

***Orthocladius (Euorthocladius) vicentei* sp. n.,
a Tyrrhenian element from coastal springs
in Corsica
[Diptera, Chironomidae]**

by Joël MOUBAYED-BREIL

Biodiversity, Marine and Freshwater Ecology, 10 rue des Fenouils, F-34070 Montpellier, France
jm.aquabiol@neuf.fr

Keywords: Diptera, Chironomidae, *Orthocladius (Euo.) vicentei* sp. n., coastal springs, Corsica, Tyrrhenian element, conservation.

Diagnoses and description of the male imago and pupal exuviae of *Orthocladius (Euorthocladius) vicentei* sp. n. are provided based on associated material of pharates and pupal exuviae collected in stenothermic springs located in some estuarine zones of W-Corsica (Fango River; Elbo stream, Scandola Nat. Reserve). The new species is considered as a typical biological indicator of coastal helocrenes and limnocrenes, which deserve greater consideration and appropriate conservation measures. Comments on its taxonomic position, ecology and geographical distribution are also given.

***Orthocladius (Euorthocladius) vicentei* sp. n., un élément tyrrhénien des sources côtières de Corse [Diptera, Chironomidae]**

Mots-Clés : Diptera, Chironomidae, *Orthocladius (Euo.) vicentei* sp. n., sources côtières, Corse, élément tyrrhénien, conservation.

L'adulte mâle et l'exuvie nymphale d'*Orthocladius (Euorthocladius) vicentei* sp. n., sont décrits à partir d'un matériel composé de pharates mâles et d'exuvies nymphales collectés dans des sources côtières de type hélocrène et limnocrène situées dans certaines zones estuariennes de la façade occidentale de la Corse (Fango à Galéria ; Elbo, Réserve Nat. de Scandola). Cette nouvelle espèce correspond à un bio-indicateur caractéristique des sources et des résurgences côtières qui nécessitent des mesures de conservation appropriées. Un commentaire sur la position systématique, l'écologie et la distribution géographique de l'espèce nouvelle est également fourni.

1. Introduction

Worldwide there are currently 30 valid species in the genus *Orthocladius* van der Wulp, subgenus *Euorthocladius* Thienemann, 1935, which are known from the Palaearctic, the Nearctic, and the Oriental Region (ASHE & O'CONNOR 2012). The description of *Orthocladius (Euo.) vicentei* sp. n., is based on associated material recently collected in 41 estuarine zones of Corsica including fully developed pharates, adults, pupal exuviae and larvae of chironomid populations sampled in three ecological zones delimited by a gradient of salinity (MOUBAYED-BREIL et al. 2013).

The new species occurs in coastal springs (helocrenes and limnocrenes) of some estuarine zones located along the coastline of W-Corsica: Fango River at Galéria; Elbo stream at Scandola natural reserve. Among the numerous collected specimens of *O. vicentei* sp. n. only 30 have been examined including 2 male pharate adults and 28 pupal exuviae. Main morphological characters of both male adult and pupal exuviae are illustrated and compared to the closest Palaearctic species in the subgenus *Euorthocladius* including: *O. ashei* Sopenis, 1990 (Corsica, Lebanon, France); *O. rivicola* Kieffer, 1911 (Algeria, France, Lebanon); *O. thienemanni* Kieffer, 1906 (Lebanon; Corsica, recorded here for the first time from this island); *O. calvus* Pinder, 1985 (France); *O. luteipes* Goetghebuer, 1937 (Algeria, Lebanon, France, Corsica); *O. abiskoensis* Thienemann & Krüger, 1937 (literature); *O. kabylianus* Moubayed-Breil & Lounaci, 2013 corresponding to *O. (Euo.)* sp. 1 in MOUBAYED et al. (2007). Taxonomic remarks are provided with reference to diagnoses characters, taxonomic notes, phylogeny and nomenclature, keys for identification for male imagines and pupal exuviae which are provided by THIENEMANN (1935), THIENEMANN & KRÜGER (1937), TOKUNAGA (1939, 1964), BRUNDIN (1956), SASA & YAMAMOTO (1977), SASA (1979), ROSSARO (1982), PINDER (1985), COFFMAN et al. (1986), CRANSTON et al. (1989), SOPONIS (1990), LANGTON (1991), ROSSARO & PIETRANGELO (1992), SASA & OKAZAWA (1992), SPIES & SÆTHER (2004), SÆTHER (2005), LANGTON & PINDER (2007), MOUBAYED-BREIL & LOUNACI (2013). *O. vicentei* sp. n., previously reported by MOUBAYED-BREIL & ASHE (2012) and MOUBAYED-BREIL et al. (2013) as *O. (Euo.)* sp. 1, is described here as male adult and pupal exuviae based on associated pharate material collected in the estuarine zone of the Fango River. Terminology and measurements follow those of SÆTHER (1980) and LANGTON & PINDER (2007) for male imago, and those of SÆTHER (1980) and LANGTON (1991) for pupal exuviae.

2. *Orthocladius (Euorthocladius) vicentei* sp. n.

Study material

Holotype: 1 male pharate, Fango River, estuarine zone, helocrenes and limnocrenes, altitude 0-5 m, Corsica, 28.V.2012, J.M-B; locality n° 29 in MOUBAYED-BREIL & ASHE (2012), n° 28 in MOUBAYED-BREIL et al. (2013).

