

***Orthocladius (Euorthocladius) kabylianus* sp. n.,
a crenophilous element inhabiting karstic helocrenes
and temporary streams in Algeria
[Diptera: Chironomidae]**

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Diagnoses and description of the adults and pupal exuviae of *Orthocladius (Euorthocladius) kabylianus* sp. n. are described, based on associated pharates material and pupal exuviae collected in karstic helocrenes of the Boubhir Wadi, located in the Kabylie Region of N-Algeria. The new species is considered as a typical biological indicator of low to middle mountain temporary karstic springs, which deserve greater consideration and appropriate conservation measures. Comments on its taxonomic position, ecology and geographical distribution are also provided.

***Orthocladius (Euorthocladius) kabylianus* sp. n., un élément crénophile inféodé aux sources et ruisseaux karstiques temporaires en Algérie (Diptera, Chironomidae)**

Mots-Clés : Diptera, Chironomidae, *Orthocladius (Euorthocladius) kabylianus* sp. n., sources et ruisseaux temporaires, Kabylie-Algérie, conservation.

Les adultes et l'exuvie nymphale d'*Orthocladius (Euorthocladius) kabylianus* sp. n., sont décrits à partir d'un matériel collecté dans des sources karstiques de type hélocrène, situées dans l'Oued Boubhir en Kabylie (N-Algérie). Cette nouvelle espèce est considérée comme un indicateur biologique pertinent pouvant caractériser des sources karstiques temporaires de moyenne et de basse montagne, qui nécessitent des mesures de conservation appropriées. La position systématique, l'écologie et la distribution géographique de l'espèce nouvelle sont commentées.

1. Introduction

Recent investigations of Chironomidae conducted by the junior author in the upstream of the Boubhir Wadi (N-Algeria) allowed us to sample fully developed pharates, adults, pupal exuviae and larvae of a new species, which belongs to the genus *Orthocladius*, subgenus *Euorthocladius*. The new species *O. (Euo.) kabylianus* sp. n. is previously reported by MOUBAYED-BREIL et al. (2007) as *O. (Euo.)* sp. 1, which occurs in the upstream and temporary karstic helocrenes of the Boubhir Wadi. Description of the mature stages and pupa is based on associated material of

pharate adults and pupal exuviae. Worldwide there are currently 31 valid species in the genus *Orthocladius* van der Wulp, subgenus *Euorthocladius* Thienemann, 1935 (including *O. vicentei* Moubayed-Breil, 2013), which are known from the Palaearctic, the Nearctic, and the Oriental Region (ASHE & O'CONNOR 2012). Main morphological characters of both male adult and pupal exuviae are figured and compared to the closest Palaearctic species in the subgenus *Euorthocladius* including: *O. abiskoensis* Thienemann & Krüger, 1937; *O. ashei* Sponis, 1990 (Corsica, France, Lebanon); *O. calvus* Pinder, 1985 (France); *O. luteipes* Goetghebuer, 1937 (France, Corsica, Algeria, Lebanon); *O. rivicola* Kieffer, 1911 (Algeria, France, Lebanon); *O. suspensus* (Tokunaga, 1939); *O. thienemanni* Kieffer, 1906 (Lebanon; Corsica); *O. vicentei* Moubayed-Breil 2013 (Corsica). Taxonomic remarks are given with reference to diagnoses characters, taxonomic notes and identification keys for male imagines and pupal exuviae, phylogeny and nomenclature which are provided by THIENEMANN (1935, 1944), 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 (2013). Terminology and measurements follow those of SÆTHER (1980) and LANGTON & PINDER (2007) for male imago, and those of SÆTHER (1980) and (1991) for pupal exuviae.

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

Study material

Holotype: 1 male pharate, Boubhir Wadi, upstream and helocrenes, altitude 160-220 m, 14.III.1994, leg. A. Lounaci; locality N° 5-6 in MOUBAYED-BREIL et al. (2007).

