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Micropsectra sofiae Stur & Ekrem, 2006 (Diptera, Chironomidae) redescribed

Abstract - The examination of adult males and pupal exuviae collected in Italian waters belonging to the genus *Micropsectra* Kieffer, 1909 allowed to discover the presence of *Micropsectra sofiae* Stur & Ekrem, 2006 in the Italian Alps. The species cannot be identified using the published keys, so it is redescribed on the basis of adult males, pharate adults and pupal exuviae. *M. sofiae* belongs to the *atrofasciata* group and is characterized in the adult male by low AR, long digitus of superior volsella projecting beyond medial margin of setiger, median volsella extending beyond caudal margin of superior volsella; in the pupal stage it is characterized by the presence of point patches on pleura, of strong points on tergites IV and V lateral to the longitudinal rows of spines. The relations with other species within the *Micropsectra atrofasciata* group are discussed and the dichotomous key given by Stur & Ekrem (2006) is emended. The distribution of the species is restricted to glacial streams and cold springs and can be considered at risk of extinction due to global climatic change.

Riassunto - L'esame di specie appartenenti al genere *Micropsectra* Kieffer, 1909 raccolte nelle acque italiane ha permesso di segnalare la presenza in Italia di *M. sofiae* Stur & Ekrem, 2006. La specie non è identificabile usando la chiave attualmente pubblicata e pertanto viene qui ridescritta sulla base di maschi adulti, adulti farati ed esuvie pupali. Si conferma la sua appartenenza al gruppo *atrofasciata*, la specie è caratterizzata nel maschio adulto da un basso valore di AR., da un digitus della volsella superiore che sporge oltre il margine mediale del setigero, da una volsella mediana che si prolunga oltre la volsella superiore; nello stadio di pupa è caratterizzata dalla presenza di microtrichi sulle pleure e di un esteso campo di microtrichi disposti lateralmente ai campi longitudinali di spinule nei tergiti IV e V. Sono quindi discusse le relazioni con le altre specie del gruppo ed è presentato un emendamento alla chiave dicotomica proposta da Stur & Ekrem (2006). La specie in Italia è ristretta alle aree glaciali ed è a rischio di estinzione in rapporto ai cambiamenti climatici.

Key Words: global change, *Micropsectra atrofasciata* group, morphology, Tanytarsini

INTRODUCTION

The *atrofasciata* group of the genus *Micropsectra* Kieffer, 1909 was recently revised (Stur & Ekrem, 2006), a key to adults, pupae and larvae were proposed and new species were described. After this revision new species were also described in the *notescens* (Gilka & Paasivirta, 2008) and in the *attenuata* group (Stur & Ekrem, 2008). The examination of material collected in the Italian Alps allowed to detect the presence of *Micropsectra sofiae* Stur & Ekrem, 2006, but the characters used to determine the species (Stur & Ekrem, 2006) in the dichotomous key did not fit both with type material and with the specimens collected in Italy, so the species, which can be determined at present only when type material is available, must be redescribed both in the pupal and adult stage.

The genus *Micropsectra* was separated into four groups on the basis of the morphological study of the male hypopygium and of pupae. In the *attenuata* group (Reiss, 1969) the superior volsella of adult male is triangular or distally narrowed, the tergites IV and V of pupa are covered with shagreen or spines; in the *notescens* group (Säwedal, 1976) the superior volsella is finger-shaped, whereas in the pupa tergites IV - V have each two fields of short spinules arranged as horizontal oval patches and no strong spines in longitudinal patches; in the *atrofasciata* group (Stur & Ekrem, 2006) the superior volsella is ball-shaped and the pupa is characterized by the presence of longitudinal field of spines on tergites IV; the *recurvata* group (Säwedal, 1981) was recently suggested to be joined to the *notescens* group (Gilka & Paasivirta, 2008), because the outwards curved stem of median volsella does not separate the two groups, as evidenced by the recently described *Micropsectra malla* Gilka & Paasivirta, 2008. The inclusion of *M. sofiae* into the *Micropsectra* groups will be thereafter discussed, based on morphological analysis.