Paratypes: 1 male pharate, 30 pupal exuviae (20 males and 10 females), same locality and same date as holotype.

Holotype, 6 pupal exuviae (4 males and 2 females), presently in the author's collection, will be deposited in the collections of the Zoologische Staatssammlung (ZSM), Museum of Munich, Germany. Remaining paratypes are deposited in the author's collection. Type material was preserved in 75-80% alcohol, cleared in 90% lactic acid and later mounted on 2 slides in polyvinyl lactophenol.

Etymology: the new species is named *vicentei* after Dr Nardo Vicente from the university of Marseille (marine biology), who remains one of the most ardent protectors of the biodiversity in the Mediterranean. He continues his applied research as professor Emeritus since 2004 and as oceanologist in contributing to preserve the Mediterranean coastline from pollution and nuisance.

Diagnosis characters of male adult and pupa

Imagine characters of *O. vicentei* sp. n. resemble those of *O. ashei*, *O. luteipes*, *O. calvus*, *O. rivicola*, *O. abiskoensis* and *O. thienemanni* while the pupal exuviae keys closer to those of *abiskoensis*, *calvus* and *kabylianus* (Algeria) than to those of *ashei*, *rivicola*, *thienemanni* and *luteipes*. The male imago is distinguishable by the following combination of characters: hairs present on proximal part of inner eye margin; low antennal ratio (1.00-1.05); virga consisting of 4 curved teeth fused at base; anal tergite broad, not narrowed; anal point parallel-sided, with round apex; superior volsella indistinct; inferior volsella unusual and well developed, bearing a characteristic rectangular dorsal lobe, ventral lobe nose-shaped and slightly overreaching apical margin of dorsal lobe; crista dorsalis absent.

Main shared features of the pupal exuviae are: its general shape (narrowed distally) and colouration pattern (darkened in general) resemble those of *ashei*, *thienemanni* and *rivicola*; shape pattern of thoracic horn and armament of tergite II keys *vicentei* near *abiskoensis*, *calvus* and *kabylianus*. Main distinguishing features of the pupal exuviae are: precorneals all bristle-like; thoracic horn stalked, elongated and occasionally sausage-like; Pedes spurii A present, PSB II absent; tergite II with posteromedian group of anteriorly directed long spines which are sclerotized and nearly fused at base; tergite III usually bare, occasionally armed with 1-2 to 4-6 points; posterior margin of tergites IV-VIII bearing a patch of small spines posteriorly produced.

The larva is known but not described.

Male imago

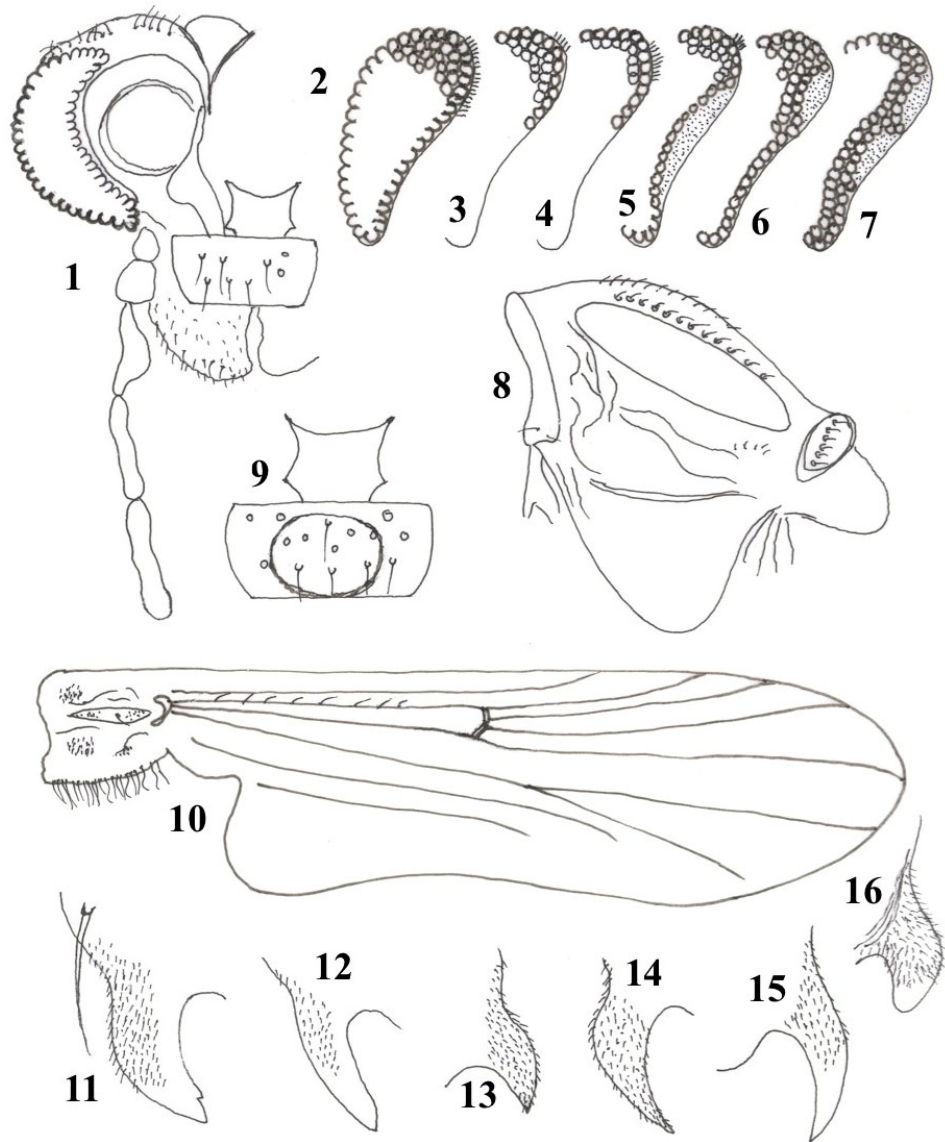
(n = 2, male pharate adults; Figures 1-2, 8, 10-11, 17-20, 29-31, 36).

