

ENTOMOLOGY

Revision of the genus *Chaetocladius* Kieffer (Diptera, Chironomidae), 1st note: description of four new species from Italy

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Abstract

Four new species belonging to the genus *Chaetocladius*, known to occur in Italy, are here described as adult males: *C. aedeagovirgatus* sp. nov., *C. subalpinus* sp. nov., *C. ticinoi* sp. nov., and *C. valdostanus* sp. nov. *C. aedeagolobatus* is characterized by a robust aedeagal lobe, *C. subalpinus* and *C. valdostanus* by a characteristic inferior volsella, *C. ticinoi* by a tubercle on the basis of gonostylus. Geographical distribution of the other species known to occur in Italy is given. A key to adult males is presented.

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Introduction

The genus *Chaetocladius* Kieffer, 1911 includes about 70 species in the world (Ashe & O'Connor, 2012; Makarchenko et al., 2017), and 28 species among them are reported up to date from Europe (Sæther & Spies, 2013).

The genus was divided into two subgenera, *Amblycladius* Kieffer, 1923, with a single species and *Chaetocladius* s. str. In this paper, the subgenus *Chaetocladius* s. str. is revised in part on the basis of materials from different collection localities in Italian Alps. As a result of our study, four new species: *C. aedeagovirgatus* sp. nov., *C. subalpinus* sp. nov., *Chaetocladius ticinoi* sp. nov. and *C. valdostanus* sp. nov. are described. The other species belonging to the genus *Chaetocladius* known to occur in Italy are: *C. dentiforceps* (Edwards, 1929), *C. dissipatus* (Edwards, 1929), *C. gelidus* Brundin, 1956, *C. gracilis* Brundin, 1956, *C. grandilobus* Brundin, 1956, *C. laminatus* Brundin, 1947, *C. perennis* (Meigen, 1830), *C. piger* (Goetghebuer, 1913) and *C. suecicus* (Kieffer in Thienemann & Kieffer, 1916); their distribution in Italy is here given. A key to adult males of all species of the subgenus *Chaetocladius* s. str. known to occur in Italy is also presented.

Materials and Methods

The adult specimens were collected with a sweep net near rivers, streams and lakes; other adult specimens, pharate pupae and their exuviae - with a drift net; some samples were collected with light traps. The pupae were associated with males based on hypopygia of pharate specimens extracted from exuviae.

The material was preserved in 70% ethanol. The specimens were cleared in 10 % KOH after the separation of wings and rinsed, including wings, in acetic acid, then transferred in xylene:phenol 3:1 (Wirth & Marston, 1968), finally mounted in Canada Balsam on slides. Morphological terminology and abbreviations follow Sæther (1980). All measures are in μm unless otherwise stated.

All the materials studied, including type specimens are deposited in DeFENS, Dipartimento di Scienze per gli Alimenti, la Nutrizione e l'Ambiente (DeFENS), Università degli Studi di Milano, Italy.

Genus: *Chaetocladius* Kieffer, 1911

SUBGENUS: *Chaetocladius* s. str. Kieffer, 1911: 182.

TYPE SPECIES: *Dactylocladius setiger* Kieffer, 1908 [=

Chironomus perennis Meigen, 1830], by subsequent designation of Goetghebuer (1940-1950).

Description based on material examined and collected in Italy.

Medium sized to large species 3.0-3.9 mm, with wing length 2.0-2.4 mm.

ANTENNA. With 13 flagellomeres; groove beginning at flagellomeres, 2 sensilla chaetica present on flagellomere 2 and 3, about 6-8 on terminal flagellomere. Apex without apical seta. Antennal ratio 1.2-1.5.

HEAD. Eyes faintly pubescent with more or less developed microtrichia between ommatidial lenses or naked; with slight wedge-shaped dorsomedial extension. Temporal setae relatively numerous, mostly uniserial; inner verticals sometime separated from outer verticals and postorbitals or not separable. Apex of palpal segment 3 with 5-15 sensilla clavata at distinct and well developed sensillum coeloconicum.

THORAX. Anteprenotum well developed, lobes gaping, meeting at a point anterior to scutal projection, with few lateral setae. Humeral pit well developed, but not transparent, mostly ovoid with several smaller pits within one larger spot. Acrostichals short but distinct, starting close to anteprenotum; dorsocentrals uniserial or partly biserial; prealars few; supraalars absent. Scutellum with mostly uniserial transverse row of setae.

WING. Membrane without setae, with coarse punctation (microtrichia visible at 40 \times). Anal lobe not projecting, forming a right angle. Costa barely extended; R₂₊₃ running midway between R₁₊₂, and R₄₊₅, or closer to R₁, ending distal to end of M₃₊₄; FCu opposite of RM; Cu, slightly sinuate distally to approximately straight; postcubitus and An ending distal to FCu. R with about 10 setae, R₁ with very few setae, R₄₊₅ without setae.

LEGS. Spurs of mid and hind leg tibiae with prominent, projecting, apicolateral denticles. Pseudo-spurs present on tarsomeres 1 and 2 of mid and hind legs, in only one species on tarsomere 1 of fore leg. Sensilla chaetica not found on legs of the examined species. Pulvilli small.

ABDOMEN. Tergites with scattered setae, more dense laterally and often with distinct anterior transverse rows.

HYPOPYGIUM. Anal point variable, but always present and hyaline, very transparent, without setae or with few scattered microtrichia on apex, but with setae and dense microtrichia at base; triangular or parallel-sided; apex pointed or rounded, base and anal point proper separated into 2 distinct parts. Phallapodeme well developed, sometime with hook-shaped anterior apex. Sternapodeme more or less strongly arched, oral projections present or reduced or absent. Virga consisting of cluster of moderately long spines, very weakly sclerotized or absent. Aedeagal lobe present or reduced, in one species very well developed. Gonocoxite with inferior volsella more or less separated into a dorsal and ventral lobe. Gonostylus curved or at right angle, sometimes with distinct outer corner, in one species with a tubercle near the base; crista dorsalis mostly long, low and preapical, megaseta present; 3 megasetae present in one species.

in Miage garden N 45°47'4.83", E 6°53'7.51", 9.IX.1995, leg. Rossaro.

Adult male (n=1).

Total length 3.13 mm. Wing length 2.01 mm. Total length/wing length 1.5. Colouration dark brown.

ANTENNA. With 13 flagellomeres; groove beginning at flagellomere 3; 2 sensilla chaetica present on flagellomeres 2 and 3, about 12 on terminal flagellomere. Apex without apical seta. AR 1.28 (last antennal flagellomere: 614 long).

HEAD. Eye with very short pubescence; with a moderate wedge-shaped dorsomedial extension. About 9 temporal setae not separable into inner and outer verticals. Palpomeres 194-204: 113-126: 125-127: 54-57: 24-26. Apex of palpomere 3 with 8 sensilla clavata in subapical distinct and well developed sensillum coeloconicum.

THORAX. Anteprenotum moderately or usually well developed, lobes gaping, meeting at a point anterior to scutal projection or occasionally not in contact, with few to several lateral setae. Two humeral pits well developed, mostly ovoid with several smaller pits within one larger spot. 17 acrostichals short but distinct, starting at anteprenotum; 9 dorsocentrals uniserial, robust about 120 long; 6 prealars; supraalars absent. Scutellum with 7 setae, uniserial.

