Two Pollen Beetles, *Meligethes subrugosus* (Gyllenhal, 1808) and *Meligethes substrigosus* Erichson, 1845 in Northern Europe

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There has been confusion regarding the identity of the pollen beetles *Meligethes caudatus* Guillebeau 1897 and *M. subrugosus* (Gyllenhal, 1808). The correct name for the pollen beetle generally known as *Meligethes caudatus* is here shown to be *M. subrugosus* and *M. caudatus* is a junior synonym. The correct name for the species generally known as *M. subrugosus* is *Meligethes substrigosus* Erichson, 1845. The two species have generally been thought to differ only by the shape of the female pygidium and their status as separate species has therefore been questioned. We demonstrate that the two taxa are distinct species with clear differences also in the male genitalia. *Meligethes subrugosus* is shown to be the common species in the Nordic Countries, occurring also in mountainous areas of Central and Southern Europe. *M. substrigosus* is widespread in the Palaearctic region, in the Nordic Countries entering Finland from the east and with a restricted distribution in southernmost Sweden.

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Introduction

Within the large Nitidulid genus *Meligethes*, the pollen beetles, subgenus *Astylogethes* Kirejtschuk, 1992, constitutes a well defined group including species with crenulated rather than dentate fore tibiae, and male genitalia with truncate, rather than bilobate tegmen. According to Audisio (1993), the group consists of three species in Europe: *M. corvinus* (Erichson, 1845), *M. subrugosus* (Gyllenhal, 1808) and *M. caudatus* Guillebaeu, 1897. *Meligethes corvinus* is easily distinguished by lacking the transverse strigosity on the elytra, which is characteristic of *M. subrugosus* and *M. caudatus*, but the definition and correct nomenclature of the latter two species has been the subject of some confusion. Recently the genus *Meligethes* was split into a number of smaller genera, and *Astylogethes* was elevated from subgenus to genus (Audisio & *al*. 2009). This subdivision is not applied here since it is not warranted by their analysis.

Meligethes subrugosus was described from Sweden as *Nitidula subrugosa* by Gyllenhal (1808). It was stated to occur "here and there in flowers" (Gyllenhal 1808). The species is characterised by the fore tibiae being crenulated rather than dentate, combined with a distinct transverse strigosity on the elytra. A second species, *Meli-*

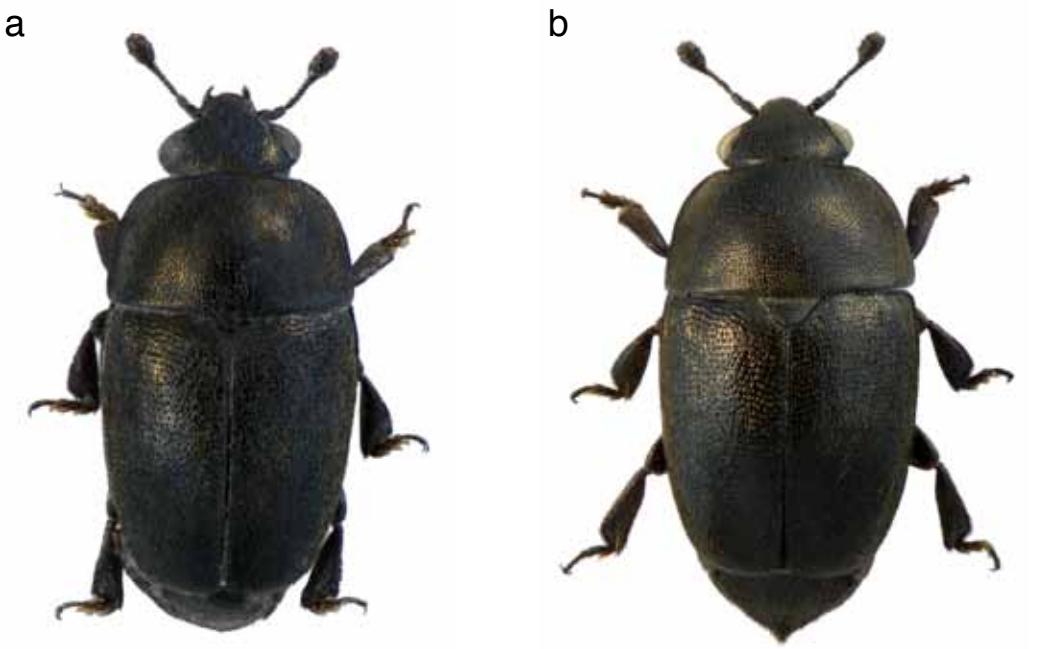

Figure 1. – a) ***Meligethes substrigosus****, male (Sweden Blekinge, Asarum); – b)* ***M. subrugosus****, female Öland, Fagerrör.*

