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Contribution to the knowledge of Homoptera Coccoidea of Sardinia with description of a new species

Abstract - A survey on scale insect fauna has been carried out during May 1995 in natural environments of North-Eastern Sardinia. A total of 46 species of scale insects were collected: 21 were not yet recorded in the island and 4 (*Acanthococcus acutus* (Goux), *Eulecanium ericae* (Balachowsky) comb.n., *Rhizopulvinaria maritima* Canard, *Aonidia mediterranea* (Lindinger)) are new for the Italian fauna. A new species (*Dysmicoccus kozari* sp. n.) is described and illustrated. A list of the 96 species recorded in Sardinia is reported together with a zoogeographical analysis of the scale insects of the island.

Riassunto - *Contributo alla conoscenza delle cocciniglie (Homoptera Coccoidea) della Sardegna con descrizione di una nuova specie.*

Un'indagine sulla fauna di cocciniglie della Sardegna è stata effettuata nel maggio 1995 in ambienti naturali della zona nord-orientale dell'isola. Complessivamente sono state raccolte 46 specie di cocciniglie di cui 21 non ancora segnalate per la Sardegna e 4 (*Acanthococcus acutus* (Goux), *Eulecanium ericae* (Balachowsky) comb.n., *Rhizopulvinaria maritima* Canard, *Aonidia mediterranea* (Lindinger)) nuove per la fauna Italiana. Viene inoltre descritta e illustrata una nuova specie, *Dysmicoccus kozari*. Viene riportata una lista delle 96 specie attualmente note per la Sardegna e un'analisi biogeografica della fauna coccidologica dell'isola.

Key words: Scale insects, Sardinia, Italy, *Dysmicoccus kozari* sp. n.

The scale insect fauna of Sardinia has been studied in the past by Targioni Tozzetti (1869), Leonardi (1907; 1908), Lindinger (1912). In all they listed 20 species of scale insects on the island. Paoli (1916) gave a valuable contribution to the knowledge of scale insects in Sardinia. In his paper the number of known species reached 42. Since the contribution of Paoli, no other papers devoted to the study of scale insects of Sardinia has ever been published, but only occasional papers mainly regarding species of agricultural importance or new records.

Table 1 - List of the species presently known in Sardinia. An asterisk marks the species previously reported in the list of Paoli (1916), in the check list of Italian Homoptera (Barbagallo et al., 1995) and the species collected during this survey.

Paoli 1916	Check list '95	Personal records	Species known in Sardinia	Chorotype
			Margarodidae	
*	*	*	*Gueriniella serratulae* Fernald, 1903	MED
	*	*	*Icerya purchasi* Maskell, 1879	C.I.
			Pseudococcidae	
	*		*Balanococcus orientalis* Danzig & Ivanova, 1967	ASE
		*	*Chorizococcus* sp.	MED
		*	*Chorizococcus rostellum* (Lobdel, 1930)	COS
		*	*Dysmicoccus kozari* sp. n.	MED
		*	*Dysmicoccus pietroi* Marotta, 1992	WME
*	*		*Euripersia inquilina* (Leonardi, 1908)	WME
*	*		*Euripersia sardiniae* (Leonardi, 1908)	WME
	*	*	*Nipaecoccus delassusi* (Balachowsky, 1925)	WME
		*	*Phenacoccus aceris* (Signoret, 1875)	ASE
	*		*Phenacoccus incertus* (Kiritchenko, 1940)	EUR
		*	*Phenacoccus* sp.	MED
*	*		*Planococcus citri* (Risso, 1813)	COS
	*		*Planococcus ficus* (Signoret, 1875)	COS
		*	*Planococcus vovae* (Nassonov, 1908)	PAL
	*		*Pseudococcus affinis* (Maskell, 1894)	C.I.
	*		*Pseudococcus calceolariae* (Maskell, 1878)	C.I.
	*		*Pseudococcus longispinus* (Targioni Tozzetti, 1888)	C.I.
		*	*Puto palinuri* Marotta & Tranfaglia, 1993	WME
*	*	*	*Puto superbus* (Leonardi, 1907)	TEM
		*	*Spinococcus* sp.	MED
	*		*Trabutina leonardii* Silvestri, 1920	MED
*	*		*Trionymus myrmecarius* (Leonardi, 1908)	WME
			Eriococcidae	
	*		*Acanthococcus araucariae* (Maskell, 1879)	C.I.
*	*	*	*Acanthococcus devoniensis* (Green, 1896)	WPA
		*	*Acanthococcus acutus* (Goux, 1938)	WME
*	*		**Micrococcidae**	
*	*		*Micrococcus silvestrii* Leonardi, 1907	MED
*	*		*Micrococcus similis* Leonardi, 1907	MED
		*	*Micrococcus* sp. n.	MED
			Kermesidae	
*	*	*	*Kermes vermilio* Planchon, 1864	MED
			Cerococcidae	
	*		*Pollinia pollini* (Costa, 1857)	MED
			Coccidae	
*	*	*	*Ceroplastes rusci* (Linnaeus, 1758)	AFM
	*		*Ceroplastes sinensis* Del Guercio, 1900	C.I.
	*		*Chloropulvinaria floccifera* (Westwood, 1870)	COS

(table 1 continued)

