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Source: The Journal of the Lepidopterists' Society, 64(2) : 79-90

Published By: The Lepidopterists' Society

URL: https://doi.org/10.18473/lepi.v64i2.a3

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Journal of the Lepidopterists' Society
64(2), 2010,79–90

AFFIRMATION OF THE NAME *PAPILIO HYLLUS* CRAMER (LYCAENIDAE) FOR A NEARCTIC BUTTERFLY, WITH THE DESIGNATION OF A NEOTYPE

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ABSTRACT. Since its description *Papilio hyllus* Cramer, 1775 has been linked to at least five lycaenine and thecline species of butterflies. Although most authors now consider *P. hyllus* to represent the same Nearctic species subsequently described as *Polyommatus thoe* Guérin-Méneville, [1832], some consider it to represent the Palearctic species described as *Papilio thersamon* Esper, 1784. For over three decades the name *Lycaena hyllus* has been employed for the Nearctic species, but the identity of *Papilio hyllus* remains contentious. The original watercolor drawings of Cramer's illustrated type specimen indicate that *P. hyllus* is a senior subjective synonym of *P. thoe*. A connection between the English entomologist Dru Drury (1725-1804) and the Dutch naturalist Hans Willem (Baron) Rengers (1722–1786) suggests that the illustrated type specimen of *P. hyllus* was collected by Thomas James in New York. A neotype is designated to objectively define the nominal species *Papilio hyllus*.

Additional key words: Dru Drury, Thomas James, William Jones, Hans Willem Rengers, *Papilio thersamon*, *Polyommatus thoe*

Papilio hyllus Cramer was described in 1775 by the Dutch naturalist Pieter Cramer (1721–1776) in his multivolume work (completed by Casper Stoll) entitled, *De Uitlandsche Kapellen Voorkomende in de Drei Waereld-deelen Asia, Africa en America / Papillon Exotiques des Trios Parties du Monde L'Asie, L'Afrique et L'Amerique* [The Foreign Butterflies Occurring in the Three Parts of the World: Asia, Africa and America]. A brief written description (in Dutch and French) accompanied illustrations of a female specimen, which is now believed to be lost or unrecognizable. The type locality was reported to be "Smirna" or "Smirne," implying Smyrna (now İsmir) in western Turkey. Despite this reference, Brown & Field (1970) revived an earlier proposal by Butler (1869, 1899) that *P. hyllus* is a senior subjective synonym of *Polyommatus thoe* Guérin-Méneville, [1832], a name applied to a Nearctic lycaenine "copper" butterfly. This synonymy was generally accepted. For over three decades the name *Lycaena hyllus* has been employed for the Nearctic species. However, Koçak (1983) suggested that *Papilio hyllus* is synonymous with a Palearctic species described as *Papilio thersamon* Esper, 1784, which is now recognized as *Lycaena thersamon*. This synonymy was questioned by Kudrna (1986), who argued that the published description and illustration of *P. hyllus* are inadequate to identify the species. Nonetheless, other Palearctic authors (e.g. Ebert & Rennwald 1991, Tuzov 1993) also associated *thersamon* with *hyllus*, but maintained the name of *thersamon* for that species. Koçak & Kemal (2007) reinforced this usage.

This uncertainty has prompted some recent American authors to question the identity of *Papilio hyllus*. Bridges (1989) stated, "I accept the view of Koçak that *hyllus* is a European species…and is the same as *thersamon* Esper." Opler & Warren (2006) noted that the name *hyllus* "appears to be a *nomen dubium*." Pelham (2008) agreed that *P. hyllus* "is arguably a *nomen dubium*," but added, "stability seems best served by maintaining the name *hyllus*." The taxonomic status of *P. hyllus* remains unresolved.

Previous studies of *Papilio hyllus* focused exclusively on its published description and accompanying illustrations. However, investigations of problematic Cramerian taxa must include the original drawings that were copied for Cramer's illustrations. These renderings are typically more accurate than the published reproductions (Chainey 2005; Calhoun 2007). The taxonomic importance of original drawings was demonstrated by Edwards (1978) and Calhoun (2003, 2004, 2006, 2007). As Hemming (1937) observed, "…it sometimes happens that the identity of a specimen figured is open to doubt. It is therefore of importance to ascertain as far as possible the present whereabouts of such of the original drawings for these figures as are still extant, for it often happens that doubts regarding the identity of a specimen figured may be readily resolved, if the original drawing is available for study." As part of the present investigation, the original drawings of *P. hyllus* were consulted for the first time.

METHODS

The original Dutch and French descriptions of *Papilio hyllus* in Cramer (1775) were translated into English and the accompanying illustrations were analyzed. The original drawing for Cramer's Plate 43 was located in The Natural History Museum, London (BMNH), and digital photographs were obtained. The figures of *P. hyllus* were carefully compared with specimens of *Lycaena thersamon* and the Nearctic species described

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as *Polyommatus thoe*. Relevant specimens were sought in the following collections: the Hunterian Museum (HMUG) (University of Glasgow), Glasgow, Scotland; the McGuire Center for Lepidoptera and Biodiversity (Florida Museum of Natural History) (MGCL), Gainesville, Florida; the Museum of Comparative Zoology (MCZ) (Harvard University), Cambridge, Massachusetts; The Natural History Museum (BMNH), London, England; the National Museum of Natural History (Smithsonian Institution) (USNM), Washington, D.C.; the Nationaal Natuurhistorisch Museum (Naturalis) (RMNH), Leiden, Netherlands; and the Zoological Museum of Amsterdam (Amsterdam University) (ZMAN), Amsterdam, Netherlands. Illustrations that accompanied the original descriptions of *Papilio thersamon* and *Polyommatus thoe* were studied. Images of additional pertinent manuscripts, including the collection catalog of Dru Drury and watercolor drawings by William Jones ("Jones' Icones"), were acquired from the Hope Library of Entomology (Oxford University Museum of Natural History) (OUMNH), Oxford, England. Transcripts of letters written by Dru Drury were obtained from BMNH.

