

New species and new data on the genus *Geocharis* Ehlers 1883 (Coleoptera: Carabidae) from Portugal

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Abstract. Three endogean carabids of the genus *Geocharis* Ehlers 1883 (Carabidae: Trechinae, Anillini) from Portugal, *Geocharis coiffaiti* n. sp., *Geocharis sebastianae* n. sp. and *Geocharis rotundata* n. sp., are described. The work provides diagnostic characters of these species, and in particular, the structure of male genitalia. Affinities with closely related species, as well as ecological and distribution comments are also included. A brief redescription and faunistic notes on *Geocharis femoralis* Coiffait 1968 and a key for the identification of the males of the species found south of the Tejo River in Portugal are also given.

Résumé. Nouvelles espèces et nouvelles données sur le genre *Geocharis* Ehlers 1883 (Coleoptera: Carabidae) au Portugal. Les auteurs décrivent trois nouvelles espèces du genre *Geocharis* Ehlers 1883 (Carabidae: Trechinae, Anillini) du Portugal : *Geocharis coiffaiti* n. sp., *Geocharis sebastianae* n. sp. et *Geocharis rotundata* n. sp. Les affinités des nouvelles espèces avec les plus proches ainsi que des remarques sur leur écologie et distribution sont données. L'espèce *G. femoralis* Coiffait 1968 est redécrite, et des nouvelles localisations sont fournies. Une clé d'identification des mâles des espèces de *Geocharis* trouvées au sud de la rivière Tejo est donnée.

Keywords: Coleoptera, Carabidae, *Geocharis*, New species, Portugal.

Species of the ground beetle subtribe Anillina occur in many parts of the world, such as North and South America, Africa (especially Madagascar), Asia Minor, southern Asia, and New Zeland. Mediterranean Europe is one of the most relevant concerning this group of carabids (Sokolov *et al.* 2004). The genus *Geocharis* Ehlers 1883 and the genus *Thyphlocharis* Dieck 1869 belong to this subtribe and are very speciose in the Iberian Peninsula, with 25 and 37 species recognized, respectively, for this Peninsula (Serrano 2003; Serrano & Aguiar 2004; Zaballos 2005). The knowledge of the systematics and distribution of *Geocharis* species from Portugal has notably increased over the last several years. There are fourteen species of *Geocharis* occurring in this Iberian country and, within this assemblage, ten species are found exclusively at south of the Tejo River (see Serrano & Aguiar 2004).

The species of *Geocharis* are endogean, living in soil and can be found frequently on the bottom surface of the deeply imbedded stones. All species are eyeless (anophtalmous) and apterous. Many species seem very restricted in distribution (precinctive) (e.g.,

G. portalegrensis Serrano & Aguiar 2000, *G. boieiroi* Serrano & Aguiar 2001), while others occur across large geographic areas (e.g., *G. femoralis* Coiffait 1968), both reflecting local and regional patterns of endemism.

This work provides descriptions of three new species of the genus *Geocharis* from Portugal. Moreover we provide additional taxonomic and geographic distribution data for *G. femoralis* and a key to the males of all known species of *Geocharis* found south of the Tejo River in Portugal.

Material and Methods

Field work was conducted in some areas near the Mértola, Almodovar and Odemira localities in the Province of Baixo Alentejo and in several localities throughout the Province of Algarve (both Provinces of Portugal); this resulted in the collection of specimens of endogean beetle species of the subtribe Anillina. After a careful study, we concluded that the specimens represent three new species of the genus *Geocharis*. The specimens were sampled by direct hand collecting under sunken stones in fragments of secondary Mediterranean forest habitats dominated by holm-oaks, rock-roses shrubs and lentisk bushes (*Quercus coccifera* Linnaeus, *Cistus ladanifer* Linnaeus and *Pistacia lentiscus* Linnaeus, respectively) with patches of man-induced land uses. Additional specimens were obtained from samples of soil taken from the above-mentioned localities using Berlese apparatus.

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The morphological study of adult specimens was done using a scanning electron microscope JEOL JSM-5200 LV. Measurements and drawings were done with a Wild M5 stereoscopic microscope equipped with a dissecting microscope ocular micrometer and a drawing tube.

The distribution of species in the descriptions is given in U.T.M. coordinates (1 km x 1 km). For practical reasons, the map used for the representation of distributions is of 10 km x 10 km squares (Fig. 41). Therefore some localities are enclosed in the same 10 km x 10 km square.

Results

Geocharis coiffaiti n. sp.

(Figs 1-8, 33-34, 41)

Holotype ♂: Portugal, Alcútem (U.T.M. coordinates: 29SPB3046), 7.I.2004; Paratypes: same locality and date of Holotype, 3 ♀♀; 5.IV.2004, 6 ♂♂, 7 ♀♀ (2 ♀♀ gold coated); Mértola (U.T.M. coordinates: 29SPB1670 and 29SPB1375), 6.I.2004, 6 ♂♂, 2 ♀♀; Mértola (U.T.M. coordinates: 29SPB1664), 7.I.2004, 2 ♂♂, 3 ♀♀ (1 ♂ and 2 ♀♀ gold coated); Mértola (U.T.M. coordinates: 29SPB1375), 3.IV.2004, 1 ♀; Cachopos (U.T.M. coordinates: 29SPB1223), 8.I.2004, 2 ♂♂, 2 ♀♀; S. João dos Caldeireiros (U.T.M. coordinates: 29SPB0864), 6.IV.2004, 2 ♂♂, 4 ♀♀; Sapos (U.T.M. coordinates: 29SPB2965), 4.IV.2004, 4 ♂♂, 7 ♀♀; Vila Verde do Ficalho (U.T.M. coordinates: 29SPB4995), 4.IV.2004, 6 ♂♂, 4 ♀♀. Holotype and paratypes are deposited in the collection of the senior author, Department of Animal Biology (Faculdade de Ciências da Universidade de Lisboa).

Diagnosis. Anophtalmous; body slightly depressed, brown with integument microreticulate. A sparse pubescence mainly on pronotum and elytra. Elytron without striae, humeral region strongly punctured, disk with one anterior seta and a posterior one. Male forelegs with the first tarsomere dilated. Males and females with a more or less developed median tooth on the internal margin of the metafemora, more robust in males. Mesotibiae with dense pubescence in both margins. Hind tibiae more or less arcuate in the internal margin. Aedeagus as in Figs 33-34.

