

New records of zerconid mites from the Iberian Peninsula and the Macaronesian region (Acari: Mesostigmata: Zerconidae)

MARÍA L. MORAZA

Departamento de Zoología y Ecología, Facultad de Ciencias, Universidad de Navarra, C/ Irunlarrea s/n, Pamplona 31080, (Navarra), Spain. e-mail: mlmoraza@unav.es

Recibido: 30-05-2006. Aceptado: 6-11-2006
ISSN: 0210-8984

ABSTRACT

Based on material collected from different habitats (natural, reforested and felled habitats) of Navarra (northern Spain), five species of the family Zerconidae are newly recorded and a key to the 29 species found in the Iberian Peninsula and the Macaronesian region, based on adult females, is provided. Ecological requirements, in terms of habitat preference, vertical distribution in the soil, and seasonal population changes of several species, are given.

Key words: Acari, Mesostigmata, Zerconidae, taxonomy, Iberian Peninsula, Macaronesian region.

RESUMEN

Nuevas citas de ácaros zercónidos para la Península Ibérica y la región Macaronésica (Acari: Mesostigmata: Zerconidae)

Sobre material recolectado en diferentes hábitats (naturales, bosques de reforestación y talados), de Navarra (Norte de España), se citan por primera vez para la fauna española cinco especies de la familia Zerconidae y se aporta una clave sistemática para hembras adultas de las 29 especies encontradas en la Península Ibérica y región Macaronésica. Para las especies más importantes se detallan algunos requerimientos ecológicos, tales como preferencia de hábitat, distribución vertical en el suelo y cambios estacionales de su población.

Palabras clave: Acari, Mesostigmata, Zerconidae, taxonomía, península Ibérica, región Macaronésica.

INTRODUCTION

Zerconid mites, an important constituent of soil microhabitats of the northern hemisphere, are relatively well known and until to date 21 species have been described from Spain (Athias-Henriot, 1961, Moraza, 1989, 1990, 1991, 2006). In the present paper, besides the species newly recorded for the Iberian fauna, some information on the ecological requirements of zerconids and the manner in which alterations in natural habitats may affect them, is given. The data may aid in the understanding of the biology of this group of mites.

MATERIAL AND METHODS

The mites were collected by the Department of Zoology and Ecology of the University of Navarra during soil ecology studies in habitats (natural forests, reforested forest, felled forest) of different climatic regions of Navarra (Table 1). Most specimens come from sampling performed once each season at each site. Every sample was 25 x 25 cm, being of different depths depending upon the amount of litter present. Although the global results are presented here, samples were extracted layer by layer (leaf litter, humus and mineral soil). Population densities are based on 1000 gr. dry weight of sample. Relative abundance refers to the number of specimens in relation to the total number of mesostigmatid mites in the sample. Mites of all developmental stages were collected (Lv: larva, Pn: protonymph; Dn: deutonymph; Ad: adult).

Other specimens are from the soil of reforested forests of *Pinus nigra* of different ages and from different areas of Navarra (localities bearing an asterisk in table 1).

Extraction method

The mesofauna of microarthropods was extracted using the Tullgren's method. Specimens examined using light microscopy were cleared in Nesbitt's solution and mounted in Hoyer's medium.

Specimens are deposited in the Acarology Collection (Acarology Laboratory) of The Ohio State University (Columbus, Ohio, USA) (OSAL) and in Museo de Zoología, Universidad de Navarra (MZUNAV).

Table I. Description of sampled localities and habitats. Localities with an asterisk (*) have not been seasonally studied.

Tabla I. Descripción de los hábitats y localidades muestreadas. Las localidades señaladas con un asterisco (*) no han sido estudiadas estacionalmente.

Locality	UTM	Altitude (m.a.s.l.)	Habitat	Vegetation
Aróstegui	30TXN05	550	Reforested pine forest	<i>Pinus nigra</i> (33 years old)
Bco. de Minchate*	30TXN6951	890-925	Praire and beech	<i>Fagus sylvatica</i>
Beorburu*	30TXN05	780	Reforested pine forest	<i>Pinus nigra</i> (29 years old)
Beunza	30TXN044584	770	Natural oak forest	<i>Quercus pyrenaica</i>
Bigüezal	30TXN5324	<817	Reforested pine forest	<i>Pinus sylvestris</i> (150 years old)
Bigüezal	30TXN5324	<817	Felled pine forest	Prairie
Caparroso	30TXM1184	295	Natural mediterranean bush	<i>Rosmarino-Ericion (Rosmarino-Linetum subfruticosi)</i>
Caparroso	30TXM1184	295	Reforested pine forest	<i>Pinus halepensis</i> (30 years old)
Carrascal	30TXN12	400	Degraded oak forest	<i>Quercus coccifera</i>
Ericé	30TXN58	593	Reforested larch forest	<i>Larix kaempferi</i>
Gulina*	30TWN95	540	Reforested pine forest	<i>Pinus nigra</i> (22 years old)
Irati	30TXN56	765	Natural beech forest	<i>Fagus Scillo-Fagetum</i>
Itoiz*	30TXN34	730	Reforested pine forest	<i>Pinus nigra</i> (50 years old)
Leiza (Mont. Arremia)*	30TWN87	690	Natural oak forest	<i>Quercus robur, Hyperico pulchri-Quercetum roboris</i>
Marcalain*	30TXN05	630	Reforested pine forest	<i>Pinus nigra</i> (21 years old)
Quinto Real (Erreguerena)	30TXN210625	950	Felled beech forest	Prairie (5 years)
Quinto Real (Preseta)	30TXN210625	800	Reforested larch forest	<i>Larix kaempferi</i> (100 years)
Sansoain	30XN1513	600	Natural oak forest	<i>Quercus rotundifolia</i>
Sansoain	30XN1513	600	Reforested pine forest	<i>Pinus nigra</i>
Zabaldica*	30TXN14	680	Reforested pine forest	<i>Pinus nigra</i> (39 years old)

