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A review of *Panurgus* (*Pachycephalopanurgus*), with the description of a new species from Spain

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ABSTRACT

Study of recently collected bees from south-eastern Spain revealed a new species of subgenus *Panurgus* (*Pachycephalopanurgus*) Patiny, 1999, closely related to *P. canescens* Latreille, 1811, and *P. calceatus* Pérez, 1895. Within this group of three species, *P. meridionalis* sp.nov. is characterized by the presence of a pair of latero-ventral teeth on the third tergum of the male (unique among Panurginae). This new species is only the second species of *Pachycephalopanurgus* recorded from Europe, the other five being North African. Distributional patterns in subgenus *Pachycephalopanurgus* are mapped and summarized.

Key words: Panurginae, *Panurgus*, sister-species, Europe, North Africa, parapatry

RESUMEN

El estudio de material de Apoidea capturado recientemente en el sureste de España ha revelado la existencia de una nueva especie del subgénero *Panurgus* (*Pachycephalopanurgus*) Patiny, 1999, estrechamente emparentada con *P. canescens* Latreille, 1811 y *P. calceatus* Pérez, 1895. Dentro de este grupo de tres especies, *P. meridionalis* sp.nov. se caracteriza por presentar un par de dientes lateroventrales sobre el tercer tergo del macho (único en Panurginae). Esta nueva especie es la segunda del subgénero *Pachycephalopanurgus* que se cita en Europa, siendo las otras cinco norteafricanas. En el presente trabajo, se cartografían y resumen los datos de distribución del subgénero.

Palabras clave: Panurginae, *Panurgus*, especies hermanas, Europa, norte de África, parapatría.

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INTRODUCTION

The Old World Panurginae (Hymenoptera, Andrenidae) consists of 150+ species divided into 14 genera (Patiny, 1999a,b, 2001, in preparation). Among these, *Panurgus* Panzer, 1806 (33 species) and *Panurginus* Nylander, 1848 (27 species in Old World, excluding *Clavipanurgus* Warncke, 1972) are the most diverse genera. Recent revision of Old-World Panurginae led to varied modifications to their taxonomy, notably subdivision of *Panurgus* into four subgenera: *Panurgus* s.str., *Euryvalvus* Patiny, 1999, *Micropanurgus* Patiny (*in* Ascher and Patiny, 2002), and *Pachycephalopanurgus* Patiny, 1999 (Patiny, 1999b, 2001, in preparation).

Since Dusmet (1935), no author has carried out any detailed study of Spanish Panurginae. The study of recently collected samples of Panurginae has resulted in the discovery of a conspicuous, undescribed species. In addition to the taxonomic interest of this finding, at least one structure of male morphology, the presence of a pair of large teeth latero-ventrally on the third tergum, is unique within the subfamily.

The biogeographic affinities of this new species seem also *a priori* particularly interesting. *Panurgus* is a typical circum-Mediterranean genus (De Lattin, 1967; Patiny & Gaspar, 2000). However, its four subgenera display distinct ranges within this area. *Panurgus* (*Panurgus*) occurs throughout the range of the genus, *Panurgus* (*Euryvalvus*) includes one European and one North African species, and *Panurgus* (*Micropanurgus*) is endemic to western Morocco. Subgenus *Panurgus* (*Pachycephalopanurgus*) is found mainly in North Africa (Patiny, 2001; Patiny & Gaspar, 2000) but three species (among the seven described) display significantly different distributions. *P. nigriscopus* Pérez, 1895 extends strongly eastward, reaching the Arabian Peninsula, and includes populations recorded from Oman (Patiny, 2001; Patiny & Gaspar 2000). *P. canescens* Latreille, 1811 and *P. meridionalis* sp.nov. are restricted to the Iberian Peninsula and the western Mediterranean basin (south of France, Italy and Mediterranean islands) (Patiny, 2001; Patiny & Gaspar 2000).

In the first part of the present paper, the new Spanish species, *P. meridionalis* sp.nov., is described and morphologically compared with its closest relative: *P. canescens*. In the second part, the relevance of its classification within *Panurgus* (*Pachycephalopanurgus*) and its morphological proximity to *P. canescens* are discussed. Finally, we discuss the biogeography of *Pachycephalopanurgus.*

MATERIAL AND METHODS

Illustration of the diagnostic morphological structures of the new species was performed using a Scanning Electron Microscope: JEOL JSM-6100 housed at the Laboratory of Marine Zoology, Mons University, Belgium.

