Linnaeus’s caddisflies (Trichoptera)

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Linnaeus described twenty species of caddisflies (Trichoptera) of which four are considered nomina dubia. All the caddisfly specimens in the Linnaean collection in The Linnean Society of London have been examined and their identities confirmed. Several of these specimens are damaged or apparently wrongly labelled and very few can be considered as definitive type-material. There are also many specimens that seem to have been added later. However, the sixteen accepted species are discussed and reassessed, taking into account previous authors’ comments on their identity. No changes of use of the Linnaean names are necessary and the well-established nomenclature of this group is confirmed. Possible reasons are proposed for the small number of caddisfly species described by Linnaeus.

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The caddisflies (Trichoptera)

In his 10th edition of Systema Naturae Linnaeus placed in the order Neuroptera fourteen caddisflies (Trichoptera) and three stoneflies (Plecoptera), all under the genus Phryganea, together with eighteen dragonflies (Odonata) under the genus Libellula, six mayflies (Ephemeroptera) under the genus Ephemereta, fifteen lacewings (Hemerobius) (now placed in the Neuroptera and Megaloptera), three scorpionflies in Panorpa (Mecoptera) and one species of snake-fly in Raphidia (now Raphidioidae). There are similar groupings in Fauna Suecica (Linnaeus 1761) and in the later editions of Systema Naturae. In his lectures on the animal kingdom given between 1748-1752 Linnaeus is said to have described the generalised life-cycle of caddisflies, from the adults laying eggs on lake shores, the eggs hatching into larvae that build cylindrical cases, the transformation into adults, and the adults flying in large numbers over the

Before the time of Carl Linnaeus (1707-1778) there are occasional mentions in the literature of “cod-worm or caddis” in streams and rivers, especially in fishing books like The Compleat Angler by Izaak Walton (1653). Even before then, illustrations of adult caddisflies had been published in 1592 in Germany and of larvae in 1602 in Italy, and the relationship between caddis larvae, pupae and adult caddisflies was known at least by 1603, when Caspar Schwennckfeld published the Theriotropheum Silesiae in Liegnitz (nowadays Legnica in Poland) (Botosaneanu & Barnard 1997).

Carl Linnaeus gave names and descriptions to about 4,400 species of animals and 7,700 species of plants (Stearn in Blunt 1971). His Systema Naturae, vol. I (10th ed., 1758) together with Clerck’s (1758) Aranei Suecici (Svenska spindlar) have been accepted by international agreement among zoologists as the starting-point for the scientific naming of animals.
Figure 1. The two boxes 11 and 12 with the Linnaean “Phryganea” specimens in the collection of the Linnean Society of London.

De två askarna nr 11 och 12 i the Linnean Society of London’s samlingar innehåller Carl von Linnés nattsländor, alla benämnda “Phryganea”.

Figure 2. Box 12 with many caddisfly specimens that seem to have been collected after Linnaeus’s time, since several species are labelled by later authors.

Ask 12 innehåller flera exemplar nattsländor som tycks ha insamlats efter Linnés tid eftersom flera av arterna är beskrivna och namngivna av forskare efter Linné.
Table 1. The *Phryganea* (and one *Tinea*) species in the complete works of Linnaeus.

De *Phryganea*-arter (och en *Tinea*-art) som nämnts i Linnës arbeten.

No. Name The name today

**Systema Naturae ed. 10, 1758:**
1. *Phryganea phalaenoides* *Semblis phalaenoides*
2. *Phryganea striata* *Oligotricha striata*
3. *Phryganea grisea* *Linmephilus griseus*
4. *Phryganea grandis* *Phryganea grandis*
5. *Phryganea rhombicu* *Linmephilus rhombicus*
6. *Phryganea bimaculata* *Neureclipsis bimaculata*
7. *Phryganea flavilat* *Nomen dubium*
8. *Phryganea bicaudata* *Diura bicaudata (Plecoptera)*
9. *Phryganea nigra* *Mystacides nigra*
10. *Phryganea longicornis* *Mystacides longicornis*
11. *Phryganea filosa* *Nomen dubium*
12. *Phryganea waeneri* *Tinodes waeneri*
13. *Phryganea albilfrons* *Athripsodes albilfrons*
14. *Phryganea bilineata* *Athripsodes bilineatus*
15. *Phryganea nebulosa* *Taeniopteryx nebulosa* (Plecoptera)
16. *Phryganea fusca* *Lencra fusca (Plecoptera)*
17. *Phryganea flav* *Nomen dubium*

