Caloptilia jurateae sp.n., a sibling species of *Caloptilia semifascia* (Haworth, 1828) (Lepidoptera Gracillariidae)

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A new species, *Caloptilia jurateae* sp.n., in the family of Gracillariidae is described and compared to the closely related *Caloptilia semifascia* (Haworth, 1828). The two species can be distinguished on the male and female genitalia. They are probably also different in their host choice, as the new species seems to exclusively mine leaves of *Acer platanoides* while *C. semifascia* only feeds on *Acer campestre*. Records of *Caloptilia jurateae* are known from Sweden, Norway, Finland, Poland and Germany.

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During the preparation of one of the forthcoming volumes on Lepidoptera in the Swedish project 'Nationalnyckeln' (The Encyclopedia of the Swedish Flora and Fauna) the author discovered that the Danish and the Swedish material of the gracillariid moth *Caloptilia semifascia* (Haworth, 1828) did not correspond with each other in their genitalia. A closer examination revealed that only one of the species occurs in Sweden while the other taxon appears in Denmark. At the same time Jarosław Buszko, Toruń (pers. comm.) had found that Polish material of *C. semifascia* apparently consisted of two different taxa. Soon it was discovered that the differences in genitalia were consistent in the studied material from several countries and thus a further sibling species had been found in the genus *Caloptilia*.

Previously several sibling species were known amongst the European members of *Caloptilia*, e.g. *elongella* (Linnaeus 1761) & *betulicola* (M Hering 1928), *alchimiella* (Scopoli 1763) & *robustella* Jäckh 1972, and *populetorum* (Zeller, 1839) & *suberinella* (Tengström, 1848). Also quite a few other species in *Caloptilia* are similar to each other and can easily be confused.

Methods and material

Available material in many official and private collections was examined to ascertain without any doubt that two different species were involved. The museum collections in London, Copenhagen, Lund and Stockholm were checked. Many colleagues have kindly allowed me to study their private collections or sent information about the taxa. Pictures of two Nearctic candidates were sent by Jean-François Landry, Ottawa, but these species were ruled out as possible synonyms. *Caloptilia* species described from the eastern Palaearctic area were also considered different from the new species. Specimens of both taxa were sent to Jurate De Prins who engaged Rodolphe Rougierie to analyse the mtDNA.

Genitalia were mounted similarly for all specimens to enable comparison of the shape of different organs. Microscope photographs were taken in order to have a large number of slide pictures to facilitate detailed evaluation of which characters differed between the two species in both sexes.

Figure 1. Illustration of ***Caloptilia onustella*** *in Hübner 1813 (pl. 45, fig. 314).*

Avbildning av ***Caloptilia onustella*** *hos Hübner 1813 (pl. 45, fig. 314).*

Previous treatment

Hübner (1813, pl. 45, fig. 314) described *onustella* but his illustration (Fig. 1) shows a specimen that differs so much from a *Caloptilia* species that doubt prevails as to which species Hübner actually depicted. Possibly the illustration represents a specimen of *Argyresthia goedartella* (Linnaeus, 1758). Type specimen(s) of *onustella* is not stated (De Prins & De Prins 2005) and the type material is destroyed. Later Haworth (1828) described *semifascia* on the basis of specimens from the second generation, in which the most frequent forms are seen. Until now only one species has been noticed but both *onustella* and *jurateae* n.sp. have been treated in the literature as a single species under the name *semifascia*.

