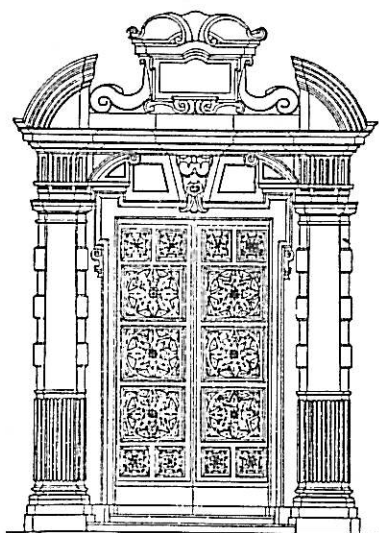


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New taxa of Poecilini
(Coleoptera, Carabidae,
Pterostichinae)
from the Azores

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ABSTRACT

A new genus (*Cedrurum* n. gen.), a new species (*C. azoricus* n. sp.) including its nominate subspecies (*C. a. azoricus*) and a new subspecies (*C. a. caveirensis* n. ssp.) of Poecilini are described (Coleoptera, Carabidae, Pterostichinae), collected during a pitfall survey in the Azorean Climax pattern of autochthonous forest from the Terceira island (1989-1991) and during the Expeditions "Santa Maria e Formigas 90" (June 1990) and "Laurel-Pico 92" (July 1992) to the islands of S. Maria and Pico respectively. Some comments on the systematics, distribution and origin of the new taxa are made. The seasonality of the Terceira population is also presented.

INTRODUCTION

During a pitfall survey in several habitats from the Terceira island (1989-1991) (see Borges, in prep.) the junior author (P. Borges) had the opportunity to collect some specimens of a ground-beetle (Coleoptera, Carabidae) belonging to an undescribed genus (*Cedrurum* n.gen.) and species (*C. azoricus* n.sp.).

Later, during the Zoological Expedition of the University of Azores (Department of Biology) to the island of S. Maria (11-19 June 1990) (see also Borges, 1991), and the Botanical Expedition "Laurel-Pico 92" (1-15 July 1992) to the island of Pico, more specimens were collected by the same author. As a consequence of differences mainly on the head and pronotum, a new subspecies is described from Pico, *C. a. caveirensis* n.ssp..

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Although peculiar and very isolated, these new taxa belong to the tribe Poecilini of the subfamily Pterostichinae.

All the Terceira specimens were collected by means of pitfall traps using several baits (Turquin, Vinegar and Formalin) (see Borges, 1992a). As a consequence of that we present the seasonality of the adults of the population from Terceira during the years 1990-1991. The specimen from S. Maria was only collected by intensive searching, in spite of the large set of pitfall traps used. The specimens of Pico were collected mainly by pitfall trapping (four), but two specimens were also collected by intensive searching.

A recent checklist of the Azorean Coleoptera (Borges, 1990) lists 15 species and subspecies of endemic carabid beetles (31,9% of the total carabid Azorean beetle fauna). The discovery of *Cedrurum azoricus azoricus* and *C. a. caveirensis* bring the number up to 17 (36,2% of endemism in the Azorean ground-beetles). *Pseudanchomenus* Tarnier and *Cedrurum* n. gen. are now the endemic ground-beetle genera known to occur in the Azores.

Some comments on the systematics, distribution and origin of the new taxa are presented.

***Cedrurum* n. gen.**

Figs. 1, 2, 3 and 4

Type species: *Cedrurum azoricus* n.sp..

Apterous. Body in general dark brown to black. Integument moderately shining. With elongate body shape, type Pterostichoid (Fig. 1).

This genus is characterized by the following features: epipleura not crossed, absence of pubescence on the tarsi; onychium without ventral pubescence; right paramere of "Synuchus - type" (see Jeannel, 1942; p. 840) (Fig. 2c) and the distal part of left paramere without membranous extension (see Fig. 2b); spermatheca with short ductus and without rings.

Antennae long, pubescent from segment 4. Palpi with last segment truncate at apex. The last two segments of maxillary palpi similar in size. Mentum tooth bifid. Genae and temporae glabrous.

Pronotum subcordate, with a setiferous pore on each side and in the hind angles (Figs 4a and 4b). Prosternum posteriorly widely truncate, unreborded and not carinate. Scutellar stria over the first interval. Mesoepisterna and metaepisterna short, with dense meshes and with a distinct punctuation.

Abdominal segments all transversely and posteriorly marginated; with a setae on each side of the middle line on the 3rd, 4th, 5th and 6th anal parts of the abdominal segments in the males; in the females the last abdominal segment has two pairs of setae.

Aedeagus curved, with ostium displaced to the right side at the apex (Fig. 2a), and with a ligula cut in the middle (Fig. 2d).

Terminal stylomere with three or four spines in the outer margin, two or three spines in the internal margin and two pre-apical setae placed together (Fig. 3).