In the text, the names of the morphological parts are abbreviated following Michener

(2000).

Maps of *Pachycephalopanurgus* species distributions are based on data included in the BDFGM (Banque de Données Fauniques Gembloux-Mons, Belgium). This database includes 230,000+ record managed using specially designed software, DFF 2.0 (*Data Fauna Flora*; Barbier et *al*., 2003). Table 1 lists the number of mapped occurrences and specimens per species. Maps were produced using the complementary mapping software CFF 2.0 (*Carto Fauna Flora*; Barbier & Rasmont, 2000).

TABLE 1. Details concerning the material included in the maps.

Species	**Number of mapped occurrences** data based upon the literature	**Number of mapped specimens (males & females)**
P. calceatus	**94**	416
	10	
P. canescens	**102**	196
	21	
P. convergens	**104**	350
	4	
P. farinosus	**38**	230
	1	
P. meridionalis sp. nov.	**7**	112
	0	
P. nigriscopus	**39**	123
	2	
P. rungsii	**92**	246
	2	

RESULTS

Checklist and updated synonymy of *Panurgus* (*Pachycephalopanurgus*)

Panurgus Panzer, 1806

Synonymies associated with *Panurgus* are available in Patiny (1999a,b, 2001)

Subgenus *Panurgus*

Subgenus *Euryvalvus* Patiny, 1999

Subgenus *Micropanurgus* Patiny, 2002

Subgenus *Pachycephalopanurgus* Patiny, 1999

Type species: *Panurgus rungsii* BENOIST, 1937 Original designation
Panurgus (*Pachycephalopanurgus*) *rungsii* BENOIST, 1937. Bulletin de la Société des Sciences Naturelles du Maroc. XVII(3–4): 163–164
Panurgus (*Pachycephalopanurgus*) PATINY, 1999. Entomofauna. 20(19): 316–317
Panurgus (*Panurgus*) PANZER, 1806. WARNCKE (1972). Polskie Pismo Entomologiczne. 52(1): 72–89 [*partim*]

1. *Panurgus calceatus* Pérez, 1895. Espèces nouvelles de Mellifères de Barbarie, Bordeaux: 59 n.125
   Panurgus djeridensis Pérez, 1895. Espèces nouvelles de Mellifères de Barbarie, Bordeaux: 59 n.126
   Panurgus algericus Friese, 1897. Természetrajzi Füzetek. XX: 88–89
2. *Panurgus canescens* Latreille, 1811. [Article in] M. Olivier (ed.), Encyclopédie Méthodique. Histoire Naturelle. Insectes. Agasse, Paris. VIII: 720 n.6
   Panurginus hispanicus Giraud, 1861. Verhandelungen zoologische und botanische Gesellschaft. Wien. XI: 456
   Panurgus soikai Pittioni, 1951. Memorie di Biogeografia Adriatica. 2: 49–62
3. *Panurgus convergens* Pérez, 1895. Espèces nouvelles de Mellifères de Barbarie, Bordeaux: 58–59 n.122
4. *Panurgus farinosus* Warncke, 1972. Polskie pismo Entomologiczne. XLII(1): 75–76
5. *Panurgus nigriscopus* Pérez, 1895. Espèces nouvelles de Mellifères de Barbarie, Bordeaux: 58 n.121
   P. nigriscopus nigriscopus Pérez, 1895
   P. nigriscopus trigonus Warncke, 1972. Polskie pismo Entomologiczne. XLII(1): 53–108
6. *Panurgus rungsii* Benoist, 1937. Bulletin de la Société des Sciences Naturelles du Maroc. XVII (3–4): 163–164

Description of *Panurgus meridionalis* sp. nov.

Diagnosis. Morphologically similar to *P. canescens* (Table 2). Females: slightly smaller than *Panurgus canescens* (5.3 mm). Integument dark blackish. Posterior third of mesonotum and scutellum finely and densely punctured. T1 coarsely sculptured, integument dull, roughened. Females of *P.canescens* have generally brownish integument and a more finely punctured scutellum and T1. Males: Clypeus with a deep subtrapezoidal median emargination as in *P.canescens* and *P.calceatus*; the edges spinose ventrally. T3 ventro-lateral margins each with a large subtriangular tooth. Penis valve with a deep baso-lateral groove on outer surface.