**Fauna Suecica ed. 2, 1761**
*Tinea robertella* *Nomen dubium*
*Phryganea reticulata* *Oligostomis reticulata*
*Phryganea azurea* *Mystacides azurea*
*Phryganea ciliaris* *Notidobia ciliaris*
*Phryganea umbrosa* *Nomen dubium*
*Phryganea saltatrix* *Nomen dubium*

**Systema Naturae ed. 12, 1766-68:**
*Phryganea marginata* *Chimarra marginata*

water (Lönnberg 1913: 246). Linnaeus was believed to have chosen the genus name *Phryganea* from the Greek noun phryganon, which means “firewood” or “dry sticks” (Wiggins 1998), but Linnaeus himself said that the name was originally from Plinius (23-79 AD), and was used by the Romans to describe the cased larvae living in the bottom of lakes (Lönnberg 1913). A similar name “Phryganium” was used by Aldrovandi (1602) for caddis larvae (Botosaneanu & Barnard 1997).

The caddisflies were moved to a new order Trichoptera by Kirby (1813) but were still called phryganeids or *Phryganeae* by many scientists until the end of 19th century, e.g. by Wallengren (1879), Ris (1889) and Thomson (1891).

Twenty of the *Phryganea* species are considered as Trichoptera, but four of the names are no
longer in use (Table 1). Of the sixteen species that are now recognised as caddisflies, only one is still in the original genus *Phryganea*, with all the others now placed in eleven different genera.

**Linnaeus’s collections to London**

After Carl Linnaeus’s death on 10th January 1778 his son, Carl Linnaeus the younger, succeeded him as professor. He worked hard to save his father’s collections but died only five years later on 1st November 1783 and, since he was not married, all the collections reverted to his mother and sisters. The widow, Mrs Sara Lisa Linnaea, sold Linnaeus’s collections to the young English naturalist James Edward Smith for a thousand guineas. Smith found in the 26 large chests rather more than he had expected. There were 14,000 sheets of pressed plants, 3,200 insects, 1,500 shells, 700 - 800 pieces of coral, 2,500 mineral specimens, with numerous books, letters and manuscripts. Smith became the first president of the Linnean Society of London, founded in 1788. After Smith’s death in 1828 the collections were purchased by the Society from Smith’s widow. The collections are now well preserved in a specially designed, climate-controlled room in the basement in Burlington House in London (Gage & Stearn 1988).

**Linnaeus’s caddisflies at the Linnean Society**

There is no information about how many caddisfly specimens there were among the 3,200 specimens of insects in the collections Smith bought in 1784. In 1976, as part of a wider study on the Linnaean insects, one of us (P.C. Barnard) transferred the specimens of the Linnaean “Neuroptera” in new boxes in a numbered series: Neuroptera boxes 1 - 19. The *Phryganea* specimens are in two boxes, with fourteen specimens in box 11 and 39 in box 12 (Fig. 1). At the same time a list of the specimens was prepared, showing the number of specimens and their known status. The list was numbered as in the 12th edition of *Systema Naturae* (Table 2), with the numbering of the 10th edition in parentheses and showing a dash (-) where it was not described in the 10th edition.

Most or all of the specimens in box 12 (Fig. 2) seem to have been collected after Linnaeus’s time, since of the determined specimens only

**Table 2. The *Phryganea* specimens and empty labels in the Linnaean collection in The Linnean Society of London numbered in accordance with 12th edition of *Systema Naturae* with the numbering of the 10th edition in parentheses.**

