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Rheocricotopus (*Psilocricotopus*) *meridionalis* sp. n. and *R.* (*Psc*.) *thomasi* sp. n., two crenophilous species inhabiting cold helocrenes and streams in the Mediterranean Region [Diptera, Chironomidae, Orthocladiinae]

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A description of *Rheocricotopus* (*Psilocricotopus*) *meridionalis* sp. n. (male and female adults and pupal exuviae) and *R.* (*Psc*.) *thomasi* sp. n. (male adults) is provided based on material collected in pristine lotic habitats delimited by helocrenes, waterfalls and rhithral of cold springs and streams located at low and medium altitude (30-800 m) in the Mediterranean Region including Lebanon, Algeria, continental France and Corsica. The two new species key in the subgenus *Psilocricotopus* on the basis of the morphological characters of the male adult and the pupal exuviae. In the male adult: humeral pit moderately large, circular to ovoid; superior volsella rounded or sub-triangular, not projecting downward. In the pupal exuviae: rounded median patch of spines absent on tergites IV-VI; posterior transverse rows of spines present on tergites III-VIII. According to various diagnostic characters found in the male adult and the pupal exuviae of *R. meridionalis* sp. n. this species keys near *R. chalybeatus* (Edwards, 1929), while the characters of the male adult of *R. thomasi* sp. n. key this latter near both *R. notabilis* Caspers, 1987 and *R. subacutus* Caspers & Reiss, 1989. The genus *Rheocricotopus* is currently represented by 8 species in continental France and by 6 species in Corsica. Consequently, the descriptions of *R. meridionalis* sp. n. and *R. thomasi* sp. n. increase the total number in the genus to 10 for continental France and to 8 for Corsica. Both *R. meridionalis* and *R. thomasi* sp. n., are exclusively rheophilic and being confined to cold and shaded pristine springs and streams. Taxonomic remarks, discussion and comments on the ecology and geographical distribution of the two new species are given.

***Rheocricotopus* (*Psilocricotopus*) *meridionalis* sp. n. et *R.* (*Psc.*) *thomasi* sp. n., deux espèces crénophiles confinées aux sources hélocrènes et aux ruisseaux froids en région méditerranéenne [Diptera, Chironomidae, Orthocladiinae]**

Mots-Clés: *Rheocricotopus* (*Psilocricotopus*) sp. n., Diptera Chironomidae, région méditerranéenne, conservation.

Le mâle adulte et l'exuvie nymphale de *Rheocricotopus* (*Psilocricotopus*) *meridionalis* sp. n. et *R.* (*Psc*.) *thomasi* sp. n. sont décrits à partir d'un matériel collecté dans des habitats lotiques (altitude 30-1000 m) délimités par des sources hélocrènes, des cascades et des parcours rapides de ruisseaux froids situés en basse et en moyenne montagne dans la région méditerranéenne (Liban, Algérie, France continentale et Corse). Les deux nouvelles espèces appartiennent au sous-genre *Psilocricotopus* sur la base des caractères morphologiques de l'imago mâle et de l'exuvie nymphale. Mâle adulte: aire humérale de taille moyenne,

circulaire à ovale; volselle supérieure arrondie ou sub-triangulaire, non projetée vers le bas. Exuvie nymphale: groupe arrondi d'épines absent sur les tergites IV-VI; rangées postérieures d'épines présentes sur les tergites III-VIII. Une diagnose spécifique basée sur plusieurs critères taxonomiques du mâle et de l'exuvie nymphale place *R. meridionalis* sp. n. près de *R. chalybeatus* (Edwards, 1929), alors que celle qui correspond à l'adulte male de *R. thomasi* sp. n. la rapproche de *R. notabilis* Caspers, 1987 et de *R. subacutus* Caspers & Reiss, 1989. Le genre *Rheocricotopus* est actuellement représenté par 8 espèces en France continentale et par 6 espèces en Corse. Par conséquent, les présentes descriptions portent le nombre d'espèces appartenant au genre *Rheocricotopus* connues de ces deux contrées biogéographiques à 10 en France continentale et à 8 en Corse. Un commentaire et des discussions sur la position systématique, l'écologie, la conservation et la distribution géographique des deux nouvelles espèces sont fournis.

1. Introduction

The genus *Rheocricotopus* Thienemann & Harnish, 1932 includes exclusively rheophilic species mainly encountered in lotic habitats delimited by helocrenes and the rhithral of rivers and streams. This genus has been revised and divided into two subgenera by SÆTHER (1985): *Psilocricotopus* Sæther and *Rheocricotopus* s. str. Three groups are currently emended within the *Psilocricotopus* subgenus by the same author: *godavarius* group, *chalybeatus* group and *atripes* group. Worldwide, there is about 70 *Rheocricotopus* valid species (ASHE & O'CONNOR, 2012, SÆTHER & SPIES, 2013). Data on the taxonomy and geographical distribution of the known *Rheocricotopus* valid species from Europe and some neighbouring areas (EDWARDS 1929, THIENEMANN & HARNICH 1932, BRUNDIN 1956, LEHMANN 1969, HIRVENOJA 1973, CHAUDHURI & SINHARAY 1983, SÆTHER 1985, SÆTHER & SCHNELL 1988, CASPERS 1987, CASPERS & REISS 1989, WANG & ZHENG 1989, 1991, BHATTACHARYAY et al. 1991, WANG 1995, WANG & SÆTHER 2001, MAKARCHENKO & MAKARCHENKO 2005, LANGTON & PINDER 2007, ASHE & O'CONNOR 2012, SÆTHER & SPIES 2013) show that there are currently about 35 valid species of which only 8 are reported from continental France and 6 from Corsica. The description here of *Rheocricotopus* (*Psc.*) *meridionalis* sp. n. and *R.* (*Psc.*) *thomasi* sp. n. increases the total number of *Rheocricotopus* species to 13 of which 10 are now reported from continental France and 8 from Corsica.

According to taxonomic characters of the genus *Rheocricotopus* (male adult and pupal exuviae) provided by SÆTHER (1985), the two new species key in the subgenus *Psilocricotopus* Sæther based on the following features found in the male adult (superior volsella large, rounded or sub-triangular, not projecting downwards; crista dorsalis triangular and distinct) and the pupal exuviae (rounded median patch of spines absent on tergites IV-VI; posterior transverse rows of spines present on tergites III-VIII). On the basis of the imaginal characters of the male adult, *R. meridionalis* sp. n. is keyed near *R. chalybeatus* Edwards, 1929 (known from the Palaearctic Region) while *R. thomasi* sp. n. is keyed near *R. notabilis* Caspers, 1987 (described from Portugal, reported from Spain and Italy) and *R. subacutus* Caspers & Reiss, 1989 (described from Turkey, reported from Spain).

In this paper, a description of *Rheocricotopus* (*Psc.*) *meridionalis* sp. n. (male and female adults and pupal exuviae) and *R.* (*Psc.*) *thomasi* sp. n. (male adult) is given based on material collected in pristine lotic habitats delimited by helocrenes, waterfalls and rhithral of cold streams located at low and medium altitude (25-850 m) in the Mediterranean Region. Biogeographic

regions and subregions of continental France are detailed by zones (from zone 1 to zone 13) as provided in MOUBAYED-BREIL (2008) and MOUBAYED-BREIL & ASHE (2016).

The type material examined here as holotype and paratypes for the two new species is detailed as follows:

- *R. meridionalis* sp. n. (associated pharate male and female adults and pupal exuviae, East and W-Mediterranean, Lebanon, Algeria, continental France and Corsica);

- *R. thomasi* sp. n. (male adults, W-Corsica and Eastern Pyrenees).

Terminology and measurements follow those of SÆTHER (1980, 1985) for the imagines, and SÆTHER (1980) for pupal exuviae. Taxonomic remarks, discussion and comments on the ecology and geographical distribution of the two new species are provided.

2. *Rheocricotopus* (*Psilocricotopus*) *meridionalis* sp. n.

Material examined

Holotype. **Lebanon.** Beirut River, Hammana helocrenes, rhithral and waterfalls, conductivity 330-350 µs/cm, altitude 700-850 m; 1 male pharate adult, leg. J. Moubayed-Breil, 26.V.1982.

Paratypes (all leg. J. M-B). **Lebanon**. Beirut River Basin, Hammana helocrenes, waterfalls and rhithral altitude 700-850 m, pharate adults (7 males, 3 females), pupal exuviae (6 males, 8 females), 26.V.1982. Awaly River Basin, south western area, rhithral and waterfalls, altitude 250-350 m, pharate adults (1 male, 1 female), pupal exuviae (2 males, 3 females), 7.XI.1997. **Algeria**. Aissi wadi, Ait Agad tributary, northern Algeria, waterfalls and rhithral, 1 male adult and 1 male pupal exuvia, altitude 550-560 m, 27.III.1986. **Continental France** (biogeographical zones are cited as provided in MOUBAYED-BREIL 2008 and MOUBAYED-BREIL & ASHE 2016). Saison River Basin, gorges of Kakueta, Western Pyrenees (zone 6b), helocrenes, waterfalls and rhithral, altitude 350-500 m, 1 male adult, 1 female pupal exuviae, 23.V.1987. Middle Basin of the Massane River, Massane Nature Reserve, S-France, Eastern Pyrenees (zone 8b), helocrenes, waterfalls and rhithral, altitude 700-850 m, 2 pupal exuviae (1 male, 1 female), 11.V.2004. Clamoux stream, tributary of the Aude River, South central France, East of Carcassonne, altitude 750 m, rhithral and waterfalls, 1 male adult, 2 pupal exuviae (1 male, 1 female), 23.V.1995. Upper basin of the Argent-Double stream, tributary of the Aude River, South central France, East of Carcassonne, altitude 650 m, 1 female pupal exuviae, 23.V.1995. Roque-Haute Volcanic table, basaltic wetland area, temporary rheocrenes, S-France (zone 9b), altitude 25-35 m. Middle basin of the Roya River at Breil-sur-Roya, rhithral and waterfulls, altitude 800-850 m, Maritime Alps, SE-France, 1 male adult, 25.IX.2014. **Corsica**. Seriera River Basin, western Corsica, rhithral and waterfalls, altitude 350-400 m, 1 male adult and 1 male pupal exuviae, 1.V.2012. Asco River Basin, helocrenes, waterfalls and rhithral, northern Corsica, altitude 650-800 m, 1 male adult, 3 pupal exuviae (1 male and 2 females), 5.VI.2014.