Paoli 1916	Check list '95	Personal records	Species known in Sardinia	Chorotype
	*		*Coccus hesperidum* Linnaeus, 1758	COS
*			*Eulecanium emerici* (Planchon, 1864)	WME
		*	*Eulecanium ericae* (Balachowsky, 1936)	WME
*	*		*Eulecanium tiliae* (Linnaeus, 1758)	OLA
*	*		*Lecanopsis myrmecophila* (Leonardi, 1908)	WME
		*	*Lichtensia viburni* Signoret, 1873	WPA
	*		*Parthenolecanium persicae* (Fabricius, 1776)	PAL
	*		*Pulvinaria vitis* (Linnaeus, 1758)	PAL
*	*		*Pulvinariella mesembryanthemi* (Vallot, 1830)	C.I.
		*	*Rhizopulvinaria maritima* Canard, 1967	WME
*	*		*Saissetia coffeae* (Walker, 1852)	C.I.
*	*		*Saissetia ficinum* (Paoli, 1915)	WME
*	*	*	*Saissetia oleae* (Olivier, 1791)	COS
*	*		*Sphaerolecanium prunastri* (Fonscolombe, 1834)	TUE
			Lecanodiaspididae	
*	*	*	*Lecanodiaspis sardoa* Targioni Tozzetti, 1869	MED
			Asterolecaniidae	
		*	*Asterodiaspis bella* (Russell, 1941)	TEM
		*	*Asterodiaspis ilicicola* (Targioni Tozzetti, 1888)	MED
*		*	*Planchonia arabidis* Signoret, 1876	OLO
	*		*Planchonia zanthenes* (Russell, 1941)	MED
			Diaspididae	
	*		*Abgrallaspis cyanophylli* (Signoret, 1869)	COS
*	*	*	*Adiscodiaspis ericicola* (Marchal, 1909)	WME
*	*		*Aonidia lauri* (Bouché, 1833)	TUM
		*	*Aonidia mediterranea* (Lindinger, 1910)	MED
	*		*Aonidiella auranti* (Maskell, 1879)	C.I.
*	*	*	*Aspidiotus nerii* Bouché, 1933	COS
*	*		*Aulacaspis rosae* (Bouché, 1833)	PAL
*	*	*	*Carulaspis carueli* (Signoret, 1869)	PAL
	*		*Carulaspis visci* (Schrank, 1781)	EUR
		*	*Chionaspis etrusca* Leonardi, 1908	CAM
		*	*Diaspidiotus bavaricus* (Lindinger, 1912)	EUR
*	*		*Diaspis echinocacti* (Bouché, 1833)	C.I.
	*		*Duplachionaspis berlesei* (Leonardi, 1898)	MED
*	*		*Ephedraspis ephedrarum* (Lindinger, 1912)	TUM
*	*	*	*Epidiaspis leperii* (Signoret, 1869)	TEM
*	*		*Furchadaspis zamiae* (Morgan, 1890)	C.I.
		*	*Gonaspidiotus minimus* (Leonardi, 1896)	MED
		*	*Hemiberlesia lataniae* (Signoret, 1869)	COS
*	*	*	*Hemiberlesia rapax* (Comstock, 1881)	COS
*	*		*Lepidosaphes beckii* (Newmann, 1869)	C.I.
	*		*Lepidosaphes conchiformis* (Gmelin, 1789)	PAL
		*	*Lepidosaphes flava* (Signoret, 1870)	TUM
	*		*Lepidosaphes gloverii* (Packard, 1895)	C.I.

(table 1 continued)

Paoli 1916	Check list '95	Personal records	Species known in Sardinia	Chorotype
	*	*	*Lepidosaphes ulmi* (Linnaeus, 1758)	PAL
*	*	*	*Leucaspis pusilla* Loew, 1883	TEM
	*		*Leucaspis signoreti* Targioni Tozzetti, 1868	MED
	*	*	*Lineaspis striata* (Newstead, 1897)	TUM
	*	*	*Parlatoria oleae* (Colvée, 1880)	TUM
*	*		*Parlatoria pergandii* Comstock, 1881	COS
*	*		*Parlatoria proteus* (Curtis, 1843)	C.I.
*	*		*Parlatoria ziziphi* (Lucas, 1853)	C.I.
*	*		*Pseudaulacaspis pentagona* (Targioni Tozzetti, 1886)	C.I.
*	*	*	*Quadraspidiotus cecconii* (Leonardi, 1908)	TUM
		*	*Quadraspidiotus labiatarum* (Marchal, 1909)	EUM
		*	*Quadraspidiotus lenticularis* (Lindinger, 1912)	EUM
*	*		*Quadraspidiotus ostreaeformis* (Curtis, 1843)	PAL
	*		*Quadraspidiotus perniciosus* (Comstock, 1881)	C.I.
		*	*Saharaspis ceardi* (Balachowsky, 1928)	WME
		*	*Targionia nigra* Signoret, 1870	TUM
*	*	*	*Targionia vitis* (Signoret, 1876)	TEM
*	*		*Unaspis euonymi* (Comstock, 1881)	C.I.

Legenda (from Vigna Taglianti et al., 1992)

AFM = Afrotropical-Mediterranean
ASE = Asiatic-European
CAM = Centralasiatic-Mediterranean
C.I. = Cultural Immigrant
COS = Cosmopolitan
EUM = European-Mediterranean
EUR = European
MED = Mediterranean
OLA = Oloarctic
PAL = Palearctic
TEM = Turanic-European-Mediterranean
TUE = Turanic-European
TUM = Turanic-Mediterranean
WME = West-Mediterranean
WPA = West-Palearctic

In the current Check list of Italian Homoptera Coccoidea (Barbagallo et al.,1995) only 70 species of scale insects are recorded for Sardinia. This number appears very low if compared to the 343 species known in the Italian peninsula and Sicily. Furthermore Kozár & Walter (1985) list 430 species for the Mediterranean region. These data highlight the fact that the Sardinian scale insects fauna is still largely unknown and that further investigations have to be carried out in order to have a satisfactory knowledge on this topic.

This paper intends to improve the information on the occurrence and distribution of scale insects on this interesting Mediterranean island.

The research was carried out in north eastern Sardinia from 21st to 25th May 1995, mainly in the plane of Siniscola and in natural environments on Monte Albo, up to 800 m asl and along the coast from S. Teodoro to Palau. A total of 46 species of scale insects were collected, of which 21 had not been recorded for Sar-

dinia, 4 are new for the Italian fauna, 5 appear to be new species. Of these one is described in this paper and the other four have been classified at generic level only. They are: *Chorizococcus* sp., collected on roots of *Lotus creticus*, *Phenacoccus* sp., collected under the leaf sheats of *Avena fatua*, *Spinococcus* sp., collected on roots of *Umbilicus rupestris*, *Micrococcus* sp., collected on the roots of *Ammophila arenaria*. We will briefly refer about the latter species, the others will constitute the subject of a further paper.

