The chromosome number and karyotype of the two morphs of *Polyommatus* (*Lysandra*) *coridon* from Greece (Lepidoptera: Lycaenidae)

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Samenvatting. Het chromosoomgetal en karyotype van de twee morfen van *Polyommatus* (*Lysandra*) *coridon* in Griekenland (Lepidoptera: Lycaenidae)

Polyommatus (*Lysandra*) *coridon* (Poda, 1761) is in Griekenland vertegenwoordigd door twee kleurvormen. De eerste is vaal blauwgrijs met een zilvergele glans in het mannetje en komt voor op de Peloponnesos, in Centraal-Griekenland en in het westelijk en centraal gedeelte van Noord-Griekenland. Hij werd beschreven als "*L.*[*ycaena*] *Coridon* var. *graeca* Heyne, [1895]". De tweede heeft zilverig blauwe mannetjes en lijkt sterk op de nominaatvorm. Hij komt voor in het oostelijk gedeelte van Noord-Griekenland en werd beschreven als "*Lysandra philippi* Brown & Coutsis, 1978", op basis van een verondersteld haploïde chromosoomgetal van *n*=20–26, in vergelijking met *P.* (*L.*) *coridon* met *n*=87–92. Beide vormen komen samen voor op Mt. Vérmio, in het centraal gedeelte van Noord-Griekenland, en tussenvormen zijn eveneens bekend. Het chromosoomnummer en karyotype van beide vormen, elk bestudeerd met materiaal uit twee verschillende populaties, wordt beschreven, geïllustreerd en vergeleken. Het karyotype blijkt identiek te zijn, terwijl slechts kleine verschillen in aantal werden geregistreerd tussen "*graecus*" (*n*=93) en "*philippi*" (*n*=88–90). Op basis van deze karyologische gelijkheid en het voorkomen van tussenvormen, worden beide morfen taxonomisch gerangschikt als behorende tot de nominaatvorm van *P.* (*L.*) *coridon* (cf. Schurian 1988).

Résumé. Le nombre de chromosomes et le caryotype des deux morphes de *Polyommatus* (*Lysandra*) *coridon* en Grèce (Lepidoptera: Lycaenidae)

Polyommatus (*Lysandra*) *coridon* (Poda, 1761) est représentée en Grèce par deux morphes. La première est d'un bleu-gris fade avec un reflet jaunâtre argenté chez le mâle et se rencontre dans le Péloponnèse, dans le centre dela Grèce et dans les parties occidentale et centrale du nord du pays: elle fut nommée "*L.*[*ycaena*] *Coridon* var. *graeca* Heyne, [1895]". La seconde comprend des mâles d'un bleu argenté très proche de la couleur de la forme nominotypique: elle existe dans la partie orientale du nord de la Grèce et a été décrite comme "*Lysandra philippi* Brown & Coutsis, 1978", sur base d'un nombre chromosomique haploide de *n*=20–26, comparativement à la formule de *n*=87–92 chez *P.* (*L.*) *coridon.* Les deux formes cohabitent au mont Vérmio, dans la partie centrale du nord de la Grèce et des formes intermédiaires ont également été trouvées. Le nombre chromosomique et le caryotype des deux formes, étudié au moyen de matériel de deux populations différentes pour chacune d'entre elles, est décrit, figuré et comparé. Le caryotype apparaît être identique, alors que seule une légère différence a pu être enregistrée entre "*graecus*" (*n*=93) et "*philippi*" (*n*=88–90). Sur base de cette similitude caryologique et de l'existence de formes intermédiaires, les deux morphes sont taxonomiquement attribués à la forme nominotypique de *P.* (*L.*) *coridon* (cf. Schurian 1988).

Key words: Lycaenidae – *Polyommatus* – *Lysandra* – *coridon* – *graecus* – *philippi* – karyotype – chromosome number – infrasubspecific taxa - Greece.