<table>
<thead>
<tr>
<th>No</th>
<th>Label</th>
<th>Specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (8)</td>
<td>bicaudata</td>
<td>Plecoptera without abdomen</td>
</tr>
<tr>
<td>2 (15)</td>
<td>nebulosa</td>
<td>Plecoptera without abdomen</td>
</tr>
<tr>
<td>3 (1)</td>
<td>phalaenoides</td>
<td>Semblis phalaenoides, abdomen missing.</td>
</tr>
<tr>
<td>4 (-)</td>
<td>reticulata</td>
<td>Oligostomis reticulata (2 ex)</td>
</tr>
<tr>
<td>5 (2)</td>
<td>striata</td>
<td>Phryganea bipunctata (1 ♂)</td>
</tr>
<tr>
<td>6 (3)</td>
<td>grisea</td>
<td>Limnephilus stigma (1 ♂)</td>
</tr>
<tr>
<td>7 (4)</td>
<td>grandis</td>
<td>Phryganea striata (now Phryganea bipunctata Retzius, see discussion), abdomen missing.</td>
</tr>
<tr>
<td>8 (5)</td>
<td>rhombica</td>
<td>Limnephilus rhobicus (1 ♂)</td>
</tr>
<tr>
<td>9 (6)</td>
<td>bimaculata</td>
<td>Limnephilus griseus (1 ♂)</td>
</tr>
<tr>
<td>11 (9)</td>
<td>nigra</td>
<td>Mystacides nigra (♀), abdomen missing</td>
</tr>
<tr>
<td>15 (10)</td>
<td>longicornis</td>
<td>Mystacides longicornis</td>
</tr>
<tr>
<td>18 (13)</td>
<td>albifrons</td>
<td>Athripsodes albifrons (2 ex) (Neotype: det. John Morse, 1974)</td>
</tr>
</tbody>
</table>

**The empty labels/Nålade etiketter utan insekter**

<table>
<thead>
<tr>
<th>No</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 (7)</td>
<td>flavilatera</td>
</tr>
<tr>
<td>12 (6)</td>
<td>azurea</td>
</tr>
<tr>
<td>13 (-)</td>
<td>ciliaris</td>
</tr>
<tr>
<td>14 (-)</td>
<td>marginata</td>
</tr>
<tr>
<td>16 (11)</td>
<td>filosa</td>
</tr>
<tr>
<td>17 (12)</td>
<td>waeneri</td>
</tr>
<tr>
<td>19 (14)</td>
<td>bilineata</td>
</tr>
<tr>
<td>20 (16)</td>
<td>fusca</td>
</tr>
<tr>
<td>21 (17)</td>
<td>flav</td>
</tr>
<tr>
<td>22 (-)</td>
<td>umbrosa</td>
</tr>
<tr>
<td>23 (-)</td>
<td>minuta</td>
</tr>
<tr>
<td>24 (-)</td>
<td>saltatrix</td>
</tr>
</tbody>
</table>
three represent species named in *Systema Naturae*, viz. *Mystacides nigra*, *Phryganea striata* (now *Phryganea bipunctata* Retzius, see discussion) and *Limnephilus griseus*, all labelled by Martin E. Mosely (1877-1948). Nine specimens represent species named by later authors. These species are *Ceraclea annulicornis* (Stephens, 1836), *Limnephilus borealis* (Zetterstedt, 1840), *Glyphotaelius pellucidus* (Retzius, 1783), *Limnephilus flavicornis* (Fabricius, 1787) (2 ex), *Limnephilus marmoratus* Curtis, 1834 (2 ex), *Grammotaullius nigropunctatus* (Retzius, 1783), and *Stenophylax permistus* McLachlan, 1895. *Ceraclea annulicornis* was determined in a neotype designation by John Morse in 1974, and all the others by Mosely. The entomologist and angler Mosely was an authority on the Trichoptera, and he examined the Linnaean caddisflies while all the insect collections were being photographed in 1940, just after their evacuation from London at the start of World War II (Gage & Stearn 1988).

Most of the other 28 specimens had no label, three are stoneflies (Plecoptera) and some are damaged, e.g. with no abdomens, antennae or legs.

Box 11 (Fig. 3) is the most interesting since it contains the caddisfly species which were named by Linnaeus. There are 24 name-labels in box 11 but only twelve of them have specimens of insects, i.e. twelve labels have no specimens belonging to them. However, two specimens are not caddisflies, some are damaged and some do not accord with the species names on the labels.