WING. Membrane without setae, with coarse punctation (microtrichia visible at 40 \times). Anal lobe not projecting. Costa barely extended; R₂₊₃ running near to R₁₊₂, R₄₊₅ ending distal to end of M₃₊₄; FCu opposite to RM; Cu moderately curved, postcubitus and An ending distal to FCu. R, R₁ and R₄₊₅ with setae. Squama with about 15 setae.

LEGS. Spurs of mid and hind leg tibiae with prominent, projecting, apicolateral denticles. Two pseudo-spurs present on tarsomeres 1, 2, 3 of hind legs, and on tarsomere 1, 2 of mid legs, absent on tarsomeres of fore leg. Pulvilli developed. Length (in μ m) and proportions of leg segments as in Table 1.

ABDOMEN. Tergites with scattered setae, more dense laterally and often with distinct anterior transverse rows.

HYPOPYGIUM. Anal point very slender about 51-52 long, less than 3.5 wide, without microtrichia; base with setae and dense microtrichia. Phallapodeme well developed, with hook-shaped anterior apex, aedeagal lobe very developed and sclerotized, 45 long. Sternapodeme strongly arched, oral projections reduced. Virga consisting of cluster of moderately long spines about 30 long, weakly sclerotized. Gonocoxite 245 long, with well developed inferior volsella; dorsal lobe appearing as a distinct rounded protuberance, well separated from the ventral lobe, visible posterior to dorsal lobe. Gonostylus curved, without distinct outer corner; crista dorsalis mostly long, low and preapical; megaseta present.

Diagnostic characters

The species is near to *C. dissipatus*, with a very slender anal point, but it differs distinctly in having very well developed stout aedeagal lobes.

Etymology

In reference to the very well developed aedeagal lobes, the unique character in the genus. The name is an adjective.

Chaetocladus aedeagolobatus Rossaro, Magoga and Montagna sp. nov. (Figures 1 and 2)

Material

HOLOTYPE: adult male, Italy, Aosta Valley, Veny Valley, spring

Table 1. *Chaetocladus aedeagolobatus* Rossaro, Magoga and Montagna sp. nov. Length (in μ m) and proportions of leg segments.

	fe	ti	ta1	ta2	ta3	ta4	ta5	LR	BV	SV
P _I	919	1078	745	356	289	185	101	0.69	2.95	2.68
P _{II}	948	955	493	290	230	150	111	0.52	3.07	3.86
P _{III}	1160	1215	730	385	340	175	110	0.60	3.07	3.25

P_{I,II,III}: fore, mid and hind legs; fe, femur; ti, tibia; ta 1-5, tarsomeres 1-5; LR, leg ratio; BV, combined length of femur, tibia, and ta1 divided by combined length of tarsomeres 2-5; SV, ratio of femur plus tibia to ta1.

***Chaetocladus subalpinus* Rossaro, Magoga et Montagna, sp. nov.** (Figures 3 and 4)

Material

HOLOTYPE: adult male, Italy, Aosta Valley, Veny Valley, spring near Rif. Monte Bianco N 45°47'52.57", E 6°55'53.58", 8.IX.1996, leg. Rossaro.

PARATYPES: adult male, same data as holotype; Italy, Aosta Valley, Veny Valley, Estellette glacier st.2, Spring near Rif. Elisabetta N 45°45'54.26" E 6°50'13.22", 8.IX.1996; leg. Rossaro; 2 males, 1 pharate pupa male, Italy, Aosta Valley, Val Veny, Col de La Seigne staz Obis, N 45°45'4.26" E 6°48'23.00" leg. Rossaro; adult male, Italy, Trentino Alto Adige, Adamello Glacier, spring below Vedretta Lobbia, N 46°11'51" E 10°35'30.68", 12.IX.1990, leg. Rossaro.

Adult male (n=6).

Total length 3.03-3.13 mm. Wing length 2.33-2.41 mm. Total length/wing length 1.3. Colouration dark brown.

HEAD. Eyes with weak dorsomedian extensions. Temporal setae: 7 verticals and 4 postorbitals. Clypeus with 6 setae. Antenna with 13 flagellomeres and well developed plume; AR 1.3. Last antennal flagellomere: 513-545, combined length of other flagellomeres: 420-423. Palps: lengths of palpomeres 2-5: 15-26: 47-52: 117-124: 116-118: 168-214. Third palpomere with 5-6 long sensilla clavata in a subapical sensillum coeloconicum.

THORAX. Anteprepronotum moderately or usually well developed, lobes gaping, meeting at a point anterior to scutal projection or occasionally not in contact, with few to several lateral setae. Two humeral pits well developed, mostly ovoid with several smaller pits within one larger spot. 17 acrostichals short but distinct, starting at anteprepronotum; 10 dorsocentrals uniserial, robust about 120 long; 6 prealars; supraalars absent. Scutellum with 8 setae, uniserial.

