

HELMINTHOFAUNISTIC ANALYSIS OF *CROCIDURA RUSSULA* (HERMANN, 1780) (INSECTIVORA: SORICIDAE) FROM THE ALBUFERA NATURAL PARK (VALENCIA, SPAIN)

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ABSTRACT: The helminthological analysis of 322 specimens of *Crocidura russula* (Hermann, 1780) (Insectivora: Soricidae) from the Albufera Natural Park (Valencia, Spain), allowed us to find 16 parasitic species: 1 Trematode, 4 Cestodes and 11 Nematodes. *Gongylonema* sp. aff. *soriceum* Fain, 1955 is found for the first time in the Iberian Peninsula. *Stammerinema rhopalocephala* (Soltys, 1952) (larvae) is new for the Spanish helminthfauna and *Pseudophysaloptera* sp. is found for the first time in an insectivore in western Europe. The qualitative and quantitative data obtained are analyzed and compared with other similar ecosystems from the Iberian Peninsula. Bioecological and zoogeographic considerations are presented. In view of the results obtained, the Albufera Natural Park can be regarded as a peculiar ecosystem within the geography of the Iberian Peninsula.

KEY WORDS: Helminths, *Crocidura russula*, Insectivora, Albufera Natural Park, Valencia, Spain.

INTRODUCTION

In the year 1975, Mas-Coma and coworkers initiated a series of studies with the purpose of investigating the helminth parasites of small mammals in Spain. To date, the Insectivora and Rodentia Orders have been the most thoroughly analyzed. However, within the context of these numerous studies, emphasis is placed (see MAS-COMA, 1978a, b, 1992) on those that have addressed peculiar ecosystems such as the Spanish Mediterranean islands (i.e., MAS-COMA & FELIU, 1977, 1984; MAS-COMA, 1979; ESTEBAN, 1983; MAS-COMA, FELIU & BEAUCOURNU, 1984; MAS-COMA & ESTEBAN, 1988; MAS-COMA *et al.*, 1993) or certain Natural Parks on the Iberian Peninsula, such as the Ebro Delta (GALLEGO, FELIU & TORRES, 1984; FELIU *et al.*, 1985, 1987, 1990; GALAN-PUCHADES, 1986; GRACENEA *et al.*, 1987; TORRES, 1988; TORRES & FELIU, 1990) and the Llobregat Delta (GRACENEA & MONTOLIU, 1992; GRACENEA, MONTOLIU & DEBLOCK, 1993; GONZALEZ-MORENO *et al.*, 1994). It is with these peculiar ecosystems with which the present study of the Albufera Natural Park (Valencia, Spain) may be compared. This Park, located a mere 10 km south of the coastal city of Valencia, is one of the few wet areas in Europe and constitutes a way station for many species of migratory birds. The Park covers an area of 21000 ha and comprises three clearly differentiated ecosystems: a) the so-called «Dehesa», with a surface of 850 ha, a littoral sandbar separating the lake from the Mediterranean sea; b) the Albufera Lake, a freshwater lagoon with an area of 2837 ha; c) the Marsh surrounding the lake and characterized by rice fields with a surface of 12000 ha.

The peculiar geomorphological, edaphic, hydrological, climatic, botanical and fundamentally faunistic characteristics, along with the rich malacological, entomolo-

gical, herpetological, pisciological, and mammalian variety present made it possible to declare the zone a Natural Park in 1986.

Within this peculiar geographical context, and in accordance with FAUS (1990), a total of 7 species of small mammals are habitually to be found: *Crocidura russula* (Hermann, 1780) (Insectivora: Soricidae), *Rattus rattus* Linnaeus, 1758, *R. norvegicus* Berkenhout, 1769, *Mus musculus* Linnaeus, 1758, *M. spretus* Lataste, 1883 and *Apodemus sylvaticus* Linnaeus, 1758 (Rodentia: Muridae) and *Arvicola sapidus* (Miller, 1908) (Rodentia: Arvicidae). To these should be added the reports of *Suncus etruscus* (Savi, 1822) (Insectivora: Soricidae) at specific locations within the Park, derived from the study of pellets regurgitated by predatory nocturnal birds (see FAUS, 1990).

