The type specimens of European butterflies from the Linnaeus collection (Lepidoptera: Rhopalocera)

Stanislav K. KORB①

Russian Entomological Society, Nizhny Novgorod Branch, P.O. Box 97 Nizhny Novgorod, RF-603009 Russia

Abstract: The status of primary types of European butterflies established by C. Linnaeus is revised. Lectotype status is confirmed for 38 taxa. Lectotypes of the following taxa are designated in this paper: *Papilio apollo* Linnaeus, 1758; *P. daplidice* Linnaeus, 1758 and *P. palaeno* Linnaeus, 1761. For the following 18 species-group taxa, the status of primary types changed from lectotypes to holotypes (by monotypy) due to their presence in the Linnean collection by single specimens: *Papilio aglaja* Linnaeus, 1758; *P. atalanta* Linnaeus, 1758; *P. boeticus* Linnaeus, 1767; *P. cardui* Linnaeus, 1758; *P. cinxia* Linnaeus, 1758; *P. deianira* Linnaeus, 1764; *P. euphrosyne* Linnaeus, 1758; *P. hero* Linnaeus, 1761; *P. janira* Linnaeus, 1758; *P. jurtina* Linnaeus, 1758; *P. lathonia* Linnaeus, 1758; *P. levana* Linnaeus, 1758; *P. megera* Linnaeus, 1767; *P. paphia* Linnaeus, 1758; *P. polychloros* Linnaeus, 1758; *P. rhamni* Linnaeus, 1758; *P. rubi* Linnaeus, 1758 and *P. sinapis* Linnaeus, 1758. Butterflies that do not have a pronounced sexual dimorphism and bright and contrasting coloration in the Linnean collection are represented in most cases by a single type specimen. The largest, brightest and most beautiful butterflies in the Linnean collection have a type series of the maximum size (4 specimens). There are no series of 5 or more specimens for European butterflies in Linnaeus' collection.

Key words: butterflies; Europe; nomenclature; primary types

林奈收藏的欧洲蝴蝶模式标本研究（鳞翅目：锤角亚目）

Stanislav K. KORB①

Russian Entomological Society, Nizhny Novgorod Branch, P.O. Box 97 Nizhny Novgorod, RF-603009 Russia

摘要: 修订了林奈（C. Linnaeus） 建立的欧洲蝴蝶主模的地位。确认了 38 个分类单元的选模地位。本文为以下分类单元指定了选模：*Papilio apollo* Linnaeus, 1758；*P. daplidice* Linnaeus, 1758 和 *P. palaeno* Linnaeus, 1761。对以下 18 个物种，由于它们在林奈收藏中仅以单个标本存在，其原始模式地位（根据独模原则）从选模改为正模：*Papilio aglaja* Linnaeus, 1758; *P. atalanta* Linnaeus, 1758; *P. boeticus* Linnaeus, 1767; *P. cardui* Linnaeus, 1758; *P. cinxia* Linnaeus, 1758; *P. deianira* Linnaeus, 1764; *P. euphrosyne* Linnaeus, 1758; *P. hero* Linnaeus, 1761; *P. janira* Linnaeus, 1758; *P. jurtina* Linnaeus, 1758; *P. lathonia* Linnaeus, 1758; *P. levana* Linnaeus, 1758; *P. megera* Linnaeus, 1767; *P. paphia* Linnaeus, 1758; *P. polychloros* Linnaeus, 1758; *P. rhamni* Linnaeus, 1758; *P. rubi* Linnaeus, 1758 和 *P. sinapis* Linnaeus, 1758。在林奈收藏中没有明显性二型和鲜艳色彩对比的蝴蝶，在多数情况下仅有单个模式标本。林奈收藏中最大、最鲜艳、最美丽的蝴蝶都有模式系列（最多 4 头标本）。林奈收藏中的欧洲蝴蝶，模式标本系列没有 5 个或更多的标本。

关键词: 蝴蝶； 欧洲；命名法； 主模

Accepted 19 August 2021. Published online 9 November 2021. Published 25 December 2021.

①Corresponding author, E-mail: stanislavkorb@list.ru

Introduction

The significance of the Lepidoptera collection of Linnaeus is enormous. Its type material is essentially the beginning in the history of systematics and taxonomy and is of both historical and nomenclatural value. The main part of the Linnaeus collection is kept in The Linnean Society of London; the other part is in the zoological section of the Uppsala University Museum of Evolution. Materials on butterflies in both parts of the Linnaeus collection were revised (Verity 1913; Honey & Scoble 2001; Vane-Wright 2007; Wallin 2014) and lectotypes were designated. Some species of butterflies established by Linnaeus are typified by neotypes or not typified. It is important to note that the collection of Lepidoptera of Linnaeus has been completely preserved.

The collection of Linnaeus was divided into two parts. One part kept at the University of Uppsala during the life of the scientist is still there and has been revised (Wallin 2014). The second part, his personal collection replenished by the son of Linnaeus until 1783, was acquired in 1784 by Sir James Edward Smith. Since 1829, this part of the collection has been kept at the Linnean Society in London (Fitton & Harman 2007). A catalogue of Linnaeus collections was published first by Jackson (1913). In that same year the detailed analysis of the Linnean butterflies was published by Verity (1913). In 2001, a complete catalogue and analysis of Linnean butterflies was published by Honey and Scoble; most of the lectotypes of Linnean butterflies were designated in this paper.

However, some portions of the lectotype designations of Linnean butterflies are incorrect. The overwhelming majority of lectotypes of butterflies, and almost all lectotypes of European butterflies from the Linnaean collection, were designated in a single paper by Honey & Scoble (2001). In total, Linnaeus established 305 species of butterflies (Vane-Wright 2007), of which 273 are in different editions of *Systema Naturae* (Borkin 2009).

Designation of a lectotype, according to Art. 74.1 of the Code, is produced *from a series of syntypes*. If the lectotype was not a syntype previously, its status as a lectotype is lost (Article 74.2 of the Code), with all the ensuing nomenclatural consequences. Some of the type specimens of Linnaeus are not syntypes; they are holotypes by monotypy because they are represented in the Linnaeus collections which has been completely preserved by a single specimen. Part of the collection of the Linnean Society of London is damaged by mold, but the specimens still physically exist. Upon acquisition, Smith mixed his collection of Lepidoptera with that of Linnaeus. Now the exact identification of Linnaeus' specimens is possible only by the original labels of Linnaeus or by the absence of any labels (Smith's specimens contain handwritten labels made by Smith). An indirect proof of specimens belonging to Linnaeus' collection is the characteristic mold of yellow color, which covers some part of those specimens of his collection transported from Uppsala to London by ship. Specimens from Smith's collection do not have such mold, or the mold is of a different color (mainly white). The last feature used to determine if the specimen is Linnean is its mounting style and pin type (Mikkola & Honey 1993).

All lectotypes of European butterflies from the collection of Linnaeus are designated from that part of the collection kept in the Linnaean Society in London. Automatically, the rest of the specimens deposited both in the Linnean Society in London and in the evolutionary museum of the University of Uppsala take the status of paralectotypes (Article 74.1.3 of the

Code). However, this is not proven fact: only in Uppsala, without any doubt, all specimens can be qualified as syntypes with which Linnaeus worked, since his collection there did not mix with others. But Linnaeus's collection of butterflies in the Linnaean Society, as indicated above, was mixed with the collection of Smith, and additionally, it was replenished by Linnaeus' son after his father deceased. In these circumstances, in the collection of the Linnaean Society, it is necessary to separate the specimens of Linnaeus from those of Smith, and to revise the lectotypes status.

It is incorrect to believe that references to insect images published before Linnaeus are references to the Linnaean type material. An image published by the previous author cannot be considered as the type material of the current author, who subsequently referred to it, unless it contains an image of the specimen to which a nomenclatural meaning is clearly and unambiguously given. This would be the case if a lectotype is designated based on this image. In all other cases, the reference to an earlier work in which there is an image of the taxon is nothing more than a reference showing images of an insect published before. It is absolutely incorrect to consider previously published (and by other authors) images as part of the Linnaeus type series.

A list of specimens of European butterflies from the Linnaeus collection is given in Table 1. For identification of original Linnaeus specimens, the following features were used:

1) Original Linnaeus labels, and labels from donations to the Linnaeus collection, described in details by Wallin (1992, 2014);

2) The characteristic yellow mold, covering part of the specimens from the Linnaeus collection;

3) Lack of geographic labels, typical for the Linnaeus collection;

4) The data published by Verity (1913);

5) The data published by Honey & Scoble (2001).