Derivatio nominis. The new genus is named after the vegetation type where it was found, the Azorean high altitude "cloud-zone forest" of "Cedro", *Juniperus brevifolia* (Seub.) Antoine. The genus is masculine.

***Cedrorum azoricus* n. sp.**

Figs. 1, 2 and 4b

Type locality: The Azores, Terceira (Terra Brava, Pico Alto); Santa Maria (Pico Alto).

Type material: *Holotype*: 1 male, 5-18.III.1990, Terra Brava - Pico Alto, Terceira, (P. Borges & F. Pereira *leg.*). Deposited in the University of Azores in Terceira (UAT); *Allotype*: 1 female, 21.VII-3.VIII.1990, Terra Brava - Pico Alto, Terceira, (P. Borges & F. Pereira *leg.*). Deposited in the University of Azores in Terceira (UAT); *Paratypes*: 1 male and 1 female, 18.V-1.VI.1990, Terra Brava - Pico Alto, Terceira, (P. Borges & F. Pereira *leg.*); 2 females, same locality, but 22.VI-6.VIII.1990 (P. Borges & F. Pereira *leg.*); 1 female, 17.VI.1990 Pico Alto, Santa Maria (P. Borges *leg.*); 2 males 21.VII-3.VIII.1990, Terra Brava - Pico Alto, Terceira, (P. Borges & F. Pereira *leg.*); 1 female, same locality, but 5-18.VIII.1990 (P. Borges & F. Pereira *leg.*); 3 males and 3 females, same locality, but 30.IX-14.X.1990 (P. Borges & M. Brás *leg.*); 1 male and 1 female, same locality, but 14-28.X.1990 (P. Borges & M. Brás *leg.*); 1 female, same locality, but 5-21.VI.1991 (P. Borges *leg.*); 1 female, same locality, but 6-20.VII.1991 (P. Borges *leg.*); 1 male and 1 female, same locality, but 30.VII-17.VIII.1991 (P. Borges *leg.*); 1 male and 3 females, same locality, but 3-14.IX.1991 (P. Borges *leg.*); 1 male and 2 females, same locality, but 27.IX-10.X.1991 (P. Borges *leg.*); 1 female, same locality, but 25.X-9.XI.1991 (P. Borges *leg.*); Two males, two females from Terceira, Paratypes, deposited in coll. A. Serrano, University of Lisbon, Faculty of Sciences; one male and one female from Terceira, Paratypes, deposited in coll. A. Machado, La Laguna, Canaries; one female from Terceira, Paratype, deposited in coll. P. Oromí, University of La Laguna, Canaries; one male and one female from Terceira, Paratypes, deposited in coll. P. M. Giachino, Torino (Italy); one male and one female from Terceira, Paratypes, deposited in coll. R. Sciaky (Milano, Italy); one male and one female from Terceira, Paratypes, deposited in coll. A. Casale, Torino (Italy); four males and eleven females Paratypes deposited in coll. UAT.

Diagnosis: Recognized by the form of pronotum (Figs 1 and 4b), the absence of crossed epipleura (Fig. 1), the shape of the aedeagus (Fig. 2) and the shape of the terminal stylomere (Fig. 3).

DESCRIPTION

Male

Size. Body length: 14,11-15,98 mm (Average = 14,95 mm); body width: 4,75-5,26 mm (Average = 5,06 mm). Apterous. With elongate body shape, of Pterostichoid type, depressed or subconvex (Fig. 1).