Description.

Female. **Head**. Clypeus deeply and sparsely punctured, the punctures separated by at

least one diameter. Labral lamella smooth and shiny, subtrapezoidal, longer than wide. Glossa shorter than the distance between clypeal apex and median ocellus. Galea densely shagreened. Maxillary palpus shorter than the first labial palpal segment. Gena finely and sparsely punctured; integument smooth and shiny between punctures. Frons densely and finely punctured; the cuticle weakly shagreened between punctures, shiny. Scape with some large, deep and widely spaced punctures. Flagellar annuli dark, somewhat lighter apico-ventrally on the terminal segments (from A7). Pilosity creamy white, dense and abundant on the whole face. **Mesosoma**. Mesonotum densely shagreened; the posterior third densely and finely punctured, the anterior part with large and sparse punctures. Scutellum finely and densely punctured like the posterior part of the mesonotum (Fig. 2a). Nota with sparse pilosity, denser and more abundant on scutellum and also on the mesopleuron. Propodeum lightly shagreened, very smooth and shiny; dorsal area weakly wrinkled. Legs with abundant creamy white pilosity. Wing venation dark brownish. **Metasoma**. T1 densely shagreened (Fig. 2b); T2–3 with weaker but noticable shagreening; T4–5 more weakly shagreened, but with stronger and deeper punctures. Apical impressed areas of terga thin, translucent, yellowish. Sterna shagreened, the apex punctured. Metasomal pilosity weakly developed, mainly restricted to the latero-apical part and to the apical margin of S5 and S6; more abundant on T4 and following segments. Anal fringe creamy white. Pygidial plate with a strong median carina.

TABLE 2. Comparative diagnosis of *P. meridionalis* and *P. canescens*.

	Panurgus meridionalis sp. nov.	*Panurgus canescens*
Females	Face finely punctured; cuticle weakly sculptured between punctures.	Face finely punctured; cuticle well sculptured between punctures.
	Mesonotum: posterior third finely and densely punctured (Fig. 2a).	Mesonotum: posterior margin with only a narrow band of punctation covering less than one third of the surface (Fig. 1a).
	T1 anteriorly strongly and rugosely sculptured (Fig. 2b).	T1 anteriorly weakly sculptured, dull but not rugose (Fig. 1b).
Males	Face with a short frontal carina (Fig. 2c).	Face with long frontal carina reaching the epistomal suture (Fig. 1c).
	T3 with well developed ventro-lateral teeth (Fig. 2d).	T3 without teeth (Fig. 1d).
	S7 apical processes concave, not hooked.	S7 apical processes strongly hooked.
	S8 apical enlargement subquadrangular (Fig. 2f).	S8 apical enlargement semicircular (Fig. 1f).
	Penis valves with a deep groove on outer face (Fig. 2e).	Penis valves with a shallow groove on outer face (Fig. 1e).