The species new for Sardinia and a few others of particular interest are discussed in this paper. Data on their distribution in the countries surrounding the Mediterranean basin and in Italy, when not otherwise mentioned, are reported from Borchsenius (1966), Kosztarab & Kozár (1988), Danzig (1993), Ben-Dov (1993, 1994), Barbagallo et al. (1995).

In this paper, on the basis of the known distribution data, we tentatively assign each species recorded in Sardinia to a chorotype, adopting the revised classification of chorotypes recently proposed by Vigna Taglianti et al. (1992). We are aware that our knowledge on the distribution of several species is rather poor. In these cases the assignment of a species to a chorotype may be questionable and could change when more data will be available. The introduced, acclimatized species of cultivated plants are regarded as «Cultural Immigrants» (Bodenheimer, 1934). The species whose origin is unclear and whose actual distribution is considered cosmopolitan are listed in such a way.

Fam. PSEUDOCOCCIDAE

Dysmicoccus kozari sp. n.

Body elongate, oval, covered with white powdery wax. Mounted female (Fig. 1) oval, reaching a length of 2,976-4,104 mm (average 3,636) and the width of 1,2-1,764 (1,533); ratio of body length to width 2,28-2,48 (2,38). Antennae each 0,552-0,696 mm long (average 0,633), normally with 9 segments (one specimen has an antenna with 7 segments and the other with 9 segments). Legs well developed; hind trochanter femur 0,384-0,42 mm (0,405) long; hind tibia-tarsus 0,48-0,528 mm (0,501) long; tibia 0,36-0,408 (0,391); tarsus 0,132-0,144 (0,141); ratio tibia-tarsus 2,18-3,09 (2,7). Ratio of lengths of hind tibia-tarsus to hind trochanter-femur 1,2-1,26 (1,237). Legs without translucent pores. Spiracles normal, small. Dorsal ostioles well developed, wide. Circulus absent. Anal ring with 6 setae. Anal lobes moderately developed, each with an apical seta 0,21-0,217 mm (0,21) long.

Dorsal surface: cerarii numbering 16 pairs. Anal lobe cerarii each on a large, sclerotized plate, with 2 strong spines , 7-9 auxiliary setae and 60-70 trilocular pores. The others on weakly sclerotized plates, with 2 spines, smaller than those on

the anal lobes cerarii, 3-4 auxiliary setae and 15-30 trilocular pores, whose number decreases from pre-anal cerarii towards the head. Trilocular pores numerous, evenly distributed. Multilocular pores rare, present only on the last abdominal segments. Oral collar tubular ducts of 2 sizes, with collar height 1/6 of the total height. Body setae slender, of various sizes, evenly distributed.

Ventral surface: trilocular pores evenly distributed. Multilocular pores numerous on the last four abdominal segments, rare multilocular pores scattered on the ventral surface of the other abdominal segments and thorax up to the anterior spiracle. Oral collar tubular ducts forming bands reaching the body margin in the last abdominal segments, scattered on the other part of venter. Dorsal setae numerous, slender, of different sizes, evenly distributed.

COMMENTS. *D. kozari* differs from the other species of *Dysmicoccus* in possessing antennae with 9 segments. It is close to *D. multivorus* (Kiritchenko) and *D. walkeri* (Newstead), but differs from *D. multivorus* in having a higher number of cerarii and ventral multilocular pores; besides *D. multivorus* usually lives on the roots (Ben-Dov, 1994), while *D. kozari* has been collected on the leaves and stems of the host plants. It differs from *D. walkeri* in lacking circulus. The main differences between *D. kozari* sp. n. and the other European *Dysmicoccus* (*D. pietroi* Marotta, *D. multivorus* (Kiritchenko), *D. patulae* (Rau), *D. walkeri* (Newstead), *D. balticus* Koteja & Lagowska) are reported in Table 2.

Table 2 - Comparison of morphological characters among the European species of Dysmicoccus.

	kozari	*pietroi*	*multivorus*	*patulae*	*walkeri*	*balticus*
Antennomeres	9	8	8	8	8	8
Cerarii	16	14	3-10	16	15-17	3-4
Circulus	absent	absent	absent	present	present	present
Vent. mult. p.	abundant	present	numerous	abundant	abundant	abundant
Dors. mult. p.	present	absent	present	absent	present	absent
Vent. pent. p.	absent	absent	absent	present	absent	absent
Dors. pent. p.	absent	absent	absent	absent	absent	absent

HABITAT AND HOST PLANTS. The specimens were collected on leaves of *Convolvolus* and undetermined gramineae at S. Teodoro, Sardinia, near the sea.

HOLOTYPE. 1 adult female, Sardinia, S. Teodoro, 22.05.1995, leg. G. Pellizzari, P. Fontana, on *Convolvolus* sp., slide n. 680/2 (Istituto Entomologia Agraria, Università di Padova, Italy). Paratypes: 1 adult female, same data as holotype, slide n. 680/3; 1 adult female, same data as holotype, on Gramineae, slide n. 680/1 (Istituto Entomologia Agraria, Università di Padova, Italy); 1 adult female, same data as holotype, on Gramineae, slide n. 676 (Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary).

DERIVATIO NOMINIS. The species is named in honour of F. Kozár, coccidologist at the Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary.

Dysmicoccus pietroi Marotta

This species has been collected in Sardinia at Siniscola on *Echium lycopsis* and on an undetermined grass. *D. pietroi* was known in Italy for the Campania region, where it was collected on *Cirsium arvense* and Graminaceae (Marotta, 1992) and the Island of Pantelleria (Sicily) on *Cistus salvifolius* (Russo, 1995).