– a) ***Meligethes substrigosus****, hane (Sverige Blekinge, Asarum); – b)* ***M. subrugosus****, hona (Sverige, Öland, Fagerrör).*

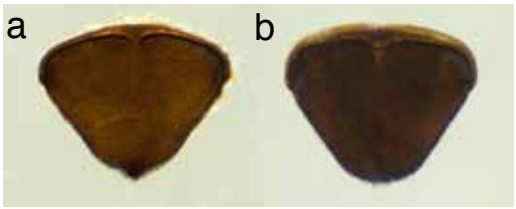

Figure 2. Pygidium of females of – a) ***Meligethes subrugosus****; – b)* ***M. substrigosus****, Photo C. Fägerström.*

Pygidium av honor – a) ***Meligethes subrugosus****; – b)* ***M. substrigosus****. Foto C. Fägerström.*

gethes substrigosus, was described by Erichson (1845), but was later considered a synonym of *M. subrugosus* (*e.g.* Audisio 1993). Gyllenhal's species was interpreted as identical to a species that is widespread in Europe (*e.g.* Erichson 1845, Reitter 1871, Spornraft 1967, Audisio 1993). In 1897 a third, closely related species *Meligethes caudatus* was described from the French Alps by F. Guillebeau (Guillebeau 1897). The new species was described as similar to *M. subrugosus*, but with a distinctly pointed pygidium in the female. However, Guillebeau's species was largely ignored by subsequent workers until it was recognised as a distinct species by Audisio (1993). Audisio mentions verified records of *M. caudatus* from the Alps, the Carpathians and the Nordic countries (specified localities in Denmark and Norway, and a dot on the map in southern Sweden), but retained *M. subrugosus* as a species distributed over all of Europe including the Nordic countries. Later, Sörensson (1999) demonstrated that most of, if not all, the Swedish material, earlier attributed to *M. subrugosus,* belonged to *M. caudatus* (sensu Audisio 1993). Finally, Kurochkin & Kirejtshuk (2005) again reduced *M. caudatus* to a synonym of *M. subrugosus*.

As a result, confusion reigns regarding the definition of species and the correct nomencla-

Figure 3. Aedoeagus of ***Meligethes substrigosus*** *(left) and* ***M. subrugosus*** *(right). – a) oblique lateral view; – b) lateral view; – c) dorsal view of apex; – d) dorsal view of base; – e) tegmen, ventral view. Photo C. Fägerström.*

Aedoeagus av ***Meligethes substrigosus*** *(till vänster) och* ***M. subrugosus*** *(till höger). – a) snett från sidan; – b) från sidan; – c) spetsen uppifrån; – d) basen uppifrån; – e) tegmen underifrån. (Foto C. Fägerström).*

ture within this group. In this paper we address three separate questions: 1) What is the identity of Gyllenhal's species *M. subrugosus*? 2) Are *M. caudatus* and *M. subrugosus* separate species? 3) What is the distribution of these taxa in Northern Europe?

Material and methods

In order to address these questions we investigated as much of the material of the two species from Finland and Sweden as we could assemble. All material in the museums of Stockholm, Lund, Gothenburg, Helsinki, Turku and

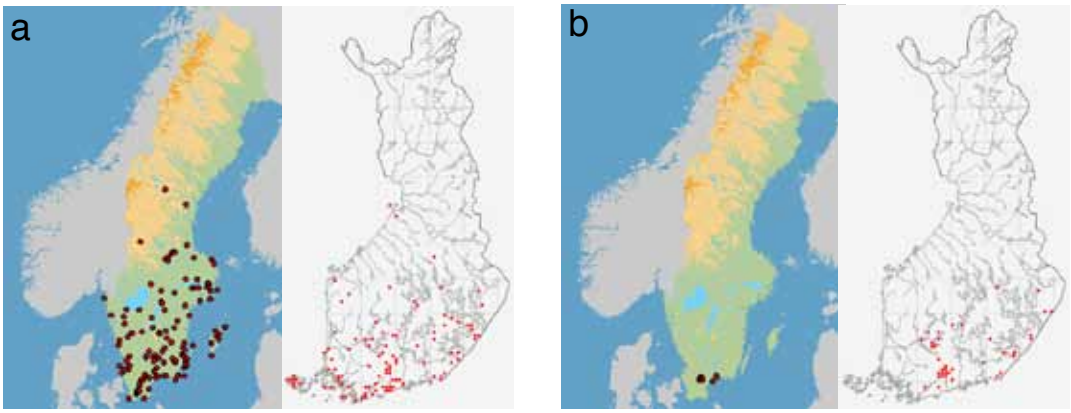

Figure 4. Distribution of – a) ***Meligethes subrugosus****, and – b)* ***M. substrigosus*** *in Sweden and Finland based on specimens examined by us. The Swedish maps are from "the recording system of terrestrial and limnic invertebrates". The Finnish maps were prepared by the "Finnish Bird Atlas".*