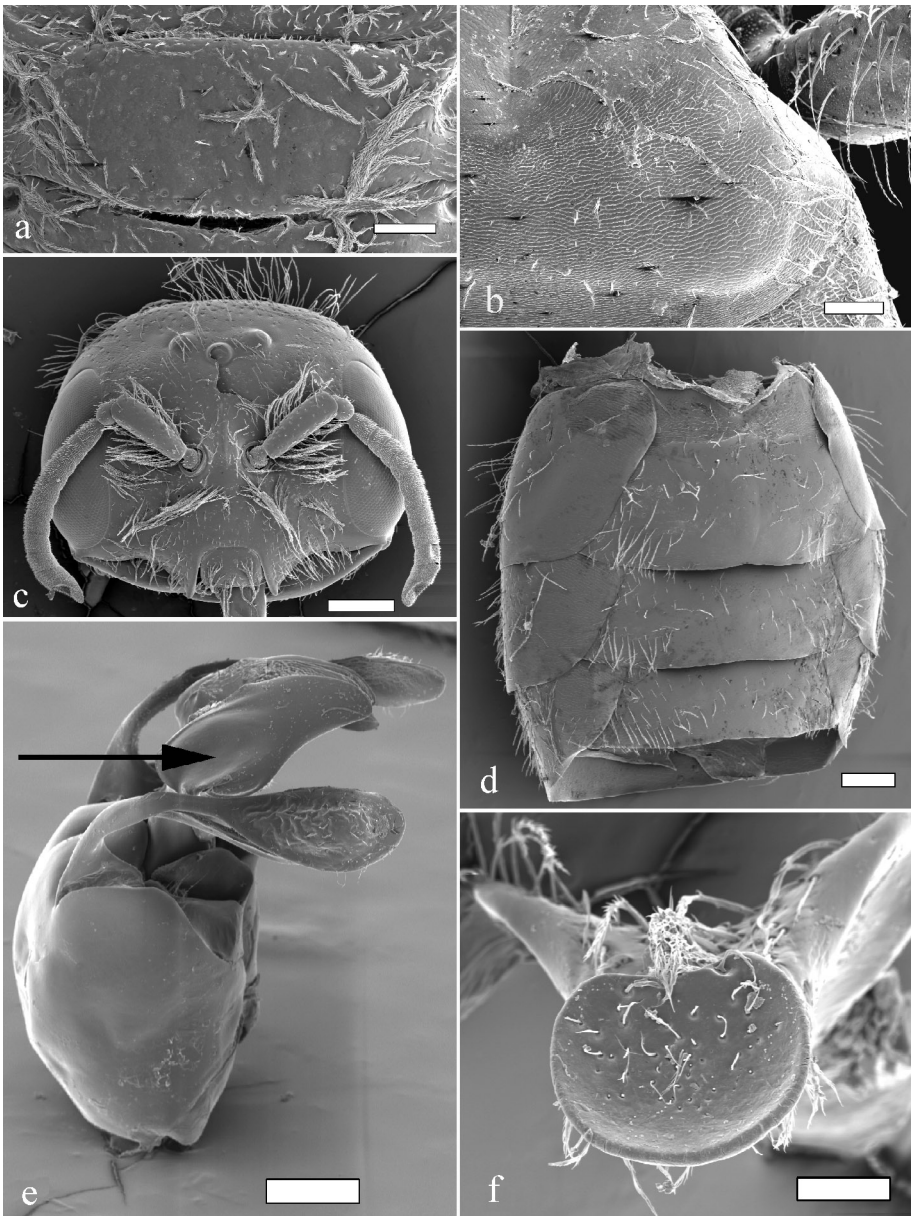


FIGURE 1. *P. canescens*, a–b: females; c–f: males, a. Punctation of the posterior margin of the mesonotum; b. Sculpture and rugosity of the anterior surface of T1; c. Frontal carina; d. Metasomal segments 1–3; Untoothed T3 latero-ventral part; e. Lateral groove of penis valves; f. Apex of S8.

Male. **Head**. Head strongly enlarged ($Width_{Head}$:$Width_{Pronotum}$ = 1.2:1). Clypeus sparsely punctured, sparsest medially; distal margin deeply emarginate medially, edges of the emargination spinose. Labral lamella weak, subtriangular. Mouthparts as in females. Gena, vertex and frons very smooth, with some sparse and fine punctures; integument strongly shiny. Frontal carina short, convex, not reaching the epistomal sulcus (Fig. 2c). Antenna dark; the apical half of flagellum reddish beneath. Head pilosity sparse, whitish. **Mesosoma**. Notal and pleural integument smooth with some strong but sparse punctures.

Pilosity very sparse, whitish. Wings as in females. Legs with very few hairs, whitish, as on thorax. **Metasoma**. Terga dark, finely shagreened (T1–3); apical impressed areas thin, yellowish. T3 with a pair of well-developed, ventro-lateral subtriangular teeth (Fig. 2d). Pilosity whitish, particularly sparse on metasoma. S7 with well-differentiated apical processes, concave ventrally, diverging distally. S8 with terminal plate sub-quadrangular (Fig. 2f). **Genitalia**. Gonostylus strongly sigmoid, diverging basally; the apex elliptically enlarged; secondary process long and thin. Penis valves large; the outer surface with a strong groove, the valves appearing notched basally in dorsal view (Fig. 2e).