WING. Membrane without setae, with coarse punctation

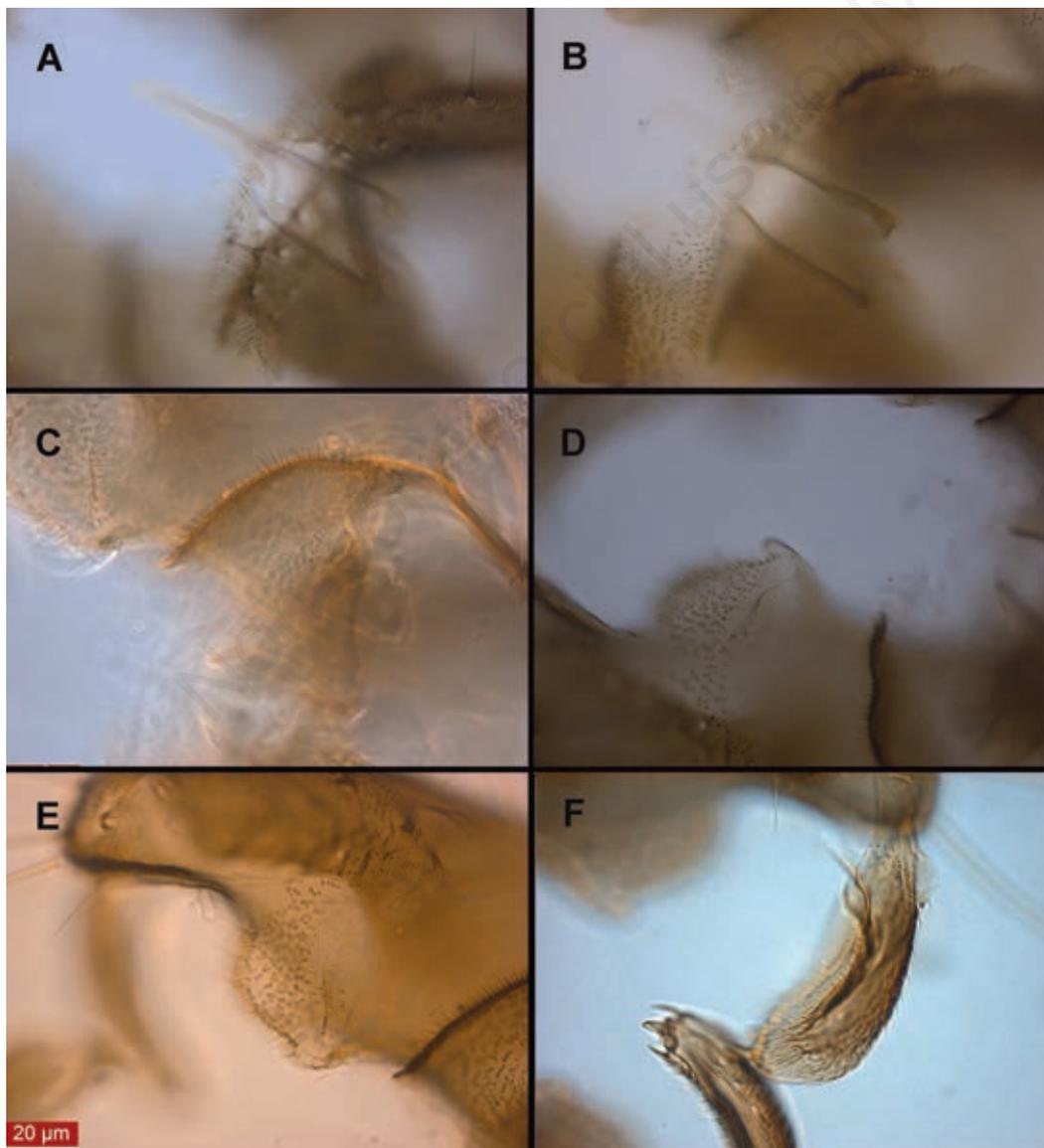


Figure 1. *C. aedeaglobatus*. A) Anal point, B) aedeagal lobes, C) phallapodeme, D) inferior volsella, dorsal lobe, E) inferior volsella, ventral lobe, F) gonostylus.

(microtrichia visible at 40 \times). Anal lobe not projecting. Costa barely extended; R_{2+3} between R_{1+2} and R_{4+5} , R_{4+5} ending distal to end of M_{3+4} ; FCu opposite to RM; Cu moderately curved, postcubitus and An ending distal to FCu. R with 10-13 setae, R_1 with 2 setae, R_{4+5} without setae. Squama with about 6-9 setae.

LEGS. Spur of fore leg tibia 62 long. Spurs of mid tibia 24-28, of hind tibia 61 long. Hind tibial comb with 12 setae. Two pseu-

dospurs present on tarsomeres 1, 2 of mid and hind legs, absent on tarsomeres of fore leg. Pulvilli small. Length (in μm) and proportions of leg segments as in Table 2.

HYPOPYGIUM. Tergite IX with 18-21 setae 26-33 long and narrowly triangular anal point 26-35 long and 6 wide at base, with microtrichia present only at base. Distal apex not reaching posterior margin of inferior volsella. Laterosternite IX with 7-9 setae on

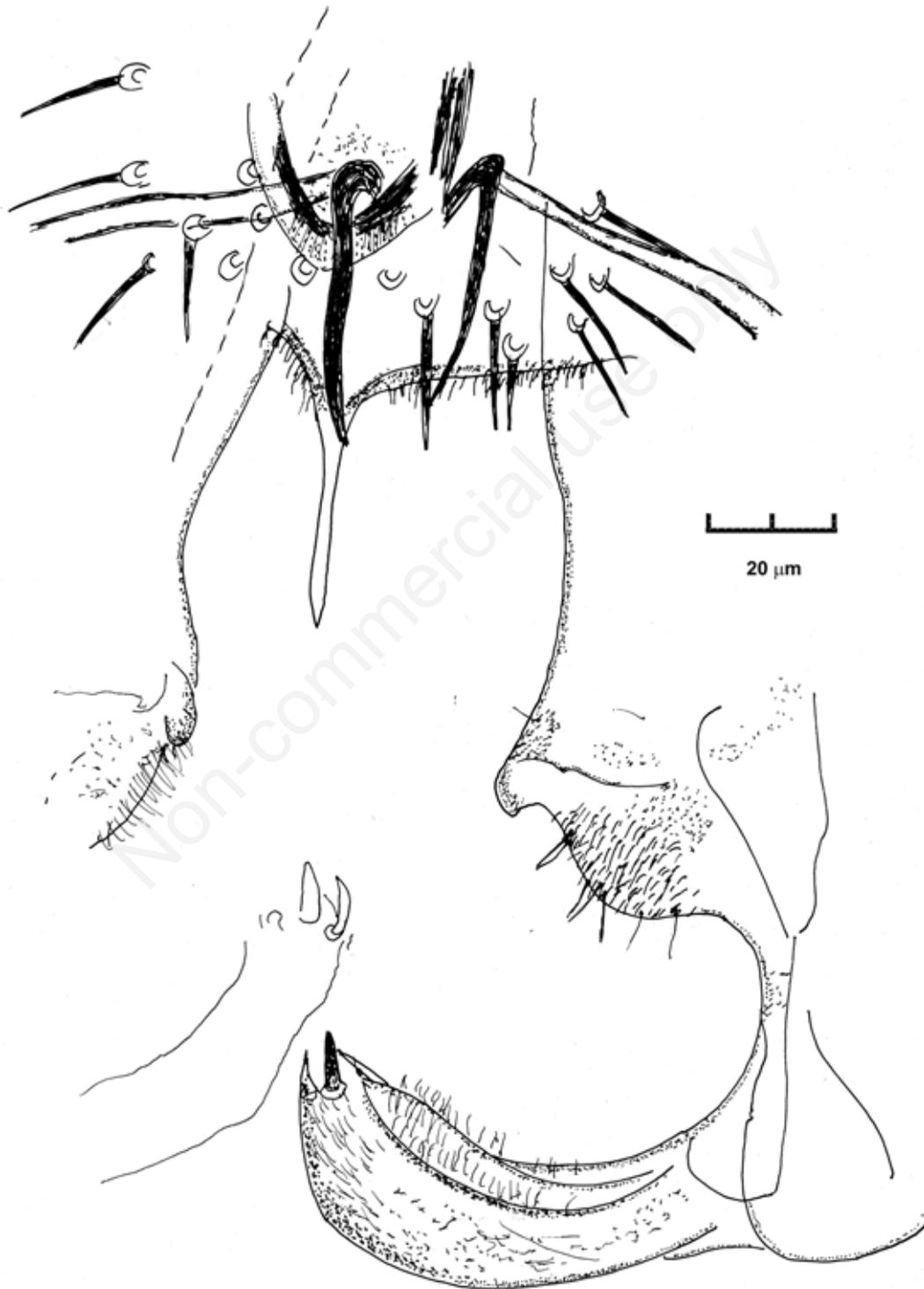


Figure 2. *C. aedeagolobatus*. Male genitalia.

each side. Transverse sternapodeme rounded, without oral projections. Virga 23 long, consisted of several setae. Gonocoxite 210-220 long; inferior volsella divided into dorsal and ventral lobe; dorsal lobe rounded, with well sclerotized median surface, almost completely covering the ventral lobe. Ventral lobe provided with short setae. Gonostylus 75 long, slender, with right angle outer

margin, without subapical crista dorsalis but with two robust setae on well developed tubercle near megaseta, megaseta 8-12 long.