Description. Length of holotype: 1.9 mm. Length of paratypes: 1.7-2.3 mm (males and females). *Head* (Fig. 1) more or less as long as wide [length: 0.34-0.42 mm (males), 0.35-0.45 mm (females); width: 0.36-0.46 (males), 0.35-0.48 mm (females)], microsculpture distinct. Chaetotaxy (fixed setae): 6 setae on the anterior margin of labrum; one pair of large clypeal setae, 1 frontal seta and 2 supraocular setae over each side and 2 or 3 additional setae on both sides of tempora. Antennae light brown, the 1st and 2nd articles longer than the others, the latter subpyriform, the 3rd and the 4th are the shortest ones and subpyriforms, the 5th to the 10th gradually longer and oval-shaped, the last one acuminate. Mouth-parts (Fig. 2) show the general pattern of the genus. *Pronotum* cordiform (Fig. 3) with round anterior angles, about 1.2 times wider than long [length: 0.38-0.50 mm (males), 0.35-0.50 mm (females); width: 0.46-0.59 mm (males), 0.43-0.60 mm (females); disk slightly convex, depressed between the two basal pits, with or without a very superficial central sulcus; anterior margin slightly arcuate, posterior margin emarginate (Fig. 3); lateral margins with 2 or 3 denticles just before the posterior angles, which are right and

dentate. Vestiture (pubescence): surface covered with scattered erect pubescence; one seta on the lateral margin in the broadest part of the pronotum, another one near the posterior angle; 2 or 3 additional setae inserted near the anterior angles. *Elytra* (Fig. 4) 1.7-1.8 times longer than wide [length: 0.96-1.30 mm (males), 0.91-1.31 mm (females), width: 0.55-0.78 mm (males), 0.53-0.75 mm (females), slightly convex, subparallel and oval posteriorly; the tegument microsculptured and strongly punctured in the shoulders (Fig. 6); disk without striae, a very slight sulcus close to the suture; lateral margin narrow, finely serrate from the humeral angles, which are rounded, to the 5th seta of the umbilicate series. Vestiture (pubescence): part of the pubescence of the disk is arranged in 5-6 irregular lines, these setae are erect and slightly directed anteriorly (Figs 4-5); umbilicate series follows the pattern of the genus. The longest setae of this series are the 2nd, the 6th and the 9th with the 3rd, 5th, 7th and 8th, more slightly inserted within the elytral margin; besides these setae there are 1 parascutellar basad, 2 discal (1 anterior and 1 posterior) and 1 apical seta (Figs 4-5). *Male legs* with the 1st protarsomere dilated; 1st tarsomere in all legs more pigmented (light brown) than the others; mesotibiae with a strong pubescence on both margins; hind femora (males and females) with a more or less strong median tooth on the internal margin (Figs 7-8). *Aedeagus* (Figs 33-34) moderately arcuate, not enlarged before the apex (lateral view), apex broadly rounded and slightly bent down, basal lobe with apophysis not prominent; internal sac as in figure 33; left paramere with 2 apical setae, dorso-basal edge slightly expanded (Fig. 33). The *female genitalia* pattern as for the other species of the genus (e.g., Zaballos & Jeanne 1987; Zaballos 1998).

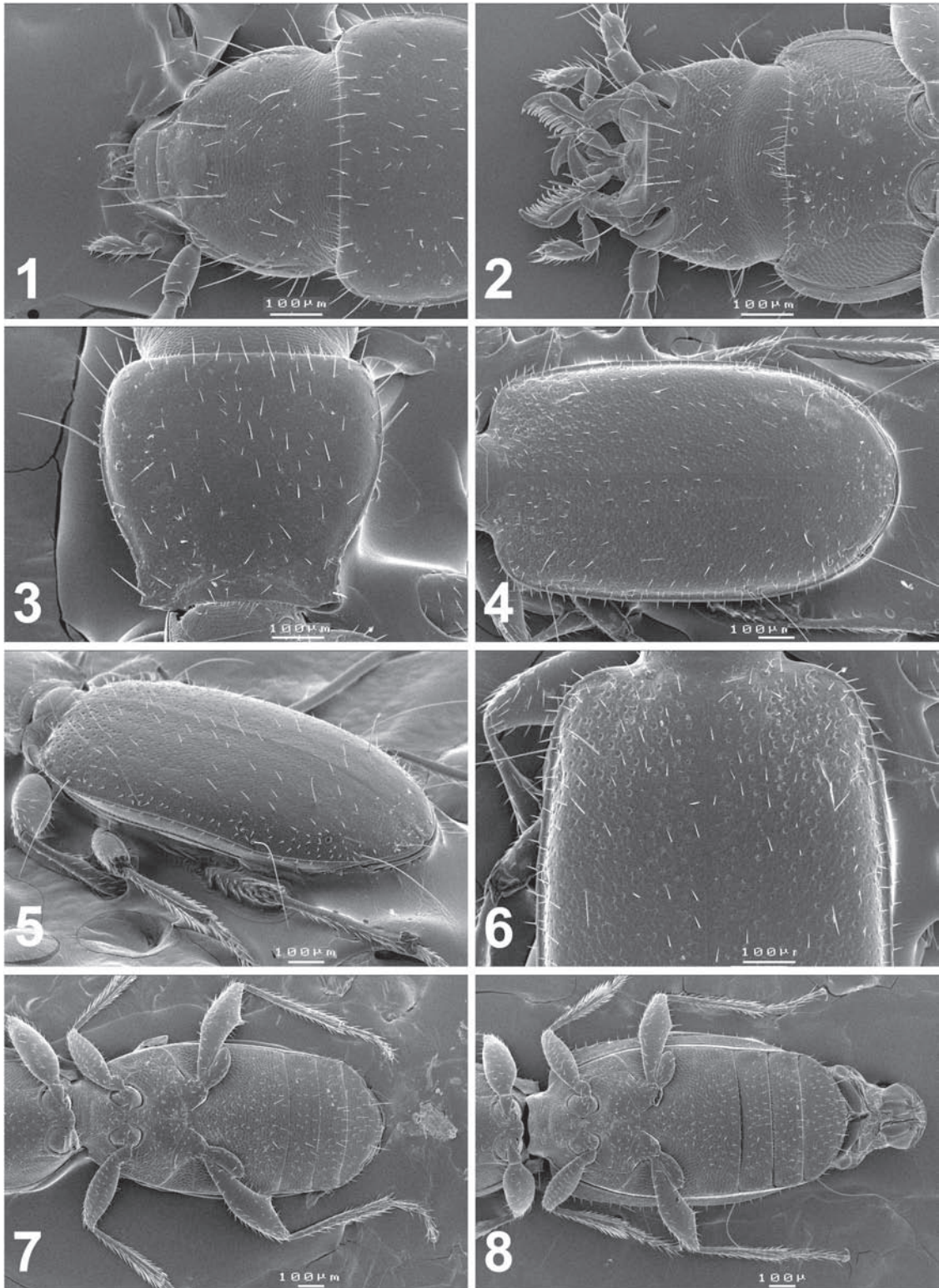
Etymology. This new species is dedicated in modest homage to the memory of the French entomologist Henri Coiffait, who had greatly contributed to the taxonomic and faunistic knowledge of the endogean carabids and staphylinids of Portugal.