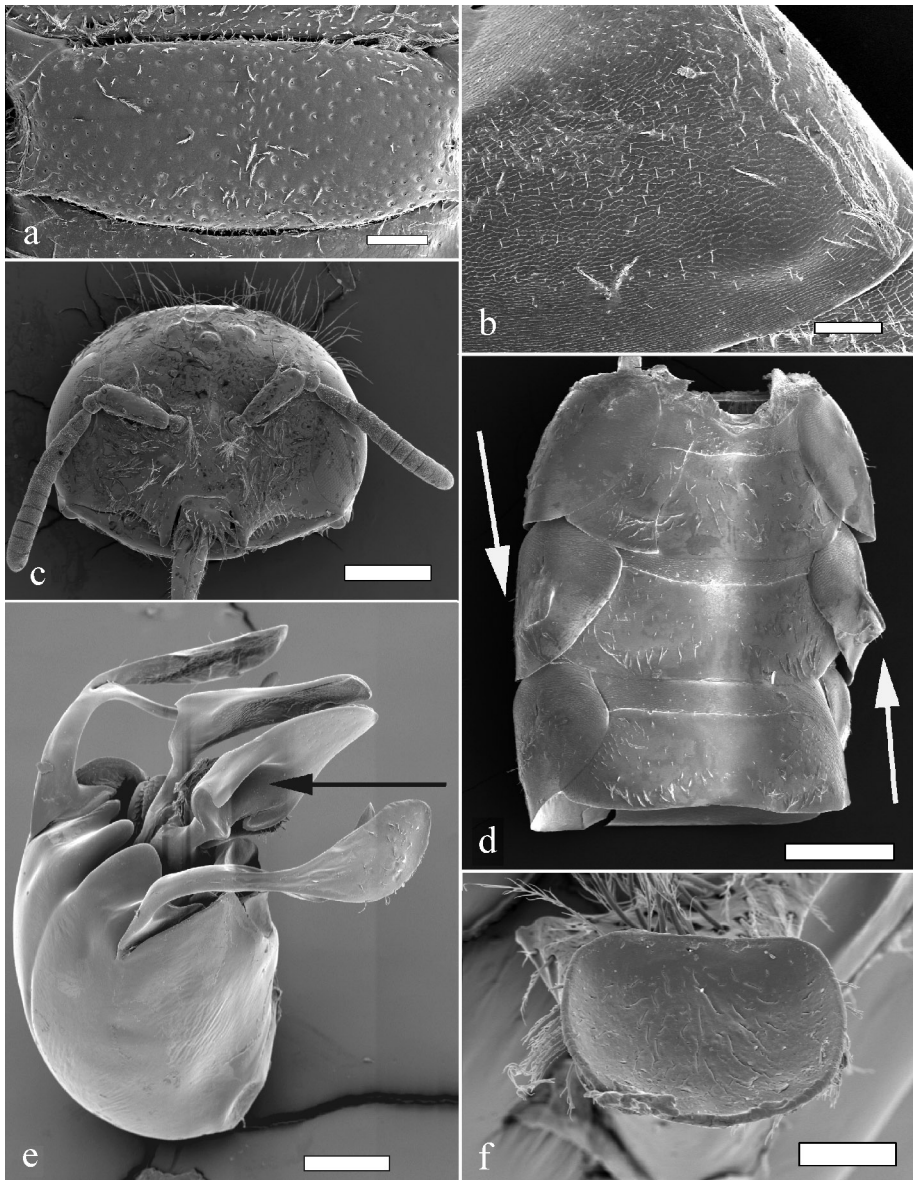


FIGURE 2. *P.meridionalis* a–b: females; c–f: males, a. Punctation of the posterior margin of the mesonotum; b. Sculpture and rugosity of the anterior surface of T1; c. Frontal carina; d. Metasomal segments 1–3; arrows indicate T3 latero-ventral teeth; e. Lateral groove of penis valve; f. Apex of S8.

Etymology: The specific epithet *meridionalis* pertains to the species known range, restricted to southern Spain.

Material Studied: *Locus typicus*: SPAIN. 25 km SW Cartagena; Original labelling: E Murcia 25 km SW Cartagena 12-V-2003 J.Halada leg.; Type depository: OberÖsterreichisches Landesmuseum (Linz, Austria): 1 male Holotype; 49 male paratypes, 48 female paratypes.

Additional material (Ortiz-Sánchez collection). SPAIN. Almería, Cerro de los Lobos (Níjar), 150 m, U.T.M.: 30SWF8877, 16-V-2004, 4 males; Cuevas de Almanzora, U.T.M.: 30SXG02, 03/09-VI-1992, 1 male (pan-trap); Rambla del Cuervo (Níjar), U.T.M.: 30SWF8881, 10 m, 16-V-2004, 1 male; Rodalquilar (Níjar), 100 m, 16-V-2004, 1 male; Murcia, Rambla Lorentes (Mazarrón), U.T.M.: 30SXG5462, 170 m, 2-V-2005, 1 male, on *Launaea arborescens* and *Sonchus tenerrimus* (Compositae); Mazarrón, U.T.M.: 30SXG4961, 50 m, 2-V-2005, 2 females, 4 males on *Sonchus tenerrimus* (Compositae). All specimens collected by F. J. Ortiz-Sánchez.