### Discussion
Naturally Linnaeus’caddisflies have previously been investigated and discussed by others. Two of the most important are the English entomologist Robert McLachlan (1837-1904) and the Swedish vicar and entomologist Hans Daniel Johan Wallengren (1823-1894). These two authors differed in their interpretation of some Linnaean species, but managed to agree on most of them. Wallengren’s (1879) paper to the Journal of the Linnean Society was in fact communicated to the Society by McLachlan, who took the opportunity to add some notes of his own at the end, outlining their differences of opinion.

McLachlan (1874-80: 81) could not accept the Linnaean name *Phryganea flava* (*Limnephilus flavus*) since he thought that it was probably a collective name for several small yellowish species, e.g. *Limnephilus centralis* and others; Wallengren (1879, 1884, 1891) persisted in his view that *Phryganea flava* could only be *Limnephilus centralis*. McLachlan’s view is now the valid one, i.e. *Phryganea flava* is considered as *nomen dubium*.

Wallengren (1879, 1884, 1890, 1891) was of the opinion that Linnaeus’s *Phryganea grisea* (*Limnephilus griseus*) is the species that is today named *Limnephilus stigma* Curtis, 1834. He stated that there is a specimen in the Linnaean collection bearing the name *grisea* in J.E. Smith’s handwriting; McLachlan reluctantly agreed that this was a specimen of *L. stigma*, but took the opportunity to cast doubt on the value of the Linnaean collection, pointing out that none of the specimens bore species labels in Linnaeus’s handwriting (although some had numbers, possibly in his hand), that there was no certainty that labels had not been moved, and concluding that the few remaining Linnaean Trichoptera could not be considered as types (McLachlan 1874-80: 56).

Wallengren was also convinced that Linnaeus’s *Phryganea bimaculata* is not *Neureclipsis bimaculata* but *Limnephilus griseus*; again McLachlan agreed that his arguments might be valid but this view was never adopted. As mentioned above, we have examined the “very small male” labelled *grisea*, and identified it as *L. stigma*. Wallengren (1890) tried to show that *Phryganea bilineata* is not *Athripsodes bilinea tus* but *Athripsodes cinereus* (Curtis, 1834). He argued that *Athripsodes cinereus* was a common species in Sweden but that *Athripsodes bilineatus* was extremely rare; it has not yet been recorded in Sweden (Forsslund & Tjeder 1942, Forsslund 1953, Gullefors 2002). Wallengren (1879) put forward detailed arguments for considering *Phryganea striata* as the senior name for *Neuronia ruficrus* Scopoli; McLachlan was rather doubtful and Hagen (1880) agreed with this view, but Wallengren’s opinion has prevailed. The specimens determined by Mosely as *Phryganea striata* in the collection, are now called *Phryganea bipunctata* Retzius. In Mos-
ley’s time the old name *Phryganea striata* was still in use, as in his famous book on the British caddisflies (Mosely 1939). Wallengren’s views on two species that are now considered as *nomina dubia*, are more controversial. He suggested that *Phryganea flavid tera* was a *Hydropsyche* sp. (possibly *H. instabilis*), but admitted that Linnaeus’s description of *P. flavid tera* cannot be interpreted with any certainty; McLachlan (in Wallengren 1879) robustly declared the argument as “far-fetched”, implying that it was beyond belief. Wallengren was convinced that *Tinea Robertella* was a species of *Leptocerus*; in 1879 he declared it to be *L. dissimilis* Stephens but by 1890 he was equally certain that it was *L. albo-guttatus* Hagen, 1860 (now *Ceraclea alboguttata*); McLachlan was unconvinced, and the name remains a *nomen dubium* today.

Wallengren (1879, 1880, 1884, 1890) based his arguments and conclusions on Linnaeus’s descriptions in *Systema Naturae* and *Fauna Suecica*. His conviction was further strengthened when it appeared that the specimens with ‘wrong’ labels in the Linnaean collection were exactly the species he had argued for. McLachlan had examined them, as did Mosely, probably in the 1940s. We re-examined some of them on 12th January 2007. Was Wallengren right? Should *Phryganea grisea* (*Linnephilus griseus*) really be the species *Linnephilus stigma* Curtis, 1834, *Phryganea bimaculata* (*Neureclipsis bimaculata*) the species *Linnephilus griseus*, and *Phryganea bilineata* (*Athripsodes bilineatus*) the species *Athripsodes cinereus* (Curtis, 1834)? According to Wallengren, the descriptions that Linnaeus gave for these species seem to agree more closely with Wallengren’s interpretations as well as with the specimens in the collections. But the inevitable questions arise: why are some specimens pinned with the wrong labels? Have they been there from the very beginning or has there been a mix-up? Have specimens been moved or have new ones been substituted when the originals were lost or damaged by pests? These questions cannot be answered, but fortunately all Linnaeus’s names are now well established, and there is no need to propose any revision of the identity of his caddisflies.

