Polyommatus (*Agrodiaetus*) *artvinensis* stat. nov. and *P.* (*A.*) *sigberti* sp. nov., two vicariant species known so far only from Turkey (Lepidoptera: Lycaenidae)

Alain Olivier, Dirk van der Poorten, Jurate Puplesiene & Willy De Prins

Samenvatting. *Polyommatus* (*Agrodiaetus*) *artvinensis* stat. nov. en *P.* (*A.*) *sigberti* sp. nov., twee vicariërende soorten, tot op heden enkel bekend uit Turkije (Lepidoptera: Lycaenidae)
De soorten *Polyommatus* (*Agrodiaetus*) *artvinensis* stat. nov. en *P.* (*A.*) *actis* sensu Hesselbarth *et al.* (1995) worden behandeld. De ontdekking van de oorspronkelijke types van *P.* (*A.*) *actis* (Herrich-Schäffer, 1851) heeft bevestigd, dat het een totaal andere soort betreft, als deze welke Hesselbarth *et al.* (1995) onder die naam verstaan (cf. Olivier 2000a, *in druk*). Laatstgenoemd taxon, *P.* (*A.*) *actis* auctorum, blijkt nog geen naam te hebben en wordt bijgevolg beschreven als *P.* (*A.*) *sigberti* sp. nov. *P.* (*A.*) *artvinensis* stat. nov. is evenmin conspecifiek met *actis* en wordt bijgevolg voor het eerst tot soortstatus verheven. Het met zekerheid gekende verspreidingsgebied ervan is beperkt tot het noordoosten van het Pontusgebergte, in de Turkse provincies Erzurum en Artvin. Van *P.* (*A.*) *artvinensis* stat. nov. wordt voor de eerste maal het haploïde chromosoomnummer vastgesteld als $n = 21$ en het karyotype wordt gedetailleerd beschreven. *P.* (*A.*) *sigberti* sp. nov. lijkt nog het meest op *artvinensis*, doch verschilt in enkele uiterlijke kenmerken (kleur en vleugeltekening), alsook in het chromosoomnummer, $n = (27)28–29$ (Lukhtanov & Kandul, niet eerder gepubliceerde gegevens). *P.* (*A.*) *sigberti* sp. nov. is tot op heden met zekerheid bekend uit het Taurusgebergte (Sultandağları, Bolkar Dağları, Aladağları), alsook uit het westelijk en oost-centraal Pontusgebergte (provincies Eskişehir en Giresun) en de provincie Erzincan (omgeving van Refahiye en Kemaliye). Beide soorten komen sympatrisch (soms syntoop) en synchroon voor met enkele nauwverwante soorten, waarvan ze echter zonder moeite kunnen worden onderscheiden op basis van uiterlijke kenmerken.

Résumé. *Polyommatus* (*Agrodiaetus*) *artvinensis* stat. nov. et *P.* (*A.*) *sigberti* sp. nov., deux espèces vicariantes, connues uniquement de Turquie jusqu'à présent (Lepidoptera: Lycaenidae)
Les espèces *Polyommatus* (*Agrodiaetus*) *artvinensis* stat. nov. et *P.* (*A.*) *actis* sensu Hesselbarth *et al.* (1995) sont traitées. La découverte du matériel-type original de *P.* (*A.*) *actis* (Herrich-Schäffer, 1851) a confirmé qu'il s'agit en fait d'une toute autre espèce que celle désignée sous ce nom par Hesselbarth *et al.* (1995) (cf. Olivier 2000a, *sous presse*). Ce dernier taxon, *P.* (*A.*) *actis* auctorum, apparaît ne pas encore avoir été nommé et est, par conséquent, décrit sous le nom de *P.* (*A.*) *sigberti* sp. nov. *P.* (*A.*) *artvinensis* stat. nov. apparaît également être distinct au niveau spécifique d'*actis*, et est par conséquent élevé pour la première fois au rang d'espèce. L'aire de répartition de cette espèce connue avec certitude se limite au nord-est des Chaînes Pontiques, dans les provinces d'Erzurum et d'Artvin en Turquie. Le nombre de chromosomes haploïde de *P.* (*A.*) *artvinensis* stat. nov. est déterminé pour la première fois comme étant $n = 21$ et une description détaillée du caryotype est présentée. *P.* (*A.*) *sigberti* sp. nov. ressemble encore le plus à *artvinensis*, mais elle en diffère par plusieurs caractères externes (couleur et dessin alaire), ainsi que par le nombre de chromosomes, $n = (27)28–29$ (Lukhtanov & Kandul, données non encore publiées précédemment). Jusqu'à l'heure actuelle, *P.* (*A.*) *sigberti* sp. nov. est connue avec certitude du Taurus (Sultandağları, Bolkar Dağları, Aladağları), ainsi que de l'ouest et du centre-est des Chaînes Pontiques (provinces d'Eskişehir et de Giresun) et de la province d'Erzincan (environs de Refahiye et de Kemaliye). Les deux espèces cohabitent (parfois dans le même habitat) et volent au même moment que certaines espèces étroitement apparentées, mais elles s'en distinguent aisément sur base de caractères externes.

Abstract. *Polyommatus* (*Agrodiaetus*) *artvinensis* stat. nov. and *P.* (*A.*) *sigberti* sp. nov., two vicariant species known so far only from Turkey (Lepidoptera: Lycaenidae)
The species *Polyommatus* (*Agrodiaetus*) *artvinensis* stat. nov. and *P.* (*A.*) *actis* sensu Hesselbarth *et al.* (1995) are treated. The discovery of the type specimens of *P.* (*A.*) *actis* (Herrich-Schäffer, 1851) has confirmed that a totally different species than the one designated under this name by Hesselbarth *et al.* (1995) is involved (cf. Olivier 2000a, *in press*). Last-mentioned taxon, *P.* (*A.*) *actis* auctorum, appears to be still unnamed, and hence is described here as *P.* (*A.*) *sigberti* sp. nov. *P.* (*A.*) *artvinensis* stat. nov. is also a different species from *P.* (*A.*) *actis* and, as a result, is newly elevated to species rank. The known range of this species is limited to the northeastern Pontic chain, in the Turkish provinces of Erzurum and Artvin. The haploid chromosome number of *P.* (*A.*) *artvinensis* stat. nov. is determined for the first time as being $n = 21$ and a detailed description of the karyotype is presented. *P.* (*A.*) *sigberti* sp. nov. resembles the most to *artvinensis*, but differs from it in some external features (colour and wing markings), as well as in chromosome number, i.e. $n = (27)28–29$ (Lukhtanov & Kandul, so far unpublished data). Up to the present, *P.* (*A.*) *sigberti* sp. nov. is known with certainty from the Taurus Mts. (Sultandağları, Bolkar Dağları, Aladağları) and from the western and central-eastern part of the Pontic chain (Eskişehir and Giresun provinces), as well as from Erzincan province (environs of Refahiye and of Kemaliye). Both species are sympatric (sometimes even syntopic) and

synchronous with some closely related species, from which they can however easily be told apart by external features.

Zusammenfassung. *Polyommatus* (*Agrodiaetus*) *artvinensis* stat. nov. und *P.* (*A.*) *sigberti* sp. nov., zwei allopatrische, bisher nur aus der Türkei bekannte Arten (Lepidoptera: Lycae nidae)
Die beiden Arten *Polyommatus* (*Agrodiaetus*) *artvinensis* stat. nov. and *P.* (*A.*) *actis* sensu Hesselbarth *et al.* (1995) werden behandelt. Das Auffinden der Typenserie von *P.* (*A.*) *actis* (Herrich-Schäffer, 1851) bestätigte, dass hier eine völlig andere Art vorliegt als diejenige, die von Hesselbarth *et al.* (1995) mit diesem Namen belegt worden war (vgl. Olivier 2000a, *in Druck*). Letzteres Taxon, *P.* (*A.*) *actis* auctorum, ist noch ohne Namen und wird daher hier als *P.* (*A.*) *sigberti* sp. nov. beschrieben. Desweiteren ist *P.* (*A.*) *artvinensis* stat. nov. von *P.* (*A.*) *actis* artverschieden und wird aus diesem Grund in den Artrang erhoben. Das bisher bekannte Verbreitungsgebiet der letztgenannten Art ist auf den nordöstlichen Teil des Pontusgebirges (Prov. Erzurum und Artvin, Türkei) beschränkt. Erstmals konnte die haploide Chromosomenzahl von *P.* (*A.*) *artvinensis* stat. nov. mit $n = 21$ ermittelt werden, der Karyotyp wird eingehend beschrieben. *P.* (*A.*) *sigberti* sp. nov. ähnelt stark *P.* (*A.*) *artvinensis* stat. nov., unterscheidet sich jedoch in mehreren äußeren Merkmalen (Flügelfärbung und –zeichnung), sowie in der Chromosomenzahl von $n = (27)28–29$ (Lukhtanov & Kandul, bisher unveröffentlicht). Sichere Vorkommen von *P.* (*A.*) *sigberti* sp. nov. sind derzeit vom Taurusgebirge (Sultandağları, Bolkar Dağları, Aladağları), vom westlichen und östlich zentralen Teil des Pontus (Provinzen Eskişehir und Giresun) und aus der Provinz Erzincan (Umgebung Refahiye und Kemaliye) bekannt. Beide Arten können sympatrisch (manchmal sogar syntop) und synchron mit einigen nah verwandten Arten gefunden werden, eine sichere Artunterscheidung ist jedoch leicht anhand äußerer Merkmale möglich.

Key words: Lycaenidae – new species – *Polyommatus* (*Agrodiaetus*) *actis* group – *Polyommatus* (*Agrodiaetus*) *artvinensis* stat. nov. – *Polyommatus* (*Agrodiaetus*) *sigberti* sp. nov. – karyotype – chromosome number – Turkey.

