.90: 1 ♂. Coloured dishes: 5.V.90: 1 ♂; 7.V.91: 5 ♂♂ 2 ♀♀. Malaise trap: 24.V.91: 7 ♂♂ 1 ♀; 7.VI.91: 19 ♂♂ 6 ♀♀; 20.VI.91: 7 ♂♂ 4 ♀♀; 6.VII.91: 1 ♂ 2 ♀♀; 7.VIII.91: 1 ♀. Moericke trap: 11.VII.90: 1 ♀. Light trap: 25.VI.93: 1 ♂.

Machimus dasypygus (Loew, 1849)

Distribution: Southern Europe and North Africa. Previously recorded from Spain by LERH (1988).

Material examined: 3 ♂♂ 1 ♀. Sweeping: on *Artemisia herba-alba*, 20.VII.92: 1 ♀; 8.VIII.92: 1 ♂; on ground, 25.VII.90: 1 ♂. Malaise trap: 18.IX.90: 1 ♂.

Machimus fortis (Loew, 1849)

Distribution: Southern Europe and North Africa. Previously recorded from Spain by LEHR (1988).

Material examined: 1 ♂ 2 ♀♀. Coloured dishes: 8.VII.91: 1 ♂ 1 ♀. Light trap: 25.VI.93: 1 ♀.

Machimus pilipes (Meigen, 1820)

Distribution: Spain, France, Italy, Morocco and Algeria.

Material examined: 42 ♂♂ 45 ♀♀. Sweeping: on *Gypsophila struthium*, 30.VIII.90: 3 ♂♂ 2 ♀♀; on *Helianthemum squamatum*, 26.X.91: 1 ♀; on *Juniperus thurifera*, 23.IX.89: 1 ♂ 2 ♀♀; on *Salsola vermiculata*, 5.IX.91: 4 ♂♂; on ground, 8.X.89: 1 ♀. Coloured dishes: 3.IX.90: 4 ♂♂ 2 ♀♀; 14.X.90: 4 ♂♂ 3 ♀♀; 9.IX.91: 5 ♂♂ 9 ♀♀; 26.X.91: 1 ♂ 1 ♀; 25.XI.91: 1 ♀. Malaise trap: 18.IX.90: 5 ♂♂ 12 ♀♀; 25.VIII.91: 1 ♂; 23.IX.91: 4 ♂♂ 1 ♀; 9.X.91: 4 ♂♂ 5 ♀♀; 20.X.91: 2 ♂♂ 3 ♀♀. Moericke trap: 25.IX.90, 1 ♂; 17.X.90: 2 ♂♂ 2 ♀♀. Light trap: 18.IX.92: 1 ♂.

Neomochtherus aquitanus Tsacas, 1964

Distribution: Spain, France and Switzerland.

Material examined: 2 ♂♂. Malaise trap: 20.VI.91: 1 ♂. Wilkening trap: on *Pinus halepensis*, 28.VI.92: 1 ♂.

Neomochtherus confusus Tsacas, 1965

Distribution: Spain, France and Switzerland.

Material examined: 8 ♂♂ 23 ♀♀. Sweeping: on *Artemisia herba-alba*, 12.IX.92: 1 ♀; on *Juniperus thurifera*, 21.VI.89: 1 ♂; on *Rosmarinus officinalis*, 6.VIII.92: 1 ♀; on *Salsola vermiculata*, 8.VIII.92: 1 ♀; on ground, 12.VI.90: 1 ♂. Coloured dishes: 27.VII.90: 1 ♀; 20.VI.91: 2 ♂♂ 4 ♀♀; 8.VII.91: 1 ♀; 9.IX.91: 1 ♀. Malaise trap: 7.VI.91: 1 ♂; 6.VII.91: 5 ♀♀. Moericke trap: 9.VII.90: 1 ♀. Light trap: 25.VI.93: 1 ♂ 1 ♀; 10.VII.93: 1 ♂ 2 ♀♀; 20.VII.93: 1 ♂ 4 ♀♀.

Tolmerus pyragra (Zeller, 1840)

Distribution: Southern and Central Europe. Recorded from Spain by PÉREZ & PORTILLO (1991).