RESULTS

Historical background. The type locality of *Papilio hyllus* implied Smyrna, Turkey, which led subsequent authors to assume that this species was Palearctic. The first was Fabricius ([1777], 1781b, 1787, 1793), who listed the name *Papilio hylla* and considered it to be synonymous with *Papilio hyllus* Cramer. Fabricius ascribed the species to "Oriente," a reference to Asia-Minor where Smyrna (i.e. Turkey) is located. Although Fabricius listed *P. hylla* pursuant to Cramer (1775), he probably applied it to actual specimens. During several visits to London, Fabricius arranged and curated the insect collection of William Hunter (1718–1783), a Scottish anatomist and physician who assembled diverse natural history collections that are now preserved in HMUG (Brock 1980; Hancock 2005; Douglas & Hancock 2007). Hunter's insect collection contains two female specimens of *Lycaena tityrus* (Poda), which are identified on an associated cabinet label as "Pap. Hylla" (Fig. 18). The label cites the source of the name as "Fabr. page 106 N^{o} 466," corresponding to the listing of *Papilio hylla* in Fabricius (1781b). Although the handwriting on the label is not consistent with that of Fabricius, he is most likely responsible for the identification of these specimens (E. G. Hancock pers comm.). Unaware of this determination, Godart ([1824]) wondered if *P. hyllus* was a form of *Papilio hippothoe* L. (=*Lycaena hippothoe*). Fifty years later, Scudder (1876) suggested that *P. hyllus* represented an Old World species of *Axiocerses* Hübner and that its type locality was "probably given correctly by Cramer." Brown & Field (1970) assumed that Scudder must have meant *Papilio perion* Cramer, now considered to be a synonym of the African species *Axiocerses harpax* (F.). However, Scudder's concept of *Axiocerses* was likely in accord with Kirby (1871), who listed 16 thecline taxa in this genus, most of which now reside within other African genera that include butterflies reminiscent of the Lycaeninae. In fact, species of the genera *Aloeides* Hübner and *Chrysoritis* Butler are also known as "coppers" (Williams 1994).

Another possibility emerged when the Nearctic species *Polyommatus thoe* was named and illustrated by Guérin-Méneville ([1832]) (Fig. 9). This species was shortly thereafter illustrated by Gray (1832) and Boisduval & Le Conte ([1835]) (Fig. 8). The illustration in Gray (1832) was a modified version of that in Guérin-Méneville ([1832]), who credited the species' name to "Boisd." [Boisduval]. The French entomologist Jean B. A. D. de Boisduval (1801–1879) used many manuscript names that were later "borrowed" by other entomologists. In 1835, Boisduval wrote of *P. thoe*, "We have already given the figure of this rare and beautiful species in the *Iconographie du Règne Animal* of Mr. Guérin; but its description has nowhere yet been published to our knowledge" (translation from French) (Boisduval & Le Conte [1835]). It is conceivable that Guérin-Méneville borrowed the illustrated type specimen of *P. thoe* from Boisduval's collection and respectfully assigned it the owner's manuscript name. For the text of his book, issued in 1844, Guérin-Méneville credited the species' name to "Boisd. et Leconte," denoting Boisduval & Le Conte ([1835]).

Butler (1869) was the first author to suggest that *Papilio hyllus* was synonymous with *Polyommatus thoe*, which was then recognized as *Chrysophanus thoe*. He based his opinion on specimens in the British Museum that were collected in 1856 in "Coldwater, near Orilla, Canada West" (Ontario) (Butler 1899). Butler presumed that anyone who was familiar with Cramer's plates would "have no hesitation in at once pronouncing his figures of *P. hyllus* to be a representation of the female of *C. thoe*" (Butler 1899). The American lepidopterist William H. Edwards agreed, as did Boisduval in France. In an 1873 letter to Edwards, Boisduval wrote, "I agree with you about the *Polyom. Thoe* and that it is on wrong information that Cramer has considered his *hyllas* [sic] as coming from Smyrna. However, one must realize that there are in the Middle East many species of the genus *Polyom*. But I have never received from [that] part of the world any female which had any resemblance to *hyllas*" (translated from

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French) (Brown 1965). Influenced by other American authors, Edwards (1877) ultimately rejected this notion. The implied Palearctic type locality proved too persuasive. Staudinger & Rebel (1901) subsequently suggested that *P. hyllus* seemed to represent an earlier name for *P. thersamon*, but their comments went unnoticed. Beginning with Barnes & Benjamin (1926) and extending through the mid-20th century, the Nearctic species was consistently recognized as *Lycaena thoe*.

Brown & Field (1970) offered the first practical investigation into the identity of *Papilio hyllus*. Based solely on an examination of the published figures in Cramer (1775), they concluded that *P. hyllus* and *P. thoe* "both represent the same insect." Unfortunately, these authors disregarded an unpopular provision of the Code (ICZN 1961, Art. 23b) and encouraged the priority replacement of *thoe* by *hyllus*, a name that was unused for over fifty years (a *nomen oblitum*). Nonetheless, other North American authors (e.g. Opler 1975) quickly adopted this synonymy. Clench & Miller (1980) defended the actions of Brown & Field (1970), arguing, "such acceptance in less than ten years belies the idea that nomenclature will be hopelessly upset by resurrection of 'unused senior synonyms'." Reinforced by Miller & Brown (1979, 1981, 1983) and Ferris (1989), the name *P. hyllus* has generally been applied to the Nearctic species for nearly 35 years. The relevant provisions of the Code, including the term *nomen oblitum*, were redefined to better preserve nomenclatural stability in such instances (ICZN 1999, Art. 23.9.1). Robbins & Lamas (2006) complied with these adapted provisions and protected several widely used junior subjective synonyms of Nearctic Lycaenidae.