Abbreviations. LSL – The Linnean Society of London; UM – Zoological Section of the Uppsala University Museum of Evolution.

Results

1. *Papilio adippe* Linnaeus, 1767

Linnean material contains two specimens, one of them identified as *P. niobe* and with Linnaeus's identification label ("*Adippe*"); the second one has no labels. Both specimens belong to the Linnean collection without doubt (Honey & Scoble 2001: 290). Thus, the type series of *P. adippe* contains two syntypes, one of them is misidentified as *P. niobe*. The ICZN Commission in Opinion 501 suppressed the name *adippe* Linnaeus, 1767 and validated the name *adippe* Denis & Schiffermüller, 1775; the neotype of the latter taxon was designated in the cited Opinion. Thus, the type material of Linnaeus has no nomenclatural but only historical value.

2. *Papilio aglaja* Linnaeus, 1758

The Linnaeus collection contains a single female of this species. All other specimens from the LSL collection were added later by Smith. This single female was designated as its lectotype (Hemming 1942: 160) but this is incorrect. This female represents a holotype by monotypy.

3. *Papilio antiopa* Linnaeus, 1758

Two specimens of the Linnaeus collection origin are in the LSL. Both are identified as syntypes. The lectotype designation was made by Honey & Scoble (2001: 297); according to this fact, the type series contains a lectotype and paralectotype.

4. *Papilio apollo* Linnaeus, 1758

There are two opposite opinions about the *P. apollo* material from LSL. First opinion: "No specimen bears a Linnean label, but everything points to the fact that one of the three specimens in the collection was Linnean. Two more specimens, from Italy, are Smith's" (Verity 1913: 176). Second opinion: "Verity … stated that there were three specimens in the LSL and although none of these was labelled by Linnaeus, Verity considered that only one specimen, 'a female of large size of the Scandinavian race', was Linnaean. The pin of this specimen is typically Linnaean, and we have designated it as a lectotype. The other two specimens he considered to be later additions, from Italy, by Smith. However, since neither of them was labelled by Smith there is no apparent basis for the suggestion that he added them to the collection. Furthermore, there exists considerable size variation across the range of this species, so the suggestion that they are from Italy also remains open to doubt. In fact, the condition of the second female suggests that it is actually Linnaean" (Honey & Scoble 2001: 298).

We can consider that none of these opinions are correct. The Linnean specimens always have the identification label pinned under the first (or single) specimen in the type series; there is no Linnean identification label under all three *P. apollo* specimens from LSL. Then, the first specimen in the LSL series have an identification label handwritten by Smith and belong to the Italian race of *P. apollo* (an opinion of Verity (1913), one of the best experts in Italian butterflies). Finally, none of these specimens are touched by the specific mold which is present in almost all large-sized specimens from the Linnaeus collection. And lastly, in the collection of UM are deposited two specimens of *P. apollo*, male and female, from a donation of Gustav IV. These specimens are only syntypes of *P. apollo*; thus, the lectotype designation made by Honey & Scoble (2001: 298) is incorrect because it was made from non-syntypic specimens. I designate here the lectotype of this species, a female deposited in UM under the number 1978. The type locality correction made by Honey & Scoble (2001) is also incorrect, because for this correction they used non-type material. I corrected the type locality of this taxon to the environs of Uppsala in Sweden (Korb 2020)

5. *Papilio arcania* Linnaeus, 1761

Verity (1913: 186) wrote that two specimens of this species in LSL have the Linnean collection origin. Honey & Scoble (2001: 298) listed only a single specimen and designated it as a lectotype. I agree with Verity opinion, there are two *P. arcania* syntypes in the LSL collection, thus, type series contain lectotype and paralectotype.

6. *Papilio argiolus* Linnaeus, 1758

Verity (1913: 190) listed only one specimen, female, as the type specimen belonging to Linnaeus collection. Honey & Scoble (2001: 299) listed two specimens; one of them, mentioned earlier by Verity, was designated as a lectotype. The second one, another female, is attributed to the type series under question. But since it is not proven that this specimen is not a part of the type series, there is no reason to think differently. So, the type series contain two specimens: lectotype and paralectotype.

7. *Papilio argus* Linnaeus, 1758

Both Verity (1913: 188) and Honey & Scoble (2001: 299) listed two males of Linnaeus origin; one of them designated by the latter authors as a lectotype. So, the type series contains a lectotype and paralectotype.

8. *Papilio arion* Linnaeus, 1758

Both Verity (1913: 189) and Honey & Scoble (2001: 300) listed two specimens of Linnaeus origin. Verity listed one male and one female but Honey and Scoble showed that Verity confused one female as a male, so both are in fact females; one of them designated by the latter authors as a lectotype. Thus, this type series contains a lectotype and paralectotype.

9. *Papilio atalanta* Linnaeus, 1758

Only one specimen from the series deposited in LSL has an original Linnaeus label and the characteristic mold. It has been designated by Honey and Scoble as a lectotype (Honey & Scoble 2001: 302). The second specimen is the addition of Smith and due to this reason cannot be treated as a type specimen. Thus, the single specimen of *P. atalanta* deposited in LSL is the holotype by monotypy.

10. *Papilio belia* Linnaeus, 1767

Two female syntypes deposited in LSL; one of them designated as a lectotype (Honey & Scoble 2001: 304). Thus, the type series contains a lectotype and paralectotype.

11. *Papilio betulae* Linnaeus, 1758

Verity (1913: 187) considered two Linnean specimens in LSL, a male and a female. Honey & Scoble (2001: 304) stated there were four specimens of Linnean origin. I agree with the latter opinion that there are four specimens in LSL from the original Linnaeus collection. So, the lectotype designation made by Honey & Scoble (loc. cit.) produced from the series of syntypes and the type series contain the lectotype and three paralectotypes.

12. *Papilio boeticus* Linnaeus, 1767

There is a problem with the type series of this taxon. Verity (1913: 188) wrote that "…it was not represented in his [Linnaeus–S.K.] collection". Honey & Scoble (2001: 304–305), contrary to Verity, wrote: "Of the four specimens in the LSL, two are possibly Linnaean"; one of these two they designated as a lectotype. In fact, there is no evidence for both specimens that their origin is Linnean: both have no characteristic mold and no Linnaeus labels. Moreover, one of them is equipped with Smith's label, providing evidence for its origin from the Smith collection. According to these facts, I cannot treat the male specimen with number LINN 0429 as a part of the type series. The only part of it is probably the female (although it is impossible to prove due to the lack of an original Linnaeus label and the specific mold) designated by Honey and Scoble as a lectotype. Summarizing, only one specimen has a possible origin from the Linnaeus collection, and it would mean this specimen is not a lectotype but a holotype by monotypy.

13. *Papilio brassicae* Linnaeus, 1758

In LSL there is a single male of this species which originates from the Linnaeus collection; this male is designated as a lectotype (Honey & Scoble 2001: 305). Two other Linnean

specimens, also males, originate from the Gustav IV donation to the Linnaeus collection and are now deposited in UM. Thus, this type series contains a lectotype and two paralectotypes.

14. *Papilio briseis* Linnaeus, 1764

Two specimens of this species are clearly identified as Linnaeus material by the Linnaeus label and characteristic mold and are preserved in LSL. One of them is designated as a lectotype (Honey & Scoble 2001: 306). Verity (1913: 184) considered only one specimen to be a type of this species based on the absence of the Linnaeus label in the second one. But in fact, these two specimens are mounted quite characteristically: one is in normal orientation and the second one is mounted upside-down. This is a very common type of the mounting in the old collections (and the Linnaeus collection too) to show the upperside of the species. Thus, the type series contains a lectotype and paralectotype.

15. *Papilio c-album* Linnaeus, 1758

There is only one specimen considered as Linnean in the LSL collection (Verity 1913: 181). This specimen is designated as a lectotype (Honey & Scoble 2001: 306). One more specimen is listed by Honey and Scoble (loc. cit.) as part of the type series from De Geer collection. So, the type series contain lectotype and paralectotype.