The parasitological study of these small mammals in this particular Iberian geographic zone is of interest from the faunistic point of view because it represents a contribution to the knowledge of the parasitic fauna of these host species. Another interesting point offered by the study of this zone is the general ecosystem heterogeneity observed and the different distributions of the small mammals throughout the three above-mentioned ecosystems, aspects that in turn allow the undertaking of ecological studies to determine the influence of such special ecological characteristics upon the helminthfaunas of these host species. From the biogeographic point of view, mention is deserved of the location of this zone, in close proximity to the Pityusic Islands (Balearic Archipelago). In this sense, the study of the parasitic faunas of the host species of this Natural Park may provide information for elucidating the colonizing routes of Pityusic Island parasite populations.

With the present paper, the first of a series, our aim is to contribute the first data on the helminthfauna of the

greater white-toothed shrew, *Crocidura russula* (Hermann, 1780) (Insectivora: Soricidae) in the Albufera Natural Park (Valencia, Spain), and which has already been the subject of preliminary studies (GALAN-PUCHADES, 1986; GRANEL, PORTOLES & ESTEBAN, 1992; GRANEL, 1993).

To date, the Spanish (Iberian Peninsula and Mediterranean islands) helminth fauna of *C. russula* comprises 47 species: 14 Trematodes, 13 Cestodes, 19 Nematodes and 1 Acanthocephalan (MAS-COMA, 1977a, b; MAS-COMA & JOURDAN, 1977; MAS-COMA & GALLEGOS, 1977a; MAS-COMA & FELIU, 1977, 1984; CORDERO DEL CAMPLLO *et al.*, 1980; ESTEBAN, MAS-COMA & FELIU, 1981; ESTEBAN, 1983; GALLEGOS & MAS-COMA, 1983; MAS-COMA & ESTEBAN, 1983a, b; MAS-COMA, FELIU & BEAUCOURNU, 1984; MALLACH *et al.*, 1985; MAS-COMA & GALAN-PUCHADES, 1985; SANMARTIN-DURAN *et al.*, 1985, 1987; TORREGROSA, ESTEBAN & MAS-COMA, 1985; FELIU *et al.*, 1986, 1990; GALAN-PUCHADES, 1986; CIRIZA *et al.*, 1987; GRACENEA *et al.*, 1987, 1989; TORRES & FELIU, 1987, 1990; TORRES, FELIU & GRACENEA, 1987; GALAN-PUCHADES *et al.*, 1988, 1994, 1995; GOMEZ *et al.*, 1988; TORRES, 1988; ALVAREZ-MASCATO *et al.*, 1991; GONZALEZ-MORENO *et al.*, 1992, 1994; GRACENEA & MONTOLIU, 1992; GRACENEA, MONTOLIU & DEBLOCK, 1993; CORDERO DEL CAMPLLO, CASTAÑON & REGUERA, 1994; MAS-COMA & MONTOLIU, 1995). Nevertheless, this host species in the Ebro Delta ecosystem includes 17 helminth species (4 Trematodes, 4 Cestodes, 7 Nematodes and 1 Acanthocephalan) (GALAN-PUCHADES, 1986; GRACENEA *et al.*, 1987; TORRES & FELIU, 1987; TORRES, FELIU & GRACENEA, 1987; GOMEZ *et al.*, 1988; TORRES, 1988; FELIU *et al.*, 1990; TORRES & FELIU, 1990) versus 10 helminth species (2 Trematodes, 2 Cestodes and 6 Nematodes) in the Llobregat Delta ecosystem (GRACENEA *et al.*, 1989; GONZALEZ-MORENO *et al.*, 1992, 1994; GRACENEA & MONTOLIU, 1992; GRACENEA, MONTOLIU & DEBLOCK, 1993).

MATERIAL AND METHODS

A total of 322 shrew specimens of the species *C. russula* were examined: 240 from the Dehesa, 43 from the Lake and 29 from the Marsh ecosystems. Samples were collected in 23 biotopes among the 75 biotopes prospected in many expeditions carried out in the Albufera Natural Park (Valencia, Spain) during the years 1985-1987 and 1990-1991 (see Fig. 1). The worms were treated according to the methodology normally used in Helminthology.