Diagnostic characters

The species can be separated from the other species by the triangular anal point covered with microtrichia, the ball shaped dorsal

Table 2. *Chaetocladus subalpinus* Rossaro, Magoga et Montagna, sp. nov. Length (in μm) and proportions of leg segments.

	fe	ti	ta1	ta2	ta3	ta4	ta5	LR	BV	SV
P _I	754-766	915-955	549-574	335-362	217-256	156-172	107-129	0.60	2.61	3.02
P _{II}	827-842	829-841	363-379	230-231	182-187	101-126	101-102	0.44	3.24	4.50
P _{III}	901-940	1001-1016	574-598	328-328	255-262	153-182	99-124	0.58	2.91	3.29

P_{I,II,III}: fore, middle, and hind legs; fe, femur; ti, tibia; ta1-5, tarsomeres 1-5; LR, leg ratio; BV, combined length of femur, tibia, and ta1 divided by combined length of tarsomeres 2-5; SV, ratio of femur plus tibia to ta1.

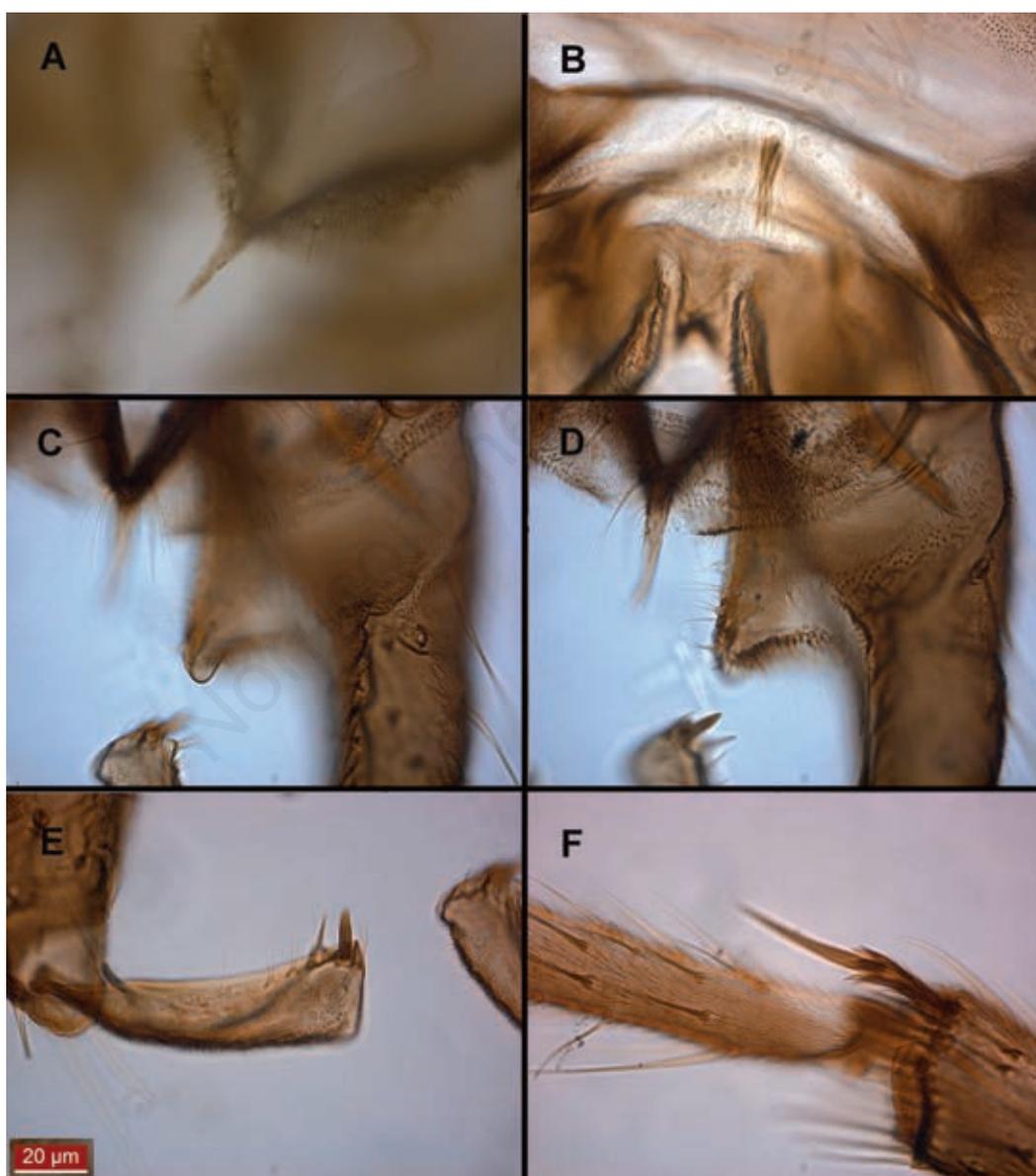


Figure 3. *C. subalpinus*. A) Anal point, B) virga, C) inferior volsella, dorsal lobe, D) inferior volsella, ventral lobe, E) gonostylus, F) spine of tibia of hind leg.

lobe of inferior volsella, the right angle of gonostylus; it differs from *C. gracilis* in having a longer anal point, a larger dorsal lobe of inferior volsella and a gonostylus with a right angle outer margin.

Comments

Using the key to British Isles (Langton & Pinder, 2007) the choice between points 4 and 5 is not possible because the anal point goes beyond middle part of inferior volsella, but does not

reach the posterior margin; following point 4 we will go to *C. melaleucus*, which has a different anal point and inferior volsella; following point 5 we will go to *C. piger*, but the anal point is shorter and inferior volsella is different.

Etymology

The species is named after sampling localities, all in Southern side of Alps. The name is an adjective.



Figure 4. *C. subalpinus*. Male genitalia.

***Chaetocladius ticinoi* Rossaro, Magoga and Montagna sp. nov.** (Figures 5 and 6)

Material

HOLOTYPE: adult male, Italy, Lombardia, Ticino river, Boffalora N 45°28'21.12" E 8°47'22.07", 30.III.1994, leg. Rossaro.

Adult male (n=1).

Large species, total length 3.9 mm. Wing length cannot be measured, because very damaged. Colouration dark brown.

HEAD. Eyes with very short pubescence between ommatidia. AR 1.22, last antennal flagellomere: 497 long; palpomeres: xx: 40:42: 101-108: 78-91: 101-147; 11 temporals, 8 clp.

THORAX: 16 dorsocentrals the last 3 separated by 3 small white spots, the first 4 setae into 2 rows, 10 scutellars in one row.

WINGS: with coarse punctuation; very damaged, squama observ-

able with 10 setae, but the rest of the wing cannot be analysed.

LEGS. Legs broken, some segments lacking. Spur of fore leg tibia 51, mid tibia tarsal segments lost, spur of hind tibia 60 long. Hind tibial comb with 14 setae. One spur visible on tarsomeres 1 of p₁, spurs absent in other segments preserved. Small pulvilli present. Length (in μm) and proportions of leg segments as in Table 3.

Hypopygium: TIX with a rectangular dorsal plate, bearing very robust but short spines; anal point large, parallel-sided with rounded apex, 47 long, 7-8 wide, sternapodeme with small oral projection, gonocoxite 290 long, well developed tubercle on gonostylus, the inferior volsella projecting medially and sharply pointed as in *Chaetocladius acuminatus* Brundin, 1956. Gonostylus with characteristic tubercle near gonocoxite connection and three megasetae.