16. *Papilio cardamines* Linnaeus, 1758

This is a rare case of a series of specimens which contain none of Smith's material: all specimens forming this series are considered as Linnean, two pairs. One pair are pinned normally; the second pair are pinned upside-down. As the lectotype of this species was designated a male with normal pinning, all other specimens in this series are paralectotypes.

17. *Papilio cardui* Linnaeus, 1758

Only one specimen from among five can be attributed as original Linnean. Thus, the lectotype designation for this species (Honey & Scoble 2001: 308) is incorrect, this specimen is a holotype by monotypy.

18. *Papilio chrysippus* Linnaeus, 1758

Two specimens are attributed to belonging to Linnean material. One of them is deposited in LSL and designated as a lectotype (Corbet & Pendelbury 1956: pl. 29, fig. 3). The second specimen in UM is a paralectotype.

19. *Papilio cinxia* Linnaeus, 1758

Only one type specimen is represented in LSL (Verity 1913: 182; Honey & Scoble 2001: 312). It was designated as a lectotype (Honey & Scoble 2001: 312). According to the fact that it is a single type specimen, its status is a holotype by monotypy.

20. *Papilio cleopatra* Linnaeus, 1767

There are three Linnean specimens: two males in LSL and one female in UM. The lectotype male designated in the LSL collection (Honey & Scoble 2001: 312). Thus, the type series contain lectotype and two paralectotypes.

21. *Papilio comma* Linnaeus, 1758

Three specimens (two males and one female) from the Linnaeus collection are deposited

in LSL. One of them is designated as a lectotype (Honey & Scoble 2001: 314) so the two other specimens are paralectotypes.

22. *Papilio crataegi* Linnaeus, 1758

A single male from the Linnaeus collection is preserved in LSL. Another male, according its labelling, is an addition from the Smith collection. There is also one more specimen (female) in the De Geer collection which is traditionally treated as part of the type series. The lectotype designation of this species was made by Honey & Scoble (2001: 314). Its lectotype is deposited in LSL, and the paralectotype in the De Geer collection.

23. *Papilio daplidice* Linnaeus, 1758

The lectotype of this species was not selected by any author. This is quite strange because the relationships between two closely related taxa, *P. daplidice* Linnaeus, 1758 and *P. edusa* Fabricius (1777) is a subject of active debates (Geiger *et al.* 1988; Wagener 1988; Porter *et al.* 1997). Wagener (1988: fig. 3) proved that the male syntype in LSL is typical *edusa*, so it would be impossible to use it for the lectotype designation of *daplidice*. Two other syntypes, females, according Verity (1913: 176) belong to the form *nitida* Verity, 1908, distributed in Spain, Algeria and Asia Minor and currently treated as *P. edusa*. In this situation the only way to validly preserve the Linnean name *daplidice* is to designate a lectotype, male, pinned upside-down and stored in UM under the number 2063. I designate this lectotype here. This specimen originates from the Gustav IV donation.

24. *Papilio deianira* Linnaeus, 1764

The only specimen which has a Linnean collection origin is stored in LSL. The MU specimen, as shown by Honey & Scoble (2001: 317), has an uncertain origin and cannot be treated with certainty as part of the type series. Honey & Scoble (loc. cit.) were unable to designate the lectotype of this taxon. That is a right decision because the LSL specimen is a holotype by monotypy.

25. *Papilio electo* Linnaeus, 1763

Verity (1913) did not mention this species in his paper. Honey & Scoble (2001: 322) listed two specimens of Linnean origin and designated one of them as a lectotype. Thus the type series of this taxon contains two specimens, lectotype and paralectotype.

26. *Papilio euphrosyne* Linnaeus, 1758

Both Verity (1913: 182) and Honey & Scoble (2001: 324) listed a single specimen as Linnean; the latter authors designated this specimen as a lectotype. Due to it being a single specimen, the correct status of it is holotype by monotypy.

27. *Papilio galathea* Linnaeus, 1758

There are five specimens of this species in LSL and one in UM. The LSL specimens are: one female with a Linnaeus collection origin, and four males added later by Smith. The specimen from UM is male and belongs to the Gustav IV donation. The female from LSL is designated as a lectotype (Honey & Scoble 2001: 327), the male from UM is a paralectotype.

28. *Papilio hermione* Linnaeus, 1764

There are two syntypes of this species in LSL; one of them is pinned upside-down. The specimen pinned normally is designated as a lectotype (Kudrna 1977: 24), thus the second one is a paralectotype.

29. *Papilio hero* Linnaeus, 1761

The only type specimen of this species is deposited in LSL and designated by Honey & Scoble (2001: 332) as its lectotype. Due to that fact that it is a single specimen, it must be treated as a holotype by monotypy.

30. *Papilio hippothoe* Linnaeus, 1761

Two specimens with a Linnaeus collection origin are deposited in LSL; one of them is designated as a lectotype (Honey & Scoble 2001: 332). Thus, the second one is its paralectotype.

31. *Papilio hyale* Linnaeus, 1758

The series in LSL contain four specimens. Verity (1913: 179) listed "two males and a female" as Linnean specimens. Later, Honey & Scoble (2001: 332) excluded one male, labelled by Smith, from the type series. This specimen was determined as *Colias philodice* Godart, 1819 (Grieshuber *et al*. 2012: 123). I cannot agree with Honey & Scoble (2001) about the type status of the excluded specimen. It has no labels (characteristic of Linnean material), but the most important feature is presence of the specific mold in all three specimens, which Verity considered to be Linnean. So, the type series of *P. hyale* contains a lectotype and two paralectotypes; the lectotype designated by Honey & Scoble (2001: 332).

32. *Papilio hyperantus* Linnaeus, 1758

Four specimens of this species are deposited in LSL. Two of them (a male and female) are considered to be Linnean. Two other males are additions from the Smith collection. The lectotype of this species, the male, was designated by Honey & Scoble (2001: 334). Thus the other type specimen, the female, is a paralectotype.

33. *Papilio idas* Linnaeus, 1761

There are two specimens (females) in LSL with a Linnaeus collection origin, one of them marked by a Linnaeus label. According to study by Verity (1913), neither represent the species currently known as *Plebeius idas* (Linnaeus, 1761). The first female is with high probability *P. argus* (Linnaeus, 1758). The second female is identified as *P. argyrognomon* (Bergsträsser, 1779). The situation with this species was ruled on by the Commission (Opinion 269) without designation of a primary type specimen.

34. *Papilio janira* Linnaeus, 1758

Both Verity (1913: 184) and Honey & Scoble (2001: 338) concluded that there is a single type specimen for this taxon. According to that conclusion this specimen is not a lectotype, as it was declared by Honey and Scoble (loc. cit.), bit is a holotype by monotypy.

35. *Papilio jasius* Linnaeus, 1767

Two specimens of this species are deposited in LSL. One of them (designated as a lectotype by Honey & Scoble (2001: 338)) has a Linnaeus label, the second one has a Smith label. The species names on these labels are different. On the Linnaeus label, it is "Jasius"; on the Smith label, it is "Jason". But the pinning style and characteristic mold are good evidence

to treat both specimens as Linnean. So, the type series for this taxon contain the lectotype and paralectotype.

36. *Papilio jurtina* Linnaeus, 1758

There is a single specimen of Linnean collection origin in LSL. It was designated as a lectotype (Verity 1913: 184). Due to it being a single specimen, its status must be treated as holotype by monotypy.

37. *Papilio lathonia* Linnaeus, 1758

The single Linnean specimen from the LSL collection was designated as a lectotype (Honey & Scoble 2001: 341). Because it is a single specimen, it must be treated as a holotype by monotypy.

38. *Papilio levana* Linnaeus, 1758

In the collection of LSL, there is only one specimen of this species, which was designated by Honey & Scoble (2001: 343) as a lectotype. Again since it is a single specimen, its status must be treated as a holotype by monotypy.

39. *Papilio ligea* Linnaeus, 1758

There are three specimens of this species in LSL, a female (designated as a lectotype by Honey & Scoble (2001: 344)) and two males. Verity (1913: 183) concluded two specimens are for sure Linnean and third one is probably Linnean. Honey & Scoble (2001) decided all three specimens are Linnean. Thus, the type series contains a female lectotype and two male paralectotypes.

40. *Papilio lucina* Linnaeus, 1758

There are two specimens of this taxon in LSL which are without doubts Linnean. One of them is designated as a lectotype (Honey & Scoble 2001: 344). The second specimen is a paralectotype of this species.