Pierce & Metcalfe (1935) illustrate male genitalia of "*semifascia*" that obviously belong to *jurateae* sp.n., on the basis of the shape of the valvae. Maybe the material they examined originated from the European mainland. The fe-

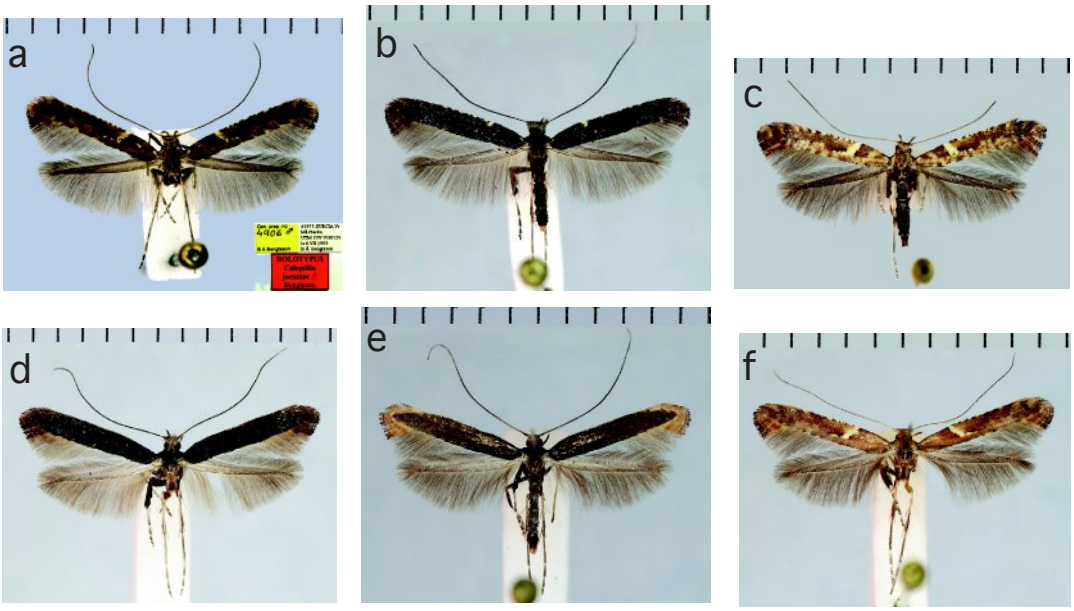

Figure 2. Imagines of – a-c) ***Caloptilia jurateae*** *sp.n. – a) Holotype. – b) Blackish brown form (male paratype: SUECIA, Öland, Skäftekärr, la. 26.VII.1995). – c) Brown and motley form (female paratype: SUECIA, Öland, Räpplinge, Lindby, 26.VII.1997), – d-f)* ***Caloptilia semifascia*** *(Hw.). All specimens with same data: DANIA, SZ, Skibinge, 12.IX.1980, leg. & coll. BÅB. Scale at top in mm.*

a-c) ***Caloptilia jurateae*** *sp.n. – a) Holotyp. – b) Svartbrun form (paratyp). – c) Brun och brokig form (paratyp). – d-f)* ***Caloptilia semifascia*** *(Hw.) alla från samma lokal (se ovan). Skalan överst på bilderna i mm.*

male genitalia may be assigned to either of the species.

Kuznetsov (1981, fig. 185:2) illustrated male and female genitalia that undoubtedly belong to *semifascia*, and so did Patzak (1986, fig. 65) but his figure of the female genitalia may also belong to either of the species.

***Caloptilia jurateae* sp. n.**

Type locality: Sweden, Värmland, Mårbacka.

Type material: Holotype: ♂ – 45973 SUECIA V[ä]r[mland], Mårbacka, UTM 33V VG0128, la 6.VII.1993, B Å Bengtsson (white label) [ex *Acer platanoides*]; Gen. prep. no 4906 ♂, B Å Bengtsson (yellow label); HOLOTYPUS, Caloptilia jurateae ♂ Bengtsson (red label). Genitalia on slide BÅB 4906. – In coll. Bengtsson/ Natural History Museum, Stockholm.