Orthocladius (*Euo.*) sp. 1 in: MOUBAYED-BREIL & ASHE (2012), MOUBAYED-BREIL et al. (2013).

Description

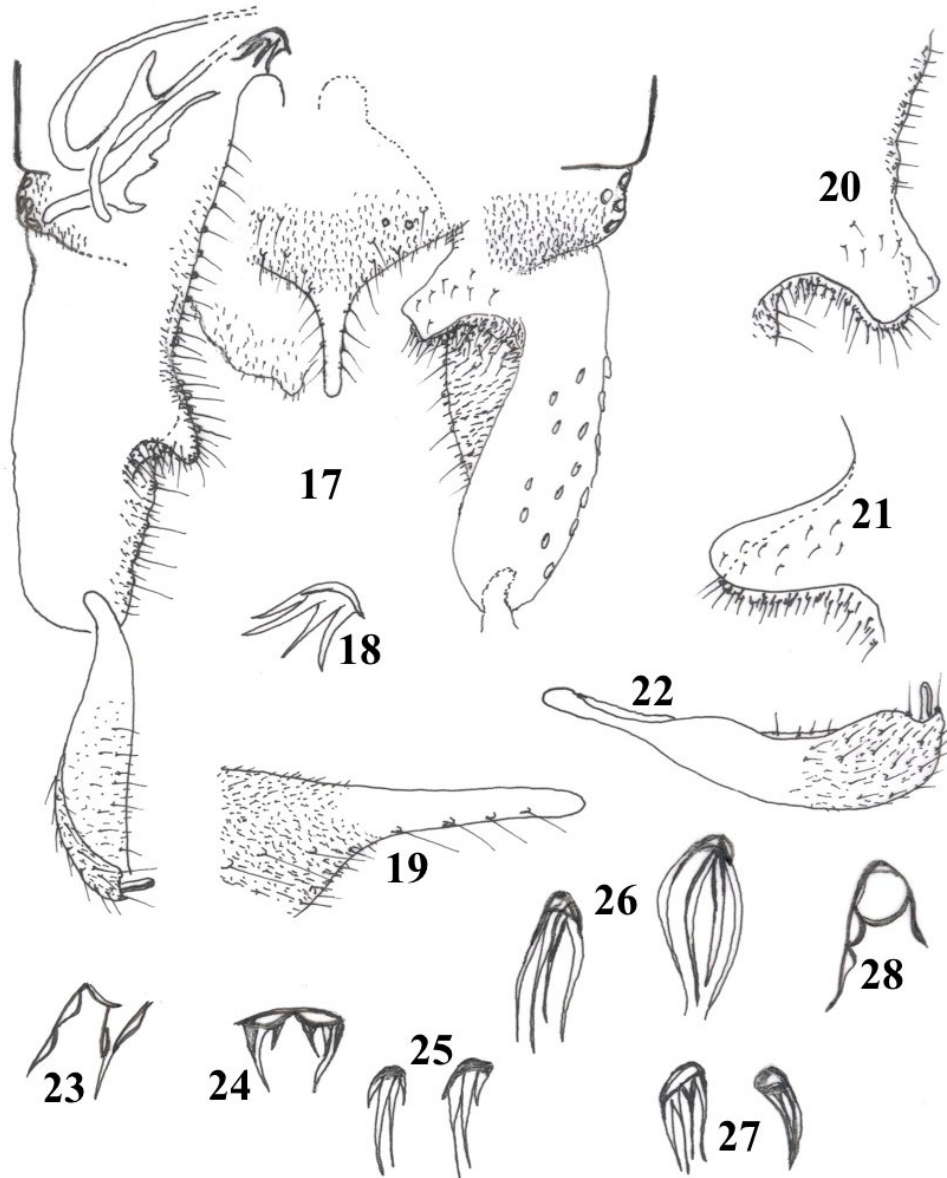
A relatively big sized *Orthocladius* (*Euorthocladius*) species. Total length 3.50-3.70 mm. Wing length 1.75-1.85 mm. General colouration contrasting blackish to brown, especially in the thorax. Head and antenna dark brown including antennal and wing sheath, halteres brownish. Thorax black to dark brown with blackish mesonotal strips. Legs yellow brownish to dark brown; apex of femur and base of tibia of PI, PII and PIII dark brown to blackish; apex of all tibiae dark brown; tarsomere ta_5 of each leg blackish.