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Introduction

Polyommatus (*Lysandra*) *coridon* (Poda, 1761) is represented in Greece by two morphs, the first one having males whose upperside is rather dull bluish-

grey with silvery-yellow reflections and the second one having males whose upperside is silvery-blue. The first morph was described as the nominal taxon "*L.*[*ycaena*] *Coridon* var. *graeca*" by Heyne ([1895], (15): 763 *in* Rühl & Heyne, 1892-1895, cf. Hemming 1931 for dating), and even though no specific locality of capture was included, the description was undoubtedly based on specimens derived from either central Greece or the Pelopónnisos, as the boundaries of Greece at that date did not extend to the north beyond the town of Lamía, central Greece. This morph is somewhat reminiscent superficially of *Polyommatus* (*Lysandra*) *hispanus* (Herrich-Schäffer, 1851) and inhabits the Pelopónnisos, central Greece and the central and western part of northern Greece, while the second morph, described as "*Lysandra philippi*" by Brown & Coutsis (1978: 201–206) and quite similar superficially to nominotypical *P.* (*L.*) *coridon*, inhabits the eastern part of northern Greece. It has also been reported to the first author that on Mt. Vérmio, central part of northern Greece, both these morphs, as well as intermediates, fly together (Ichtiároglou, pers. comm.).

Recently a number of chromosomal fixations relating to both these morphs were made by the first author and their respective chromosome numbers and karyotypes were determined and studied by the second author. The reason for this endeavour was the investigation of the true taxonomic status of *philippi*, as well as its cytological relationship to *graecus*. The method used for the preparation of the chromosomes is described in Olivier *et al*. (1999).

The *philippi*-morph

Four chromosome preparations of this morph were examined from 2 localities: JC99034 and JC99039, both Greece, Makedonía, Dráma district, Mt. Falakró, 1600–1900m, 6.VIII.1999; JC99044 and JC99045, both Greece, Makedonía, Kavála district, Mt. Pangéo, 1600–1800m, 8.VIII.1999 (type locality of *Lysandra philippi*).

In the case of JC99034 six cysts were found carrying 13 metaphase *M*I and 4 metaphase *M*II cells. The karyotype was found to be asymmetric and possessing a single, outstandingly large bivalent in the centre of the plate, surrounded by middle-sized bivalents of gradually decreasing size (Pl. 1). The large bivalent is heterochromatic and shows positive pycnosis at its edges, perhaps mainly due to a higher degree of C-heterochromatin condensation. The shape of this bivalent varies from rounded to elongated and at times even appears as a conjugation of two univalents divided between them by a small gap, probably suggesting that the process of chiasmata separation develops fast in this bivalent. The middle-sized bivalents are, as a rule, elongated and homochromatic in *M*II, but may show slightly variable pycnosis to dye adhesion in *M*I. These bivalents tend to form small associations of 2-3 elements, in the pattern of small chains. Occasionally one or two B univalents may also be present in *M*I plates, either as attachments to middle-sized bivalents, or as separate elements, usually located close to the center of the metaphase plate; this, however, may also be due to the splitting of bivalents into two univalents that appear as B's. The chromosome

number of clearly legible cells was found to be in certain cases *n*=88, while in others *n*=90, thus giving evidence to the polymorphic character of the karyotype of this morph.