RESULTS

Currently, the family Zerconidae Berlese, 1892 is represented in Spain by 23 species. In the present paper, five species, with new localities and habitats in Spain, are recorded for the first time (Table 1, 2).

Prozercon cambriensis Skorupski & Luxton, 1996

Western European species, found here in soil of a natural oak forest (*Quercus robur*) in Leiza, on a silicean substrate with a mean Ph of 4.17 (Table 3). The species is newly recorded for the Iberian Peninsula.

Table 2. Presence (+) of zerconid species in different habitats of Navarra (* new records for the Iberian Peninsula).

Tabla 2. Presencia (+) de especies de zercónidos, in diferentes hábitats de Navarra (* nuevas citas para la Península Ibérica).

Zerconidae species	Bush	Beech	Oak	Larch	Pine	Praire
<i>Prozercon cambriensis</i> Skorupski & Luxton, 1996*			+			
<i>Prozercon davidi</i> Moraza, 2006		+				+
<i>Prozercon escalai</i> Moraza, 1988					+	
<i>Prozercon fimbriatus</i> (C.L.Koch, 1839)		+			+	+
<i>Prozercon juanensis</i> Moraza 1988					+	
<i>Prozercon lutulentus</i> Halasková, 1963				+	+	
<i>Prozercon masani</i> Moraza, 2006					+	
<i>Prozercon ornatus</i> (Berlese, 1904)			+			+
<i>Prozercon tellecheai</i> Moraza, 1988		+	+	+		
<i>Prozercon</i> - Species richness		3	3	2	5	3
<i>Zercon aberrans</i> Mihelcic, 1960						+
<i>Zercon arcuatus</i> Trägårdh 1931		+				
<i>Zercon blesti</i> Evans, 1954*		+	+			
<i>Zercon franzi</i> Willmann, 1943*					+	
<i>Zercon guadarramicus</i> Mihelcic, 1960		+		+		
<i>Zercon hugoi</i> Moraza, 2006			+			+
<i>Zercon italicus</i> Sellnick, 1944*						+
<i>Zercon keiseri</i> Schweizer 1949				+		
<i>Zercon montigenus</i> Blaszak 1972*					+	
<i>Zercon navarrensis</i> Moraza, 1989			+	+	+	+
<i>Zercon paenenudus</i> Athias-Henriot, 1961		+	+			+
<i>Zercon parivus</i> Moraza, 1991		+			+	
<i>Zercon peltatus</i> CL Koch 1836			+			
<i>Zercon pinicola</i> Halasková, 1969					+	
<i>Zercon pustulescens</i> Athias-Henriot, 1961			+	+	+	+
<i>Zercon subguttulatus</i> Moraza, 2006			+			
<i>Zercon</i> sp.	+					
<i>Zercon</i> – species richness	1	5	7	4	6	6
Zerconidae - Species richness	1	8	9	6	11	9

Table 3. Seasonal abundances/relative abundance of species of *Prozercon* in sampled habitats and localities (S= spring; S'= summer; A= autumn; W= winter; Be=Beunza; Bi=Bigüezal; BR=Bardenas Reales; Ca=Carrascal; Er=Erize; I=Irati; Le=Leiza; Sa=Sansoain).

Tabla 3. Abundancia estacional/abundancia relativa de especies de *Prozercon* en los hábitats y localidades muestreados.

Prozercon	S	S'	A	W
<i>Pr. cambriensis</i>				
Oak Leiza*	7	¿	3	6
<i>Pr. fimbriatus</i>				
Prairie Q.R.	16/13	44/12	37/12	2/6
Beech Irati	—	70/7	—	—
<i>Pr. lutulentes</i>				
Larch Q.R.	5/2	—	—	7/1
Pine Gulina*	26	?	47	?
<i>Pr. ornatus</i>				
Oak Sa	3/1	—	—	—
Prairie Bi	7/4	—	—	—
<i>Pr. tellecheai</i>				
Larch Be	66/11	—	190/39	110/34
Oak Be	—	20/2	17/4	2/1
Oak Sa	12/4	—	19/7	24/4
Oak Le	18	¿	14	15

Material examined - Oak forest, Leiza (23 specimens, 09.IV.1991; 37 specimens, 18.III.1992; 44 specimens, 02.VII.1992; 54 specimens, 17.XII.1992; 35 specimens, 16.XII.1993).