Paratypes: 1 male adult, 4 male pharates, 3 female pharates, 9 pupal exuviae (5 males and 4 females), same locality and same date as holotype, leg. A. L.

The holotype, 1 female pharate and 4 pupal exuviae (2 male and 2 female), 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 1 slide in polyvinyl lactophenol.

Etymology: The new species is named *kabylianus* after the Kabylie Region, located east of Algiers (N-Algeria) where the type material was collected.

Diagnosis characters of male adult and pupa

Imagine characters of *O. kabylianus* sp. n. resemble those of *O. abiskoensis*, *O. suspensus* and *O. thienemanni* while the pupal characters key the new species closer to those of *O. calvus*, *O. abiskoensis*, *O. vicentei* than to *O. ashei*, *O. rivicola*, *O. luteipes*. The male imago is separable by the following combination of characters: inner eye margin bare, dense microtrichia present between inner eye margin and ommatidia; relatively high antennal ratio (1.70-1.75); clypeus bearing a darkened circular mark; scutellum with 21-22 setae, biserial, placed transversally in 1 row which is interrupted medially; virga present and characteristic; anal tergite narrowed distally; anal point uniformly tapering; dorsal lobe of inferior volsella broad at base and narrowed apically, ventral lobe nose-shaped, narrower than dorsal lobe and prominently extended beyond apical margin of dorsal lobe; gonostylus with a triangular preapical crista dorsalis.

Main distinguishing features of the pupal exuviae are: frontal apotome with domed and rugose frontal tubercles; thoracic horn oval, elongated and stalked; precorneal setae include 2 bristle-like and one thickest; tergite I bare, occasionally with a group of few spines placed near the posteromedian margin; tergite II with a posteromedian band of fine spines (about 75-85 spines in several rows) which are anteriorly directed and not fused at base; pedes spurii A present; rows of posteriorly produced small spines present on posterior margin of tergites III-V; anal lobe not narrowed distally and lacking setae. The larva is known but not described.

Male imago

(n = 4, male pharate adults; Figures 1, 3-8)

Orthocladius (Euorthocladius) sp. 1 in: MOUBAYED-BREIL et al. (2007).