Holotype (on 1 slide, including the male adult and its pupal skin), paratypes (2 slides with 2 additional male and female pupal exuviae, Beirut River) are deposited in the collections of the National Museum of Ireland, Kildare Street, Dublin 2, Ireland. Remaining paratypes are deposited in the author's collection. Type material was preserved in 75% alcohol, and later mounted in polyvinyl lactophenol. For each adult, the head, thorax and abdomen were cleared in 90% lactic acid before mounting on slides.

Etymology: the new species is named *meridionalis* after its wide geographical distribution throughout the Mediterranean Basin including areas located in both Near Eastern areas (Lebanon, Levantine Province) and the W-Mediterranean (Algeria, continental France and Corsica).

Diagnostic characters

The new species keys in the subgenus *Psilocricotopus*, Sæther based on the following features found in the male adult (superior volsella large, rounded or sub-triangular, not projecting

downwards; crista dorsalis triangular and distinct) and the pupal exuviae (rounded median patch of spines absent on tergites IV-VI; posterior transverse rows of spines present on tergites III-VIII).

The specific features found in the male adult and pupal exuviae of *R. meridionalis* sp. n. can easily distinguish it from other related *Rheocricotopus* species and especially from its nearest one *R. chalybeatus*.

- In the male adult: high to medium value of the antennal ratio AR 1.10-1.20; antepronotum and scutum separated by a distinct notch; R 14-15, R_{2+3} and R_{4+5} bare; humeral pit large and ovoid, inverted-egg shaped; anal point small sized; gonocoxite with rounded apex; superior volsella triangular with concave inner margin, narrowed and bent apically reaching base of inferior volsella; inferior volsella consists of two nearly subequal lobes (dorsal lobe nose-like shaped to truncate, occasionally rectangular, distal area with 2-3 minute setae; ventral lobe covered with stout setae); unusual distribution pattern of setae on median area of tergites I-V; gonostylus strongly bent upwards, lacking distinct crista dorsalis.

- In the female adult: antenna 257 µm long, last flagellomere 91 µm long, AR 0.55; humeral pit ovoid, inverted egg-like shaped; R with 9-10 setae, R_{2+3} and R_{4+5} bare. Squama with 8-9 setae; distribution pattern of setae on median area of tergites I-V: 2, 5, 4, 5, 5; notum with distinct rami; ventrolateral lobe extended horizontally, dorsomesal lobe rounded anteriorly, apodeme lobe distinctly swollen medially; sternite VIII with 8 setae; seminal capsule 140 µm long, 90 µm wide, pearl-like shaped, sclerotized in apical and lateral part; tergite IX semicircular, distinctly divided on its posteromedian area and bearing 10 setae.

- In the pupal exuviae: big sized species; anteromedian area of cephalothorax distinctly wrinkled and rugulose; thoracic horn distinctly swollen medially with rounded and smooth apex; precorneals placed long distance upwards from base of thoracic horn; distance between dorsocentrals shorter, especially between Dc_2 and Dc_3; caudal transverse spines on tergites III-VII large; longest spines on tergite VII 26-30 µm long, shorter spines 12-20 µm long; distribution pattern of caudolateral spines, spinules and shagreen on sternites II-VI becoming gradually larger and more extensive, those on sternite V are interrupted while those on VI are continued; lateral setae are conspicuously long and bristle-like to stout on segments II-VI and lamelliform on segments VIII-VIII; 1 lateral seta is regularly forked on segments II-IV; fringe of anal lobe with 22-24 filaments.

Description

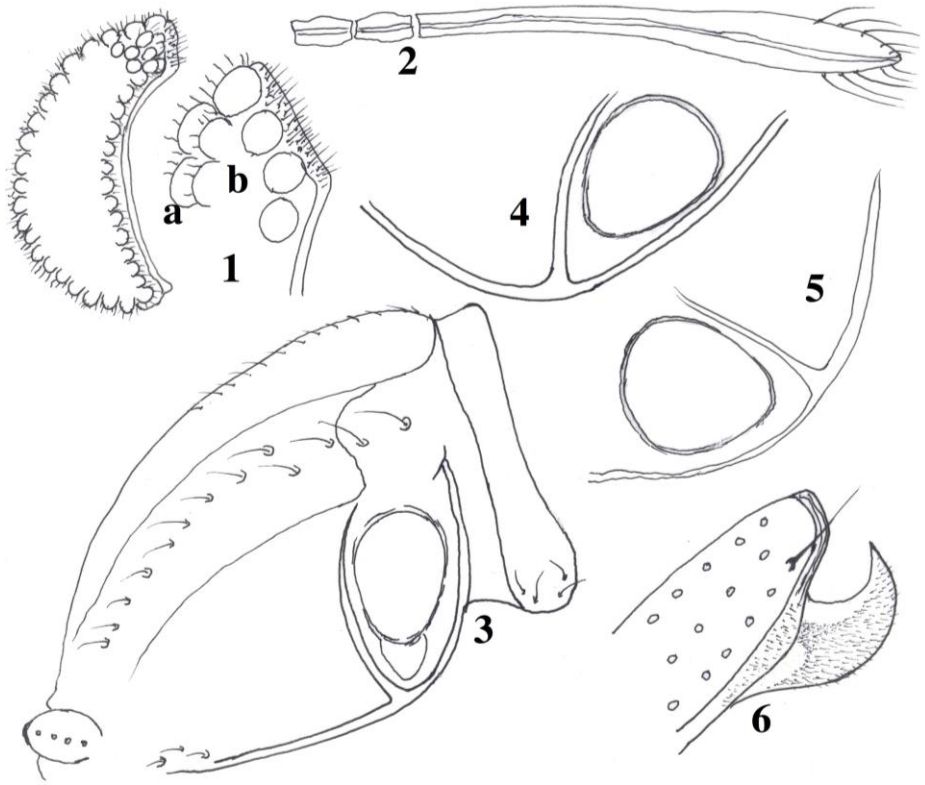
Male imago

(n = 5, male pharate adults; Figs 1-11, 13-18)

Big sized species (among the biggest *Rheocricotopus* species). Total length 3.55-3.75 mm. Wing length 1.50-1.60 mm. General colouration variable from dark brown to brown greenish according to their geographical origin:

- specimens collected in mountain areas are: contrasting brown to dark brown, especially on the thorax which is nearly brown blackish; head, antenna and halteres brown; thorax brown with dark brown mesonotal stripes which are indistinctly fused; humeral pit brown yellowish; wing with distinct dark shading; legs dark brown to brown, coxa and trochanter darker; abdominal tergites I-VIII entirely brown to dark brown, anal segment dark brown;

- specimens occurring in lowland areas are brown to brown greenish in general.

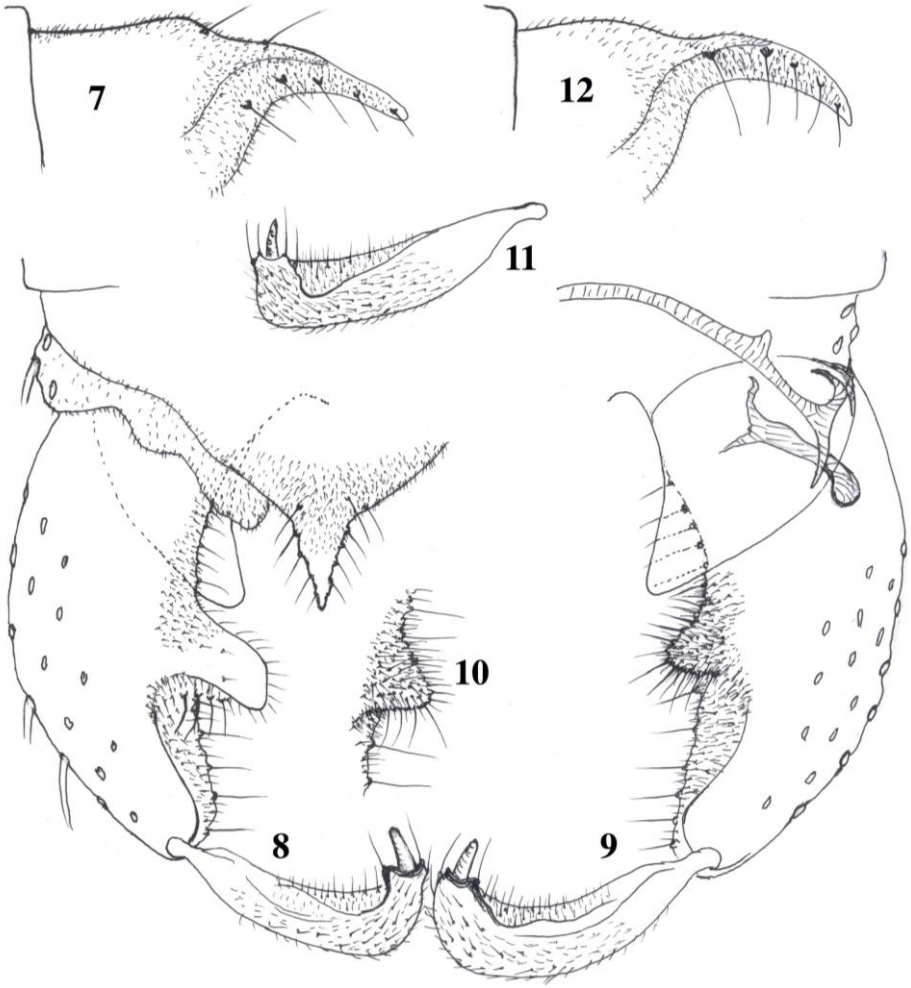


Figures 1-6. Male imago of *Rheocricotopus* (*Psc.*) *meridionalis* sp. n. Hairs on inner margin of eyes and details of the proximal area (1a-1b); antenna, segments 11-12 and last flagellomere (2); thorax, lateral view (3); humeral pit, two aspects (holotype, 4; paratype, 5); femoral claw of PI (6);

Figures 1-6. Imago mâle de *Rheocricotopus* (*Psc.*) *meridionalis* sp. n. Pubescence de la membrane interne des yeux et détails de l'aire proximale (1a-1b); antenne, segments 11-12 et dernier flagellomère (Fig. 2); thorax, vue latérale (3); aire humérale, deux aspects (holotype, 4; paratype, 5); griffe fémorale de la patte PI (6).