Prozercon fimbriatus (C.L.Koch, 1839)

Palaearctic species, found in the soil of prairies, beech forests (Moraza, 1988) and pine forests. In the beech forest, deutonymphs and adult mites were collected in the summer; in pine forests, the species was collected in late spring.

In the prairie of Quinto Real is found one of the most abundant and frequent species of soil mesostigmatid mites. Winter appears to be the least favourable season for its populations (lower density and lower relative abundance in the community) (Table 3). *Pr. fimbriatus* lives indistinctly on the surface and in humus. Immature instars appear throughout the year.

New material studied – From beech forest: Irati (12♀♀, 7 ♂♂, 2Dn, 1Lv, 18.I.83; prairie: Quinto Real (2♀♀, 1♂, 2lv, 08.III.1983; 7♀♀, 4♂♂, 1Dn, 1Pn, 26.VIII.1982; 9♀♀, 1♂, 1Pn, 10.XI.1982); pine forest: Gulina (2♀♀, 2 ♂♂, 3Dn, 1 Lv, 11.VI.1986).

Prozercon lutulentus Halasková, 1963

Central European species found in a reforested larch forest (Moraza, 1988) established on the middle of a natural beech forest, and in pine forest litter. Specimens were not collected in summer and autumn and it prefers deeper layers of soil. Immature instars are found most frequently in the spring, however the species overwinters as an active population with all types of development instars.

New material studied – From pine forest: Gulina (5 ♀♀, 1Pn, 1 Dn, 24.XI.1986; 2 ♀♀, 1 ♂, 1Dn, 11.VI.1986).

Prozercon tellecheai Moraza, 1988

This species has frequently been found in the soil of oak forests (Moraza, 1988) and in the reforested forest of *Larix kaempferi*, and is one of the most abundant species. The species prefers the oak forest in summer and the larch forest in winter. It prefers the surface and organic layers of soil (litter). Their immature instars (larva, protonymph and deutonymph) have been found in fall and winter.

The substitution of the natural oak forest of Beunza by larch trees in the same area (Erize), produces an increase in absolute and relative abundance of *Pr. tellecheai* (Table 3). However, the substitution of the oak forest by a pine forest in Sansoain produces the opposite effect and populations of *Pr. tellecheai* have difficulty adapting to the new ecological conditions and subsequently disappear.

New material studied – From oak forest: Beunza (5 ♀♀, 8 ♂♂, 10.VIII.1982; 4 ♀♀, 2Dn, 24.XI.1982; 1 ♂, 01.02.83), (1 ♂, 23.XI.1989); Leiza (31, 09.IV.1991; 25, 18.III.1992; 18, 02.VII.1992; 13, 17.II.1992, 15, 16.12.1993); beech forest: Barranco de Mincahte (7 ♀♀, 3 ♂♂, 6 Dn, 1 Pn, 10.VII.1990).

Zercon aberrans Mihelcic, 1960

Species found in the felled habitat of Bigüezal. As most species of *Zercon*, the favorable season is autumn and the critical time is summer. Immature instars have been found in the fall and winter seasons. In the fall, its relative abundance is high and represents more than 50% of the mesostigmatid soil community.

Material studied - Prairie, Bigüezal (7 ♀♀, 3 ♂♂, 27.IV.1982; 10 ♀♀, 10Dn, 4Pn, 17.XI.1982; 2 ♀♀, 1Dn, 1Pn, 25.I.1983).

Zercon arcuatus Trägårdh 1931

Material studied – From leaf litter (8 specimens) and humus (2) from the beech forest of Irati (3 ♀♀, 3 ♂♂, 4Dn, 08.VI.1982).

Zercon franzi Willmann, 1943

The species is newly recorded in the Iberian Peninsula.

Material examined - One female of Carrascal (Bardenas Reales) pine forest in winter (18.I.1983).

Zercon gadarramicus Mihelcic, 1960

Material examined - From larch forest litter: Brangueta (Q.R) (1♀, 01.VI.1982; 1♂ 26.VIII.1982); from beech forest humus: Irati (1♀, 1♂, 08.VI.82)

Zercon italicus Sellnick, 1944

The species is newly recorded in the Iberian Peninsula.

Material examined - Species found under the surface layer of a prairie: Biguezal (1♀, 27.IV.82).

Zercon keiseri Schweizer, 1949

Material examined - Species found in larch forest litter of Brangueta (Q.R) (3♂♂, 1Dn, 01.VI.1982; 1♂, 08.III.1983).