MATERIAL AND METHODS

Samples of pharate pupae and pupal exuviae were collected in Italian lakes, streams and cold springs by means of a pond net and a drift net (250 mm mesh size), adults were captured with a hand net. Terminology follows Sæther (1980), Langton & Visser (2003) and Stur & Ekrem (2006).

The difference between spines, teeth, spinules, points and shagreen is not always clear-cut, because there is a continuity from stout, elongate spines to short, conical points and the largest spines from small specimens can be smaller than the spinules from large specimens (Langton & Visser, 2003).

Measurement methods follows Soponis (1977). Lengths are given in micron if not otherwise specified, abbreviations follow Sæther (1980). LR is the ratio of foreleg first tarsomere and tibia length (ta_1/ti) and SV is the ratio between femur fe + ti and ta_1 length, i.e. SV = (fe+ti)/ ta_1. Measurements were carried out at different magnification (x 40 - x 100) using a LEICA® DM LS B2 optic microscope equipped with a LEICA® DFC320 camera and a IM50® software. Adults (after removal of wings) and pupal exuviae (when necessary) were cleared in hot 10% KOH for about 2 minutes, rinsed and dehydrated in acetic acid and then in a mixture of xylene-phenol (1:3), slides were mounted in Canada

Balsam following Soponis (1977). Wings were dehydrated and mounted following the same procedure without clearing in KOH. The specimens collected in Italy are deposited at Università degli Studi di Milano, DiPSA Department (Milan, Italy).

TAXONOMIC ACCOUNTS

Micropsectra sofiae Stur & Ekrem, 2006

Material examined

1 ♂ with associated pupal exuviae (Pe), from a small tributary of Aviolo lake, Brescia, Lombardy, lat 46° 11' 30", long 10° 24' 00", altitude 1920 m a.s.l., 6.IX.1979.

1 ♂ with associated Pe, from a cold spring near Dora di Veny, Aosta Valley, lat 45° 45' 54", long 06° 50' 13", altitude 2150 m a.s.l., 14.IX.1997,

1 ♂ from Combal lake, Dora di Veny, Aosta Valley, lat 45° 46' 06", long 06° 52' 53", altitude 2100 m a.s.l., 6.IX.1996,

1 ♂ 1 Pe from the glacial stream La Les Blanche, Aosta Valley, lat 45° 46' 06", long 06° 50' 52", altitude 1975 m a.s.l., 11.IX.1995,

1 Pe from the glacial stream Brouillard, tributary of Dora di Veny, Aosta Valley, lat 45° 47' 01", long 06° 52' 24", altitude 1800 m a.s.l., 16.VII.1995,

1 Pe from the glacial stream Lys, Biella, Piedmont, lat 45° 52' 00", long 07° 48' 00", altitude 1900 m a.s.l., 29.VI.1987,

1 ♂ from the Vermigliano river, Presanella glacier, near Stavel, Trentino-Alto Adige, at 46° 16' 37", long 10° 39' 45", altitude 1261 m a.s.l., 30.IV.1978,

1 ♂ 4 Pe from Conca glacial stream, Rendena Valley, Trentino-Alto Adige, lat 46° 06' 53", long 10° 37' 48", altitude 2690 m a.s.l., 1.VIII.1996, 1 ♂ 17.IX.1997

5 ♂ from a glacial stream near Bedole Refuge, Genova Valley, Trentino-Alto Adige, lat 46° 11' 51", long 10° 35' 43", altitude 1640 m a.s.l., 12.IX. 90.