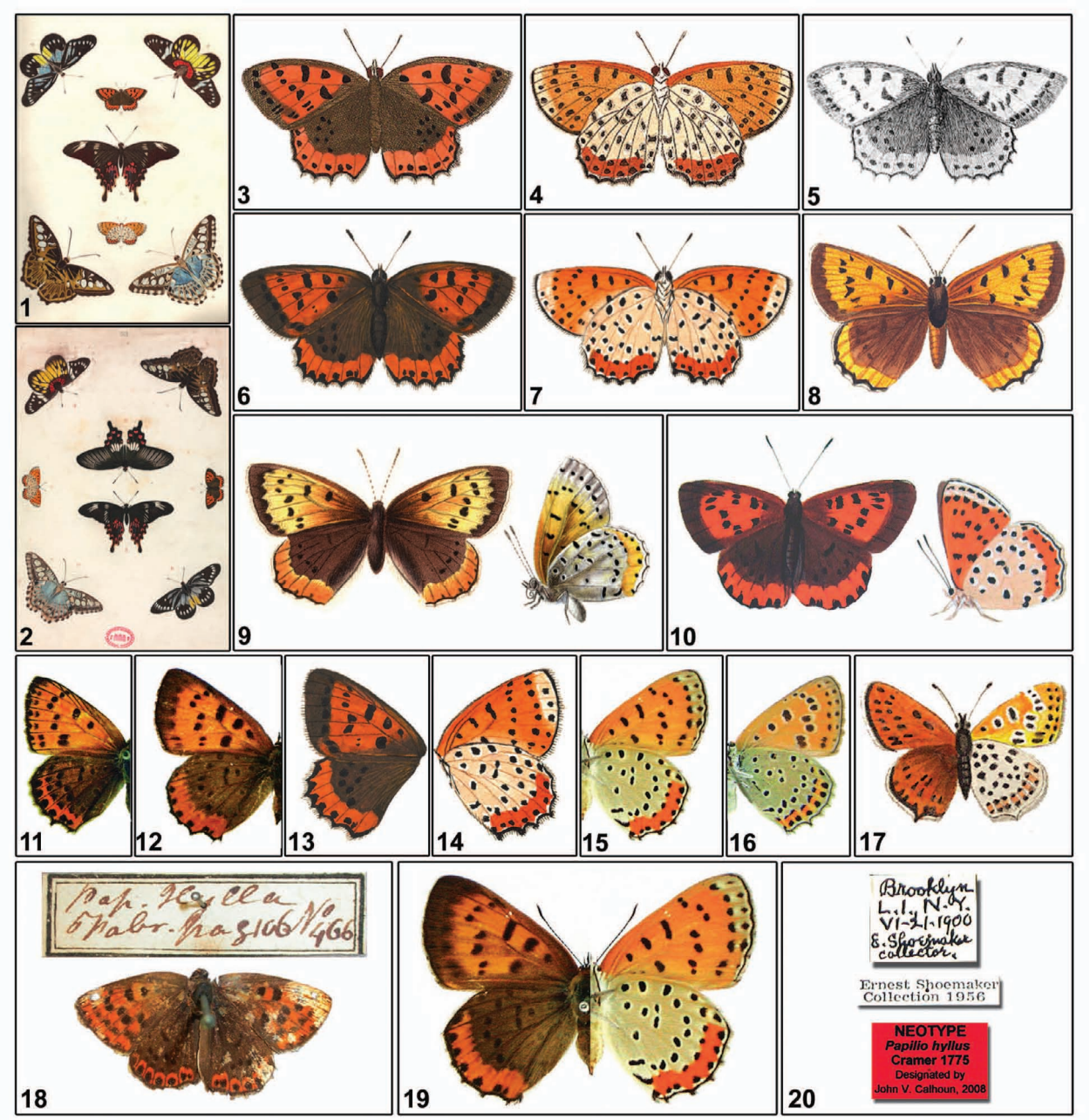
Despite the compelling arguments of Brown & Field (1970), Koçak (1983) revived the concept that *P. hyllus* is synonymous with *Papilio thersamon*. He called this taxon *Thersamon*ia *hylla*, employing the feminine genus-species conformation of the name. Koçak based his opinion on the purported type locality and the perception that "In females of *thersamon* Esper, the markings and the colouration of both upper-, and underside of the wings are very similar to those of *hyllus* Cramer." Given that Miller & Brown (1979) designated *Papilio hyllus* as the type species of their genus *Hyllolycaena*, Koçak (1983) treated this genus as a junior subjective synonym of the genus *Thersamonia* Verity, whose type species is *Papilio thersamon*. Koçak proposed the genus *Hellolycaena* and designated *Polyommatus thoe* as its type species. Koçak & Kemal (2007) also considered *P. hyllus* to be a synonym of *P. thersamon*, but treated *Hyllolycaena* and *Hellolycaena* as subgenera of *Lycaena*. Although most authors continue to employ the name *hyllus* for the Nearctic species, the Palearctic interpretation continues to cast doubt on its identity.