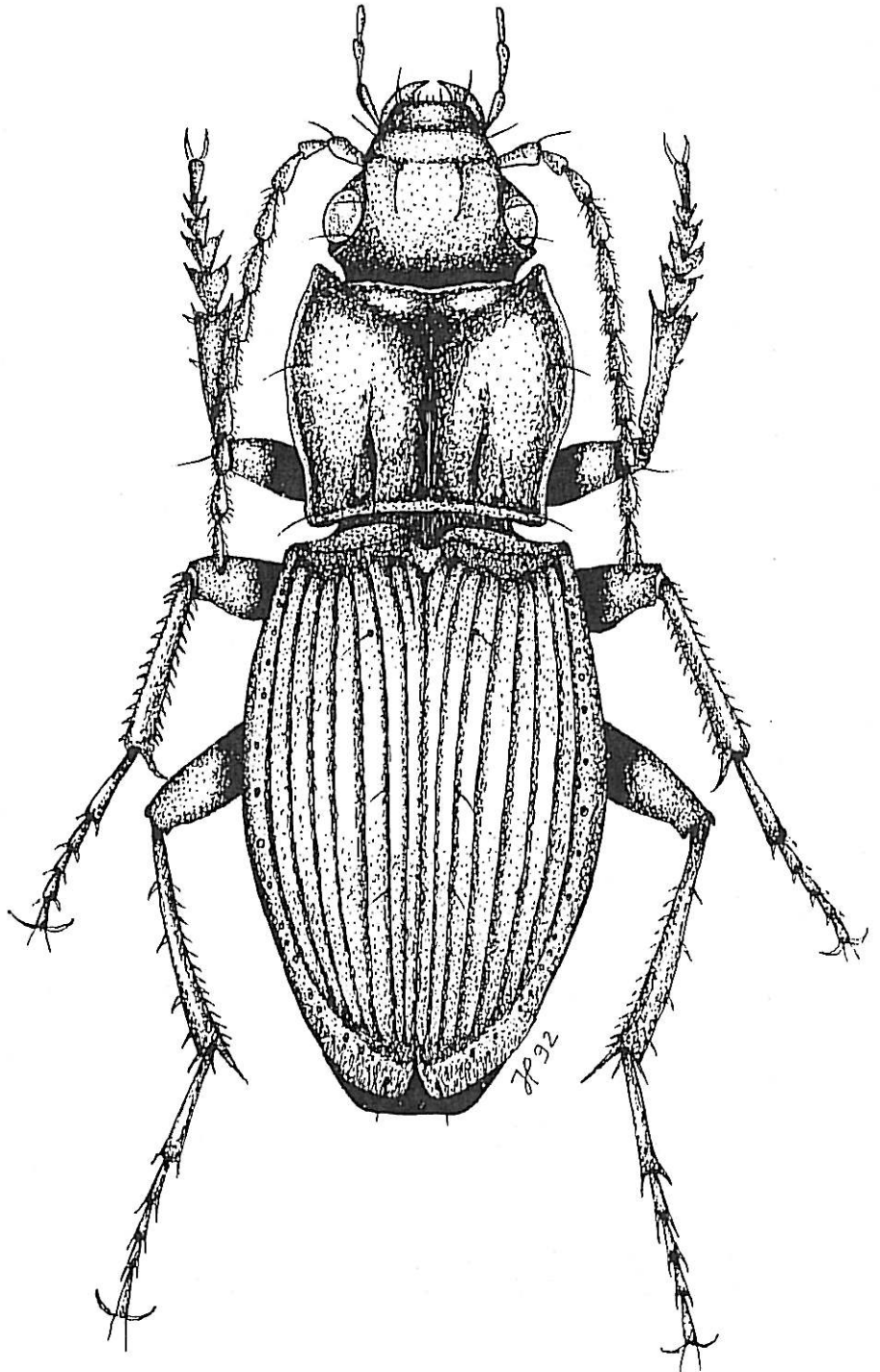


Figure 1 - Dorsal view of *Cedrorum azoricus* n. sp.: habitus (Holotype male). Scale: 1 mm (Original drawing by J.P. Barreiros).

Integument. Shining dark brown to black, often with metallic tinge; mouthparts and appendages brown except infuscated femora and tibia. Lateral and hind margin of pronotum and lateral border of elytra brownish. Antenna pubescence yellowish.

Head. Slightly narrower than pronotum (0,67x). Eyes well developed and slightly prominent.

Cephalic chaetotaxy as in the Pterostichinae: two pair of supraorbital setiferous pores present, two setae (one on each side) near the lateral side of the clypeus and six setae on the front part of the labrum. The anterior margin of labrum concavely arcuate.

Mouthparts like in the other Pterostichinae. First segment of the labial palpi with two setae; last segment with the apex truncated. The last two segments of the maxillary palpi subequal. Mentum bifid.

Frontal furrows only slightly impressed.

Integuments in lateral supraorbital areas with strongly coarsely engraved longitudinal arranged rows, reaching the temporae and genae and to form longitudinal elongate meshes. Vertex almost smooth.

Antennae. Length: 6,91-7,78 mm (Average = 7,46 mm). Elongate, reaching the first third of the elytra; antennomeres 5th-11th compressed and 4th-11th pubescent.

Pronotum. Length: 3,07-3,58 mm (Average = 3,29 mm); Width: 4,02-4,60 mm (Average = 4,29 mm); Slightly transverse, 1,31x as wide as long. Widest part immediately behind the first setiferous pore.

Subcordate, rounded at the sides, moderately sinuate posteriorly. Hind angles acute; front angles prominent. Base very sinuate and unbordered. Margins narrowly beaded, laterobasally with poorly developed carina. Median furrow in the disc deeply impressed, the disc depressed. Two pairs of setiferous pores, one near the middle and one in the hind angles.

Basal region reticulate and sparsely punctate, reaching the lateral margins and terminating just behind the middle.

Front margin strongly arched, and border with yellow setae.

Elytra. Length: 7,92-8,93 mm (Average = 8,38 mm); Width: 4,75-5,26 mm (Average = 5,06 mm); About 1,18x as wide as pronotum. Long, distinctly longer (1,66x) than broad. Slightly oval.

Elytral shoulder well marked. Humeral tooth present but only slightly developed. Basal carina subsinuate and slightly depressed in the middle; marginal furrow large.