Head. Eyes hairy, elongated vertically; proximal part of inner eye margin (Figs 1a-1b) covered with dense minute setae. Temporal setae 7, including 4 inner and 3 outer verticals, postorbitals absent. Clypeus trapezoidal, maximum width 120 µm, minimum width 75 µm, bearing 13-14 setae in 4 rows. Palp 5-segmented; length (µm) of palpomeres 35, 55, 100, 135, 205; 3th and 4th palpomeres bearing a rounded apical patch of minute microtrichia; sensilla clavata present on distal part of 3rd segment.

Antenna (Fig. 2, segments 11-12 and flagellomere) 680-825 µm long, 13-segmented; antennal groove reaching flagellomere 3-4; segments 1 to 12 with a nearly equal width; segments 6 to 12 linear and nearly subequal; ultimate flagellomere distinctly clubbed distally, bearing a brush of curved sensilla chaetica apically. Length (µm) of the first 12th segments 325-375 µm; last flagellomere 355-450 µm long. AR 1.10-1.20.



Figures 7-12. Male imago of *Rheocricotopus* (*Psc.*) spp. *R. meridionalis* sp. n.: anal point, lateral view (7); hypopygium, dorsal (left, 8) and ventral (right, 9-10); right gonostylus, lateral view (paratype, 11). *R. chalybeatus*: anal point, lateral view (12).

Figures 7-12. Imago mâle de *Rheocricotopus* (*Psc.*) spp. *R. meridionalis* sp. n.: pointe anale, vue latérale (7) ; hypopyge, vues dorsale (à gauche, 8) et ventrale (à droite, 9-10); gonostyle gauche en vue latérale (11). *R. chalybeatus*: pointe anale, vue latérale (12).

Thorax (Fig. 3). Antepronotum separated from scutum by a distinct notch. Lateral antepronotals 4-5, acrostichals 12-13, dorsocentrals 14-15, prealars 3, supraalars 0. Humeral pit (Figs 4-5) large and ovoid, inverted-egg shaped. Scutellum with 8 uniserial setae.

Wing. Brachiolum with 1 seta. Distribution of setae on veins: - specimens collected in mountainous areas (R, 14-15; R_1, 2-3; R_{2+3}, 0; R_{4+5}, 0-1; in some specimens R_{4+5} is bearing 4-5 apical

setae); - specimens occurring at low altitude (R, 4-5; R_1, 0; R_{2+3}, 0; R_{4+5}, 0). Squama with 6-7 setae in a single row.

Legs. Femoral claw of PI (Fig. 6) 60-75 µm long. Tarsomere 5 of PI, PII and PIII truncate apically. Sensilla chaetica present in low number (proximally and distally) on tarsomeres 1-4 of PI, PII and PIII. Length (µm) and proportions of legs:

	fe	**ti**	**ta_1**	**ta_2**	**ta_3**	**ta_4**	**ta_5**	**LR**	**BV**	**SV**	**BR**
PI	555	495	250	125	105	65	65	0.51	3.61	4.20	1.6
PII	565	645	385	210	185	90	85	0.60	2.80	3.14	2.0
PIII	545	630	375	205	165	70	80	0.60	2.98	3.13	3.0

" LR = Length of tarsomere ta1 divided by length of tibia (ti); BV = Combined length of femur (fe), tibia and ta1 divided by combined length of tarsomeres ta2-ta5; SV = Ratio of femur plus tibia to tarsomere ta1; BR = Ratio of longest seta of ta1 divided by minimum width of ta1, measured one third from apex."

Abdomen. Hypopygium in dorsal and ventral view (Figs 8-10, 15). Tergite IX rounded to nearly cup-like with narrowed posterior margin. Anal point 160-170 µm long, small sized and short, triangular, large and broadened at base, uniformly narrowed and not sharply pointed in both dorsal (Figs 8, 15) and lateral view (Fig. 7); base bearing 2-3 setae, lateral margin with 7-8 setae. Laterosternite IX with 3 setae. Transverse sternapodeme and phallapodeme as in figures 9 and 15. Virga absent. Gonocoxite 180-185 µm long, maximum width 120-130 µm, with rounded apex. Superior volsella (Figs 8-9, 13-15) triangular with distinct concave inner margin, narrowed distally and bent apically reaching base of inferior volsella. Inferior volsella (Figs 8-9, 13-15) consists of two nearly subequal lobes. Dorsal lobe about 250 µm wide, slightly larger than ventral lobe, nose-like shaped to truncate (Fig. 8), occasionally rectangle-like shaped (Figs 15-16); distal area with 2-3 distinct minute setae; basal margin bearing several small setae. Ventral lobe 240 µm wide, sub-triangular, less prominent than dorsal lobe; inner and outer margin densely covered with stout setae, posterior margin with 3-4 stout setae downwardly directed. Gonostylus (Figs 8-9, 11, 15) 85-90 µm long, strongly bent upwards, basal margin slightly rounded medially; anterior margin swollen in proximal part and bearing 6-7 orally directed setae, distal part distinctly concave. Crista dorsalis indistinct. Megaseta 15-20 µm long, slender and bent inwards. Distribution pattern of setae on median area of tergites I-V and II-V as illustrated in Figs 17-18: tergite I (2, posteromedian area), II (5), III (5-6), IV-V (4, occasionally 5).

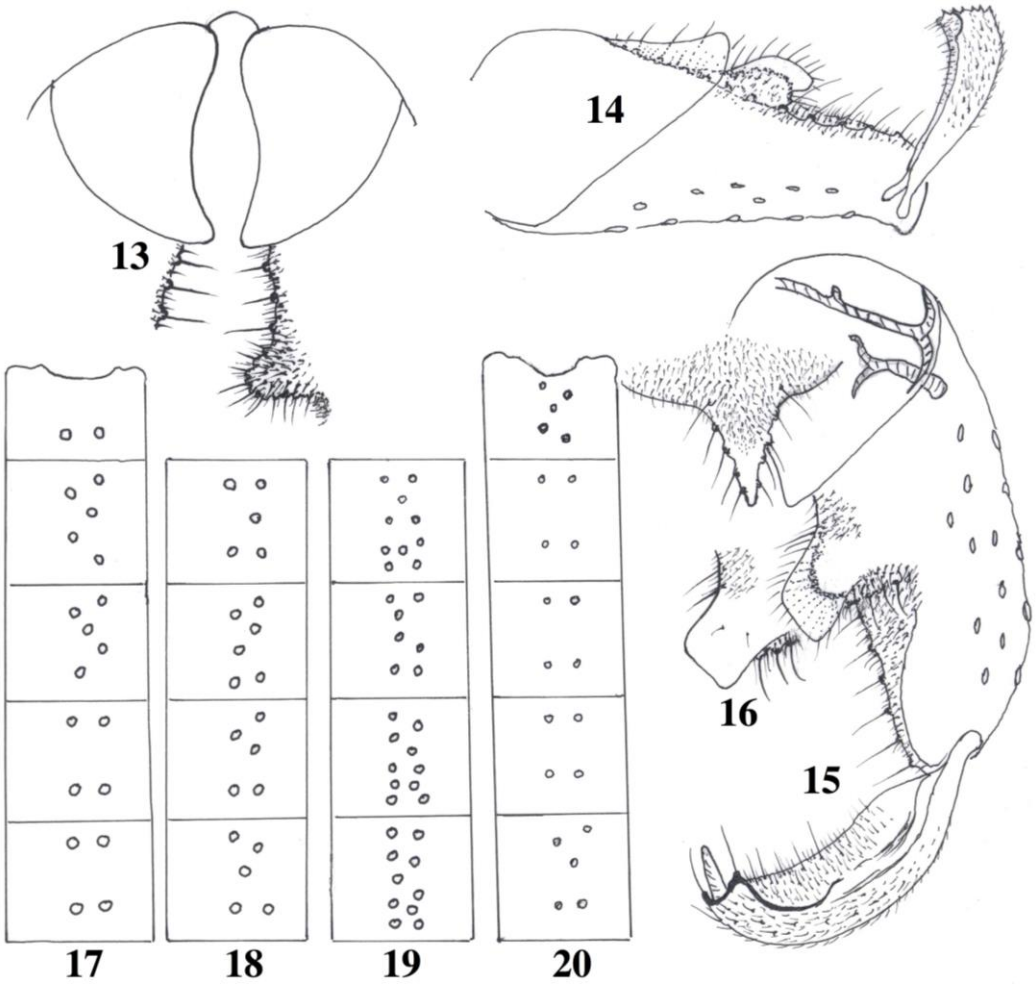
Female imago

(n = 3, female pharate adults; Figs 21-28)

Big sized species. Total length 3.60-3.75 mm. Colouration as in the male except for the antenna, which is distinctly contrasting dark brown to brown yellowish (pedicel and last segment much darker than segments 1 to 4. Wing length 1.40-1.50 mm. Head. Eyes hairy, elongated vertically; proximal part of inner eye margin with dense minute setae as in the male adult.