Zercon montigenus Blaszak, 1972

The species is newly recorded in the Iberian Peninsula. It has been found in litter of several pine forests of *Pinus nigra*: Marcalain (6 ♀♀, 1Pn, 1Dn, 4.VI.1986), Itoiz (5♀♀, 1♂, 3Dn, 21.V.1986), Zabaldica (3♀♀, 21.V.1986), Arostegui (5♀♀, 5♂♂, 11.VI.1986)

Zercon navarrensis Moraza, 1989

This species lives in oak forests and in several reforested pine forests. The species appears to behave differently from one habitat to another, however, if we focus on the mean population dynamics, its absolute and relative abundance is highest in autumn, although the latter index remains virtually unchanged throughout the year.

In oak forests, the species inhabits leaf litter and humus, and in pine forests the species can also be found in the deepest mineral soil. Immature instars (Lv, Pn and Dn) may be collected throughout the year.

The substitution of natural oak forest by pine forests of *Pinus nigra* in Sansoain, just as the substitution of oak forest in Beunza by larch forest (*Erica*), results in a decrease in its population abundance, although *Z. navarrensis* is able to adapt to the new conditions.

New material examined: pine forests: Biguezal (15♀♀, 10♂♂, 3Dn, 2Lv, 27.IV.1982; 25♀♀, 1♂, 1Dn, 03.VIII.1982; 44♀♀, 8♂♂, 10Dn, 24Pn, 34 Lv, 17.XI.1982; 2♀♀, 6Dn, 6Pn, 25.I.1983), Zabaldica (9♀♀, 3♂♂, 1Dn),

Barranco de Minchate (15♀♀, 20.XI.1990; 15♀♀, 18.VII.1990); prairie, Bco. de Minchate (2♀♀, 10.VII.1990).

Zercon paenenudus Athias-Henriot, 1961 (Figs. 2, 3)

First described in the Valle de Ordena (Western Pyrenees, Spain) by Athias-Henriot (1961), until now only females had been found. In describing the species in this paper, notation of dorsal idiosomal setae follows Lindquist & Moraza (1999) and dorsal adenotaxy and poroidotaxy follows Johnston & Moraza (1991) and Našán & Fenda (2004).

Diagnosis - Anterior margin of ventrianal shield with two pairs of setae. Dorsal fossae scarcely developed (outer fossae at least twice as large as inner fossae and axes of outer fossae are inclined with respect to the longitudinal axis of the body). Glands *gdJ4* (Po3) situated between J and Z- setal row, on the line connecting setae Z4 and J5 or on the line connecting Z3 and Z4. Setae J1-J3, not reaching the bases of following setae; setae J4 and J5 longer ($J4 < J5$), reaching the bases of following setae; setae J5 absent. Setae Z2 and Z3 similar in form and length, smooth, needle-like; setae Z4, Z5, S4 and S5 prolonged, with undulate and a thread-like apical part, and at least twice as long as the other opisthotal setae. Setae S4 reaching beyond the margin of the idiosoma. Lateral margins of opisthotal shield with shallow and obtuse serration, marginal setae R long, extending beyond the bases of the following setae, similar in shape to other dorsal setae. Opisthotal shield with reticulate pattern and smooth posterior part (Fig. 19).

MALE - Length of idiosoma 540 µm, width 380 µm. Dorsum similar to the female (Fig. 2).

Venter (Fig. 3) - Sternogenital shield completely fused to the endopodal shields and with four pairs of sternal setae, smooth and needle-like in shape. An unsclerotized sternal area between setae *st1* and *st2*; wide posterior edge of shield at level of posterior margin of coxae IV. Large ventrianal shield with one pair of setae at the anterior margin and glands *gv2* triple and with the openings included in the shield.

Studied material - From oak forest litter, Leiza (1♂, 1♀, 16.XII.1993); from leaf litter and soil of beech forest, Barranco de Minchate (13♀♀, 2♂♂, 10.VII.1990); from prairie, Barranco de Minchate (6♀♀, 10.VII.1990) .

Zercon parivus Moraza, 1991

Species well represented in the oak forest of Beunza and in the beech forest of Irati (Moraza, 1991) (table 4), has been found again in the larch forest of Brangueta and infrequently in other habitats (table 2). It always lives beneath the leaf litter layer.

New material examined – From humus of pine forests: Sansoain (1♀, 01.XII.1982); from larch forest litter: Brangueta (Q.R) (1♀, 01.VI.1982; 1♂, 08.III.1983).

Zercon peltatus C.L Koch, 1836.

Species found in leaf litter from oak forest leaf litter, Beunza (1♀, 10.V.1982).

Zercon pustulescens Athias-Henriot, 1961

The species is generally found in leaf litter (except for the oak forest of Beunza) of oak, larch and pine forests. Autumn is the season when the species exhibits maximum population density and relative abundance (Table 4) and when highest number of larvae, protonymphs and deutonymphs were collected in the pine forest (*Pinus sylvestris*) of Biguezal.

Although *Z. pustulescens* has been collected in *Pinus nigra* pine forests, the substitution of the natural oak forest of Beunza with this type of pine forest appears to cause the species to disappear from the habitat (Table 4).