DISCUSSION

Taxonomy and classification of *P. meridionalis*

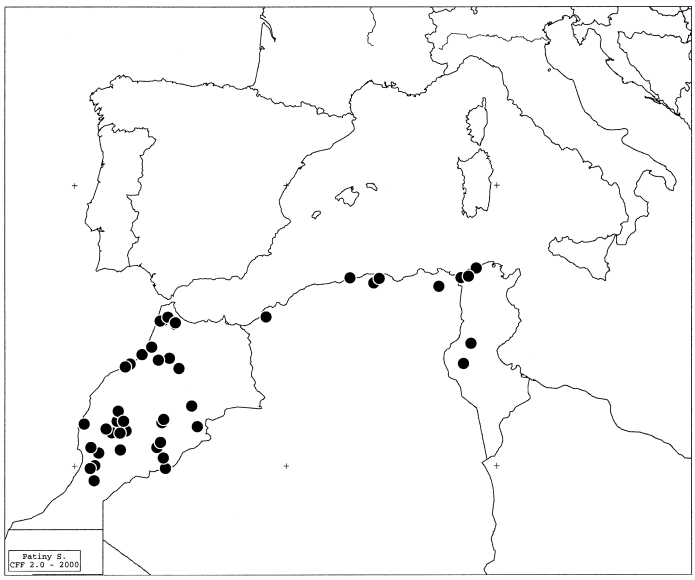
Among *Panurgus*, the subgenus *Pachycephalopanurgus* is well characterized by the presence of a long tapered secondary process on the gonostylus that branches ventrally (Patiny, 1999a,b, 2001). The presence of this genital structure of the males constitutes a synapomorphy shared by most *Panurgus* species (except those included in the subgenus *Euryvalvus* displaying a plesiomorphic lack of this feature). However, the tapered form of this process is a unique feature of *Pachycephalopanurgus*. The monophyly of this latter subgenus is supported by this apomorphy and several others: 1. the strongly enlarged male head; 2. the undifferentiated male hind trochanter; 3. the shape of the male metasoma (with stronger enlargement between T2–3); 4. the morphologies of S7–8 (Figs. 1f, 2f). These diagnostic characters are all present in *P. meridionalis* and support its placement in subgenus *Pachycephalopanurgus*.

Despite its global homogeneity, at least two species-groups can be described within *Pachycephalopanurgus*. One contains the five North-African species (excluding the more widely distributed *P. calceatus*), the second includes *P. calceatus*, *P. canescens* and *P. meridionalis*. Several synapomorphies are shared by the latter three species, notably the deep subquadrangular emargination of the clypeus (males), the elliptical enlargement of the gonostylar apex (males), the typically shagreened cuticle of the mesonotum (both sexes) and the typical shape of S7 and S8 (males). In addition, the three species are strongly characterized by the presence or absence of some structures. *P. calceatus* males display a strong hair fringe along the posterior edge of the metabasitarsus. This character is also observed in other species in the subgenus, such as *P. rungsii* but is entirely absent in *P.*

canescens and *P. meridionalis*. On the other hand, *P. meridionalis* is characterized by the unique presence of teeth ventro-laterally on T3; this is unique within the subgenus, as well as among all Old-World Panurginae. Conversely, *P.canescens* is characterized by the absence of these modifications of the hind legs and metasoma. In other described species, T6–7 and S7–8 are usually the only sclerites displaying morphological apomorphies in males (Patiny, 1999a,b, 2001).