Paratypes:

3 ♂♂ and 4 ♀♀, same data as in holotype, genitalia of two paratypes on slides BÅB 4905 and BÅB 5687. In coll. BÅB;

1 ♂ SUECIA Sm[åland], 1 km S Ålem, UTM 33V WD8511, 7.VIII.1988, B Å Bengtsson. Genitalia on slide BÅB 5588. In coll. BÅB;

2 ♂♂ 2 ♀♀ SUECIA Öl[and], Skäftekärr, UTM 33V XD2047, la 26.VII.1995, B Å Bengtsson. Genitalia of one male on slide BÅB 4904 and one female on slide BÅB 4902. In coll. BÅB;

1 ♀ SUECIA Öl[and], Skäftekärr, UTM 33V XD2047, 1.V.1998, B Å Bengtsson. Genitalia on slide BÅB 4899. In coll. BÅB;

1 ♂ and 1♀ SUECIA Sm[åland], Kråksmåla, Mjöshyltan, UTM 33V WD6016, 30.V.1993 and 5.VI.1993 respectively, B Å Bengtsson; genitalia of male on slide BÅB 5669. In coll. BÅB and Royal Museum for Central Africa, Tervuren, Belgium;

1 ♀ SUECIA Öl[and], Löttorp, UTM 33V XD2037, 10.IX.1995, B Å Bengtsson. In coll. BÅB;

1 ♀ SUECIA Öl[and], Högsrum, Odens flisor, UTM 33V WC9891, 16.V.1999, B Å Bengtsson. In coll. Royal Museum for Central Africa, Tervuren, Belgium;

1 ♀ SUECIA Öl[and], Torslunda, Kalkstad, UTM 33V WC9275, 21.IX.1999, B Å Bengtsson. In coll. Royal Museum for Central Africa, Tervuren, Belgium;

2 ♀ ♀ SUECIA Öl[and], Sm[åland], Ålem ,Vitsten, UTM 33V WD7316, 8.VI.1996, B Å Bengtsson. Genitalia on slides BÅB 4907 and 5691. In coll. BÅB;

1 ♀ SUECIA Öl[and], Högby, Horn, UTM 33V XD1739, 23.V.1993, B Å Bengtsson. In coll. BÅB;

1 ♀ SUECIA Öl[and], Källa, Långerum, UTM 33V XD2831, 14.V.1998, B Å Bengtsson. Genitalia on slide BÅB 4903. In coll. BÅB;

1 ♂ [Suecia, Västergötland] Kinnekulle, kl. 1.8.[19]36, Benander. Genitalia on slide BÅB 1596X. In coll. Zoological Museum, University of Lund;

1 ♂ 5225 SUECIA, Vr, Väse, Lövhöjden, UTM 33V VF3894, el 1-5.8.1995, Ingvar Svensson. Genitalia on slide BÅB 1597X. In coll. Zoological Museum, University of Lund.

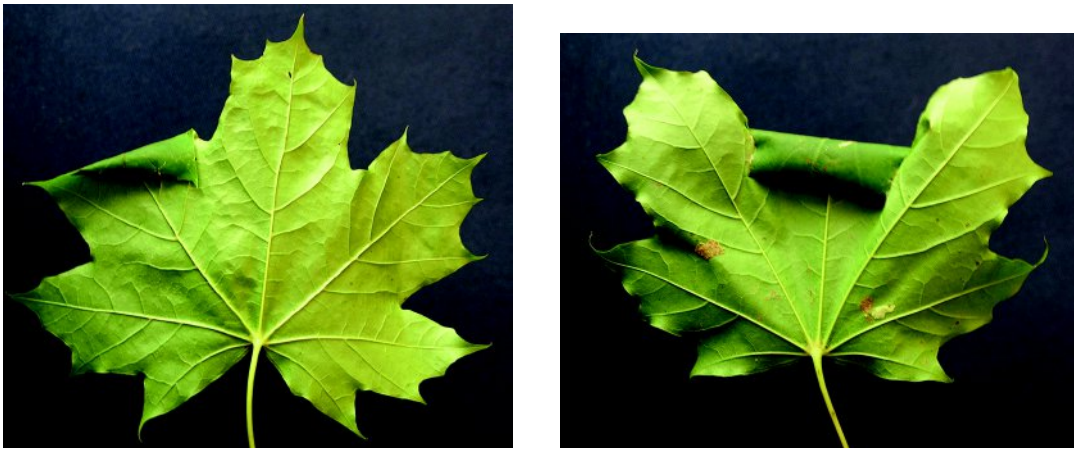

*Figure 3. Leaf rolls of **Caloptilia jurateae** sp. n. on **Acer platanoides**.*