Head including right eye, cibarial pump, tentorium, clypeus and palp as illustrated in figure 1. Eyes bare between ommatidia, hairs present on proximal part of inner eye margin (Fig. 2). Temporal setae 13 including 5 inner verticals, 5 outer verticals and 3 postorbitals. Clypeus trapezoidal, with lateral sides curved and bearing 10-11 setae. Palp 5-segmented; length (μ m) of segments 41, 73, 105, 85, 125. Antenna 975-980 μ m long, 12-segmented; segments 1-3 globulous of 55, 28 and 25 μ m long; segments 4 to 11 subequal (31-35 μ m long each); ultimate flagellomere 490-495 μ m long. AR 1.00-1.05. Thorax (Fig. 8). Antepronotum with 2 lateral setae. Acrostichals 12 uni-biserial, placed in proximal half of thorax not close to antepronotum; dorso-centrals 12; prealars 5-7. Scutellum with 13 setae, uniserial. Preepisternum bare. Wing (Fig. 10). Brachiolum with 1 seta. R with 5-8 setae, other veins bare. Anal lobe well pronounced. Squama with 17-21 setae.



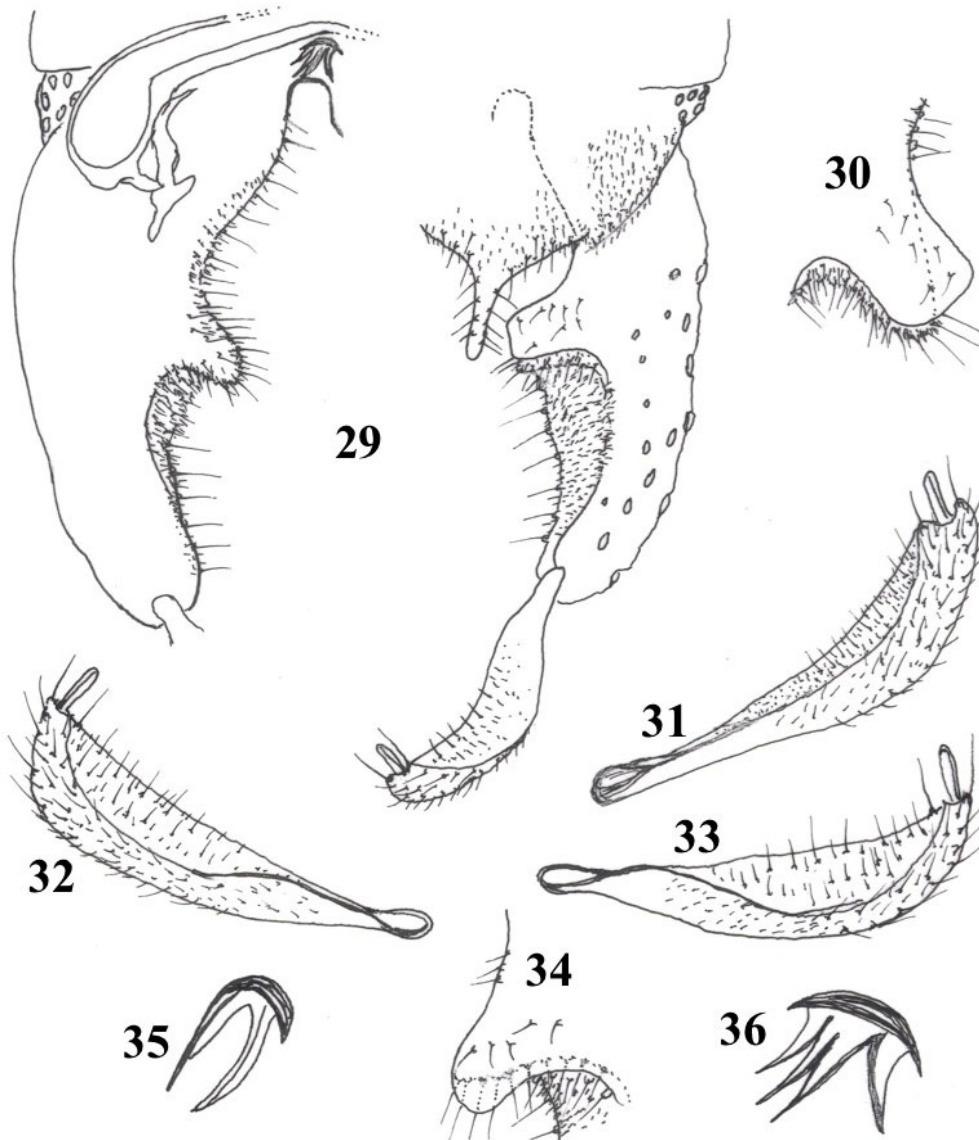
Figures 1-16. *Orthocladius* (*Euorthocladius*) spp. Head of *O. vicentei* sp. n. (1); Hairs on inner margin of eyes: (2) *O. vicentei* sp. n.; (3) *O. thienemanni*; (4) *O. ashei*; (5) *O. luteipes*; (6) *O. rivicola*; (7) *O. kabylanus*. (8) thorax of *O. vicentei*. (9) clypeus of *O. kabylanus*. (10) wing of *O. vicentei*. Femoral claw of: (11) *vicentei*; (12) *O. kabylanus*; (13) *ashei*; (14) *rivicola*; (15) *luteipes*; (16) *thienemanni*.