Epipleura "uncrossed"; the posterior lateral part of the elytra strongly aplanate. Apex rounded. Elytral disc with some convexity. Tegument with a distinct microreticulation.

Three pairs of discal pores: anterior setiferous pore in the third interval closer to the third striae; the intermediate and posterior setiferous pores in the middle of the third interval. Scutellar pore absent. Basal stria between the scutellum and the first striae. Apical and subapical setae present and adjoining the seventh striae. Umbelical series $6+1(2)+9$. Striae all well impressed, the intervals subconvex.

All abdominal segments glabrous and transversely and posteriorly marginated; a setae is present on each side of the middle line of the 3rd, 4th, 5th and 6th anal parts. Abdominal segments are strongly punctulate in the lateral side from the 1st to the 3rd segment, being sparsely punctulate in the 4th and 5th and with no punctuation on the 6th.

Legs. Normal; tibia slightly bent. Tarsi without pubescence; onychium without ventral pubescence. The first three segments of the pre-tarsus are asymmetrically dilated and cordiform. Claws simple.

Aedeagus (Fig. 2). Curved and with the apex slightly displaced to the right side. The apical ostium is large and the lips of the endophallus are chitinated. The right paramere type *Synuchus* (see Jeannel, 1942; p. 840) and the left paramere with the distal part without membranous extension.

Female

Size. Body length: 14,11-15,98 mm (Average = 15,32 mm); body width 4,52-5,62 mm (Average = 5,17 mm). Habitus similar to the male, but the body in general bigger.

Antennae. Length: 6,91-7,63 mm (Average = 7,28 mm).

Pronotum. Length: 3,07-3,58 mm (Average = 3,35 mm); Width: 4,02-4,67 mm (Average = 4,39 mm); 1,31x as wide as long like in the males.

Basal region more reticulate and more punctulate than in the male, reaching the lateral margins and terminating just behind the middle (Fig. 4b).

Elytra. Length: 8,06-9,22 mm (Average = 8,62 mm); Width: 4,52-5,62 mm (Average = 5,17 mm); About 1,18x as wide as pronotum. Distinctly longer (1,67x) than broad.

Abdominal segments with a setae in each side of the median line on the 3rd, 4th, 5th anal parts of the abdominal segments as in the male but the last abdominal segment (6th) has two pairs of setae. Abdominal segments (from the 1st to the 3rd segment) strongly and more punctulate in the lateral side than in the male, being sparsely punctulate in the 4th and 5th and with no punctuation in the 6th.