RESULTS

Qualitative data

In the Albufera Natural Park of Valencia, the greater white-toothed shrew exhibits 16 species of helminths:

- Trematoda: *Brachylaima* sp. (Brachylaimidae);

- Cestoda: *Hymenolepis pistillum* (Dujardin, 1845), *H. scalaris* (Dujardin, 1845), *H. tiara* (Dujardin, 1845), and *Pseudohymenolepis redonica* Joyeux et Baer, 1935 (Hymenolepididae) (*Hymenolepis* individuals not determined for different reasons – insufficient material, badly fixed specimens, defective fixation, lack of necessary parts such as rostellar hooks, etc. – are only considered in the quantitative analysis);
- Nematoda: *Calodium splenaeum* (Dujardin, 1843), *C. soricicola* (Nishigori, 1924), *Liniscus incrassatus* (Diesing, 1851), *Aonchotheca europaea* Mas-Coma et Galán-Puchades, 1985 (Trichuridae), *Parastrongyloides winchesi* Morgan, 1928 (Strongylidae), *Paracrenosoma combesi* Mas-Coma, 1977 (Crenosomatidae), *Longistriata* sp. (Heligmosomidae), *Porrocaecum* sp. (larvae) (Ascarididae), *Gongylonema* sp. aff. *sororis* Fain, 1955 (Gongylonematidae), *Pseudophysaloptera* sp. (Physalopteridae) and *Stammerinema rhopalocephala* (Soltys, 1952) (larvae) (Acuariidae).

The different species have been identified according to the descriptions and findings published in JOYEUX & BAER (1936), VAUCHER (1971), MAS-COMA & GALLEGOS (1975), MAS-COMA (1977a, b), MAS-COMA & GALAN-PUCHADES (1985) and MONTOLIU & MAS-COMA (1986). Species not found by these authors are discussed in the following.

Most relevant faunistic data

***Longistriata* sp.:** In the intestine of some specimens of *C. russula* obtained in the three ecosystems studied in the Albufera Natural Park, some heligmosomids were found. Unfortunately, most of those studied underwent defective fixation, hindering observations of the internal anatomy (fundamentally the configuration of the caudal bursa of the male specimens). Nevertheless, the morphological study of this material agrees with the description of *Longistriata* sp. by TORRES (1988) based on *C. russula* specimens from the Ebro Delta. This author opted not to specifically assign his specimens, upon observing smaller dimensions of the spicules (100-155 µm) and a different configuration of the caudal bursa of the male with respect to the habitual heligmosomid species of crocidurins (*L. confusa* Desportes et Chabaud, 1961) in Europe (VAUCHER & DURETTE-DESSERT, 1973; MAS-COMA, 1977b).

The caudal bursa and the dimensions of the spicules (86-105 µm) of our material, closer to those described by TORRES (1988), led us to include it as *Longistriata* sp. Future studies of materials in perfect conditions will most probably show that a species new to science is involved.

***Porrocaecum* sp. (larvae):** Certain nematodes were detected in some shrews from the Dehesa ecosystem - in some cases in an abundant number (up to 27 specimens per host) - located within the thoracic, and especially abdominal, cavities. Despite the fact that these were larval

stages, some morphological features (i.e., oesophagus with globoid ventriculus; ventriculus without appendices; and an intestinal caecum as broad as the oesophagus) justify their inclusion in the genus *Porrocaecum* (Railliet et Henry, 1912), within the subfamily Toxocarinae (Hartwich, 1954), family Ascarididae Baird, 1853