Figures 1-16. *Orthocladius* (*Euorthocladius*) spp. Tête d'*O. vicentei* sp. n. (1) ; pubescence du bord interne des yeux : (2) *O. vicentei* sp. n. ; (3) *O. thienemanni* ; (4) *O. ashei* ; (5) *O. luteipes* ; (6) *O. rivicola* ; (7) *O. kabylanus*. (8) thorax d'*O. vicentei*. (9) clypeus d'*O. kabylanus*. (10) aile d'*O. vicentei*. Griffes fémorales de : (11) *vicentei* ; (12) *O. kabylanus* ; (13) *ashei* ; (14) *rivicola* ; (15) *luteipes* ; (16) *thienemanni*.



Figures 17-28. Male imago of *Orthocladius* (*Euo.*) spp. *O. vicentei* sp. n. (holotype): (17) hypopygium, ventral (left) and dorsal (right); (18) virga; (19) anal point in lateral view; (20) inferior volsella, dorsal and ventral lobes. *O. calvus*: (21) inferior volsella; (22) gonostylus. Virga of: (23-24) *O. kabylianus*; (25) *ashei*; (26) *thienemanni*; (27) *luteipes*; (28) *rivicola*.

Figures 17-28. Imago mâle d'*Orthocladius* (*Euo.*) spp. *O. vicentei* sp. n. (holotype) : (17) hypopyge, vue ventrale (à gauche) et vue dorsale (à droite) ; (18) virga ; (19) pointe anale en vue latérale ; (20) volsella inférieure, lobes dorsal et ventral. *O. calvus* : (21) volsella inférieure ; (22) gonostyle. Virga de : (23-24) *O. kabylianus* ; (25) *ashei* ; (26) *thienemanni* ; (27) *luteipes* ; (28) *rivicola*.



Figures 29-36. Male imago of *Orthocladius* (*Euo.*) spp. *O. vicentei* sp. n. (paratype): (29) hypopygium, ventral (left) and dorsal (right); (30) inferior volsella; (31) gonostylus (left); (36) virga. *O. ashei*: gonostylus (32) right, (33) left; (34) inferior volsella; (35) virga.

Figures 29-36. Imago mâle d'*Orthocladius* (*Euo.*) spp. *O. vicentei* sp. n. (paratype) : (29) hypopyge, vue ventrale (à gauche) et vue dorsale (à droite) ; (30) volsella inférieure ; (31) gonostyle gauche ; (36) virga. *O. ashei* : gonostyles (32) droit et (33) gauche ; (34) volsella inférieure ; (35) virga.

Legs. Femoral claw present on femur of mid and hind legs (Fig. 11), 62 μm long, notched distally and covered with fine setae basally and medially. Spur and pseudospurs present: spur of front tibia 62 μm long, spurs of middle tibia 31 and 27 μm long, spurs of hind tibia 35 and 28 μm long. Length (μm) of pseudospurs: middle ta_1 , 31 and 29; hind ta_1 , 35 and 28; middle and hind ta_2 , 21-26 each. Hind comb with 10-11 setae. Sensilla chaetica: on ta_1 of mid leg, 6-8; on ta_1 of hind leg, 5-7. Length (μm) and proportions of legs:

	fe	ti	ta ₁	ta ₂	ta ₃	ta ₄	ta ₅	LR	BV	SV	BR
PI	721	792	615	362	257	183	135	0.78	2.27	2.46	2.3
PII	725	695	385	205	163	114	116	0.55	3.02	3.69	3.6
PIII	786	725	388	206	155	113	127	0.53	3.16	3.89	3.4

“ LR = Length of tarsomere ta_1 divided by length of tibia (ti); BV = Combined length of femur (fe), tibia and ta_1 divided by combined length of tarsomeres ta_2 - ta_5 ; SV = Ratio of femur plus tibia to tarsomere ta_1 ; BR = Ratio of longest seta of ta_1 divided by minimum width of ta_1 , measured one third from apex.”

Hypopygium in dorsal and ventral view as in figures 17 (holotype) and 29 (paratype). Anal tergum broad, 125-137 μm wide, bearing 14 setae (7 on each side of anal point); anal point 45-55 μm long, robust, parallel-sided, with rounded apex, bearing 8-9 lateral setae. Laterosternite IX with 4 setae. Transverse sternapodeme and phallapodeme as in figures 17 and 29, sternapodeme with well developed oral projection. Virga (Figs 18, 36) consists of 4 characteristic subequal spines (14-17 μm long), which are distinctly curved and fused at base. Gonocoxite 225-250 μm long; superior volsella indistinct, occasionally more or less broad; inferior volsella (Figs 17, 20, 29-30) bearing two distinct lobes: dorsal lobe 37-41 μm long, 17-21 μm wide, unusually rectangular and bearing 7-8 small setae; ventral lobe 35-37 μm long, nose-shaped, densely covered with setae, slightly extended beyond apical margin of dorsal lobe. Gonostylus (Figs 17, 29 and 31) 105-110 μm long, with low and long triangular weak apical crista dorsalis, bearing 2 stout orally directed setae apically on each side of megaseta; megaseta 7-10 μm long.