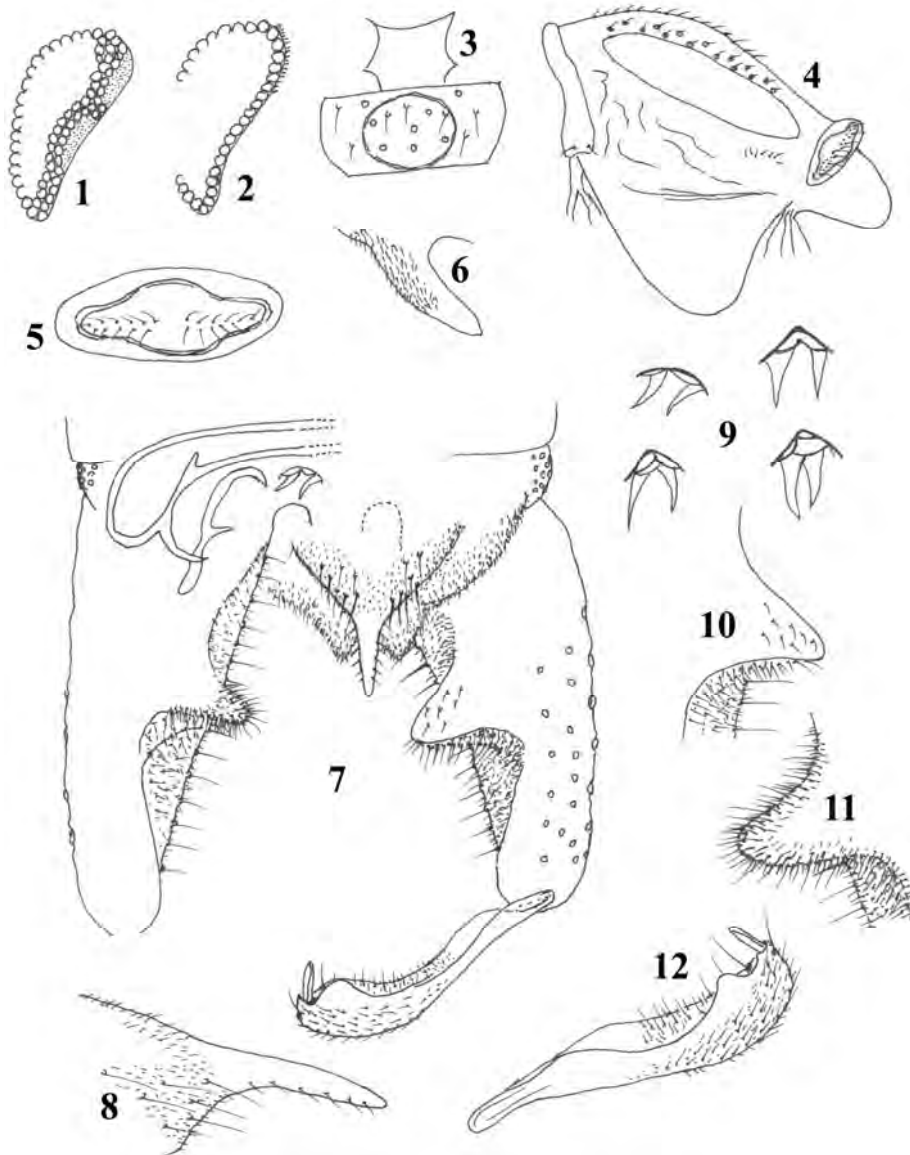
Description

A big sized *Orthocladius (Euorthocladius)* species. Total length 4.80-4.90 mm. Wing length 2.85-2.95 mm. General colouration brown to dark brown, especially in the cephalothorax. Head and antenna dark brown including antennal and wing sheath, halteres brownish. Thorax dark brown with blackish mesonotal strips. Legs brownish to yellowish; base of tibia and apex of femur of PI, PII and PIII dark brown to blackish; tarsomere ta_5 of each leg blackish.

Head. Eyes bare between ommatidia, hairs absent on inner eye margin, dense microtrichia present between inner eye margin and ommatidia (Fig. 1). Temporal setae 13 including 5 inner verticals, 4 outer verticals and 4 postorbitals. Clypeus (Fig. 3) trapezoidal with curved lateral sides, bearing 12-13 setae, darkened circular mark is present medially. Palp 5-segmented; length (μm) of segments: 61, 118, 171, 183, 272. Antenna 12-segmented, 1320-1330 μm long, progressively tapering; length (μm) of segments 1-11, 68, 25, 28, 31, 35, 35, 35, 38, 38, 41, 45; ultimate flagellomere 835-845 μm long. AR 1.70-1.75. Thorax (Fig. 4). Anteprepronotum with 2 lateral setae. Acrostichals 15-16 uni-biserial, placed in proximal half of thorax not close to anteprepronotum; dorsocentrals 15-17; prealars 7-8. Scutellum (Figs 4-5) with 22-23 setae, biserial, placed transversally in 2 rows, which are interrupted medially. Preepisternum bare. Wing. Brachiolum with 1 single seta. R_1 with 6-8 setae, first 3-4 setae inserted near the arculus; remaining veins bare. Anal lobe well produced. Squama with 29-34 setae. Legs. Femoral claw present on mid and hind legs (Fig. 6): 63 μm long on PII, 81 μm long on PIII, covered with fine setae basally and medially. Spurs and pseudospurs present: spur of front tibia 83 μm long; spurs of middle tibia 47 and 41 μm long; spurs of hind tibia 82 and 35 μm long. Length (μm) of pseudospurs: middle ta_1 , 35 and 31; hind ta_1 , 46 and 33; middle and hind ta_2 lacking pseudospurs. Length (μm) and proportions of legs:

	fe	ti	ta₁	ta₂	ta₃	ta₄	ta₅	LR	BV	SV	BR
PI	1033	1190	925	585	385	230	165	0.78	2.31	2.40	2.10
PII	995	1105	545	331	263	181	157	0.49	2.84	3.85	2.15
PIII	1135	1375	738	437	232	195	178	0.54	3.12	3.40	2.35

“ 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.”



