Studies on Neotropical Fauna and Environment

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/nnfe20

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Version of record first published: 19 Nov 2008.

To cite this article: E. Jaramillo (1982): Taxonomy, natural history and zoogeography of sand beach isopods from the coast of Southern Chile, Studies on Neotropical Fauna and Environment, 17:4, 175-194

To link to this article: http://dx.doi.org/10.1080/01650528209360610

Studies on Neotropical Fauna and Environment 17 (1982), pp. 175-194.

Taxonomy, Natural History and Zoogeography of Sand Beach Isopods from the Coast of Southern Chile

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(Valdivia)

ABSTRACT

Seven species of marine isopods were collected on sandy beaches of Southern Chile (from about 37° S until 42° S). From these, *Excirolana hirsuticauda* Menzies, *Excirolana monodi* Carvacho, *Chaetilia paucidens* Menzies, *Macrochiridothea setifer* Menzies and *M. mehuinensis* Jaramillo are known only from the Chilean coasts. Another species, *Excirolana braziliensis* Richardson, is known from other areas of American coasts. One species is identified here as *Macrochiridothea* aff. *lilianae* by its resemblance with *M. lilianae* Moreira from Southern Brazil. All these species are here briefly described and some aspects of their ecology added. Also zoogeographic characterization of the studied area is discussed in relation to the distributional patterns of isopods living in them.

INTRODUCTION

Zoogeographical provinces can be made out on the basis of the composing patterns of the fauna as a whole or based on any particular group. Several authors (Mann, 1954; Balech, 1954; Madsen, 1956 and Menzies, 1962) have studied the biogeographical situation analyzing the distributional patterns of fishes, molluscs, starfishes and isopods on the Chilean coast. This littoral is quite extensive (about 4,000 km) ranging from 18°30'S to 55°S, covering about 36 degree of latitude. The faunistic provinces of this coast have been discussed by several authors (Balech, 1954; Dahl, 1960; Knox, 1960 and Castilla, 1976). In general, three regions can be outlined: a northern warm temperate region (from about 18°S to 30°S), a southern cold temperate region (from about 42°S to 55°S) and a region of transitional character between these two which is one of the most discussed among them. According to Viviani (1969), in this area of the Chilean littoral there is an overlap of faunistic elements of subtropical and subantarctic origin, living together with a group whose distributional nucleus is in this area and can be considered endemic.

Sandy beaches have considerable extension in this region; one of the most representative groups living on them are isopods. This group has been studied (specially from ecological and taxonomic points of view) by Dahl (1953), Menzies (1962), Epelde-Aguirre et al. (1975) and Jaramillo (1977, 1978). Nevertheless, its biogeography and some taxonomic aspects (i.e., male appendix) are poorly known.

The main purpose of this study is to describe the species of marine isopods that are found on sandy beaches of Southern Chile and to make an approach to the zoogeographical characterization of this region using this group. The use of isopods in this kind of analysis is permissible because they are not adapted to significant migrations, since they carry their juvenile; they are richly represented in warm and cold waters and their range is usually limited to specific regions (Kussakin, 1968). Six sandy beaches in the South of Chile were sampled for this study. They are: Laraquete (37°09'S, 73°11'W), Mehuín (39°26'S, 73°13'W), Niebla (39°51'S, 73°24'W), Pucatrihue (40°28'S, 73°43'S), Muicolpué (40°35'S, 73°46'W) and Cocotué (41°54'S, 74°04'W) (Fig. 1). All the animals used for taxonomic studies are kept in the collection of Isopoda Crustacea of the Zoological Institute, Universidad Austral de Chile (IZUA-IC).

TAXONOMY

Key to marine isopods that are found on sandy beaches of Southern Chile.

1. Uropods lateral 2
   Uropods folded under pleotelson and forming a cover over the branchial chamber 4
2. Apex of pleotelson broadly rounded. On its dorsal face there is a transversal lowering with two semicircles on its endings ..... *Excirolana braziliensis* Richardson
   Apex of pleotelson triangular shaped; its dorsal face is smoth, without a transversal lowering . 3
3. Antenna 2 extends until the end of pereonite 5 or slightly overpasses it. Male appendix curved to the outside; in the middle of its external edge presents a short lateral process ..... *Excirolana hirsuticauda* Menzies
   Antenna 2 extends until the end of pereonite 2 or slightly overpasses it. Male appendix curved to the outside, without a lateral process in its external middle edge ..... *Excirolana monodi* Carvacho
4. Lateral margins of chephalon not incised. Sixth pair of pereopods as long as body ..... *Chaetilia paucidens* Menzies
   Lateral margins of cephalon deeply incised. Any perceopods as long as body 5
5. Antenna 1 with peduncular article 2 strongly projected at the apex ..... *Macrochiridothea mehuinensis* Jaramillo
   Antenna 1 with its peduncular article 2 not projected at the apex 6
6. Lateral incisions of cephalon are wide; anterior expantions of head separated from the posterior ones ..... *Macrochiridothea setifer* Menzies
   Lateral incisions of cephalon are narrow; anterior and posterior expantions of head are close to each other ..... *Macrochiridothea* aff. *lilianae* Moreira

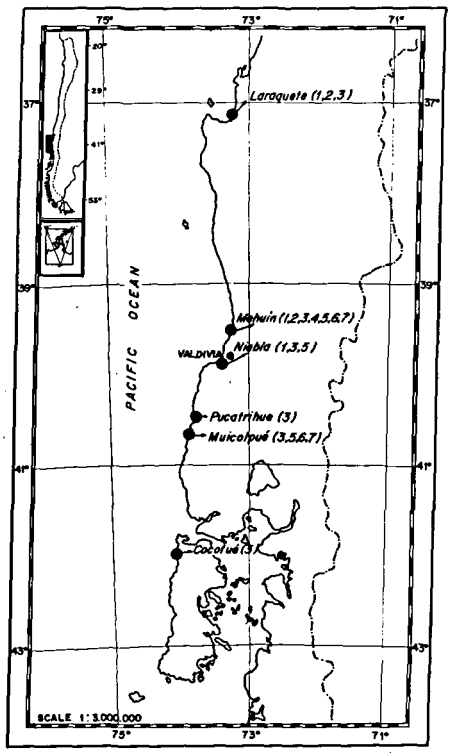

Fig. 1. Sandy beaches where were collected marine isopods. 1: *Excirolana braziliensis*, 2: *Excirolana monodi*, 3: *Excirolana hirsuticauda*, 4: *Chaetilia paucidens*, 5: *Macrochiridothea mehuinensis*, 6: *Macrochiridothea setifer* and 7: *Macrochiridothea* aff. *lilianae*.