The original description. The brief original description of *Papilio hyllus* was published on pages 67 and 68 in Cramer (1775). Provided in Dutch and French, it is too ambiguous to identify the species. The Dutch version reads, "Deze Dag-Kapel, gelykt van boven naar het kleine Europische Aard-Kapelletje (Phleas Sp. Linn. 252). Doch van onderen is 'er een merkelyk onderscheid met de evengemelde. Hett is een zespootige Kapel, en behoort tot de Argusjes (Pap. Pleb. Ruralis) Zy komt van Smirna" [The upperside of this butterfly is similar to the small European copper butterfly (*Papilio phlaeas*; species 252 of Linnaeus (1767)); but the undersides considerably differ. It is a six-legged butterfly, and belongs to the *Argus* (*Papilio Plebejus Rurales*). It comes from Smyrna]. The French version is analogous: "Ce Papillon ressemble en-dessus beaucoup au petit Papillon de l'Europe, nommé le Bronzé (Phlaeas Sp. Linn. 252); mais en le regardant en dessous on Remarque une difference sensible entre-eux. C'est un Papillon six-pede & appartient aux Argus (Pap. Pleb. Ruralis). Il vient de Smirne" [The upperside of this butterfly very much resembles the small European butterfly named the Bronze (*Papilio phlaeas*; species no. 252 of Linnaeus (1767)). But by looking at the underside one notices a substantial difference between them. It is a six-legged butterfly and belongs with *Argus* (*Papilio Plebejus Rurales*). It comes from Smyrna].

The French name "le Bronzé" has been used in connection with *Lycaena phlaeas* (Linneaus) since the mid-eighteenth century. Coincidentally, this name is evocative of "Bronze Copper," which Scudder (1889) proposed many years later for the Nearctic species, then recognized as *Chrysophanus thoe*. The Linnaean subgroup *Papilio Plebejus Rurales* denoted small butterflies with dark spots. Cramer's reference to *Papilio hyllus* being six-legged probably reflects the fact that males of the Lycaenidae have forelegs that often appear to be shorter than those of females; he frequently noted this character in association with his figured specimens of the subgroup *Papilio Plebejus Rurales* that are now known to portray females. Like many of Cramer's type localities, the reference to "Smyrna" must be viewed with suspicion (see below).

The published figures. *Papilio hyllus* was illustrated as life-sized figures "B" (dorsal) and "C" (ventral) on Plate 43 of Cramer (1775) (Figs. 1, 3, 4). The figures clearly portray the female of a large *Lycaena*. The forewing lengths (base to apex) are 20

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FIGS. 1–20. Illustrations and specimens associated with the history of *Papilio hyllus*. **1,** Plate 43 from Cramer (1775) (*P. hyllus*, center top and bottom). **2,** drawing no. 93 by G. W. Lambertz* (*P. hyllus*, center left and right). **3,** dorsal figure of *P. hyllus* from Cramer (1775). **4,** ventral figure of *P. hyllus* from Cramer (1775). **5,** copy of Cramer's dorsal figure from Bonnaterre (1770–1797). **6,** original dorsal figure* of *P. hyllus*. **7,** original ventral figure* of *P. hyllus*. **8,** female *Polyommatus thoe* from Boisduval & Le Conte ([1835]). **9,** figures of *P. thoe* from Guérin-Méneville ([1832]) (most copies were uncolored). **10,** *P. hylla* from "Jones' Icones." **11,** dorsal female *L. thersamon* ("Parnassus" (Greece), no date; MGCL). **12,** dorsal female *Lycaena hyllus* (Brooklyn, Kings Co., NY, 27.vi.1900; USNM). **13,** rotated ("mounted") original dorsal figure* of *P. hyllus*. **14,** rotated ("mounted") original ventral figure* of *P. hyllus*. **15,** ventral female *Lycaena hyllus* (Brooklyn, Kings Co., NY, 21.vi.1900; USNM). **16,** ventral female *L. thersamon* (same data as Fig. 11). **17,** figure of *Papilio thersamon* from Esper (1776-1801). **18,** one of two dorsal females of *L. tityrus* from William Hunter's collection, with cabinet label that identifies it as "Pap[ilio] Hylla." **19,** dorsal (left) and ventral aspects of the neotype of *Papilio hyllus*. **20,** labels of neotype of *P. hyllus*. *© The Natural History Museum, London.

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mm (dorsal) and 19 mm (ventral). With the exception of those on the ventral hindwings, all the black spots were added by the colorists, resulting in variability in their number, size and location in different copies of the book. Bonnaterre (1790–1797; Pl. 16, figs. 1, 1 bis.) copied Cramer's *P. hyllus* figures, calling the species Le P. [Papillion] Thisbé (the Thisbé butterfly) (Fig. 5). Bonnaterre duplicated and named many of Cramer's figures, but as Lamas (1995) pointed out, Bonnaterre's names were vernacular French and not scientific in nature.

Swainson (1840) characterized the figures in *Uitlandsche Kapellen* as "faulty and inaccurate in their outlines," but "well coloured and can immediately be recognized." Vane-Wright (1975) described the illustrations as "somewhat stylized and idealized, but in a very subtle manner." Clench & Miller (1980) were less forgiving and noted more marked inconsistencies between Cramer's published figures and the specimens they portrayed. Although the figures of *Papilio hyllus* most closely resemble the Nearctic species (=*P. thoe*), subtle characters were often overlooked, obscured, or exaggerated by the engravers and colorists. As with my analysis of *Papilio daunus* Cramer (Calhoun 2007), a critical assessment of *P. hyllus* must include the original watercolor figures to determine the accuracy of the resulting published illustrations.