Distribution of *Pachycephalopanurgus*

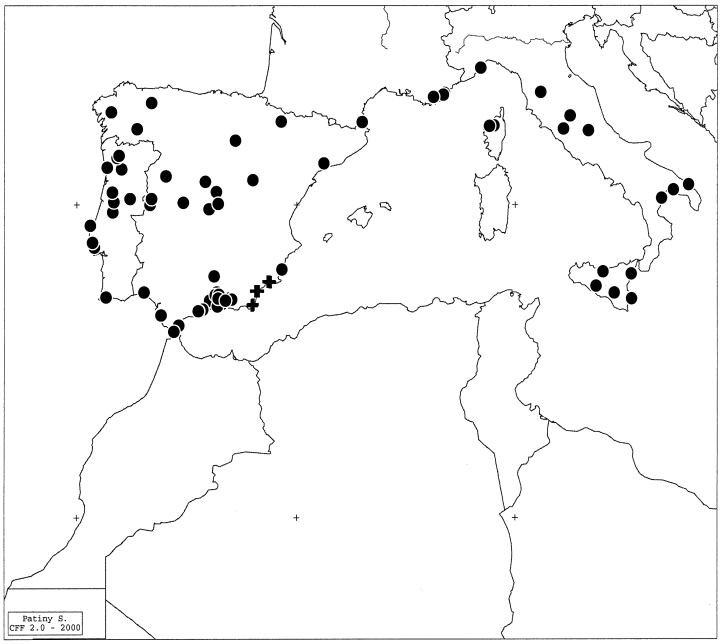
As mentioned in the introduction, the species included in *Pachycephalopanurgus* are mostly North African and North Saharan in distribution and their ranges fit rather exactly with those of the Mediterranean and North Saharan ecoregions (NGS, 2001; White, 1986). *P. calceatus* displays the most typical North African distribution, being found in Morocco, Algeria, and Tunisia, mainly to the north of the Atlas mountains (Map 1). To the south, this species occurs mainly following river valleys. *P. convergens*, *P. farinosus*, and *P. rungsii* are more narrowly distributed in southern Morocco. Their ranges extend mainly along the southern slopes of the Atlas Mountains (Maps 3, 4, 6). Conversely, *P. nigriscopus* is much more widely distributed being recorded from various isolated parts of northern Sahara, in the Jordan Valley, and northern Oman (Map 5) (Patiny & Gaspar, 2000).



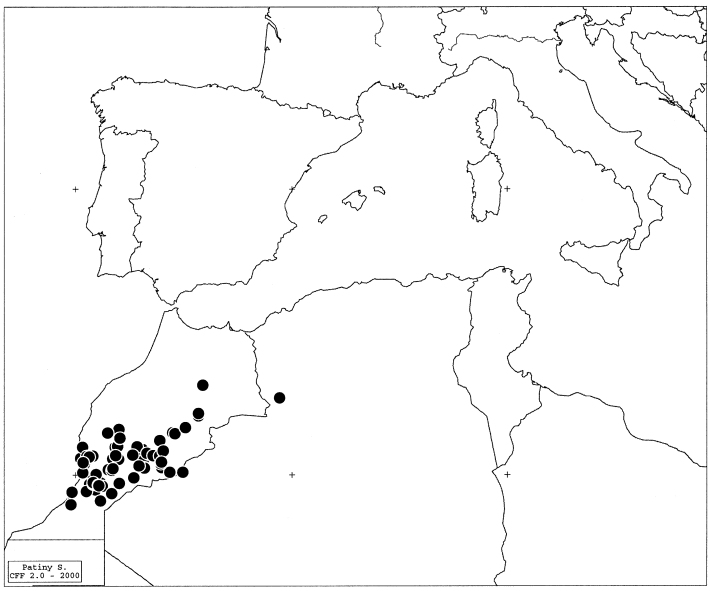
MAP 1. Distribution of *Panurgus calceatus*

In contrast to these five species, *P. canescens* and *P. meridionalis* are strictly European. *P. canescens* has been recorded from Portugal, Spain, France (Corsica included) and Italy (Sicily included) (Map 2). This species range seems to follow the Mediterranean eco-

systems of southwestern Europe (NGS, 2001). It is notable that, even after careful revision of several long series of specimens, no notable morphological variation among the included populations was recorded within this extensive range.



MAP 2. Distributions of *Panurgus canescens* (dots) and *Panurgus meridionalis* sp.nov. (crosses).