Family Cirolanidae

Excirolana braziliensis Richardson, 1912
Figure 2

Cirolana salvadorensis Schuster, 1954: 105, fig. 2
Cirolana koepckei Bott, 1954: 107-108, fig. 1
Cirolana koepkei, Carvacho, 1977: 30, fig. 2
Excirolana braziliensis, Glynn et al. 1975: 509-521, fig. 1-5

Cephalon width almost three times its length. Big eyes, they took almost a half of the lateral edge of the cephalon. Antenna 1 reaches the half of pereonite 3, at the same time the antenna 2 goes until the end of pereonite 5. Coxal plates without setae on their inferior edges. Lateral edges of pleonites without setae.

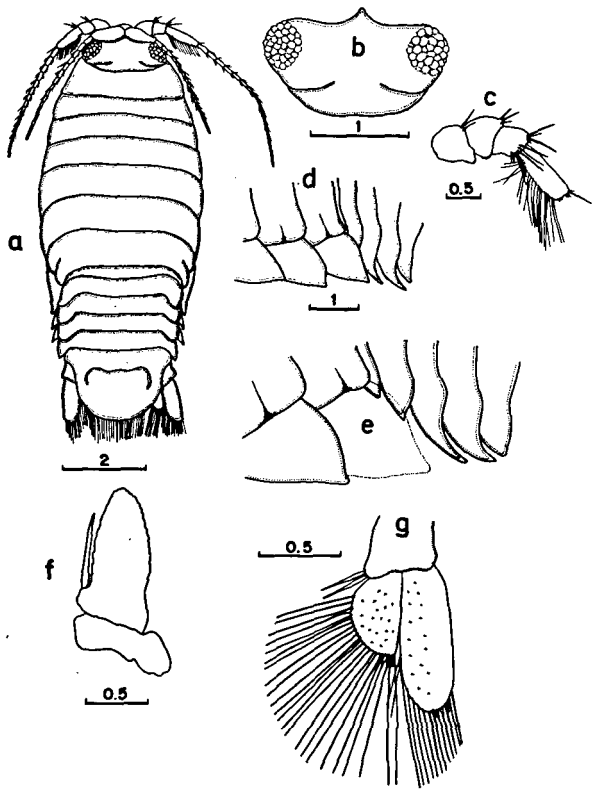

Fig. 2. *Excirolana braziliensis* Richardson. a. dorsal view of a 9.1 mm male, b. cephalon, c. peduncular articles of antenna 2, d. lateral view of a part of pereon and pleon, e. idem to d, but without coxal plate VII, f. endopod of pleopod 2 and male appendix, g. uropods. All the measurements in mm.

Telson of rounded apex. On its dorsal face we have a transversal lowering with two semi-circles on its endings. Straight male appendix, thin and with a pointed apex.

Material analyzed. IZUA.IC. 91 to IZUA.IC. 97, 4 ♂, 3 ♀, Mehuín (29.3.75); IZUA.IC. 98 and IZUA.IC. 99, 2 ♀, Laraquete (7.1.77); IZUA.IC. 100, 1 ♂, Niebla (29.12.76).
Size ranges. 5.5 mm (IZUA.IC. 94) to 8.8 mm (IZUA.IC. 98).

Excirolana braziliensis goes on east Pacific, from California Gulf (Glynn et al. 1975) to Niebla (39°51'S) in Chile; at the same time in West Atlantic (including West Indias) from Mexico Gulf to Brazil (Glynn et al. 1975). Carvacho, (1977) mentions this species (as *Cirolana koepkei)* along the coast of Chile

from Valparaíso (33°02'S) to north. In the Southern Chile we have collected *Excirolana braziliensis* in Laraquete, Mehuín and Niebla (Figure 1).

Excirolana hirsuticauda Menzies, 1962

Figure 3

Excirolana hirsuticauda Menzies, 1962: 127, *fig. 41 A-C*
Excirolana hirsuticauda, Carvacho, 1977: 38-40, fig. 6