Material examined - Pine forest: Bardenas (1Dn, 30.III.1982), Biguezal (19♀♀, 6♂♂, 03.VIII.1982; 10♀♀, 3Dn, 8Pn, 52 Lv, 17.XI.1982), Marcalain (3♀♀, 3♂♂, 4.VI.1986), Beorburu (1dn, 4.VI.1986), Arostegui (1♀, 11.VI.1986), Barranco de Minchate (1♀, 18.VII.1990); larch forests: Brangueta (Q.R) (1♂, 2Dn, 10.XI.1982; 1♂, 1Dn, 1Lv, 08.III.1983); Erreguerena (1♀, 10.XI.1982); oak forests: Beunza (3♀♀, 2♂♂, 2Dn, 11.VI.1982; 3♀♀, 10.VIII.1982); Carrascal (1 Dn, 03.X.1982); Sansoain (5♀♀, 1♂, 01.XII.1982; 8Dn, 1Pn, 1Lv, 22.II.1983); Leiza (1♀, 02.VII.1992).

Habitat preference of zerconid mites in Navarra

When comparing population densities of *Prozercon* in different habitats which have been studied throughout the year (Tables 2, 3), the greatest abundance of these mites is found in the soil of the larch forest (*Larix kaempheri*) in Erice (49% of the specimens were collected from this habitat), which replaces the natural oak forest of the region. However, comparing the species richness among the habitats, the pine forest of *Pinus nigra* host the greatest number of species (five) (Table 2).

Population densities of *Zercon* in different habitats which have been studied throughout the year are greater in oak and pine forest in Sansoain and Bigüezal (Table 4). Oak forests, pine forests and prairies are the habitats

Table 4. Seasonal abundances/relative abundance of species of *Zercon* in sampled habitats and localities (S= spring; S'= summer; A= autumn; W= winter; Be=Beunza; Bi=Bigüezal; BR=Bardenas Reales; Ca=Carrascal; Er=Erize; I=Irati; Le=Leiza; Sa=Sansoain).

Tabla 4. Abundancia estacional/abundancia relativa de especies de *Zercon* en los hábitats y localidades muestreados.

Zercon	S	S'	A	W
<i>Z. aberrans</i>				
Prairie Bi	17/10	—	84/59	10/12
<i>Z. arcuatus</i>				
Beech Irati	30/17	—	—	—
<i>Z. franci</i>				
Pine BR	5/3	—	—	—
<i>Z. gadarramicus</i>				
Larix QR	2/1	3/1	—	—
Beech I	4/1	—	—	—
<i>Z. italicus</i>				
Prairie Bi	2/1	—	—	—
<i>Z. keiseri</i>				
Larix QR	25/2	—	—	2/0.2
<i>Z. navarrensis</i>				
Oak Sa	142/42	—	165/57	365/56
Pine Sa	3/1	—	24/26	9/3
Pine Bi	48/2	40/11	259/30	20/16
<i>Z. parivus</i>				
Oak Be	19/8	78/7	32/7	20/10
Larix QR	2/1	—	—	2/0.2
Pine Sa	—	—	2/2	
Beech I	5/2	4/2	—	5/1
<i>Z. peltatus</i>				
Oak Be	1/0.4	—	—	—
<i>Z. pustulescens</i>				
Larix QR	—	—	29/3	29/1
Prairie QR	—	—	4/1	—
Pine BR	3/6	—	—	—
Pine Bi	—	61/11	388/17	—
Oak Be	9/3	5/0.4	—	—
Oak Ca	—	—	2/4	
Oak Sa	—	—	10/4	27/4
Oak Le	1	?	—	—

preferred by *Zercon* (Table 2). *Z. navarrensis* and *Z. pustulescens* are the species most frequently found.

Differences among species are highlighted in the following key for females (measurements are given in micrometers: idiosomal length and idiosomal width).

Key to species of the genus *Prozercon* (females) from the Iberian Peninsula

- 1 Peritrematal setae *r1* (p1) plumose or apically serrated 4
- 2 All central and submarginal podonotal setae, except *j1* and *j2*, are smooth; setae *S2* smooth; tips of opisthonotal setae, except *J3* and *Z3*, do not reach the bases of the following setae; setae *S3-S5* and *Z5* are the longest setae; body size: 355 long, 250 wide.....*Pr. lutulentus*
- 3 Podonotal central setae, except *j1*, *z6* and *s5*, smooth; submarginal podonotal setae plumose; *S2* plumose, nearly equal in length to pilose setae *Z1* and *J1* and located in front of *Z1*; tips of *J3* reach the bases of the following setae; bases of *J3-J5* on the same incline direction; body size: 360 long, 240 wide.....*Pr. masani*
- 4 Peritrematal setae *r1* smooth..... 1
- 5 All marginal opisthonotal setae (*S1* and *R1-R7*) smooth; podonotal setae *z6* and *s5* pilose 10
- 6 Setae *S2* similar in length and shape to setae *J1* and *Z1*; setae *s2* pubescent; *S2* located behind *Z1*; bases of setae *J3*, *J4* and *J5* in the same horizontal direction; body size: 331 long, 270 wide..... *Pr. tellecheai*
- 7 Setae *S2* smooth and different from *J1* and *Z1*; setae *S2* nearly 1/2 as long as *Z1* 6
- 8 Setae *S2* located at the same level as *Z1*; bases of setae *J3-J5* on the same incline line; setae *s2* smooth; body size: 350 long, 260 wide.....
.....*Pr. fimbriatus*
- 9 Setae *S2* located in front of *Z1*; bases of *J3*, *J4* and *Z4* horizontally, in the same direction; setae *s2* pilose; body size: 353 long, 302 wide.....
..... *Pr. davidi*
- 10 One or more marginal opisthonotal setae are plumose, central podonotal setae *z6* and *s5* pilose or plumose 5
- 11 Only marginal setae *R1* pilose; setae *s2* smooth; fossae indistinct; body size: 326 long, 262 wide.....*Pr. juanensis*
- 12 All marginal opisthonotal setae pubescent; all podonotal setae plumose except *J5*