Phenacoccus aceris (Signoret)

P. aceris has been found on twigs and aments of *Quercus ilex* on Monte Albo. In addition, several young and ovipositing females have also been collected on *Arbutus unedo*, growing on the border of a holly oak wood. In Italy it was previously known throughout the peninsula and Sicily. *P. aceris* is widely distributed throughout the Palearctic region on bushes and trees.

Planococcus vovae (Nassonov)

It has been collected on Monte Albo on plants of *Juniperus oxycedrus* ssp. *macrocarpa*. In Italy it has been recorded to date in the Tuscany, Apulia and Campania regions (Francardi & Covassi, 1992). *P. vovae* is linked to Cupressaceae and is widespread throughout the Palearctic region. In the countries of the Mediterranean basin it is recorded in Morocco, France, Corsica, Israel and Turkey.

Puto palinuri Marotta & Tranfaglia

Several adult females and one winged male of this species have been collected on Monte Albo at a height between 400 and 800m asl, on plants of *Cistus incana, C. monspeliensis, Calicotome villosa* and *Asperula* sp. This scale was recorded in 1993 in the Campania region (Italy) on *Limonium remotispiculatum, Anthriscum* sp. and *Anthyllis* sp., growing on rocks near the sea (Marotta & Tranfaglia, 1993), and recently on the island of Lampedusa (Sicily) on *Chrysanthemum coronarium* and *Lolium* sp. (Russo, 1995).

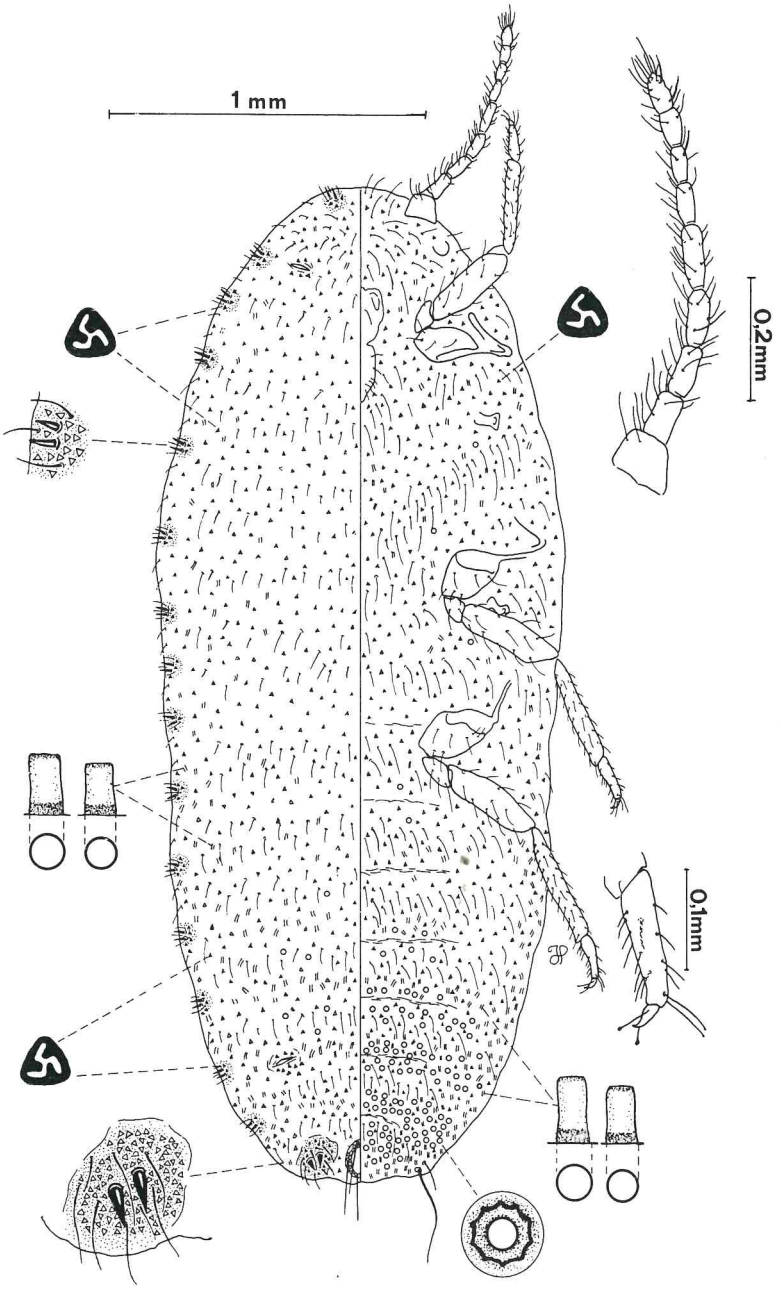

Fig. 1 - *Dysmicoccus kozari* sp. n. adult female.

Puto superbus (Leonardi)

Puto superbus was described by Leonardi, who collected specimens of this species in Sardinia, and is known in several countries of the Palearctic region (Tunisia, Morocco, France, Italy, Sicily, Sardinia, Germany, Hungary, ex Jugoslavia, Bulgaria, Greece, Cyprus, Ukraine, Armenia, Iran) (Marotta and Tranfaglia, 1993). We collected several specimens of this species (females and males) on Graminaceae, *Asphodelus* and *Carduus* from different places in Sardinia (Monte Albo, S. Teodoro, Arzachena). Our specimens differ from the recent redescription of *P. superbus* by Marotta and Tranfaglia (1993) only in the number of ventral multilocular pores posterior to the circulus. In fact, according to the description of the above-mentioned authors, *P. superbus* should have 250-300 multiloculars posterior to the circulus. The specimens we collected at S. Teodoro (16 females) have 32-70 pores; the two specimens from Arzachena have 106 and 110 pores respectively and the specimen collected from Monte Albo has 130 pores.