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1. Introduction

During a visit to the Museum für Naturkunde der Humboldt-Universität zu Berlin, the first author of the present contribution had the opportunity to examine the syntypes (♂, ♀) of the nominal taxon *Polyommatus* (*Agrodiaetus*) *actis* (Herrich-Schäffer, 1851), which appeared to differ clearly from the taxon treated by Hesselbarth *et al.* (1995) under that name, and to correspond to their *P.* (*A.*) *firdussii* (Forster, 1956) pro parte. The far-reaching taxonomic and nomenclatural consequences of this discovery with respect to the correct application of the name *actis* are dealt with in detail in a separate publication (Olivier 2000b, *in press*).

In the present publication, we deal with the nominal taxon "*Agrodiaetus actis artvinensis*", recently described by Carbonell (1997), as well as with "*Polyommatus* (*Agrodiaetus*) *actis* sensu Hesselbarth *et al.* (1995)" that, as will be shown, still has no valid name and hence is described here as new.

In July 1999, the four of us, accompanied by Mr. Martin Wiemers (Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn), were able to collect material of *artvinensis* in the province of Artvin in northeastern Turkey and to fix testes for karyological study. The results of this study are dealt with in the present publication, along with so far unpublished data on the chromosome number of material of the new species, collected in the Aladağları, in the province of Niğde in the central-eastern Taurus in southern Turkey, by Harry van Oorschot, Hubertus van den Brink (both Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum Amsterdam) and two of us (DVP, WDP) in July 1994, and studied by Dr. Vladimir Lukhtanov and Dr. Nikolai P. Kandul (both Dept. of Entomology, Faculty of Biology, University of St.-Petersburg). We further present data on the morphology, distribution and bionomics of both taxa, as obtained during various trips to Turkey in the 1990's, as well as resulting from the study of the collection of the Zoologische Staatssammlung München and of the private collections of

both Dr. Wolfgang Eckweiler (Frankfurt am Main) and Dr. Klaus G. Schurian (Kelkheim/Ts., Germany).

2. Material and methods

In July 1999, the testes of five ♂ of *artvinensis* were fixed (code numbers WP99075–9) and slide mounts were prepared by one of us (JP), following by and large the procedure detailed in Olivier *et al.* (1999: 4), but with the following differences: after fixing the material in freshly mixed solution (3 parts ethanol and 1 part glacial acetic acid) for 5–7 months, periodically replacing the old solution with freshly mixed one, the gonads were immersed into 2% acetic orcein staining solution for 1 hour. The slides were made in 45% acetic acid. To obtain permanent slides the cover slips were removed by using the carbon dioxide ice method and dehydrated by immersing the slides into Carnoy solution for 20 min. The slides were air dried for 5 min. with a vacuum pump and 15 min. with a stream of hot air. The air dried slides were then stored in a dust free incubator for 7 days at room temperature. The further treatment was done based on the Puro & Nokkala method (1977), which is especially useful for thin prophase chromosomes with an adapted approach to Lepidoptera chromosome staining (Nokkala, personal communication). Slides followed the treatment of hydrolysis in 1N HCl at room temperature and at 60°C water bath (20 min. and 7 min. respectively) and were stained with freshly made reagent of Schiff. Afterwards, the slides were carefully washed in Sørensen buffer (pH 6.8). The third dye was applied by immersing the slides into 5% Giemsa: Sørensen buffer solution for 30 min. at +4°C and 20 min. at room temperature. The staining was followed by rinsing the slides with distilled water and the slides were subsequently dried with a vacuum pomp and hot air. Finally, permanent preparations were obtained by applying a drop of Entellan on the air dried slides and covering with a cover glass.

The slides were observed and scanned using the microscope Opton. The microphotopictures and measurements of chromosomes were done using a Zeiss Axiodoc microscope coupled to a PC, equipped with the program Zeiss Axiodoc (Zeiss©) and processed with Corel Photo Paint. The slides are deposited in the Vlaamse Lepidoptera Collectie Anwerpen (VLCA).

3. *Polyommatus* (*Agrodiaetus*) *artvinensis* (Carbonell, 1997) stat. nov.

Plates 1 and 2, figs 1–6 (♂), 7–8 (♀); text figs 1–4 (karyotype).

"*Agrodiaetus actis artvinensis* n. ssp." Carbonell, F., 1997: 140–141, pl. coul., Figs 1–3. Type locality: "gorge après Tortum, 1400 m, prov. Erzurum". Type material: **Holotype** ♂, Turkey, Erzurum province, gorge near Tortum, leg. J. Salmon, in coll. Muséum National d'Histoire Naturelle, Paris; **paratypes** 64♂, 9♀ — Turkey, Erzurum province: ♂, Kayser, 1500–1700 m, 15.VII.1976, leg. et coll. W. Eckweiler; ♂, Derekapi, 1100 m, 11.VII.1991, leg. et coll. P. François; 3♂, Aksukapi, 1400–1800 m, 18.VII.1991, leg. et coll. J. Verhulst; ♂, Demirciler, 1400 m, 13.VII.1992, leg. et coll. J. Salmon; 2♂, Demirciler, 1400 m, 30.VI.1994, leg. et coll. J. Salmon; 4♂, Demirciler, 1400 m, 17.VII.1994, leg. et coll. J. Salmon; 2♂, Demirciler, 1600 m, 26.VII.1995, leg. et coll. F. Carbonell; ♂, Aksu Kapi, 1300 m, 11.VII.1994, leg. et coll. J. Salmon; ♂, gorge near Tortum, leg. J. Salmon, in coll. F. Carbonell; ♂, Azot Geçidi, 2400 m, 26.VII.1995, leg. et coll. F. Carbonell; 7♂, ♀ Tortum, Haho-Kilesı, 1250 m, 23.VI.1996, leg. et coll. W. ten Hagen; 7♂ Tortum, Haho-Kilesı, 1250 m, 23.VI.1997, leg. W. ten Hagen, in colls. W. ten Hagen (5), W. Eckweiler (1) and K. G. Schurian (1); ♂ Tortum Gölü, 1100 m, 23.VI.1997, leg. et coll. W. ten Hagen; 3♂, Tortum, Ösk-Kilesı, 1250 m, 23.VI.1997, leg. W. ten Hagen; 3♂, ♀, Tortum, Haho-Kilesı, 1250 m, 23.VII.1997, leg. et coll. W. ten Hagen; 5♂, 2♀, vic. Tortum, Pehlivanlı Boğazı, 1400–1600 m, 2.VIII.1997, leg. et coll. K. G. Schurian — Turkey, Artvin province: ♂, ♀, N. Kılıçkaya, 900 m, 25.VII.1995, leg. et coll. F. Carbonell; 2♂, ♀, Yusufeli, Kılıçkaya, 1300–1500 m, 29.VII.1996, leg. et coll. W. Eckweiler; 3♂, ♀, Yusufeli, Kılıçkaya, 1300–1500 m, 30.VII.1996, leg. et coll. W. Eckweiler; 7♂, Yusufeli, Kılıçkaya, 1300–1500 m, 29.VII.1996, leg. et coll. K. G. Schurian; 2♀, 3 km S. Kılıçkaya, 1400–1500 m, St. 2295,

30.VII.1996, leg. W. De Prins, A. Olivier & D. van der Poorten, in coll. VLCA; 8♂, Akdağ, 5–7 km W. Olur, 1500–1600 m, St. 2319, 1.VIII.1996, leg. W. De Prins, A. Olivier & D. van der Poorten, in coll. VLCA.

Material examined. 65♂, 12♀

8♂ paratypes, Erzurum province, Akdağ, 5–7 km W. Olur, 1500–1600 m, St. 2319, 1.VIII.1996, leg. W. De Prins, A. Olivier & D. van der Poorten; 14♂, Artvin province, 10 km E. Kılıçkaya, 1350 m, St. 2525, 8.VII.1999, leg. W. De Prins, A. Olivier, J. Puplesiene & D. van der Poorten; 2♀ paratypes, Artvin province, 3 km S. Kılıçkaya, 1400–1500 m, St. 2295, 30.VII.1996, leg. W. De Prins, A. Olivier & D. van der Poorten, all in coll. Vlaamse Lepidoptera Collectie Antwerpen (VLCA).

♂ paratype, Erzurum province, İspir, Kayser, 1500–1700 m, 15.VII.1976, leg. W. Eckweiler; ♂ paratype, Erzurum province, Tortum, Haho-Kilesi, 1250 m, 23.VII.1997, leg. W. ten Hagen; 2♂, 3♀ paratypes, Artvin province, Yusufeli, Kılıçkaya, 1300–1500 m, 29.VII.1996, leg. W. Eckweiler; 3♂, ♀ paratypes, Artvin province, Yusufeli, Kılıçkaya, 1300–1500 m, 30.VII.1996, leg. W. Eckweiler; 7♂, Erzurum province, Dikmen, SW. Uzundere, 1300 m, 16.VII.1998, leg. P. Hofmann; 15♂ Artvin province, Kılıçkaya, SW. Yusufeli, 1100–1200 m, 13.VII.1998, leg. P. Hofmann, all in coll W. Eckweiler.

♂ paratype, Erzurum province, Tortum, Haho-Kilesi, 1250 m, 23.VI.1997, leg. W. ten Hagen; 5♂, 5♀ paratypes, Erzurum province, vic. Tortum, Pehlivanlı Boğazı, 1400–1600 m, 2.VIII.1997, leg. K. G. Schurian; 3♂ paratypes, Artvin province, Yusufeli, Kılıçkaya, 1300–1500 m, 29.VII.1996, leg. et coll. K. G. Schurian; ♂ paratype, Artvin province, Yusufeli, Kılıçkaya, 1300–1500 m, 30.VII.1996, leg. K. G. Schurian; ♀, Artvin province, 10 km N.–10 km S. Yusufeli, 1200 m, 1.VIII.1994, leg. K. G. Schurian; 2♂, Artvin province, Çoruh Valley, vic. Kılıçkaya, 1200 m, 4.VIII.1997, leg. K. G. Schurian; 2♂, Artvin province, Kılıçkaya, SW. Yusufeli, 1100–1200 m, 13–17.VII.1997, leg. K. G. Schurian, all in coll. K. G. Schurian.