Diagnostic characters

The species has an inferior volsella similar to that of *C. acuminatus* but it has a different anal point and a developed tubercle at

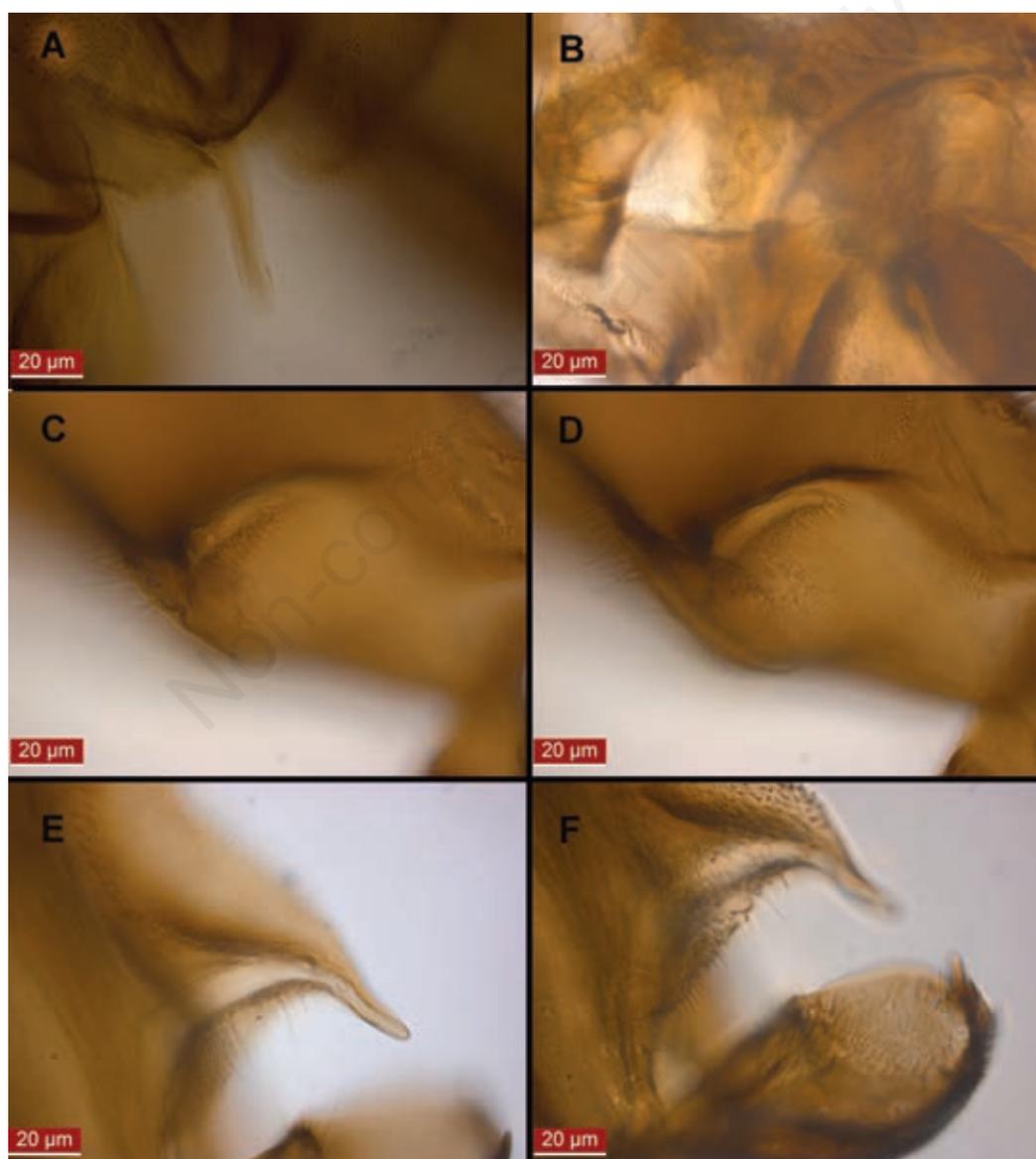


Figure 5. *C. ticinoi*. A) Anal point, B) sternapodeme, C) inferior volsella, dorsal lobe, D) inferior volsella, ventral lobe, E) inferior volsella at a different viewpoint, F) gonostylus.

the base of gonostylus; characteristic is also the rectangular plate on TIX, covered with short strong spines.

Etymology

The species is named from sampling locality, the Ticino river. The name is a genitive.

Chaetocladus valdostanus Rossaro, Magoga et Montagna, sp. nov. (Figures 7 and 8)

Material

HOLOTYPE: adult male Italy, Aosta Valley, Val Veny, Col de La Seigne staz 3bis, N 45° 44' 56.06" E 6°48'41.12", 7.IX.1996, leg. Rossaro.

PARATYPES: adult male with associated pupal exuviae, same

locality as holotype; 14.IX.1997, leg. Rossaro, 2 males Italy, Aosta Valley, Val Veny, Col de La Seigne staz 2bis, N 45°44'56.08" E 6°48'41.10", 7.IX.1996, leg. Rossaro, adult male sorg Lobbia, N 46°11'51" E 10°35'30.68", 12.IX.1990, leg. Rossaro.

Adult male (n=5).

Total length 3.50-3.56 mm. Wing length 2.27-2.31 mm. Total length/wing length 1.54. Colouration dark brown.

HEAD. Eyes without microtrichia, but with few short points between ommatidia lenses (pubescent), dorsomedian extension weak; 11 temporal setae not separable into verticals and postorbital. Clypeus with 10 setae. Antenna with 13 flagellomeres and well developed plume; AR 1.18. Length of ultimate flagellomere: 488. Lengths of palpomeres 1-5: 20-25: 61-73: 73-80: 114-122. Third palpomere with 5-6 sensilla clavata subapically.

THORAX. Anteprepronotum with few lateral setae. Ac 14-18, beginning close to anteprepronotum; Dc 8; Pa 4-5; Scts 5, in 1 row.

WING. R with 10 setae, R₁ with 1 seta and R₄₊₅ without setae. Costa extension very reduced. Apex of R₄₊₅ at the same distance of

Table 3. *Chaetocladus ticinoi* Rossaro, Magoga and Montagna sp. nov. Length (in μm) and proportions of leg segments.

	fe	ti	ta1	ta2	ta3	ta4	ta5	LR	BV	SV
P _I	866-894	970	658							
P _{II}	904-923	908-	-	-	-	-	-	-	-	-
P _{III}	1025	1012	557	292	250	138	129	0.55	3.21	3.66

P_{I,II,III}: fore, middle, and hind legs; fe, femur; ti, tibia; ta1-5, tarsomeres 1-5; LR, leg ratio; BV, combined length of femur, tibia, and ta1 divided by combined length of tarsomeres 2-5; SV, ratio of femur plus tibia to ta1.