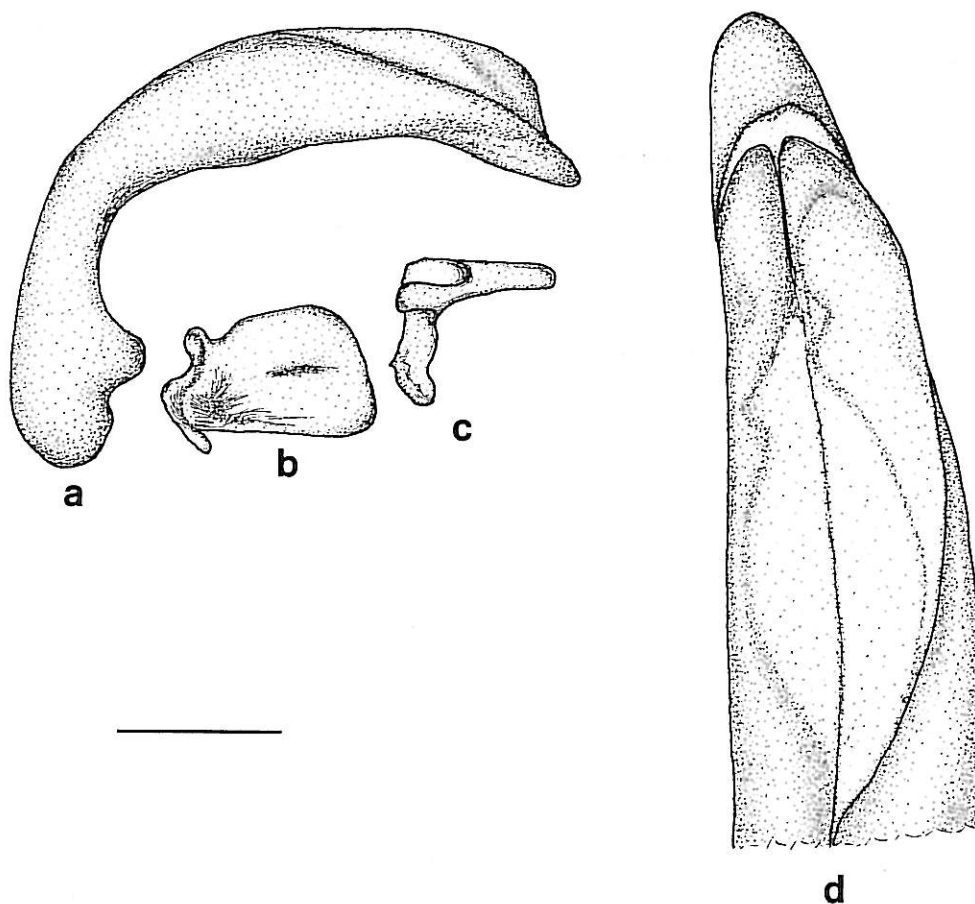


Figure 2 - *Cedrorum azoricus* n. sp. (Holotype male): a = lateral view of aedeagus; b = lateral view of left paramere; c = lateral view of right paramere; d = apical portion of median lobe of aedeagus, in dorsal view. Scale: a,b,c = 1 mm; d = 0,5 mm.

Genitalia. Spermatheca with short ductus and without rings [Note: a more detailed description of this type of female genitalia is presented in Giachino & Sciaky (1991)]. The terminal stylomere has three or four spines in the outer margin, two or three spines in the internal margin and two pre-apical setae placed together (Fig. 3).

Derivatio nominis. Named based on the archipelago where it has been found.

Bionomics. In the Terceira island the species was collected using pitfall traps with several baits (Turquin, Vinegar and Formalin) in a natural forest

consisting mainly of *Juniperus* and *Laurus*-trees. The specimen from S. Mar island was collected by means of intensive search, in the Natural Reserve of Pico Alto, in the same type of vegetation.

***Cedrorum azoricus caveirensis* n. ssp.**

Figs. 3 and 4a

Type locality: The Azores, Pico (Cabeço do Caveiro).

Type material: *Holotype*: 1 male, 3-13.VII.1992, Cabeço do Caveiro, Pico (P. Borges leg.) Deposited in the University of Azores in Terceira (UAT); *Allotype*: 1 female, 3-13.VII.1992, Cabeço do Caveiro, Pico (P. Borges leg.). Deposited in the University of Azores in Terceira (UAT); *Paratypes*: 1 male and 1 female, 8.VII.1992, Cabeço do Caveiro, Pico (P. Borges leg.); females, same locality, but 3-13.VII.1992 (P. Borges leg.). One male and one female Paratype deposited in coll. A. Serrano, University of Lisbon, Faculty of Sciences; two females Paratype deposited in coll. UAT.

Diagnosis: Recognized by the form of pronotum (Fig. 4a) and the lack of punctuation in the head and pronotum.

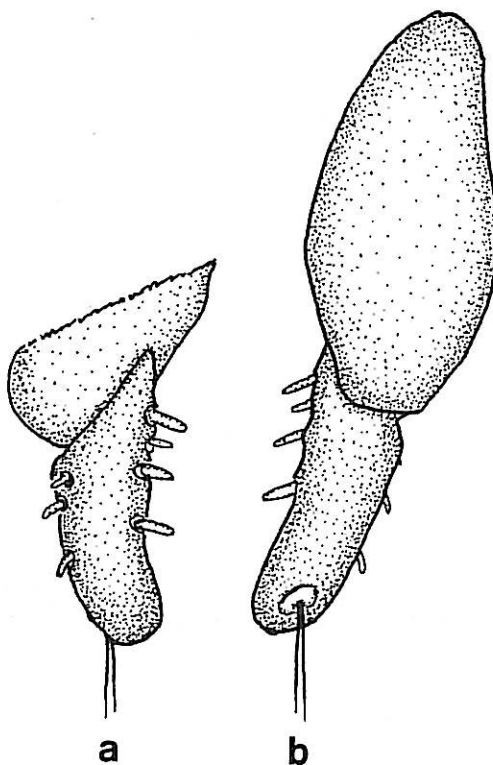


Figure 3 - Terminal stylomere of *Cedrorum azoricus caveirensis* n. ssp. (Allotype female): a = dorsal view; b = ventral view. Scale: 0,5 mm.