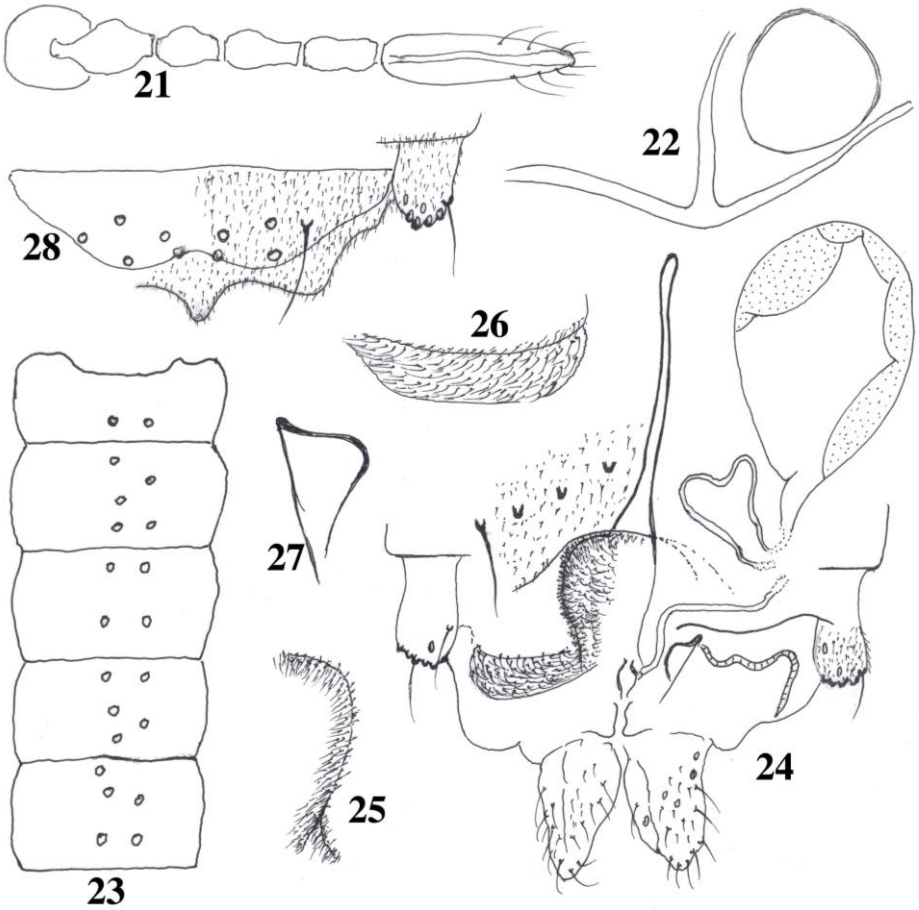
Temporals 6-8, including 2-3 inner and 4-5 outer verticals, postorbitals absent. Clypeus with 8 setae. Palp 5-segmented bearing 18-19 setae; length (µm) of segments: 30, 35, 55, 75, 140.

Antenna (Fig. 21) 257 µm long, 5-segmented; length (µm) of segments: 49, 35, 40, 42, 91; segments 1 swollen medially, segments 2 and 3 swollen proximally, segment 4 linear; last flagellomere club-shaped, slightly narrowed, bearing several sensilla chaetica apically; antennal groove restricted to last flagellomere; AR 0.55.



Figures 13-20. Male imago of *Rheocricotopus* (*Psc.*) spp. *R. meridionalis* sp. n.: proximal and median part of gonocoxite, ventral view (13); gonocoxite and gonostylus, lateral view (14); hypopygium, dorsal and ventral view (paratype, basaltic helocrenes at Roque-Haute, S-France, 15-16). Distribution pattern of setae on median area of tergites: I-V (*R. meridionalis* sp. n., holotype, 17); II-V (*R. meridionalis* sp. n., paratype, 18); II-V (*R. atripes*, 19); I-V (*R. chalybeatus* 20).

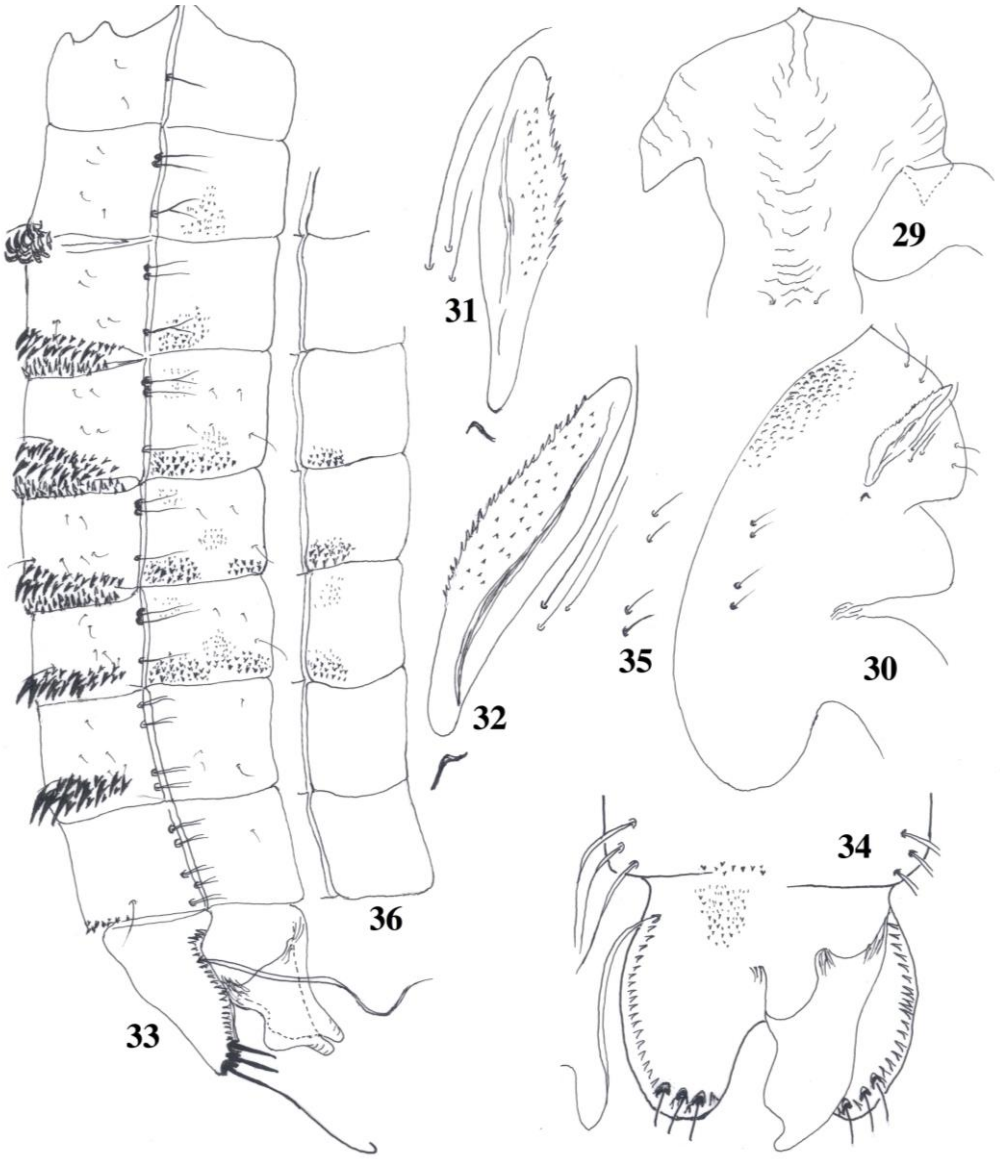
Figures 13-20. Imago mâle de *Rheocricotopus* (*Psc.*) spp. *R. meridionalis* sp. n.: aire proximale et médiane du gonocoxite, vue ventrale (13); gonocoxite et gonostyle, vue latérale (14); hypopyge vue dorsale et ventrale (paratype, sources hélocrènes de Roque-Haute, S-France, 15-16). Distribution des soies sur l'aire médiane des tergites: I-V (*R. meridionalis* sp. n., holotype, 17); II-V (*R. meridionalis* sp. n., paratype, 18); II-V (R. *atripes*, 19); I-V (*R. chalybeatus*, 20).



Figures 21-28. Female imago of *Rheocricotopus* (*Psc.*) *meridionalis* sp. n.: antenna (21); humeral pit (22); distribution pattern of setae on median area of tergites I-V (23); genitalia, dorsal and ventral view (24) including gonapophysis VIII, sternite VIII, seminal capsule, left gonocoxite and cercus; dorsomesal lobe (25); ventrolateral lobe (26); apodeme lobe (27); tergite IX and right gonocoxite, dorsal (28).

Figures 21-28. Imago femelle de *Rheocricotopus* (*Psc.*) *meridionalis* sp. n.: antenne (21); aire humérale (22); distribution des soies sur l'aire médiane des tergites I-V (23); genitalia, vue dorsale et ventrale (24) y compris gonapophyse VIII, sternite VIII, capsule séminale, gonocoxite gauche et cerque; lobe mésodorsal (25); lobe ventrolatéral (26); lobe de l'apodème (27); tergite IX et gonocoxite droit, vue dorsale (28).