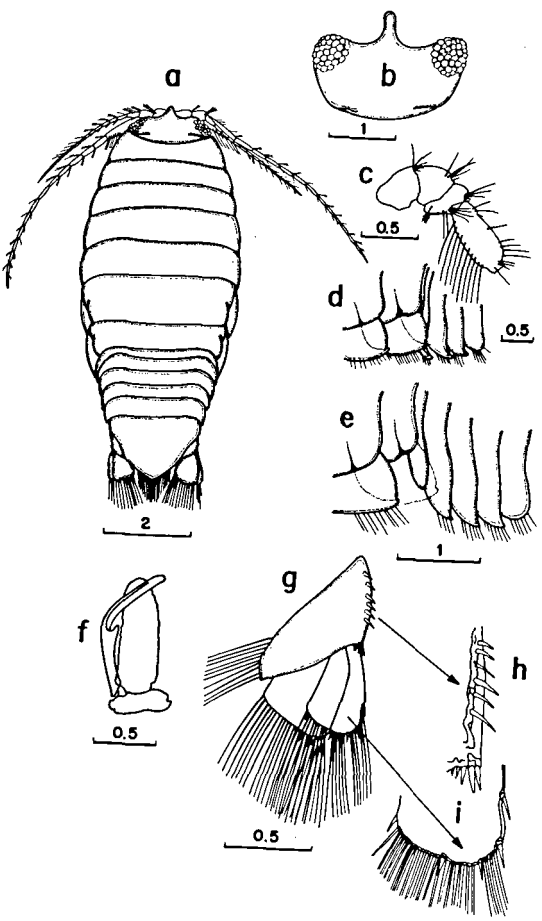

Fig. 3. *Excirolana hirsuticauda* Menzies. a. dorsal view of a 8.5 mm male, b. cephalon, c. peduncular articles of antenna 2, d. lateral view of a part of pereon and pleon, e. idem to d, but without coxal plate VII, f. endopod of pleopod 2 and male appendix, g. uropod, h and i. details of g. All the measurements in mm.

Width of the cephalon almost three times the length of itself. Big eyes, that covered almost the half of the lateral edge of the cephalon. Antenna 1 extends until the end of pereonite 3, on the other hand the antenna 2 extends until the end of pereonite 5 or slightly overpasses it. Coxal plates with setae on their low edges. Lateral edges of pleonites with setae. Lateral edges in the middle of telson rather concave. Male appendix curved to the outside, with rounded apex. In the middle of its external edge presents a short lateral process.

Material analyzed. IZUA.IC. 76 to IZUA.IC. 81, 4 ♂, 2 ♀, Mehuín (29.3.75); IZUA.IC. 82, 1 ♂, Pucatrihue (13.12.76); IZUA.IC. 83 to IZUA.IC. 85, 3 ♀, Muicolpué (12.12.76); IZUA.IC. 86, 1♀, Laraquete (7.1.77); IZUA.IC. 87 and IZUA.IC. 88, 2 ♂, Niebla (29.12.76); IZUA.IC. 89 and IZUA.IC. 90, 2 ♂, Bahía Cocotué (6.4.77).

Size ranges. 4.5 mm (IZUA.IC. 90) to 10.9 mm (IZUA.IC. 80).

According to Carvacho (1977), *Excirolana hirsuticauda* ranges from Guanaqueros, Chile (approximately 31°S) to the Islands of Chiloé (approximately 42°S). This species has been collected on all sandy beaches sampled in Southern Chile (Fig. 1).

Excirolana monodi Carvacho, 1977
Figure 4

Excirolana monodi Carvacho, 1977: 35-38, fig. 5

Cephalon width almost twice the length of itself. Small eyes, that take almost a third of the lateral edge of the cephalon. Antenna 1 reaches the end of pereonite 1, on the other hand antenna 2 goes until the end of pereonite 2 or slightly beyond it. Coxal plates with setae on their low edges. Lateral edges of pleonites with setae. Telson of triangular shape. Male appendix curved to the outside, with rounded apex.

Material analyzed. IZUA.IC. 69 to IZUA.IC. 73, 2 ♂, 3 ♀, Mehuín (30.3.75); IZUA.IC. 74 and IZUA.IC. 75, 2 ♂, Laraquete (7.1.77).

Size ranges. 6.9 mm (IZUA.IC. 74) to 14.1 mm (IZUA.IC. 73).

Excirolana monodi has been mentioned by Carvacho (1977) along the coasts of the province of Aconcagua, Chile (approximately 32°S). In Southern Chile we have collected this species in Laraquete and Mehuín (Fig. 1), this last place being the most southern latitude where *Excirolana monodi* has been captured.

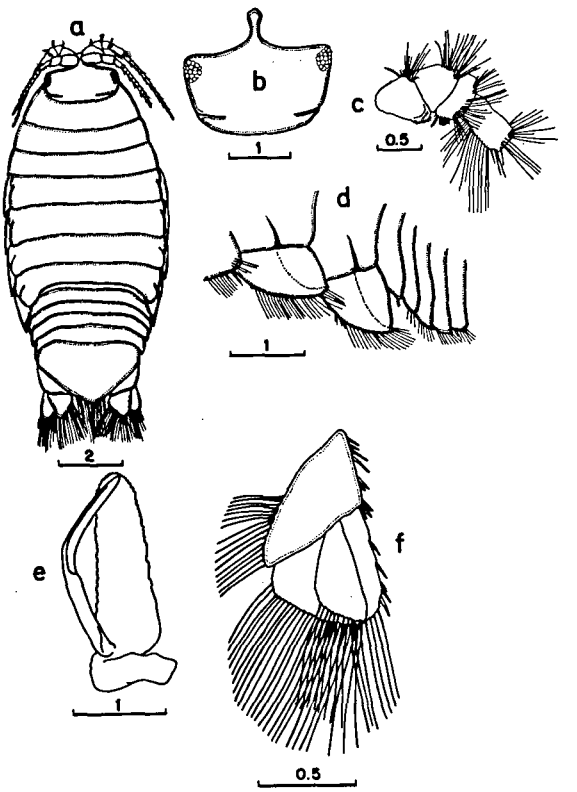

Fig. 4. *Excirolana monodi* Carvacho. a. dorsal view of a 11 mm male, b. cephalon, c. peduncular articles of antenna 2, d. lateral view of a part of pereon and pleon, e. endopod of pleopod 2 and male appendix, f. uropods. All the measurements in mm.

Family Idotheidae

Chaetilia paucidens Menzies, 1962
Figure 5

Chaetilia paucidens Menzies, 1962: 103, fig. 35

Lateral edges of the cephalon extended on the supraocular area in the shape of small horns. Each of these ones carry 1-3 setae. Antenna 1 is a little bit short than antenna 2. Pereopod 6 with an approximate length almost the same as the body. Pleon with three somites, besides the telson. Serrated apex of the telson. Male appendix curved to the inside in its distal third. Apex of the same rounded. Distal internal third with spines.