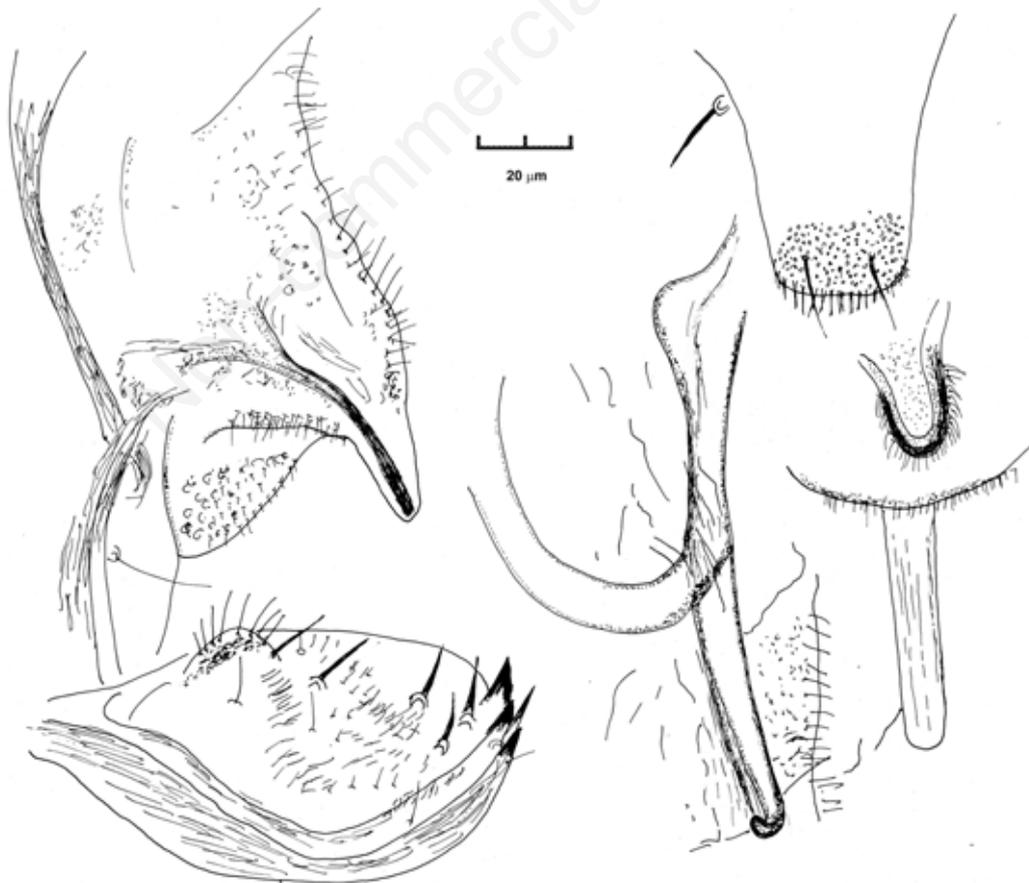


Figure 6. *C. ticinoi*. Male genitalia.

M₃₊₄. Cu₁ curved in apical quarter. Anal lobe reduced, rectangular-rounded. Squama with 8 setae.

LEGS. Spur of fore leg tibia 52. Spurs of mid leg tibia 18 and 20 long, of hind leg tibia 48-50 long. Hind leg tibial comb with 14 setae. Two pseudospurs present on tarsomeres 1, 2 of mid and hind legs, absent on tarsomeres of fore leg. Small pulvilli present.

Length (in μm) and proportions of leg segments as in Table 4.

HYPOPYGIUM. Tergite IX with 18-21 long setae. Anal point triangular, 25-45 long, 7 wide at its base without microtrichia, rounded at apex. Laterosternite IX with 5-6 setae on each side. Transverse sternapodeme rounded, without oral projections. Virga 21 long, consisted of several setae. Gonocoxite 200-218 long; inferior volsella in

Table 4. *Chaetocladius valdostanus* Rossaro, Magoga et Montagna, sp. nov. Length (in μm) and proportions of leg segments.

	fe	ti	ta1	ta2	ta3	ta4	ta5	LR	BV	SV
P _I	657	580	361	234	142	147	97	0.62	2.58	3.43
P _{II}	647	590	247	160	131	118	92	0.42	2.96	5.01
P _{III}	692	762	393	214	213	119	91	0.52	2.90	3.70

P_{I,II,III}: fore, middle, and hind legs; fe, femur; ti, tibia; ta1-5, tarsomeres 1-5; LR, leg ratio; BV, combined length of femur, tibia, and ta1 divided by combined length of tarsomeres 2-5; SV, ratio of femur plus tibia to ta1.

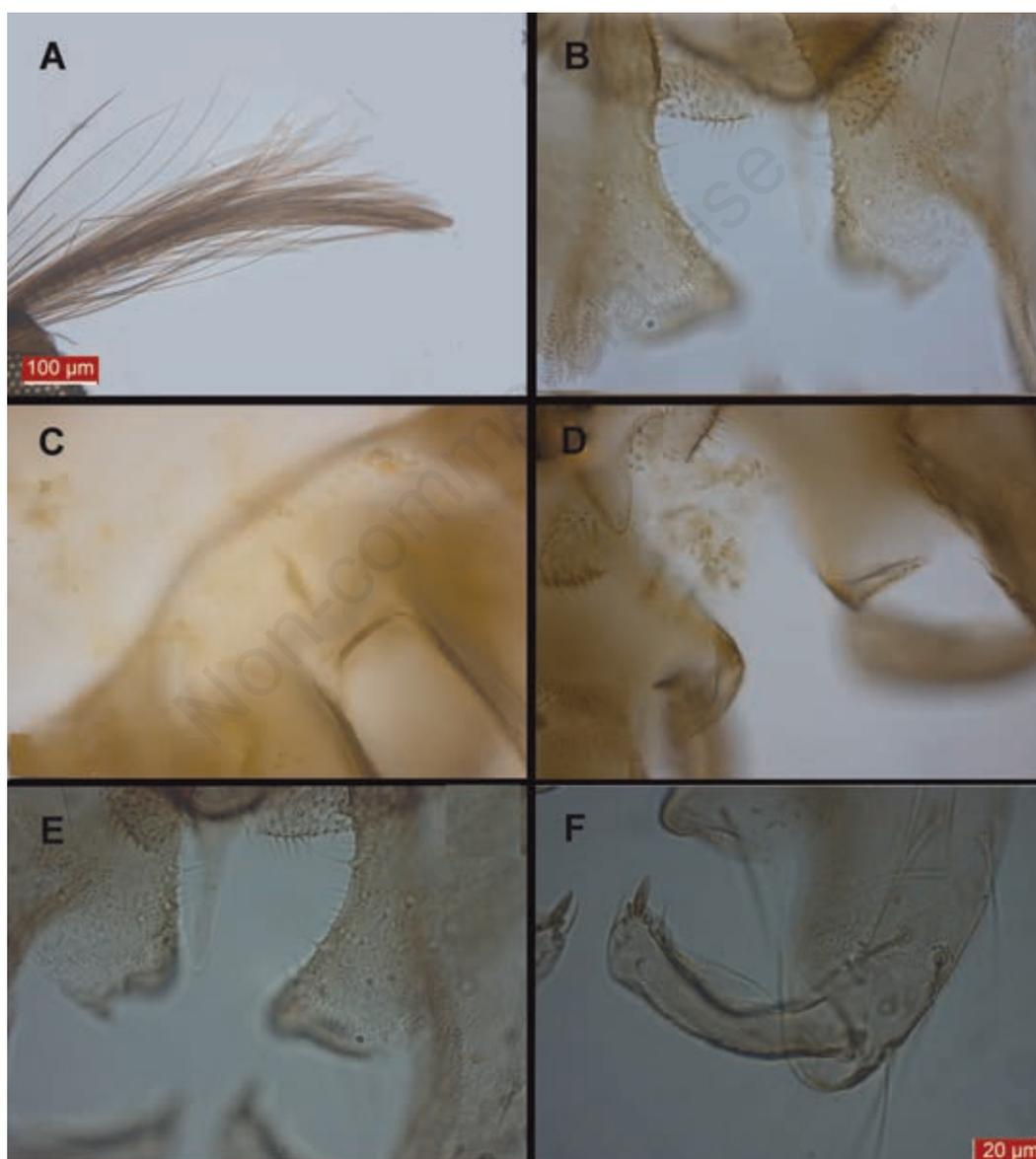


Figure 7. *C. valdostanus*. A) antenna, B) anal point, C) virga, D) inferior volsella, dorsal lobe, E) inferior volsella, ventral lobe, F) gonostylus.

caudal position not well divided into a dorsal and ventral lobe, with a well sclerotized dorsal lobe rounded, and a characteristic posterior undulated margin. Gonostylus 70-72 long, with small subapical crista dorsalis in form of tooth, megaseta 12 long.