DIAGNOSTIC CHARACTERS

M. sofiae can be separated from other species in the *atrofasciata* group by the following combination of characters: adult male with a light green color, frontal tubercles present and minute; low AR between 0.3 and 0.5; small pulvilli; anal point well developed, digitiform, apically blunt, rounded; crests well developed, knob between crests present; superior volsella with a large ball-shaped setiger without 'nose', digitus thin, very long, reaching or going beyond median margin of superior volsella; median volsella long, thin, broadest at base, projecting beyond superior volsella, apically pointed, inferior volsella with a small protuberance in its middle.

The pupa differs from all the other known species because of the presence of a field of points on pleurae of T_{II}- T_{III} -T_{IV} and of strong points on tergites lateral to longitudinal rows of spines in T_{IV}-T_V. Pupae have small cephalic tubercles; thoracic horn relatively short with comparatively long chaetae on distal 3/4; prealar tubercle present but not

developed, rounded; small dorsal field of granulation on mid thorax; spines on T_{III-V}, on T_{III} 2 patches of spines forming 2 upper letters L (the left L in a reverse picture), on T_{IV} and T_V two oval patches of spinules with horizontal major axis, on T_{IV} two longitudinal, lateral patches of spines; on T_V two longitudinal, lateral patches of spinules, much smaller than spines on T_{IV}; only point patches on T_{VI} of smaller size than patches on T_{IV-V}; points present between spine patches on T_{III}, leaving a posterior area devoid of points, extending anterolaterally.

DESCRIPTION

Adult male

Measurements and ratios are in Tables 1 and 2.

Coloration. Body pale green, with brown eyes. Vittae orange.

Head. Antenna with 13 flagellomeres. Frontal tubercles present as minute dots; temporal setae in one row; palpomere 3 with 4–5 sensilla clavata disposed in a circle.

Wings. Subcosta and media bare, brachiolum with 2 setae, squama bare.

Legs. Pulvilli small, reaching base of claws. Fore tibia with small scale, small spur 10–20 μm long; middle and hind tibial combs 30-35 μm long; middle tarsomere ta_1 with 1-2 sensilla chaetica.

Hypopygium (Figure 1, Figure 2). Anal tergite with bands separated, posteriorly directed, reaching crests of anal point; 6–8 median tergite setae placed on an elevated hump anterior to anal point base; 8–12 ventral apical setae. Anal point measured from the beginning of crest about 50 μm long and 11 μm large, rounded at apex, with a knob between crests, without a notch at apex; large microtrichia free area around base. Setiger of superior volsella large about 1500 μm^2, without nose with about 5-8 setae on dorsal surface and 2 median setae, 1 strong seta on stem; large field of dorsal microtrichia on stem and several long microtrichiae ventrally on setiger, anterior to base of digitus; no wrinkles ventroapically on setiger. Digitus thin, 28 μm long well projected beyond the medial margin of superior volsella.

Median volsella comparatively long, thin, broader at base, pointed at apex, with medially directed setiform and spoon-shaped lamellae on distal 1/3; stem reaching well beyond superior volsella. Inferior volsella quite straight, bearing numerous distal setae, with small dorsoapical swelling. Inner margin of gonocoxite with 3-4 strong setae.

Pupa

Measurements and ratios are in Table 3.

Coloration. pupal exuviae transparent with dark brown apodemes; anterior, dorsal and posterior area of cephalothorax, margin of wing sheath, T_{VIII} and anal lobe darker, T_{VIII} spur brown.

Table 1 - Adult male characters: measurements are in µm, ratios are pure numbers (for abbreviations see Sæther, 1980).