Utbredningen av – a) ***Meligethes subrugosus*** *och – b)* ***M. substrigosus*** *i Sverige och Finland baserad på exemplar undersökta av oss. De svenska kartorna är från Artportalen, de finska har framställts av Finsk fågelatlas.*

Oulu was investigated, as well as much material from private collections (in all more than 800 specimens). Additionally, some eighty or ninety specimens collected from the Russian part of Fennoscandia, and from Estonia were examined. The type material of *M. subrugosus* (Gyllenhal) and *M. substrigosus* Erichson was studied. We also, but to a lesser extent, investigated material from Norway and Denmark, as well as from most parts of the Palaearctic region. A considerable number of specimens were genitally dissected. Swedish maps are from the "Reporting System for Terrestrial and Limnic Invertebrates" (Artportalen), Finnish maps are from the "Finnish Bird Atlas".

Results

The identity of ***Meligethes subrugosus*** *(Gyllenhal, 1808)*

In the Gyllenhal collection at The Museum of Evolution in Uppsala there are three specimens of *Meligethes subrugosus* in the type collection, one female and two males, all without original labels. The female has a pointed pygidium and is clearly conspecific with *M. caudatus*. Preparation of the genitalia demonstrated that the males also belong to the same species. Obviously Gyllenhal's species, *M. subrugosus,* is conspecific with *M. caudatus*, and not with *M. subrugosus* sensu Audisio (1993). This result is in accordance with the observation by Sörensson (1999), that *M. caudatus* is by far is the most common and widespread of the two species in Sweden. The fact that Gyllenhal's species has been erroneously interpreted by subsequent Central European authors is part of a recurrent pattern (see *e.g.* Wanntorp 2008).

While Gyllenhal's epithet has been, mistakenly, adopted for another species for a long time, the correct identification has been retained by Nordic authors, such as Thomson (1862), Hansen (1950) and Lundberg (1995). The name *Meligethes caudatus*, on the other hand has been used by few authors. There is therefore no case for conservation of the latter name according to ICZN Article 23.9 (1999) and in spite of the widespread mistaken identification of the species, Gyllenhal's epithet must prevail. *Meligethes subrugosus* (Gyllenhal, 1808) should therefore be used for the species generally named *Meligethes caudatus* Guillebeau, 1897 and the latter name should be considered a junior synonym.

For the species commonly identified as *Meligethes subrugosus* outside Scandinavia, the name *Meligethes substrigosus* Erichson 1845 is available (Audisio 1993). In order to confirm this, we investigated Erichson's type material, which is preserved in Berlin. Five specimens labelled as syntypes are preserved in the historical collection. The male genitalia were extracted from one male. Both aedoeagus and tegmen is identical to that of *M. subrugosus* (auct.) (Fig. 3). Erichson gives the size of *M. substrigosus* to be 1-1.5 mm and "mostly half as big as *M. subrugosus*". The specimens mentioned, however, range from 1.4 to 2.1 mm, which is well within the range given for *M. subrugosus* (auct.) (Audisio 1993). The name of the species, commonly referred to as *M. subrugosus* (Gyllenhal, 1808) should thus be *M. substrigosus* Erichson, 1845.

Typification

Meligethes subrugosus *(Gyllenhal, 1808)*

Type material: a male, originally mounted on a thin pin, labelled "Uppsala Univ. Zool. Mus. Gyllenhals saml. TYP nr. 1170 b". Lectotype, here designated. Paratypes: a female with the number 1170 a, and a male with the number 1170 c.

Synonym: *Meligethes caudatus* Guillebeau, 1897.