Figures 1-12. Male imago of *Orthocladius* (*Euorthocladius*) spp. Inner margin of eyes: (1) *O. kabylianus* sp. n.; (2) *O. vicentei* (Corsica). Male imago of *O. kabylianus* sp. n.: (3) clypeus; (4) thorax; (5) scutellum; (6) femoral claw; (7) hypopygium, ventral (left) and dorsal (right); (8) anal point in lateral view; (9) virga (4 aspects); dorsal (10) and ventral lobes (11) of inferior volsella; (12) gonostylus (left).

Figures 1-12. Imago mâle d'*Orthocladius* (*Euorthocladius*) spp. Pubescence de la marge interne des yeux : (1) *O. kabylianus* sp. n. ; (2) *O. vicentei* (Corse). Imago mâle d'*O. kabylianus* sp. n. : (3) clypeus ; (4) thorax ; (5) scutellum ; (6) griffe fémorale; (7) hypopyge, vue ventrale (à gauche) et vue dorsale (à droite) ; (8) pointe anale en vue latérale ; (9) virga (4 aspects) ; volsella inférieure, lobes dorsal (10) et ventral (11) ; (12) gonostyle (gauche).

Hypopygium in dorsal and ventral view as illustrated in Fig. 7 (dorsal, right; ventral, left). Tergite IX narrowed apically, 90 μm long, 150 μm maximum wide, 35 μm minimum wide, bearing 14-16 setae (7-8 on each side of anal point). Anal point 55-63 μm long, uniformly tapering, robust with a nearly pointed apex, bearing 5-7 lateral setae; anal point in lateral view (Fig. 8). Laterosternite IX with 9-10 setae. Transverse sternapodeme and phallapodeme as in Fig. 7, sternapodeme with well developed oral projection. Virga (Fig. 9, 4 aspects) consists of 2 characteristic nearly subequal spines, which are distinctly fused at base. Gonocoxite 320-330 μm long; superior volsella indistinct; inferior volsella (Figs 7, 10-11): -dorsal lobe 47-50 μm long, 41 μm maximum wide, 25 μm minimum wide, broad at base and narrowed at tip, bearing 6-8 small setae; -ventral lobe nose-shaped, narrowest than dorsal lobe, slightly projecting upward, distinctly extended beyond apical margin of dorsal lobe, densely covered with setae. Gonostylus (Figs 7, 12) 160-165 μm long, bearing a characteristic triangular preapical crista dorsalis, presence of stout orally directed setae; megaseta 15-18 μm long.