Character	Measures or ratios
abd length	2101.6
thorax length	785.0-892.3
thorax height	699.0-727.8
Wing length	2043.7-2078.4
VR	1.07-1.13
Head width	429.5
Distance between eyes	94.0-136.9
Terminal flagellomere length	240-290
AR	0.36–0.56
Palpomere lengths	28, 58, 157, 127, 217
Clypeus length	71
No. setae on clypeus	12
Cibarial pump width	50
Tentorium length; width	130; 30
No. temporal setae (iv; ov; po)	3–4, 2–5, 4
No. acrostically	16–20, 18
No. dorsocentrals	8–11, 9
No. scutellars	8
No. prealars	2
Tergite IX length	140–173, 156
Anal point length; width	68; 20
Setiger diameter	34-37
Gonocoxite length	110
Gonostylus length	121
HR Gc/Gs	0.91
Phallapodeme length	85
Transverse sternapodeme length; width	15 ; 70
Median volsella length	62 - 71
Median volsella lamellae length	10
Inferior volsella length	95

Table 2 - Length of legs segments in µm and legs ratios of examined adult males of *Micropsectra sofiae* (for abbreviations see Sæther, 1980).

leg	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR(ta_1/ti)	Sv=(fe+ti)/ ta_1
p1	897	645	995	500	395	298	155	1.54	1.53
p2	897	723	445	251	212	140	88	0.62	3.67
p3	1055	948	659	399	331	200	132	0.70	3.04

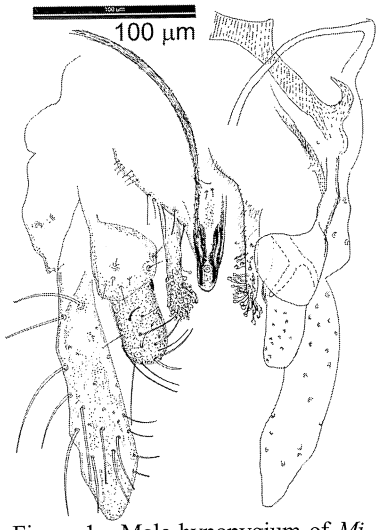

Figure 1 - Male hypopygium of *Micropsectra sofiae* (drawing).

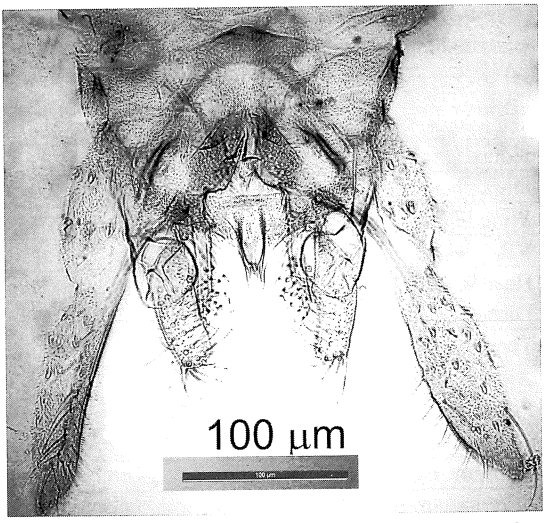

Figure 2 - Male hypopygium of *Micropsectra sofiae* (photo).

Cephalothorax. Cephalic tubercles present and small, pedicel sheath tubercle dark, weakly developed. Thoracic horn 245 µm long, with numerous apical long chaetae inserted on the apical 2/3 of horn, 100-160 µm long; precorneals arranged in triangular pattern, the 2 anteriormost setae situated closer to each other than to the third, posterior precorneal longer (117-123 µm) than the anterior (67-107 µm) and medial (49-77 µm); 1 median antepronotal, 1 lateral antepronotal near one sensillum basiconicum; 2 pairs of dorsocentrals, anterior pair shorter and weaker than posterior pair, setae of each pair equally strong. A well developed granulose field is present dorsal along median suture on thorax. Prealar tubercle a shallow rounded mound; nose of wing sheath well developed.
Abdomen (Figure 3, Figure 4). $T_{II-III-IV}$ with 3 lateral setae. $T_{III-IV-V}$ with point fields present beside spines. Points cover T_{II} and T_{III} and are reduced in T_{IV}-T_{V}.
Segment I with 3 D and 1 V setae. Segment II with 3 D, 4 V, 3 L setae. T_{II} covered with points except for anterolateral patches and 1 posteromedian oval patch; points more developed postero-medially; pleura with an extended field of small points; small pedes spurii B present; hook row less than half as long as segment width.