*Bladrullar på skogslönn av **Caloptilia jurateae** sp. n.*

Additional material: A large number of specimens of *Caloptilia jurateae* sp.n. has been studied but are not included in the type material, e.g. dissected specimens from Norway (Kai Berggren, pers. comm.), and specimens in the Zoological Museum, University of Lund.

Diagnosis

Caloptilia jurateae sp. n. (Fig. 2 a-c) cannot be distinguished from *C. semifascia* by external appearance. On the average *semifascia* (Fig. 2 d-f) may look less mottled but there is a great deal of overlap regarding the coloration and pattern in the forewing. No external character has been found to provide a reliable difference.

On the other hand, the genitalia show distinct differences in females, less distinct in males. In the male genitalia the cucullus of *C. jurateae* sp. n. is more oblique, making the valva looking more extended and more pointed (Fig. 5a). The saccus is, in general, narrower and with straight or concave margins but there is overlap in the shape of this structure between the species. The tip of the aedeagus (Fig. 5c) is cut off at an angle of about 45° in *C. jurateae* while in *C. semifascia* it narrows to a fine point (Fig. 5d) and furthermore is usually equipped with minute teeth along the margins of the tip, only visible at high magnification.

In order to get a value on the different shapes of the valvae in *C. jurateae* and *C. semifascia* three points were chosen, viz. the transtilla base (1) and the places where the bristled margin meets the dorsal (2) and costal (3) margin of the valva. The distances (1)-(2) = a, and (2)-(3) = b. The angle between the two connection lines was measured (Fig. 4). Although the number of specimens is small the results presented in Table 1 is interesting:

The female genitalia of *C. jurateae* (Fig. 5 e,g) show distinct differences from those of *C. semifascia* (Fig. 5 f,h). In *C. jurateae* the lamella antevaginalis is shaped as a semi-circular pouch and directed anteriorly, and has an evenly arched rim. In *C. semifascia* the lamella antevaginalis is directed posteriorly and shows a wide but shallow posterior concavity. Lamella postvaginalis also exhibits a distinct indentation at posterior margin in *C. semifascia*, not so in *C. jurateae* where the plate is triangular or trapezoid without apparent indentation. The apophyses anteriores are shorter in *C. jurateae* than in *C. semifascia*. In the corpus bursae two huge thorn-like signa

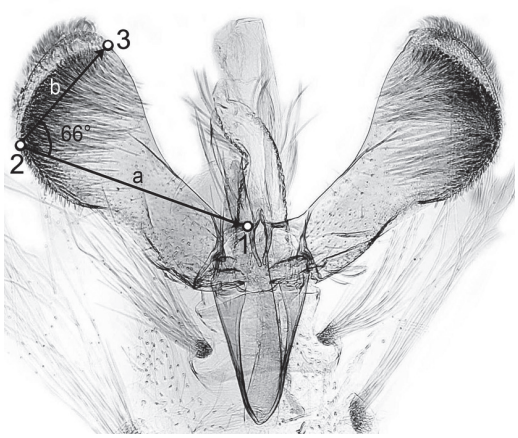

Figure 4. Explanation of how the angle and the ratio a/b is measured in the valva (see Table 1).

Förklaring hur vinkeln och kvoten a/b mäts (se Tabell 1).