Meligethes substrigosus *Erichson, 1845*

Type material: a male originally glued to a small triangle, mounted on a pin with one label with printed number "8546"; one label handwritten, "*substrigosus* Er. Austr. Ullr. Schüpp."; one label printed "Hist.-Coll. (Coleoptera) Nr. 8546 *Meligethes substrigosus* Erichs. Austria Ullrich Schüppel Zool. Mus. Berlin"; one label, red, printed "SYNTYPUS Meligethes substrigosus Erichson 1845 labelled by MNHUB 2010". Lectotype here designated. Paratypes: four specimens with the same number and printed labels but without handwritten label.

Synonym: *Meligethes subrugosus* auct. non Gyllenhal

Identification of the two species.
Obviously, *Meligethes subrugosus* (Gyllenhal 1808) and *M. caudatus* Guillebeau 1897 are conspecific, and the correct name for *M. subrugosus* auctt. is *M. substrigosus* Erichson 1845. The question whether the two latter are separate species remains to be settled, as do their distribution in the Nordic countries. To answer these questions we investigated as much material from Finland and Sweden as we could obtain.

According to Guillebeau (1897) the main character separating the two species is the apiculate pygidium of the females in *M. subrugosus*. According to Audisio (1993) the males also have a less narrow, but still rather distinctly prominent pygidium tip. He could find no differences in the genitalia of the two species. Recently Kurochkin & Kirejtshuk (2005) synonymised the two species, considering the apiculate pygidium in some females to represent an extreme in a morphological continuum of one variable species.

As to external morphology, our results comply with the description of Audisio (1993). Females of the two species are easily separated by the apiculate pygidium in *M. subrugosus* (Gyll.), which contrasts markedly with the rounded shape in *M. substrigosus* Er. (Fig. 2). Males are more difficult. Often the pygidium of male *M. subrugosus* has a clearly offset lobate apex but more blunt than in the females, although this is not always evident. Kurochkin & Kirejtshuk (2005) report a very great variation in the shape of the pygidium, which caused them to merge the two species. Also Sörensson (1999) comments on the great variation. According to our investigation, the variation is not considerable and we suspect that this misconception was caused by not clearly separating the sexes and the species. There is indeed a continuum of sorts from female *M. subrugosus*, to male *M. subrugosus*, and female *M. substrigosus* to male *M. substrigosus* (Fig. 2), which may make identification difficult from using external characters alone if the sex is not correctly determined.

Genitalia
According to Audisio (1993), the genitalia in these two taxa are identical. This is also the view of Spornraft (1998). In the opinion of these authors, the sole means of identification is the outline of the apex of the pygidium, making the males often difficult to separate. According to our investigation, the aedoeagus is indeed rather similar, but only in outline (Fig 3c). Closer investigation shows clear and constant differences. In *M. substrigosus*, the apex of the aedoeagus is dorsally flat, or slightly convex with a narrow central furrow, as shown in Audisio (1993, Fig. 137p). In *M. subrugosus*, however the apex is dorsally concave (Fig. 3 a, d). There is also a distinct difference in the profile of the aedoeagus, which is dorsally uniformly curved in *M. subrugosus*, while in *M. substrigosus* it becomes flat apically, or even bent slightly upwards (Fig. 3b). The tegmen also differs, being parallel in outline in *M. subrugosus*, whereas that of *M. substrigosus* tapers distinctly towards the apex. There are also further differences in the tegmen, especially when viewed ventrally as in Fig. 3e.

In our opinion *M. substrigosus* and *M. subrugosus* are clearly distinct species. It has been argued that the two species can only be identified with certainty in the female sex, but as demonstrated here the differences in male genitalia permit a reliable identification also of males.

Distribution
In the Nordic countries *Meligethes subrugosus* is widely distributed in Sweden and Finland (Fig. 4a) and also in Denmark (Hansen & *al*. 1996) and Norway (F. Ødegaard pers. comm.). According to Audisio (1993) it is also distributed in the Apennine, Alpine and Carpathian mountain ranges. We have seen material from Bavaria and from the Hartz in Germany, so it seems that the species has a wider distribution in Central Europe.

Meligethes substrigosus is distributed from Western Europe to eastern Asia. In the Nordic countries it enters the south-eastern part of Finland. In Sweden, it is only known from a small area in the counties Skåne and Blekinge in the south (Fig 4b). It is unknown from Norway and has not yet been recorded from Denmark (Hansen & *al*. 1996).