Another interesting question is why Linnaeus named and described only sixteen caddisfly species (together with additional species that are now are considered as *nomina dubia*) when there are now 224 species recorded in Sweden (Gullefors 2002, 2006; Gullefors & Johanson 2007). All the Linnaean caddisflies have Sweden as the type-country. Furthermore, Linnaeus had many contacts with scientists abroad, and his students (or ‘apostles’) travelled all over the world so that overseas and exotic species could have been collected and described. Linnaeus himself had the ambition of naming and describing all the plants and animals on the Earth! He believed that in the whole world there were 20,000 species of plants and 20,000 species of animals of which 12,000 were insects (Linnaeus 1749).

There are probably several explanations why there are only sixteen Linnaean caddisfly species: 1) Linnaeus was principally a botanist; 2) he was very busy describing material of all groups of organisms (7,700 plants and 4,400 animals); 3) most of the Swedish caddisflies are dull and inconspicuous and most are nocturnal or crepuscular so would receive less attention than more spectacular groups of animals such as butterflies (Honey & Scoble 2001); 4) to study caddisflies in detail you need a microscope of considerably better quality than the ones that were available when Linnaeus was alive.

On the other hand, it is remarkable that Linnaeus’s garden, then the Uppsala Botanical Garden, is only a short distance from the small river Fyrisån, which even today is home to several caddisfly species. The garden also contained three large ponds of various depths, with a steady flow of water from one to another, the first being spring-fed (Linnaeus 1745). Surely these would have provided suitable habitats for many more species of caddisflies? But perhaps the main reason that Linnaeus did not describe any more species is that, as he admitted (Lön nberg 1913: 246), the species are difficult to distinguish because they quickly lose their colour, a statement that many recent entomologists would agree with!
Acknowledgements
We thank Dr. Mike Fitton, curator of the Linnean Society’s insects for enabling us to study Linnaeus’s caddisflies. The pictures of the Neuroptera boxes 11 and 12 and their content are taken and published by permission of the Linnean Society of London, Burlington House, London.

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Sammanfattning

Carl von Linné beskrev och namngav endast tjugo nattsländor (Trichoptera). Fyra av dessa får anses "nomina dubia", dvs. namnen är av tveksam eller okänd tillämpning. Vi har granskat alla exemplar av nattsländor i Linnés samlingar tillhörande The Linnean Society of London. Samtliga nattsländor finns i två askar, nr 11 och 12 (Fig. 1-3).

Flera av nattsländorna är skadade eller felaktigt namngivna. Endast några enstaka kan anses vara typmaterial. De flesta nattsländor i ask 12 (Fig. 2) har troligen insamlats efter Linnés tid eftersom endast tre arter finns med i Systema Naturae.

Från Linnés föreläsningar, i anteckningar av hans studenter, framgår att han hade god kunskap om nattsländornas livscykel, från honornas äggläggning vid vattnet, med äggs kläckning till larver som bygger cylindriska rör ("husmaskar") och den slutliga förvandlingen till vuxna sländor.

Linné borde ha kunnat beskriva betydligt fler nattsländor. Det fanns goda förutsättningar för nattsländelarver i Linnés närhet. På hans tid fanns en bäck och tre dammar i Linnéträdgården, då kallad Uppsala Botaniska trädgård, dessutom ligger Fyrisån nära. Att Linné inte namngav fler än tjugo nattsländor tror vi beror på att han i första hand var botanist. Han var fullt sysselsatt med att beskriva alla de växter och djur som han fick i sin hand (7700 växtarter, 4400 djurarter). Mer spektakulära grupper av djur, t ex fjärilar fick säkert företräde före de mindre iögonenfallande kvälls- och nattaktiva nattsländorna, som Linné ansåg var svåra att bestämma.