Segment III with 5 D, 4 V, 2 L, 1 lateral semitaeniate seta; T_{III} with two posteromedian field of spines longer than 40 µm shaped as two large upper letter L, stronger spines directed posteriorly in posterior area of tergite, shagreen extensively distributed lateral and anterior to spine patches, points present between patches, leaving only a posteromedian ovoid point free area. Pleura with an extended point patch.

Segment IV with 5 D, 4 V, 1 L, 2 lateral taeniae; T_{IV} with 2 transverse oval fields of spinules on anterior part, a lateral longitudinal row of strong spines posterior to transverse

Table 3 - Pupal characters: measurements are in μm, ratios are pure numbers (for abbreviations see Sæther, 1980).

Character	Measures or ratios
Total length	4530
Abdomen length	3365.9
Thorax length	1164.7
Frontal seta length	90
Cephalic tubercle length	8
Thoracic horn length; width	245; 25
Thoracic horn chaetae length	138-160
Anterior precorneal seta length	67-107
Median precorneal seta length	49-78
Posterior precorneal seta length	117-123
Median antepronotal seta length	85
Lateral antepronotal seta length	30
Dc1; Dc2 length	36; 21
Dc3; Dc4 length	51; 47
Hook row width	260
Spine, spinule patch T_{III} length	262
Spine, spinule patch TIV length	316
Spinule patch TV length	297
Spine length T_{III}	50-55
Spine length TIV	35-45
Spinule length TV	17-20
Lateral comb Seg VIII width	46
No. apical teeth on comb	5-7
No. taeniae in anal fringe	35-45
Male genital sac length	330
Anal lobes length; wide	180-188; 267-314
Anal setae length	260-382

fields, patches of T_{IV} laterally curved posteriorly; lateral to this row there is an extended field of strong points; pleura with points.

Segment V with 5 D, 4 V, 3 lateral taeniae; T_V with 2 transverse oval fields of spinules on anterior part, a lateral longitudinal row of small spinules present posterior to transverse field, much smaller than the ones on T_{IV}; lateral to the spinules an area of smaller points is present. Patches of T_V similar to those of T_{IV} in shape and construction, somewhat shorter not laterally curved posteriorly.

Segment VI with 5 D, 4 V, 4 lateral taeniae; T_{VI} with 2 longitudinal point fields. Patches of T_{VI} consisting only of shagreen, smaller than patches on T_V, distinctly shorter.

Segment VII with 5 D, 4 V, 4 lateral taeniae; T_{VII} devoid of points only with anterolateral shagreen patches.

