Revision of some taxa of the *Polyommatus* (Agrodiaetus) transcaspicus group with description of a new species from Central Anatolia (Lepidoptera: Lycaenidae)

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Samenvatting. Revisie van enkele taxa behorend tot de *Polyommatus* (Agrodiaetus) transcaspicus groep met beschrijving van een nieuwe soort uit Centraal-Anatolië (Lepidoptera: Lycaenidae).


Résumé. Révision de certains taxa appartenant au groupe de *Polyommatus (Agrodiaetus) transascipicis* et description d'une nouvelle espèce d'Anatolie centrale (Lepidoptera: Lycaenidae).


Une étude caryologique du matériel appartenant à l'espèce collective *P. (A.) theresiæ* a révélé que le matériel toptotypique (Turquie, province d'Adana, environs de Saimbeyli) possède *n* = 59, tandis que le matériel de la province de Konya, aux environs de Taşkent, possède *n* = 41–42, ainsi qu'un karyotype différent. Sur cette base, complétée de quelques légères différences de morphologie externe non constantes il est vrai, cette dernière description est décrétée comme nouvelle espèce. En ce qui concerne le taxon libanaise *P. (A.) larsiæ*, *n* = 25 a été confirmé après étude de deux exemplaires: son karyotype est décrit et figuré pour la première fois. Après étude du lectotype de *P. (A.) damonides* et de 3 × 2 paralécotypes supplémentaires, déposés au Museum für Naturkunde der Humboldt-Universität zu Berlin, et de 3 × 2 ex coll. Vlaamse Lepidoptera Collectie Antwerpen, et comparaison avec du matériel de *P. (A.) nitæ* (Forster, 1956) et de *P. (A.) eblurus*icus, la conspécificité éventuelle avec le premier peut être écartée dès à présent. Par conséquent, *P. (A.) damonides* et *P. (A.) eblurus*icus se ressemblent énormément: toutefois, en l'absence de toute information quant au nombre de chromosomes et au karyotype de *P. (A.) damonides*, toute spéculation concernant la conspécificité de ces deux taxa semble prématurée.

Kandul & Lukhtanov (1997) et Lukhtanov et al. (1998) ont proposé que *P. (A.) dama* (Staudinger, 1892) et *P. (A.) theresiæ* pourraient n'être que sous-espèces, en se basant sur le nombre de chromosomes supposé identique ainsi que sur la distribution allopatique des taxa dans question. Cette hypothèse est conspécificité est ici invalidée, vu que les deux entités sont apparentement sympatiques et, de surcroît, différents sensiblement tant par leur aspect externe que par leur nombre de chromosomes. Il apparaît que, à l'intérieur du sous-genre *Agrodiaetus*, le processus de spéciation est souvent accompagné de changements assez radicaux tant du nombre de chromosomes que du karyotype. Les nombres de chromosomes et les karyotypes offrent des caractères d'une grande valeur taxinomique pour l'identification d'espèces distinctes. Par conséquent, il n'y a aucune evidence à présenter que tel soit le cas lors d'une reconstruction phylogenétique éventuelle.

Abstract. Revision of some taxa of the *Polyommatus (Agrodiaetus) transascipicis* group with description of a new species from Central Anatolia (Lepidoptera: Lycaenidae).

Current problems with the delinitation of supraspecific groups within the subgenus *Polyommatus (Agrodiaetus)* are dealt with: the main reason therefore lies in the great variability of the species group taxa themselves and the sometimes minute differences among these, together with the seemingly complete lack of useful morphological characters allowing any cladistic analysis. In the present study, the authors treat some taxa of the *Polyommatus (Agrodiaetus) transascipicis* (Heyne, [1895]) species group, i.e. *P. (A.) guezelmavi sp. n.*, *P. (A.) theresiæ* Schurian, van Oorschot & van den Brink, 1992 sp. rev., *P. (A.) larsiæ* (Carbonnell, 1994) stat. rev., *P. (A.) eblurus*icus (Forster, 1956) and *P. (A.) damonides* (Staudinger, 1899).

A karyological study of material of the collective species *P. (A.) theresiæ* revealed that toptotypic material (Turkey, Adana province, vic. Saimbeyli) has *n* > 59, while material from Konya province, vic.Taşkent, has *n* = 41–42 and a different karyotype. On these grounds, as well as on small, though inconstant, morphological differences between both populations, the latter one is described as a new species. For the Lebanese taxon *P. (A.) larsiæ*, *n* = 25 was confirmed in two specimens examined: its karyotype is described and figured for the first time. After study of the lectotype of *P. (A.) damonides* and a further 3 × 2 paralécotypes, deposited in the Museum für Naturkunde der Humboldt-Universität zu Berlin, as well as a single 3 × 2 in coll. Vlaamse Lepidoptera Collectie Antwerpen, and comparison with series of *P. (A.) nitæ* (Forster, 1956) and of *P. (A.) eblurus*icus, conspécificity with the former taxon can be discounted. On the other hand, *P. (A.) damonides* and *P. (A.) eblurus*icus look strikingly similar but, as the chromosome number and karyotype of *P. (A.) damonides* remain unknown, any speculation on the conspécificity of these two taxa seems premature.