Thorax. Lateral-antepronotals 5, acrostichals 6-8, dorsocentrals 9-10, prealars 3; humeral pit (Fig. 22) large, ovoid, inverted-egg shaped maximum width 100-105 µm. Scutellum with 8 uniserial setae. Wing. R with 9-10 setae, R_{2+3} and R_{4+5} bare. Squama with 8-9 setae. Sensilla chaetica present in low number on tarsomeres 1-4 of PI, PII and PIII. Legs. Distribution of sensilla chaetica on tarsomeres 1-4 of PI, PII and PII as in the male.



Figures 29-36. *Rheocricotopus* (*Psc.*) spp., pupal exuviae. Male pupal exuviae of *R. meridionalis* sp. n.: frontal apotome (29); cephalothorax (30); two aspects of thoracic horn (31-32); armament pattern and chaetotaxy of abdominal segments I-VIII, lateral view (33); anal segment, dorsal and ventral view (34). *R. chalybeatus*: distribution of dorsocentrals (35); chaetotaxy and armament of sternites III-VIII (36).

Figures 29-36. *Rheocricotopus* (*Psc.*) spp., exuvie nymphale. Exuvie nymphale mâle de *R. meridionalis* sp. n.: pièce frontale (29); céphalothorax (30); deux aspects de la corne thoracique (31-32); ornementation et chaetotaxie des segments abdominaux I-VIII, vue latérale (33); segment anal en vues dorsale et ventrale (34). *R. chalybeatus*: mode de distribution des soies dorso-centrales (35); chaetotaxie et ornementation des sternites III-VIII (36).

Abdomen. Distribution pattern of setae on median area of tergites I-V (Fig. 23) as follows: I (2, placed on posteromedian area), II (5), III (4), IV-V (5). Genitalia in dorsal and ventral view as illustrated in Fig. 24. Notum 175-180 µm long, rami distinct and very long reaching genital openings. Gonapophysis VIII including ventrolateral, dorsomesal and apodeme lobe (Figs 25-27): ventrolateral lobe (Fig. 25) nearly linear and conspicuous; dorsomesal lobe (Fig. 26) rounded in proximal and median part; apodeme lobe (Fig. 27) distinctly swollen medially. Sternite VIII with 8 setae (4 on each side of gonapophysis VIII). Seminal capsules (Fig. 24) 140 µm long, 90 µm wide, pearl-like, sclerotized part occupying the apical and lateral part. Spermathecal ducts with loops and fused openings. Tergite IX and gonocoxite (Fig. 28). Tergite IX nearly semi-circular, distinctly divided on its posteromedian part in 2 rounded lobes, bearing 10 setae (5 on each side), posterior margin winding; gonocoxite lobe-like, bearing 7 setae. Cercus 150 µm long.

Male pupal exuviae

(n = 10: 5 males and 5 females; Figs 29-34)

Colouration in general brownish to dark brown. Frontal apotome brown and distinctly wrinkled and rugulose. Anteromedian area of cephalothorax markedly rugulose and wrinkled; blackish shading present near the base of thoracic horn and wing sheath; outer and inner margin of antennal sheath brownish. Abdomen brownish, lateral margin of segments VII-VIII markedly dark brown and thick. Anal lobe and genital sac brownish. Total length 3.60-3.80 mm.

Cephalothorax (Figs 29-30). Frontal apotome (Fig. 29) nearly semi-circular, lateral margin bearing (occasionally) a distinct protuberance apically, frontal setae on prefrons 23-25 µm long. Thorax. Median antepronotal 30-35µm long nearly subequal, lateral antepronotals 80-85 and 130-135 µm long; precorneals 45-50, 85-90 and 110-115 µm long, inserted long distance upward from base of thoracic horn. Thoracic horn (Fig. 31-32) 220-230 µm long, maximum width 50-60 µm, toothed on one side, basal part linear, gradually swollen medially with smooth and rounded apex. Dorsocentrals (Fig. 30) well developed and nearly subequal (25-30 µm long); distance between Dc_1 to Dc_2 18-23 µm, Dc_3 to Dc_4 19-25 µm; Dc_2 and Dc_3 separated by 37-43 µm.

Abdomen and anal segment (Fig 33-34). Armament and distribution pattern of shagreen, rows of posterior transverse spines and hooks of abdominal segments as illustrated in figure 33. Tergite I bare. Transverse rows on posterior margin of tergite II armed with 3-5 rows of hooks, orally projecting and occupying about 1/3 of segment width. Caudal transverse spines present on tergites III-VII are gradually larger and less extensive on each segment (relatively sparse on tergite VII); tergite VIII (Figs 33-34) with 1-2 rows of minute spines; length (µm) of the longest spines on tergites III-VII: 18-20 (III), 19-22 (IV), 23-22 (V), 25-28 (VI), 27-33 (VII); shortest spines 12-20 µm long. Conjunctives III/IV to V/VI each with 2-3 rows of pin-shaped orally directed spinules which are restricted to median area. Sternites I and VII-VIII bare; caudolateral area of sternites II-VI with patch of spinules becoming gradually larger and more extensive on IV-VI. Caudolateral and posteromedian patch of spines and spinules on sternites V-VI are interrupted on V and distinctly continued on VI. Pedes spurii B absent. Pedes spurii A present on sternites IV-VI. Lateral setae on segments I-VI conspicuously long, stout to bristle-like, and lamelliform on segments VII-VIII. Distribution of lateral and lamelliform setae on segments I-VIII as follows: I-VI (1, 3, 3, 3, 3, 3); VII-VIII 4, 5. One forked seta is regularly present on segments II-IV. Anal segment (Fig. 34) 225-230 µm long 270-280 µm wide, fringe bearing 22-24 lamelliform setae. Genital sac (Figs 33-34) 180-185 µm long, swollen distally and narrowed

apically, overreaching apical margin of anal lobe by 45-50 µm. Macrosetae 310-325 µm long curved and pointed apically.

Larva

Unknown.

3. *Rheocricotopus* (*Psilocricotopus*) *thomasi* sp. n.

Material examined

Holotype, **Corsica.** Prezzuna River (W-Corsica), helocrenes, waterfalls and rhithral, conductivity 135-175 µs/cm, altitude 250-300 m; 1 male adult leg. J. Moubayed-Breil, 05.VI.2015.

Paratype (leg. J. M-B). Continental France, Eastern Pyrenees, zone 8b in MOUBAYED-BREIL & ASHE (2012), rhithral and waterfalls, upstream area of the Massane River, Massane Nature Reserve, conductivity 75-85 µs/cm, altitude 700-800 m; 1 male adult, 07.VI.2013.

Holotype (on 1 slide) is deposited in the collections of the National Museum of Ireland, Kildare Street, Dublin 2, Ireland. Paratype is deposited in the author's collection. Type material was preserved in 70% alcohol, and later mounted in polyvinyl lactophenol. For each adult, the head, thorax and abdomen were cleared in 90% lactic acid before mounting on slides.

Etymology: the new species is named *thomasi* after my colleague Dr Alain Thomas from the University of Toulouse who is currently retired but remains active as a taxonomist on Ephemeroptera and several families of Diptera. His contribution in the training, transmission of skills, technical and practical expertise and knowledge in taxonomy to young researchers is kindly appreciated as well as in the preservation of environment and habitats of endemics species in France including French territories located overseas and Corsica.

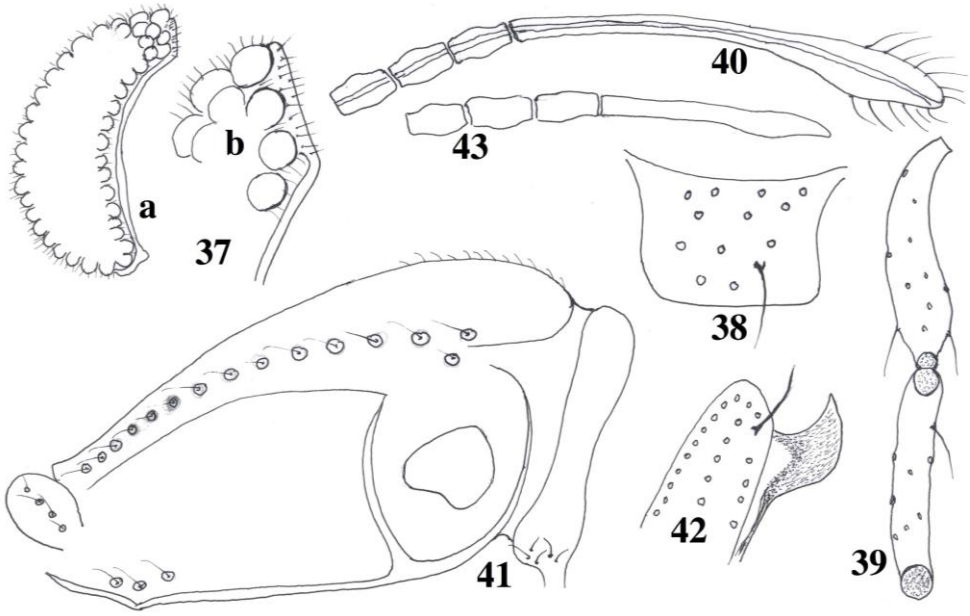
Diagnostic characters

The male adult of the new species keys in the subgenus *Psilocricotopus* based in the following characters: superior volsella large, rounded and not projecting downwards; crista dorsalis triangular and well pronounced. The new species is easily separated from other members of the genus in having: high value of antennal ratio AR 0.87; antepronotum and scutum separated by a distinct notch; humeral pit medium sized, inverted-heart shaped; R with 14-15 setae, R_1 2-3, R_{2+3} and R_{4+5} bare, squama with 6-7 setae; distribution of setae on median area of tergites II-V: II (10), III (7), IV (8), V (8); anal point big sized and long; gonocoxite with rounded apex; superior volsella very large, rounded and not bent apically; inferior volsella moderately projecting downwards apically (dorsal lobe larger than ventral lobe, bearing a distinct nose-like apex, distal area with 4-5 minute setae; ventral lobe densely covered with setae); gonostylus without an outer projection, uniformly elongated with posterior margin linear and straight; crista dorsalis well developed, tooth-like, rounded apically, surrounded by 5-6 stout and long setae. In addition, the latter characters of *R. thomasi* sp. n. will easily distinguish it from its nearest species *R. notabilis* and *R. subacutus*, which are known from the Mediterranean Region (*R. notabilis* from Portugal, Spain and Italy; *R. subacutus* from Turkey and Spain).