The original figures. The original watercolors for *Uitlandsche Kapellen* were completed by the Dutch artist Gerrit Wartenaar Lambertz (1747–1803). Lambertz was commissioned to illustrate specimens of Lepidoptera in Cramer's collection, as well as those of other Dutch naturalists (Cramer 1775). The drawings were acquired in 1913 by BMNH, where they now reside in the Entomology Library (Harvey 2005). Gilbert (2000) observed, "The copper engravings for the published volumes are very fine, but the work of the colouring artists does not match the exquisite colouring of the originals." After studying the original watercolor drawings, Eliot & Kawazoé (1983) considered the published figures of *Papilio ladon* Cramer to be "caricatures." Chainey (2005) noted that the original drawings more closely resemble surviving type specimens than do the published plates.

The original figures of *Papilio hyllus* are identified as "D" on Lambertz's drawing no. 93 (Figs. 2, 6, 7). A handwritten legend, pasted onto the same larger sheet of paper as the drawing, identifies figures "DD" as "Pap.^{o} Hyllus — Smyrna." The spelling of "Smyrna" and a reference to the "male" of another figured species suggest that the legend was prepared at a later date, possibly by the Englishman James A. Turner who owned the drawings during the nineteenth century.

The original figures of *Papilio hyllus* are much more detailed than the published versions. The forewing length of both figures is 19 mm. The wing shapes are more precise and the dorsal forewing has a wider dark margin. A row of ill-defined submarginal black spots is barely discernable along the inner edge of the dark forewing margin. These spots are too vivid and outwardly displaced on the engraved plate. The forewing postmedian spots are more accurately positioned and a diffuse orange patch is visible in the tornal region of the forewing. The ventral figure is a more refined version of the published engraving.

Figures 11–16 compare the original dorsal and ventral watercolors of *Papilio hyllus* with specimens of *L. thersamon* and the Nearctic species formerly recognized as *P. thoe*. The extreme similarity of the figures to the Nearctic butterfly is undeniable (Figs. 12–15). Although the sizes of the illustrations are probably not identical to the specimen they portray, the forewing measurements of the original figures of *P. hyllus* (19 mm) are more consistent with the Nearctic species, whose females average 20 mm (Opler & Krizek 1984). The forewings of female *L. thersamon* measure only 14–16 mm (Higgins & Riley 1970; Chinery 1998). The broad dark forewing margin, flanked by a row of black spots, and the diffuse pale patch in the tornal region of the forewing are also reminiscent of the Nearctic species. In contrast, the forewing margin of *L. thersamon* is very narrow and broken into separate black spots. As noted by Brown & Field (1980), Palearctic members of the Lycaeninae lack a defined black spot in cell CuA^2 (Cu^2) of the forewing. This spot is well developed in both *P. hyllus* and the Nearctic species (ironically, this definitive character is indistinct on the dorsal figure of *P. thoe* by Guérin-Méneville ([1832]); Fig. 9). *Lyceana thersamon* lacks a third discal spot on the dorsal forewing and has a much narrower orange band on the hindwing that is bordered by a submarginal row of black spots. The two-toned coloration of the ventral forewing of *P. hyllus* is also more similar to the Nearctic species. Finally, the basal and postmedian black spots on the ventral forewing of *L. thersamon* are prominently ringed with white, which is inconsistent with *P. hyllus* and the Nearctic species. These features are apparent on the published figure that accompanied the original description of *Papilio thersamon* in Esper (1780–1786) (Fig. 17). *Papilio hyllus* superficially resembles other Palearctic species, including *Lycaena dispar* (Haworth) and *L. tityrus*, but numerous characters preclude these species. This evidence corroborates Butler (1869, 1899) and Brown & Field (1970), who concluded that *Papilio hyllus* Cramer is synonymous with *Polyommatus thoe* Guérin-Méneville.

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Source of the figured type specimen. Kudrna (1986) suggested that the type locality of *Papilio hyllus* may refer to a city in the United States. At least eight municipalities are named Smyrna in the United States, but they were founded during the nineteenth century or are located outside the range of *Lycaena hyllus*. Moreover, it is well established that many of Cramer's localities are erroneous (Butler 1899; Clench & Miller 1980; Chainey 2005; Calhoun 2007). Locality labels were rarely affixed to specimens during the eighteenth and early nineteenth centuries. Cabinet labels (pinned at the head or foot of a series of specimens) were used for identification purposes, but locality data were often recorded in separate catalogs or log books. If the specimens were later sold or exchanged, locality information was frequently lost or imprecisely conveyed. The illustrated type specimen of *Papilio hyllus* likely passed through the hands of at least four people during its existence, thus its type locality cannot be trusted. Additional evidence suggests a plausible origin of the illustrated type of *P. hyllus*.

Cramer (1775) stated that all the butterflies on Plate 43, including *Papilio hyllus*, came from the cabinet of "Baron Rengers." The Dutch naturalist Hans Willem (Baron) Rengers (1722–1786) was a subscriber to *Uitlandsche Kapellen*. Cramer (1775, 1779–1780) described Rengers as a Lieutenant General of the Cavalry, Chamberlain (Gentleman-in-waiting) of Her Royal Highness the Princess of Orange, President of the High Council of War, and a generous patron of the arts and sciences. Little else is recorded about the man, other than he served with distinction in the Battle of Recoux in 1746 (Harderwijk & Schotel 1874; Anon. 1889). In the preface of his first volume, Cramer (1775) thanked Rengers for supporting his efforts and enriching *Uitlandsche Kapellen* with over 150 species for illustration on the color plates. Cramer characterized Rengers' natural history collections as "magnificent and rich." Rengers generously shared his specimens, as shown by the many references to his insects and mollusks by contemporary authors (see Smit *et al*. 1986).

The fate of Rengers' Lepidoptera collection is unknown. A few of his butterflies may be deposited in BMNH (Vane-Wright 1975). It is unclear, however, if Cramer returned Rengers' specimens after they were illustrated and described. Putative Cramer type specimens are deposited in RMNH and BMNH (Vane-Wright 1975; Chainey 2005). Cramer specimens may also exist in ZMAN (Chainey 2005). Searches of these collections failed to locate a potential type specimen of *Papilio hyllus*.