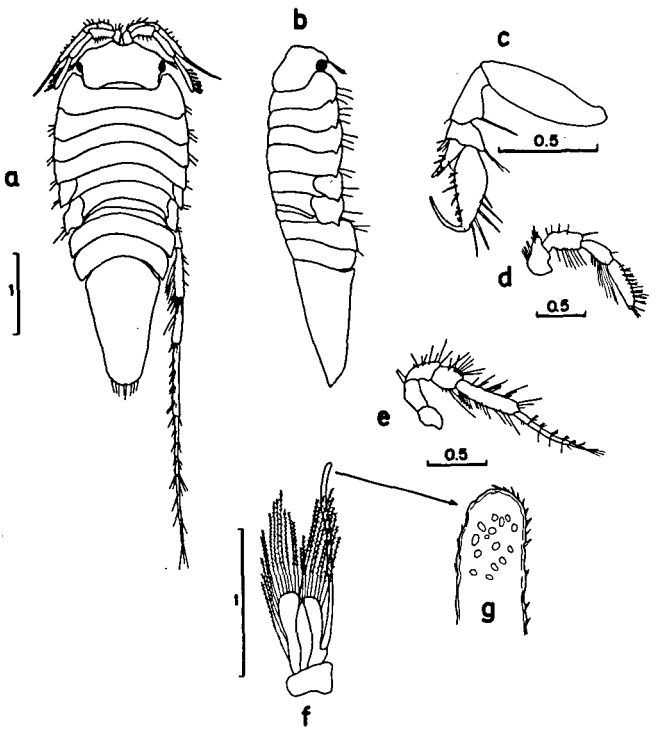

Fig. 5. *Chaetilia paucidens* Menzies. a. dorsal view of a 4.1 mm male, b. lateral view, c. gnathopod, d. antenna 1, e. antenna 2, f. pleopod 2 and male appendix, g. detail of apex in the male appendix. All the measurements in mm.

Material analyzed. IZUA.IC. 55 to IZUA.IC. 66, 12 ♀, Mehuín (28.3.75); IZUA.IC. 67 and IZUA.IC. 68, 2 ♂, Mehuín (8.5.76).

Size ranges. 4.1 mm (IZUA.IC. 62) to 5.6 mm (IZUA.IC. 55).

Chaetilia paucidens has been mentioned on the coast of central Chile (Montemar, 32°57′S, 71°33′W) by Menzies (1962). This species has been collected by J. Castilla (Universidad Católica de Chile, Santiago; personal communication) on the sandy littoral in the north of Chile; Chañaral (26°15′S, 70°39′W) is the northernmost place where it has been captured. The only place in Southern Chile where we have collected this species is Mehuín (Fig. 1) which represents the southern limit known to it.

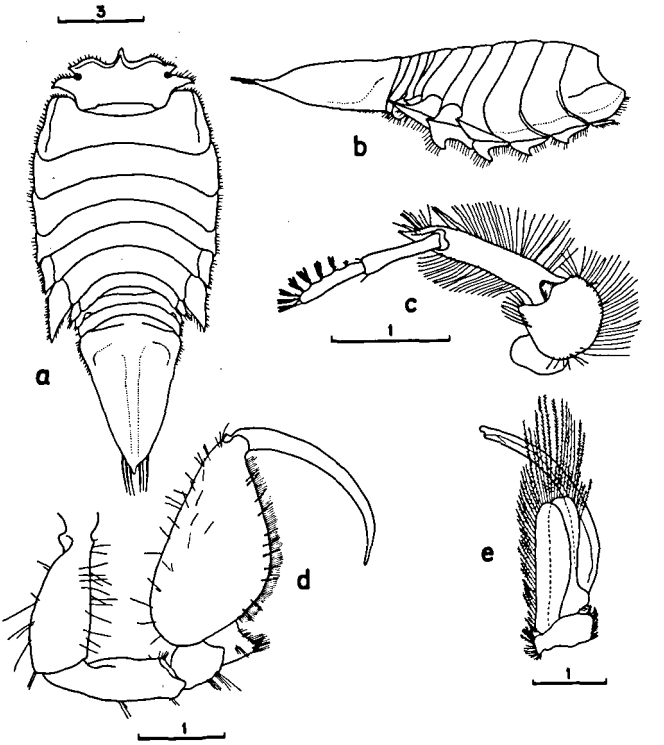

Fig. 6. *Macrochiridothea mehuinensis* Jaramillo. a. dorsal view of a 14.3 mm female, b. lateral view, c. antenna 1, d. gnathopod, e. pleopod 2 and male appendix. All the measurements in mm.

Macrochiridothea mehuinensis Jaramillo, 1977
Figure 6

Macrochiridothea mehuinensis Jaramillo, 1977: 71-80, figs. 1-3

Dorsal area of the cephalon, pereon and pleon plain and without tubercles. Winding carina on lateral areas of pereonite 1. Present eyes. Anterior cephalic expansions to the eyes rather shorter than the posterior ones. These last ones are thin, with pointed distal extremes and directed obliquely to the back. Pleon with four somites, besides the telson. Pleon (proximate part), with setae. Antenna 1 with the article 2 with a peduncle directed in a pointed apex. Pereopod 1 with oval and long propodus. Its length is approximately equivalent to twice its width. Male appendix curved to the outside, with distal extreme bicapitated.

Material analyzed. IZUA.IC. 1 and IZUA.IC. 2, 1 ♀, 1 ♂, Mehuín (8.5.76); IZUA.IC. 3 to IZUA.IC. 5, 3 ♀, Mehuín (28.3.75); IZUA.IC. 6 to IZUA.IC.

9, 2 ♀, 2 ♂, Mehuín (25.1.76); IZUA.IC. 10, 1 juvenile, Mehuín (28.3.75); IZUA.IC. 11, 1 juvenile, Mehuín (25.1.76); IZUA.IC. 13 to IZUA.IC. 17, 2 ♂, 3 ♀, Niebla (29.12.76); IZUA.IC. 18 to IZUA.IC. 21, 2 ♀, 2 ♂, Muicolpué (12.12.76).