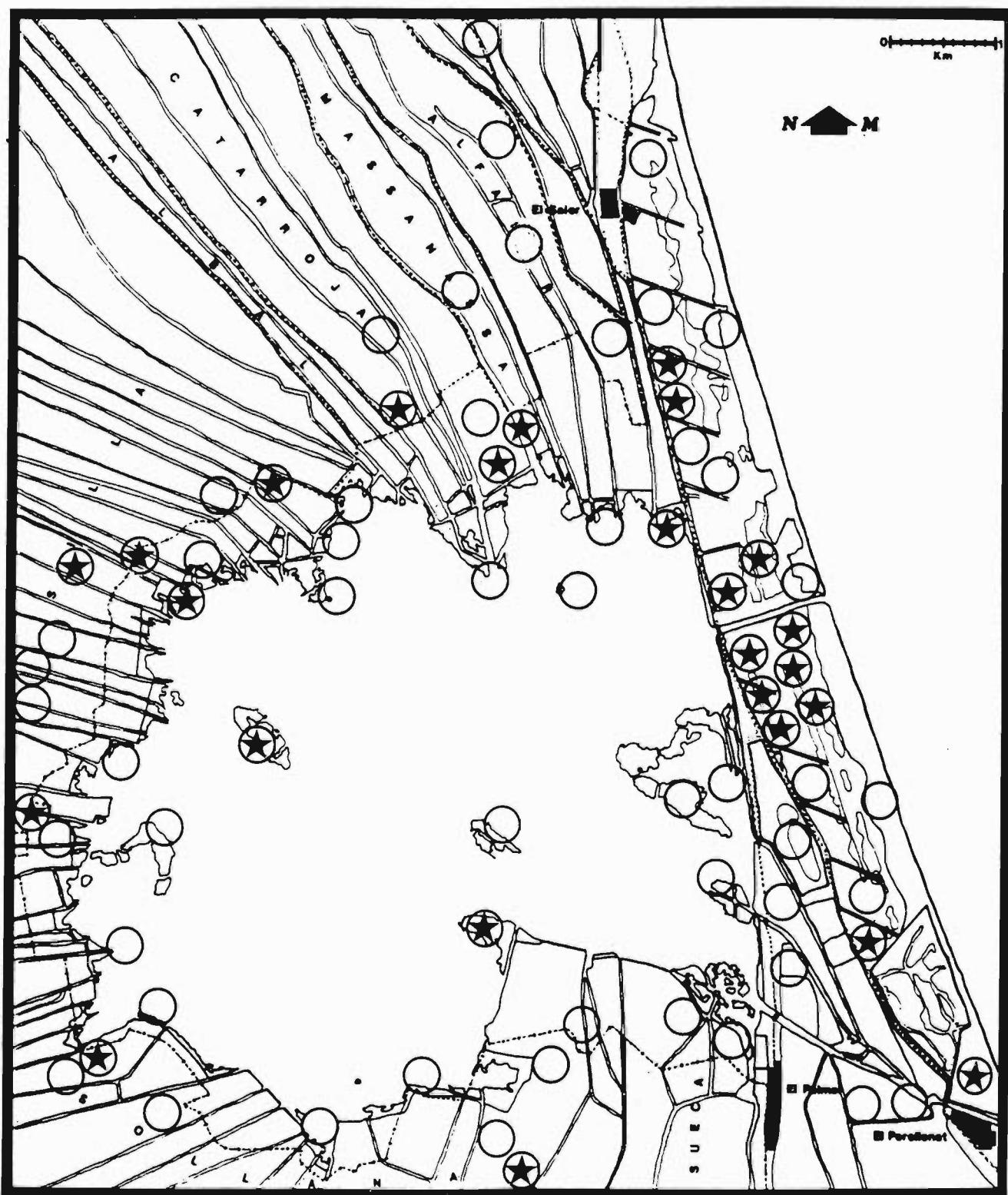


Fig. 1.—Geographical distribution of the prospected biotopes (circles) and of those in which *Crocidura russula* was captured (circles with stars) in the three ecosystems of the Albufera Natural Park of Valencia.

(*sensu* HARTWICH, 1974). However, the lack of adult specimens prevented us from attempting a specific classification.

To date, larval stages of this genus parasitizing *C. russula* in Spain have already been detected in the Galician Autonomous Community by ALVAREZ-MASCATO *et al.* (1991). Consequently, the present report broadens the scope of the parasitic helminthfauna of this host species in Spain.

Gongylonema sp. aff. soricis: In five *C. russula* from the Dehesa ecosystem we found at oesophageal level only female specimens of a species belonging to the genus *Gongylonema* (Molin, 1857). Some peculiar morphological characteristics of these specimens, such as the length of the tail (65-107 µm), the vulva-posterior end distance (251-501 µm) and the eggs (49-55/30-34 µm), as well as the nature of the host (Crocidurinae), allow us to include it as *Gongylonema* sp. aff. *soricis*, in accordance with MAS-COMA & FELIU (1984). These authors describe one female specimen detected in one *C. russula* from the island of Ibiza (Balearic Archipelago), and comment on the convenience or not of including this material within *G. soricis*, a parasite known exclusively from Crocidurinae in Equatorial Africa, or from *G. pithyusensis* (Mas-Coma, 1977), a parasite of the oesophagus of *Eliomys quercinus* (Linnaeus, 1766) (Rodentia: Gliridae) on the island of Formentera (Balearic Archipelago). Unfortunately, and as also applies to the work of MAS-COMA & FELIU (1984), the lack of more material (particularly males) makes it necessary for the time being to leave open the question of definitive specific determination.