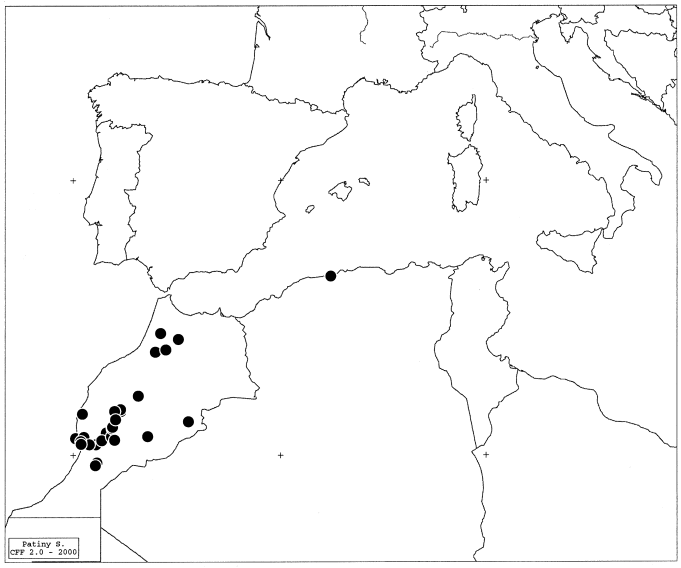


MAP 3. Distribution of *Panurgus convergens.*

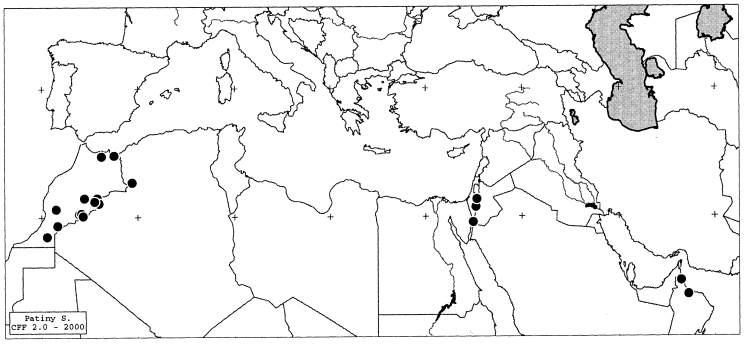
Current knowledge of the distribution of *P. meridionalis* is limited. However, based on available specimens, one can point out some unique and remarkable features of this

species range. First, the available specimens are endemic to two contiguous Spanish regions (Murcia and Andalusia), in the coastal area between Cartagena and Almería, suggesting rarity and a narrow distribution. Second, detailed study of many specimens of Spanish *Panurgus* revealed no additional individuals of the new species. On this basis, it can be considered that *P. meridionalis* is narrowly endemic to a small area of south-eastern Spain from which the closely related species *P. canescens* is unknown. This is a parapatric distributional pattern between the broadly distributed *P. canescens* and the more precinctive *P. meridionalis*.

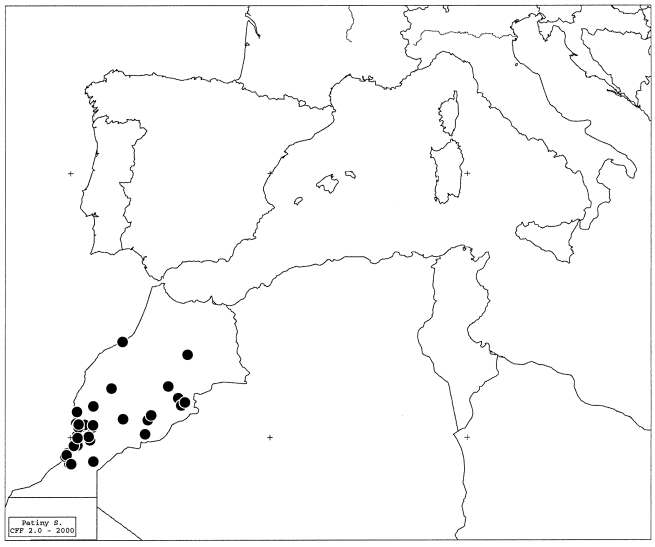
In addition, it can be underlined that there is no correspondence between the two taxonomic (species related to *P.calceatus* vs species related to *P.rungsii*) and biogeographic (European vs North African species) groups within *Panurgus* (*Pachycephalopanurgus*). Whereas, most species range in North-Africa, the three species associated in the *P. canescens* group range in both, Europe (*P. canescens* and *P. meridionalis*) and in North-Africa (*P. calceatus*).



MAP 4. Distribution of *Panurgus farinosus.*



MAP 5. Distribution of *Panurgus nigriscopus.*



MAP 6. Distribution of *Panurgus rungsii*.

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