Female imago

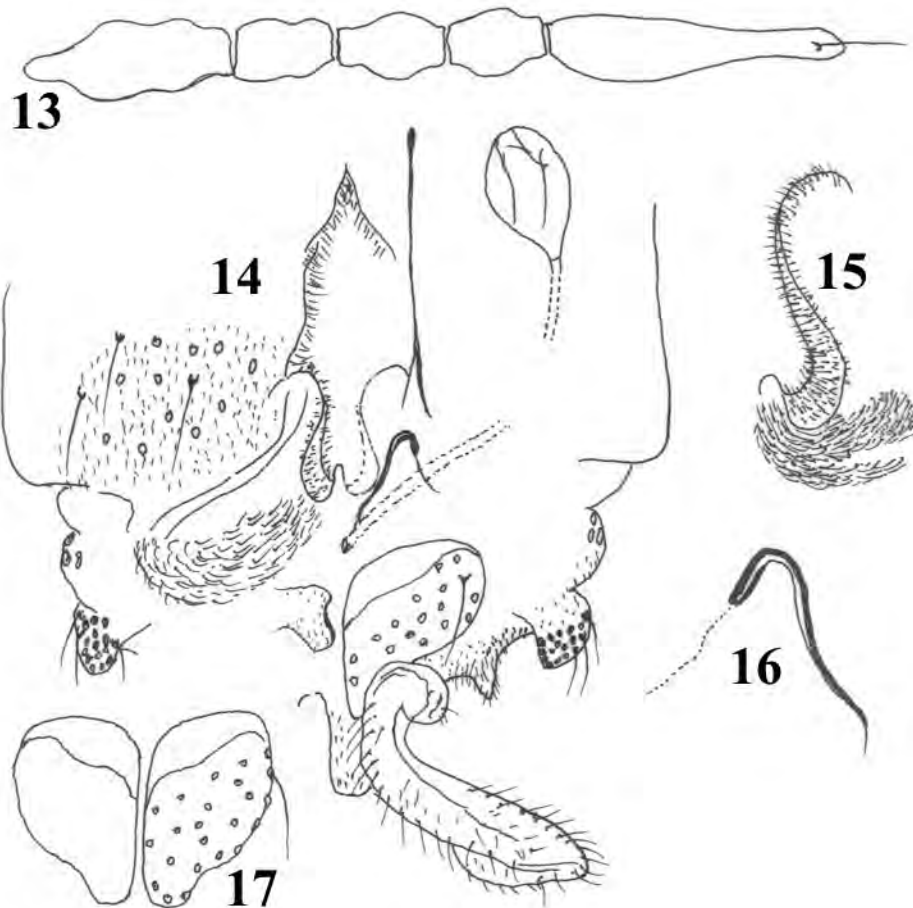
(n = 2, female pharate adults; figures 13-17)

Description

A big sized *Orthocladius* (*Euorthocladius*) species. Total length 4.90-5.80 mm. Wing length 2.90-2.95 mm. Antenna length 405-435 μm . General colouration relatively darker than in the male adult: contrasting blackish to dark brown, especially in the cephalothorax. Thorax dark brown with blackish mesonotal strips. Legs dark brownish to brown yellowish; base of tibia and apex of femur of PI, PII and PIII dark brown to blackish; tarsomere ta_5 of each leg blackish.

Head. Temporals 14 including 4 inner verticals, 5 outer verticals and 5 postorbitals. Clypeus trapezoidal (as in the male adult), bearing 15-16 setae. Palp 5-segmented; length (μm) of segments 47, 55, 96, 87, 135. Antenna (Fig. 13) 5-segmented, 405-425 μm long; flagellomere lengths (in μm) 95, 49, 51, 50, 175; last flagellomere swollen proximally, uniformly elongated distally and bearing a stout preapical seta; AR 0.67-0.71. Thorax. Anteprenotals 2; acrostichals 15-16 uni-biserial, inserted in proximal half of thorax; dorsocentrals 14-16; prealars 7-8. Scutellum with 24 setae, biserial, placed transversally in 2 rows, which are interrupted medially as in the male adult. Preepisternum bare. Wing. Brachiolum with 1 single seta. R with 12-13 setae, R_1 with 14-15 setae; remaining veins bare. Anal lobe well developed. Squama with 33-35 setae.

Genitalia as in Fig. 14 (dorsal and ventral). Notum 214-220 μm long, rami distinct. Gonapophysis VIII (Fig. 15, including dorsomesal and ventrolateral lobes); dorsomesal lobe S-shaped with a rounded oral projection; apodeme lobe (Fig. 16) distinctly projecting anteriorly. Seminal capsules 52 μm long, 61 μm wide, pear-shaped, darkly sclerotized in their anterior half. Spermathecal ducts with slight loops and separate openings. Sternite VIII with 13 setae. Laterosternite with 2-3 setae. Gonocoxite (Fig. 14) triangular to lobe-like, with 17-19 setae. Tergite IX (Fig. 17) heart-like, with 24-26 setae, distinctly divided into 2 protrusions, which are broadened proximally and narrowed distally. Cercus 185 μm long.