It has already been demonstrated that environmental conditions play an important role in intraspecific variability (e.g. Cox, 1983; Cox and Ben-Dov, 1986) and we agree with the recent paper of Marotta and Tranfaglia (1995) in that the identification of related species, based on numerical morphological characters only, may not be reliable. In the case of *P. superbus* we believe that the different number of ventral multilocular pores exhibited by our specimens, in comparison with others from different localities, could depend on morphological variations in populations living in different habitats. It would be interesting to study the variability in the *P. superbus* group with the support of electrophoretic tecniques.

Fam. ERIOCOCCIDAE

Acanthococcus acutus (Goux)

An *Acanthococcus* species was collected at Siniscola on dry grass growing under bushes of *Euphorbia arborea*. It was characterized by numerous dorsal spines forming dense bands across the segments.

On the basis of the most recent works on Eriococcidae (Williams, 1985; Tranfaglia and Esposito, 1985; Kosztarab and Kozár, 1988) it was not possible to ascribe our specimen to anyone of the reported species. We therefore started to check the descriptions of Mediterranean Eriococcids by Balachowsky and Goux. We found that two descriptions could fit our specimen, namely *Eriococcus henryi* Balachowsky, collected on *Euphorbia spinosa* in Southern France, and *Eriococcus acutus* Goux, collected in Southern France on *Piptatherum multiflorum* and *Dactylis hispanica*. A comparison with a paralectotype of *E. henryi* received on loan from

the Museum Nationale d'Histoire naturelle, Paris (slide n. 4957-4) showed several differences with our specimen, expecially in the number and distribution of dorsal spines, so it was excluded. Subsequently, description and drawings of *E. acutus* were carefully checked and compared with our specimen. After this we concluded that, according to the original description, our species could be ascribed to *Acanthococcus acutus*. Because it was not possible to have type material on loan for comparison, we present a drawing and a short description of the species collected in Sardinia. Numeric data and measurements are reported in table 4 and compared with those reported by Goux (1938). Unfortunately, in his paper, Goux does not give a minimum and maximum of his measurements, taken from numerous specimens, but reports only an average, sometimes accompanied by the word «about».

Description: body of the adult female elongate, oval; antenne 7-segmented (fig. 2). Legs well developed, hind coxa with translucent pores; claw slender, without denticle. Anal ring with 8 setae.

Dorsal surface with numerous stout spines evenly distributed on head and forming eleven well defined, dense bands across the segments. The spines are of three different sizes (see table 3), but the largest ones are the most numerous. Tubular ducts of two sizes, evenly distributed, the larger more numerous than the narrow.

Ventral surface with slender setae of various sizes. Tubular ducts of two sizes.

Table 3 - Comparison of data of Acanthococcus acutus *(Goux) and of the specimen from Sardinia (measuraments in μm).*

	A. acutus (Goux) (data from the original description)	Specimen from Sardinia ascribed to *A. acutus*
Length	2050	2000
Width	900	1206
Antennae	~250	307
Hind trochanter + femur		225
Hind femur		172
Hind tibia + tarsus	275	316
Hind tibia		172
Hind tarsus		163
Hind claw length		36
Total length of hind leg	~600	694
Nº of dorsal spines	530	570
Length of large spines	~60	48 - 57,6
Basal diameter of large spines	17 - 20	14 - 19
Length of median spines		28
Basal diameter of median spines		12
Length of small spines		20
Basal diameter of small spines		8,4
Apical seta of anal lobes		271