Material examined: 12 ♂♂ 9 ♀♀. Sweeping: on *Rosmarinus officinalis*, 8.V.92: 1 ♂. Coloured dishes: 22.IV.90: 2 ♂♂; 5.V.90: 1 ♀; 7.V.91: 3 ♂♂ 1 ♀; 7.VI.91: 1 ♂. Malaise trap: 24.V.91: 2 ♀♀; 7.VI.91: 1 ♂ 2 ♀♀; 6.VII.91: 1 ♂. Moericke trap: 20.V.91: 1 ♂. Light trap: 25.VI.93: 1 ♂; 10.VII.93: 1 ♀. Wilkening trap: on *Juniperus phoenicea*, 25.V.92: 1 ♂; 14.VII.92: 1 ♀; on *Pinus halepensis*, 10.V.92: 1 ♀.

DISCUSSION

The total number of species recorded here are 35, belonging to 6 subfamilies and grouped in 23 genera. This is a small number when compared to the 140 species recorded by LEHR (1988) from Spain or the 56 species recorded from sierra de Gredos by PÉREZ & PORTILLO (1991), but it is highly related to other local studies as SÉGUY (1934), who listed 21 species from the whole of Spain; OLDROYD (1972), who listed 17 species from the Pyrenees and the Montes Universales; GAYUBO *et al*. (1987), who listed 25 species from the meridional Sierras of the province of Badajoz or WEINBERG & BÁEZ (1992), who listed 26 species from the Canary Islands. The records of another 7 species not previously recorded from Spain (*Loewinella virescens* [Loew, 1871], *Rhadinus megalonyx* Loew, 1856, *Holopogon siculus* [Macquart, 1834], *H. venustus* [Rossi, 1790], *Leptogaster gracilis* Loew, 1847, *Acanthopleura naxia* [Macquart, 1838] and *Dysmachus stylifer* [Loew, 1854]) bring the number of species of Asilidae known at present from Spain, as a result of our present data, to 150.

Among the 569 specimens collected, *Machimus pilipes* is certainly the most common species, with 87 specimens, with *Dioctria gagates* (50 speci-

mens), *Lasiopogon cinctus* (61 specimens), *Saropogon obesulus* (62 specimens) and *Machimus chrysitis* (62 specimens) as the other dominant species. There are five species represented by only one specimen each, and another 16 species represented by less than ten specimens each.

Table I shows the 35 taxa included in their chorological categories. These data imply a high percentage, 62,8%, of Mediterranean elements, a percentage which agrees with those of other groups already studied like the Heteroptera (67,7%) (RIBES *et al*., 1997), the Thysanoptera (45%) (ZUR STRASSEN *et al*., 1997) or the plants (70%) (MOLERO, 1988). Out of the total number of studied taxa, 11,4% can be considered, as far as we know, as endemic to the Iberian Peninsula (for the flora it is 8% [MOLERO, 1988] and for the Heteroptera it is 7,8% [RIBES *et al*., 1997]), including the two new species, of the genera *Psilocurus* and *Machimus*, whose description will be the subject of another paper.

Table I. Chorology of the Asilidae of Retuerta de Pina's juniper forest.
Tabla I. Corología de los Asilidae del sabinar de Retuerta de Pina.

Chorology	Number of species	Percentage
European	9	25,7
Holomediterranean	6	17,1
Westmediterranean	4	11,2
Palaearctic	4	11,4
Euromediterranean	3	8,5
Eastmediterranean	2	5,7
Iberian	2	5,7
Los Monegros endemic	2	5,7
Northmediterranean	2	5,7
Westpalaearctic & afrotropical	1	2,8

Another thing worth noting is the presence of species known up till now only from the Eastern Mediterranean eastwards, like *Loewinella virescens* and *Leptogaster gracilis*, or the new species of *Psilocurus*, whose nearest relatives occur in Asia, strengthening the hypothesis of an ecological continuity with Los Monegros since the Tertiary (RIBERA & BLASCO-ZUMETA, 1998).

Despite the fact that the purpose of this paper was not the compilation of a species inventory of the Asilidae, the systematic use of arthropod trapping methods permits a qualitative assessment of the effectiveness for this group of the collecting techniques used (Table II). The collecting method with the highest effectiveness is the Malaise trap, with 75,7% of the recorded species. It seems that flight interception traps are suitable for the detection of a group which has good flight capabilities and actively explores a territory.