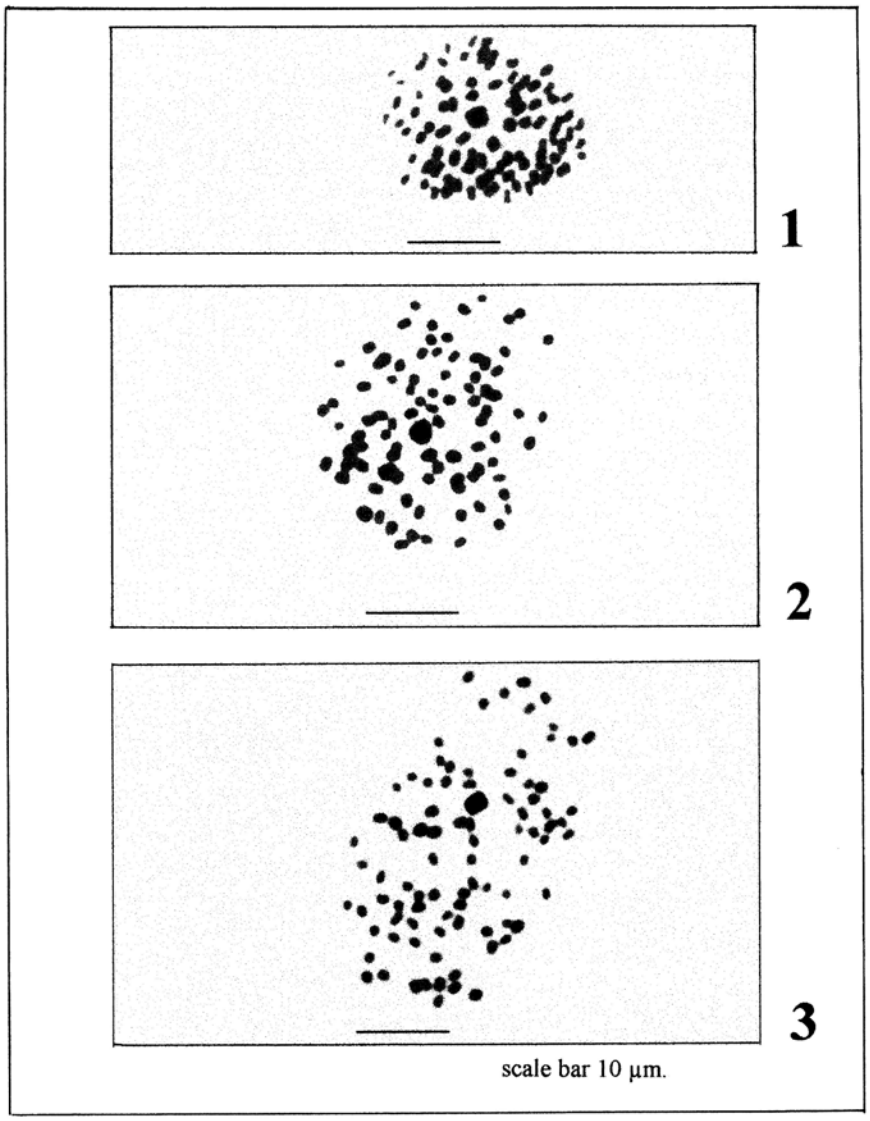

Plate 1: Karyotype of *Polyommatus* (*Lysandra*) *coridon* (Poda, 1761), morph *philippi* (Brown & Coutsis, 1978), Greece, Makedonía, Dráma district, Mt. Falakró, 1600–1900m, 06.VIII.1999. Prep. No. JC99034. 1.– *M*I, *n*=90, 2.– *M*I, *n*=89, 3.– *M*I, *n*=88 (photographs by JDP).

In the case of JC99039 one MI plate and two cysts of apyrene sperm were found. The general appearance of that single plate is similar to that of the plates of JC99034, showing a single, centrally placed, large bivalent, surrounded by a multitude of middle-sized ones, but the spreading of the chromosomes was not good enough to allow precise counting.

In JC99044, a small number of cells in anaphase *A*II, one cell in metaphase *M*I and many cysts of apyrene sperm were found, perhaps denoting the old age of the specimen at hand. The chromosome number of the single *M*I cell was found to be *n*=ca. 90 (overlapping of certain of the bivalents made precise counting impossible). A point of interest is that the centrally placed large bivalent was found to be smaller than its counterpart in preparations JC99034 and JC99039, but the possible significance of this cannot be understood and discussed on the basis of just that single available plate.

In JC99045 three cysts were found containing nine metaphase *M*II cells and a single *M*I cell, as well as a number of cysts containing cells of apyrene sperm and many spermatids. It was not possible to determine chromosome number, as the *M*II plates were not suitable for counting, the *M*I plate was in polar view and the apyrene spermatocytes showed irregular divisions.

The *graecus*-morph

Eight chromosome preparations of this morph were examined from 2 localities: JC98013, JC98015, JC98016, JC98027 and JC98028, all Greece, Ípiros, South Píndos Mts, east side of Mt. Tzoumérka, 1400–1600m, 11.VIII.1998; JC98006, JC98008 and JC98026, all Greece, Stereá Ellás, Mt. Vardoúsia, 1800–2000m, 23.VII.1998.

JC98013 included 10 very clear metaphase *M*I plates. In nine out of these, the chromosome number was found to be *n*=93 (Pl. 2). One of the plates showed *n*=94, consisting of 92 bivalents and 2 univalents, the latter of which may have derived from the splitting of a single bivalent, probably due to its chromosome holocentricity. A single outstandingly large, isopycnotically stained, oval or bent bivalent is placed at the centre of the metaphase plate and is surrounded by middle-sized bivalents of gradually diminishing size, the smallest of which are situated at the edge of the metaphase plate. Five of the middle-sized bivalents often show telomeric associations.

In JC98015, there were three *M*I plates, all showing *n*=93 and the karyotype was found to be the same as in JC98013.

In JC98016, no spermatocyte divisions appeared in evidence.