Geocharis sebastianae n. sp. (Figs 9-16, 37-38, 41)

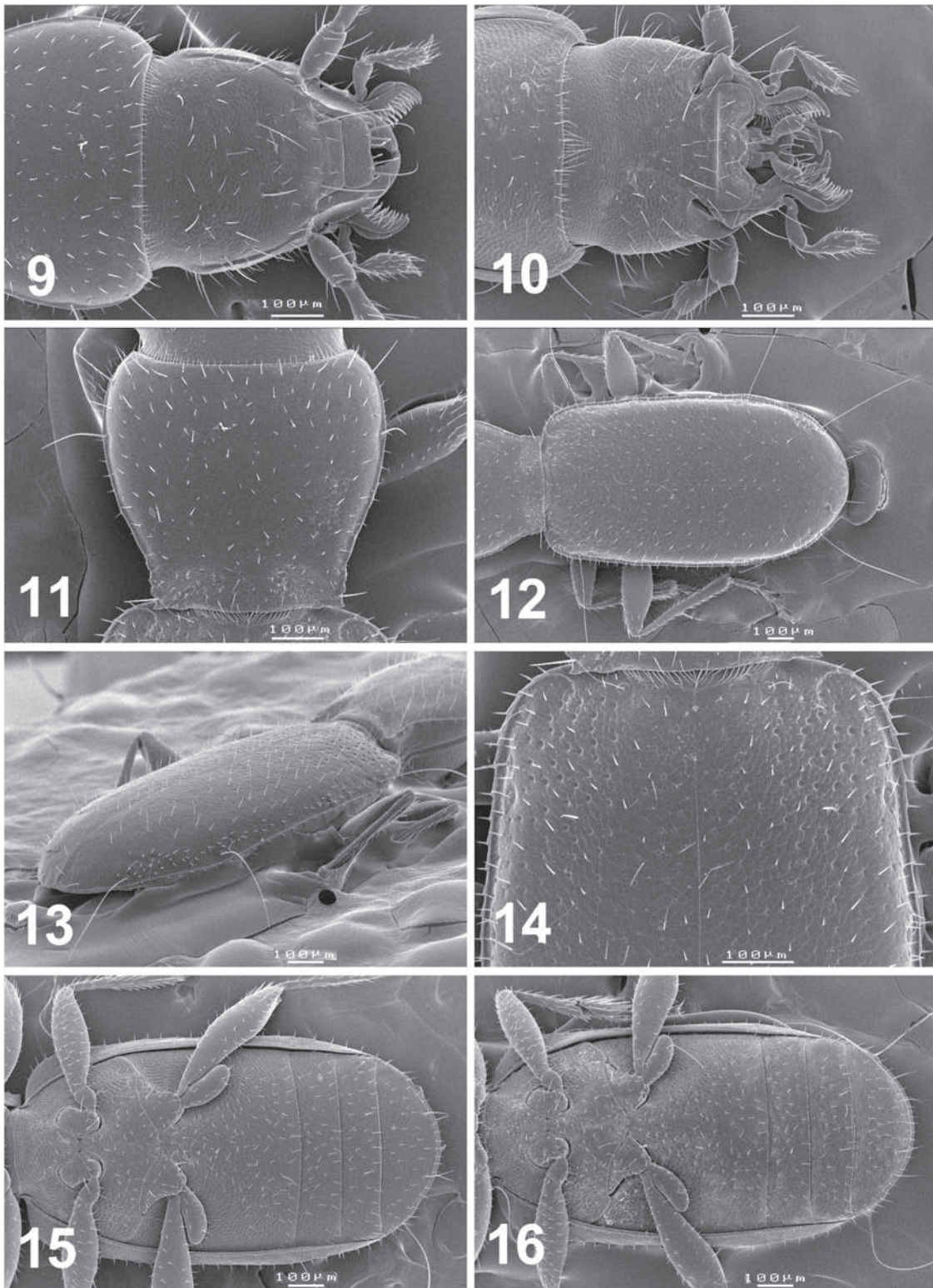
Holotype ♂: Portugal, Bensafrim (U.T.M. coordinates: 29SNB2116), 11.X.2003; Paratypes: Pincho (U.T.M. coordinates: 29SNB2218), 10.I.2004, 2 ♂♂, 3 ♀♀ (1 ♂ and 2 ♀♀ gold coated). Holotype and paratypes are deposited in the collection of the senior author, Department of Animal Biology (Faculdade de Ciências da Universidade de Lisboa).

Diagnosis. Anophtalmous; body depressed, brown with integument strongly microreticulate. A sparse pubescence mainly on pronotum and elytra. Elytron without striae, humeral region strongly punctured, with one anterior seta and a posterior one. Male forelegs with the first tarsomere dilated. Males and females without a median tooth on the internal margin of the metafemora. Hind tibiae slightly arcuate in the internal margin. Aedeagus as in Figs 37-38.

Description. Length of holotype: 2.1 mm. Length of paratypes: 2.0-2.2 mm (males), 2.0-2.1 (females). *Head* (Fig. 9) more or less as long as wide [length: 0.40-0.46 mm (males), 0.40-0.43 mm (females); width: 0.42-0.44 (males), 0.41-0.44 mm (females)], slightly depressed in the insertion of the front and clypeal setae. Chaetotaxy (fixed setae): 6 setae on the anterior margin of labrum; one pair of large clypeal setae, 1 frontal seta and 2 supraocular setae over each side, and 2 or 3 additional setae on both sides of tempora. Antennae light brown, the 1st and 2nd articles longer than the others, the latter subpyriform, the 3rd and the 4th are the shortest ones and subpyriforms, the



Figures 1-8
Geocharis coiffaiti n. sp. 1, head (dorsal view). 2, head (ventral view). 3, pronotum (dorsal view). 4, elytra (dorsal view). 5, left elytron (latero-dorsal view). 6, anterior half of elytra (dorsal view). 7, thorax and abdomen (male, ventral view). 8, thorax and abdomen (female, ventral view).



Figures 9-16

Geocharis sebastianae n. sp. 9, head (dorsal view). 10, head (ventral view). 11, pronotum (dorsal view). 12, elytra (dorsal view). 13, right elytron (latero-dorsal view). 14, anterior half of elytra (dorsal view). 15, thorax and abdomen (male, ventral view). 16, thorax and abdomen (female, ventral view).