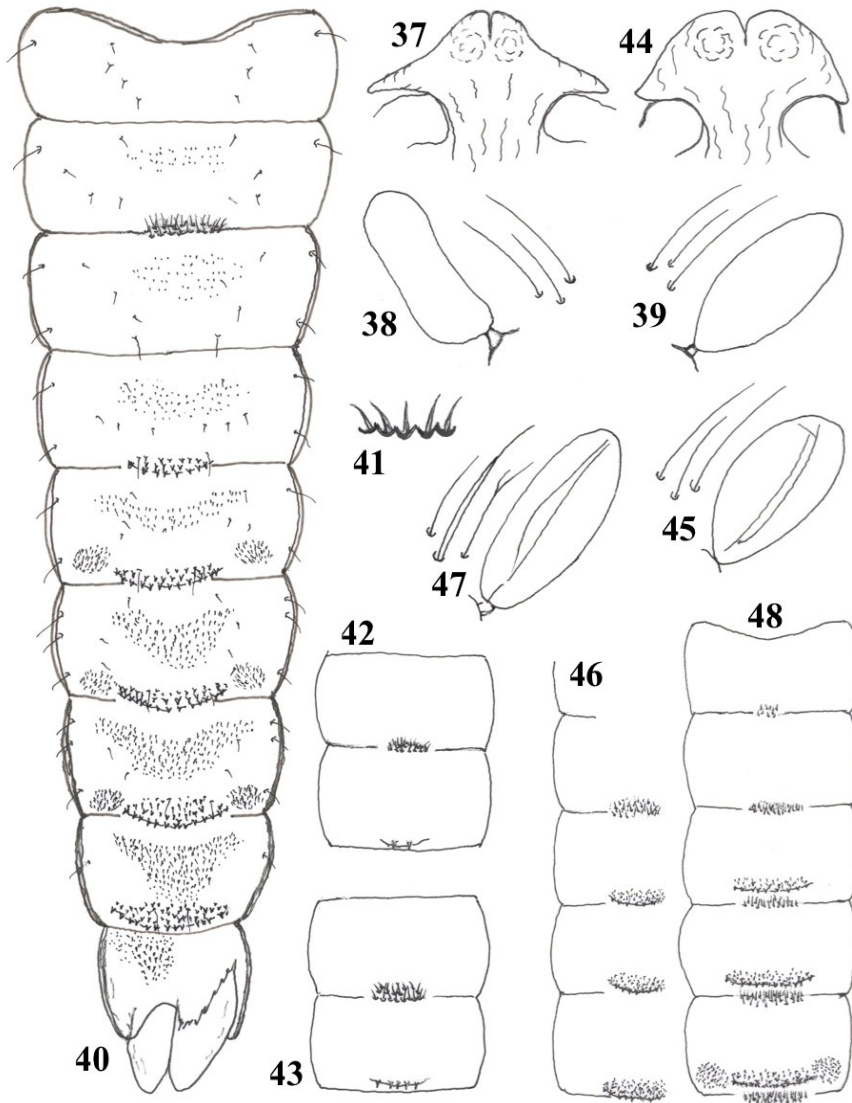
Male pupa

(n = 30; Figures 37-43).

Orthocladius (Euo.) sp. 1 in: MOUBAYED-BREIL & ASHE (2012), MOUBAYED-BREIL et al. (2013).

Description

Colouration brownish to brown dark in general; cephalothorax brown with faint dark shading on thorax, antennal and wing sheaths, thoracic suture anteriorly granulated; abdomen brownish with indistinct apophyses; lateral area of segments IV/V-VIII with conspicuous rugosities (especially on segments VII-VIII) which often hide the lateral setae; anal segment brown. Antennal and wing sheaths with dark faint shading. Total length 3.60-3.80 mm; abdomen 2.60-2.80 μm long. Cephalothorax (Figs 25-26). Frontal apotome (Fig. 37) darkened and rugulose, with distinctly domed and broadened frontal tubercles, frontal setae absent.



Figures 37-48. *Orthocladius* (*Euoa*) spp. Male pupal exuviae of *O. vicentei* sp. n.: (37) frontal apotome; (38-39) two aspects of thoracic horn; (40) armament of abdominal segments I-IX; (41) shape pattern of spines on tergite II; (42-43) tergites II-III, showing variation in the armament of tergite III. *O. calvus*: (44) frontal apotome; (45) thoracic horn; (46) armament of tergites I-V. *O. kabylanus*: (47) thoracic horn; (48) armament of tergites I-V.

Figures 37-48. *Orthocladius* (*Euoa*) spp. Exuvie nymphale mâle d'*O. vicentei* sp. n. : (37) pièce frontale ; (38-39) corne thoracique, deux aspects ; (40) segments abdominaux I-IX, ornementation et chaetotaxie ; (41) forme des épines sur le tergite II ; (42-43) tergites II-III, variation dans l'ornementation du tergite III. *O. calvus* : (44) pièce frontale ; (45) corne thoracique ; (46) ornementation des tergites I-V. *O. kabylanus* : (47) corne thoracique ; (48) ornementation des tergites I-V.