41. *Papilio machaon* Linnaeus, 1758

The type material of this species is divided in two parts: two specimens (females) are deposited in LSL and another two (male and female) in UM. The lectotype has been designated from LSL (Honey & Scoble 2001: 345). There is no doubt about origin of Linnean specimens; thus the second female in LSL and both specimens in UM are paralectotypes.

42. *Papilio maera* Linnaeus, 1758

There are two pairs of this species with Linnean origin in the LSL collection (Verity 1913: 185; Honey & Scoble 2001: 345). One of them has been designated as a lectotype (Honey & Scoble 2001: 345). Thus, the status of these specimens is clear and the type series represent a lectotype and three paralectotypes.

43. *Papilio malvae* Linnaeus, 1758

The lectotype was designated by Honey & Scoble (2001: 345). There is no doubt that the type series of this species contains two specimens, so it contains a lectotype and paralectotype.

44. *Papilio maturna* Linnaeus, 1758

Two Linnean specimens are known from the LSL collection (male and female). The male specimen has been designated as a lectotype (Honey & Scoble 2001: 346). Thus, the type series contains a lectotype and paralectotype.

45. *Papilio megera* Linnaeus, 1767

There is only one specimen with Linnean origin in the LSL collection. It was designated as a lectotype by Honey & Scoble (2001: 346). Actually, because it is a single specimen of the type series, it is a holotype by monotypy.

46. *Papilio mnemosyne* Linnaeus, 1758

The type series contains three specimens: two females in LSL and one male in UM. One of the females has been designated as a lectotype (Honey & Scoble 2001: 351). There is a problem with the type locality of this species. Honey & Scoble (2001: 351) indicated it as "Finland: Tavastia" using a Linnaeus reference to the dissertation of Uddmann. I can conclude that it is impossible to prove that the specimens from the Linnean collection were collected by Uddmann. In this situation the assumption that Linnaeus collected his material himself is more logical. The type locality of this species, widely distributed in Europe, I consider to be the Åland Island which was visited by Linnaeus in one of his research trips.

47. *Papilio napi* Linnaeus, 1758

Only one specimen in LSL can be confidently identified as Linnean (Verity 1913: 177). All other specimens in this collection are not Linnean (Honey & Scoble 2001: 352). The second syntypic specimen is deposited in UM. Honey and Scoble (loc. cit.) excluded it from the type series based on that fact that this specimen was not listed in the first revision of the Catalogue of type specimens of the Uppsala University. But in the last revision of this Catalogue known to me (Wallin 2014: 30), it is present. With the lectotype designated by Honey & Scoble (2001: 352) from the LSL collection, the specimen in UM has paralectotype status.

48. *Papilio niobe* Linnaeus, 1758

There are two specimens from the Linnaeus collection in LSL. One of them was designated as a lectotype (Honey & Scoble 2001: 354). The second one is a paralectotype.

49. *Papilio palaeno* Linnaeus, 1761

There are three specimens of this species with surely Linnean origin and all are in LSL. The first specimen, bearing a Linnaeus label, was treated by Verity (1913: 179) as the North American *Colias alexandra* Edwards, 1863. Later (Grieshuber *et al*. 2012: 171) was shown that this is an aberrant specimen of *C. palaeno* which can be collected around Uppsala. No lectotype was selected, and due to the reason that the first syntypic specimen can be treated as a different species, it is strictly needed. So, I designate here a lectotype of *Papilio palaeno*, a male specimen with label "no label" deposited in LSL under the number LINN 0172. Both of the other two specimens are paralectotypes.

50. *Papilio pamphilus* Linnaeus, 1758

Two specimens of Linnean collection origin are found in LSL. The other specimens from the series of this species are additions by Smith. One of the Linnean specimens is designated as a lectotype (Honey & Scoble 2001: 358), so the second one is paralectotype.

51. *Papilio paphia* Linnaeus, 1758

The type series contain two males and one female; only one male is considered to be a Linnean specimen (Verity 1913: 183; Honey & Scoble 2001: 359). This specimen was designated as a lectotype (Honey & Scoble, 2001: 359). As the only specimen proven as Linnean, its status must be treated as holotype by monotypy.

52. *Papilio polychloros* Linnaeus, 1758

Three specimens are in LSL. Only one of them has all the characteristic features of Linnean material, so only one specimen represents the type series. The lectotype was designated by Honey & Scoble (2001: 368); in fact, this specimen is a holotype by monotypy.

53. *Papilio populi* Linnaeus, 1758

There are two Linnean specimens in LSL. One of them was designated by Honey & Scoble (2001: 371) as a lectotype. Thus the second one is a paralectotype.

54. *Papilio pruni* Linnaeus, 1758

The type series contains two specimens of two species. The first type series specimen is *pruni* and it was designated as a lectotype (Honey & Scoble 2001: 375). The second specimen was determined to be *Fixsenia ilicis* (Esper, 1779) (Verity 1913: 186). Thus, the lectotype status of the first specimen is correct.

55. *Papilio quercus* Linnaeus, 1758

There are five specimens: four in LSL (one of them designated as a lectotype by Honey & Scoble (2001: 376)) and one in MU. Only one specimen in LSL (designated as lectotype) is Linnean. A second Linnean specimen is stored in MU. Three other specimens in LSL are Smith additions. Thus, the status of the two Linnean specimens are lectotype and paralectotype.

56. *Papilio rapae* Linnaeus, 1758

According the data published by Honey & Scoble (2001: 377), only one specimen of this species is deposited in LSL (it was designated as a lectotype in the cited paper). Actually, there are three specimens of *rapae* in LSL (see Table 1) and all three are considered to be Linnean by presence of specific mold, style of mounting and pins. So, the type series contains not one but three specimens: a lectotype and two paralectotypes.

57. *Papilio rhamni* Linnaeus, 1758

The type series of this species in LSL contains four specimens (two males and two females). Only one male from this series is considered as Linnean. This specimen was designated by Honey & Scoble (2001: 377) as a lectotype. Since only one type specimen is present, it is not a lectotype but holotype by monotypy.

58. *Papilio rubi* Linnaeus, 1758

Verity (1913: 187) stated that only one specimen in the LSL series is Linnean and this specimen was designated as a lectotype (Honey & Scoble 2001: 378). In fact, it is a holotype by monotypy.

59. *Papilio semele* Linnaeus, 1758

There are five specimens in the type series. Two of them were considered to be Linnean and the specimen bearing the Linnaeus label was designated as a lectotype (Honey & Scoble

2001: 379). Three other specimens are considered to be Smith's additions. Actually, the male specimen pinned upside-down contains the specific mold and does not have any labels. Most likely this specimen is also Linnean. Thus, the type series contains a lectotype and two paralectotypes.

60. *Papilio sinapis* Linnaeus, 1758

The type series contain four males, but only one of them is considered to be Linnean. This male was designated as a lectotype (Honey & Scoble 2001: 380). Therefore, the status of this single type specimen is not a lectotype but holotype by monotypy.

61. *Papilio tages* Linnaeus, 1758

The series in LSL contains seven specimens with three of them considered to be Linnean. The first male in the series bearing a Linnaeus label designated as a lectotype (Honey & Scoble 2001: 382). Two others are paralectotypes.

62. *Papilio virgaureae* Linnaeus, 1758

The series in LSL contains six specimens. Three of them are considered to be Linnean. The lectotype of this species was designated by Honey & Scoble (2001: 391), so the type series contains a lectotype and two paralectotypes.

Discussion

Analysis of the type material for European butterflies established by Linnaeus shows that 18 out of 62 taxa require a change in the status of the types from lectotypes to holotypes by monotypy. For one taxon (*Papilio apollo*), the lectotype was not designated from a series of syntypes, which means that the designated lectotype loses the status of the primary type. Instead, I designate a lectotype of it from a series of syntypes deposited in UM. Besides *P. apollo*, the lectotypes of two other species are also designated. The status of the type material of the remaining 40 taxa did not change, since it was proven that their series consisted of syntypes.

The question is whether these nomenclatural changes are needed because Linnaeus is a kind of standard, the starting point of zoological systematics in its present form? The answer to this question is unequivocal: yes, they are necessary, and precisely because it is a standard. The status of type specimens of Linnaeus must be determined unambiguously, without errors and discrepancies.