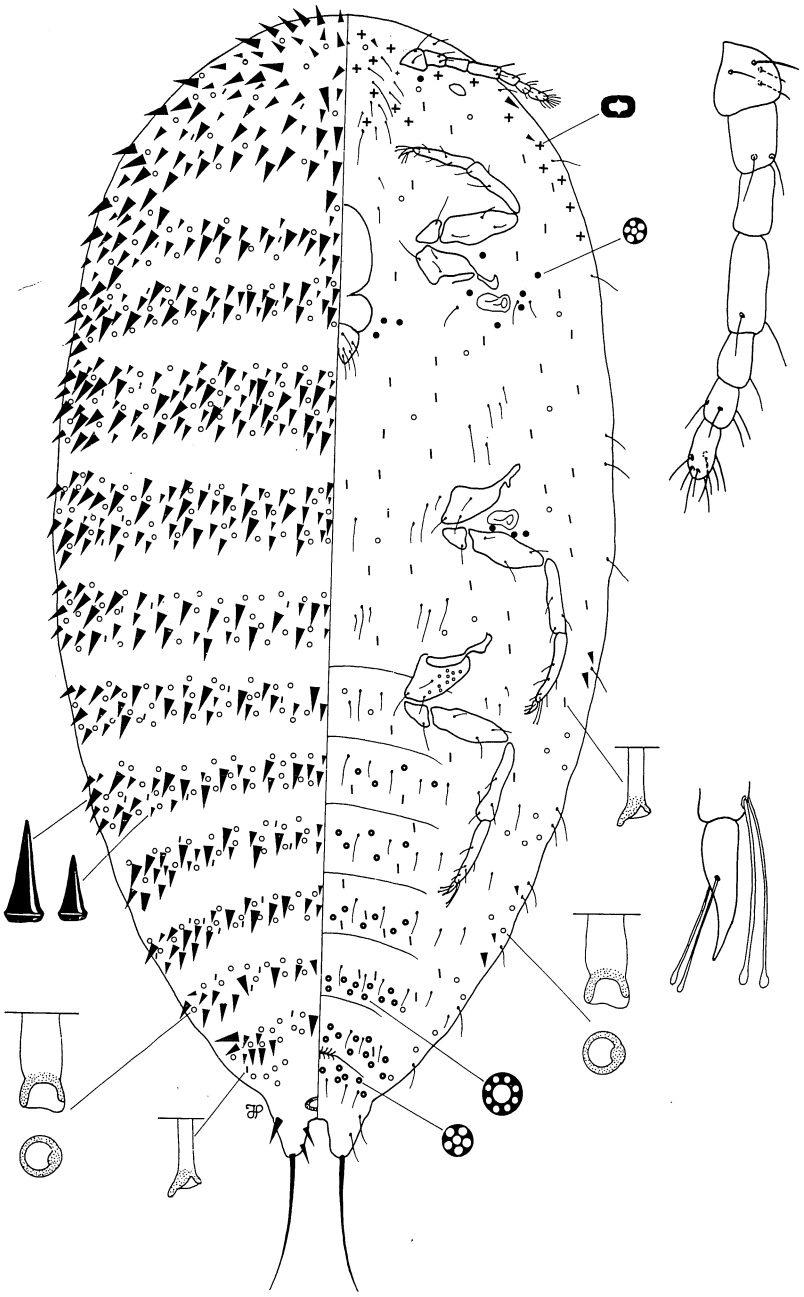

Fig. 2 - *Acanthococcus acutus* (Goux) adult female.

The larger type, the same as the dorsal ones, mainly distributed around the margin of the last segments; the narrow type evenly distributed. Disc pores with 5-8 loculi, numerous on the last segments, sparse on anterior abdominal segments and thorax. Some quinquelocular pores near labium and spiracular openings. Few cruciform pores on head.

Fam. MICROCOCCIDAE

Micrococcus sp.

Seven adult females and a few crawlers of a *Micrococcus* sp. were collected on the roots of *Ammophila arenaria* on the beach of Capo Ceraso. Two species of *Micrococcus*, namely *M. silvestrii* Leonardi and *M. similis* Leonardi had previously been reported in Sardinia. On the basis of the recent revisional paper of the Family Micrococcidae by Miller and Williams (1995) and the redescription of the type species of *Micrococcus silvestrii* by Marotta et al. (1995) we were unable to ascribe our specimens to any of the six described species. Whereas the crawlers are close to the crawler of *Micrococcus bodenheimeri* Bytinski-Salz, the adult females do not fit any known species of the genus.

The known geographical distribution of the genus *Micrococcus* so far covers only some countries of the Mediterranean basin (Morocco, Algeria, Tunisia, Southern Italy, Sicily and Sardinia, Israel). In the conclusion of their revisional paper, Miller and Williams report that probably only a small portion of the total *Micrococcidae* fauna is known and hypothesize that «many of the larger Mediterranean islands will have endemic species» and that «many Mediterranean countries ...will have micrococcid components in their scale fauna». The *Micrococcus* we collected in Sardinia is likely a new species.

Fam. COCCIDAE

Eulecanium ericae (Balachowsky) comb. n.

Ctenochiton ericae Balachowsky, 1936: 122. *Rhizopulvinaria ericae* (Balachowsky); Borchsenius, 1957: 271; Ben-Dov, 1993: 292.

Two specimens of *E. ericae* (adult postreproductive females) were collected in Sardinia on *Erica arborea* on Monte Albo (fig. 3). They are conspecific with a syntype of *Ctenochiton ericae* Balachowsky we received on loan from the Museum Nationale d'Histoire Naturelle, Paris (slide n. 4908/1). The type-species of *Cteno-*

chiton ericae was collected on *Erica arborea* on the Massif d'Esterel (France) by Balachowsky in 1936. No other records of this apparently rare species have ever been recorded. In 1957 Borchsenius, on the basis of the description and drawing of Balachowsky, transferred this species from the genus *Ctenochiton* to the genus *Rhizopulvinaria*. To justify this transfer he took into consideration the shape of the marginal spines, spiracular spines and digitules. Canard (1968) inserted *R. ericae* in his key of Mediterranean *Rhizopulvinaria* species, but was doubtful about its real pertinence to the genus *Rhizopulvinaria* and, in his opinion, its status had to be regarded as «fragile et provisoire».

On the basis of the study of the syntype and of our specimen we believe that

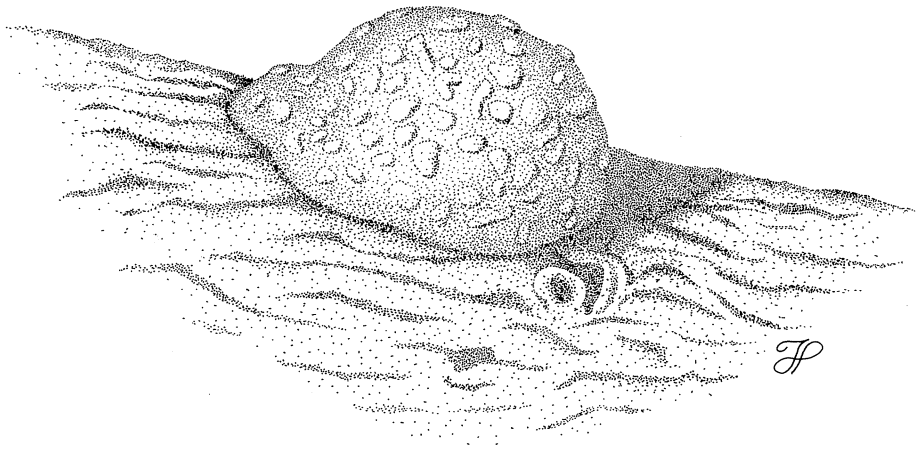

Fig. 3 - *Eulecaniun ericae* (Balachowsky) post-reproductive female.

this species cannot be retained in the genus *Rhizopulvinaria* for the following reasons: 1) absence of tibio-tarsal sclerosis, that is typical of all the species of Pulvinariinae 2) the postreproductive females present convex body and sclerotized integument 3) the adult female does not produce a waxy eggsac as all the Pulvinariinae do 4) eggs are retained under the mother's body that becames concave: it was possible to recognize several chorions of eggs under the body cavity of the specimens we collected.