- 13 Setae *J1-J4* along two parallel lines; *gdJ3* (Po3) paraxial to the line connecting *Z3-Z4*; dorsal fossae indistinct; body size: 328 long, 250 wide..... *Pr. escalai*
- 14 Setae *J1-J4* not parallel lines; *gdZ3* (Po3) antiaxial to the line connecting *Z3-Z4*; dorsal fossae distinct; distance between setae *J4* twice as long as between setae *J3*; body size: 335 long, 260 wide.....
.....*Pr. ornatus*

Key to the species of *Zercon* (adult females) from the Iberian Peninsula, and the Balearic and Canary Islands

- 1 Anterior margin of the ventrianal shield with one pair of ventrianal setae 4
- 2 The axes of the outer opisthonotal fossae are inclined toward the longitudinal axis of the body. Glands Po3 in position *gdJ4*, on the line connecting *J5-Z4*; setae *S5* seated on a sharp triangular tubercle: body size: 450 long, 330 wide.....*Z. klingei* Mihelcic 1960
- 3 The axes of the inner fossae are inclined toward the longitudinal axis of the body. Dorsal setae heterogeneous; setae *S4*, *S5*, *Z4*, *Z5* and *J5* are distally expanded with a flattened, rounded tip; body size: 430 long, 325 wide.....*Z. balearicus* Athias-Henriot, 1961
- 4 Anterior margin of the ventrianal shield with two pairs of ventrianal setae 1
- 5 Opisthonotum with an incomplete complement of setae: setae *S2* and *S3* absent 8
- 6 Setae *J1-J5* short; setae *Z3-Z5*, *S4* and *S5* thickened, apically pilose and with paddle-like hyaline ending and about two and a half times as long as smooth setae *Z2*; Glands Po3 in position *gdJ4*, situated along the line connecting setae *Z4* and *J4*; body size: 403 long, 322 wide.....*Z. hugoi*
- 7 Setae *J1-J4* short, other opisthonotal setae are long and finely serrated distally; outer fossae at least twice as large as the inner fossae; *gdJ4* on the line connecting *J4-Z4*; body size: 410 long, 300 wide.....
.....*Z. aberrans*
- 8 Opisthonotum with a complete complement of setae (setae *S2* and *S3* present)..... 5
- 9 Po3 in position "gdZ": between *Z3* and *Z4* or somewhat antiaxial or medially to the line connecting *Z3 - Z4* 28
- 10 Glands Po3 in position *gdZ3*, medially along the line connecting *Z3* and *Z4* 13

- 11 Longest setae *Z4*, *Z5*, *S3-S5* with expanded and rounded tips; setae *R* longer than *Z1* and serrated; body size: 420 long, 310 wide
..... *Z. cazorlensis* Athias-Henriot, 1961
- 12 Longest setae are not expanded; setae *R* as short as setae *J*; setae *J1* and *J2* longer than *J3-J5*; setae *Z3* are three times longer than *Z2*; body size: 470 long, 330 wide..... *Z. franci*
- 13 Glands *gdZ3* (Po3) antiaxial to the line connecting *Z3* and *Z4*..... 10
- 14 Opisthonotal shield, except for the anterolateral corners, completely covered with small tubercles; setae *Z4*, *Z5* and *S5* with expanded, rounded tips; body size: 500 long, 385 wide *Z. pustulescens*
- 15 Opisthonotal shield is not completely covered with small tubercles.....
..... 14
- 16 Setae *Z3* are one and a half times longer than *Z1*; all marginal opisthonotal setae, *Z3* to *Z5* and *S5* with flattened, oar-shaped hyaline rounded tips; setae *J3-J5* do not extend beyond the bases of the following setae; body size: 532 long, 457 wide..... *Z. subguttulatus*
- 17 Setae *Z3* two or three times longer than *Z1* 16
- 18 Setae *Z4* situated in front of the outer fossae; *S3* reach the margin of the shield; longest opisthonotal setae are plumose below their tapered tips; body size: 455 long, 325 wide *Z. italicus*
- 19 Setae *Z4* situated laterally to the outer fossae
- 20 Setae *Z4* and *J5* located at the same level; the bases of *J1-J5* and *Z1-Z5* are situated along a straight line; body size: 540 long, 330 wide.....
..... *Z. keiseri*
- 21 Setae *Z4* and *J5* are not located at the same level
- 22 At least all marginal opisthonotal setae with flattened, oar-shaped and rounded tips
- 23 All opisthonotal setae, except *J1*, *J2*, *Z1* and *Z2*, flattened, oar-shaped and rounded tip; setae *J3-J5* extend beyond the bases of the following setae; body size: 590 long, 500 wide
..... *Z. guttulatus* Athias-Henriot, 1961
- 24 Marginal setae “R”, *S1*, *Z2*, *S3*, *S5* with a flattened, oar-shaped hyaline rounded tip; longest setae with a hyaline extension; opisthonotal fossae paired; setae *J5* in front of the inner fossae; body size: 447 long, 461 wide..... *Z. parivus*
- 25 Marginal setae “R”, *S1*, *Z2*, *S3*, *S5* pointed, smooth, without a hyaline rounded tip; opisthonotal setae uniformly short; setae *Z4* and *J4* are located at the same level