Description. ♂ Forewing length 13.5–16.0 mm. Upperside ground-colour purplish violet, much as in *P.* (*A.*) *turcicus* Koçak, 1977, often with a faintly marked discoidal spot on forewing; often with extensive blackish suffusion in the distal third of the hindwing and, as a black margin of about 2 mm wide, along the outer margin of forewing up (or nearly) to the apex: sometimes the blackish suffusion invades most of the hindwing except for the basal area, sometimes it is entirely absent on all four wings, in the latter case the veins are always blackened, especially on hindwing; fringes blackish grey basally, white distally. Underside ground-colour warm greyish brown, without any or at most a vestigial blue-green basal suffusion; all spots well developed, black with creamy ocellation; submarginal row of markings sometimes well expressed; white streak always well expressed, narrow and straight, sometimes pointed distally, rather sharply contrasting with ground-colour.

♀ Slightly smaller than ♂. Upperside ground-colour almost uniformly dark brown, with blackish brown discoidal spot on forewing. Underside ground-colour warm brown, darker than in ♂.

Chromosome number and karyotype. Three preparations allowed unambiguous counting of the haploid chromosome number as n = 21 and 20–21. In preparation WP99075, 38 cells of *M*I, 2 cells of *M*II, 4 cells in diakinesis and three cysts of irregular divisions were found. In prep. WP99077, 5 *M*I cells, 20 diplotene cells and 7 cells in mitotic division were found, n = 21. Prep. WP99076 showed no spermatogonian or spermatocyte divisions, but only mature sperms. In preparation WP99079, no eupyrene spermatocyte divisions were found, but 2 cysts showed apyrene spermatogenesis and the preparation contained plenty of mature sperms.

The bivalents of *Polyommatus (Agrodiaetus) artvinensis* are homochromatic, usually round or a little bit elongated and large in size, showing a gradual, very slightly decreasing series (Fig. 1, table 1).

Legend of plates 1 (uppersides) and 2 (undersides)

1–8: *Polyommatus* (*Agrodiaetus*) *artvinensis* Carbonell, 1997 stat. nov.

1–3. ♂, Turkey, Artvin province, 10 km E. Kılıçkaya, 1350 m, St. 2525, 8.VII.1999, leg. W. De Prins, A. Olivier, J. Puplesiene & D. van der Poorten, in coll. VLCA.

4. ♂, same data. Prep. WP99075, *n* = 21.

5–6. Paratype ♂, Turkey, Erzurum province, Akdağ, 5–7 km W. Olur, 1500–1600 m, St. 2319, 1.VIII.1996, leg. W. De Prins, A. Olivier & D. van der Poorten, in coll. VLCA.

7–8. Paratype ♀, Artvin province, 3 km S. Kılıçkaya, 1400–1500 m, St. 2295, 30.VII.1996, leg. W. De Prins, A. Olivier & D. van der Poorten, in coll. VLCA.

9–10: *Polyommatus* (*Agrodiaetus*) *actis* (Herrich-Schäffer, 1851)

9. ♂, "Kleinasien | Amasia Korb" [handwritten], "Sammlung Osthelder" [printed], in coll. Zoologische Staatssammlung München.

10. ♂, "Kleinasien | Konia | Korb" [handwritten], "Sammlung Osthelder" [printed], in coll. Zoologische Staatssammlung München.

11–12: *Polyommatus* (*Agrodiaetus*) ?*sertavulensis* (Koçak, 1979) species incertae sedis

11. ♂, Turkey, Niğde province, Aladağları, 15 km SE Çamardı, 1800–2100 m, St. 2009, 30.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins, in coll. Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum Amsterdam. Testes fix. No 94/123, *n* = 23–24.

12. ♂, Turkey, Niğde province, Aladağları, 15 km SE Çamardı, 1800–2100 m, St. 2009, 30.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins, in coll. Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum Amsterdam. Testes fix. No 94/126, *n* = 23–24.

13: *Polyommatus* (*Agrodiaetus*) *cilicius bolkarensis* (Carbonell, 1998)

13. ♂, Turkey, Konya province, env. İvrız, 20 km SE. Ereğli, 1200 m, St. 1995, 22.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins, in coll. Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum Amsterdam. Testes fix. No 94/046, *n* = 28.

14–32: *Polyommatus* (*Agrodiaetus*) *sigberti* sp. nov.

14. Holotype ♂, Turkey, Kayseri province, Aladağları E. side, 34 km S. Yahyalı, 2800–2900 m, St. 2384, 7.VIII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten, in coll. Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum Amsterdam.

15. Paratype ♂, "Asia min. c. | Anatolia c. | Akşehir Sultan Dagh | 17–2200 m 1.–15.7.34 | Coll. E. Pfeiffer München", in coll. Zoologische Staatssammlung München.

16. Paratype ♂, "Asia min. c. | Anatolia c. | Akşehir Sultan Dagh | 17–2200 m 15.–30.7.34 | Coll. E. Pfeiffer München", in coll. Zoologische Staatssammlung München.

17. Paratype ♂, "Anatolien | Konia | 1899 Korb | Sammlung I. K. H. Prinzessin Therese von Bayern", in coll. Zoologische Staatssammlung München.

18. Paratype ♂, Turkey, Isparta province, Sultandağları, 22–23 km S. Akşehir, 1500–1800 m, St. 1746, 26–27.VII.1991, leg. D. v. d. Poorten & W. De Prins, in coll. VLCA.

19. Paratype ♂, Turkey, Niğde province, Bolkar Dağları, SW. Maden, 2600–2800 m, St. 1996, 24.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins, in coll. VLCA.

20–21. Paratype ♂, Turkey, Konya province, 5 km W. Aktoprak, 15 km S. Ulukışla, 1500 m, St. 2367, 29.VII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten, in coll. VLCA.

22. Paratype ♂, Turkey, Niğde province, Aladağları W. side, 15 km SE. Çamardı, Koraç Boğazı, 1800–2000 m, St. 2105, 1.VIII.1995, leg. D. v. d. Poorten & W. De Prins, in coll. VLCA.

23. Paratype ♂, Turkey, Kayseri province, Aladağları E. side, 35 km S. Yahyalı, 2000 m, St. 2097, 27.VII.1995, leg. D. v. d. Poorten & W. De Prins, in coll. VLCA.

24. Paratype ♂, Turkey, Kayseri province, Aladağları E. side, 34 km S. Yahyalı, 2800–2900 m, St. 2097, 31.VII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten, in coll. VLCA.

25. Paratype ♂, Turkey, Niğde province, Aladağları, 15 km SE Çamardı, 1800–2100 m, St. 2009, 30.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins, in coll. Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum Amsterdam. Testes fix. No 94/122, *n* = 29.

26. Paratype ♂, Turkey, Niğde province, Aladağları, 15 km SE Çamardı, 1800–2100 m, St. 2009, 30.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins, in coll. Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum Amsterdam. Testes fix. No 94/125, *n* = 28.

27–28. Paratype ♂, Turkey, Erzincan province, 10 km N. Kemaliye (= Egin), 1200 m, 23.VII.1996, leg. et coll. W. Eckweiler.

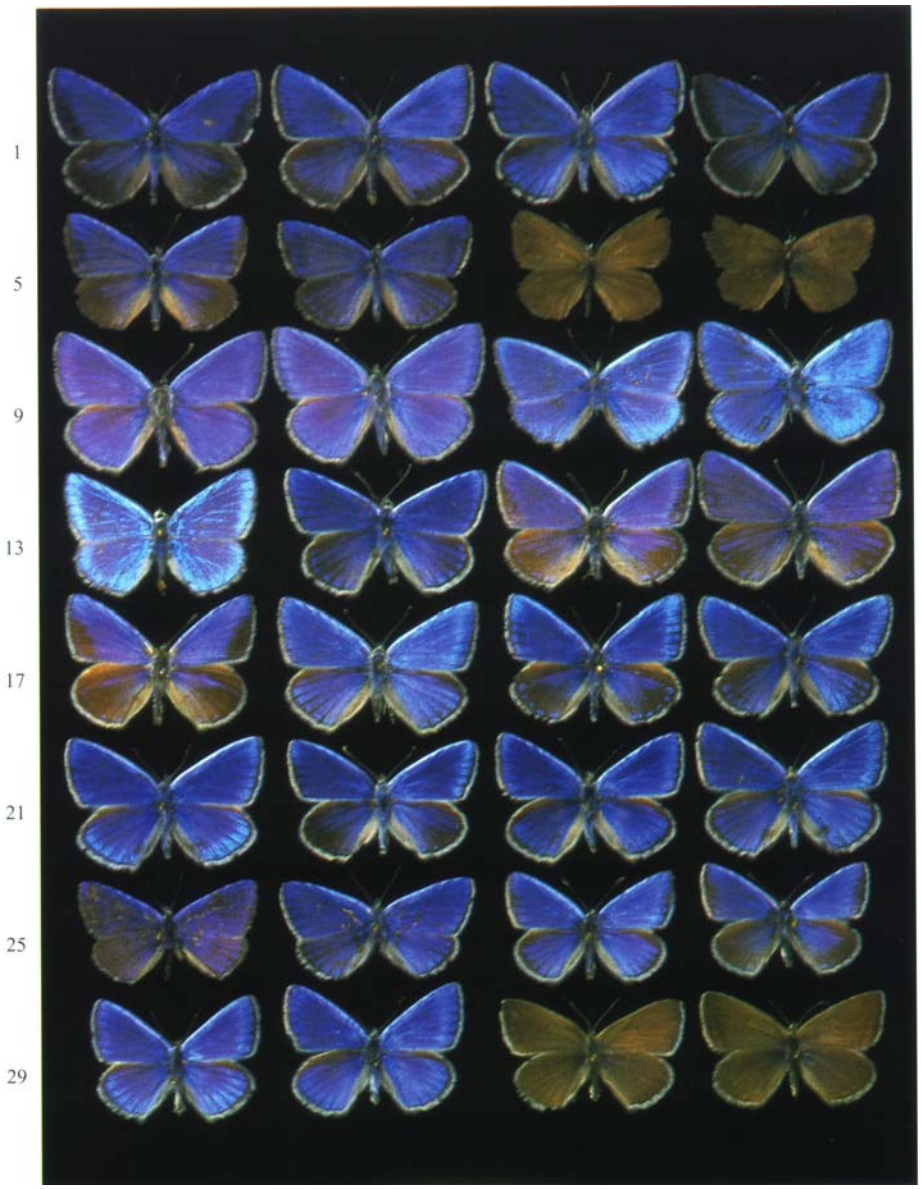
29. Paratype ♂, Turkey, Erzincan province, 3–5 km W. Refahiye, 1450 m, Coll. Nr. 229, 24.VII.1986, leg. K. G. Schurian, in coll. VLCA.