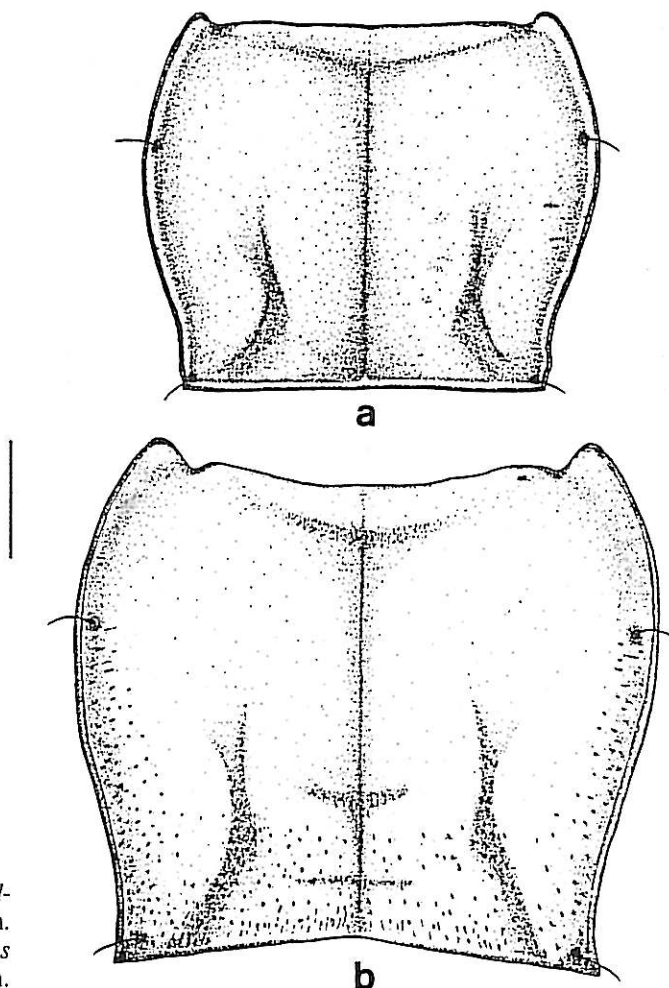


Figure 4 - Pronotum: a = *Cedrorum azoricus caveirensis* n. ssp.; b = *Cedrorum azoricus azoricus* n. ssp.. Scale: 1 mm.

DESCRIPTION

(Note: In this description we will only present the differences in relation to the nominate subspecies *C. a. azoricus*).

Male

Size. Body length: 13,39-15,54 mm (Average = 14,46 mm); body width: 4,60-4,67 mm (Average = 4,54 mm). Apterous. In general smaller and more convex than *C. a. azoricus*.

Integument. Black.

Head. Narrower than pronotum (0,75x). Tegument in general almost smooth.

Antennae. Length: 6,06 mm (Average = 6,06 mm).

Pronotum. Length: 2,99-3,14 mm (Average = 3,07 mm); Width: 3,61-3,87 mm (Average = 3,76 mm); Less transverse, 1,25x as wide as long.

Subcordiform; hind angles almost straight; the front angles less prominent. Front and basal margins not sinuate, almost linear. Median furrow less impressed, the disc convex.

As in the head the tegument is in general almost smooth.

Elytra. Length: 7,78-7,92 mm (Average = 7,85 mm); Width: 4,60-4,6 mm (Average = 4,64 mm); About 1,23x as wide as pronotum. Long, distinctly longer (1,69x) than broad.

Elytral shoulder less marked. Humeral tooth not visible. Marginal beak narrower.

Female

Size. Body length: 14,69-14,98 mm (Average = 14,76 mm); body width 4,60-4,89 mm (Average = 4,73 mm). Habitus similar to the male, but the body in general larger.

Antennae. Length: 5,77-5,99 mm (Average = 5,86 mm).

Pronotum. Length: 2,99-3,29 mm (Average = 3,14 mm); Width: 3,65-4,09 mm (Average = 3,85 mm); Less transverse, 1,23x as wide as long.

The differences between *C. a. azoricus* and *C. a. caveirensis* n. ssp. in the shape of pronotum are more evident in the females being in general more aplanated and transverse in *azoricus* (Fig. 4b) and more convex and smooth in *caveirensis* (Fig. 4a).

Elytra. Length: 7,49-8,21 mm (Average = 7,88 mm); Width: 4,60-4,89 mm (Average = 4,73 mm). About 1,23x as wide as pronotum.

Derivatio nominis. Named based on the place where it was found

Bionomics. This new subspecies from Pico was collected using pitfall traps with several baits (Turquin, Vinegar and Formalin) and by means of intensive search in the high altitude Climax pattern of autochthonous forest consisting mainly of *Juniperus* - trees.

SEASONALITY

MATERIAL AND METHODS

The trapping site was primarily selected to cover the major autochthonous plant community in the Azores. The chosen area is a natural forest, consisting mainly of *Juniperus* and *Laurus* - trees in the Terceira island (Terra Brava, Pico Alto; 500 m of altitude).

A total of 18 pitfall traps in series of 6 for each of the three baits, were used. The traps were used from November 1989 to November 1991, and had been in operation during two weeks in each month. The pitfall traps used had a radius of 22 mm and a depth of 80 mm. They were dug into the ground in a linear transept.

The baits used were: 5% Formalin solution with some detergent added; Turquin liquid - (Ashmole & Ashmole, 1987) [10 g chloral hydrate, 5 ml formalin, 5 ml glacial acetic acid, 1 ml detergent and dark beer to 1 litre]; Vinegar (modified from Iacovone, 1985) [solution with 50% of commercial vinegar and 50% of water, and 10 ml of formalin and 1 ml of detergent for each litre of solution].