5th to the 10th gradually longer and oval-shaped, the last one acuminate. Mouth-parts (Fig. 10) conformed to the genus pattern. *Pronotum* cordiform (Fig. 11) with round anterior angles, about 1.2 times wider than long [length: 0.46-0.48 mm (males), 0.43-0.45 mm (females), width: 0.51-0.55 mm (males), 0.50-0.54 mm (females)]; disk flattened, depressed between the two basal pits, these ones slightly punctured, with a faint central sulcus; anterior margin regularly emarginate, posterior margin almost straight or slightly expanded (Fig. 11); lateral margins with 3 or 4 denticles just before the posterior angles, which are acute and dentate. Vestiture (pubescence): surface covered with erect pubescence; one seta on the lateral margin in the broadest part of the pronotum, another one near the posterior angle; 2-3 or even more additional setae inserted near the anterior angles. *Elytra* (Fig. 12) 1.8 times longer than wide [length: 1.17-1.23 mm (males), 1.14-1.20 mm (females)], width: 0.64-0.67 mm (males), 0.62-0.66 mm (females)], parallel and oval posteriorly; dorso-ventrally flattened on the disk, the tegument microsculptured and strongly punctured in the shoulders (Fig. 14); disk without striae; lateral margin narrow, finely serrated from the humeral angles, which are rounded, to the last seta of the umbilicate series. Vestiture (pubescence): part of the pubescence of the disk is arranged in 6 lines, these setae are erect and slightly directed anteriorly (Figs 12-13), minor setae along the lateral margins from humeral angles to the last seta of the umbilicate series; these series follows the pattern of the genus. The longest setae of this series are the 2nd, the 6th and the 9th with the 3rd, 5th, 7th and 8th, more slightly inserted within the elytral margin; besides these setae there are 1 parascutellar basad, 2 discal (1 anterior and 1 posterior) and 1 apical seta (Figs 12-13). Male *legs* with the first protarsomere dilated; 1st tarsomere in all legs more pigmented (brown) than the others; hind femora of males and females without a median tooth on the internal margin (Figs 15-16); hind tibiae slightly arcuate in the internal margin. *Aedeagus* (Figs 37-38) slightly acuminate in the apex (lateral view), arcuate, apex rounded, basal lobe with apophysis not very prominent; internal sac with a twisted sclerite; left paramere with 2 apical setae, dorso-basal edge expanded (Fig. 37). The *female genitalia* pattern as for the other species of the genus (e.g., Zaballos & Jeanne 1987; Zaballos 1998).

Etymology. This new species is dedicated to an octogenarian native of the Algarve Province, Maria Sebastiana, Godmother and "second mother" of the senior author and which since childhood, has friendly supported his academic career.

Geocharis rotundata n. sp.

(Figs 17-24, 39-40, 41)

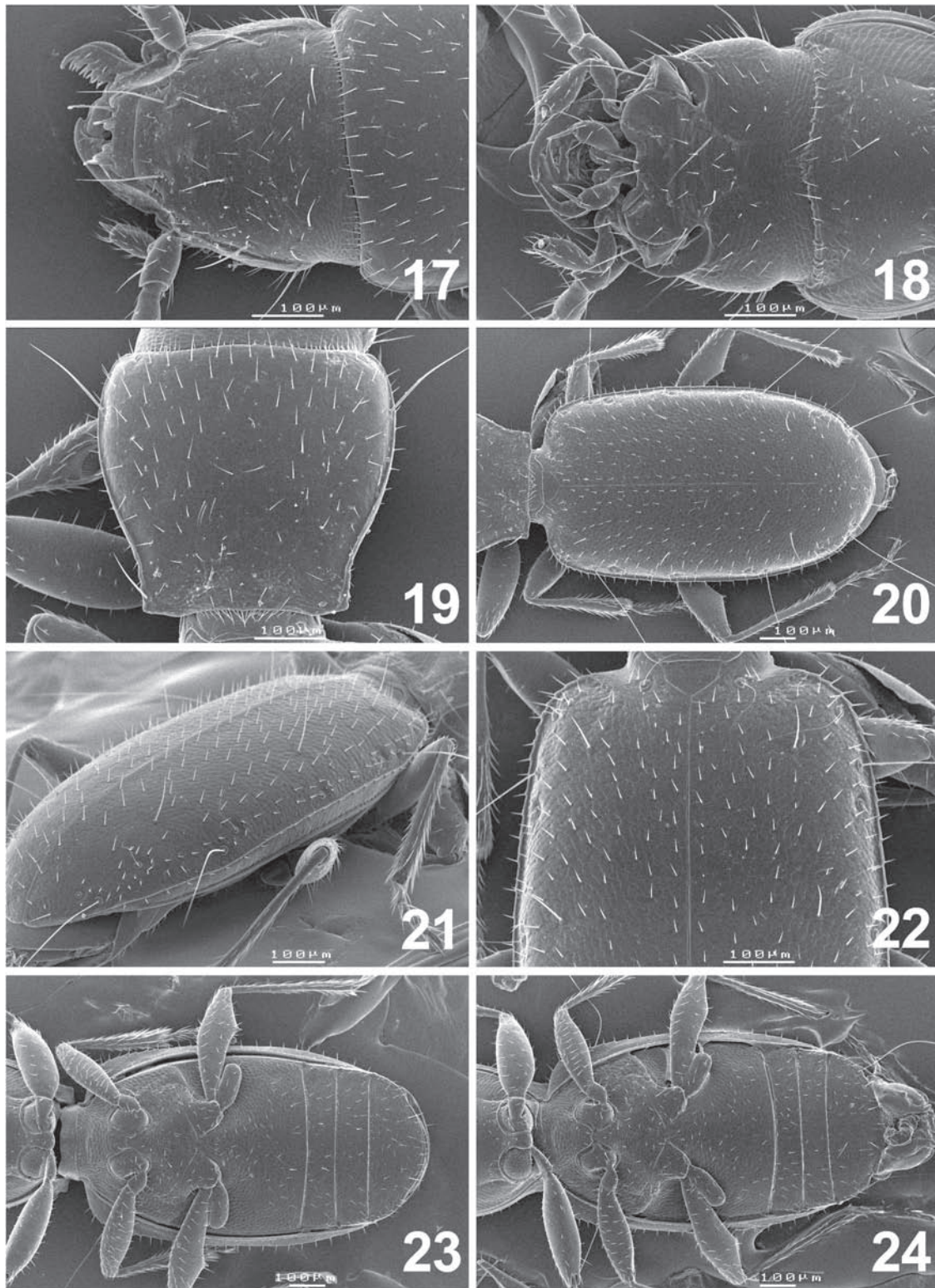
Holotype ♂: Portugal, Vila Verde do Ficalho (U.T.M. coordinates: 29SPB4995), 4.IV.2004. Paratypes: same locality and date of Holotype, 6 ♂♂, 2 ♀♀ (2 ♂♂ and 1 ♀ gold coated). Holotype and paratypes are deposited in the collection of the senior author, Department of Animal Biology (Faculdade de Ciências da Universidade de Lisboa).

Diagnosis. Anophtalmous; body slightly depressed, brown with integument strongly microreticulate. A sparse pubescence mainly on pronotum and elytra. Elytron without striae, disk strongly punctured, with three setae, an anterior, a median and a posterior ones. The longest setae of the umbilicate series are the 2nd, the 6th and the 8th with the 3rd, 5th, 7th and

9th, more slightly inserted within the elytral margin. Male forelegs with the first tarsomere dilated. Males with a median tooth on the internal margin of the metafemora. Hind tibiae slightly arcuate in the internal margin. *Aedeagus* as in Figs 39-40.