Kandul & Lukhtanov (1997) and Lukhtanov et al. (1998) have suggested that *P. (A.) dama* (Staudinger, 1892) and *P. (A.) theresiæ* could possibly be subspecies because of their apparently similar chromosome number and their allopatric distribution. This hypothesis of conspécificity is invalidated here, as both taxa are in fact sympatric, differ markedly in external morphology and have a different chromosome number. It appears that, within the subgenus *Agrodiaetus*, speciation is often accompanied by rather radical changes in chromosome number and karyotype. Chromosome numbers and karyotypes offer quite reliable taxonomic characters for the identification of distinct species. On the contrary, there is no current evidence for any usefulness of these features for phylogenetic reconstructions.

*Phegea* 27 (1) (1.III.1999): 2


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1. Introduction

One of the aims of the field trip to Turkey in 1997 by three of us (WD, AO, DVP) was to get material of the legendary *Polyommatus* (Agrodiaetus) *dama* (Staudinger, 1892) in order to try to confirm its karyotype. This had already been done by de Lesse (1959) but, as they found no trace of any material referred to by de Lesse in the collection of the Musée National d’Histoire Naturelle, Paris, Schurian & Eckweiler (1997) questioned the correct determination of this material.

We were able to get material of *P. (A.) dama* near Malatya, its type locality. We further collected toptotypical material of *P. (A.) theresa* Schurian, van Oorschot & van den Brink, 1992 near Saimbeyli, Adana province, anticipating to confirm a haploid chromosome number of n = 41–42 for both nominal taxa. Our expectations were met with the former taxon, but one single specimen of the latter taxon surprisingly revealed n = 65–66, while n = 41–42 had previously been established for specimens from Taşkent, Konya province (Kandul & Lukhtanov 1997), thus suggesting distinct species status for both populations. In July 1998, we decided to check our results and therefore, three of us
(WDP, DVP, MW) collected and fixed material attributed to *P. (A.) thersiae* in both Adana and Konya provinces. At about the same time, one of us (AO) collected and fixed topotypical material of *P. (A.) larseni* (Carbonell, 1994), initially described as a subspecies of *P. (A.) thersiae*, at Les Cédres [El Arz] in Lebanon. The results of our studies on both last-named taxa are dealt with in the present note, while *P. (A.) dama* will be treated in a separate paper. We also discuss *P. (A.) elbursicus* (Forster, 1956) and *P. (A.) damonides* (Staudinger, 1899).

2. Material and methods

Male imagines were used for karyological preparations. Testes were taken from collected, fresh butterflies when still alive and immediately placed in small vials in which a freshly mixed solution of 3 parts 96% ethanol and 1 part 100% acetic acid was kept. The individual fixations were given a code number which was also noted on the paper in which the donor butterfly was kept. The vials were immediately put into a thermos filled with icy water in order to keep the fixations at a low temperature of 0–4°C. The whole operation was done in the field or slightly later, in the early evening. After the expedition, the vials were put into a regular refrigerator at 4°C, where they were kept for a couple of months.

The fixation mixture was removed and changed by the fresh one two times. The testes were stained in 2% acetic orcein for 48–72 hours. Then a stained test is was placed on a numbered slide in a drop of 45% acetic acid solution and thoroughly macerated using fine micropins. The preparations were made under the binocular microscope at a 28× enlargement. The solution of 45% acetic acid was replaced and changed two or three times letting the cells of testes tissue slowly spread on a slide for 1–2 minutes. Thereupon the preparation was covered by a coverslip and vertically squashed. The excess of acetic acid solution was removed with filter paper.

The chromosomes were observed during meiotic divisions I and II, meiotic prometaphase, diakinesis, anaphase and gonial mitosis. Haploid chromosome numbers were determined in metaphase I (*M I*) and in metaphase II (*M II*) of spermatogenesis. Photomicrographs were taken using Opton Research light microscope under polarized light. Negatives and photographs of the studied preparations are kept at the Vlaamse Lepidoptera Collectie Antwerpen (VLCA).