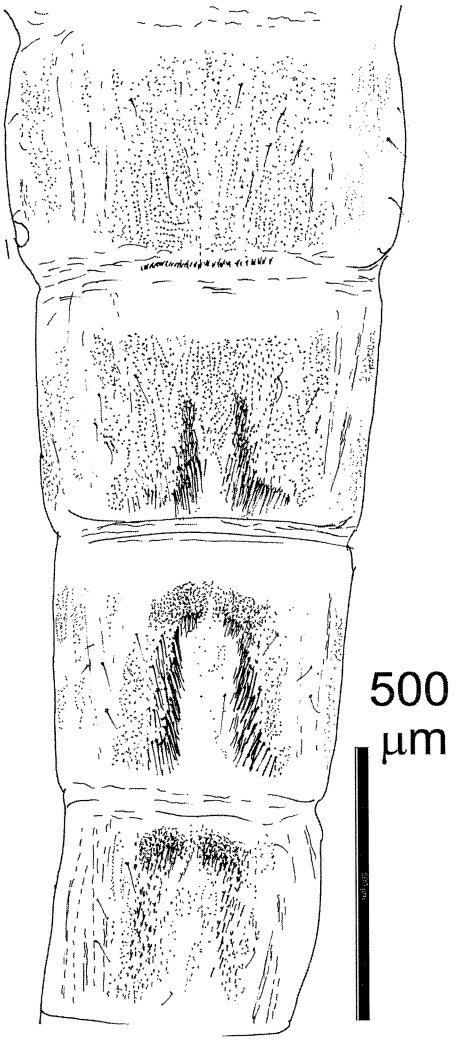

Figure 3 - Segments II-III-IV-V of pupal exuviae of *Micropsectra sofiae* (drawing).

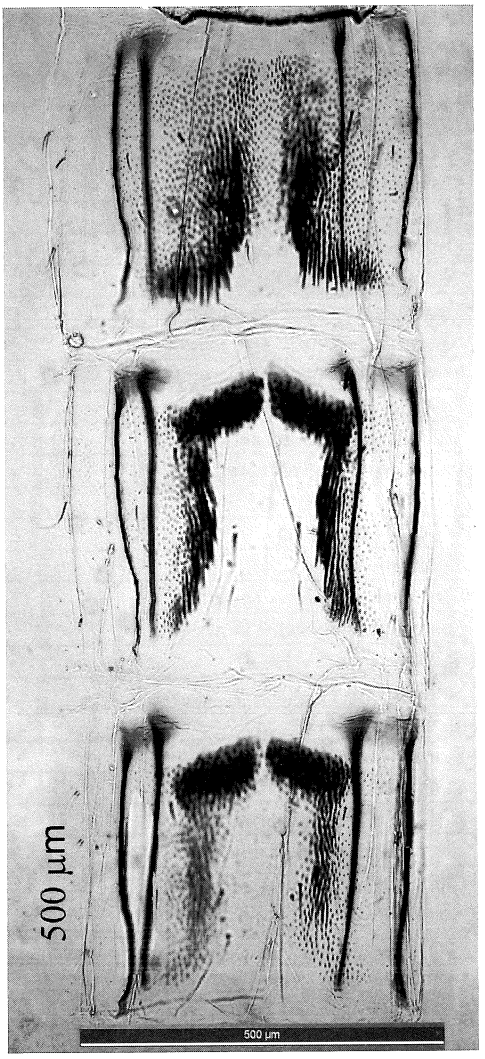

Figure 4 - Segments III-IV-V-VI of pupal exuviae of *Micropsectra sofiae* (photo).

Segment VIII with 1 dorsal taenia, 1 ventral taenia, 5 lateral taeniae; with a comb composed by 3-4 spines. Postero-lateral comb of segment VIII usually with 2-4 marginal teeth longer than the others.

T_{VIII} with small anterolateral shagreen patches.

Anal tergite with 1 dorsal taenia.

Anal lobe with evenly convex lateral margins, fringe with about 570 µm long taeniae in 1 row.

About 35 taeniae on anal lobes.

ECOLOGY

The species was collected in glacial streams, cold springs and tributaries of alpine lakes, always above 1500 m a.s.l. and frequently over 2000 m a.s.l. in water with very low water temperature. The collection below 1500 m a.s.l. near Vermigliano river at 1261 m a.s.l. is in any case in a glacial stream. It seems characteristic of kryal. In a tributary of the Aviolo lake water temperature (temp) measured in summer at different day hours was 4.8-12 °C, conductivity (cond) 19.7 µS cm^{-1}, alkalinity (alkal) 25 mg l^{-1}, pH 7.2, dissolved oxygen (O_2) 9.0 mg l^{-1}. In Veny valley in the cold spring near Elisabetta Soldini Refuge temp was constantly 4.9 °C during the day, cond 202 µS cm^{-1}, pH 8.3, O_2 9.1 mg l^{-1}. In the glacier stream La Les Blanche at the confluence with Dora di Veny, temp was 1-8 °C, cond 17-124 µS cm^{-1}, pH 7.7-8.9, O_2 9-12.5 mg l^{-1}. In Lys glacial stream temp was 0.01-4 °C, cond 11 µS cm^{-1}, pH 7, O_2 10.2 mg l^{-1}. In Conca glacial stream temp was 3.74 °C, cond 10.4 µS cm^{-1}, alkal 21 mg l^{-1}, pH 6.57, O_2 8.8 mg l^{-1}. In glacial stream near Bedole Refuge temp was 3.2 °C and cond 77 µS cm^{-1}.