Figures 13-17. Female imago of *Orthocladius (Eu.) kabylianus* sp. n.: (13) antenna; (14) hypopygium, ventral (left) and dorsal (right); (15) gonapophysis VIII, dorsomesal and ventrolateral lobes; (16) apodeme lobe; (17) tergite IX.

Figures 13-17. Imago femelle d'*Orthocladius (Eu.) kabylianus* sp. n. : (13) antenne ; (14) hypopyge en vue ventrale (gauche) et dorsale (droite) ; (15) gonapophyse VIII, lobes dorsomérial et ventrolatéral ; (16) lobe de l'apodeme ; (17) tergite IX.

Male pupa

(n = 7; Figures 18-23)

Orthocladius (Euorthocladius) sp. 1: in MOUBAYED-BREIL et al. (2007).

Description

Colouration brown to dark brown in general; frontal apotome and frontal tubercles dark brown and rugulose, cephalothorax brown with faint dark shading on thorax, antennal and wing sheaths dark brown, thoracic suture anteriorly granulated; abdomen brownish with distinct

brown apophyses; segments I-III yellowish to brownish; segments IV-VIII brown to dark brown; anal segment dark brown, anal lobes dark brown with blackish apex. Total length 4.85-5.00 mm (female, 5.00-5.90 mm); abdomen 3.90-4.00 mm long (female, 4.20-4.90 mm).