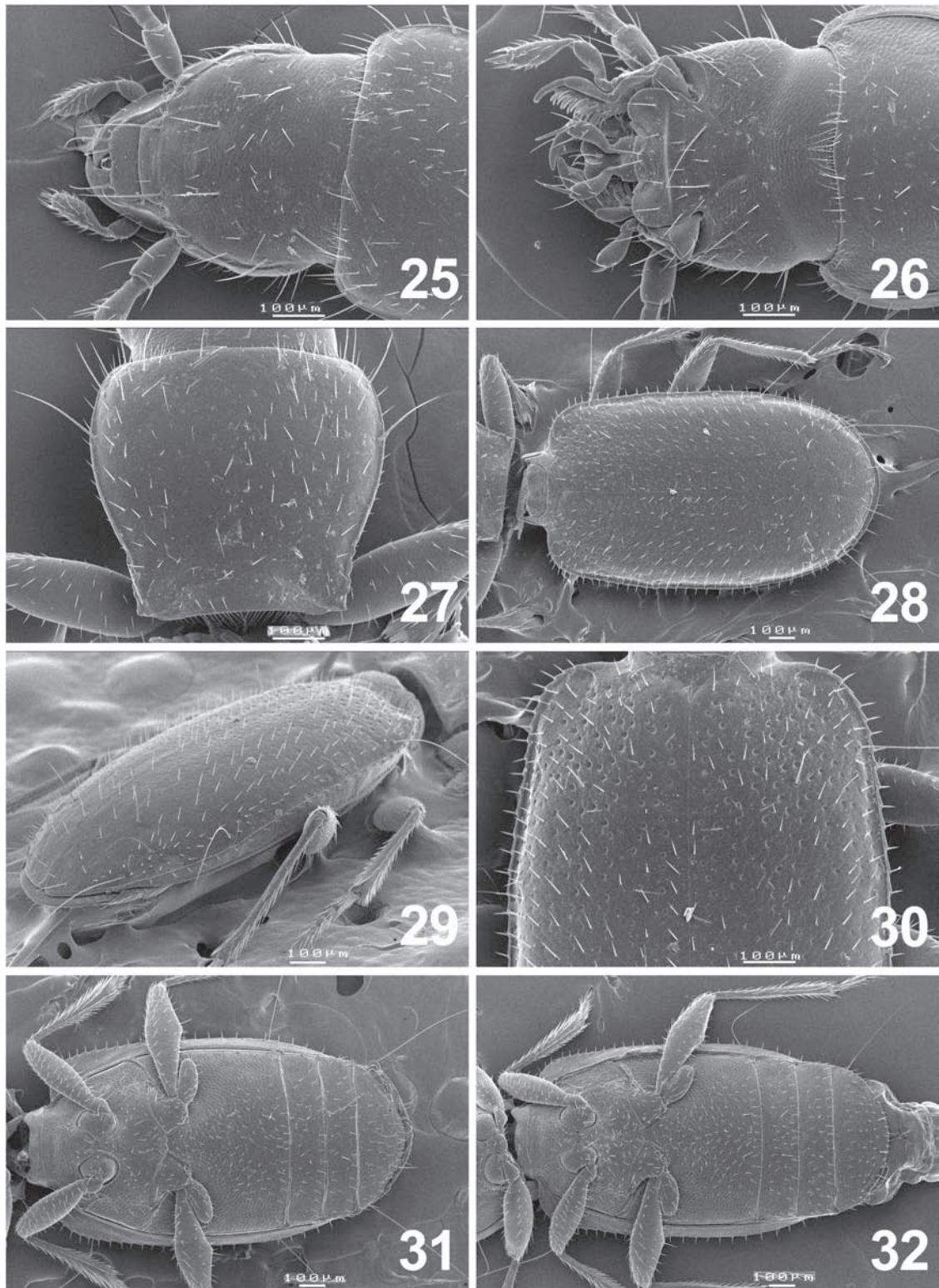
Description. Length of holotype: 1.7 mm. Length of paratypes: 1.7 mm (males and females). *Head* (Fig. 17) more or less as long as wide [length: 0.35-0.37 mm (males), 0.35 mm (females); width: 0.35-0.37 (males), 0.36-0.37 mm (females)], slightly depressed in the insertion of the front setae and with a median tubercle on frons. Chaetotaxy (fixed setae): 6 setae on the anterior margin of labrum; one pair of large clypeal setae, 1 frontal seta and 2 supraocular setae over each side, and 1-2 additional setae on both sides of tempora. Antennae light brown, the 1st and 2nd articles longer than the others, the latter subpyriform, the 3rd and the 4th are the shortest ones and subpyriforms, the 5th to the 10th gradually longer and oval-shaped, the last one acuminate. Mouth-parts (Fig. 18) conformed to the genus pattern. *Pronotum* cordiform (Fig. 19) with round anterior angles, about 1.2-1.3 times wider than long [length: 0.34-0.36 mm (males), 0.35 mm (females); width: 0.43-0.45 mm (males and females)]; disk flattened, depressed between the two punctured basal pits, with a faint central sulcus; anterior margin slightly expanded in the middle region, posterior margin emarginate (Fig. 19); lateral margins with 2 or 3 faint denticles just before the posterior angles, which are slightly obtuse. Vestiture (pubescence): surface covered with erect pubescence; one seta on the lateral margin in the broadest part of the pronotum, another near the posterior angle; none additional setae inserted near the anterior angles. *Elytra* (Fig. 20) 1.7 times longer than wide [length: 0.94-0.98 mm (males), 0.94-0.96 mm (females); width: 0.54-0.58 mm (males), 0.56 mm (females)], largely rounded and oval posteriorly; dorso-ventrally flattened on the disk, the tegument microsculptured, not punctate in the disk (Fig. 22) and without any punctures in the shoulders; disk without striae; lateral margin narrow, finely serrate from the humeral angles, which are rounded, to the 8th seta region of the umbilicate series. Vestiture (pubescence): part of the pubescence of the disk is arranged in irregular 5-6 lines, these setae are erect and slightly directed anteriorly (Figs 20-21); umbilicate series presents the following pattern: The longest setae of this series are the 2nd, the 6th and the 8th with the 3rd, 5th, 7th and 9th, more slightly inserted within the elytral margin; besides these setae there are 1 parascutellar basad, 3 discal (1 anterior, 1 median and 1 posterior) and 1 apical seta (Figs 20-21). Male *legs* with the 1st protarsomere dilated; first tarsomere in all legs more pigmented (brown) than the others; mesotibiae with a strong pubescence in both margins; hind femora of males with a strong median tooth on the internal margin, females without a median tooth on the internal margin of hind femora (Figs 23-24); meso and hind tibiae slightly arcuate in the internal margin. *Aedeagus* (Figs 39-40) dorsally enlarged before the apex, strongly arcuate, apex acute and slightly elevated, basal lobe with posterior apophyse prominent; internal sac with one worm like sclerite; left paramere with three apical setae, being the median longer than the others, dorso-basal edge expanded (Figs 39). The *female genitalia* pattern as for the other species of the genus (e.g. Zaballos & Jeanne 1987; Zaballos 1998).

Etymology. The specific epithet is the Latin noun, named for the slightly round conformation of elytra.



Figures 17-24

Geocharis rotundata n. sp. 17, head (dorsal view). 18, head (ventral view). 19, pronotum (dorsal view). 20, elytra (dorsal view). 21, right elytron (latero-dorsal view). 22, anterior half of elytra (dorsal view). 23, thorax and abdomen (male, ventral view). 24, thorax and abdomen (female, ventral view).