Description

Male imago

(n = 2, male adult; figures 37-42, 44-46, 49-50)



Figures 37-43. Male imago of *Rheocricotopus* (*Psc.*) spp. *R. thomasi* sp. n.: hairs on inner margin of eyes and details of the proximal area (37a-37b); clypeus (38); palp, 3rd and 4th segments (39); antenna, segments 10-12 and last flagellomere (40); thorax in lateral view (41); femoral claw of PI (42). *R. notabilis*: antenna, segments 10-12 and last flagellomere (43).

Figures 37-43. Imago mâle de *Rheocricotopus* (*Psc.*) spp. *R. thomasi* sp. n.: pubescence de la membrane interne des yeux et détails de l'aire proximale (37a-37b); clypeus (38); palpe, 3ème et 4ème segments (39); antenne, segments 11-12 et dernier flagellomère (40); thorax, vue latérale (41); griffe fémorale de la patte PI (42). *R. notabilis*: antenne, segments 11-12 et dernier flagellomère (43).

Big to medium sized. Total length 3.20-3.30 mm. Wing length 1.50-1.55. General colouration contrasting dark brown to brown reddish, especially on the thorax, legs and tergites. Head, antenna and halteres brown. Thorax brown with dark brown mesonotal stripes which are indistinctly fused; humeral pit brown yellowish. Wing with distinct dark shading. Legs brown, trochanter and base of femur of PI-PIII pale, contrasting yellow to transparent. Abdominal tergites I-III and VII-VIII dark brown, tergites IV-VI pale. Anal segment dark brown.

Head. Eyes hairy, elongated vertically; proximal part of inner eye margin (Fig. 37a-37b) bearing few minute setae. Temporal setae 7, including 4 inner and 3 outer verticals, postorbitals absent. Clypeus (Fig. 38) trapezoidal, maximum width 120 µm, minimum width 75 µm, bearing 13-14 setae in 4 rows. Palp 5-segmented; length (µm) of palpomeres 35, 55, 100, 135, 205; 3th and 4th palpomeres (Fig. 39) bearing a rounded apical patch of minute microtrichia (apically on 3th segment; basally and apically on 4th segment; sensilla clavata present on distal part of 3rd segment. Antenna (Fig. 40) 785 µm long, 13-segmented; antennal groove reaching flagellomere 3; segments 1 to 12 with a nearly equal width; segments 6 to 12 linear and nearly subequal; ultimate flagellomere 365 µm long, distinctly clubbed distally, bearing a brush of curved sensilla chaetica apically. Length (µm) of the first 12th segments 420 µm. AR 0.87 (holotype).

Thorax (Fig. 41). Antepronotum separated from scutum by a distinct notch. Lateral antepronotals 4, acrostichals 12-13, dorsocentrals 14-15, prealars 3, supraalars 0. Humeral pit medium sized, inverted-heart distinctly shaped. Scutellum with 8 uniserial setae.

Wing. Brachiolum with 1 seta. Distribution of setae on veins: R, 14-15; R_1, 2-3; R_{2+3}, 0; R_{4+5}, 0. Squama with 6-7 setae in a single row.

Legs. Femoral claw of PI (Fig. 42) 55-60 µm long. Tarsomere 5 of PI, PII and PIII truncate apically. Numerous sensilla chaetica present (proximally and distally) on tarsomeres 1-4 of PI, PII and PIII. Length (µm) and proportions of legs:

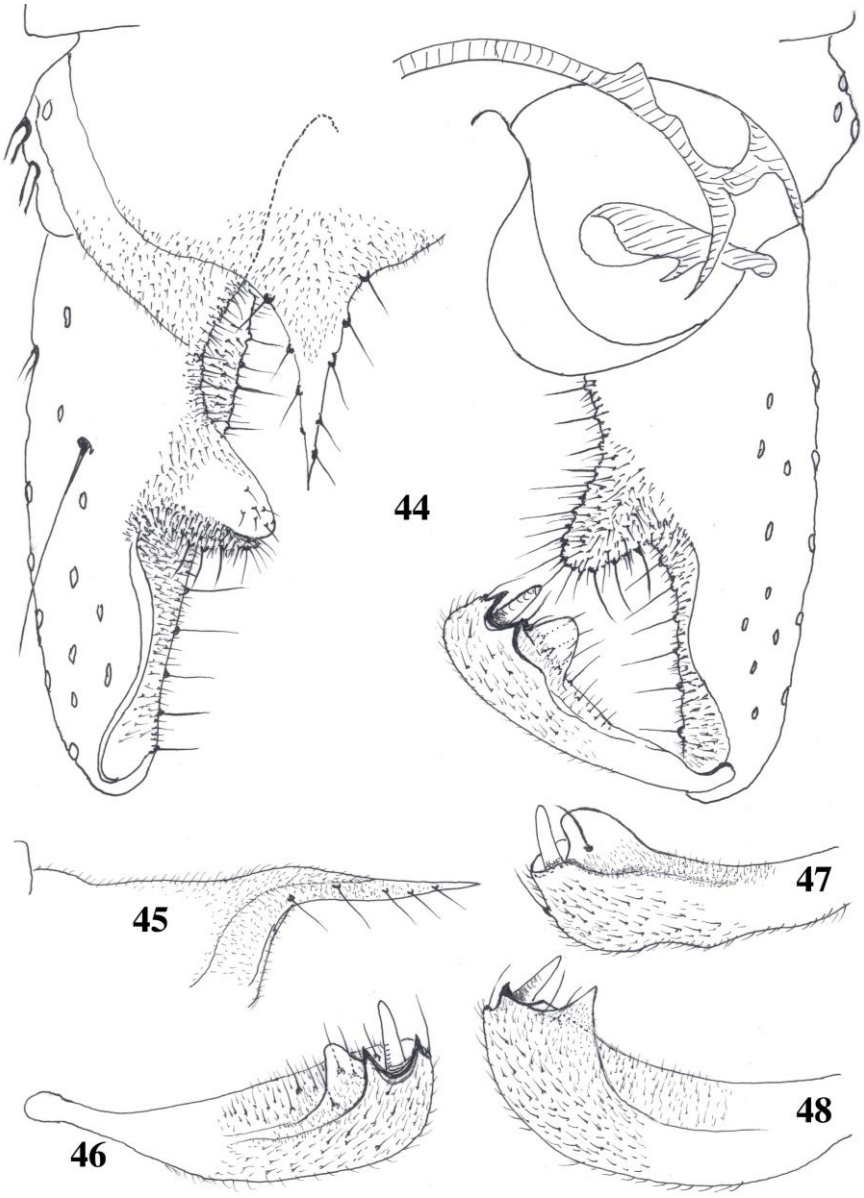
	fe	**ti**	**ta_1**	**ta_2**	**ta_3**	**ta_4**	**ta_5**	**LR**	**BV**	**SV**	**BR**
PI	765	715	610	335	250	170	105	0.85	2.43	2.42	1.6
PII	695	615	380	170	135	75	80	0.61	3.67	3.44	1.5
PIII	745	805	480	225	190	110	105	0.59	3.22	3.23	1.8

" LR = Length of tarsomere ta1 divided by length of tibia (ti); BV = Combined length of femur (fe), tibia and ta1 divided by combined length of tarsomeres ta2-ta5; SV = Ratio of femur plus tibia to tarsomere ta1; BR = Ratio of longest seta of ta1 divided by minimum width of ta1, measured one third from apex."

Abdomen. Hypopygium in dorsal and ventral view (Fig. 44). Tergite IX nearly rectangular and broad with a nearly straight posterior margin. Anal point (Figs 44-45) 55 µm long, broadened at base, uniformly narrowed and sharp, strongly pointed in both dorsal and lateral view, proximal half of dorsal part as well as ventral and lateral areas densely covered with small setae, presence of 8-9 stout and long setae along the lateral margin (4-5 on each side). Laterosternite IX with 3 setae. Transverse sternapodeme and phallapodeme (Fig. 44). Phallapodeme 40 µm long, club-like with rounded apex, bearing a posterior medial projection. Virga absent. Gonocoxite 175 µm long, maximum width 67 µm, with rounded apex. Superior volsella 57 µm long, large, rounded and not bent apically. Inferior volsella 37 µm long, maximum width 25 µm, well developed, moderately projecting and bent downwards apically, consists of two nearly subequal lobes. Dorsal lobe larger than ventral lobe, nose-like shaped apically, distal area bearing 4-5 distinct minute setae; distal part slightly swollen. Ventral lobe densely covered with setae, outer margin bearing numerous stout and long setae. Ventral inner margin of gonocoxite bearing 12-13 stout setae. Gonostylus (Figs 44, 46) 87 µm long, maximum width 20 µm, not projecting, uniformly elongated with linear to straight posterior margin, distal part bearing 5-6 orally directed setae placed near the crista dorsalis; 2 distinct teeth are placed apically (1 proximal and 1 distal to the megaseta) in both dorsal (Fig. 44) and lateral view (Fig. 46). Crista dorsalis well developed and located on distal part, sub-triangular and smooth apically (Fig. 30); megaseta 12 µm long, slender and bent inwards. Distribution pattern of setae on median area of tergites II-V (Fig. 50) as follows: II (10), III (7), IV (8), V (8).