30. Paratype ♂, Turkey, Giresun province, 5 km N. Şebinkarahisar, 1300 m, 16.VII.1995, leg. et coll. K. G. Schurian.

31. Paratype ♀, Turkey, Niğde province, Bolkar Dağları N. side, SW. Maden, 1750 m, St. 2368, 29.VII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten, in coll. VLCA.

32. Paratype ♀, Turkey, Kayseri province, Aladağları E. side, 34 km S. Yahyalı, 2800–2900 m, St. 2384, 7.VIII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten, in coll. VLCA.

Plate 1



Phegea **28** (2) (1.VI.2000): 62

Plate 2

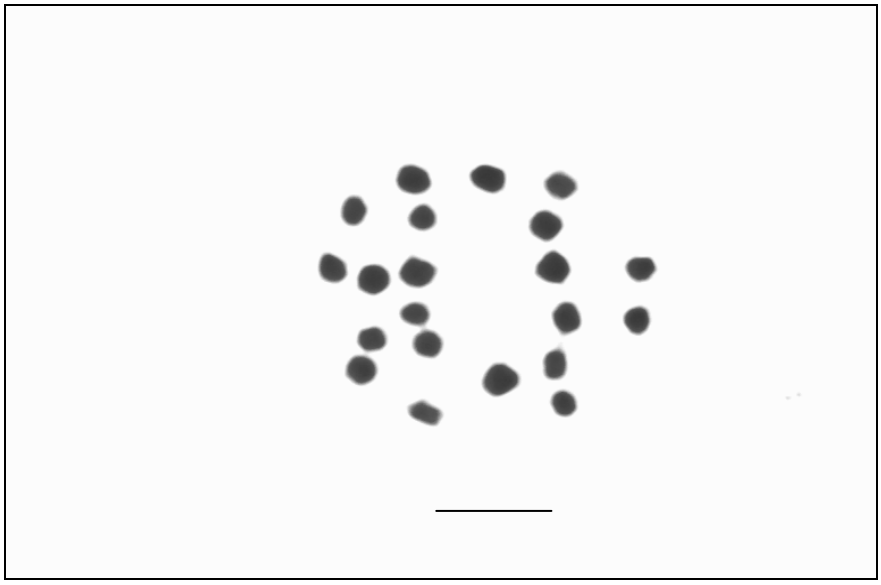


Fig. 1. Karyotype of *Polyommatus* (*Agrodiaetus*) *artvinensis* Carbonell, 1997 stat. nov., *M*I in prep. WP99075, *n* = 21, Turkey, Artvin province, 10 km E Kılıçkaya, 1350 m, 40°42'N 41°29'E, UTM GF01, 8.VII.1999, leg. W. De Prins, A. Olivier, J. Puplesiene & D. van der Poorten. Scale bar 10µm.

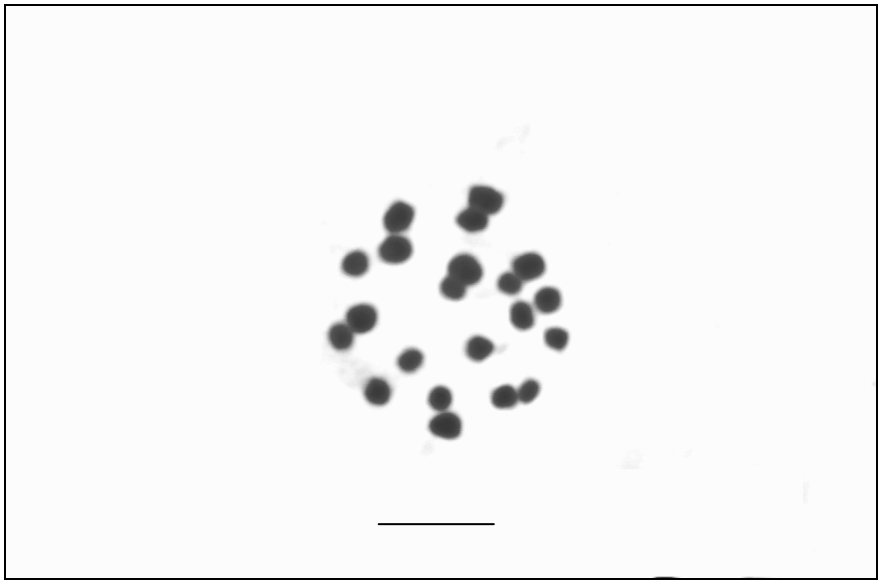


Fig. 2. Karyotype of *Polyommatus* (*Agrodiaetus*) *artvinensis* Carbonell, 1997 stat. nov., two-bivalent associations in prep. WP99075, *n* = 21, Turkey, Artvin province, 10 km E Kılıçkaya, 1350 m, 40°42'N 41°29'E, UTM GF01, 8.VII.1999, leg. W. De Prins, A. Olivier, J. Puplesiene & D. van der Poorten. Scale bar 10µm.

Table 1. *Polyommatus* (*Agrodiaetus*) *artvinensis* Carbonell, 1997 stat. nov.: chromosome size in µm²

***M*I plate**	**WP99075a**	**WP99075b**	**WP99075c**
1st bv. in series	5.774	4.770	5.124
2nd bv. in series	5.749	4.657	4.549
3rd bv. in series	5.120	4.532	3.895
The smallest bv.in series	3.374	2.700	2.816
The ratio 1st/last bv.	1.711	1.766	1.819

One bivalent shows a higher degree in dye adhesion, it contains more C-heterochromatin; one other bivalent is clearly heterochromatic, with one of the constituting chromosomes small and the other medium-sized. The bivalents tend to the formation of telomeric associations. The smallest bivalent shows a lesser degree in dye adhesion, i.e. in chromatin contraction, and is usually situated at the edge of the plate.

8 pairs of bivalents in early metaphase I tend to form two-bivalent associations, while the remaining five behave as separate units (Fig. 2).

In diakinesis, the bivalents vary in shape and in chiasmata number. The largest three bivalents still carry 2–3 chiasmata and have the shape of a regular ring or a complex form, combining a ring and two, in the largest bivalent even three, separate "tails". Nevertheless, the smaller bivalents are already contracted to an oval shape and do not show interstitial chiasmata. The smallest bivalent shows a slightly different behaviour and was located almost outside the plate, appearing prematurely contracted. We may assume that it could be the sex bivalent (Fig. 3). In general the bivalents in diplotene are of complicated configuration: 3 of these possess two chiasmata and an irregular structure. The bivalents tend to the formation of telomeric association.

Three cysts were found where bivalents have split up into univalents. The univalents in anaphase I are dispersed all along the chromatin spindle, showing different speed of separation (Fig. 4).

Distribution. Only known from Turkey, Erzurum province, various localities (Carbonell 1997: 140–141; this study); Artvin province, environs of Kılıçkaya (Carbonell 1997: 140–141; this study).

Bionomics. Flowery meadows and moderately shady places, often at humid spots, between 900 and 2400 m, in one brood from late June to early August (Carbonell 1997; Olivier *et al.*, own observations 1996 and 1999). Sympatric with *P.* (*A.*) *wagneri* (Forster, 1956) and *P.* (*A.*) "*firdussii*" (Forster, 1956) (Hesselbarth *et al.* 1995; Carbonell 1997).

Notes.

(1) *P.* (*A.*) *artvinensis* stat. nov. differs markedly from *P.* (*A.*) *actis* and *P.* (*A.*) *sigberti* sp. nov. in external morphology, from the latter also in chromosome number (see below). It has also been reported as being sympatric with "*firdussii*": therefore, it is established here as a distinct species.

(2) There are slight differences in numbers of paratypes listed by Carbonell (1997) and specimens labelled as such in colls. W. Eckweiler and K. G. Schurian (compare list of paratypes with material examined in the present study).

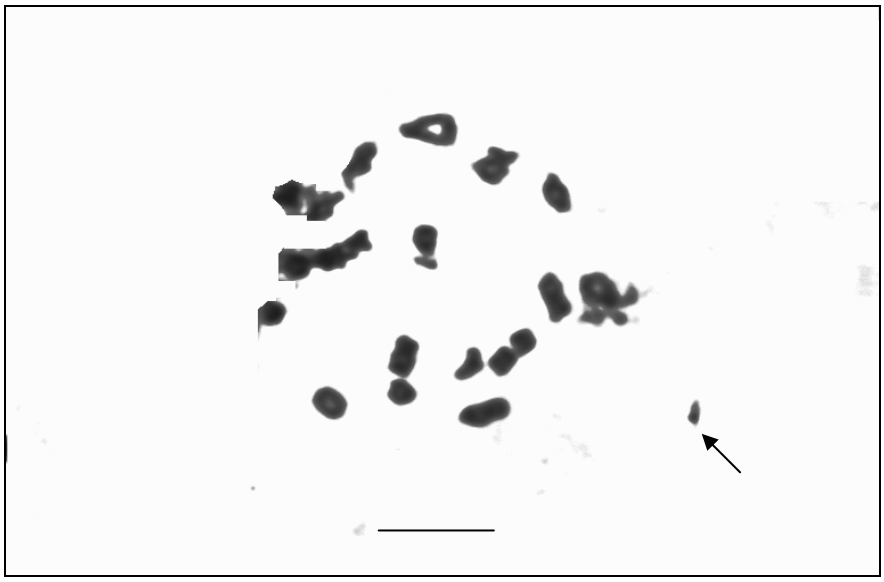


Fig. 3. Karyotype of *Polyommatus* (*Agrodiaetus*) *artvinensis* Carbonell, 1997 stat. nov., diakinesis in prep. WP99075, Turkey, Artvin province, 10 km E Kılıçkaya, 1350 m, 40°42'N 41°29'E, UTM GF01, 8.VII.1999, leg. W. De Prins, A. Olivier, J. Puplesiene & D. van der Poorten. An arrow indicates the smallest bivalent. Scale bar 10µm.