Table 1. Morpho-geometrical comparison of male genitalia in ***Caloptilia jurateae*** *sp. n. and* ***C. semifascia.*** *Measures are defined in Fig. 4.*

Geometrisk jämförelse mellan hanliga genitalierna av ***Caloptilia jurateae*** *sp. n. och* ***C. semifascia.*** *Måtten definieras i Fig. 4.*

		Angles (°)		Ratio a/b	
Species	n	Observations	Average	Observations	Average
Caloptilia jurateae sp. n.	6	69, 69, 70, 72, 72, 73	71	1.57, 1.60, 1.63, 1.69, 1.78, 1.80	1.68
Caloptilia semifascia (Hw.)	3	61, 66, 67	65	1.90, 1.97, 2.00	1.96

are present, both of which are approximately 20 % shorter than in *C. semifascia*. The bursa wall exhibits minute folds all over in both *semifascia* and *jurateae*.

The mitochondrial DNA of the sibling species has been sequenced but found identical, thus a case similar to e.g. *Phyllonorycter nicellii* (Stainton, 1851) and *P. klemannella* (Fabricius, 1781), both of which are considered good species (J. De Prins pers. comm.).

Description

Wingspan (9.0-) 10-13.5 mm. Forewing coloration and markings varying:

Brown form (Fig. 2a,c): Head covered by appressed, brownish or beige scales, face with whitish, dark tipped scales. Antenna slightly longer than forewing, each flagellomere dark brown with a cephalic pale ring, thus making the flagellum appear ringed except for the apical part of the flagellum. Maxillary palpus straight, thin, mottled, paler on inner side. Labial palpus ascending, curved, third segment slightly longer than second, both segments covered by brown-tipped scales, paler on inner side and with pale rings at base and tip of third segment. Tegula and thorax brown. Forewing brown with the following yellowish white markings: a small spot near wing base; a slightly oblique, costal dash at one-quarter reaching fold; distal to this dash approximately 10 small, pale costal spots separated by brown or blackish scales. Fringe fuscous but at termen browner and with 2–3 fringe lines. Hindwing fuscous, paler basally and with fuscous fringe. Foreleg brown in different shades; femur with 1–2 thin, pale rings, ventrally with tuft of long scales; tibia dark brown with a thin ring at middle, epiphysis partly hidden by long scales; tarsi with whitish bases, distally gradually becoming dark brownish. Midleg similarly coloured but femur at base whitish. Tibia with long scales ventrally, partly hiding pair of terminal spurs. Hindleg coloured as fore and midlegs; spurs on tibia very long and slender, caudal pair only 1/5 from anterior end of tibia. Abdomen slender, dark fuscous dorsally, dirty whitish ventrally. Several specimens, especially females, have mottled forewing with pale, rather big, blurred spots at dorsum (Fig. 2c).

Dark form (Fig. 2b): Ground colour black or blackish brown; pale markings reduced to a short strigula at ¼ and a series of costal spots (rarely missing). Leg coloration brightly dark brown and white.

Male genitalia (Fig. 5 a,c): Uncus and gnathos atrophied. Tegumen membranous with lateral, bent, weakly sclerotized reinforcements. Valva claviform, almost equally broad in basal half, cucullus broader, with oblique terminal margin making the latero-posterior corner of valva appear bluntly pointed. Transtilla slightly longer than in *semifascia*. Saccus comparatively narrow, usually with slightly concave lateral margins. Aedeagus (Fig. 5c) without cornuti, straight, almost evenly broad or insignificantly tapering distally, at tip obliquely truncate at an angle of about 45°, tip rims without minute teeth.

Female genitalia (Fig. 5 e,g): Papillae anales

Table 2. Review of the characteristics of the genitalia of ***Caloptilia jurateae*** *sp.n. and* ***C. semifascia*** *(Hw.).*
Några karaktärer som skiljer genitalierna hos ***Caloptilia jurateae*** *sp.n. och* ***C. semifascia*** *(Hw.).*