Linnaeus did not describe the material on which his descriptions were based. Therefore, Honey & Scoble (2001) used references to other sources given by Linnaeus to determine the status of Linnaean specimens, type localities etc. It seems to me that the approach of Verity (1913) is more objective: describing the collection itself and determining the status of each specimen versus analyzing references, which are usually just references to earlier works of predecessors in which the taxon was mentioned before Linnaeus. The analysis of references cannot serve as unequivocal proof of the origin of the material. Moreover, it may eventually lead to erroneous conclusions.

In the case of this Linnaeus collection, everything is very clear. The collection has been fully preserved and is available for research. Accordingly, the research of nomenclatural issues related to the Linnaeus collection should not raise questions. The only problem that can arise when analyzing Linnean material is that it was mixed with the Smith collection in the

LSL. However, in the overwhelming majority of cases, this problem is easily solvable: to unambiguously determine the status of the specimen (Linnean or not), a combination of features is used: the style of mounting, pinning, labels, and characteristic mold.

Linnaeus' collections were very extensive for a scientist of his time. He was interested in all aspects of biology. He owned not only a collection of insects, but also an extensive herbarium, a collection of shells, ornithological materials, etc. Private collections of such size required a lot of storage space, so the number of specimens from one taxon was limited, usually to no more than two, less often three, but often to a single one. It is wrong to expect large series of the same species in Linnaeus' collection.

Linnaeus compiled a collection, like many scientists of his time, not only systematically, but also on an aesthetic principle. The largest and most beautiful species in his collection are usually represented by more than one specimen. The same applies to species with a sharply different coloration of the upper and under sides of the wings (in this case, there are usually two specimens in the collection, the first is pinned normally, and the second pinned upside-down). Species with sexual dimorphism are in the collection in pairs (male and female); in some cases, Linnaeus believed that butterflies of different sexes represented different species; the classic example is *Papilio janira* and *P. jurtina*. Small and medium-sized butterflies, which do not have a remarkable appearance or developed sexual dimorphism, are represented in the Linnaeus collection, with rare exceptions, by a single specimen.

The dependence of the size of the type series of European butterflies from the Linnean collection on color, size and sexual dimorphism is shown in Table 2. In total, I analyzed 62 taxa of European butterflies described by Linnaeus. Of these, 22.6% of taxa are large butterflies, 45.2% are medium and 32.2% are small. These 62 taxa are represented in the Linnaean collection by 124 specimens, an average of exactly 2 specimens per taxon. Of these: large butterflies are represented by 28 specimens (22.6% of specimens); medium by 58 specimens (46.8% of specimens) and small by 38 specimens (30.6% of specimens). The distribution of specimens almost coincides with the distribution of taxa in size for medium and small butterflies and completely coincides with that for large ones.

There are 3 species of butterflies with pronounced sexual dimorphism among the large species in the Linnaean collection, all of them represented by type series of 2 or 3 specimens. All large butterflies are brightly colored, with contrasting bands or sharp color transitions. All large species without sexual dimorphism are represented in the type series by a single specimen. The distribution of type material by the number of specimens in a series among large butterflies from the Linnaean collection is as follows: the only type specimen is represented by a series of 4 taxa (28.6% of large species), two specimens in the type series are present in 7 species (50.0% of large species), three specimens by 2 species (14.3% of large species) and one species is represented by 4 specimens in the type series (7.1% of large species). The type series of the following taxa have series of more than two specimens: *P. brassicae*, *P. machaon*, *P. mnemosyne*. These are either butterflies with pronounced sexual dimorphism and bright colors (*P. brassicae*, *P. mnemosyne*), or bright and beautiful butterflies (*P. machaon*).

Among medium sized butterflies (28 species), sexual dimorphism is well expressed in 12 species; all 12 species are presented in series of at least 2 specimens. A single specimen in the type series contains 10 medium-sized species (35.7% of medium-sized butterflies), 2 specimens in the type series are present in 9 medium-sized species (32.1% of medium-sized

butterflies). Type series of three specimens are presented in 5 species (20.8% of medium size butterflies); finally, 3 species have a type series of 4 specimens (11.4% of medium size butterflies). The most extensive type series are found in the following species of medium-sized butterflies in the Linnaean collection: *P. cardamines* (males with red apex of the front wings, females with black apex, both sexes with a very beautiful green stroke pattern on the under surface of the hind wing), *P. daplidice* (upperside with a beautiful contrasting black and white pattern, underside with beautiful green spots on the hind wing) and *P. maera* (butterflies with well-developed sexual dimorphism (males with extensive black androconial spots on the fore wing) and contrasting bright coloration of the underside of the wings).

Among small butterflies (20 species), sexual dimorphism is developed in 9 species (45.0% of small butterflies); all of them are presented in standard series of at least 2 specimens. The type series of three specimens is present in 3 species (15.0% of small species); a series of 4 specimens is present in only one species (5.0% of small butterflies). 7 species (35.0% of small butterflies) are represented by type series of a single specimen. All these species are rather ordinary-looking. Of the species with extensive type series, three are bright and beautiful (*P. betulae*, *P. comma*, *P. virgaureae*). The only species that stands out from this general trend is *P. tages*. It is rather inconspicuous, has no sexual dimorphism, but is represented in the Linnaeus collection by three specimens.

Thus, the following pattern is evident: Linnean butterflies with no pronounced sexual dimorphism and bright and contrasting coloration are represented in most cases by a single type specimen. The largest, brightest and most beautiful butterflies in the Linnaeus collection have type series of a larger size (up to 4 specimens). There are no series of 5 or more specimens for European butterflies in the Linnean collection.

Table 1. European butterflies deposited in LSL and UM and their status

Specimen number	Collection	Mold	Linnaeus label	Smith's label	Sex	Specimen status by Honey & Scoble	Specimen status by features	Real status of specimen
Papilio adippe Linnaeus, 1767								
LINN 0392 (*niobe*)	LSL	Yes	Yes	Yes	♀	-	Type	-
LINN 0393	LSL	Yes	No	No	♂	-	Type	-
LINN 0394	LSL	Yes	No	Yes	♂	-	No type	-
LINN 0395	LSL	No	No	Yes	♂	-	No type	-
LINN 0396	LSL	No	No	Yes	♀	-	No type	-
LINN 0397	LSL	No	No	Yes	♂	-	No type	-
LINN 0398	LSL	Yes	No	Yes	♂	-	No type	-
LINN 0399	LSL	Yes	No	Yes	♀	-	No type	-
Papilio aglaja Linnaeus, 1758								
LINN 0387	LSL	Yes	Yes	Yes	♀	LT	Type	HT
LINN 0388	LSL	Yes	No	Yes	♂	-	No type	-
LINN 0389	LSL	Yes	No	Yes	♂	-	No type	-
LINN 0390	LSL	Yes	No	Yes	♂	-	No type	-

Continued Table 1.

Specimen number	Collection	Mold	Linnaeus label	Smith's label	Sex	Specimen status by Honey & Scoble	Specimen status by features	Real status of specimen
LINN 0391	LSL	Yes	No	Yes	♂	-	No type	-
Papilio antiopa Linnaeus, 1758								
LINN 0317	LSL	Yes	Yes	No	♀	LT	Type	LT
LINN 0318	LSL	Yes	No	No	♂	-	Type	PLT
LINN 0319	LSL	Yes	No	Yes	♀	-	No type	-
Papilio apollo Linnaeus, 1758								
LINN 090	LSL	No	No	Yes	♂	LT	No type	-
LINN 091	LSL	No	No	No	♀	-	No type	-
LINN 092	LSL	No	No	No	♂	-	No type	-
LINN 1881	LSL	No	No	No	♀	-	No type	-
1978	UM	No	No	No	♀	-	Type	ST
1979	UM	No	No	No	♂	-	Type	ST
Papilio arcania Linnaeus, 1761								
LINN 0464	LSL	No	Yes	Yes	♂	LT	Type	LT
LINN 0465	LSL	No	No	No	♂	-	Type	PLT
LINN 0466	LSL	No	No	Yes	♂	-	No type	-
Papilio argiolus Linnaeus, 1758								
LINN 0449	LSL	No	Yes	Yes	♀	LT	Type	LT
LINN 0450	LSL	No	No	No	♂	-	Type	PLT
LINN 0451	LSL	No	No	Yes	♂	-	No type	-
LINN 0452	LSL	No	No	Yes	♂	-	No type	-
LINN 0453	LSL	No	No	Yes	♀	-	No type	-
Papilio argus Linnaeus, 1758								
LINN 0440	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0441	LSL	Yes	No	No	♂	-	Type	PLT
LINN 0442	LSL	No	No	Yes	♂	-	No type	-
LINN 0443	LSL	No	No	Yes	♂	-	No type	-
LINN 0444	LSL	No	No	Yes	♀	-	No type	-
Papilio arion Linnaeus, 1758								
LINN 0437	LSL	No	Yes	Yes	♀	LT	Type	LT
LINN 0438	LSL	Yes	No	No	♀	-	Type	PLT
Papilio atalanta Linnaeus, 1758								
LINN 0339	LSL	Yes	Yes	Yes	?	LT	Type	HT
LINN 0340	LSL	No	No	Yes	♀	-	No type	-
Papilio belia Linnaeus, 1767								
LINN 0145	LSL	Yes	Yes	Yes	♀	LT	Type	LT

Continued Table 1.