RESULTS

The Pitfall results (Fig. 5) show that the activity peak was somewhat similar in both years, with the maximum around September-October. This peak of

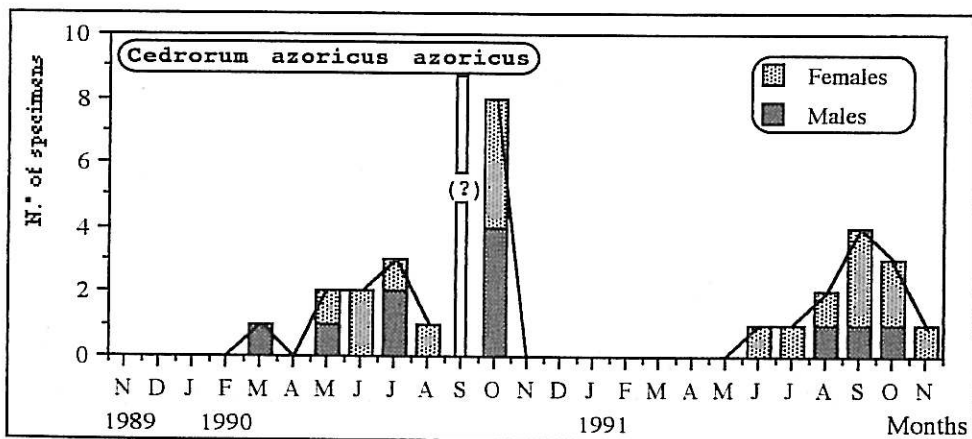


Figure 5 - Seasonal activity from November 1989 to November 1991 of the adults of *Cedrorum azoricus azoricus* in the Climax pattern of autochthonous forest of Pico Alto (Terceira, Azores) (see text for further explanations).

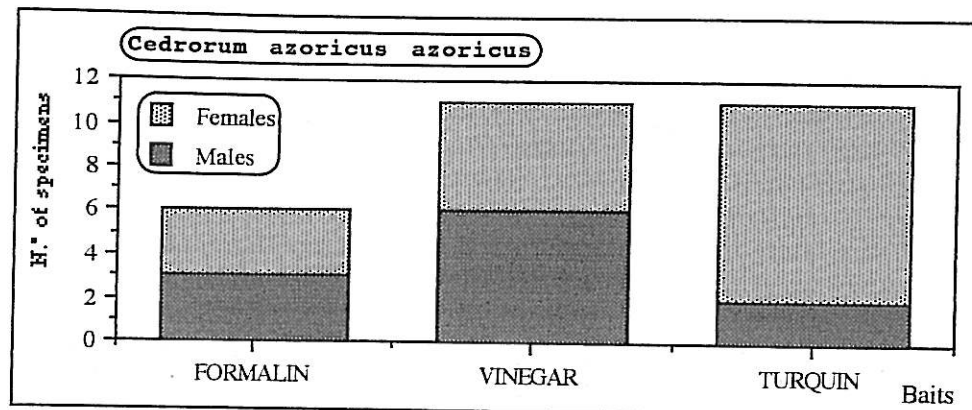


Figure 6 - Differential pattern of attraction of the adults of *Cedrorum azoricus azoricus* by the three baits used in the pitfall traps (see text for further explanations).

activity is coincident with the beginning of the Azorean autumn. The results also show that the beginning of the activity of the adults was somewhat heterogeneous in the two years, starting in March (1990) and in June (1991). The reasons for these differences could be related to some climatic factors.

Therefore, *Cedrorum azoricus* n.sp. is an "autumn-breeder", (*sensu* Larson, 1933), that may reproduce in autumn or even from the height of summer onwards and usually hibernate as larvae. Thus, larva and pupa may develop (including larval dormancy) during a long wet season from autumn to late spring (about 9 to 10 months from September to June) (Hurka, 1986). Such type of development seems to be rare in other Ground-Beetles species from the Azores (see Borges, manuscript) or Canaries (see Machado, 1992), where most of the Carabids investigated by these authors, a lot of the Canarian ones endemic inhabitants of climax forests, are true "spring-breeders". However, Peraza et al. (1986) in Machado (op. cit.) found in four high altitude endemic Canarian *Calathus* spp. a slightly similar phenological pattern to *Cedrorum*, being probably this fact related to similar ecological requirements.

Concerning the sex-ratio, the traps caught a higher number of females mainly in the second year. This can probably be biased by the different baits used in the traps. In fact, Fig. 6 shows us that Turquin attracted more females than males, being the males collected mainly by Formalin and Vinegar.

DISCUSSION

This new genus (*Cedrorum* n. gen.) belongs to the tribe Poecilini of the subfamily Pterostichinae. It is probably in the same phyletic line of *Wolltinerfia* and *Eutrichopus* (two endemic Canarian genera), in which the aedeagus has

a ligula cut in the middle. The uncrossed epipleura are a peculiar character of *Cedrurum*.