Compared organ	*C. jurateae*	*C. semifascia*
valva	Distinctly extended	Not or slightly extended
saccus	Usually with slightly concave sides	Triangular, with straight or slightly convex sides
aedeagus	Tip cut off at about 45° angle, without minute teeth at tip	Tip cut off at <20°, with sclerotized extension and minute teeth at tip
lamella postvaginalis	Subtriangular or subtrapezoid, without posterior indentation	Subtrapezoid with posterior emargination
lamella antevaginalis	Pouch-shaped, semi-circular, directed anteriorly	A truncate cone, with incurvation, directed posteriorly
apophyses anteriores	Short stumps	As long as apophyses posteriores

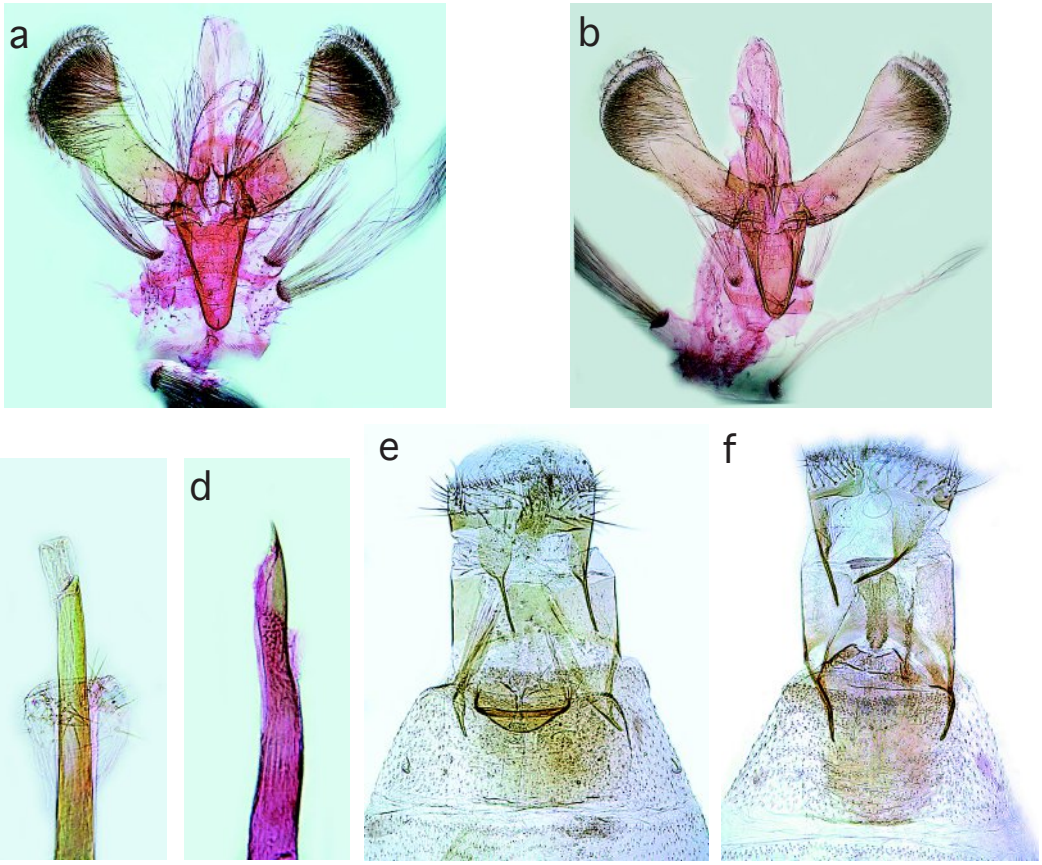

Figure 5. Genitalia of ***Caloptilia jurateae*** *and* ***Caloptilia semifascia*** *(Hw.):*
– a, b) Male genitalia of – a) ***Caloptilia jurateae*** *(Paratype, slide BÅB 5688), – b)* ***Caloptilia semifascia*** *(Hw.) (DANIA, SZ, Skibinge, 12.IX.1980; slide BÅB 5689),*
– c, d) Tip of aedeagus. – c) ***Caloptilia jurateae, –*** *d)* ***Caloptilia semifascia,***
– e, f) Posterior part of female genitalia – e) ***Caloptilia jurateae*** *(slide BÅB 4903), – f)* ***Caloptilia semifascia*** *(Hw.) (DANIA, SZ, Skibinge, 12.IX.1980, leg. & coll. BÅB; slide BÅB 4900),*
– g, h) Corpus bursae with signa – g) ***Caloptilia jurateae*** *(slide BÅB 4902), – h)* ***Caloptilia semifascia*** *(Hw.) (Data as in A; slide BÅB 4981).*