Size ranges. 5.4 mm (IZUA.IC. 11) to 14.3 mm (IZUA.IC. 1).

Macrochiridothea mehuinensis has been mentioned by Jaramillo (1977) in Mehuín and Punta Pangal, Chile (41°36′S, 73°39′W). On the sandy beaches examined in Southern Chile, we have collected this species in Niebla and Muicolpué, besides Mehuín (Fig. 1).

Macrochiridothea setifer Menzies, 1962
Figure 7

Macrochiridothea setifer Menzies, 1962: 101, fig. 34

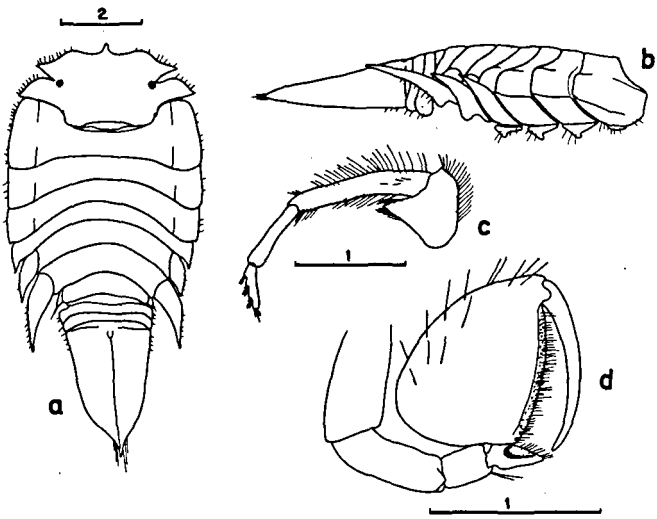

Fig. 7. *Macrochiridothea setifer* Menzies. a. dorsal view of a 10.1 mm female, b. lateral view, c. antenna 1, d. gnathopod. All measurements in mm.

Dorsal area of the cephalon, pereon and pleon, plain and without tubercles. Present eyes. Distal extremes of the anterior cephalic expansions of the eyes reach approximately the middle of the cephalic posterior expansions. These last ones are wide, with distal pointed extremes and directed obliquely to the back. Pleon with four somites, besides the telson. Pereopod 1 with globoid

propodus, its length equals approximately to 1.2 times its width. Distal extreme of the coxal plate overgoes the distal edge of pleonite 4.

Material analyzed. IZUA.IC. 27 to IZUA.IC. 33, 5 juveniles, 2 ♀, Mehuín (30.3.75); IZUA.IC. 34 to IZUA.IC. 39, 3 juveniles, 3 ♀, Mehuín (29.3.75); IZUA.IC. 40 to IZUA.IC. 43, 4 ♀, Muicolpué (12.12.76).

Size ranges. 4.5 mm (IZUA.IC. 33) to 10 mm (IZUA.IC. 40).

Macrochiridothea setifer has been mentioned on Guafo Island (43°37'S, 74°45'W) by Menzies (1962) and Playa Blanca (37°03'S, 73°09'W) by Epelde-Aguirre et al. (1975). J. Castilla (personal communication) has collected this species on the sandy beaches of the north of Chile until northermost limits like Morrillos (30°09'S, 71°24'W). On the sandy beaches of Southern Chile we have collected this species in Mehuín and Muicolpué (Fig. 1).

Macrochiridothea aff. *lilianae* Moreira, 1973
Figure 8

Macrochiridothea lilianae Moreira, 1973: 22-25, figs. 48-76

Dorsal area of the cephalon, pereon and pleon, plain and without tubercles. Strong carina on the lateral area of pereonite 1. Present eyes. Anterior cephalic expansions to the eyes quite close to the posterior ones. Pereopode 1 with globoid propodus and rather big, its length is equivalent approximately to its width. Straight male appendix in almost all its length, on its distal part is curved. External distal and serrated edge.

Material analyzed. IZUA.IC. 44 to IZUA.IC. 51, 8 ♀, Mehuín (25.1.76); IZUA.IC. 52 and IZUA.IC. 53, 2 ♀, Mehuín (30.3.75); IZUA.IC. 54, 1 ♂, Muicolpué (12.12.76).

Size ranges. 9.3 mm (IZUA.IC 53) to 11.7 mm (IZUA.IC. 52).

On the sandy beaches examined in Southern Chile we have collected this species in Mehuín and Muicolpué (Fig. 1). *Macrochiridothea lilianae* Moreira (species rather similar to our own) it is known in the south coast of Brasil, where it has been mentioned in Río de Janeiro (Isla Grande), Sao Paulo (Isla Anchieta) and Rio Grande do Sul (Moreira, 1973).

NATURAL HISTORY

With the aim to know the distribution of marine isopods across a sandy beach from Southern Chile (also the other species of macrofauna living on them) a