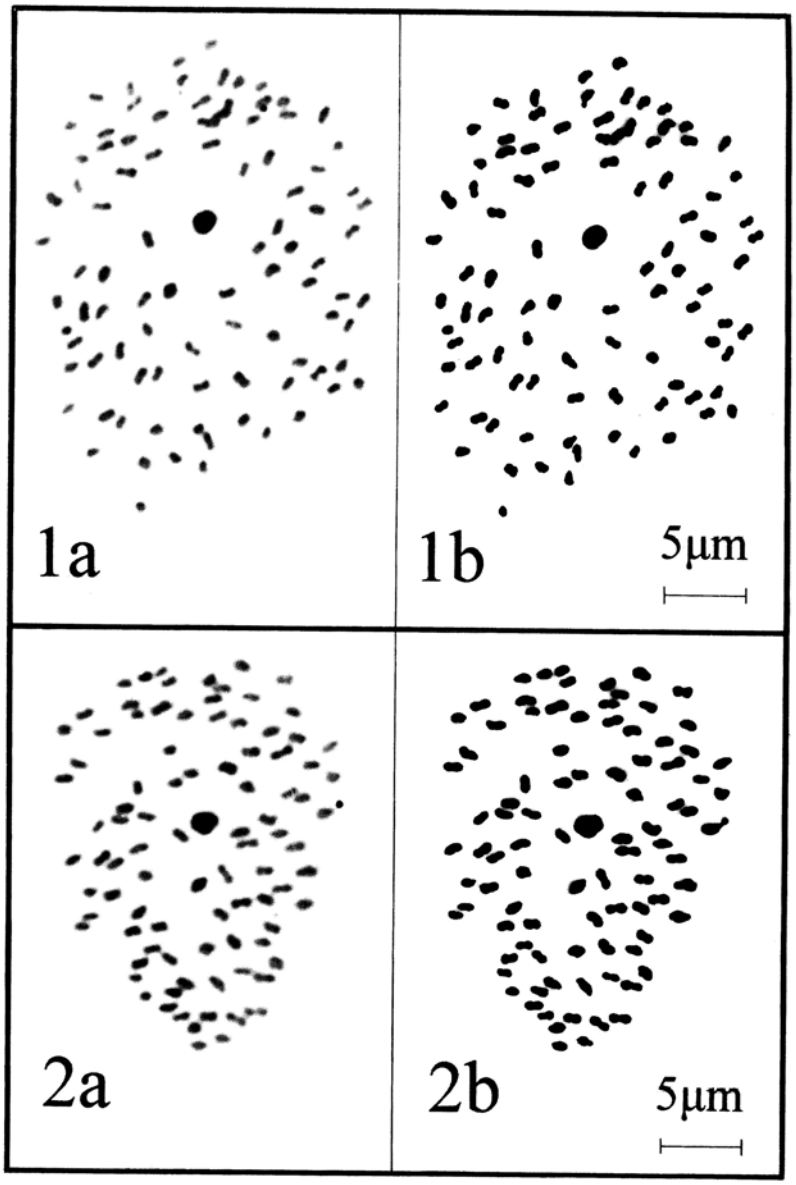

Plate 2: Figs 1–2. Karyotype of *Polyommatus* (*Lysandra*) *coridon* (Poda, 1761), morph *graecus* (Heyne, [1895]). Greece, İpiros, South Píndos Mts, east side of Mt. Tzoumérka, 1400–1600m, 11.VIII.1998. Prep. No. JC98013. *M*I, *n*=93 (a. Photograph of chromosomes, – b. Interpretative drawing of chromosomes) (Photographs by JDP, drawings by JGC).

In JC98027, twenty prometaphase plates were located, as well as three metaphase *M*I and one metaphase *M*II plates. The chromosome number was determined as *n*=90 in one *M*I plate, *n*=ca. 88–89 in a second one, *n*=ca. 86–88 in a third one and *n*=ca. 89–90 in the single *M*II plate. The karyotype was the same as in JC98013.

In JC98028, one metaphase *M*I plate and two meiotic prometaphase plates were encountered. The single *M*I plate showed *n*=ca. 87–88, while the prometaphase plates showed *n*=ca. 86–87. The karyotype was found to be the same as in JC98013.

In JC98006, three metaphase *M*I and two prometaphase plates were found. The chromosome number was determined as *n*=93. The karyotype was the same as in JC98013.

In JC98008, no divisions were observed at all.