Figures 25-32

Geocharis femoralis. 25, head (dorsal view). 26, head (ventral view). 27, pronotum (dorsal view). 28, elytra (dorsal view). 29, right elytron (latero-dorsal view). 30, anterior half of elytra (dorsal view). 31, thorax and abdomen (male, ventral view). 32, thorax and abdomen (female, ventral view).

***Geocharis femoralis* Coiffait 1968**

(Figs 25-32, 35-36, 41)

Within the genus *Geocharis* this species was the second one described for Portugal (Coiffait 1968). It was recorded for two localities in the Province Algarve (Lagos and Querença) (Jeanne & Zaballos 1986) based in four specimens. The capture of several specimens from different localities in the Provinces of Baixo Alentejo and Algarve, showed for this species a wider distribution in the south territory of Portugal than previously thought. The number of specimens captured allows us also to give a brief description of *G. femoralis*, including quantitative data and the characters of aedeagus (conformation of median lobe and internal sac features).

Material examined: Palheirinhos (Tavira): (U.T.M. coordinates: 29SPB1713), 15 ♂♂ and 11 ♀♀, 8.I.2004; Srª da Graça dos Padrões (Almodovar): (U.T.M. coordinates: 29SNB9055), 2 ♂♂ and 2 ♀♀, 6.IV.2004; Monte do Cerro (Stª Bárbara): (U.T.M. coordinates: 29SNB8569), 7 ♂♂ and 4 ♀♀, 3.IV.2004; Porto Nobre (Loulé-Querença): (U.T.M. coordinates: 29SNB8916), 5 ♂♂ and 3 ♀♀, 9.I.2004; Sobradinho: (U.T.M. coordinates: 29SNB7826), 1 ♀, 9.I.2004; Alferce (Monchique): (U.T.M. coordinates: 29SNB4320), 18 ♂♂ and 15 ♀♀, 12.I.2004; Bensafrim: (U.T.M. coordinates: 29SNB2116), 3 ♂♂ and 4 ♀♀, 11.X.2003; Pincho: (U.T.M. coordinates: 29SNB2218), 7 ♂♂ and 3 ♀♀, 10.I.2004; Mesquita (Carrapateira): (U.T.M. coordinates: 29SNB1422), 1 ♂ and 2 ♀♀, 11.I.2004; Odeixe: (U.T.M. coordinates: 29SNB2242), 2 ♂♂ and 4 ♀♀, 10.X.2003, 10 ♂♂ and 13 ♀♀, 13.I.2004; Odemira: (U.T.M. coordinates: 29SNB3262), 5 ♂♂ and 9 ♀♀, 5.X.2003. All specimens are deposited in the collection of the senior author, Department of Animal Biology (Faculdade de Ciências da Universidade de Lisboa).

Description. Length: 1.8-2.3 mm (males), 1.8-2.4 mm (females). **Head** (Fig. 25) more or less as long as wide [length: 0.35-0.46 mm (males), 0.32-0.48 mm (females); width: 0.34-0.46 (males), 0.36-0.47 mm (females)], anophtalmous, microsculpture distinct, depressed in the insertion of the front setae and with a median tubercle in frons. Cephalic chaetotaxy (fixed setae): 6 setae on the anterior margin of labrum; one pair of large clypeal setae, 1 frontal seta and 2 supraocular setae over each side, and 2 or 3 additional setae on both sides of tempora. Antennae light brown, the 1st and 2nd articles longer than the others, the latter subpyriform, the 3rd and the 4th are the shortest ones and subpyriforms, the 5th to the 10th gradually longer and oval-shaped, the last one acuminate. Mouth-parts (Fig. 26) show the general pattern of the genus. **Pronotum** slightly cordiform (Fig. 27) with round anterior angles, about 1.1-1.2 times wider than long [length: 0.37-0.50 mm (males), 0.37-0.51 mm (females); width: 0.43-0.59 mm (males), 0.44-0.61 mm (females); disk slightly convex, depressed between the two basal pits, with a central sulcus; anterior margin arcuate, posterior margin emarginate (Fig. 27); lateral margins with 4, even 5 denticles just before the posterior angles, which are right and more or less dentate. Vestiture (pubescence): surface covered with scattered erect pubescence; one seta on the lateral margin in the broadest part of the pronotum, another one near the posterior angle; 2 or 3 additional setae inserted near the anterior angles. **Elytra** (Fig. 28) 1.7-1.8 times longer than wide [length: 1.01-1.36 mm (males), 1.04-1.38 mm (females), width: 0.56-0.78 mm (males), 0.59-0.82 mm (females)], slightly convex, subparallel and oval posteriorly; the tegument microsculptured and strongly punctured in the shoulders (Fig. 30); disk without striae, a sulcus close to the suture; lateral margin

narrow, serrate from the humeral angles, which are rounded, to the 5th seta of the umbilicate series. Vestiture (pubescence): part of the pubescence of the disk is arranged in 5-6 irregular lines, these setae are erect and slightly directed anteriorly (Figs 28-29); umbilicate series follows the pattern of the genus. The longest setae of this series are the 2nd, the 6th and the 9th with the 3rd, 5th, 7th and 8th, more slightly inserted within the elytral margin; besides these setae there are 1 parascutellar basad, 2 discal (1 anterior and 1 posterior) and 1 apical seta (Figs 28-29). **Male legs** with the 1st protarsomere dilated; first tarsomere in all legs more pigmented (light brown) than the others; mesotibiae with a strong pubescence on both margins; hind femora (males and females) with a median tooth on the internal margin more or less developed (Figs 31, 32). **Aedeagus** (Figs 35-36) slightly arcuate, with a prominent ventral enlargement before the apex (lateral view), apex rounded and with a marked down bending, basal lobe with apophysis not prominent; internal sac as in figure 35; left paramere with two apical setae, dorso-basal edge slightly or not expanded (Fig. 35). The **female genitalia** pattern as for the other species of the genus (e.g. Zaballos & Jeanne 1987; Zaballos 1998).

Key to the males of the species of *Geocharis* from Portugal south of Tejo River

1. Disk of elytra with three pairs of setae, one anterior, one median and a posterior one. Internal margin of hind femora markedly dentate. Left paramere with three apical setae..... ***G. rotundata* n. sp.**
- Disk of elytra with two pairs of setae, one anterior and one posterior. Internal margin of hind femora inerm or dentate. Left paramere with two apical setae **2**
2. Left paramere slender, with dorso-basal edge not expanded (lateral view); median lobe always more or less acuminate (lateral view) **3**
- Left paramere wider, with the dorso-basal edge more or less expanded (lateral view) (e.g., Fig. 37) **4**
3. Length ≤ 1.8mm. Basal lobe with a strongly prominent apophysis; internal sac with a shaped arciform sclerite (lateral view). Internal margin of hind femora strongly dentate ***G. sacarraoi* Serrano & Aguiar 2003**
- Length > 1.8mm. Basal lobe without a prominent apophysis; internal sac with a rolled or twisted-shape arciform sclerite (lateral view). Internal margin of hind femora just dentate ***G. boieiroi* Serrano & Aguiar 2001**
4. Internal margin of hind femora dentate **5**
- Internal margin of hind femora inerm **10**
5. Median lobe of aedeagus more or less rounded or pointed **6**
- Median lobe of aedeagus more or less truncate in the apex and ending in a membranous part, internal sac with a spiral-shaped sclerite ***G. grandolensis* Serrano & Aguiar 2000**
6. Apex of median lobe of aedeagus slightly bent to right (dorsal view) **7**
- Apex of median lobe of aedeagus do not bent to right (dorsal view), strongly enlarged or not before apex (lateral view) **8**
7. Pronotum strongly cordiform, disk flattened and anterior margin straight or slightly arcuate. Internal