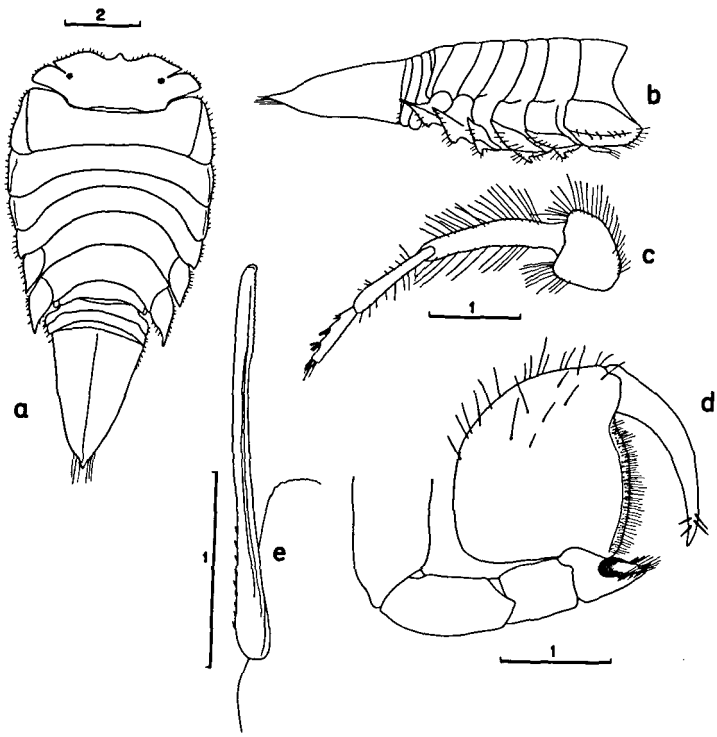

Fig. 8. *Macrochiridothea* aff. *lilianae* Moreira. a. dorsal view of a 11.2 mm male, b. lateral view, c. antenna 1, d. gnathopod, e. male appendix. All the measurements in mm.

sample was made in Mehuín (exposed place) in February 1978. Samples were taken at stations over a transect extending from the back side of the beach to the wash zone. At each station a metal quadrat (33 by 33 cm) was dug into the bottom to a depth of 15 cm. The sand extracted was washed through a 1 mm mesh sieve to obtain the animals. In the upper levels of the infralittoral zone samples were taken (only for the species known living there) with a shovel because of the difficulties caused by surf action. In this study these levels included the area of the beach concerned from the level of the low tide (MLWST) until an approximate depth of the water of 1.5 m, an extension of 30 m, more or less. The sand obtained in this area was washed with the same mesh forementioned. All animals were removed and fixed in formalin (10%) for their later examination and classification in the laboratory.

Zonation of the captured marine isopods on a sandy beach of Mehuín (also the other species of macrofauna living on them) is shown in Fig. 9. On the supralittoral zone, *Phalerisidia maculata* (Insecta, Coleoptera), *Orchestoidea tuberculata* Nicolet (Amphipoda, Talitridae) and *Excirolana braziliensis* Ri-

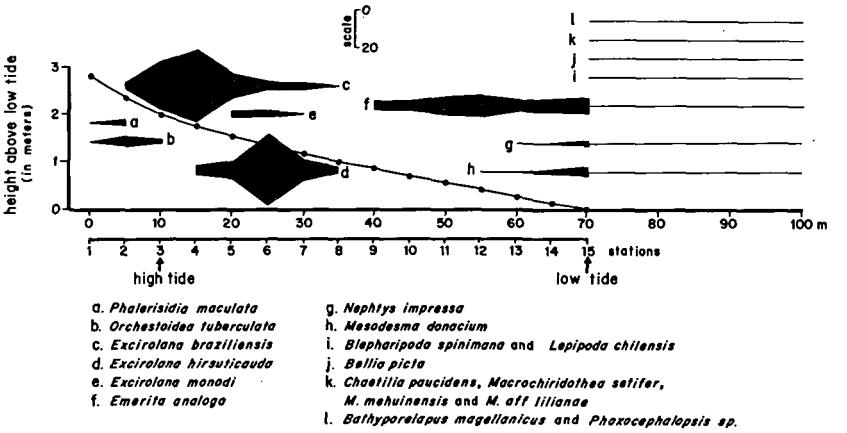

Fig. 9. Zonation of the sandy beach macrofauna at Mehuín Bay.

chardson were collected. In the high and middle levels of the midlittoral zone live *Excirolana braziliensis, E. hirsuticauda* Menzies and *E. monodi* Carvacho, the first species being the cirolanid that goes up on its transversal zonation followed by the other two respectively. In some beaches of Mehuín, *Excirolana hirsuticauda* and *E. monodi* had been also collected in the lower levels of the midlittoral zone. This occurs in protected beaches washed for brackish waters (10-30‰) of the estuary mouth of Lingue River, which ends on Mehuín Bay. In the lower levels of the midlittoral zone of the studied beach (Fig. 9) live *Emerita analoga* (Stimpson) (Anomura, Hippidae), *Nephtys impressa* Baird (Polychaeta, Nereidae) and *Mesodesma donacium* (Lamarck) (Bivalvia, Mesodesmatidae), species that also live in the upper levels of the infralittoral zone.

Peracaridans (fundamentally Isopoda) numerically dominate the macrofauna of sandy beaches of Mehuín and also other beaches of Southern Chile (personal observations). For example, cirolanid isopods contributed 67.5% of the numerical composition of the whole collected macrofauna in Mehuín (240 specimens). On the other hand these isopods are the species with the broadest distribution across these beaches. *Excirolana braziliensis* and *E. hirsuticauda* were the species represented by the largest number of animals (89 and 66 respectively) representing 37.08% and 27.5% of all collected specimens (240) in the supralittoral and midlittoral zone of Mehuín (Table 1). For *E. braziliensis* the greatest number of animals per station was recorded in station 4 (349 per m^2) and for *E. hirsuticauda* in station 6 (349 per m^2). In general, the specimens of these species were more abundant in the middle levels of its zonation. *E. monodi* was the cirolanid isopod represented by the least number of animals (7) representing 2.91% of all captured animals (240, Table 1). For

Table 1. Structure of the macrofaunistic communities at one sandy beach sampled in Mehuin Bay.