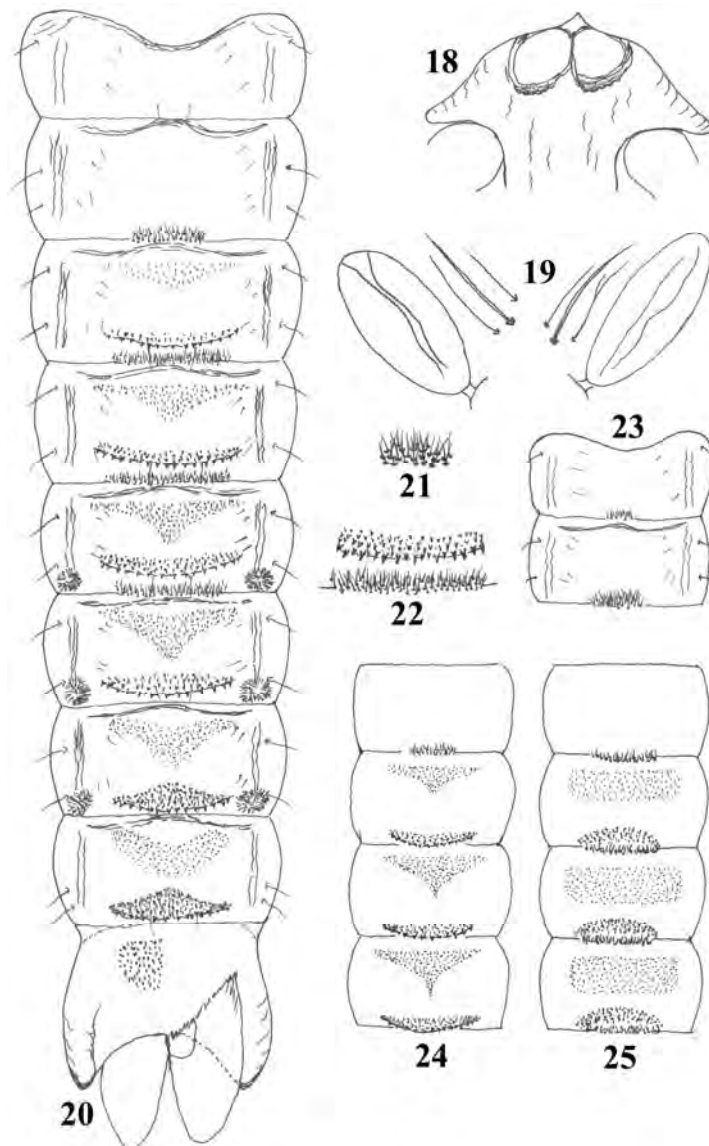
Cephalothorax. Frontal apotome (Fig. 18). Frontal tubercles 65-70 μm wide, 85-90 μm high, distinctly broadened and domed, bearing few anteromedian rugulose warts, frontal setae absent. Thorax weakly granulose anteriorly near the thoracic suture. Lateral anteprenotals 80-85 and 75-80 μm long, median anteprenotals 65-70 and 45-50 μm long. Thoracic horn (Fig. 19, 2 aspects) 145-155 μm long, stalked, elliptic, elongate and smooth; precorneal setae 80-85, 90-95, 90-93 μm long, consist of 2 bristle-like setae and 1 slightly thickest (placed in the middle), 1 occasionally forked. Dorsocentrals Dc_1 , Dc_2 and Dc_3 subequal (90-105 μm long); distance (μm) between dorsocentrals: Dc_1 - Dc_2 , 55; Dc_2 - Dc_3 , 85; Dc_3 - Dc_4 , 80. Abdomen. Armament and distribution pattern of patches of spines and points, chaetotaxy and lateral setation of segments as illustrated in Figs 20-23. Segments II-V 48-51 μm long and 104-93 μm wide. Posterior margin of tergite II armed with a transverse row of orally projected long pin-shaped spines (3-4 rows of 70-85 thin spines) occupying about 1/4 width of segment, spines are sclerotized but not fused at base (Figs 20-21). Anteromedian patches of small points present on tergites III-VIII: faint and weak on III, gradually becoming more extensive on each segment, triangle-like on tergites IV-VI, nearly semi-circular on tergite VIII. Posteromedian transverse rows of orally projected small pin-shaped spines are restricted to tergites III-V and occupying about 1/2 width of segments (Figs 20, 22). Tergite I usually bare, occasionally (Fig. 23, about 15% of the collected exuviae) with a weak transverse posteromedian band of orally directed pin-shaped spines (7-13) similar to those on tergite II. Posteromedian transverse patches of spines and points present on tergites III-VIII (Figs 20, 22), becoming gradually more extensive on each segment. Pedes spurii A present on tergites V-VII. Pedes spurii B absent. Sternites bare. Apophyses distinct on segments II-VIII. Anal lobes 375-385 μm long, 370-380 wide, slightly narrowed to tips, occasionally folded over, without any macrosetae. Genital sac 325-335 μm long, smooth and rounded distally, overreaching apical margin of anal lobe by 70-75 μm .

Larva: known but not described.

3. Taxonomic remarks

The male adult of *O. kabylianus* sp. n. resembles those of *O. abiskoensis*, *O. calvus*, *O. luteipes*, *O. rivicola* and *O. suspensus*, meanwhile its pupal exuviae is keyed, in particular, near those of *abiskoensis*, *calvus* and *vicentei*. Nevertheless, according to taxonomic data in the literature the male adult and the pupa of the new species can be easily distinguished from other related members by a combination of main differentiating characters.

- In the male adult: (i) absence of hairs on inner lateral margin of eyes (Fig. 1), different in *vicentei* (Fig. 2); (ii) clypeus bearing a circular blackish patch (Fig. 3); (iii) scutellum with 2 rows of setae which are interrupted medially (Fig. 5); (iv) virga (Fig. 9, 4 aspects) is distinctly illustrated in *ashei*, *luteipes*, *rivicola*, *thienemanni* and *vicentei* (see MOUBAYED-BREIL 2013); (v) anal point tapering distally; (vi) inferior volsella broad basally, narrowed apically, nose-like and not parallel sided (Figs 7, 10, 11) is easily distinguished from those of *calvus* (parallel-sided), *vicentei* (rectangle-like); (vii) gonostylus (Figs 7, 12) is differently figured in *ashei*, *calvus*, and *vicentei* (see MOUBAYED-BREIL 2013).