Genitalier av ***C. jurateae*** *och* ***C. semifascia*** *(Hw.):*
– a, b) Hangenitalier – a) ***C. jurateae****, – b)* ***C. semifascia****,*
– c,d) Spetsen på aedeagus. – c) ***C. jurateae****, –* ***d) C. semifascia,***
– e, f) Bakre delen av honans genitalier – e) ***C. jurateae****, – f)* ***C. semifascia*** *,*
– g, h) Corpus bursae med signa – g) ***C. jurateae****, – h)* ***C. semifascia*** *(Hw.).*

membranous with short bristles at terminal margin, longer laterally and anteriorly. Apophyses posteriores slender, extending from broad bases connected with papillae anales. Apophyses anteriores short stumps, sometimes bent. Lamella postvaginalis subtriangular or trapezoid with more or less rounded or flat posterior margin. Lamella antevaginalis trough-shaped, semicircular, flipped anteriorly, with convex anterior margin. Two signa of about equal size, scimitar-shaped, with inner margin densely furnished with small teeth standing aslant. Signa in *semifascia* (n = 3) at the average 25 % longer than in *jurateae* (n = 7).

Biology

The differences of the preimaginal stages between *C. jurateae* sp.n. and *C. semifascia* have not been studied. Both are associated with maples *Acer* spp. In Denmark *C. semifascia* has been reared from *Acer campestre* but not from *A. platanoides*. *C. jurateae* only feeds on *Acer platanoides* in Sweden, Norway and Finland. There is thus indication that the taxa have different hosts but further studies are needed.

During the first instars (of *C. semifascia*) the larva feeds in a mine on the liquid substances within the leaf (Emmet et al. 1985), which also should be the case in *C. jurateae*. During the next period the larva of *C. jurateae* is tissue-feeding and makes cylindrical or conical leaf-rolls (Fig. 3). The larval stage lasts from June to July (in Sweden). The pupation probably takes place at the ground but cocoons have been found on the infested leaf close to the roll when the larvae have been kept in captivity. The moth emerges in July or August and hibernates. It appears again during spring up to early June. In central and west Europe the phenology is differently reported. Eckstein (1933) and Spuler (1910) stated the adults of "*semifascia*" to appear in July-August and October-April, and Schütze (1931) reported imagines to fly in August, obviously being unaware of the first generation.

Distribution

C. jurateae sp.n. is recorded from Norway (K. Berggren pers. comm.), Sweden, Finland (J. Kullberg pers. comm.), Poland and Germany (J. Buszko pers. comm.). However, the distribution area is certainly much larger and may extend over most of Europe. The distribution of *C. semifascia* is also incomplete but so far specimens from U.K., Denmark and Poland have been studied.

Etymology

The new species is dedicated to Jurate De Prins at the Royal Museum for Central Africa (Tervuren, Belgium) who is one of the most prominent world specialists on Gracillariidae.

Acknowledgement

My sincere thanks are due to Jurate De Prins, Royal Museum for Central Africa, Tervuren, and Klaus Sattler, Natural history Museum, London for valuable discussions and suggestions. I am greatly indebted to Jarosław Buszko, Toruń, Poland for information about the occurrence of the *Caloptilia* species in Poland and providing literature data. I thank Kai Berggren, Kristiansand, Norway for giving me information on the occurrence in Norway. I also thank Rodolphe Rougerie, Biodiversity Institute of Ontario, for barcoding specimens of both species. Roland Johansson, Växjö, Ole Karsholt, Zoologisk Museum, Copenhagen, Jaakko Kullberg, Natural History Museum of Helsinki, and Ingvar Svensson, Österslöv, are thanked for supplying with information and/or for stimulating discussions. Roy Danielsson, Zoological Museum, Lund kindly supported me with additional Swedish material of *Caloptilia jurateae* sp.n. Finally, my thanks are due to John Langmaid, Southsea, Hampshire, UK for patiently enduring several requests for correcting the English.