Species (ordered in rank by mehuin. number of collected animals)	Number of collected animals by species	Percentage %	Density per m2 from a 1.089 cm2 (33 x 33 cm) quadrat at beach sampled in														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. *Excirolana braziliensis*	89	37.08	-	28	239	349	119	37	37	9	-	-	-	-	-	-	-
2. *Excirolana hirsuticauda*	66	27.50	-	-	-	46	83	349	101	28	-	-	-	-	-	-	-
3. *Emerita analoga*	52	21.66	-	-	-	-	-	-	-	-	37	46	92	101	55	64	83
4. *Mesodesma donacium*	9	3.75	-	-	-	-	-	-	-	-	-	-	-	9	9	18	46
5. *Orchestoidea tuberculata*	8	3.33	9	46	18	-	-	-	-	-	-	-	-	-	-	-	-
6. *Excirolana monodi*	7	2.91	-	-	-	-	28	28	9	-	-	-	-	-	-	-	-
7. *Nephtys impressa*	5	2.08	-	-	-	-	-	-	-	-	-	-	-	-	9	9	28
8. *Phalerisidia maculata*	4	1.66	9	28	-	-	-	-	-	-	-	-	-	-	-	-	-
	240		18	102	257	395	230	414	147	37	37	46	92	110	73	91	157

Table 2. Frequency of cirolanid isopods at all the stations sampled at one sandy beach of Mehuín Bay.

	Frequency at stations (15)	
	n	%
Excirolana braziliensis	7	46.6
Excirolana hirsuticauda	5	33.3
Excirolana monodi	3	20.0

this species the highest number of specimens was recorded in station 5 and 6 (28 per m^2), these animals being more abundant in the high levels of its distribution. Excluding cirolanid isopods, the most abundant species of the macrofauna was the mole crab *Emerita analoga* (Fig. 9, Table 1), represented with 52 specimens (21,66% of the whole sample: 240).

Frequency of occurrence of circolanid isopods at stations sampled (15) in supralittoral and midlittoral zone is shown in Table 2. *Excirolana braziliensis* was captured in seven stations (from a whole of 15) representing a 46.6% frequency and being the cirolanid with the broadest zonation across the beach. After this species comes *Excirolana hirsuticauda* with a frequency of 33.3% (captured in five stations) and *E. monodi* present only in three stations (20% of frequency).

The species of Idotheidae present on the sandy beaches of Mehuín, *Chaetilia paucidens* Menzies, *Macrochiridothea mehuinensis* Jaramillo, *M. setifer* Menzies and *M.* aff. *lilianae* Moreira, live in the upper levels of the infralittoral zone. Together with these species live *Nephtys impressa, Mesodesma donacium, Emerita analoga, Blepharipoda spinimana* (Philippi) and *Lepidopa chilensis* Lenz (Anomura, Albuneidae), *Bellia picta* Milne Edwards (Brachyura, Atelecyclidae), *Bathyporeiapus magellanicus* Schellenberg (Amphipoda, Oedicerotidae) and one amphipod species belonging to the Haustoriidae family (genus *Phoxocephalopsis* Schellenberg).

Regarding the other sandy beaches sampled in Southern Chile, some variability is present between zonation patterns of isopods (and macrofauna in general), that live on them (manuscript in preparation). Nevertheless, a general schema can be proposed for this area of Chilean littoral. In this model there are three faunistic levels: the uppermost with insecta, amphipods (Talitridae) and cirolanid isopods (fundamentally *Excirolana braziliensis),* a middle with cirolanid isopods and a lowest with Crustacea Decapoda, Polychaeta, Bivalvia, Amphipoda and idotheid isopods. This zonation pattern has some resemblance with the schema proposed by Dahl (1953) for temperate sandy beaches of the southern hemisphere. In that model, talitrid amphipods characterize the upper zone of these biotopes, cirolanids the middle zone and the amphipods. Haustoriidae and Oedicerotidae are characteristic of the infralittoral zone. But one has to be careful when one uses this zonation pattern

because several authors have mentioned variations to it (Wood, 1963 in Ficham, 1974; Fincham, 1974; Epelde-Aguirrte et al., 1975 and Jamarillo, 1978).

ZOOGEOGRAPHY

On the sandy beaches of Southern Chile live marine isopods can be found distributed along different biogeographic provinces of the Chilean and southamerican littoral. From the six species (excluding from this analysis *Macrochiridothea* aff. *lilianae*) living in some of these beaches (Mehuín Bay), five (83.3%) viz. *Excirolana hirsuticauda, E. monodi, Chaetilia paucidens, Macrochiridothea setifer* and *M. mehuinensis*, are distributed only along Chilean coast, while one (16.6%) *Excirolana braziliensis,* has a wider distribution (Fig. 10).

The first group (endemic species of Chile) forms part of an extensive transitional area that goes approximately from 30°S to 42°S and that has been called Chilean Center Province by Knox (1960) (Fig. 10). In this group, *Excirolana hirsuticauda* and *Macrochiridothea setifer* are the species with a wider distribution, going from the littoral of Coquimbo, approximately 30°S (J. Castilla, personal communication) to the Island of Chiloé, approximately 43°S (Menzies, 1962; Carvacho, 1977). Both species form part of the Magallanic Province (Fig. 10) that goes in Chile from 42° S (Island of Chiloé) to 55°S, Cape Horn (Balech, 1954; Knox, 1960).

According to these boundaries, all the archipelago of Chiloé is included in the Magellanic Province. Nevertheless, some authors have made reference to difference between the outside (exposed coast) and inside of the Island of Chiloé (protected coast). Dahl (1960) mentions differences in the salinity between the interior of these archipelagos and the outside coast. While the salinity is high at the outside, it is low and variable in the inside coast. Castilla (1976) makes reference to the fact that the marine fauna (at least the littoral one) of the outside coast of Chiloé is completely different from the one found at the inside coast. Taking these considerations into account, this author places the open coast of the Island of Chiloé in the Exposed Valdivia Province. At the same time he asigns the areas which are between this island and the continent to the Protected Province of Chiloé. Thus, the area of the archipelagos of Chiloé that has been included (Balech, 1954; Knox, 1960) in a single biogeographic province (Magellanic) would be formed by two biogeographic provinces (Castilla, 1976).