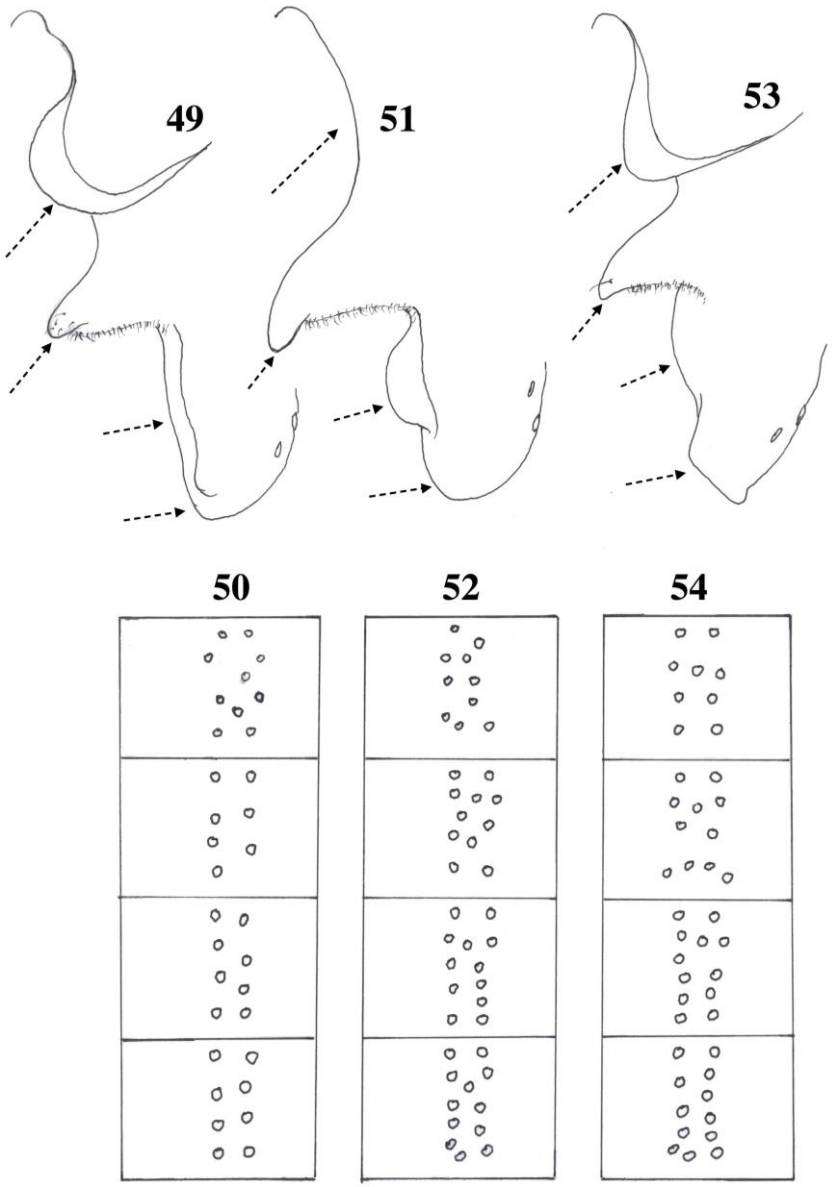
4. Taxonomic position

The two new species keys in the subgenus *Psilocricotopus* Sæther based on some main features provided by SÆTHER (1985) and found in the male adult (superior volsella large, rounded or sub-triangular, not projecting downwards; crista dorsalis triangular and distinct) and the pupal exuviae (rounded median patch of spines absent on tergites IV-VI; posterior transverse rows of spines present on tergites III-VIII). While *R. meridionalis* sp. n. is placed near *R. chalybeatus*, *R. thomasi* sp. n. resembles in general *R. notabilis* and *R. subacutus*.



Figures 44-48. Male imago of *Rheocricotopus* (*Psc.*) spp. *R. thomasi* sp. n.: hypopygium, dorsal (left) and ventral (right) (44); anal point, lateral view (45); left gonostylus, lateral view (46). Details of distal part of gonostylus: *R. notabilis* (47) after CASPERS & REISS (1987); *R. subacutus* (48) after CASPERS & REISS (1989).

Figures 44-48. Imago mâle de *Rheocricotopus* (*Psc.*) spp. *R. thomasi* sp. n.: hypopyge, vue dorsale (à gauche) et ventrale (à droite) (44); pointe anale, vue latérale (45); gonostyle gauche, vue latérale (46). Détails de la partie distale du gonostyle de: *R. notabilis* (47), d'après CASPERS (1987); *R. subacutus* (48) d'après CASPERS & REISS (1989).



Figures 49-54. Male imago of *Rheocricotopus* (*Psc.*) spp. Comparative details of gonocoxite and distribution of setae on median area of tergites II-V of: *R. thomasi* sp. n. (49-50); *R. notabilis* (51-52), after CASPERS (1987), *R. subacutus* (53-54), after CASPERS & REISS (1989).

Figures 49-54. Imago mâle de *Rheocricotopus* (*Psc.*) spp. Détails comparatifs de la partie dorsale du gonocoxite et de la distribution des soies sur l'aire médiane des tergites II-V de: *R. thomasi* sp. n. (42), *R. notabilis* (43) after CASPERS (1987), *R. subacutus* (44) after CASPERS & REISS (1989). Mode de distribution des soies sur la partie moyenne des tergites II-V de: *R. thomasi* sp. n. (49-50), *R. notabilis* (51-52) d'après CASPERS (1987), *R. subacutus* (53-54) d'après CASPERS & REISS (1989).

***R. meridionalis* sp. n.** The specific characters found in the male and female adults and pupal exuviae will separate *R. meridionalis* sp. n. from other related members of the genus including *R.* (*Psc.*) *atripes* (Kieffer, 1913) and especially from its nearest one, *R. chalybeatus*.

- In the male adult: antepronotum and scutum separated by a distinct notch (Fig. 3); R_{2+3} and R_{4+5} bare; humeral pit (Figs 4-5) large, inverted-egg shaped while it is rectangular in *R. chalybeatus* (Lehmann 1969, Fig. 12b); superior volsella triangular with a distinct concave inner margin, projecting downwards and narrowed apically (Figs 8, 9, 13, 15) while it is larger nearly right-angle shaped and not narrowed apically in *R. chalybeatus* (LEHMANN 1969, Fig. 1); inferior volsella nose-like to truncate (Figs 8-9), occasionally rectangular (Figs 15-16) while it is beak-like in *R. chalybeatus* (LEHMANN 1969, Fig. 1); distribution pattern of setae on median area of tergites I-V (Figs 17-18) differently figured in *R. atripes* (Fig. 19) and *R. chalybeatus* (Fig. 20).

- In the female adult: distribution of setae on median area of tergites I-V (Fig. 23) is differently illustrated in *R. chalybeatus* (Fig. 20); shape and form of gonapophysis VIII (ventrolateral and dorsomesal lobes, Figs 25-26), especially that of the apodeme lobe (Fig. 27) are differently figured in *R. chalybeatus* (SÆTHER 1985, Fig. 9E); seminal capsules pear-shaped bearing a distinct sclerotized area (Fig. 24) while it is circular and homogeneous in *R. chalybeatus* (SÆTHER 1985, Fig. 9C); tergite IX distinctly divided posteriorly in 2 rounded lobes (Fig. 28).

- In the pupal exuviae: big sized species; thoracic horn and precorneals (Figs 31-32), thoracic horn distinctly swollen medially, moderately toothed with rounded and smooth apex; elongated, linear and more toothed in *R. chalybeatus* (SÆTHER 1985, Fig. 10B); precorneals inserted long distance upward from base of thoracic horn, the latter are placed downward in *R. chalybeatus* (SÆTHER 1985, Fig. 10B); anteromedian area of cephalothorax distinctly rugulose; distance between dorsocentrals shorter, especially between Dc_2 and Dc_3 (Fig. 30) compared to that of *R. chalybeatus* (Fig. 35); caudal spines of tergites III-VII (Fig. 33) moderately larger than in *R. chalybeatus*; distribution pattern of spinules and shagreen on sternites II-VI (Fig. 33) becoming gradually larger and more extensive caudolaterally and posteromedially; caudolateral and caudal patch of spinules are interrupted on sternite V and continued on VI in *R. meridionalis* sp. n. while only caudolateral patch is present on sternites III-V of *R. chalybeatus* (Fig. 36; SÆTHER 1985, Fig. 10D); forked lateral setae, present in *R. meridionalis* sp. n. (Fig. 33) are absent in *R. chalybeatus*.