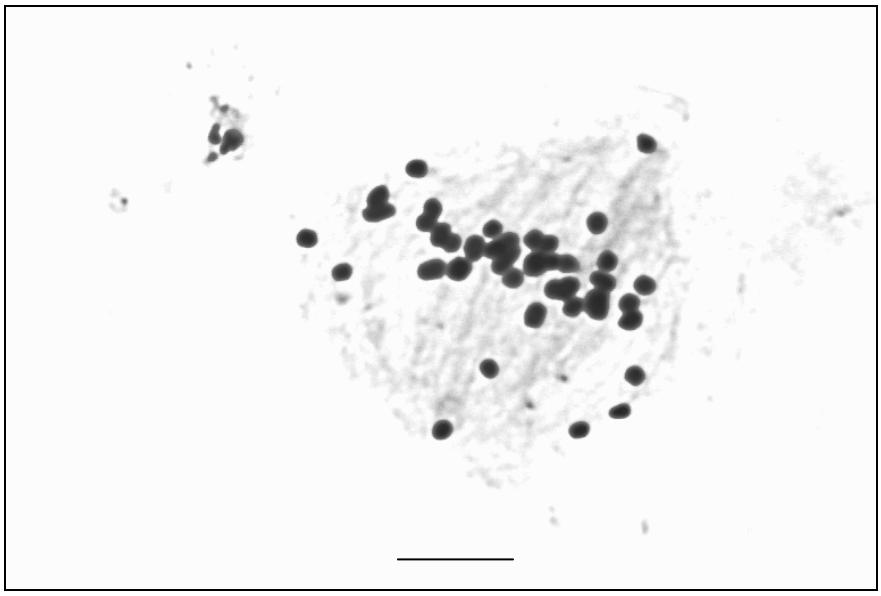


Fig. 4. Anaphase I in side view of *Polyommatus* (*Agrodiaetus*) *artvinensis* Carbonell, 1997 stat. nov., irregular division cell in prep. WP99075, Turkey, Artvin province, 10 km E Kılıçkaya, 1350 m, 40°42'N 41°29'E, UTM GF01, 8.VII.1999, leg. W. De Prins, A. Olivier, J. Puplesiene & D. van der Poorten. Scale bar 10µm.

4. *Polyommatus* (*Agrodiaetus*) *sigberti* sp. nov.

Plates 1 and 2, figs 14–30 (♂), 31–32 (♀); Plate 3, figs 1–4.

Type material. **Holotype** ♂ with printed white label "TURKEY St. 2384 | Kayseri 2800-2900 m | Aladaglari E-side, 34 km | S Yahyali, 7.VIII.1997| leg. W.De Prins, A.Olivier | & D.van der Poorten"; designated with printed orange label "*Polyommatus* (*Agrodiaetus*) | *sigberti* Olivier, | van der Poorten, | Puplesiene & | De Prins, 2000 | HOLOTYPUS ♂", in coll. Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum Amsterdam.
Paratypes 1019♂, 113♀:
7♂, "Asia min. | Anatolia | Konia | E. Pfeiffer, München"; ↵, "Anatolien | Konia | 1914 leg. Korb | e. coll. Cl. Hörhammer | Staatsslg. München"; 3♂, "Anatolien | Konia | 1914. Korb"; 8♂, ♀, "Asia min. o | Anatolia c. | Akşehir Sultan Dagh | 17–2200 m | 15.–30.7.34 | Coll. E. Pfeiffer München"; ♂, "Konia | Staatsslg. München | e. coll. Cl. Hörhammer; 10♂, 4♀, "Asia min. c. | Anatolia c. | Akşehir Sultan Dagh | 17–2200 m 1.–15.7.34 | Coll. E. Pfeiffer, München"; ♂, Asia min. c. | Anatolia c. | Akşehir | 20.–30.VI.34 | 10–1500 m | E. Pfeiffer München leg."; ♂, "Anatolien | Konia ♂ | 1899 Korb | [handwritten] actis v. athis"; ♂, "Kleinasien | Konia | Korb leg. | Sammlung Osthelder"; 2♂, ♀, "Anatolien | Konia | 1914. Korb | Collection v. Rosen"; ♂, "Athis Frr. ♂ | Anatolien | Sammlung M. Schneider"; ♂, "Lycaena actis var. athis ♂ Frr. | Collection Max Korb"; 2♂, "Anatolien | Konia | 1899 Korb | Sammlung I. K. H. Prinzessin Therese von Bayern"; ♂, "Anatolien | Konia | 1899 Korb | ♂ | Lycaena Athis Frr."; ♂, "Anatolien | Konia | 1914. Korb | Sammlung L. F. Müller"; ♂, "Anat. Korb. 1899"; ♂, "Anatolien | Sammlung M. Schneider"; 2♂, "Asia m., Anatolia | Sultan Dagh | 1.–9.VII.1934 | Schwingenschuss | Sammlung Osthelder"; ♀, "Anatolien | Konia | Korb leg. | Sammlung Osthelder"; ♂, "Anatolien | Konia | 1899 Korb | Coll. Alberti", all in coll. Zoologische Staatssammlung München.
224♂, Afyon province, Sultandağları, 10 km S. Çay, 1300 m, 18.–25.VII.1980, leg. Fam. H. v. Oorschot; 50♂, 2♀, Afyon province, Sultandağları, 10 km S. Çay, 1200–1500 m, 16.VII.1981, leg. H. v. Oorschot, Th. v. Oorschot & H. v. d. Brink; ♂, Afyon province, Sultandağları, 15 km SE. Çay, 1400–1800 m, 14.–18.VII.1981, leg. H. v. Oorschot, Th. v. Oorschot & H. v. d. Brink; 2♂, Afyon province, Sultandağları, 13 km SE. Çay, 1300–1500 m, St. 267, 17.VII.1985, leg. B. v. Oorschot & W. De Prins; 29♂, 2♀, Isparta province, Sultandağları, 15 km S. Akşehir, 1500 m, 12.–21.VII.1981, leg. H. v. Oorschot, Th. v. Oorschot & H. v. d. Brink; 13♂, ♀, Isparta province, Sultandağları, 15 km S. Akşehir, 1800 m, St. 323, 4.VII.1986, leg. W. De Prins; 2♂, Konya province, Sultandağları, 15 km SE. Çay, 1700m, 18.–25.VII.1980, leg. Fam. H. v. Oorschot; 2♂, Konya province, Hills SW. İvriz, 20 km SE. Ereğli, 1300–1500 m, St. 271, 21.VII.1985, leg. B. v. Oorschot & W. De Prins; 34♂, Konya province, Hills SW. İvriz, 20 km SE. Ereğli, 1500–2100 m, St. 272, 22.–23.VII.1985, leg. B. v. Oorschot & W. De Prins; 14♂, Konya province, env. İvriz, 20 km SE. Ereğli, 1200 m, St. 1995, 22.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; 3♂, 2♀, Konya province, Bolkar Dağları, Aydos Dağ, 2500–3150 m, St. 273, 25.–26.VII.1985, leg. B. v. Oorschot & W. De Prins; 6♂, Konya province, Bolkar Dağları, Aydos Dağ, Env. Kaleimindos, 1800–2500 m, St. 274, 26.–27.VII.1985, leg. B. v. Oorschot & W. De Prins; ♂, Niğde province, Bolkar Dağları, 2800 m, 16.VII.1994, leg. J.-P. Borie; 23♂, Niğde province, Bolkar Dağları N. side, SW. Maden, 2600–2800 m, St. 1996, 24.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; 4♂, Niğde province, Bolkar Dağları N. side, SW. Maden, 1850 m, St. 1997, 24.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; 2♂, Niğde province, Bolkar Dağları, 9 km SW. Maden, 2100–2300 m, 23.VII.1995, leg. H. A. Coene & J. H. H. Felten; ♂, Niğde province, Bolkar Dağları, 7 km SW. Maden, 2400–2600 m, 29.VII.1995, leg. H. A. Coene & J. H. H. Felten; 26♂, Niğde province, Aladağları, 18 km SE. Çamardı, 1600–1800 m, St. 43, 1.–2.VII.1982, leg. H. v. Oorschot & H. v. d. Brink; 5♂, ♀, Niğde province, Aladağları, 18 km SE. Çamardı, 1800–2100 m, St. 44, 1.–2.VII.1982, leg. H. v. Oorschot & H. v. d. Brink; 18♂, Niğde province, Aladağları, 18 km SE. Çamardı, 1700–2100 m, St. 70, 4.–8.VIII.1982, leg. B. v. Oorschot; 28♂, Niğde province, Aladağları, 18 km SE. Çamardı, Esnevit, 2600 m, St. 72, 6.–7.VIII.1982, leg. B. v. Oorschot; 24♂, Niğde province, Aladağları, 15 km SE. Çamardı, 1600–1800 m, St. 112, 21.VII.1983, leg. Fam. H. v. Oorschot; 42♂, Niğde province, Aladağları, 15 km SE. Çamardı, 1600–1800 m, St. 136, 6.–11.VIII.1983, leg. H. v. Oorschot, H. v. d. Brink & H. Wiering; 28♂, Niğde province, Aladağları, 18 km SE. Çamardı, 1800–2100 m, St. 137, 7.–11.VIII.1983, leg. H. v. Oorschot, H. v. d. Brink & H. Wiering; 5♂, Niğde province, Aladağları, 18 km SE. Çamardı, Avciveli, 2100–2800 m, St. 138, 8.VIII.1983, leg. H. v. Oorschot, H. v. d. Brink & H. Wiering; 3♂, Niğde province, Aladağları, 18 km SE. Çamardı, Esnevit, 2200–2600 m, St. 139, 9.VIII.1983, leg. H. v. Oorschot, H. v. d. Brink & H. Wiering; 2♂, Niğde province, Aladağları, 22 km SE. Çamardı, 2300–2700 m, St. 140, 10.VIII.1983, leg. H. v. Oorschot, H. v. d. Brink & H. Wiering; 12♂, Niğde province, Aladağları, 15 km SE. Çamardı, 1600 m, 17.–21.VII.1985, Don. H. v. Oorschot; 3♂ Niğde province, Aladağları, 15 km SE. Çamardı, Emli Boğazı, 23.VII.1987, leg. J.-P. Borie; 15♂, ♀, Niğde province, Aladağları, Demirkazık, 2300–2600 m, St. 1999, 24.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; 3♂, Niğde province, Aladağları, Emli Boğazı, 15 km SE. Çamardı, 1800–2100 m, St. 2009, 30.VII.–1.VIII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins, all in coll. Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum Amsterdam.
8♂, Afyon province, Sultandağları, 10 km S. Çay, 1200–1500 m, 16.VII.1981, leg. H. v. Oorschot, Th. v. Oorschot & H. v. d. Brink; 8♂, Isparta province, Sultandağları, 15 km S. Akşehir, 1800 m, St. 323, 4.VII.1986, leg. W. De Prins; 5♂, 2♀, Isparta province, Sultandağları, 22–23 km S. Akşehir, 1500–1800 m, St. 1746, 26.–27.VII.1991, leg. D. v. d. Poorten & W. De Prins; 3♂, Konya province, env. İvriz, 20 km SE. Ereğli, 1200 m, St. 1995,