This report is the first of this parasite species in the Iberian Peninsula.

Pseudophysaloptera sp.: Nine shrews from the Dehesa ecosystem were infected by stomach parasites of the Physalopteridae family (*sensu* CHABAUD, 1975). Characteristics of the cephalic extremity (atrophic buccal cavity, each pseudolabium with one amphid, one extero-lateral and three internolateral teeth, without a double pair of submedian teeth) and the caudal bursa of the male (caudal papillae small and sessile, and spicules not visible), allow its classification within the genus *Pseudophysaloptera* (Baylis, 1934). The most important morphometric characteristic measurements (in µm) of our materials are the following.

Male easily differentiated from female by its smaller size and coiled posterior end. Body length 6072-10081; maximum width 516-659. Cephalic extremity 69-103 wide, surrounded by cuticular collarette 103-172 wide. Cervical alae 34-103 in maximum width. Body width 379-529 at posterior end of oesophagus and 356-597 at cloacal level. Nerve-ring and excretory pore located 218-379 and 494-517, respectively, from anterior extremity. Muscular and glandular portions of oesophagus 315-401 and 1833-2873. Spicules and gubernaculum not

detected. Caudal alae well developed and united on ventral surface of body, 1002-1718 in length and 802-1375 in maximum width. Caudal bursa not ornamented ventrally, and the number and distribution of sessile papillae could not be determined.

The female is larger and more frequently found than the male. Body length 17069-22912; maximum width 859-916; width 103-161 at cephalic level, 517-575 at posterior end of oesophagus, 379-586 at vulval level and 230-299 at anal level. Tail rounded, 425-487 long. Cuticular collarette 161-218 wide; lateral alae 34-80 in maximum width. Nerve-ring and excretory pore located 379-517 and 402-643, respectively, from anterior extremity. Muscular and glandular portions of oesophagus 544-573 and 3322-4067. Vulva situated in distinct narrowing of body, 5442-7103 or 30-33% of body length from anterior extremity. Eggs thick-shelled, embryonated, 40-46/26-31.

To date, 9 species of this genus have been reported in different mammalian hosts (see BAYLIS, 1934; CHEN, 1937; KOBULEJ & VERSENYI, 1953; KOBULEJ, 1955; CHABAUD, RAUSCH & DURETTE-DISET, 1963; SCHAD, 1963; FAROOQUI & ALI, 1965; LOVEKAR, 1969; QUENTIN, 1969; MAS-COMA & GALLEGOS, 1977b). Nevertheless, only 6 species are known to parasitize shrews: *P. soricina* Baylis, 1934 from Africa, Turkey and North America; *P. formosana* (Yokogawa, 1922) Lincicome, 1948, *P. riukiuana* Lincicome et McConaughey, 1948, *P. lincicomei* Chabaud, Rausch et Durette-Desset, 1963, and *P. indiana* Farooqui et Ali, 1965 from Asia; and *P. kotlani* (Kobulej et Versenyi, 1953) Morozov, 1960 from eastern Europe.

The morphological and biogeographical characteristics of our material approach those of *P. soricina* and *P. kotlani*. However, the difficulties found in studying the papillae of the caudal bursa of our male specimens (as a result of poor fixation conditions) prevented us from carrying out the essential comparative study. We have thus opted to temporarily leave open the question of definitive specific determination.

The present report is the first of this parasite genus regarding the parasitization of an insectivore in western Europe.