Thorax dorsally wrinkled to granulose anteriorly near the thoracic suture. Lateral anteprenotals 70-75 and 75-80 μm long, median anteprenotals 50-55 and 30-35 μm long. Thoracic horn (Figs 38-39) 100-113 μm long, stalked, elongate in general, smooth and occasionally sausage-like. Precorneal setae 91-96, 90-95, 71-76 μm long, bristle-like, 2 subequal in length and one shorter. Dorsocentrals inserted as in figure 25; nearly equal in length (about 45 μm long each), Dc_1 , Dc_2 and Dc_3 equidistant, confined together, separated by about 70 μm ; distance between Dc_3 and Dc_4 215-235 μm . Thorax covered with broad darkened granulations on thoracic suture, dark shadings present on dorsocentral area between Dc_3 and Dc_4 . Abdomen (Fig. 40). Armament and distribution patterns of shagreen, patches of spines and spinules, chaetotaxy and lateral setation of segments as illustrated in figures 40-43. Tergite I bare. Pedes spurii A present on tergites V-VII. Pedes spurii B absent. Sternites bare. Posterior margin of tergite II with median patch of anteriorly directed fine spines (3-4 rows of 15-36 long blackish spines 15-25 μm long) occupying about eleventh width of segment, spines are well sclerotized and fused at base (Fig. 41); tergite III usually lacking spinulae on apical margin (Fig. 39 for 70-80% of the 30 examined exuviae), occasionally armed with 1-2 or 4-6 small spines on apical margin (Figs 42-43 for 20-25%); anteromedian patch of shagreen and small points present on tergites II-VIII, gradually becoming larger posteriorly on each segment; posteromedian patch of small spines present on tergites IV-VIII. Lateral abdominal setae weak, hair-like, consisting of reduced minute to vestigial setae. Apophyses indistinct. Anal lobes 225-230 μm long, 270-275 μm wide, not narrowed to tips, occasionally turned over, without any setae. Genital sac 260-265 μm long, uniformly narrowed distally and extended beyond apical margin of anal lobe by 110-115 μm .

Larva: known but not described.

3. Taxonomic remarks

In this paper, *O. vicentei* sp. n. is compared as well in both male and pupal exuviae to the following nearest related members of *Euorthocladius* subgenus: *O. ashei*, *O. abiskoensis*, *O. calvus*, *O. rivicola*, *O. luteipes*, *O. thienemanni* and *O. kabylianus* (Algeria). According to taxonomic data in the literature, the male adult and the pupa of the new species can be distinguished from other related species by a combination of main differentiating characters.

- Male adult: (i) hairs on median area of inner lateral margin of eyes (Fig. 2) are differently arranged in *thienemanni* (Fig. 3), *ashei* (Fig. 4), *luteipes* (Fig. 5), *rivicola* (Fig. 6) and *kabylianus* (Fig. 7); (ii) clypeus lacking circular darkened mark as in *kabylianus* (Fig. 9); (iii) the femoral claw (notched in *vicentei*, Fig. 11) is differently illustrated in *kabylianus* (Fig. 12), *ashei* (Fig. 13), *rivicola* (Fig. 14), *luteipes* (Fig. 15) and *thienemanni* (Fig. 16); (iv) the virga (bearing 4 curved spines, Figs 18, 36) is easily distinguished from those of *kabylianus* (Figs 23-24), *ashei* (Figs 25, 35), *thienemanni* (Fig. 26), *luteipes* (Fig. 27), *rivicola* (Fig. 28); (v) the characteristic unusual rectangular inferior volsella separates easily *vicentei* sp. n. from those of *calvus* (Fig. 21) and *ashei* (Fig. 34); (vi) gonostylus (Figs 17, 29, 31) is distinctly represented in *calvus* (Fig. 22) and *ashei* (Figs 32-33).

- Pupal exuviae: (a) precorneals bristle-like; (b) thoracic horn elongate, stalked, occasionally sausage-like (Figs 38-39) is differently figured in *O. calvus* (Fig. 45) and *kabylianus* (Fig. 47); (c) general armament and shagreen pattern of abdominal segments (Figs 40-43) are distinctly represented in *ashei*, *rivicola*, *thienemanni* and *luteipes*; (d) group of orally projecting spines present is placed: - only on tergites II in *O. calvus* (Fig. 46), - on tergites II-V in *abiskoensis*, -

on tergites I/II-V in *kabylianus* (Fig. 48); (e) posteromedian rows of spines present: - on tergites III/IV-VIII in *vicentei*, - on tergites III-VIII in both *calvus* and *kabylianus* (Figs 46, 48); (f) armament on apical margin of tergites II-III and II-V can easily distinguish *vicentei* (Figs 42-43) from *calvus* (Fig. 46) and *kabylianus* (Fig. 48); anal lobes not narrowed to tips as in *abiskoensis* and *kabylianus*.

4. Ecology

Orthocladius vicentei sp. n. is a relatively rheophilic species which is strictly confined to slow flowing water of coastal lowland springs (altitude 0-15 m) located in some estuarine zones of W-Corsica (Figs 49).