The genus that best fits this species is, in our opinion, the genus Eulecanium. In fact, according to key of the Coccidae recently proposed by Hodgson, this species clearly belongs to the subfamily Eulecaniinae and not to the Pulvinariinae. We also checked the major morphological characters of the genus *Eulecanium* as reported by Hodgson and our species fits most of them. Besides, in the genus

Eulecanium there is another species living on Ericaceae, namely *E. franconicum* Lindinger, whereas in the genus *Rhizopulvinaria* there is not. On the other hand some authors (Danzig, 1980; Kosztarab and Kozár, 1988) consider the presence of a spiracular peritreme as large as the coxa or the lenght of femur as being a morphological character typical of the genus *Eulecanium*. This character is lacking in the specimens we studied.

For the above mentioned reasons the species *Rhizopulvinaria ericae* is transferred to the genus *Eulecanium*.

Lichtensia viburni Signoret

It has been collected on *Pistacia lentiscus* on Monte Albo. This species is widespread in the Palearctic region and is very common in the Mediterranean countries (Algeria, Morocco, Spain, France, Italy, Sicily, ex Jugoslavia, Greece, Israel, Malta) mainly on the following host plants: *Pistacia lentiscus, Ilex aquifolium, Hedera helix, Viburnum tinus, Arbutus unedo, Myrtus communis, Olea europaea, Phillyrea media, Spirea salicifolia.*

Rhizopulvinaria maritima Canard

An adult female of this species has been collected on a twig of *Helichrysum italicum* on Monte Albo. *R. maritima* was known so far in southest France (Canard, 1967) and Portugal only (Kozár and Franco, 1995). In both cases it was collected on *Helichrysum* plants. *R. maritima* is morphologically similar to *R. artemisiae* Signoret, but differs in the number of quinquelocular pores (20 in *R. maritima*, 50 in *R. artemisiae*), in the length of legs (shorter in *R. artemisiae*), and in possessing stout spines on the anal plates. Furthermore the biology also appears different in the two species. Canard (1967) reports that the nymphs of *R. maritima* settle on the twigs of the host plant, while the other *Rhizopulvinaria* species usually settle on the roots or on the root-crown of their host plant. This species is new for the Italian fauna.

Fam. ASTEROLECANIIDAE

Asterodiaspis bella (Russell)

It has been recorded on *Quercus ilex* on Monte Albo and on *Q. suber* in S. Teodoro. The known distribution of *A. bella* covers Morocco, Southern Italy and Sicily, Hungary, Bulgaria, Greece, Israel and Iraq.

Asterodiaspis ilicicola (Targioni Tozzetti)

It has been collected on *Quercus ilex* on Monte Albo. *A. ilicicola* lives on evergreen oaks and is widespread in the countries surrounding the Mediterranean basin (Algeria, Spain, France, Corsica), Central and Southern Italy (Russell, 1941), and Turkey (Russo, personal communication).

Planchonia arabidis Signoret

This widespread species, especially common on *Hedera helix*, has been collected on *Echium lycopsis* in the plane of Siniscola.

Fam. DIASPIDIDAE

Aonidia mediterranea (Lindinger)

Several specimens (adult females and 2nd instars) ascribed to *A. mediterranea* have been collected on *Juniperus communis* on Monte Albo. They agree with the description and illustration of *A. mediterranea* as given by Ferris (1937) in his paper devoted to the redescription of the type genus of the Diaspididae. They differ from the drawings of the same species as given by Koronéos (1934), Balachowsky (1954) and Danzig (1993) in the length of the macroducts and the shape of the antennae. *A. mediterranea* has been recorded in Algeria, Spain, Greece, Armenia and Azerbajan. This species is new for the Italian fauna.

Chionaspis etrusca Leonardi

C. etrusca has been collected on *Tamarix gallica* in S. Teodoro. In Italy it has been recorded to date in Romagna (Zocchi, 1971) and Tuscany only. This species lives on plants of the genus *Tamarix* and is widespread in the western Mediterranean countries (France, Spain, Algeria, Morocco, Tunisia and some oases of Central Sahara). In the Eastern Mediterranean basin it is recorded in Greece, Turkey, Israel. On the basis of the recent synonyms of this species (Danzig, 1993) it is also present in Saudi Arabia, Iran, Iraq, Middle Asia and apparently its distribution area covers the distribution area of the genus *Tamarix* (Arendt, 1926), with the exception of the Ethiopic Region where the scale has not yet been recorded.

Diaspidiotus bavaricus (Lindinger)

D. bavaricus has been collected in Sardinia on *Erica arborea* on Monte Albo and in Palau. It is a common species recorded on Ericaceae throughout Europe and the Italian peninsula.

Gonaspidiotus minimus (Leonardi)

A few specimens of this species have been collected on leaves of *Q. ilex* on Monte Albo. *G. minimus* is linked to evergreen oaks (*Quercus ilex, Q. suber, Q. coccifera*) and is recorded in many Mediterranean countries (Algeria, Morocco, Spain, France, Corsica, peninsular Italy and Sicily, Malta, ex Jugoslavia, Greece, Turkey).

Hemiberlesia lataniae (Signoret)

In Sardinia it has been collected on *Calicotome villosa* at Capo Ceraso. This polyphagous species is widely distributed in tropical and subtropical regions. In the countries of the Mediterranean basin it has been recorded on cultivated and wild plants in Tunisia, Algeria, Morocco, Portugal, Spain, Malta, Greece, Cyprus, Israel, Egypt. It is a common species in the European greenhouses. In Italy it has been recorded outdoors only in Sicily (Inserra and Calabretta, 1985; Pellizzari Scaltriti, 1986).