Diagnostic characters

The shape of dorsal lobe of inferior volsella is very characteristic possessing a sclerotized undulated margin and allows separation from the presumable closest relative - *C. gracilis*.

Comments

Using the key to British Isles (Langton & Pinder, 2007) at point 4 we will go to *C. melaleucus*, but the anal point and inferior volsella are different.

Etymology

The species is named from sampling localities, most of them in the Aosta Valley. The name is an adjective.

Other species

C. dentiforceps: adult male Sarca di Genova river, spring below vedretta della Lobbia, N 46°11'51" E 10°35'30.68", 12.IX.1990 leg. Rossaro, adult male Dora Baltea, val Veny, Col de La Seigne stream st. 1bis N 45°45'4.25" E 6°48'23.1" 14.IX.1997, leg. Rossaro

Note: anal point 17 long rounded at apex

C. dissipatus: adult male Adda river Forni glacier st g N 46°25'8.93" E 10°33'56.17", 18.IX.2001 leg. Rossaro

C. gelidus: adult male Lombardia Oglio Frigidolfo river, small stream near S. Apollonia, N 46°18'18.95" E 10°29'46.66", 8.VII.1978 leg. Rossaro, adult male Gallavesa stream, N 45°49'6.97" E 9°27'0.56", 12.XI.1977, leg. Rossaro

C. gracilis: adult male Vedretta Lobbia, N 46°11'51" E 10°35'30.68", 12.IX.1990, leg. Rossaro, adult male Settimo Milanese, N 45°28'48.44, E 9°2'47.69", 3.XII.1977, leg. Rossaro,

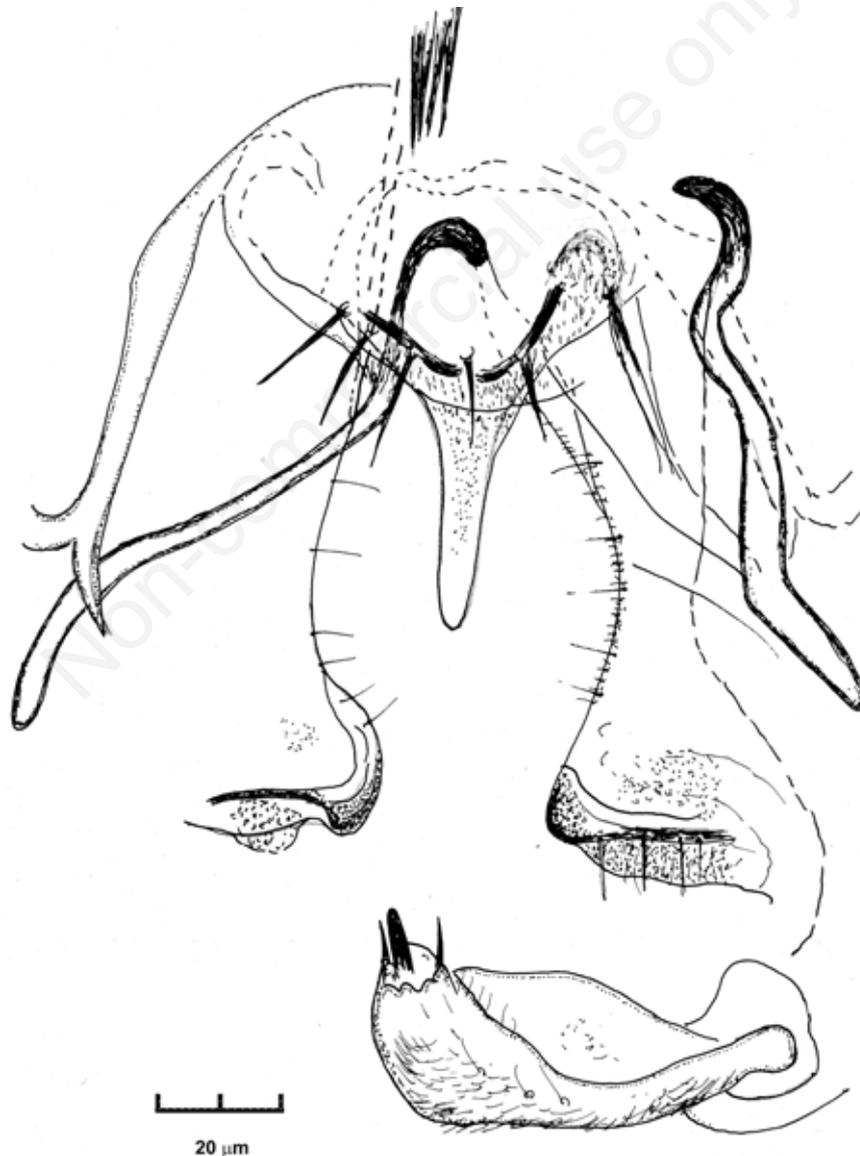


Figure 8. *C. valdostanus*. Male genitalia.

adult male Abruzzi, Vera spring, N 42°22'10.50" E 13°27'32.09", 21.IV.1990, 1.V.1990, 23.VII.1990, 1.VIII.1990, 22.VIII.1990, 1.IX. 1990, leg. Rossaro. Note: AR=1.56 anal point triangular 22-24-30 long 10 wide at its base

C. grandilobus: 2 males Lombardia Oglio Frigidolfo river, small stream near S. Apollonia, N 46°18'18.95" E 10°29'46.66", 18.IV.2014 leg. M. Montagna

C. laminatus: adult male Aso stream st 01 N 42°59'7.57" E 13°28'40.12", 29.I.1979, 28.III.1979, 17.IV.1980, 15.X.1980, leg. Bareggi, 1 pharate pupa male, Trexenda stream near Dané, N 44°18'4.94" E 8°22'31.35", 15.I.1997, leg. Zunino, adult male small stream in Elba Isle, N 42°47'11.51" E 10°12'34.00", 3.I.1980, leg. Rossaro, Lambro river st 01 near Magreglio N 45°55'18.98" E 9°15'44.42", 20.I.1978, leg. Rossaro.