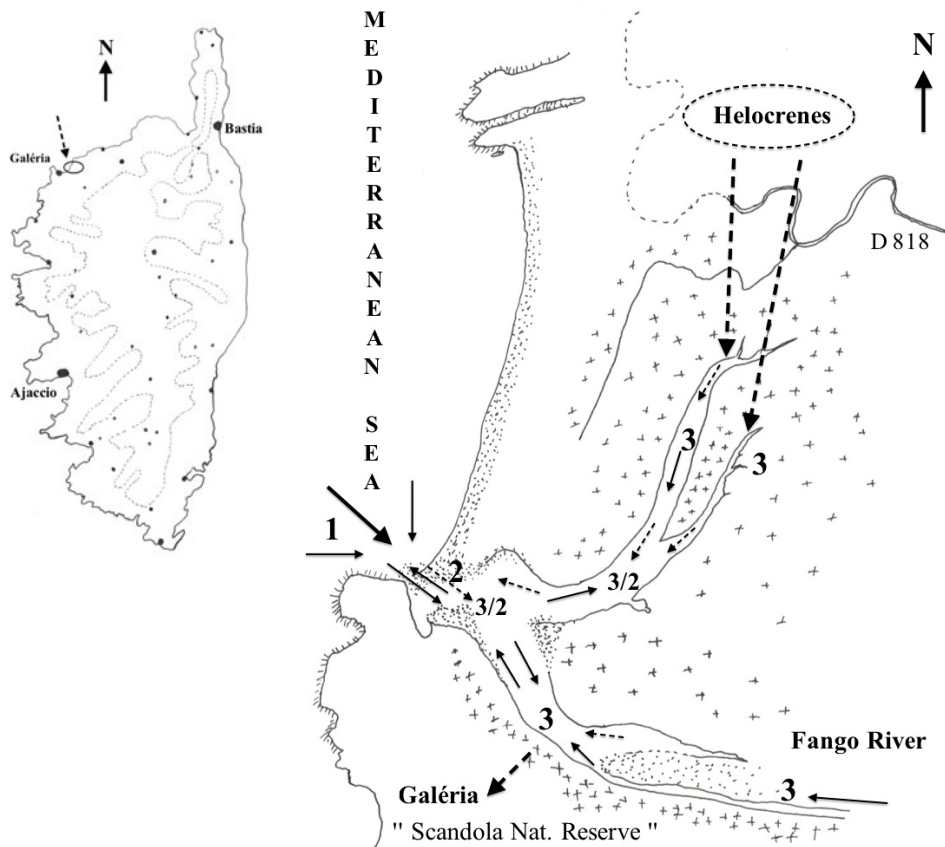


Figure 49. Up and left: geographical location of the estuarine zone of Fango River in Corsica. Right: the estuarine zone of the Fango River (W-Corsica). Delimitation of the three ecological zones along the gradient of salinity. Zone 1, seawater; zone 2, brackish water; zone 3, freshwater.

Figure 49. En haut à gauche : localisation géographique de la zone estuarienne du fleuve Fango en Corse. À droite : la zone estuarienne du fleuve Fango (W-Corse). Délimitation des trois zones écologiques le long d'un gradient de salinité. Zone 1, eau marine ; zone 2, eau saumâtre ; zone 3, eau douce.

The type locality where larvae, male adult paratypes and exuviae were collected, consists of shady stenothermic helocrenes and limnocrenes with helophytes and sandy to gravely substrata where fresh underground water maintains low variation of temperature and favourable environmental characteristics: T°C 10-13; conductivity, 120-140 µS/cm; water depth, 0.5-2 m; salinity about 0.5-1 g/l. The new species is considered as a typical biological indicator of coastal helocrenes and limnocrenes, which deserve greater consideration and appropriate conservation measures. It belongs to the large community of crenobiontic and crenophilous species documented by LINDEGAARD (1995). Occurrence of this confined crenophilous species to springs located in the estuarine zones of W-Corsica indicates that it is likely more widespread in the island and possibly in Tyrrhenian Province. Crenobiontic and crenophilous species encountered in the same localities include: *Arctopelopia griseipennis* (Wulp, 1859); *Procladius sagittalis* (Kieffer, 1909); *Bryophaenocladus muscicola* (Kieffer, 1906); *B. subvernalis* (Edwards, 1929); *Chaetocladus melaleucus* Brundin, 1956; *Corynoneura celtica* Edwards, 1924; *C. gratias* Schlee, 1936; *Eukiefferiella coerulea* (Kieffer, 1926), *E. ilkleyensis* (Edwards, 1926); *Krenosmittia camptophleps* (Edwards, 1929); *Metriocnemus hirticollis* (Staeger, 1839); *Paraphaenocladus impensus impensus* (Walker, 1856); *Paratrissocladius excerptus excerptus* (Walker, 1856); *Rheocricotopus effusus* (Walker, 1856); *Micropsectra junci* (Meigen, 1818); *M. notescens* (Walker, 1856); *Paratanytarsus oconnori* Moubayed-Breil, Ashe & Langton, 2012; *Stempellina bausei* (Kieffer, 1911); *Tanytarsus heusdensis* Goetghebuer, 1923.

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