22.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; ♂, Konya province, 10–20 km E. İvriz, 1500 m, St. 2366, 29.VII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten; 2♂, ♀, Konya province, Bolkar Dağları, Aydos Dağ, 2500–3150 m, St. 273, 25.–26.VII.1985, leg. B. v. Oorschot & W. De Prins; 15♂, Konya province, 5 km W. Aktoprak, 15 km S. Ulukışla, 1500 m, St. 2367, 29.VII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten; 4♂, ♀, Niğde province, Bolkar Dağları N. side, 1800 m, St. 2076, 18.VII.1995, leg. D. v. d. Poorten & W. De Prins; 17♂, 8♀, Niğde province, Bolkar Dağları N. side, SW. Maden, 2600–2800 m, St. 1996, 24.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; 2♂, 3♀, Niğde province, Bolkar Dağları N. side, SW. Maden, 1850 m, St. 1997, 24.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; ♂, Niğde province, Bolkar Dağları N. side, env. Maden, 1500–1850 m, St. 2077, 18.VII.1995, leg. D. v. d. Poorten & W. De Prins; ♂, Niğde province, Bolkar Dağları N. side, SW. Maden, 1500 m, St. 2004, 26.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; 3♂, 7♀, Niğde province, Bolkar Dağları N. side, SW. Maden, 1750 m, St. 2368, 29.VII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten; ♂, Niğde province, Aladağları, Çamardı/Çukurbağ, 1600–2000 m, 1.–6.VIII.1983, leg. W. Eckweiler; 8♂, Niğde province, Aladağları, 15 km SE. Çamardı, 1600 m, 17.–21.VII.1985, Don. H. v. Oorschot; 2♂, 2♀, Niğde province, Aladağları, Demirkazık, 2300–2600 m, St. 1999, 24.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; ♂, ♀, Niğde province, Aladağları, Demirkazık, 1800–2000 m, St. 2000, 25.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; 3♂, Niğde province, Aladağları, Emli Boğazı, 15 km SE. Çamardı, 1800–2100 m, St. 2009, 30.VII.–1.VIII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; ♂, Niğde province, Aladağları, 18 km SE. Çamardı, Avcı Veli, 2500–2800 m, St. 2010, 31.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins; 8♂, Niğde province, Aladağları W. side, Emli Boğazı, 15 km SE. Çamardı, 1600–1800 m, St. 2079, 19.VII.1995, leg. D. v. d. Poorten & W. De Prins; 5♂, 3♀, Niğde province, Aladağları W. side, 15 km SE. Çamardı, Koraç Boğazı, 1800–2000 m, St. 2080, 19.VII.1995, leg. D. v. d. Poorten & W. De Prins; 7♂, 2♀, Niğde province, Aladağları W. side, 15 km SE. Çamardı, Koraç Boğazı, 1800–2000 m, St. 2105, 1.VIII.1995, leg. D. v. d. Poorten & W. De Prins; ♂, Niğde province, Aladağları W. side, Koraç Boğazı, 1800 m, St. 2370, 30.VII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten; ♀, Niğde province, Aladağları W. side, Koraç Boğazı, 1800–2400 m, St. 2390, 12.VIII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten; ♂, Kayseri province, Aladağları E. side, 11 km S. Yahyalı, 1700 m, St. 2095, 26.VII.1995, leg. D. v. d. Poorten & W. De Prins; 2♂, Kayseri province, Aladağları E. side, 48 km S. Yahyalı, 2800–2900 m, St. 2096, 28.VII.–2.VIII.1995, leg. D. v. d. Poorten & W. De Prins; 13♂, Kayseri province, Aladağları E. side, 35 km S. Yahyalı, 2000 m, St. 2097, 27.VII.1995, leg. D. v. d. Poorten & W. De Prins; 6♂, 2♀, Kayseri province, Aladağları E. side, 34 km S. Yahyalı, 2800–2900 m, St. 2372, 31.VII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten; 4♂, 6♀, Kayseri province, Aladağları E. side, 34 km S. Yahyalı, 2800–2900 m, St. 2384, 7.VIII.1997, leg. W. De Prins, A. Olivier & D. v. d. Poorten; ♂, Erzincan province, 3–5 km. W. Refahiye, 1450 m, Coll. Nr. 229, 24.VII.1986, leg. K. G. Schurian, all in coll. Vlaamse Lepidoptera Collectie Antwerpen (VLCA).

2♂, [Konya province], As. m., Anatolia, Sultan-Dagh, 1.–9.VII.1934, leg. L. Schwingenschuss; 2♂, [Konya province], Asia min. o., Anatolia c., Akşehir-Sultan-Dagh, 1700–2000 m, 15.–30.VII.1934, ex coll. E. Pfeiffer; 5♂, Niğde province, Bolkar Dağları, Darboğaz, 1700–1900 m, 9.VII.1995, leg. W. Eckweiler; 2♂, 2♀, Niğde province, Bolkar Dağları, Darboğaz, 2200–2400 m, 25.VII.1995, leg. W. Eckweiler; ♂, Niğde province, Aladağları, Demirkazık, 1600–1950 m, 5.VII.1976, leg. A. Ö. Koçak; ♂, Niğde province, Aladağları, S. Çukurbağ, 1600 m, 26.VII.1981, leg. G. Hesselbarth; 9♂, Niğde province, Aladağları, Çukurbağ (prope Çamardı), 1600 m, 26.VII.1981, leg. C. Naumann & S. Naumann; 54♂, 8♀, Niğde province, Aladağları, Çamardı, Çukurbağ, 1600–2000 m, 1.–6.VIII.1983, leg. W. Eckweiler; 3♂, 12♀, Niğde province, Aladağları, Çamardı, 2100–2500 m, 3.–5.VIII.1983, leg. W. Eckweiler; 5♩, Niğde province, Aladağları, Çukurbağ, N. Çamardı, 1650 m, 18.–21.VII.1984, leg. K. Rose; 11♂, 2♀, Niğde province, Aladağları, Çukurbağ, N. Çamardı, 1650 m, 18.–21.VII.1984, leg. P. Hofmann; 15♂, Niğde province, Aladağları, Çukurbağ, N. Çamardı, 1650 m, 12.VII.1990, leg. P. Hofmann; 8♀, Niğde province, Aladağları, Demirkazık, 1500–1700 m, 14.–18.VII.1990, leg. P. Hofmann; ♀, Niğde province, Aladağları, above Pınarbaşı, 1900–2300 m, 14.–16.VII.1991, leg. W. Eckweiler; 4♂, ♀, Niğde province, Aladağları, above Pınarbaşı, 2300–2600 m, 14.–16.VII.1991, leg. W. Eckweiler; ♂, Niğde province, Aladağları, above Pınarbaşı, 2300–2600 m, 12.–15.VII.1994, leg. P. Hofmann; 2♂, Niğde province, Aladağları, Demirkazık, 1900–2100 m, 10.VII.1995, leg. W. Eckweiler; 9♂, Erzincan province, 10 km N. Kemaliye (= Egin), 1200 m, 23.VII.1996, leg. W. Eckweiler, all in coll. W. Eckweiler.