- sac with a bow-shaped sclerite (lateral view)
 *G. saldanhai* Serrano & Aguiar 2000
- Pronotum less cordiform, disk strongly flattened and anterior margin arcuate, slightly expanded in the middle. Internal sac with a twisted sclerite (left side down to right side up) *G. portalegrensis* Serrano & Aguiar 2000
8. Internal sac of median lobe with a spiral-shaped sclerite (dorsal view); median lobe strongly enlarged before apex (dorsal and ventral views). Elytra parallel to subparallel *G. estremoensis* Serrano & Aguiar 2003
- Internal sac without a spiral-shaped sclerite. Elytra subparallel to ovate 9
9. Median lobe of aedeagus slightly arcuate, strongly enlarged before the apex (lateral view), apex with a marked down bending (Figs 35-36) *G. femoralis* Coiffait, 1968
- Median lobe of aedeagus arcuate, without a prominent ventral enlargement before the apex (lateral view), apex without a marked down bending (Figs 33-34) *G. coiffaiti* n. sp.
10. Median lobe of aedeagus strongly arcuate, enlarged before the apex (lateral view); apex of median lobe slightly toward to right (dorsal view)
 *G. monfortensis* Serrano & Aguiar 2000
- Median lobe of aedeagus arcuate, not enlarged before the apex (lateral view) 11
11. Apex of median lobe rounded (dorsal and lateral views) 12
- Apex of median lobe more or less acuminate (dorsal and lateral views). Elytra 1.8 times longer than wide *G. sebastianae* n. sp.
12. Elytra 1.7 times longer than wide. Internal sac with a twisted arciform sclerite; left paramere with dorso-basal edge more expanded *G. moscatelus* Serrano & Aguiar 2001
- Elytra 1.7-1.9 times longer than wide. Internal sac with two rolled sclerites; left paramere with dorso-basal edge less expanded
 *G. submersus* Serrano & Aguiar 2003

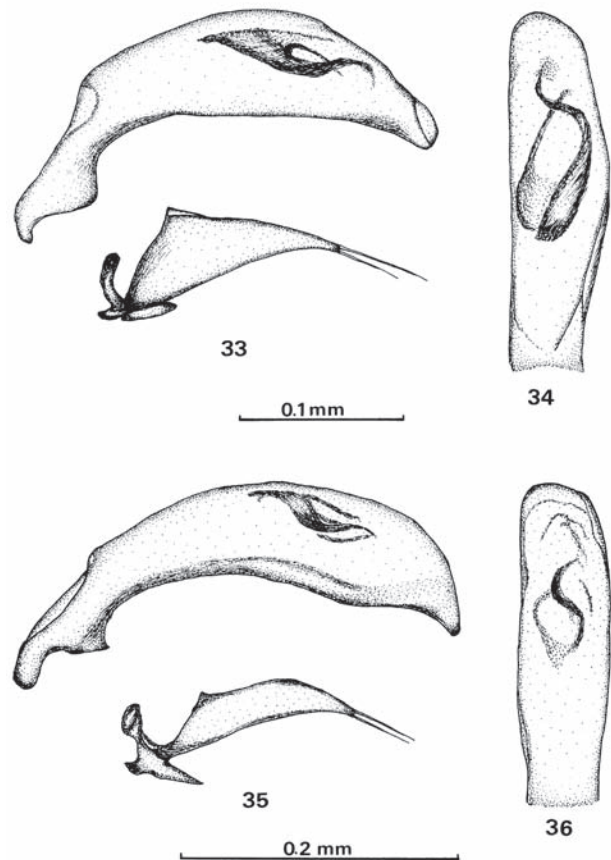
Discussion

Taxonomic remarks

Geocharis coiffaiti n. sp. and *G. sebastianae* n. sp. are akin to most species of *Geocharis* by the possession on the elytral disk of two setae, one anterior and one posterior. *Geocharis rotundata* n. sp., on the other hand, has three setae on the elytral disk (one anterior, one median and a posterior one). This new species is very close to *G. cordubensis* (Dieck 1869) taking the previous character into account plus the occurrence of three apical setae on left paramere and the presence of a tooth on the internal margin of the hind femora of males. However, they can be easily discriminated by the form of the median lobe of aedeagus. Some other species of *Geocharis* present a different number and/or localization of these discal setae which are: *G.*

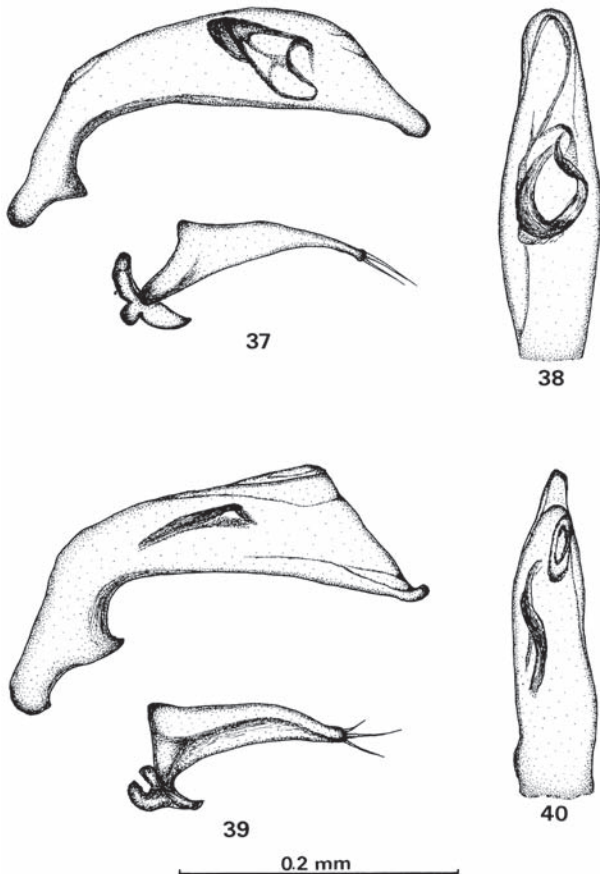
olisipensis Schatzmayr 1937, *G. falcipenis* Zaballos & Jeanne 1987 and *G. ruiztapiadori* Zaballos 1996 (one or two pairs of setae: A posterior one only, or both a median and a posterior ones). *Geocharis coiffaiti* n. sp. is very close to *G. femoralis* with respect to the external body characters. However, the lateral shape of the median lobe of aedeagus (*cf.* figs 33 and 35) easily allows segregation of both species.