Specimen number	Collection	Mold	Linnaeus label	Smith's label	Sex	Specimen status by Honey & Scoble	Specimen status by features	Real status of specimen
LINN 0146	LSL	Yes	No	No	♀	-	Type	PLT
Papilio betulae Linnaeus, 1758								
LINN 0418	LSL	No	Yes	Yes	♀	LT	Type	LT
LINN 0419	LSL	Yes	No	No	♂	-	Type	PLT
LINN 0420	LSL	Yes	No	No	♀	-	Type	PLT
LINN 0421	LSL	Yes	No	No	♂	-	Type	PLT
LINN 0422	LSL	No	No	Yes	♀	-	No type	-
Papilio boeticus Linnaeus, 1767								
LINN 0429	LSL	No	No	Yes	♂	-	No type	-
LINN 0430	LSL	No	No	No	♀	LT	Type	HT
LINN 0431	LSL	No	No	Yes	♀	-	No type	-
LINN 0432	LSL	No	No	Yes	♀	-	No type	-
Papilio brassicae Linnaeus, 1758								
LINN 0126	LSL	No	Yes	Yes	♂	LT	Type	LT
LINN 0127	LSL	No	No	Yes	♀	-	No type	-
2060	UM	No	Yes	No	♂	-	Type	PLT
2061	UM	No	No	No	♂	-	Type	PLT
Papilio briseis Linnaeus, 1764								
LINN 0249	LSL	Yes	Yes	Yes	♀	LT	Type	LT
LINN 0250	LSL	Yes	No	No	♂	-	Type	PLT
LINN 0251	LSL	No	No	Yes	♂	-	No type	-
Papilio c-album Linnaeus, 1758								
LINN 0325	LSL	Yes	Yes	Yes	♀	LT	Type	LT
LINN 0324	LSL	No	No	Yes	♀	-	No type	-
LINN 0327	LSL	No	No	Yes	♂	-	No type	-
LINN 0328	LSL	Yes	No	Yes	?	-	No type	-
-	De Geer	No	No	No	♀	-	Type	PLT
Papilio cardamines Linnaeus, 1758								
LINN 0147	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0148	LSL	Yes	No	No	♀	-	Type	PLT
LINN 0149	LSL	Yes	No	No	♀	-	No type	PLT
LINN 0150	LSL	Yes	No	No	♂	-	No type	PLT
Papilio cardui Linnaeus, 1758								
LINN 0299	LSL	Yes	Yes	Yes	♂	LT	Type	HT

Continued Table 1.

Specimen number	Collection	Mold	Linnaeus label	Smith's label	Sex	Specimen status by Honey & Scoble	Specimen status by features	Real status of specimen
LINN 0300	LSL	No	No	Yes	?	-	No type	-
LINN 0301	LSL	No	No	Yes	♂	-	No type	-
LINN 0302	LSL	No	No	Yes	♂	-	No type	-
LINN 0303	LSL	No	No	Yes	?	-	No type	-
Papilio chrysippus Linnaeus, 1758								
LINN 0209	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0210	LSL	Yes	No	Yes	♂	-	No type	-
LINN 0211	LSL	No	No	Yes	?	-	No type	-
1926	UM	No	No	No	♂	-	Type	PLT
Papilio cinxia Linnaeus, 1758								
LINN 0373	LSL	Yes	Yes	Yes	♀	LT	Type	HT
LINN 0374	LSL	No	No	Yes	♂	-	No type	-
LINN 0375	LSL	No	No	Yes	♀	-	No type	-
LINN 0376	LSL	No	No	Yes	♂	-	No type	-
Papilio cleopatra Linnaeus, 1767								
LINN 0187	LSL	No	Yes	Yes	♂	LT	Type	LT
LINN 0188	LSL	Yes	No	No	♂	-	Type	PLT
LINN 0189	LSL	No	No	Yes	♂	-	No type	-
LINN 0190	LSL	No	No	Yes	♂	-	No type	-
2062	UM	No	Yes	No	♀	-	Type	PLT
Papilio comma Linnaeus, 1758								
LINN 0486	LSL	No	Yes	Yes	♂	LT	Type	LT
LINN 0487	LSL	Yes	No	No	♀	-	Type	PLT
LINN 0488	LSL	Yes	No	No	♂	-	Type	PLT
Papilio crataegi Linnaeus, 1758								
LINN 0121	LSL	Yes	Yes	Yes	♂	LT	Type	HT
LINN 0122	LSL	Yes	No	Yes	♂	-	No type	-
Papilio daplidice Linnaeus, 1758								
LINN 0142	LSL	Yes	Yes	Yes	♀	LT	Type	LT
LINN 0143	LSL	Yes	No	No	♂	-	Type	PLT
LINN 0144	LSL	Yes	No	No	♀	-	Type	PLT
2063	UM	No	No	No	♂	-	Type	PLT
Papilio dejanira Linnaeus, 1764								
LINN 0291	LSL	No	Yes	Yes	♂	-	Type	HT
1977	UM	No	No	No	?	-	?	?

Continued Table 1.

Specimen number	Collection	Mold	Linnaeus label	Smith's label	Sex	Specimen status by Honey & Scoble	Specimen status by features	Real status of specimen
Papilio electo Linnaeus, 1763								
LINN 0178	LSL	No	Yes	Yes	♂	LT	Type	LT
LINN 0179	LSL	No	No	No	♂	-	Type	PLT
LINN 0180	LSL	No	No	Yes	♂	-	No type	-
LINN 0181	LSL	No	No	Yes	♂	-	No type	-
LINN 0182	LSL	No	No	Yes	♂	-	No type	-
Papilio euphrosyne Linnaeus, 1758								
LINN 0404	LSL	Yes	Yes	Yes	♂	LT	Type	HT
LINN 0405	LSL	No	No	No	♂	-	No type	-
LINN 0406	LSL	Yes	No	Yes	♂	-	No type	-
LINN 0407	LSL	Yes	No	Yes	♀	-	No type	-
Papilio galathea Linnaeus, 1758								
LINN 0272	LSL	Yes	Yes	Yes	♀	LT	Type	LT
LINN 0273	LSL	No	No	Yes	♂	-	No type	-
LINN 0274	LSL	No	No	Yes	♂	-	No type	-
LINN 0275	LSL	No	No	Yes	♂	-	No type	-
LINN 0276	LSL	No	No	Yes	♂	-	No type	-
2065	UM	No	No	No	♂	-	Type	PLT
Papilio hermione Linnaeus, 1764								
LINN 0282	LSL	Yes	Yes	Yes	?	LT	Type	LT
LINN 0283	LSL	Yes	No	No	?	-	Type	PLT
Papilio hero Linnaeus, 1761								
LINN 0481	LSL	No	Yes	Yes	♂	LT	Type	HT
Papilio hippothoe Linnaeus, 1761								
LINN 0479	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0480	LSL	Yes	No	No	♂	-	Type	PLT
Papilio hyale Linnaeus, 1758								
LINN 0174	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0175	LSL	Yes	No	No	♂	-	Type	PLT
LINN 0176	LSL	Yes	No	No	♀	-	Type	PLT
LINN 0177 (*philodice*)	LSL	No	No	Yes	♂	-	No type	-
Papilio hyperantus Linnaeus, 1758								
LINN 0224	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0225	LSL	Yes	No	No	♀	-	Type	PLT
LINN 0226	LSL	No	No	Yes	♂	-	No type	-
LINN 0227	LSL	No	No	Yes	♂	-	No type	-

Continued Table 1.