♂, [Konya province], Akşehir, 1000–1500 m, 20.–30.VI.1934, ex coll. E. Pfeiffer; ♂, [Konya province], Asia min. o., Anatolia c., Akşehir-Sultan-Dagh, 1700–2200 m, 1.–15.VII.1934, ex coll. E. Pfeiffer; ♂, Konya province, Bolkar Dağları, "Aufforstungsgeb.", 1700 m, 20.VII.1994, leg. K. G. Schurian; 4♂, 6♀, Konya province, Bolkar Dağları, 2000–2300 m, 20.VII.1994, leg. K. G. Schurian; 2♀, Konya province, Bolkar Dağları, 2000–2300 m, 10.VIII.1994, leg. K. G. Schurian; ♂, 3♀, Niğde province, Bolkar Dağları, Darboğaz, 2200–2400 m, 9.VII.1995, leg. K. G. Schurian; 3♂, Niğde province, Bolkar Dağları, Darboğaz, 2200–2400 m, 25.VII.1995, leg. K. G. Schurian; 2♂, Adana province, Pozantı–Tekir, 1400–1900 m, Coll. Nr. 168, 24.–25.VII.1984, leg. K. G. Schurian; ♂, Niğde province, Aladağları, Demirkazık, 1600–1950 m, 5.VII.1976, leg. A. Ö. Koçak; 5♂, Niğde province, Aladağları, Çukurbağ (prope Çamardı), 1600 m, Coll. Nr. 2029, 26.VII.1981, leg. C. Naumann & S. Naumann; 9♂, Niğde province, Aladağları, Çamardı, Çukurbağ, 1600–2000 m, 1.–6.VIII.1983, leg. W. Eckweiler; 10♀, Niğde province, Aladağları, Emli Boğazı, 1500–1700 m, Coll. Nr. 165, 21.–22.VII.1984, leg. K. G. Schurian; 5♂, Niğde

province, Aladağları, Emli Boğazı, 1500–1700 m, Coll. Nr. 200, 6.VII.1986, leg. K. G. Schurian; 32♂, Aladağları, "Quelle", 1600 m, Coll. Nr. 201, 7.VII.1986, leg. K. G. Schurian; ♂, Aladağları, "Quelle", 1900 m, Coll. Nr. 201, 7.VII.1990, leg. K. G. Schurian; 6♂, Niğde province, Aladağları, Emli Boğazı, 1400–1600 m, Coll. Nr. 299, 17.VII.1990, leg. K. G. Schurian; ♂, 2♀, Niğde province, 5 km N. Demirkazık, 1600 m, 19.VII.1990, Coll. Nr. 301, leg. K. G. Schurian; 3♂, Niğde province, Aladağları, vic. Pınarbaşı, 2400–2600 m, 14.VII.1992, leg. K. G. Schurian; ♂, Niğde province, Aladağları, Emli Boğazı, 2300–2500 m, 15.VII.1992, leg. K. G. Schurian; ♀, Niğde province, Aladağları, above Pınarbaşı, 2300–2600 m, 7.VIII.1995, leg. K. G. Schurian; 5♂, Erzincan province, 3–5 km W. Refahiye "Flußtal", 1450 m, Coll. Nr. 229, 24.VII.1986, leg. K. G. Schurian; 5♂, Erzincan province, 4–6 km W. Refahiye, 1500 m, Coll. Nr. 254, 7.VIII.1988, leg. K. G. Schurian; ♂, Giresun province, 5 km N. Şebinkarahisar, 1300 m, 16.VII.1995, leg. K. G. Schurian, all in coll. K. G. Schurian.

Description. ♂. Forewing length 11.0–15.0 mm (holotype 14.0 mm). Upperside ground-colour dark violet blue, rarely as purplish as in *P.* (*A.*) *artvinensis* stat. nov. and often lighter, rarely with a faintly marked discoidal spot on forewing; occasionally with a blackish suffusion in the distal third of hindwing, that rarely reaches the basal area (relatively infrequent in the Aladağları and in the Bolkar Dağları, as well as in Erzincan province; predominating in the Sultandağları), sometimes with submarginal violet blue lunules on hindwing, very rarely traces of any blackish suffusion along outer margin of forewing; when the blackish suffusion is absent, the veins are as a rule blackened, especially on hindwing; fringes blackish grey basally, white distally. Underside ground-colour creamy grey, with blue-green basal suffusion; spots black with creamy white ocellation, as a rule faintly marked on hindwing; submarginal row of markings rarely well expressed; white streak well expressed, narrow and straight, often broadening distally.

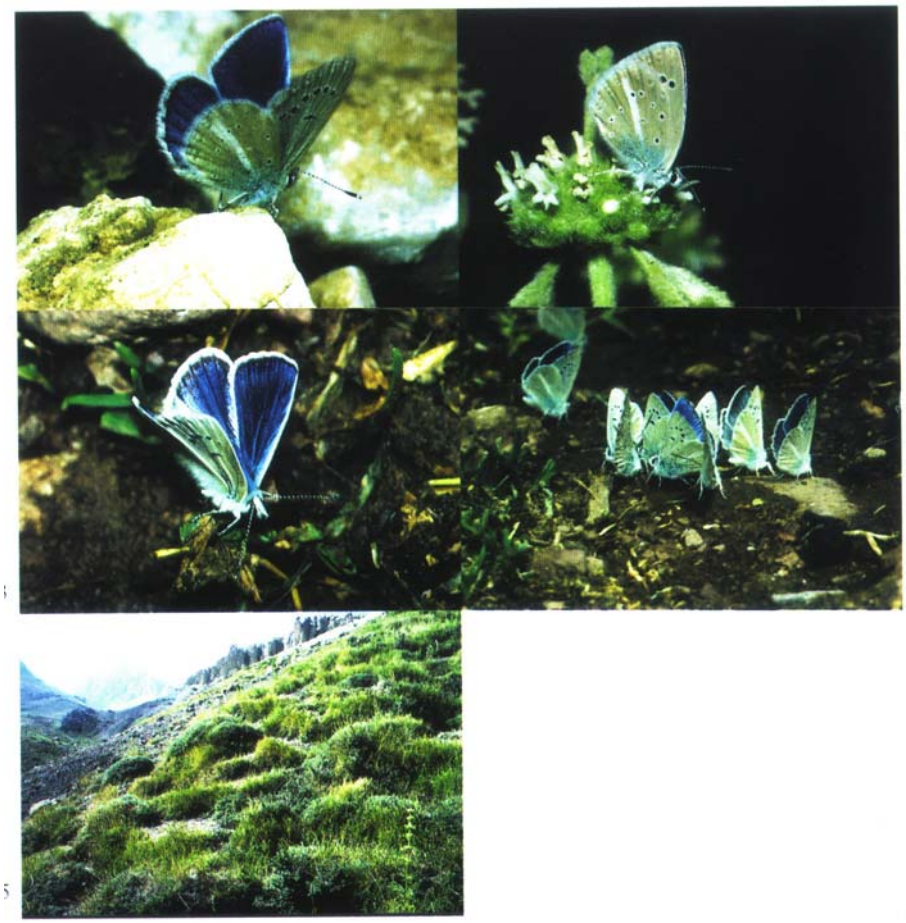
♀ Slightly smaller than ♂. Upperside ground-colour almost uniformly brown, with blackish brown discoidal spot on forewing. Underside ground-colour greyish brown to warm brown, darker than in ♂.

Chromosome number. The karyotype remains unknown. Two paratype specimens from Turkey, Niğde province, Aladağları, 15 km SE Çamardı, 1800–2100 m, St. 2009, 30.VII.1994, leg. H. v. Oorschot, H. v. d. Brink, D. v. d. Poorten & W. De Prins, have been fixed. Testes fix. No 94/122 showed $n = 29$ and testes fix. No 94/125 showed $n = 28$ (Lukhtanov & Kandul, unpubl.). Material from "Bürücek" [Tekir, İçel province] with $n = 27$ (de Lesse 1962) possibly belongs to a different taxon (cf. Carbonell 1997; Olivier 2000a, *in press*), but see below, note 5.

Distribution. Only known from Turkey, Taurus Mts.: Sultandağları (Afyon, Isparta and Konya provinces); Çay (Afyon province); Bağkonak (Isparta province); Arslanköy, Tekir ("Bürücek")? (İçel province); Pozantı–Tekir (Adana province); Akşehir, Aydos Dağı, İvrız (Konya province); Bolkar Dağları (Konya and Niğde provinces), Aladağları (Niğde and Kayseri provinces) (Hesselbarth *et al.* 1995: 732; this study). Further also in the western and in the central-eastern part of the Pontic system (Eskişehir province, 19 km NW Mihalıççık, leg. Hesselbarth — Hesselbarth *et al.* 1995: 732, also Plate 123, Fig. 8; Giresun province, 5 km N. Şebinkarahisar — leg. et coll. K. G. Schurian), as well as in Erzincan province, 3–5 km NW. Refahiye (Hesselbarth *et al.* 1995: 732; leg. et coll. K. G. Schurian) and 10 km N. Kemaliye (leg. et coll. W. Eckweiler).

Bionomics. Xeromontane habitats: flowery places and mountain meadows, often near water, between 1000 and 3150 m, from late June till early August (Hesselbarth *et al.* 1995: 732; van der Poorten & De Prins, own observations 1991, 1994, 1995; Olivier *et al.*, own observations 1997; Dr. W. Eckweiler, pers. comm., cf. this study, Plate 3, figs 4–5). Syntopic and synchronous with *P.* (*A.*) *wagneri* (Forster, 1956) and, in the Bolkar Dağları and Aladağları, with populations provisionally ascribed to respectively *P.* (*A.*) *cilicius bolkarensis* (Carbonell, 1998) and *P.* (*A.*) *sertavulensis* (Koçak, 1979) species incertae sedis (Hesselbarth *et al.* 1995; this study, cf. Plates 1 & 2, figs 11–13, Plate 3, fig. 4).

Plate 3



Legend of plate 3

1–2. *Polyommatus* (*Agrodiaetus*) *sigberti* sp. nov. ♂, Turkey, Niğde province, Aladağları, Pınarbaşı, 7.VIII.1996, photo Dr. W. Eckweiler.

3. *Polyommatus* (*Agrodiaetus*) *sigberti* sp. nov. ♂, Turkey, Niğde province, Aladağları, Emli Boğazı near Çukurbağ, 1.VIII.1983, photo Dr. W. Eckweiler.

4. Congregation of *P.* (*A.*) *sigberti* sp. nov., *P.* (*A.*) *sertavulensis* (Koçak, 1979) species incertae sedis and *P.* (*A.*) *phyllis* (Christoph, 1877) drinking at mud, Turkey, Niğde province, Aladağları, Emli Boğazı near Çukurbağ, 1.VIII.1983, photo Dr. W. Eckweiler.

5. Habitat of *P.* (*A.*) *sigberti* sp. nov., Turkey, Niğde province, Aladağları, above Emli Boğazı near Çukurbağ, 1.VIII.1983, photo Dr. W. Eckweiler.