Taking into account the pattern of the internal sac of the median lobe and the presence of a tooth on the internal margin of the hind femora of males, both species seem to have a closer relationship with *Geocharis saldanhai* Serrano & Aguiar 2001. There are other species more than *G. coiffaiti* n. sp., *G. rotundata* n. sp. and *G. saldanhai*, such as *Geocharis leoni* Zaballos 1998, *G. cordubensis*, *G. femoralis*, *G. grandolensis* Serrano & Aguiar 2000, *G. portalegrensis* Serrano & Aguiar 2000, *G. boieiroi* Serrano & Aguiar 2001, *G. estremoensis* Serrano & Aguiar 2003, *G. sacarraoi* Serrano &



Figures 33-36
 Aedeagus of *Geocharis* species. 33 and 35, median lobe and left paramere in lateral view.-33, *G. coiffaiti* n. sp. 35, *G. femoralis*. 34 and 36, apex of median lobe in dorsal view.-34, *G. coiffaiti* n. sp. 36, *G. femoralis*.

Aguiar 2003, *G. fermini* Serrano & Aguiar 2004, *G. quartau* Serrano & Aguiar 2004 and *Geocharis juncoi* Zaballos 2005, with a tooth in the internal margin of the hind femora of males. Adults of the new species described herein lack traces of striae on elytra unlike *G. quartau*, *G. massinissa* (Dieck 1869), *G. korbi* (Ganglbauer 1900), *G. juliana* Zaballos 1989 and *G. montecristoi* Zaballos 2005. The new species differ from *G. leoni*, among other features, also by characters of the left paramere, which does not bear any lamellar and membranous scales in the apex (Zaballos 1998). On the other hand, *G. sebastianae* n. sp. is akin to *G. korbi*, *G. massinissa*, *G. olisipensis*, *G. falcipenis*, *G. juliana*, *G. iborensis* Zaballos 1990, *G. ruiztapiadori*, *G. amicum* Zaballos 1997, *G. monfortensis* Serrano & Aguiar 2000, *G. moscatelus* Serrano & Aguiar 2001, *G. submersus* Serrano & Aguiar 2003, *G. bivari* Serrano & Aguiar 2004, *G.*



Figures 37-40

Aedeagus of *Geocharis* species. 37 and 39, median lobe and left paramere in lateral view. 37, *G. sebastianae* n. sp. 39, *G. rotundata* n. sp. 38 and 40, apex of median lobe in dorsal view. 38, *G. sebastianae* n. sp. 40, *G. rotundata* n. sp.

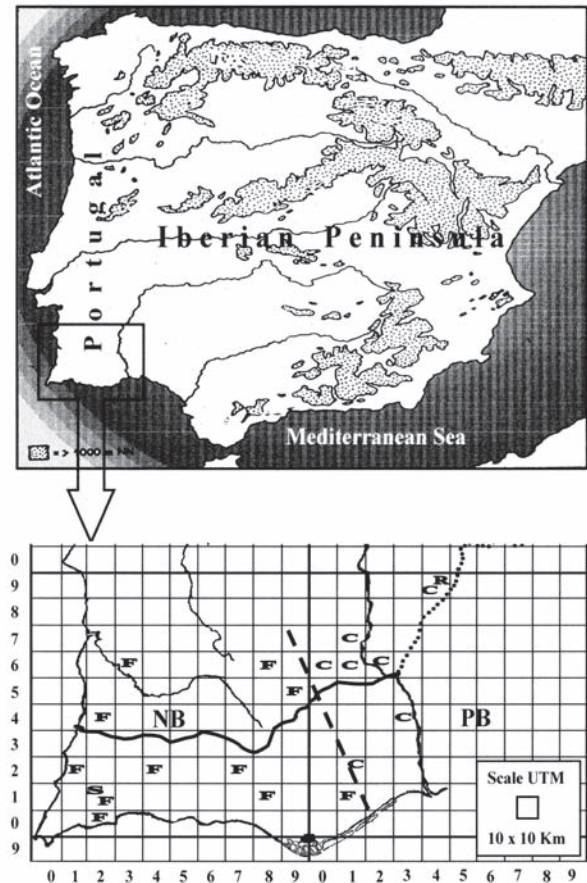


Figure 41

Distribution in Portugal. *G. coiffaiti* n. sp. (C), *G. femoralis* (F), *G. sebastianae* n. sp. (S), *G. rotundata* n. sp. (R).

notolampros Zaballos 2005, *G. fenestrata* Zaballos 2005, *G. bifenestrata* Zaballos 2005, *G. montecristoi*, *G. liberorum* Zaballos 2005 and *G. testatetrafoveata* Zaballos 2005 by the absence of a tooth in the hind femora of males. Interestingly, *G. sebastianae* n. sp. exhibits a similar form of the median lobe and the same armature pattern of the internal sac as *G. boieiroi*, a species found in the Arrábida Mountain (almost 250 km to north). However, they are quite different by the left paramere shapes and the absence (*G. sebastianae* n. sp.) or the presence (*G. boieiroi*) of a tooth on the internal margin of the hind femora of males. Finally, we can point out that the new species are easily separated among them by differences in the shape of median lobe, the sclerite(s) of the internal sac, the left paramere and pronotum forms, the elytral microsculpture and the tooth of hind femora (present or absent).

Ecological and geographical considerations

The new species are endogean, like the others of the genus *Geocharis*, living in the soil at different depths of the B-horizon. Normally, only one species of *Geocharis* occurs at any one locality, however, there are some observed exceptions. Some pairs of species of this genus (e.g., *G. moscatelus* and *G. boieiroi*, *G. fermini* and *G. olisipensis*, *G. bivari* and *G. quartauì*) (Serrano & Aguiar 2001, 2004) were already recorded for the same date in the same locality (syntopics). Now we would like to point out that the same phenomenon was observed with *G. femoralis* and *G. sebastianae* n. sp. in the Bensafrim and Pincho localities and with *G. coiffaiti* n. sp. and *G. rotundata* n. sp. in Vila Verde do Ficalho. Nevertheless, this does not mean that these species are obligatory syntopics. For instance, observing the map of figure 41, one can realize that there are many localities where *G. femoralis* or *G. coiffaiti* n. sp. were found alone. Concerning the latter, as we had previously pointed out, the external characters of both species are similar and it is difficult to distinguish them without recourse to the observation of the median lobe of male genitalia (see Figs 33 and 35). Furthermore we have never found both forms in the same station. So their allopatric distribution suggests the occurrence of other unknown barriers besides the male genitalia, such as physical or/and ecological ones, contributing to isolate both forms. *G. femoralis* spreads from a virtual line between Tavira (Algarve) and Almodovar (Baixo Alentejo) westerly to the littoral. On the other hand, the known distribution of *G. coiffaiti* n. sp. occurs westerly from the foresaid line to the river Guadiana easterly. The precise limits of both species to the northern region are difficult to address with no additional data available. Moreover, one cannot exclude the possibility that *G. coiffaiti* n. sp. and also *G. rotundata* n. sp. occur in the Spanish territory.

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