Table II. Number of species collected by different methods (excluding *Psilocurus* sp. nov. and *Machimus* sp. nov.).
Tabla II. Número de especies colectadas mediante diferentes métodos (excluidos Psilocurus *sp. nov. y* Machimus *sp. nov.).*

Trapping method	Number of species	Percentage
Malaise trap	25	75,7
Sweeping	23	69,6
Coloured dishes	22	66,6
Moericke trap	11	33,3
Light trap	7	21,2
Wilkening trap	4	12,1

The size of most of the species in the group, their *de visu* detectability and the use that they make of vegetation, turn the entomological net into an indispensable tool for inventorying Asilidae, with 69,6% of the species detected by sweeping. As for attraction methods, only traps using colour have proved effective, with coloured dishes collecting 66,6% of the species and Moericke traps with 33,3%. The higher effectiveness of coloured dishes over Moericke traps is due to their higher detectability, as they take up a bigger surface on the ground. Of the other trapping methods used, only light traps (with 21,2% of the species collected) have been of any use.

The phenological pattern of the Asilidae in the area under study (Table III) coincides with that of other groups, such as the Heteroptera (RIBES *et al*., 1997), the Thysanoptera (ZUR STRASSEN *et al*., 1997) or the Chrysomelidae (Coleoptera) (PETITPIERRE *et al*., 2000) with the minimum number of species in Winter and the peak in Spring and Summer.

Table III. Number of species and specimens collected during the four seasons (excluding *Psilocurus* sp. nov. and *Machimus* sp. nov.).
Tabla III. Número de especies y de ejemplares colectados durante las cuatro estaciones (excluidos Psilocurus *sp. nov. y* Machimus *sp. nov.).*

Season	Number of species	Percentage	Number of specimens	Percentage
Spring	12	36,3	176	33,8
Summer	30	90,9	231	44,4
Autumn	9	27,2	113	21,7
Winter	1	3,0	1	0,1

There seems to be a marked seasonality in the group, both in absolute and relative terms, with 90,9% of the species and 44,4% of the specimens collected in Summer. Spring would be the second most important season regarding the number of species (12%), followed by the Autumn (9%), a period when the number of specimens is dominated by the presence of *Machimus pilipes*, with 81 specimens, an Autumn species which reaches the month of November.

The faunistic study of Los Monegros region, which is highly important in this respect, has produced, also for the Asilidae, good arguments for legal protection and permanent conservation of this area.

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SUMARIO

El inventario de la biocenosis de un sabinar de *Juniperus thurifera* L. en Los Monegros ha permitido obtener los datos que motivan esta nota. De los métodos de trampeo utilizados, solo el barrido, los platos de colores, la trampa Malaise, la trampa Moericke, la trampa luminosa y la trampa Wilkening han resultado efectivos para el grupo.

Se han detectado un total de 569 ejemplares pertenecientes a 35 especies de 23 géneros. Las especies *Loewinella virescens*, *Rhadinus mega-*

lonyx, *Holopogon siculus*, *H. venustus*, *Leptogaster gracilis*, *Acanthopleura naxia* y *Dysmachus stylifer* son citadas por primera vez para España y *Psilocurus* sp. nov. y *Machimus* sp. nov. son nuevas para la ciencia. Las especies con mayor número de ejemplares colectados son *Machimus pilipes* (87 ejs.), *Dioctria gagates* (50 ejs.), *Lasiopogon cinctus* (61 ejs.), *Saropogon obesulus* (62 ejs.) y *Machimus chrysitis* (62 ejs.).

La tabla I muestra la corología del grupo, que es, con el 62,8%, eminentemente mediterránea, con un alto porcentaje, el 11,4%, de endemismos ibéricos. Destaca la presencia de especies conocidas hasta ahora solo del oriente del Mediterráneo hacia el este, como *Loewinella virescens* y *Leptogaster gracilis*, o la nueva especie de *Psilocurus*, un género conocido solo en Asia, reforzando la hipótesis de una continuidad ecológica en Los Monegros desde el Terciario.

La tabla II muestra la eficiencia de las técnicas de muestreo utilizadas. El método de recolección que se muestra más eficiente es la trampa Malaise, con el 75,7% de las especies detectadas, seguido en segundo lugar por el barrido de vegetación, con el 69,6%. En cuanto a los sistemas de atracción, solo las trampas que utilizan el color han resultado efectivas, con el 66,6 y 33,3%, respectivamente, de especies detectadas con platos de colores y trampa Moericke. De los demás sistemas de trampeo utilizados, solo la trampa luminosa (con el 21,2% de las especies colectadas) ha resultado de alguna efectividad.

El esquema fenológico de los Asilidae en el área estudiada (Tabla III) tiene una marcada estacionalidad, tanto en términos absolutos como relativos, con una presencia en verano del 90,9% de las especies detectadas y el 44,4% de los ejemplares colectados. La primavera sería la segunda estación con mayor número de especies (12%), seguida del otoño (9%) y solo con algún ejemplar ocasional durante el invierno.

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