CONCLUSIVE REMARKS

The species is quite similar to *M. schrankelae* and *M. pallidula* in the adult stage. The specimens collected in Italy disagree with the original description (Stur & Ekrem, 2006) for important details. The examination of adults belonging to type material confirms the disagreement, in such an extent that the key to adults given in Stur & Ekrem (op. cit.) does not allow to identify the species correctly. In particular the median volsella is developed beyond the superior volsella and digitus is developed beyond the median margin of setiger. These are not minor details, because the short median volsella was considered a key character in separating *M. sofiae* from other species within the *atrofasciata* group and the digitus projecting beyond median margin of setiger was considered a key character to separate *M. scharankelae* and *M. pallidula* from all the other species. The digitus projecting beyond setiger was also considered a key character to separate *M. bidentata* Goeth., 1921 (Pinder, 1978) from *M. atrofasciata*, Kieffer, 1911. At present *M. bidentata* is considered a junior synomym of *M. atrofasciata*, the reason of synonymy between *M. atrofasciata* and *M. bidentata* is that the specimens labeled *M. bidentata* "type" in IRSNB are not type material because they were collected after the original description, these specimens have a long digitus and are now assigned to *M. pallidula* (Stur & Ekrem, 2006), still emphasizing the importance of the length of digitus as a key character. Only the examination of type material allowed to identify *M. sofiae* correctly. In any case *M. sofiae* is difficult to separate in the adult stage, because it differs from all the other known species only by few morphometric characters as the low AR.

In the adult male key to species (Stur & Ekrem, 2006) the point 11 ("Median volsella short, not reaching posterior or median margin of superior volsella") must be deleted because it is not true, as can be evidenced in all the examined specimens. To identify *M. sofiae* you have to follow points 12, 13 and 14: at this point only the lower AR allows to separate *M. sofiae* from *M. schrankelae,* so the association with pupae is recommended. The species can be more easily separated in the pupal stage, because associated pupal exuviae lack the strong spines in a longitudinal row in T_V as observed in *M. schrankelae* and pleurae have points on T_{II}-T_{III}-T_{IV}. The presence of points on pleurae is reported only for *Micropsectra auvergnensis* in the key to pupae, which belongs to the *attenuata* group, so at point 4 in the key to pupae (Stur & Ekrem, op. cit.) one must be cautious and has to select: "Pleura of segments II–VII bare or with small patches of scattered, minute shagreen", keeping in mind that a small patches of scattered shagreen are present, because pleura is not bare. T_{IV} and T_V have well developed points patches lateral to longitudinal rows of spines (T_{IV}) and spinules (T_V); this arrangement is not present in the other species, so at point 20 of the dichotomous key to pupae it is suggested to add: "points lateral to spines are present on tergites IV and V".

The morphology of adult male and pupal exuviae confirms the inclusion of the species in the *atrofasciata* group. Nevertheless the morphology of pupal exuviae also suggests some relation with the *attenuata* group. The phylogenetic relationships between the species within the *atrofasciata* group will be cleared when all the semaphoronts (adult males, females, pupae and larvae) will be available for all the known species.

M. sofiae seems to be restricted to glacial areas in Italy, therefore it could be at risk of extinction in response to global warming.

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