- 26 *J5* twice as long as *J1* and located close to the inner fossae; *Z5* are the longest setae; body size: 630 long, 515 wide..... *Z. arcuatus*
- 27 *J5* equal in length to *J1*; body size: 620 long, 460 wide.....
..... *Z. montanus* Willmann, 1953
- 28 *Po3* in position *gdJ3*, paraxial to the line connecting *Z3* - *Z4*..... 9
- 29 Setae *Z4* situated in front of the outer fossae; *gdJ3* close to the base of *Z4*; longest setae are smooth below their tapered tips; 455 x 325 μm ; body size: 408 long, 322 wide..... *Z. navarrensis*
- 30 Setae *Z4* situated laterally to the outer fossae
- 31 Dorsal shields ornamentation weakly expressed; *gdJ3* along the line connecting *J5-Z4*; setae *J5* shortest setae of the series *J*; longest setae thin and smooth; setae *S3* do not reach the margin of the shield; body size: 415 long, 290 wide..... *Z. blesti*
- 32 Dorsal shield ornamentation very distinct
- 33 Setae *J1-J5* short, of homogeneous length and/or uniform structure.....
..... 38
- 34 Seta *S3* extend beyond the margin of the shield; *gdJ3* on the line connecting *J4-Z4*; setae *S4*, *Z3* y *Z4* do not reach the bases of the following setae; body size: 520 long, 400 wide *Z. berlesei* Sellnick, 1958
- 35 Seta *S3* do not extend beyond the margin of the shield; *gdJ3* along the line connecting *J5-Z4* or behind the line *J4-Z4*; *Z4* equal in size to *Z5*
- 36 Setae *Z1-Z3* uniform in length and shape and shorter than setae *S2* and *S3*; longest setae reach the bases of the following setae; longest setae without hyaline endings; body size: 420 long, 300 wide.....
..... *Z. guarramicus*
- 37 Setae *Z1-Z2* uniform in length and shape and similar in length to *S2* and *S3*; longest setae with hyaline ending; body size: 576 long, 447 wide..... *Z. tenerifensis* Moraza, 2006
- 38 Setae *J1-J5* of heterogeneous length and/or structure 33
- 39 *J1* are the short setae in series "J"; body rounded; distance between setae *J2* three times *J3-J3* and longer than *J1-J1*; *gdJ3* in front of the line connecting *J5-Z4*; posterior half of opisthotal shield smooth; body size: 440 long, 430 wide..... *Z. latissimus* Sellnick, 1944
- 40 Setae *J1* and *J2* are short, the other setae *J* are longer and thicker.....
..... 45
- 41 Setae *S3* long, their tips reach the bases of *S4*; *gdJ3* on the line connecting *J5-Z4*..... 44
- 42 Setae *S3-S5* and *Z5* with flattered, expanded hyaline tips and serrate before the end; setae *J3-J5* plumose; distance between setae *J5* twice the distance between *J4*; *gdJ3* on the line connecting *J5-Z4*; body size: 450 long, 340 wide *Z. montigenus*