Stammerinema rhopalocephala (larvae): At intestinal level, as well as within abdominal cavity cysts, many specimens of *C. russula* from the Dehesa and Marsh ecosystems exhibited larval stages of nematodes. The presence of long cordons extending longitudinally and expanding largely on the cervical region allowed its inclusion within the subfamily Acuarinae Railliet, Henry et Sisoff, 1912 (*sensu* CHABAUD, 1975). The study of the anterior extremity of this material showed four cephalic cordons weakly recurrent and sinuous, but not anastomosing on the lateral surface in front of the deirids; cordons with transverse striations and a median ridge running through striations and communicating with the inner surface of pseudolabium; and a long pharynx and tricuspid deirids followed by two rows of spines on late-

ral fields behind the cordons. These relevant morphological characteristics agree with the fourth larval stage of *S. soricis* (Tiner, 1951) described by QUENTIN & BEVERIDGE (1986) and renamed posteriorly by QUENTIN & WERTHEIM (1986) as *S. rhopalocephala*. According to OSCHE (1955), this last species is synonymous of *S. soricis*, but QUENTIN (1986) and QUENTIN & WERTHEIM (1986) believe *S. soricis* to be a parasite from Nearctic, *S. rhopalocephala* from European and *S. globocephala* Quentin et Wertheim, 1986 from Mediterranean soricids.

Up to the present, this paper is the first report of this species in the Spanish helminthfauna.

Quantitative data

The total and particular prevalences of the helminth species detected in *C. russula* in each of the three ecosystems studied and in the global Park are reflected in Table 1.

DISCUSSION

Whereas the results obtained show that *C. russula* exhibits exponents of all the most important classes of hel-

minths (Trematoda, Cestoda, Nematoda), not all helminth species showed the same distribution throughout the Albufera Natural Park. Thus, while in the Dehesa ecosystem a total of 15 species were detected, in the Lake and Marsh ecosystems 11 species were obtained. The nematodefauna was found to be fundamentally responsible for these differences in distribution. Such qualitative differences, along with the quantitative results obtained (with highly significant differences among helminth species but not in the total parasitization prevalences recorded) allow us to establish four groups of species as a function of their bioecological requirements:

- species with an optimum bioecological status in the Dehesa ecosystem: *H. tiara*, *Porrocaecum* sp. larvae, *Gongylonema* sp. aff. *soricis*, *Pseudophysaloptera* sp. and *S. rhopalocephala* larvae;
- species with an optimum bioecological status in the Lake ecosystem: *C. soricicola* and *P. combesi*;
- species with an optimum bioecological status in the Lake and Marsh ecosystems: *C. splenaeum*, *L. incrasatus*, *A. europaea*, *P. winchesi* and *Longistriata* sp.;
- species distributed throughout the Park: *Brachylaima* sp., *H. pistillum*, *H. scalaris* and *P. redonica*.

If we set up a comparison with Spanish data, a considerable impoverishment in number of species (more cle-

	DEHESA n = 240	LAKE n = 43	MARSH n = 29	WHOLE PARK n = 312
	No. inf. (%)	No. inf. (%)	No. inf. (%)	No. inf. (%)
TREMATODA				
<i>Brachylaima</i> sp.	8 (3.3) 8 (3.3)	2 (4.7) 2 (4.7)	2 (6.9) 2 (6.9)	12 (3.9) 12 (3.9)
CESTODA				
<i>H. pistillum</i>	146 (60.8) 57 (23.8)	15 (34.9) 8 (18.6)	17 (58.6) 10 (34.5)	178 (57.1) 75 (24.0)
<i>H. scalaris</i>	35 (14.6)	2 (4.7)	3 (10.3)	40 (12.8)
<i>H. tiara</i>	45 (18.8)	— (—)	1 (3.5)	46 (14.7)
<i>Hymenolepis</i> spp.	4 (1.7)	1 (2.3)	— (—)	5 (1.6)
<i>P. redonica</i>	85 (35.4)	9 (20.9)	6 (20.7)	100 (32.1)
NEMATODA				
<i>C. splenaeum</i>	123 (51.3) 3 (1.3)	28 (65.1) 5 (11.6)	14 (48.3) 2 (6.9)	165 (52.9) 10 (3.2)
<i>C. soricicola</i>	3 (1.3)	2 (4.7)	— (—)	5 (1.6)
<i>L. incrasatus</i>	— (—)	2 (4.7)	1 (3.5)	3 (1.0)
<i>A. europaea</i>	4 (1.7)	3 (7.0)	1 (3.5)	8 (2.6)
<i>P. winchesi</i>	7 (2.9)	12 (27.9)	4 (13.8)	23 (7.4)
<i>P. combesi</i>	5 (2.1)	7 (16.3)	— (—)	12 (3.9)
<i>Longistriata</i> sp.	4 (1.7)	21 (48.8)	5 (17.2)	30 (9.6)
<i>Porrocaecum</i> sp. (larvae)	82 (34.2)	— (—)	— (—)	82 (26.3)
<i>G. sp. aff. soricis</i>	5 (2.1)	— (—)	— (—)	5 (1.6)
<i>Pseudophysaloptera</i> sp.	9 (3.8)	— (—)	— (—)	9 (2.9)
<i>S. rhopalocephala</i> (larvae)	51 (21.3)	— (—)	1 (3.5)	52 (16.7)
Nematoda gen. sp. (larvae)	3 (1.3)	1 (2.3)	— (—)	4 (1.3)
TOTAL	194 (80.8)	33 (76.7)	22 (75.9)	249 (79.8)