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Sammanfattning

Vid bearbetningen av manuskriptet till en kommande volym om småfjärilar i Nationalnyckeln (planerad utgivning 2011) upptäckte författaren att en art, *Caloptilia semifascia* (Haworth, 1828), bestod av två arter. Fjärilar fångade i Danmark hade annat utseende på genitalierna än fjärilar från Sverige. Efter upptäckten visade det sig att båda typerna också hade påträffats i Polen av Jarosław Buszko, Torun.

Dessutom finns det sedan tidigare oklarheter om vilket namn som ska gälla för *C semifasciata*, då den enligt vissa författare bör heta *Caloptilia onustella* (Hübner, 1813). *C. onustella* har ansetts vara den första generationens form av *C. semifascia*, som skiljer sig från eftersommar- och höstgenerationen genom att den vitaktiga framkantsfläcken är avsevärt större. Denna form är ännu inte upptäckt i Sverige men finns i Mellaneuropa. Emellertid är illustrationen av *C. onustella* som Hübner presenterade så avvikande från en *Caloptilia*-art, att det sannolikt är fråga om en helt annan art från en helt annan grupp. Möjligen visar bilden en något avvikande alhängemal *Argyresthia goedartella* (Linnaeus, 1758).

Den nya arten kan inte särskiljas på yttre kännetecken från *C. semifascia* men det finns tydliga skillnader i genitalierna hos båda könen, i synnerhet hos honan. Hos hanen är valverna skevare än hos *C. semifascia* så att valvaspetsen blir mer utskjutande. Snittytan vid spetsen av aedaegus lutar ungefär 45º. Hos *C. semifascia* är aedaegus mycket vasst tillspetsad och snittkanterna är fint naggade. I hongenitalierna är skillnaderna tydligare. Plattan bakom och ovanför ostium (lamella postvaginalis) är hos båda arterna trapetsformad, men hos *C. jurateae* sp.n. är bakkanten i stort sett rak eller konvex, medan den hos *C. semifascia* är urnupen i bakkanten. Plattan framför och under ostium (lamella antevaginalis) är hos *C. semifascia* brett trapetsformad, ganska djupt urnupen och riktad bakåt så att ostium mynnar i toppen av en stympad kon. Hos *C. jurateae* är denna platta motsatt riktad och formad som en trågformad, sklerotiserad ficka. Dessutom är de främre apofyserna bara korta stumpar hos *C. jurateae*, hos *C. onustella* lika långa som de bakre apofyserna.

Det som är känt visar att biologin hos de båda arterna är likartad. I Sverige, Norge och Finland lever larven hos *C. jurateae* på bladen av skogslönn *Acer platanoides*, medan *semifascia* - åtminstone i Danmark och Storbritannien - lever på naverlönn *Acer campestre*. Båda arternas larver gör bladrullar eller -käglor i de sista stadierna.

Caloptilia jurateae sp.n. har hittills konstaterats från Sverige, Norge, Finland, Tyskland och Polen, men den har säkerligen en större utbredning. *C. semifascia* som kollektivart är känd från ett tjugotal europeiska länder. Alla fynd i Sverige tillhör *C. jurateae* och utbredningen finns publicerad i Svensson (1994) och i de efterföljande årsrapporterna av Svensson i Entomologisk Tidskrift. *C. semifascia* är ännu inte påträffad i Sverige, men bör eftersökas i Skåne och i övriga Sydsverige, där naverlönn finns planterad på många håll.