C. perennis: adult male Lombardia, Oglio river, waterhole in Vezza N 46°14'14.60" E 10°24'27.46", 16.VII.78, leg. Rossaro, adult male Sarca di Genova river, waterfall Nardis N 46°10'4.19" E 10°40'37.18", 13.IX.1990, leg. Rossaro, adult male Orta lake near Buccione, N 45°47'59.17" E 8°24'54.79", 3.II.1978, 1.IV.1994, leg. Rossaro, adult male Brembo river st 01 Cassiglio N 45°58'2.83" E 9°36'53.27", 23.V.1980, leg. Rossaro, adult male spring near Serina N 45°52'40.72" E 9°43'56.41", 11.IV.1981, leg. Rossaro, adult male Brembo river Oltre il Colle Ola spring N 45°53'27.60" E 9°46'14.22", 15.XII.1982, leg. Rossaro, adult male Ticino river near Boffalora N 45°28'16.55" E 8°47'23.56", 11.II.1993, leg. Rossaro, adult male Abruzzi Tasso stream PN08 N 41°52'0.10" E 13°53'42.49", 25.5.1978, leg. Rossaro, fontana alto Sangro PNA02, N 41°54'4.86" E 13°44'0.91", 19.V.1978, leg. Rossaro, Sangro SS 84 Km 41 PNA04 N 41°51'4.14" E 13°46'40.92", 20.V.1978, leg. Rossaro. Note: anal point 34-39 long 16 wide at its base, sternapodeme with well developed oral projections, aedeagal lobes visible, very slender with hook at apex.

C. piger: adult male, Italy, Lombardia, Lago Maggiore, Angera N 45°46'15.46" E 8°34'34.65", 2.II.1995, leg. L.Marziali, Varese lake, Schiranna, N 45°47'41.75" E 8°47'29.13", 10. II.1997, leg. Rossaro, adult male, 1 pupal exuviae, Alserio lake N 45°46'51.88" E 9°12'26.48", 27.1.2005. Note: anal point 62-66 long 26 wide at its base.

C. suecicus adult male, Italy, val d'Aosta, Lys glacial stream, Gressoney, N 45°50'17.33" E 7°49'5.75", 1.VII.1987, leg. Rossaro, adult male, Piemonte, Acqualba stream, near Orta Buccione, N 45°48'33.29" E 8°22'8.42", 3.III.1978, leg. Rossaro, adult male, Lombardia, Oglio river, Vezza N 46°14'14.60" E 10°24'27.46", 25.III. 1978, leg. Rossaro. Note: anal point with parallel margins rounded at apex, 69 long 8 wide at its base

Key to males of Italian species of *Chaetocladus* s. str. Kieffer

- 1 gonostylus with a tubercle at its base and 3 megasetae at apex (Figure 5F); eyes pubescent; anal point large, parallel sided, rounded at apex *C. ticinoi* sp. nov.
- gonostylus without tubercle at its base and with only one megaseta, anal point variable in shape 2
- 2 anal point very slender and delicate in appearance, less than 3 μ m wide. 3
- anal point larger 4
- 3 aedeagal lobe not visible; eyes relatively slightly pubescent *C. dissipatus* (Edwards)
- aedeagal lobe very well developed (Figure 1B), eyes heavily pubescent *C. aedeagolobatus* sp. nov.
- 4 gonostylus with a distinct outer corner; eyes pubescent . . . 5

- gonostylus with a rounded or right angle outer margin, eyes pubescent or naked 6
- 5 outer margin of gonostylus produced into a distinct tooth *C. dentiforceps* (Edwards)
- gonostylus with outer margin very expanded at right angle, but without an evident tooth *C. laminatus* Brundin
- 6 inferior volsella large, clearly double, with ventral lobe well extending beyond dorsal lobe caudally and occupying at least about three-quarters of the inner margin of gonocoxite, virga weak, consisting of some pale setae; eyes naked *C. perennis* (Meigen)
- if inferior volsella divided into two lobes, ventral lobe does not extend much behind dorsal lobe 7
- 7 anal point roughly parallel-sided and apically rounded 8
- anal point triangular 9
- 8 anal point long, at least 50 μ m long, eyes pubescent *C. suecicus* (Kieffer)
- anal point short, less than 40 μ m long . . . *C. gelidus* Brundin
- 9 inferior volsella very large, eyes naked *C. grandilobus* Brundin
- inferior volsella smaller, eyes somewhat pubescent. 10
- 10 anal point long, about 60 μ m long and 20 μ m wide, extending near to distal margin of inferior volsella; virga developed; inferior volsella with a characteristic semicircular shape; AR 1.54 *C. piger* (Goetghebuer)
- anal point short, 26-41 μ m, with microtrichia, inferior volsella somewhat separated into a dorsal and a ventral lobe, but ventral lobe does not extend caudally. 11
- 11 dorsal lobe of inferior volsella with a large rounded median tubercle, ventral lobe not extending caudally beyond dorsal lobe (Figure 3C,D), anal point about 25 μ m, pointed at apex *Chaetocladus subalpinus* sp. nov.
- dorsal lobe of inferior volsella with a small rounded tubercle medially, anal point longer 25-35 μ m, less pointed 12
- 12 inferior volsella without a typical crest; eyes pubescence very reduced, but visible *C. gracilis* Brundin
- inferior volsella characteristic (Figure 7D,E), with a typical crest on the caudal margin of dorsal lobe, eyes almost naked *Chaetocladus valdostanus* sp. nov.

Discussion and Conclusions

The genus *Chaetocladus* was established by Kieffer (1911); Edwards (1929) and Goetghebuer (1940-50) described and illustrated many Palaearctic species; Brundin (1947; 1956) well illustrated the male genitalia of some known species and described new species; a key to British Isles species was more recently presented (Langton & Pinder, 2007).

Unfortunately for many species there are no recent re-descriptions and this makes difficult the identification of some species; as a matter of fact it is emphasized that there are disagreement between descriptions and figures reported by different authors.

For example, the drawing of hypopygium of *Chaetocladus melaleucus* (Meigen, 1818) reported in Langton & Pinder (2007) does not fit the drawing of Goetghebuer (1940-1950), the species being represented with very different anal points and inferior volsellae, so the two drawings probably belong to different species. Similarly the figure of *C. piger* reported in Langton & Pinder (2007) with a long anal point does not agree with the figure reported in Makarchenko *et al.* (2017), with a much shorter anal point. The genitalia of *Chaetocladus holmgreni* (Jacobson, 1898) drawn in Makarchenko & Makarchenko (2007) do not match with the

drawing of Brundin (1956) [sub *C. festivus* (Holmgren, 1869)]; in Brundin's drawing the gonostylus is more or less rounded, even if Brundin (1956) describes it as "endglieder distalwärts kräftig erweitert", in agreement with Makarchenko & Makarchenko (2007) drawing, where a clear right angle outer margin is figured. Another evident disagreement is in the drawing of *C. dissipatus* given in Brundin (1956) and the ones reported by Edwards (1929), Goetghebuer (1940-1950) and Langton & Pinder (2007); in Brundin (1956) the anal point is not figured as a slender one as pictured in all the other drawings reported for this species.

Another unresolved problem is the separation among *C. dentiforceps*, *C. laminatus*, *Chaetocladius holmgreni* (Jacobson, 1898) and the recently described *Chaetocladius purbeckensis* Langton & Armitage, 2015; *C. dentiforceps* is represented with a very pointed outer margin (Edwards, 1929; Langton & Pinder, 2007), while *C. laminatus* has a gonostylus with right angle outer margin (Brundin, 1956), and a more or less angular shape is observed in *C. holmgreni* and *C. purbeckensis* (Langton & Armitage, 2010). The examined specimens from different localities in Italy emphasize that intermediate shapes of gonostylus can be observed. The genetic distance measured between *C. laminatus* and *C. purbeckensis* is 7.7%, high enough to support the existence of two different species (Langton & Armitage, 2015).

DNA sequencing of the largest number of species as possible of *Chaetocladius* will aid to give light to many unresolved problems.

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