In JC98026, five prometaphase plates were observable and a further three metaphase plates were in polar view, none of which were suitable for counting.

Legend of plate 3:

Figs. 1–12 *Polyommatus* (*Lysandra*) *coridon* (Poda, 1761), morph *philippi* (Brown & Coutsis, 1978)

1–6 uppersides, 7–9 undersides

1. Greece, Kavála District, Mt. Pangéon, 1700 m, 20.VIII.1996, leg. D. van der Poorten.
2. Greece, Kavála District, Mt. Pangéon, 1650 m, 04.VIII.1993, leg. T. W. Tolman.
3. Greece, Kavála District, Mt. Pangéon, 1500 m, 19.VIII.1986, leg. D. van der Poorten.

4, 7. Greece, Dráma District, Mt. Phalakrón, 1400 m, 13.VII.1981, leg. D. van der Poorten.
5, 8. Greece, Dráma District, Granítis, 700 m, 30.VII.1986, leg. D. van der Poorten.
6, 9. Idem.

Figs. 10–18 *Polyommatus* (*Lysandra*) *coridon* (Poda, 1761), morph *graecus* (Heyne, [1895]).

10–15 uppersides, 16–18 undersides

10. Greece, Imathía District, Mt. Vérmion, 1150 m, 20.VII.1985, leg. J. Dils.
11. Greece, Evritanía District, Mt. Timfristós, 1600 m, 17.VII.1984, leg. D. van der Poorten.
12. Greece, Fthiótis District, Mt. Íti, 1700 m, 06.VIII.1986, leg. D. van der Poorten.

13, 16. Greece, Tríkala District, Katára Pass, 1750 m, 18.VII.1981, leg. D. van der Poorten.
14, 17. Greece, Kastoriá District, Hrisí, 750 m, 13.VIII.1988, leg. J. Dils.
15, 18. Greece, Kastoriá District, Epáno Aréna, 1700 m, 13.VIII.1986, leg. J. Dils.

(All in coll. VLCA, Vlaamse Lepidoptera Collection Antwerpen).

Plate 3

Phegea **29** (2) (1.VI.2001): 69

Discussion

The chromosome number of the *philippi*-morph from Mt. Falakró was determined to be *n*=88–90, suggesting a slight degree of polymorphism, while a single preparation of the same morph from Mt. Pangéo (type locality of *philippi*) showed this number to be *n*=ca. 90. In both cases the haploid chromosome number was found to be comprised within the limits of the already known chromosome number of *coridon* (i.e. *n*=87–92, cf. de Lesse 1969, 1970), and also to be totally different from the number determined for *philippi* by Brown & Coutsis (1978) as being *n*=20–26 (attributable, no doubt, to a lapsus calibrae), a condition which had formed the basis for differentiating specifically *philippi* from *coridon*. In addition to this, the karyotype of *philippi* was found to be the same as that of *coridon* (a single large, centrally placed bivalent surrounded by small bivalents). In view of these findings the status of the nominal taxon *Lysandra philippi* as a junior subjective synonym of *Papilio coridon* Poda, 1761, as established by Schurian (1988: 130), is confirmed. The slight differences observed between the karyotypes of material from the Mt. Falakró and Mt. Pangéo populations, based on but a few examples, should not at present be considered as indicative of any taxonomic differentiation between them.

The haploid chromosome number of the *graecus*-morph was, in most cases, clearly found to be *n*=93 and in one instance even *n*=94, the latter consisting of 92 bivalents and two univalents that most probably were derived from the splitting of a single bivalent. Other counts, based on approximations due to visual indistinctness that stemmed from poor focusing or overlapping of elements, placed this number at *n*=ca. 86 to *n*=ca. 90. In either case these values fall very close to be within the limits of the known haploid chromosome number of *coridon* (*n*=87–92). As with *philippi*, the karyotype was found to be the same as that of *coridon*.

The difference in chromosome number between *philippi* (*n*=88–90) and *graecus* (*n*=93) in such high chromosome number karyotypes is probably too small to be of any taxonomic significance. Furthermore, in view of the fact that these two morphs share the same karyotype with nominotypical *coridon*, that they have been found flying together along with intermediates and that *coridon* is known to exhibit a slight degree of geographic variation in its high chromosome number as well as in superficial characters, it is suggested that at present, and pending more information on the subject, both *philippi* and *graecus* should be considered as mere colour forms of nominotypical *P. coridon*.

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