Rengers exchanged specimens with other naturalists, including Dru Drury (1725–1804) of London, who acquired and distributed more American insects than any other European naturalist of the period. In a letter to Rengers, dated 15 May 1773, Drury wrote, "I have taken the liberty of presenting you…with a few insects principally from America…the place Cap[tain] Mays informs me you chiefly wish to receive any from." Drury added, "any that I have duplicates of shall certainly be conveyed to you" (Drury correspondence, BMNH). One of the American species that Drury acquired was *Lycaena hyllus*.

Around 1783, William Jones (1745–1818) of Chelsea, England began illustrating species of Lepidoptera contained in various London collections, including that of Dru Drury. Jones continued to work on his watercolors for over a decade, adding new drawings and providing handwritten identifications. For most of his drawings, Jones recorded the owner of the figured specimens, identified the depicted species, and copied descriptions from relevant publications. These drawings, known as "Jones' Icones," are currently preserved in the Hope Library of Entomology (OUMNH) (Smith 1986). Drawing no. 57 of volume 6 (now identified as vol. 5) includes dorsal and ventral representations of a female *Lycaena hyllus* (Fig. 10). Jones credited the specimen to "Drury" and identified the species as "Hylla," citing the source of that name as "Fabricius No 466" [Fabricius 1781b]. Beneath his figures, Jones transcribed the Latin description of *Papilio hylla* as published by Fabricius (1781b).

In a letter to James E. Smith, dated August 1787, Jones remarked, "Fabricius is in London...he is going through my drawings, to correct, amend, and add to a Mantissa that he has now in hand" (Smith correspondence, Linnean Society of London; Smith 1832). This visit preceded the publication of Fabricius' *Mantissa Insectorum*, which appeared in December of that year (Fabricius 1787). In his autobiography, Fabricius recalled, "In the summer [1787] I again went with all my family to England" (Hope 1845). Fabricius (1792) listed Jones ("Jones Londoni") among the naturalists that he visited during his travels, but it is unclear if they met more than once. Fabricius possibly saw the specimen of *Lycaena hyllus* that Jones portrayed, as he worked with Drury's collection on numerous occasions beginning in 1767 (Hope 1845; Armitage 1960). Fabricius may have considered *L. hyllus* to be conspecific with *L. tityrus*, a species that he likely identified as *Papilio hylla* some years earlier (Fig. 18). This is not surprising given that specimens of these species were evidently scarce. Many years later, *L. hyllus* was still rare in collections (Boisduval & Le Conte [1835]). The insect collection of the American

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entomologist Thaddeus W. Harris (1795–1856) (MCZ) includes only one specimen, from 1851. The American naturalist Titian R. Peale (1799–1885) did not possess this species, but his collection includes two females of *L. phlaeas* from Philadelphia that are misidentified as "*Polyommatris* [sic] *thoe*" (ANS 2004).

Based on the known distribution of *Lycaena hyllus*, Drury's specimen most likely came from the northeastern United States. Drury's collection catalog can be very helpful in identifying the sources of his specimens. Comprised of four notebooks written in Drury's hand, this catalog was presented by Drury to the English naturalist Edward Donovan (1768–1837), who inscribed on one of the notebooks, "These I received from Mr. Drury for whom I wrote the sale catalogue of Drury's Insects; These he gave me as I declined payment." Donovan prepared the catalog for the auction of Drury's insect collection, which took place after Drury's death ([Donovan] 1805). Drury's notebooks were later acquired by the English naturalist John O. Westwood (1805–1893) (Westwood 1837) who served as the first Hope Professor of Zoology at Oxford University. These notebooks are now preserved in the Hope Library of Entomology, OUMNH (see Smith 1986).

Dru Drury's Coleoptera notebook is dated 1784, but there are entries in this and other notebooks as late as 1789 and it appears that the information was copied from earlier documents. Drury retired from his silversmith business in 1789, after which he spent much time "arranging and improving his cabinet" (Smith 1842). Drury recorded the locality, source, and year of receipt for most of his specimens. Unfortunately, he generally did not identify his specimens unless the species was figured in his *Illustrations of Natural History* (Drury 1770–1782) or was previously described in the works of Carl Linnaeus (Carl von Linné). Drury's notebooks include some obvious errors and they do not inventory duplicate specimens that he previously sold or exchanged. Nonetheless, they provide a valuable record of the contents of Drury's collection around the year 1790. Typical of insect collections of that period, most species were represented by only one or two specimens.

Like Cramer, Drury strictly followed the classification scheme of Linnaeus and he arranged his Lepidoptera notebook accordingly. As a result, Drury likely aligned his specimens of *Lycaena hyllus* with the Linnaean subgroup *Papilio Plebejus Rurales* (small species with dark spots). This is supported by a notation adjacent to one of the entries in this subgroup that reads, "Examine is this Virgaurea." *Papilio virgaureae* L. is a Palearctic species currently recognized as *Lycaena virgaureae*. This specimen possibly corresponded to Lot 29 of the auction of Drury's collection, which included two specimens, "*Papilio* Virgaurea, and 1 other" ([Donovan]) 1805).