Specimen number	Collection	Mold	Linnaeus label	Smith's label	Sex	Specimen status by Honey & Scoble	Specimen status by features	Real status of specimen
Papilio idas Linnaeus, 1761								
LINN 0445	LSL	No	Yes	No	♀	-	US	ST
LINN 0446	LSL	No	No	No	♀	-	US	ST
Papilio janira Linnaeus, 1758								
LINN 0295	LSL	Yes	Yes	Yes	♂	LT	Type	HT
LINN 0296	LSL	No	No	Yes	♂	-	No type	-
LINN 0297	LSL	No	No	Yes	♂	-	No type	-
LINN 0298	LSL	No	No	Yes	♂	-	No type	-
Papilio jasius Linnaeus, 1767								
LINN 0050	LSL	Yes	No	Yes	♂	LT	Type	LT
LINN 0051	LSL	Yes	Yes	No	♀	-	Type	PLT
Papilio jurtina Linnaeus, 1758								
LINN 0292	LSL	Yes	Yes	Yes	♀	LT	Type	HT
LINN 0293	LSL	No	No	Yes	♀	-	No type	-
LINN 0294	LSL	No	No	Yes	♀	-	No type	-
Papilio lathonia Linnaeus, 1758								
LINN 0400	LSL	Yes	Yes	Yes	♂	LT	Type	HT
LINN 0401	LSL	No	No	No	♂	-	No type	-
LINN 0402	LSL	No	No	Yes	♂	-	No type	-
LINN 0403	LSL	No	No	Yes	?	-	No type	-
Papilio levana Linnaeus, 1758								
LINN 0366	LSL	Yes	Yes	Yes	♂	LT	Type	HT
Papilio ligea Linnaeus, 1758								
LINN 0266	LSL	Yes	Yes	Yes	♀	LT	Type	LT
LINN 0267	LSL	Yes	No	No	♂	-	Type	PLT
LINN 0268	LSL	Yes	No	No	♂	-	Type	PLT
Papilio lucina Linnaeus, 1758								
LINN 0368	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0369	LSL	Yes	No	No	♂	-	Type	PLT
LINN 0370	LSL	Yes	No	Yes	♂	-	No type	-
Papilio machaon Linnaeus, 1758								
LINN 0058	LSL	No	Yes	Yes	♀	LT	Type	LT
LINN 0059	LSL	No	No	No	♀	-	Type	PLT
LINN 0060	LSL	No	No	Yes	♀	-	No type	-
2068	UM	No	Yes	No	♀	-	Type	PLT
2069	UM	No	No	No	♂	-	Type	PLT

Continued Table 1.

Specimen number	Collection	Mold	Linnaeus label	Smith's label	Sex	Specimen status by Honey & Scoble	Specimen status by features	Real status of specimen
Papilio maera Linnaeus, 1758								
LINN 0253	LSL	Yes	Yes	Yes	♀	LT	Type	LT
LINN 0254	LSL	Yes	No	No	♂	-	Type	PLT
LINN 0255	LSL	Yes	Yes	Yes	♀	-	Type	PLT
LINN 0256	LSL	Yes	No	No	♂	-	Type	PLT
Papilio malvae Linnaeus, 1758								
LINN 0505	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0506	LSL	Yes	No	No	♀	-	Type	PLT
LINN 0507	LSL	No	No	Yes	♂	-	No type	-
LINN 0508	LSL	No	No	Yes	♂	-	No type	-
Papilio maturna Linnaeus, 1758								
LINN 0371	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0372	LSL	Yes	No	No	♀	-	Type	PLT
Papilio megera Linnaeus, 1767								
LINN 0257	LSL	Yes	Yes	Yes	♀	LT	Type	HT
LINN 0258	LSL	No	No	Yes	♂	-	No type	-
LINN 0259	LSL	No	No	Yes	♂	-	No type	-
LINN 0260	LSL	No	No	Yes	♀	-	No type	-
LINN 0261	LSL	No	No	Yes	♂	-	No type	-
Papilio mnemosyne Linnaeus, 1758								
LINN 0093	LSL	Yes	Yes	Yes	♀	LT	Type	LT
LINN 0094	LSL	Yes	No	No	♀	-	Type	PLT
2071	UM	No	No	No	♂	-	Type	PLT
Papilio napi Linnaeus, 1758								
LINN 0131	LSL	Yes	Yes	Yes	♂	LT	Type	HT
LINN 0132	LSL	No	No	Yes	♀	-	No type	-
LINN 0133	LSL	No	No	No	♀	-	No type	-
2072	UM	No	No	No	♂	-	No type	-
Papilio niobe Linnaeus, 1758								
LINN 0408	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0409	LSL	Yes	Yes	No	♂	-	Type	PLT
Papilio palaeno Linnaeus, 1760								
LINN 0171	LSL	Yes	Yes	Yes	♂	-	Type	ST
LINN 0172	LSL	Yes	No	No	♂	-	Type	ST

Continued Table 1.

Specimen number	Collection	Mold	Linnaeus label	Smith's label	Sex	Specimen status by Honey & Scoble	Specimen status by features	Real status of specimen
LINN 0173	LSL	Yes	No	No	♀	-	Type	ST
Papilio pamphilus Linnaeus, 1758								
LINN 0460	LSL	No	Yes	Yes	♂	LT	Type	LT
LINN 0461	LSL	No	No	No	♂	-	Type	PLT
LINN 0462	LSL	No	No	Yes	♂	-	No type	-
LINN 0463	LSL	No	No	Yes	♂	-	No type	-
Papilio paphia Linnaeus, 1758								
LINN 0384	LSL	Yes	Yes	Yes	♂	LT	Type	HT
LINN 0385	LSL	No	No	Yes	♂	-	No type	-
LINN 0386	LSL	No	No	Yes	♀	-	No type	-
Papilio polychloros Linnaeus, 1758								
LINN 0320	LSL	Yes	Yes	Yes	?	LT	Type	HT
LINN 0321	LSL	No	No	Yes	♀	-	No type	-
LINN 0322	LSL	No	No	Yes	?	-	No type	-
Papilio populi Linnaeus, 1758								
LINN 0313	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0314	LSL	Yes	No	No	♀	-	Type	PLT
LINN 0315	LSL	No	No	Yes	♂	-	No type	-
Papilio pruni Linnaeus, 1758								
LINN 0423	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0424 (*ilicis*)	LSL	Yes	No	No	♀	-	Type	-
Papilio quercus Linnaeus, 1758								
LINN 0425	LSL	No	Yes	Yes	♀	LT	Type	LT
LINN 0426	LSL	No	No	Yes	♀	-	No type	-
LINN 0427	LSL	No	No	Yes	♂	-	No type	-
LINN 0428	LSL	No	No	Yes	♂	-	No type	-
1956	UM	No	Yes	No	♂	-	Type	PLT
Papilio rapae Linnaeus, 1758								
LINN 0128	LSL	Yes	Yes	Yes	♂	LT	Type	LT
LINN 0129	LSL	Yes	No	No	♀	-	Type	PLT
LINN 0130	LSL	Yes	No	No	♀	-	Type	PLT
Papilio rhamni Linnaeus, 1758								
LINN 0191	LSL	No	Yes	Yes	♂	LT	Type	HT
LINN 0192	LSL	No	No	Yes	♂	-	No type	-
LINN 0193	LSL	No	No	Yes	♀	-	No type	-

Continued Table 1.