Figures 18-25. *Orthocladius (Euo.)* spp. Male pupal exuviae of *Orthocladius (Euo.) kabylianus* sp. n.: (18) frontal apotome; (19) two aspects of thoracic horn; (20) armament and chaetotaxy of abdominal segments I-IX; (21) shape pattern of spines on tergite II; (22) shape pattern of posteromedian patches on tergite V; (23) armament pattern of tergites I-II. Armament pattern of tergites II-V of: *O. calvus* (24); *O. abiskoensis* (25).

Figures 18-25. *Orthocladius (Euo.)* spp. Exuvie nymphale mâle d'*Orthocladius (Euo.) kabylianus* sp. n. : (18) pièce frontale ; (19) corne thoracique (2 aspects) ; (20) segments abdominaux I-IX, ornementation et chaetotaxie ; (21) forme des épines sur le tergite II ; (22) ornementation de l'aire postéromédiane du tergite V ; (23) ornementation des tergites I-II. Ornementation des tergites II-V de : *O. calvus* (24) ; *O. abiskoensis* (25).

- In the pupal exuviae: (a) frontal tubercles present and bearing few rugulose warts; (b) thoracic horn elliptic and smooth, precorneals consist of 2 bristle-like setae and 1 thickest seta; (c) general armament pattern and chaetotaxy of abdominal segments (Figs 20-23) are distinctly represented in *abiskoensis*, *ashei*, *calvus*, *luteipes*, *rivicola*, *thienemanni* and *vicentei*; (d) posteromedian transverse rows of orally directed spines on tergites I/II and III-V can easily distinguish *kabylianus* (Figs. 20-23) from those of *calvus* (absent on tergites III-V, Fig. 24), *abiskoensis* (restricted to tergites III-V, but rows of pin-shaped spines are replaced by rows of hooks, Fig. 25) and *vicentei* (spines are fused at base); (e) shape pattern of the anal lobes keys *kabylianus* closer to *calvus* (lacking macrosetae) than to *abiskoensis* (bearing macrosetae, narrowed and interned to tips).

4. Ecology

Orthocladius kabylianus sp. n. is a rheophilic species, which is strictly confined to the temporary upper stream of Boubhir Wadi in northern Algeria. The type locality where larvae, pharates and exuviae were collected consists of low mountain weakly shaded stretches with sandy to gravely calcareous substrata where fresh underground water maintains a low range of temperature and favourable environmental characteristics. The new species is believed to be a typical biological indicator of temporary karstic helocrenes and upstream areas located in the Kabylie Region, which deserve greater consideration and conservation. It belongs to the large community of crenobiontic and crenophilous species documented by LINDEGAARD (1995). Distribution of this confined crenophilous species to karstic streams in northern Algeria indicates that it is likely more widespread in temporary mountain streams located in North Africa. Crenobiontic and crenophilous species encountered in the same localities include: *Paramerina vaillanti* Fittkau, 1962; *Damesa hamaticornis* Kieffer, 1924; *D. insignipes* Kieffer, 1908; *Chaetocladius acuticornis* (Kieffer, 1914); *C. algericus* Moubayed, 1989; *C. melaleucus* (Meigen, 1818); *Cricotopus levantinus occidentalis* Moubayed-Breil & Ashe (2011); *E. coerulescens* (Kieffer, 1926); *E. gracei* (Edwards, 1929); *Orthocladius rivulorum* Kieffer, 1909; *O. saxosus* (Tokunaga, 1939); *O. vaillanti* Langton & Cranston, 1991; *Paraphaenocladius pseudirritus pseudirritus* Strenzke, 1950; *Paratrachocladius lanzavecchiai* Rossaro, 1990; *Rheocricotopus effusus* (Walker, 1856); *R. gallicus* Lehmann, 1969; *Thienemanniella clavicornis* (Kieffer, 1911); *Micropsectra zernyi* Marcuzzi, 1950; *Tanytarsus heusdensis* Goetghebuer, 1923.

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