Out of the two species of isopods dealt with in this paper and that have been collected in corresponding latitudes to the Archipelago of Chiloé, *Excirolana hirsuticauda* is found in exposed coast (Cocotué, this paper) and protected coast (Ancud Bay, Menzies, 1962). On the other hand *Macrochiridothea setifer* has only been mentioned in an outside place (Guafo Island, Menzies, 1962).

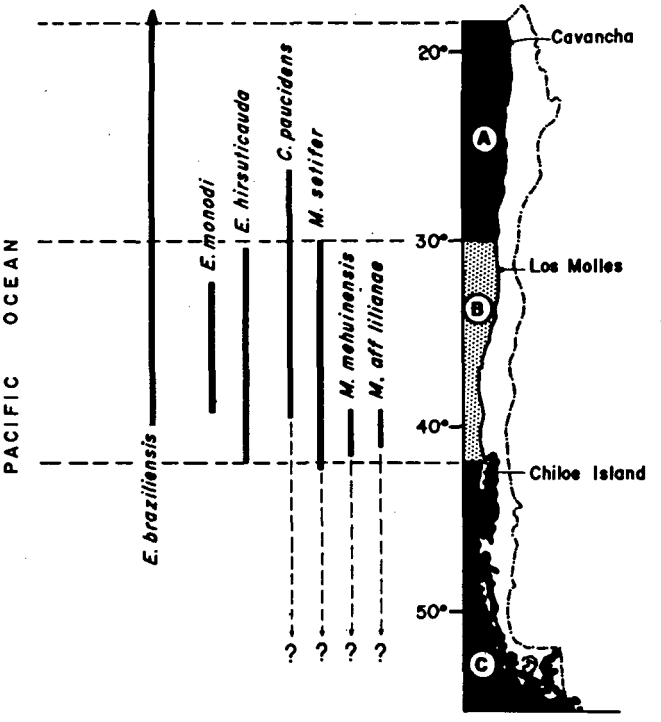

Fig. 10. Distribution pattern in the Chilean coast of the marine isopods that are found on sandy beaches of Southern Chile. A: Peruvian Province, B: Chilean Center Province, C: Magallanic Province.

The other species that lives on the sandy beaches of Southern Chile, *Excirolana braziliensis,* forms part (in the tropical region of Southamerica) of the Antillean (Atlantic Coast) and Panamic Provinces (Pacific Coast), whose boundaries have been given by Balech (1954). This species is also distributed in the Peruvian Province (Fig. 10) that goes approximately from 2°S to 32°S (Knox, 1960) and in the Chilean Center Province. *Excirolana braziliensis* seems to be the species with a more eurythermic character of the present ones on the sandy beaches of Southern Chile. Its wider distribution includes sandy beaches with tropical waters, subtropical and temperate ones (Glynn et al. 1975).

From the previous analysis we can postulate that the marine isopod fauna that is found on the sandy beaches of Southern Chile (Chilean Center Province; transitional area) would be formed by two faunal units. One of them is represented by *Excirolana braziliensis,* a taxon that can be considered an element of warm and temperate waters that gets to this area, presenting in the same one its southermost and distributive boundary on the Pacific Coast. The

other unity is formed by *Excirolana monodi, E. hirsuticauda, Chaetilia paucidens, Macrochiridothea setifer,* and *M. mehuinensis (M.* aff. *lilianae* can be included here). All these species belong to or are characteristic for this area. In this way, characteristic elements or of wider distribution in Subantarctic waters (Magallanic Province) are absent in these biotopes. Nevertheless, considering the actual distribution of the genus *Macrochiridothea* (principally in the southern extreme of Southamerica: cold temperate or subantarctic waters) it could be postulated that the species belonging to this taxon (and probably also *Chaetilia paucidens)* represent such elements in the Chilean littoral area with a transitional character.

Such an idea is reinforced in observing the notorious decrease of the species of valviferans in the sandy beaches of the Chilean littoral while we are getting closer to subtropical waters (Peruvian Province). In Mehuín Bay (39°S) four species of valviferans are found *(Chaetilia paucidens, Macrochiridothea setifer, M. mehuinensis* and *M.* aff. *lilianae)* forming a 57.1% of the total (seven species), in the beaches of Los Molles (30°S) two of them *(Chaetilia paucidens* and *Macrochiridothea setifer),* that constitute a 40% of the species of isopods present (five, Castilla et al., 1977, Castilla, personal communication); on the other hand in Cavancha (20°S) there are no valviferan isopods (personal observations). The poor representation of this suborder of isopods in temperate and warm waters is not very surprising due to the fact that there is really a scarcity of them in tropical and subtropical waters (Miller, 1968; in Menzies and Miller, 1972).

On the other hand the fact of not mentioning in the Magallanic Province the valviferan species that live in the transitional area of the Chilean littoral could be due to the lack of studies and gathering in the southern extreme of Chile. Thus, intensive studies in this last area could demonstrate that such species are characteristical elements of cold temperature or subantarctic waters that are distributed in the Chilean Center Province reaching in the same one their more boreal boundaries of dispersion. If such a situation could be demonstrated we would have in this area of the Chilean littoral three faunal units: one of warm and warm temperate waters (*Excirolana braziliensis*), one of cold and temperate waters (*Chaetilia paucidens, Macrochiridothea setifer, M. mehuinensis* and *M.* aff. *lilianae*) and one belonging only to the area (*Excirolana hirsuticauda* and *M. monodi*).

ACKNOWLEDGMENTS

The author is grateful to Mr. Roy Olerod (Naturhistoriska Riskmuseet, Stockholm) for the loan of type specimens of *Chaetilia paucidens* and *Macrochiridothea setifer*, beside paratype specimens of *Excirolana hirsuticauda.* To Dr. J. Castilla (Universidad Católica de Chile, Santiago) for his valuable communications and specially to the Dirección de Investigación, Universidad Austral de Chile by Grants IV.3.2. (1976) and S-77-37 (1977).

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