Lepidosaphes flava (Signoret)

L. flava has been collected on *Phillyrea angustifolia, Olea europaea* var. *sativa, O. europaea* var. *sylvestris* on Monte Albo and in Palau. It is common on *Olea* and *Phillyrea* in all the Mediterranean countries (Tunisia, Algeria, Spain, France, Corsica, Italy, Sicily, ex Jugoslavia, Greece, Cyprus, Israel (Balachowsky, 1954; Borchsenius, 1966; Biche and Bourahla, 1993). It has also been recorded in Crimea, Azerbajan, Turkmenistan (Danzig, 1993). This species is well known in the Mediterranean countries as *L. destefanii* Leonardi (Lupo, 1939; Pegazzano, 1951; Balachowsky, 1954; Pellizzari and Camporese, 1990; Barbagallo et al., 1995). We have checked the original description of *L. flava* by Signoret (1870) and consequently we agree with the conclusion of Danzig (1993) and accept the synonymy of *L. destefanii* Leonardi with *L. flava* (Signoret).

Lineaspis striata Newstead

The occurrence of this species in Sardinia was mentioned in a non-scientific paper by Goidanich in 1969. Later, its presence on the island was confirmed by one of the authors (Pellizzari) who collected several specimen of *L. striata* near Oliena on *Cupressus* in 1974. *L. striata* proved to be a common species on Monte Albo on *Juniperus phoenicia.* This Turanic-Mediterranean species is recorded in Algeria, Morocco, Spain, France, Greece, Cyprus, Turkey, Israel, Egypt, Georgia and Armenia (C.I.S.).

Quadraspidiotus labiatarum (Marchal)

Specimens of *Q. labiatarum* have been collected on *Stachys glutinosa* on Monte Albo. This species is known in many countries surrounding the Mediterranean basin (Algeria, Morocco, Spain, France, Corsica, Italy, ex Jugoslavia, Greece) and has been recorded in the xerothermic oasis in Central Europe too.

Quadraspidiotus lenticularis (Lindinger)

Previously recorded throughout Italy and Sicily, it has been collected in Sardinia on *Olea europaea* var. *sativa* on Monte Albo. This polyphagous species is largely distributed in the Palearctic region and most of the Mediterranean countries.

Saharaspis ceardi (Balachowsky)

For several decades *S. ceardi* was known only in Morocco and Algeria (Balachowsky, 1951) where it has been recorded in different localities on many species of cultivated plants (*Ceratonia siliqua, Ficus carica, Morus alba, Olea europaea, Vitis vinifera, Ziziphus lotus*). In 1986 it was collected in Sicily on *Ceratonia siliqua, Ficus carica, Pistacia vera, P. lentiscus* (Inserra and Calabretta, 1986). *S. ceardi* proved to be a common species in Sardinia. Several specimens have been collected in three different localities (S. Teodoro, Capo Ceraso, Palau) on *Pistacia lentiscus.* These new records suggest that this species could occur in other western Mediterranean countries.

Targionia nigra Signoret

T. nigra has proved to be very common in Sardinia on *Helichrysum italicum* on Monte Albo. Widely distributed in the Mediterranean countries (Algeria, Tu-

nisia, Morocco, Spain, Canary Islands, France, Corsica, Italy, Sicily, ex Jugoslavia, Lebanon, Israel, Egypt) and also recorded in Iran and Turkmenistan, this species has mainly been collected on Compositae such as *Helichrysum, Santolina, Senecio*.

CONCLUSIONS

With this contribution, the number of scale insects known in Sardinia reaches 95 species. Among the collected species, several are widely distributed throughout the Mediterranean Region and their presence in Sardinia was predictible. These are *Asterodiaspis bella, A. ilicicola* and *Gonaspidiotus minimus*, living on evergreen oaks, *Lepidosaphes flava* on *Olea* and *Phyllirea, Quadraspidiotus labiatarum, Q. lenticularis, Planchonia arabidis*, polyphagous and widespread in the Palearctic region, but not yet recorded in Sardinia.

The occurrence in Sardinia of species such as *Rhizopulvinaria maritima, Eulecanium ericae, Aonidia mediterranea* and *Saharaspis ceardi* assumes a major biogeographical interest. *R. maritima* and *E. ericae* are clearly rare species. The first was known till now only in France and Portugal, the second only in the type locality in southern France. The new records of these species should indicate a western Mediterranean distribution. A new status for *R. ericae* (now *Eulecanium ericae*) is introduced herein. *Aonidia mediterranea* is new for the Italian fauna. The recording of *S. ceardi* in Sardinia also appears interesting, it being known so far only in North Africa and Sicily. On the basis of the distribution data, it appears to be a West-Mediterranean species, common on *Pistacia lentiscus*.

In this paper we attempt a zoogeographical analysis of the Sardinian scale insects, even if we are aware that the number of recorded species is very low with respect to the expected real number of scale insect fauna. Furthermore, among the 96 known species listed, 18 are Cultural Immigrants and 11 are considered Cosmopolitan: these species were excluded from the analysis and subsequently the number of known autochthonous species is reduced to 67. As was predictible, the most numerous elements are the Mediterranean (18 species), followed by the West-Mediterranean elements (14 species). Together they constitute the 48% of the total fauna. The Turanic-Mediterranean elements also appears well represented (7 species), while the Turanic-European-Mediterranean comprehend 5 species and the European 3 species. Other chorotypes are rapresented by 1 or 2 species only (see table 4).

Despite the encouraging results obtained in a short time, our knowledge of Sardinian scale insects still remains unsatisfactory. On the other hand, the finding of species wich are probably new for science indicates that the Sardinian scale insects fauna is rich and deserves more thorough investigation.

Table 4 - Zoogeographical spectrum of scale insects in Sardinia.

Elements	N. of species	%
Mediterranean	18	26.86
West-Mediterranean	14	20.89
Palearctic	9	13.43
Turanic-Mediterranean	7	10.44
Turanic-European-Mediterranean	5	7.46
European	3	4.47
European-Mediterranean	2	2.98
Asiatic-European	2	2.98
West-Palearctic	2	2.98
Oloarctic	2	2.98
Turanic-European	1	1.49
Afrotropical-Mediterranean	1	1.49
Centralasiatic-Mediterranean	1	1.49

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