In the collection of the Central Museum of Natural History, Helsinki, some ten to twenty

Figure 5. – a) Habitat of ***Meligethes substrigosus*** *in Finland with host plant,* ***Campanula glomerata*** *(Photo A -P. Rutanen); – b) Habitat of* ***M. substrigosus*** *in Sweden with the host plant* ***Jasione montana*** *(Photo B. Ericson).*

– a) Lokal för ***Meligethes substrigosus*** *i Finland med värdväxten, toppklocka (Foto A-P. Rutanen); – b) lokal för* ***M. substrigosus*** *i Sverige med värdväxten, monke (foto B. Ericson).*

specimens of both species collected from Estonia were found. The majority of these proved to be *M. subrugosus*, but also a few *M. substrigosus* were found.

Both species also occur in the Russian part of Fennoscandia. In the collection of Helsinki we identified 45 specimens of *M. subrugosus* and 26 specimens of *M. substrigosus* collected in various localities of this area, from the Karelian Isthmus in the south along the River Svir up to Lake Onega. In the collection of the Museum of Helsinki, we also examined some twenty specimens collected by Finnish coleopterists in different parts of Siberia during the 19th and beginning of 20th century. This material consisted entirely of *M. substrigosus*.

Biology

Both species develop in the flowers of different Campanulaceae. There are few records of host plants. Audisio (1993) mentions only *Campanula rotundifolia* as the host plant for *Meligethes subrugosus*. This is also the case in Finland (personal observations). From Sweden it is recorded from several bellflower species: except for *Campanula rotundifolia,* also from *C. patula*

and *C. trachelium,* as well as from *Jasione montana* (personal observations).

According to Audisio (1993), *M. substrigosus* is found on different species, mainly *Jasione montana*, but also on *Campanula glomerata* (Fig. 5), *C. trachelium* and *C. rapunculoides*. In Finland it is only recorded from *C. glomerata* (personal observation). In Sweden it is only known from *Jasione montana* (B. Ericson in. litt.).

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Sammanfattning

Pollenbaggen *Meligethes subrugosus* beskrevs ursprungligen från Sverige av L. Gyllenhal (1808). Arten lever på blåklockeväxter och känns igen på sina tvärritsade täckvingar och fintandade framtibier. Ute i Europa kom Gyllenhals namn tidigt att användas för en där vanlig art som stämde med denna beskrivning. Senare beskrevs en snarlik art från de franska Alperna, *Meligethes caudatus* Guillebeau, 1897. Den skiljer sig från *M. caudatus* bara genom att honan har en spetsigt utdragen bakkroppspets. Arten ignorerades i stort sett, tills Audisio (1993) påvisade att det nog rörde sig om en god art trots att han inte kunde finna några fler tydliga skillnader än honans bakkroppspets. Enligt Audisio (1993) är de hanliga genitalierna hos de två artertna identiska. Han visade att *M. caudatus* huvudsakligen förekom i Mellaneuropas bergstrakter och i Norden. Sörensson (1999) påvisade att *M. caudatus* var den vanliga arten i Norden, medan *M. subrugosus* inte säkert kunde påvisas. Nyligen förkastade Kurochkin & Kirejtshuk (2005) *M. caudatus*. Dessa författare betraktade hela materialet som tillhörande en enda variabel art,

Meligethes caudatus. Vi bestämde oss därför för att närmare försöka utreda arternas verkliga status och deras förekomst i Norden. Undersökning av de hanliga genitalierna visade att arterna, trots att Audisio hävdat motsatsen, faktiskt tydligt skiljer sig i de hanliga genitalierna. Både Aedoeagus och tegmen uppvisar klara och genomgående skillnader, både inom och utanför Norden. En undersökning av typmaterialet för *M. subrugosus* i Gyllenhals samling i Uppsala visade, att det, som man kunde förvänta, rörde sig om den i Sverige vanliga arten som dittills kallats *M. caudatus*. Denna måste då byta namn till *M. subrugosus* och namnet *M. caudatus* blir en yngre synonym. Den art som hittills gått under namnet *M. subrugosus* måste få ett nytt namn. Den skall i stället heta *M. substrigosus* Erichson, 1845. Lectotyper har utsetts för båda arterna i Gyllehals och Erichsons samlingar. En genomgång av omkring 1000 exemplar i nordiska samlingar visade att *M. subrugosus* är vitt spridd, medan *M. substrigosus* i Norden bara förekommer i sydöstra delarna av Finland samt i ett begränsat område i Skåne och Blekinge i Sverige. *Meligethes subrugosus* förekommer på flera olika arter av blåklockeväxter. *M. substrigosus* däremot, är i Finland bara konstaterad på toppklocka, en art som i Sverige är ursprunglig bara i östra Svealand. I Sverige är *M. substrigosus* ännu bara säkert funnen på monke.

Maria och Thure Palms minnesfond samt Överbys fond

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