Derivatio nominis. This butterfly is named in honour of Dr. P. Sigbert Wagener, the main author of the monumental "Die Tagfalter der Türkei " and specialist of the satyrine genus *Melanargia*.

Differential diagnosis. From the syntopic *P.* (*A.*) *wagneri*, *P.* (*A.*) *cilicius bolkarensis* and *P.* (*A.*) *sertavulensis* species incertae sedis, the new species can be separated readily by the colour (the three former taxa are sky blue, never with any trace of black suffusion); from *P.* (*A.*) *sertavulensis* species incertae sedis and *P.* (*A.*) *cilicius bolkarensis* also by the absence of any blackening of the veins in these two taxa; from the allopatric *P.* (*A.*) *actis* by the more vivid blue (less violet) tinge of upperside ground-colour, as well as the (near) absence of any blackening of the veins, combined with a generally larger size, in the latter (the allopatric *P.* (*A.*) *ernesti* Eckweiler, 1989 species incertae sedis, *P.* (*A.*) *firdussii* (Forster, 1956) and *P.* (*A.*) *pseudactis* (Forster, 1960) species incertae sedis also differ in their markedly lighter blue colour and in the absence of any blackening of the veins); from the allopatric *P.* (*A.*) *artvinensis* stat. nov., it differs both in phenotype and in chromosome number (this study, Plates 1–2, compare also descriptions).

Notes.

(1) Freyer (1851, 6(96): 147) describes "*Lycaena* Pap.[ilio] *Athis*" as follows (translated from German): "the male of this *Lycaena* usually resembles *P. Alexis* on the upperside" [*Papilio alexis* is a junior primary homonym of *Papilio alexis* Poda, 1761 — currently *Glaucopsyche alexis* (Poda, 1761) — and a senior subjective synonym of *Papilio icarus* Rottemburg, 1775 — currently *Polyommatus icarus* (Rottemburg, 1775)]. In so doing, he applies the name *athis* to a taxon that probably is the same as *P.* (*A.*) *actis* (Herrich-Schäffer, 1851), his name thus being a junior subjective synonym of the latter name (see Olivier 2000a, *in press*, for a detailed discussion). It is nevertheless possible that Freyer referred to specimens of another taxon that lacked the black submarginal suffusion (such specimens are encountered both in *P.* (*A.*) *artvinensis* stat. nov. and in *P.* (*A.*) *sigberti* sp. nov.). On the next page, Freyer (*op.cit.*) describes (but does not name!) a "very nice form that is darker blue with black suffusion on the distal half of the wing". The emphasis on the darker blue colour supports the attribution of his *athis* to *actis* and the former name was synonymised under the latter already by Herrich-Schäffer (1854, 1(65): Index 1). Subsequently, the name *athis* has been applied also to material with black submarginal suffusion and from other areas, e.g. the Taurus Mts. (see Olivier 2000a, *in press*, for a lengthy discussion). For these reasons, we follow the traditional attribution of *athis* as a junior subjective synonym of *actis*. In any case, in absence of any known extant type material, *athis* is a nomen dubium and thus best considered as a rejected name.

(2) Schwingenschuss (1935: 132) reports from Akşehir and the nearby Sultandağları "*Lycaena athis* Frr." and "*athis* nov. ab. *lunulata* Schw." without any description, hence his name is unavailable (ICZN, Art. 10.2, 45.6.1, 45.6.2) and, the more, a nomen nudum (ICZN, Art. 13.1.1). Subsequently, Schwingenschuss (1938: 146) gives a description of his "*Lycaena actis* H. S. ssp. *athis* Frr. *lunulata*" (translated here from German): "with beautiful blue lunules on the hindwings". His name does not become available, however, as it stays infrasubspecific (ICZN, Art. 10.2, 45.5, 45.6.1).

(3) Hesselbarth *et al.* (1995: 732, Plate 123, Figs 1–21) apply the name *Polyommatus* (*Agrodiaetus*) *actis* (Herrich-Schäffer, 1851) to an entirely different species than the one originally denoted by that name (see Olivier 2000a, *in press*, for a lengthy discussion). Their unintentionally created *Polyommatus* (*Agrodiaetus*) *actis* auct. was accepted as such by subsequent authors (Häuser & Eckweiler 1997; Eckweiler & Häuser 1997; Bálint & Johnson 1997; Carbonell 1997; Koçak & Seven 1998; Reinhardt & Eitschberger 1999; Carbonell & Naderi 2000) dealing with the taxon, hence this species remained undescribed until now.

(4) Material, that is possibly referable to *P.* (*A.*) *sigberti* sp. nov., has been reported from the central Pontic chain, i.e. from Tokat province (environs of Tokat, Freyer 1851, 6(96): 147–148; Staudinger, 1878: 254–255; Forster, 1960: 106, see also Olivier 2000a, *in press*). The illustrations in Freyer (1851, 6(96): Tab. 573, Figs 2–3), reproduced in Olivier (2000a: 94, Fig. 3, *in press*), are not adequate for judging unambiguously whether *P.* (*A.*) *artvinensis* stat. nov. or *P.* (*A.*) *sigberti* sp. nov. is involved, though the known distribution of *P.* (*A.*) *sigberti* sp. nov. in the Pontic chain (see below) makes attribution to the latter taxon most plausible. Material from Amasia province, environs of Amasia (leg. Korb, 1888 — Forster, 1960: 106) belongs to *P.* (*A.*) *actis* (this study, cf. Plates 1 & 2, fig. 9).

(5) Material from "Bürücek" [Tekir, İçel province] with n = 27 (de Lesse 1962) possibly belongs to a different taxon (cf. Carbonell 1997; Olivier 2000a, *in press*). We have not seen this material, about which Carbonell (1997: 139) writes (translated here from French): "The majority of the males concerned effectively have the veins blackened over several mm, but without a trace of any black submarginal suffusion". Tekir lies close to the Bolkar Dağları, from where "*firdussii*" has n = 27–28 (Hesselbarth *et al.* 1995: 705). We were able to see these three "*firdussii*" specimens, originating from İvrız: phenotypically they rather agree with *P.* (*A.*) *sertavulensis* species incertae sedis (cf. Olivier 2000a, *in press*), being slightly larger, more sky blue and with hardly any distal blackening of the veins on male upperside, further with a very weakly expressed to nearly absent white streak on underside hindwing (Plates 1 & 2, fig. 13). Probably they belong to the nominal taxon *P.* (*A.*) *cilicius bolkarensis* (Carbonell, 1998), the type locality of which — Çaykavak Geçidi (Niğde province) — is quite close (cf. Carbonell 1998). *P.* (*A.*) *sigberti* sp. nov. from the Bolkar Dağları shows a variable degree in the extent of the black submarginal suffusion on upperside hindwing, most specimens indeed without any black suffusion, but mostly with distal blackening of the veins. We therefore tend to consider de Lesse's specimens from "Bürücek" as belonging to *P.* (*A.*) *sigberti* sp. nov., as we do with the specimen figured in Carbonell (1997: 142, Fig. 5). If so, this would mean that the haploid chromosome number of this taxon from the Bolkar Dağları and the Aladağları varies from 27 to 29. As the karyotype remains unknown, we cannot at present rule out that the higher numbers (28, 29) actually reflect the presence of one or two B-chromosomes, rather than a real variation in the basic chromosome number. Most interestingly, in the Aladağları, 15 km SE Çamardı, 1800–2100 m, material of "*P.* (*A.*) *sertavulensis*", that agrees rather well phenotypically with material from İvrız — except for the underside with all markings, including the white streak, being clearly expressed (Plates 1 & 2, figs 11–12) — was collected together with the *P.* (*A.*) *sigberti* sp. nov. specimens, in which n = 28, 29 was found. This "*sertavulensis*" population, however, has n = 24! Clearly, further research on both *sigberti* and *sertavulensis* topics — and apparently also on *P.* (*A.*) *cilicius cilicius* (Carbonell, 1998) and *P.* (*A.*) *cilicius bolkarensis* (Carbonell, 1998) — is highly desirable.

(6) Mr. Jean-François Charmeux (in litt., 20.III.2000) collected material in Erzincan province, Akarsu, ca. 1600 m, 22.VII.1991, that is probably also referable to *P.* (*A.*) *sigberti* sp. nov., according to his description. Akarsu lies in the immediate vicinity of the locality "3–5 km W. Refahiye, 1450 m", where Dr. K. G. Schurian collected a series of the new taxon (cf. Plates 1 & 2, fig. 29).

(7) The specimen figured in Carbonell (1997: 142, Fig. 6), originating from Erzurum province, 15 km E. Erzurum, is probably referable to *P.* (*A.*) *actis*, though it admittedly resembles somewhat *P.* (*A.*) *sigberti* sp. nov. as well. A correct attribution of such specimens will only be possible when the karyotype of both topotypical *P.* (*A.*) *actis* and

of material from this locality near Erzurum (as well as from *P.* (*A.*) *sigberti* sp. nov.) will be known.

5. Discussion

The discovery of the types of *Polyommatus* (*Agrodiaetus*) *actis* made it clear that the nominal taxon listed as such by Hesselbarth *et al.* (1995) is a different species, that was still unnamed until now (Olivier 2000a, *in press*; this study). The chromosome number of this taxon, *P.* (*A.*) *sigberti* sp. nov., *n* = (27?)28–29, differs markedly from that of *P.* (*A.*) *artvinensis* stat. nov. with *n* = 21. For that reason, we consider both taxa as specifically distinct (cf. Olivier *et al.* 1999: 22–23). Both species further differ slightly in colour and wing markings and, as far as known, are strictly allopatric.

A karyological study of *P.* (*A.*) *sigberti* sp. nov. from the Sultandağları, the Bolkar Dağları and topotypical material from the Aladağları, as well as that of other critical populations of the *artvinensis*-*sigberti* complex in the Pontic system (vide supra) appears highly desirable in order to establish more precisely the range of both taxa, as well as possible further differentiations in this assemblage.

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