All the unidentified American butterflies listed in Drury's collection catalog under *Papilio Plebejus Rurales* were recorded as having been received in 1766 from Thomas James of New York. Prior to 1780, the majority of Drury's American butterflies were received from Thomas James and Rev. Devereux Jarrett (1732–1801) of Virginia. Drury possessed nearly 250 insects (including 32 butterflies) that he received from Thomas James during the period 1764–1776 (dates of 1762 and 1763 are in error). Drury purportedly received the majority of his butterflies from James in 1766. Published remarks by Drury and entries in his Lepidoptera notebook suggest that James' specimens likely served as types of five butterflies described by Drury (1770–1782): *Speyeria idalia*, *Phyciodes tharos*, *Euphydryas phaeton*, *Vanessa virginiensis*, and *Limenitis arthemis*. Several other insects from James were also described and figured by Drury (1770–1782). Virtually ignored by entomologists, Drury's collection notebooks are valuable in clarifying the origins of his lost type specimens.

In BMNH (Entomology Library) are numerous fair copies of letters that Drury wrote to correspondents between 1761 and 1783 (Cockerell 1922; Sherborn 1937). Contained in this folio letter book are copies of 14 letters to Thomas James, dated 1763 to 1772. Two others were written to James on behalf of the London naturalist John Reup. Pamela Gilbert (formerly of BMNH Entomology Library) generously provided transcripts of these letters. Drury first addressed them to "Guanoes, Long Island" and a location in "Flat Bush" (Flatbush, Brooklyn). James later directed Drury to send parcels to the attention of "Mr. Rapalje" at "Brookland Ferry" (Brooklyn Ferry, Brooklyn). John Rapalje (1728–1802), a British loyalist, owned the largest estate in Brooklyn (Stiles 1867). In 1767 James moved about 64 km (40 mi) from the city, but Drury continued to address his letters to Brookland Ferry.

In his first letter to James in America, dated 3 December 1763, Drury wrote, "…as I have heard you was settled in New England I have sent you this to ask if you will continue collecting Flys as you used to do and whether you can send a collection here to England." Drury instructed James in proper collecting techniques and sent him the necessary equipment. He also asked James to obtain lizards, birds, snakes, frogs, and toads. Drury offered to pay for the specimens, telling James, "I have known persons who have picked up a good deal of money by things of these kinds, sent home from abroad." Drury instructed James to obtain duplicates of

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insects whenever possible, which Drury traded or sold to other naturalists (e.g. Baron Rengers). Drury exhibited James' specimens at meetings of the second Aurelian Society in London. This introduced James to other London naturalists who desired his insects, but only Thomas Martyn (fl. 1790–1816) appears to have received anything from James. Drury was very anxious to receive insects from James, writing, "America affords a kind of New World among the Insects." The letters do not reveal James' occupation. He composed music that he hoped to publish, so perhaps he was a musician by trade. James' wife and child remained in England where Drury met with them on several occasions to convey letters and information. James was often neglectful of his family, forcing Drury to provide them money. Drury once waited over three years to receive a new shipment of insects from James.

Drury recalled in August 1768 that he had previously received many butterflies from James, including the "Large Emperor" (prob. *L. arthemis*), the "Great Fritillaries" (*Speyeria* spp.), and the "Black Swallow-Tails" (*Papilio* spp.). In this same letter, Drury clearly described *Danaus plexippus* (L.) and a worn specimen of *E. phaeton*, a species that he illustrated as new two years later; "I received it from New York, where my correspondent assures me, he has caught them in June and September" (Drury 1770–1782) (Drury's Lepidoptera notebook implies that he replaced James' worn specimen of *E. phaeton* with another collected in 1774 by John Harris of Boston). The specimen of *Lycaena hyllus* that Jones illustrated during the 1780s is not recognizable in the catalog for the auction of Drury's collection ([Donovan] 1805). It was possibly the unidentified specimen offered in Lot 29 with *L. virgaureae*. Some of Drury's specimens were sold prior to this auction (Hayek 1985).

This evidence indicates that Drury most likely acquired *Lycaena hyllus* from Thomas James. It is also known that Drury provided American specimens to Rengers, who was the source of the figured type of *Papilio hyllus*. In addition, Cramer (1775) illustrated and described several species that came from Drury's collection. In 1776, Drury complained that Cramer had figured some specimens that Drury had given to Rengers. It was Drury's intention to describe them in his own *Illustrations of Natural History*. Comparing this to "putting a knife into ye hands of another in order to cut his own throat," Drury implored Rengers not to allow Cramer to "figure any more that have been in my collection," adding, "I would wish not to receive any farther injury from him" (letter dated 23 July 1776, Drury corresp., BMNH). In the preface for the third volume of his *Illustrations*, Drury stated that these offending figures were published "about the year 1775." *Papilio hyllus* was included in one of the first parts of Cramer's work, issued in 1775. The illustrated type of *P. hyllus* was conceivably among Drury's specimens that were figured by Cramer without Drury's consent. If so, it was probably acquired from Thomas James, who presumably collected it around 1766 in the vicinity of Brooklyn, New York. At that time, the western portion of Long Island was largely cultivated, but tracts of forest and marshland were scattered throughout the region (Ratzer 1776). A large portion of the island was still unbroken wilderness (Flint 1896). The human population of Long Island in 1771 was only 27,739 (Prime 1845); it now exceeds 7.5 million. *Lycaena hyllus* was formerly uncommon to rare in the vicinity of New York City where it has not been recorded since 1982 (Beutenmüller 1893; Glassberg 1989, 1993; Cech 1993; Shapiro 1974). Referring to the species' occurrence on Long Island, Forbes (1928) stated that it was "not overly common" and listed records from Flushing, Jamaica, and Brooklyn. Klots (1951) figured a male *L. hyllus* from Flushing, and Glassberg (1989) listed three specimens in AMNH from Flushing Meadows (these probably include Klots' figured specimen). Several additional specimens from Long Island are deposited in USNM.