Specimen number	Collection	Mold	Linnaeus label	Smith's label	Sex	Specimen status by Honey & Scoble	Specimen status by features	Real status of specimen
LINN 0194	LSL	No	No	No	♂	-	No type	-
Papilio rubi Linnaeus, 1758								
LINN 0455	LSL	No	Yes	Yes	♀	LT	Type	HT
LINN 0456	LSL	No	No	Yes	♀	-	No type	-
LINN 0457	LSL	No	No	Yes	♀	-	No type	-
LINN 0458	LSL	No	No	Yes	♂	-	No type	-
Papilio semele Linnaeus, 1758								
LINN 0277	LSL	Yes	Yes	Yes	♀	LT	Type	PT
LINN 0278	LSL	Yes	No	No	♀	-	Type	PLT
LINN 0279	LSL	No	No	Yes	♂	-	No type	-
LINN 0280	LSL	Yes	No	No	♂	-	?	?PLT
LINN 0281	LSL	No	No	Yes	♀	-	No type	-
Papilio sinapis Linnaeus, 1758								
LINN 0136	LSL	Yes	Yes	Yes	♂	LT	Type	HT
LINN 0137	LSL	No	No	Yes	♂	-	No type	-
LINN 0138	LSL	No	No	Yes	♂	-	No type	-
LINN 0139	LSL	No	No	No	♂	-	No type	-
Papilio tages Linnaeus, 1758								
LINN 0509	LSL	No	Yes	Yes	♂	LT	Type	LT
LINN 0510	LSL	No	No	No	♂	-	Type	PLT
LINN 0511	LSL	No	No	No	♂	-	Type	PLT
LINN 0512	LSL	No	No	Yes	♂	-	No type	-
LINN 0513	LSL	No	No	Yes	♂	-	No type	-
LINN 0514	LSL	No	No	Yes	♀	-	No type	-
LINN 0515	LSL	No	No	Yes	♀	-	No type	-
Papilio virgaureae Linnaeus, 1758								
LINN 0473	LSL	No	Yes	Yes	♂	LT	Type	LT
LINN 0474	LSL	No	No	No	♂	-	Type	PLT
LINN 0475	LSL	No	No	No	♂	-	Type	PLT
LINN 0476	LSL	No	No	Yes	♂	-	No type	-
LINN 0477	LSL	No	No	Yes	♀	-	No type	-
LINN 0478	LSL	No	No	Yes	♀	-	No type	-

Table 2. External conditions of Linnean butterfly material and its allocation by type series size

N	Species name	Sexual dimorphism	Wing pattern beauty	Type series size
Big size				
1	*Papilio antiopa*	No	Yes	2
2	*P. apollo*	No	Yes	2
3	*P. atalanta*	No	Yes	1
4	*P. brassicae*	Yes	Yes	3
5	*P. briseis*	No	Yes	2
6	*P. cardui*	No	Yes	1
7	*P. chrysippus*	No	Yes	2
8	*P. hermione*	No	Yes	2
9	*P. jasius*	No	Yes	2
10	*P. machaon*	No	Yes	4
11	*P. mnemosyne*	Yes	Yes	3
12	*P. paphia*	No	Yes	1
13	*P. polychloros*	No	Yes	1
14	*P. populi*	Yes	Yes	2
Medium size				
1	*Papilio adippe*	Yes	No	2
2	*P. aglaja*	No	No	1
3	*P. arion*	Yes	Yes	2
4	*P. belia*	No	No	2
5	*P. c-album*	No	Yes	2
6	*P. cardamines*	Yes	Yes	4
7	*P. cinxia*	No	No	1
8	*P. cleopatra*	Yes	Yes	3
9	*P. crataegi*	No	No	1
10	*P. daplidice*	No	Yes	4
11	*P. dejanira*	No	No	1
12	*P. electo*	Yes	Yes	2
13	*P. galathea*	No	Yes	2
14	*P. hyale*	Yes	Yes	3
15	*P. hyperantus*	No	No	2
16	*P. janira*	No	No	1
17	*P. jurtina*	No	No	1
18	*P. lathonia*	No	No	1
19	*P. ligea*	No	Yes	3
20	*P. maera*	Yes	No	4
21	*P. maturna*	No	Yes	2

Continued Table 2.

N	*Species name*	Sexual dimorphism	Wing pattern beauty	Type series size
22	*P. megera*	No	No	1
23	*P. napi*	No	No	1
24	*P. niobe*	Yes	No	2
25	*P. palaeno*	Yes	Yes	3
26	*P. rapae*	Yes	No	3
27	*P. rhamni*	Yes	No	1
28	*P. semele*	Yes	Yes	3
Small size				
1	*Papilio arcania*	Yes	Yes	2
2	*P. argiolus*	Yes	Yes	2
3	*P. argus*	Yes	Yes	2
4	*P. betulae*	Yes	Yes	4
5	*P. boeticus*	No	Yes	1
6	*P. comma*	Yes	Yes	3
7	*P. euphrosyne*	No	No	1
8	*P. hero*	No	No	1
9	*P. hippothoe*	Yes	Yes	2
10	*P. idas*	Yes	Yes	2
11	*P. levana*	No	No	1
12	*P. lucina*	No	Yes	2
13	*P. malvae*	No	Yes	2
14	*P. pamphilus*	No	No	2
15	*P. pruni*	No	No	1
16	*P. quercus*	Yes	Yes	2
17	*P. rubi*	No	No	1
18	*P. sinapis*	No	No	1
19	*P. tages*	No	No	3
20	*P. virgaureae*	Yes	Yes	3

References

Borkin LY. 2009. Carl Linnaeus (1707–1778) as a zoologist. *Proceedings of the Zoological Institute of the Russian Academy of Sciences*, 1(supplement): 9–78.

Corbet AS & Pendlebury HM. 1956. *The Butterflies of the Malay Peninsula*. Second edition. Oliver & Boyd, Edinburgh, 537 pp.

Fitton M & Harman K. 2007. The 'Linnean' insect collection. *The Linnean Special Issue*, 7: 47–58.

Geiger H, Descimon H & Scholl A. 1988. Evidence for speciation within nominal *Pontia daplidice* (Linnaeus, 1758) in southern Europe (Lepidoptera: Pieridae). *Nota Lepidopterologica*, 11: 7–20.

Grieshuber J, Worthy B & Lamas G. 2012. *The Genus* Colias *Fabricius, 1807. Jan Haugum's Annotated Catalogue of the Old World* Colias (*Lepidoptera, Pieridae*). Tshikolovets Publications, Pardubice, 438 pp.

Hemming F. 1942. On the correct name of the species commonly known as *Argynnis aglaja* (Linnaeus, 1758) (Lep. Nymphalidae) and matters incidental thereto. *Proceedings of the Royal Entomological Society of London*, (B)11: 155–160. DOI: 10.1111/j.1365-3113.1942.tb00715.x

Honey MR & Scoble MJ. 2001. Linnaeus's butterflies (Lepidoptera: Papilionoidea and Hesperioidea). *Zoological Journal of the Linnean Society*, 132: 277–399. DOI: 10.1111/j.1096-3642.2001.tb01326.x

Jackson BD 1913. Catalogue of the Linnean specimens of Amphibia, Insecta and Testacea, noted by Carl von Linné. *Proceedings of the Linnean Society of London*, 125(supplement): 1–48. DOI: 10.1111/j.1095-8312.1912.tb01434a.x

Korb SK. 2020. An annotated checklist of the tribus Parnassiini sensu Korshunov of the Old World (Lepidoptera, Papilionidae). *Acta Biologica Sibirica*, 6: 59–86. DOI: 10.3897/abs.6.e53717

Kudrna O. 1977. *A revision of the genus Hipparchia Fabricius*. Classey, Farington, 300 pp.

Mikkola K & Honey MFL. 1993. The Noctuoidea (Lepidoptera) described by Linnaeus. *Zoological Journal of the Linnean Society*, 108: 103–169. DOI: 10.1111/j.1096-3642.1993.tb00292.x

Porter AH, Wenger R, Geiger H, Scholl A & Shapiro AM. 1997. The *Pontia daplidice-edusa* hybrid zone in north western Italy. *Evolution*, 51: 1561–1573. DOI: 10.2307/2411208

Vane-Wright RI. 2007. Linnaeus' butterflies. *The Linnean Special Issue*, 7: 59–74.

Verity R. 1913. Revision of the Linnean types of Palaearctic Rhopalocera. *Journal of the Linnean Society*, 32: 173–191. DOI: 10.1111/j.1096-3642.1913.tb02409.x

Wagener S. 1988. What are the valid names for the two genetically different taxa currently included within *Pontia daplidice* (Linnaeus, 1758)? (Lepidoptera: Pieridae). *Nota Lepidopterologica*, 11: 21–38.

Wallin L. 1992. Linnaean specimens in the Zoological Museum of Uppsala University. *Archives of Natural History*, 19(2): 219–230. DOI: 10.3366/anh.1992.19.2.219

Wallin L. 2014. *Catalogue of Type Specimens. 4. Linnean Specimens*. Uppsala University, Uppsala, 128 pp.