***R. thomasi* sp. n.** The male adult of this new species can be separated from other members of the genus and especially from its nearest species *R. notabilis* and *R. subacutus* by a combination of differentiating characters. Last flagellomere of antenna (Fig. 40) much longer (365 µm) than in *R. notabilis* (146 µm, Fig. 43). High value of antennal ratio AR 0.87; AR 0.30 for *R. notabilis*, 0.78 for *R. subacutus*. Antepronotum and scutum separated by a distinct notch (Fig. 41). Humeral pit (Fig. 41) medium sized and inverted-heart shaped while it is inverted ellipse-like shaped in *R. notabilis* (CASPERS 1987, Fig. 2). R with 14-15 setae, R_1 2-3, R_{2+3} 0, R_{4+5} 0 while R_1, R_{2+3} and R_{4+5} bear numerous setae in both *R. notabilis* and *R. subacutus*. Squama with 6-7 setae, 2-3 in *R. notabilis*. Gonocoxite rounded apically in *R. thomasi* sp. n. and *R. notabilis* (Figs 49, 51) while it is truncate in *R. subacutus* (Fig. 53; CASPERS & REISS 1989, Fig. 22). Superior volsella large and rounded in *R. thomasi* sp. n. (Fig. 49), indistinct and weakly represented in *R. notabilis* (Fig. 51), sub-triangular in *R. subacutus* (Fig. 53; CASPERS & REISS 1989, Fig. 22). Inferior volsella moderately projecting with a distinct lobe to nose-like apex in *R. thomasi* sp. n. (Fig. 49) while it is strongly projecting and bent downwards apically in *R. notabilis* (Fig. 51), narrowed apically to beak-like in *R. subacutus* (Fig. 53; CASPERS & REISS 1989, Fig. 22); distal

area bearing 4-5 minute setae in *R. thomasi* sp. n., only one in *R. subacutus* and bare in *R. notabilis*; presence of a distinctive rounded lobe on distal part of gonocoxite in *R. notabilis* (Fig. 51; CASPERS 1987, Fig. 5) while it is absent in both *R. thomasi* sp. n. and *R. subacutus* (Figs 49 and 53). Gonostylus distinctly linear with a nearly straight posterior margin in *R. thomasi* sp. n. (Figs 44, 46) while it is winding in *R. notabilis* and rounded in *R. subacutus* (Figs 47-48); distal area including distribution pattern of setae and shape of crista dorsalis is different than in *R. thomasi* sp. n., *R. notabilis* and *R. subacutus* (Figs 47-49); crista dorsalis well developed, tooth-like with smooth apex in *R. thomasi* sp. n. (Figs 44, 46) while it is rectangular to truncate in *R. notabilis* (Fig. 47) or spine-like in *R. subacutus* (Fig. 48). Distribution pattern of setae on median area of tergites II-V for *R. thomasi* sp. n. (Fig. 50), *R. notabilis* (Fig. 52) and *R. subacutus* (Fig. 54) shows a significant less number of setae for *R. thomasi* sp. n.

5. Ecology and geographical distribution

R. meridionalis sp. n. and *R. thomasi* sp. n. are both rheophilic species commonly encountered in lotic habitats including both karstic and basaltic rheocrenes, rhithral and potamal. Localities where material was collected consist of shaded pristine stretches and cold mountain streams including waterfalls and small riffles on stony to gravely and sandy substrata. Bryocolous and hygropetric habitats including waterfalls probably represent the most common aquatic areas for larval populations. Such lotic habitats, which are endangered by ecotourism and both natural and accidental flooding, deserve much greater consideration, protection and preservation. The new species are typically rheophilic and representative of helocrenes and cold stenothermic streams. They belong to the crenobiontic and crenophilous community of species as documented by LINDEGAARD (1995).

While associated material, composed of male and female pharate adults and pupal exuviae belonging to *R. meridionalis* sp. n. were collected, only male adults of *R. thomasi* sp. n. were obtained. The first new species is occurring in the upper and middle basins (altitude 30-850 m) of both karstic and siliceous helocrenes and cold streams delimited by both the Mediterranean coastal ecosystem (Lebanon, Algeria, continental France and Corsica) and the Atlantic coastal ecosystem of continental France (Western Pyrenees). The second is apparently confined to springs and pristine cold streams located in the Tyrrhenian province (Prezzuna stream, western Corsica, altitude 250-300 m; Massane Nature Reserve, Eastern Pyrenees, altitude 700-800 m).

Geographical distribution of the two new described species throughout the Mediterranean Basin is illustrated in figure 55. *R. meridionalis* sp. n. is considered as a widespread species in the Mediterranean Region, while *R. thomasi* sp. n. is currently known only from western Corsica and the Eastern Pyrenees. Moreover, *R. subacutus* was known only from Turkey and Spain (CASPERS & REISS 1989). The limit of distribution of this species throughout the Mediterranean Basin can actually be extended to the southern part of the Levantine Province where extensive previous investigations allowed us to record it from some streams and rivers in Lebanon (helocrenes and rhithral at: Assi, Labwe, Yammune and Beirut). Nevertheless, *R. subacutus* has been recently reported by MOUBAYED-BREIL & ASHE (2016) as a queried record from continental France (*R.* cf. *subacutus*, Maritime Alps, zone 10a) where its presence is still to be accurately confirmed. On the other hand, *R. notabilis*, previously described from Portugal (CASPERS 1987), is hitherto known from Portugal, Spain and Italy (ASHE & O'CONNOR 2012, SÆTHER & SPIES

2013). As well as for *R. subacutus*, despite large investigations in continental France and Corsica *R. notabilis* has not been recorded from these two geographic areas.

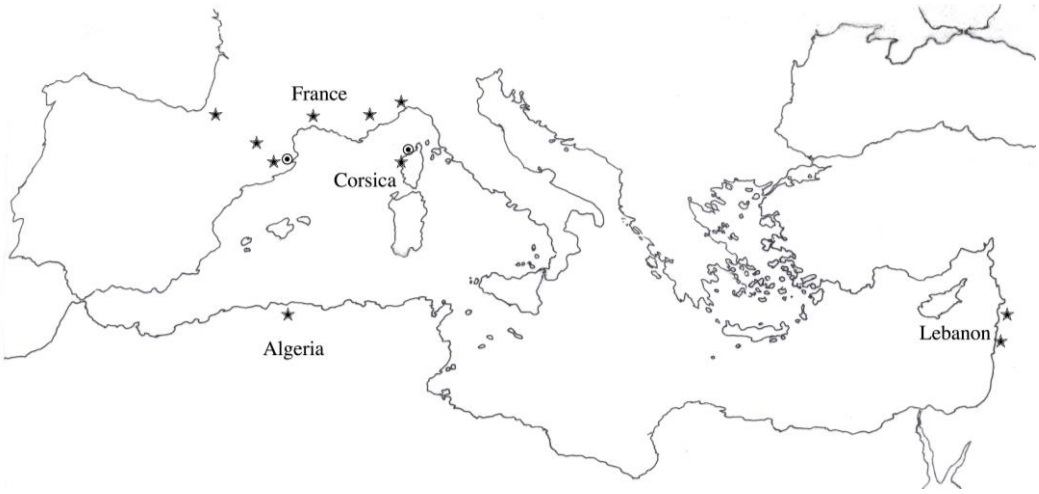


Figure 55. *Rheocricotopus* (*Psc.*) spp. Geographical distribution of *R.* (*Psc.) meridionalis* sp. n. (✯), and *R.* (*Psc.) thomasi* sp. n. (◉) in the Mediterranean Region. Other known taxa from Eastern Pyrenees and Corsica include: *Rheotanytarsus dactylophoreus*, *Trissocladius orsinii*, Orthocladiinae genus. n., sp. n.

Figure 55. *Rheocricotopus* (*Psc.*) spp. Distribution géographique de *R.* (*Psc.) meridionalis* sp. n. (✯) et *R.* (*Psc.) thomasi* sp. n. (◉) dans la région méditerranéenne. Autres espèces connues des Pyrénées Orientales et de Corse: *Rheotanytarsus dactylophoreus*, *Trissocladius orsinii*, Orthocladiinae genus. n., sp.

Within the Tyrrhenian Province, *R. thomasi* sp. n. is also regarded as the fourth recently documented pyreneocorsican element including the three other chironomid species (*Trissocladius orsinii* Moubayed-Breil & Ashe, 2015; *Rheotanytarsus dactylophoreus* Moubayed-Breil, Ashe & Langton, 2012; Orthocladiinae, genus nov., sp. nov.) which are reported by MOUBAYED-BREIL & ASHE (2012, 2016). Moreover, the latter biogeographic data reinforce affinities between western Corsica and the eastern part of the Eastern Pyrenees. Occurrence of this rare and sparsely distributed new rheophilic species in both Corsica and the Eastern Pyrenees indicates that it is apparently more widespread in similar cold mountain springs and streams of the Tyrrhenian subregion, and therefore it can be expected to occur in other similar geographic areas of the West Mediterranean, including for example similar high altitude pristine streams located in Spain and Italy.

The chironomid communities occurring in rivers and streams delimited by the Mediterranean coastal ecosystem are still little known and need more investigation. During the last four decades, both lotic and lentic habitats including karstic springs as well as all estuarine zones located in the Mediterranean coastal areas are becoming degraded and seriously threatened by the impact of various human activities and perturbation factors (ecotourism planning, camping, modifications of habitats, toxic chemical pollutants, eutrophication, natural and accidental flooding). In addition, these habitats consist of endangered hotspots of diversity similar to what is found in many coastal ecosystems around the world (MOUBAYED-BREIL 2008, MOUBAYED-

BREIL et al. 2013, MOUBAYED-BREIL & ASHE 2015, 2016). Their biogeographical significance is still underestimated and deserves therefore greater consideration, protection and preservation in the years to come.

Associated species encountered in the same localities as *R. meridionalis* sp. n. and *R. thomasi* sp. n. include: *Boreoheptagyia legeri* (Goetghebuer, 1933); *Diamesa insignipes* Kieffer, 1908; *D. latitarsis* (Goetghebuer, 1921); *D. tonsa* (Haliday, 1856); *Bryophaenocladius aestivus* (Brundin, 1947); *B. nidorum* (Edwards, 1929); *Chaetocladius melaleucus* (Meigen, 1818); C. *perennis* (Meigen, 1830); *Corynoneura gratias* Schlee, 1968; *C. lobata* Edwards, 1924; *Eukiefferiella minor* (Edwards, 1929); *E. tirolensis* Goetghebuer, 1938; *Heleniella ornaticollis* (Edwards, 1929); *H. serratosioi* (Ringe, 1976); *Krenosmittia camptophleps* (Edwards, 1929); *Parametriocnemus stylatus* (Spärck, 1923); *Pseudorthocladius curtistylus* (Goetghebuer, 1921); *Rheocricotopus effusus* (Walker, 1856); *R. fuscipes* (Kieffer, 1909); *Thienemannia gracilis* Kieffer, 1909; *Rheotanytarsus curtistylus* (Goetghebuer, 1921); *R. pentapoda* (Kieffer, 1909); etc.

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