- 43 Setae *S3-S5* and *Z5* without flattened, expanded hyaline tips and smooth; setae *J3-J5* thickened and smooth; distance between setae *J5* twice the distance between *J3*..... *Z. triangularis* C.L. Koch, 1936
- 44 Setae *S3* short, their tips do not reach the bases of *S4*; setae *Z3* plumose; opisthonotal shield covered with small pits; setae *J1, J2, Z1, Z2*, homogeneous in length and shape; *gdJ3* in front of the line connecting *J5-Z4*; body size: 420 long, 320 wide.....*Z. hispanicus* Sellnick, 1958
- 45 Setae *J1-J3* are short, the rest are longer and thicker 51
- 46 Fossae not developed; setae *Z3* smooth; *gdJ3* in front of the line connecting *J4-Z4*; body size: 540 long, 380 wide *Z. paenenudus*
- 47 Fossae well developed
- 48 *gdJ3* on the line connecting *J5-S5* in front of the outer fossae
- 49 Longest setae slightly barbed; body size 330 x 360..... *Z. similis*
- 50 Longest setae thick, pubescent; tips of smooth setae *J3* reach the bases of *J4*; body size: 340 long, 380 wide..... *Z. peltatus*
- 51 *J1-J4* smooth and short; setae *J5* pilose; *gdJ3* on the line connecting *J5-Z4*; setae *Z3-Z5* and *S4-S5* pilose before the hyaline rounded end; opisthonotal shield, except for the anterolateral corners, completely covered with small pits; body size: 480 long*Z. pinicola*

ACKNOWLEDGEMENTS

Special thanks to the late Dr. Donald Johnston, who taught me about Mesostigmata mites. This work was supported by the Departamento de Educación, Universidades e Investigación, the Gobierno Vasco (Spain), the Universidad de Navarra (Spain) and The Ohio State University (USA).

REFERENCES

- ATHIAS-HENRIOT, C., 1961. Mesostigmates (Urop. excl.) edaphiques mediterraneens (Acaromorpha, Anactinotrichida) (Collect. Prof. H. Franz et C. Athias-Henriot). *Acarologia*, 3: 381-509.
- BŁASZAK, C., 1972. Two new species of mites (*Acari, Zerconidae*) from Poland. *Bull. Acad. Pol. Sci. Biol.*, CI II, vol. XX (10): 713-719.
- EVANS, G.O., 1954. Some new and rare species of Acarina. *Proc. Zool. Soc. London*, 123: 793-811.
- HALAŠKOVÁ, V., 1963. On the genus *Prozercon* SELLNICK, 1943. *Acta Societatis entomologicae Čechosloveniae*, 60: 203-208.
- JOHNSTON, D. E. & M.L. MORAZA, 1991. The idiosomal adenotaxy and poroidotaxy of Zerconidae (Mesostigmata: Zerconina). In DUSBÁBEK, F. & V. BUKVA (Eds.): *Modern Acarology*: 2: 349-356. Academia, Prague.
- Boln. Asoc. esp. Ent.*, 30 (3-4): 97-113, 2006

- KOCH, C.L., 1839. Deutschlands Crustaceen, Myriapoden und Arachniden. Fasc. 27. F. Putset, Regensburg.
- LINDQUIST, E. E. & M. L. MORAZA, 1999. Observations on homologies of idiosomal setae in Zerconidae (Acari: Mesostigmata), with modified notation for some posterior body setae. *Acarologia*, 39 (1998): 203-226
- MIHELČIČ, F., 1960. Einige neue *Zercon*-Arten (Acarina) aus Ost- und Südtirol und Kärnten. *Zoologischer Anzeiger*, 165: 22-29.
- MORAZA, M.L., 1989. Descripción de *Zercon navarrensis* sp. n. encontrada en Navarra (Norte de España) (Acari, Mesostigmata: Zerconidae). *Eos*, 65: 57-64.
- MORAZA, M.L., 1990. El género *Prozercon* Sellnick, 1943 en la Península Ibérica y descripción de tres nuevas especies. (Acari, Mesostigmata, Zerconidae). *Miscellanea Zoologica*, 12, 69-77.
- MORAZA, M.L., 1991. *Zercon parivus* n. sp., a new species of Acari (Mesostigmata: Zerconidae). Boletín de la Asociación Española de Entomología, 15, 79-90.
- MORAZA, M.L., 2006. New species of zerconid mites from southern Europe and the Macaronesian region (Acari: Mesostigmata: Zerconidae). *Zootaxa*, 1255: 1-15.
- NAŠÁN, P. & P. FENDA, 2004. Zerconid mites of Slovakia (Acari, Mesostigmata, Zerconidae). Institute of Zoology, Slovak Academy of Sciences, Bratislava. 238 pp.
- SCHWEIZER, J., 1949. Die Landmilben des schweizerischen Nationalparks. I. Teil: Parasitiformes Reuter 1909. Résult. Rech. Sci. Parc. Natl. Suisse N. S. 2 (21): 99pp.
- SELLNICK, M. 1944. *Zercon* C.L. Koch. Acari, Blätter für Milbenkunde, 5: 30-41.
- SKORUPSKI, M & M. LUXTON, 1996. Mites of the Family Zerconidae Canestrini, 1891 (Acari: Parasitiformes) from the British Isles, with description of two new species. *Journal of Natural History*, 30: 1815-1832.
- TRÄGÅRDH, I., 1931. Terrestrial Acarina. *Zool. Farnes* 2(49): 1-69
- WILLMANN, C., 1943. Terrestrische Milben aus Swedisch-Lappland. *Archiv für Hydrobiologie*, 40(1): 208-239.