Drury's collection notebooks also offer an explanation for the erroneous type locality of *Papilio hyllus*. Drury listed 26 insect specimens from Smyrna, which were acquired between 1760 and 1765 from "Mr. Barker." The specimen of *L. virgaureae* in Drury's collection was received from Barker in 1762. William G. Barker (1737–1825), a merchant from Derbyshire, England, emigrated to Smyrna, Turkey in 1760 as a member of the Levant Company (Stephen 1885; TNA 2008). Drury's letters show that Barker had initially arranged for his parson to acquire insects for Drury. In late 1762 the parson either died or was no longer available to send specimens to Barker. Barker obviously found another willing collector, perhaps himself. Several species were attributed to Smyrna in *Uitlandsche Kapellen*. Those specimens, or at least their purported geographic origin, may be traceable to Barker via Drury. This connection further implicates Drury's involvement in the history of *P. hyllus*. A simple transcription error is perhaps to blame for over two centuries of confusion regarding the origin and identity of *Papilio hyllus*.

Neotype designation. Fisher (1981) referred to a neotype of *Papilio hyllus*, stating that it was from "Coldwater, near Orilla, Canada West (Ontario)." This corresponds to the specimens of *Lycaena hyllus* that Butler (1869) listed from the British Museum, having been collected by a "Mr. Bush" in 1856. However, the

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origin of this statement in Fisher (1981) is unknown. This designation was never formally published and a recent search of BMNH failed to locate this neotype or any other specimens from Coldwater, Canada. The section on the Lycaeninae in Fisher (1981) was prepared by Lee D. Miller (M. S. Fisher pers. comm.). Miller co-authored a classification of the American Lycaeninae (Miller & Brown 1979), which included the Nearctic species under the name *Hyllolycaena hyllus*. The other author of this monograph, F. Martin Brown, was a co-editor of Ferris & Brown (1981), the book in which the purported neotype was mentioned. Miller and/or Brown probably intended to designate this neotype, but could not locate the chosen specimen.

A neotype for *Papilio hyllus* Cramer, 1775 (Fig. 19) is hereby designated in accordance with ICZN (1999) Article 75.3. This clarifies the taxonomic status of *P. hyllus* and supports the use of this name for the Nearctic species as defined by Miller & Brown (1979). A female specimen was selected on the basis of the following criteria: 1) it was collected in Brooklyn, New York, where the lost type of *Papilio hyllus* may have originated, 2) it is consistent with the type as portrayed in the original drawing by G. W. Lambertz, and 3) with the exception of a missing antenna, it is in excellent condition. The dorsal surface of another specimen from Brooklyn, with analogous data, is remarkably similar to the illustrated type (Figs. 12, 13), but it is more worn and two wing tears were repaired with pieces from other species. The neotype bears a handwritten label [Brooklyn / L. I. N.Y. / VI-21-1900 / E. Shoemaker / collector.] and a printed label [Ernest Shoemaker / Collection 1956]. A red printed neotype label has been affixed to the specimen [NEOTYPE / *Papilio hyllus* / Cramer 1775 / Designated by / John V. Calhoun 2008]. The original type locality was erroneous; the new type locality is Brooklyn, Kings County, New York. The large insect collection of Ernest Shoemaker, who lived in Brooklyn, was gifted in 1957 to USNM (Clarke 1974), where the neotype of *Papilio hyllus* is deposited. Shoemaker also collected *L. hyllus* at Aqueduct, Queens County, Long Island (Anon. 1898). Many of Shoemaker's specimens were collected in habitats that were subsequently lost to urban sprawl (Clarke 1959). Sadly, this applies to his specimens of *Lycaena hyllus* from Long Island.

ACKNOWLEDGEMENTS

I extend my thanks to Ruth Nott, Sharon Touzel, and Katie Anderson (BMNH) for locating, photographing, and measuring the original drawings of *Papilio hyllus*. Sharon Touzel provided information from Dru Drury's letter books. Stella Brecknell (Hope Library of Entomology, OUMNH) generously arranged for photography of figures in "Jones' Icones" and provided scans of Dru Drury's collection catalog; scanning was completed by Darren Mann. Julia Harvey and Sharon Touzel (BMNH) kindly related my request for copies of Drury's letters to Pamela Gilbert (formerly BMNH), who graciously shared transcripts. Robert K. Robbins (USNM) helped to locate specimens of *L. hyllus* and provided photographs. I also thank Eileen Mathias (Academy of Natural Sciences, Philadelphia), Leslie K. Overstreet (Smithsonian Institution Libraries), Beverly Pope & Alice Sanders (Division of Plant Industry Library, Gainesville, Florida), Suzanne Smailes (Thomas Rare Book Library, Wittenberg Univ.) and Steve Walter (New York City Butterfly Club) for fulfilling my many requests for literature. Behnaz van Bekkum-Ansari (RMNH), Blanca Huertas (BMNH), and Rob de Vos (ZMAN) kindly searched for specimens under their care. E. Geoff Hancock (HMUG) photographed William Hunter's specimens and provided valuable insight into Fabricius' interaction with Hunter's collection. Philip D. Perkins (MCZ) granted access to the T. W. Harris insect collection. Rienk de Jong translated the original Dutch description of *P. hyllus*. Clifford D. Ferris and Michael S. Fisher responded to inquiries concerning the supposed neotype of *P. hyllus*. Staff of the McGuire Center for Lepidoptera and Biodiversity (Florida Museum of Natural History) offered much assistance. Jonathan P. Pelham provided literature and shared my regret over the demise of the name *thoe* for a North American butterfly. Rick Cech and Harry Zirlin related information on the occurrence of *L. hyllus* around New York City. Finally, I thank J. P. Pelham, Robert K. Robbins, Andrew D. Warren and an anonymous reviewer for comments on the manuscript.

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Received for publication 3 March 2009; revised and accepted 18 August 2009

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