On the other hand it is interesting to notice that the right paramere of the aedeagus is of *Synuchus* type (*Synuchini*) (Casale, 1988).

Concerning the female genitalia, the gonostyli of *Cedrurum* n. gen. agrees with the gonostyli so far examined in *Poecilini*, and this is also true for other characters (e.g. shape of bursa copulatrix, spermatheca with short ductus) (Casale and Giachino, pers. comm.; Giachino & Sciaky, 1991).

Particularly, the gonostylus morphology is extremely similar to that of *Wolltinertia* Machado (see Machado, 1992), an endemic genus of Tenerife including specialized, microphthalmic, endogean species.

As pointed out by Borges (1992b) most of the beetle endemic species are allopatrically distributed in the Azores with the exception of some *Tarphius* (Coleoptera, Colydiidae) and the paleo-endemic Carabid *Pseudanchomenus aptinoides* Tarnier (found on Pico and S. Miguel); the same is true for the nominate subspecies of *Cedrurum azoricus* n. sp. that is presently known from Terceira and S. Maria.

Remarkable is the presence of *P. aptinoides* and *Cedrurum azoricus caveirensis* n.ssp. in the same place (Cabeço do Caveiro) in Pico. However, the two species were collected in two different fractions of the sampled area: the specimens of *P. aptinoides* were collected in traps burrowed in mud conduits in the soil of a dense *Juniperus* - Forest; the specimens of *C. a. caveirensis* n.ssp. were collected either by traps or under stones in an open "wet peatland vegetation mire", biotope marginating the *Juniperus* - Forest.

Also interesting is the fact that *P. aptinoides* Tarnier (found on Pico and S. Miguel) and *Cedrurum azoricus* n. sp. (found on Terceira, Pico and S. Maria) occur simultaneously on a old island (S. Miguel or S. Maria) and on a geologically young island(s) (Pico or/and Terceira). This leads us to the hypothesis that both are paleo-endemics (*sensu* Lindroth, 1960), being relict species and inhabitants of the Climax pattern of autochthonous forest. The fact that *C. azoricus* n. sp. has a primitive female genitalia reinforces this hypothesis. Furthermore, Hurka (1986) states that development with larval dormancy, which seems to occur in *C. azoricus* n. sp., is the original (therefore, primitive) type of reproduction in the temperate zones.

The fact that both species are flightless does not impossibilite their capacity of dispersion from the older to the younger islands. For instance Ashmole & Ashmole (1988) demonstrated that a wide variety of endemic species from Tenerife, some flightless or scarcely vagile, do participate in aerial dispersal. Thus, the occurrence of a new subspecies (*C. a. caveirensis* n. ssp.) in Pico is probably a consequence of a recent and rapid divergency via the founder effect.

The occurrence of a new genus of *Poecilini* in the Azores is quite interesting: the hypothesis that *Cedrurum* n. gen. belongs to the same phyletic line of

Eutrichopus and *Wolltinerfia* (two endemic Canarian ground-beetle genera) could confirm the hypothesis already advanced by Borges (1992b) that there is a close relationship between the Azorean endemics and some Madeiran and Canarian relatives. These facts give plausibility to a colonization of the Azores originating in a Macaronesian "Island Rosary" ("stepping stones" theory).

The Azorean beetle fauna is presently known to consist of 526 species and subspecies, in 307 genera, in 51 families and the number of known species and subspecies for each island is now: 21 from Corvo, 182 from Flores, 212 from Faial, 156 from Pico, 101 from Graciosa, 121 from S. Jorge, 246 from Terceira, 336 from S. Miguel and 252 from S. Maria (up-dated from Borges, 1990 and 1992b).

As concluded by Borges (1992b) the poverty of the Azorean Coleoptera is somewhat illusory, because the differences in diversity between the Azores and other Macaronesian archipelagoes may be explained, in a probable order of importance by: isolation, geological youth, lack of strong ecological diversity and an unsuitable humid climate. The action of the Pleistocene glaciations, in spite of being difficult to prove, could provide an alternative or complementary explanation to the others (see for instance Eason & Ashmole, 1992).

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We would also like to thank our companions Mr. F. Pereira and Lic. M. Brás for their help in collecting beetles. Our sincere thanks to Eng. J. P. Barreiros for drawing of the habitus of the species described.

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RIASSUNTO

Nuovi taxa di Poecilini (Coleoptera, Carabidae, Pterostichinae) delle Azzorre.

Cedrorum (n. gen.) *azoricus* n.sp. e *C. azoricus caveirensis* n.ssp. di Poecilini sono descritti delle formazioni forestali-autoctone dell'Isola di Terceira (spedizione "Santa Maria e Formigas 90") e dell'Isola di Pico (spedizione "Laurel-Pico 92").

Sono discusse la posizione sistematica, la distribuzione, l'origine dei nuovi taxa e sono presentati i risultati delle indagini sull'attività stagionale della popolazione di Terceira.

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