Table 1.— Qualitative (number and nature of parasite species) and quantitative (No. inf. = number of infested hosts; % = general and individual helminth prevalences) results obtained in *Crocidura russula* (n = number of specimens analyzed) in each of the ecosystems studied and for the whole Albufera Natural Park of Valencia.

arly with respect to trematodes) can be detected. Specifically, species of trematodes from *Crocidura* not detected so far in Albufera Natural Park are: *Brachylaima simoni* Feliu *et al.*, 1986, *Pseudoleucochloridium soricis* (Soltys, 1952), *P. pericardicum* Mas-Coma et Montoliu, 1995, *Platynosomum soricis* (Diesing, 1858), *Postorchigenes gymnesicus* Mas-Coma, Bargues et Esteban, 1981, *Maritrema felii* Gracenea, Montoliu et Deblock, 1993, *Maritrema* spp., *Levinseiniella* sp. and *Nephrotrema truncatum* (Leuckart, 1842). Identical considerations apply to the comparative study of other peninsular ecosystems analogous to that investigated in the present study, such as the Ebro and Llobregat Deltas, which are characterized by their trematode species (4 and 2 species, respectively).

The cestodefauna detected is qualitatively very similar to that known for the Ebro Delta, with the exception of *H. raillieti* present in this ecosystem, and *H. tiara* found in the Albufera Natural Park. Nevertheless, it is much richer than that known for the Llobregat Delta (with only 2 hymenolepidid species). From the quantitative point of view, the infestation percentages obtained are clearly higher.

The nematodefauna likewise characterizes the results obtained in the area studied. Specifically, its qualitative richness (11 species) contrasts with the variety known for the Ebro and Llobregat Deltas, with only 7 and 6 species, respectively (all of which were detected in the present paper). Concretely, a series of new elements may be emphasized (*Gongylonema* sp. aff. *soricis*, *Pseudophysaloptera* sp. and *S. rhopalocephala* larvae), whose absence elsewhere on the Iberian Peninsula in general and in the Ebro and Llobregat Deltas in particular, points to the peculiar biogeographical characteristics of the Albufera Natural Park. Concerning the quantitative aspect, the general and individual infestation indexes seem to be similar to those found in the Llobregat Delta but slightly lower than those evident on the Ebro Delta.

From the general zoogeographical point of view, the helminthfauna found in *C. russula* within the Albufera Natural Park fundamentally comprises European, Mediterranean or Circum-Mediterranean species, with some species (*Gongylonema* sp. aff. *soricis* and probably also *Pseudophysaloptera* sp.) showing the influence of Africa. The geographical position of the Albufera Natural Park, in close proximity to the Pityusic Islands, where some helminth species of *C. russula* (*Hymenolepis* sp. and *Gongylonema* sp. aff. *soricis*) likewise point to this influence, agrees with the hypothesis proposed by MAS-COMA & FELIU (1984) regarding the past relationships to African shrews, a fact that likewise coincides with the paleontological data presupposing an African origin of Crocidurinae with posterior introduction into Europe.

The helminthfauna obtained in *C. russula* suggests that the Albufera Natural Park constitutes a peculiar ecosystem within the setting of the geography of the Iberian Peninsula.

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