Table 1. Chromosome numbers of the studied taxa

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Code number of specimen</th>
<th>Haploid chromosome number (<em>n</em>)</th>
<th>Number and stage of cells examined</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Polyommatus</em> (Agrodiaetus) guezelnavi sp. n.</td>
<td>98031</td>
<td><em>n</em> = 41</td>
<td>8 M I, 2 M II</td>
</tr>
<tr>
<td></td>
<td>98032</td>
<td><em>n</em> = 42</td>
<td>4 M I</td>
</tr>
<tr>
<td><em>Polyommatus</em> (Agrodiaetus) thersiae Schurian, van Oorschot &amp; van den Brink, 1992 sp. rev.</td>
<td>MW98240</td>
<td><em>n</em> &gt; 59</td>
<td>2 M I</td>
</tr>
<tr>
<td></td>
<td>MW98241</td>
<td><em>n</em> = 63</td>
<td>1 M I</td>
</tr>
<tr>
<td></td>
<td>MW98243</td>
<td><em>n</em> &gt; 59</td>
<td>2 M I</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>n</em> = 63</td>
<td>2 M II</td>
</tr>
<tr>
<td><em>Polyommatus</em> (Agrodiaetus) larseni (Carbonell, 1994) stat. rev.</td>
<td>AO98016</td>
<td><em>n</em> = 25</td>
<td>4 M I</td>
</tr>
<tr>
<td></td>
<td>AO98020</td>
<td><em>n</em> = 25</td>
<td>4 M I</td>
</tr>
</tbody>
</table>
3. Current problems with the delimitation of supraspecific groups within subgenus Agrodiaetus

While the delimitation of subgenus Agrodiaetus is still contentious (see Häuser & Eckweiler 1997 and references therein for further discussion), such is even more the case with the division in several “groups”, as will be seen with the various assemblages to which the taxa dealt with here have been placed by different authors. The main reason lies in the great variability of the species group taxa themselves and the sometimes minute differences between these, together with the seemingly complete lack of useful morphological characters allowing any cladistic analysis. Several authors have put an emphasis on some kind of characters in preference to others, e.g. Forster (1956, 1960–1961) and Carbonell (1993, 1994) relied on external morphology while Lukhtanov and colleagues (Lukhtanov, Dantchenko & Kandul 1997; Kandul 1997; Dantchenko 1997; Kandul & Lukhtanov 1997; Lukhtanov et al. 1998) place some species group taxa together on similarity in karyotype. There is little hope that either morphological or karyological data will very much improve our knowledge on the phylogenetic relationships within Agrodiaetus, unless perhaps used in conjunction with other — biochemical and molecular — data. The latter type of data may prove most appropriate for a delimitation of and assessment of interrelationships between various supraspecific assemblages within Agrodiaetus.

Hesselbarth, van Oorschot & Wagener (1995) have attempted at delimiting various groupings within the present subgenus. We follow these authors in ascribing the taxa revised here to the Polynnatus (Agrodiaetus) transcaspicus (Heyne, 1895) species group (they do not formally list P. (A.) damonides in this group), considering this a sound working hypothesis, as all taxa treated in the present study do indeed look very much alike. For a further review of the species group taxa associated with the P. (A.) transcaspicus assemblage one is referred to Lukhtanov (1989), Carbonell (1993, 1994), Hesselbarth, van Oorschot & Wagener (1995) and Eckweiler & Häuser (1997).

4. The nominal taxa

We arrange the taxa reviewed here according to their geographical proximity, dealing resp. with the Tauric, Levantine and East Anatolian/Iranian population groups. While all look very similar externally, they differ markedly in both their chromosome number and karyotype. Only one single taxon, i.e. P. (A.) damonides, remains unknown in this respect. The first taxon will be described at length, for the subsequent ones only differentiating characters will be discussed.

4.1. Polynnatus (Agrodiaetus) guezelmavi sp. n.

ILLUSTRATIONS. Plates 1 & 2, fig. 1 (holotype ♂), figs. 2–3 (paratypes ♀), figs. 13–14 (paratypes ♀); text figs. 3–4 (karyotype).


Paratypes 26♂, 10♀; 6♂, Turkey, St. 126, Konya 1500–1600 m, Palaz Dağı, Taşkent, 4–5.VIII.1981, leg. B. van Oorschot, H. Coene, J. Lucas & V. Kilinc; 23♂ 12♀, Turkey, St. 74, Konya 1500–1600 m, Palaz Dağı, Taşkent, 10.VIII.1982, leg. B. van Oorschot; 2♂ 2♀, Turkey, St. 276, Konya 1500–1600 m, Palaz Dağı, Taşkent, 31.VII.1985, leg. B. van Oorschot & W. De Prins; 31♂ 9♀, Turkey, St. 1993, Konya 1500–1600 m, Palaz Dağı, Taşkent, 20–21.VII.1994, leg. H. van Oorschot, H. van den Brink, D. van der Poorten & W. De Prins, all in coll. Institut voor Systematiek en Populatiebiologie, Zoologisch Museum Amsterdam.

♂, Turkey, St. 126, Konya 1500–1600 m, Palaz Dağı, Taşkent, 4–5.VIII.1981, leg. B. van Oorschot, H. Coene, J. Lucas & V. Kilinc; 4♂ 3♀, Turkey, St. 276, Konya 1500–1600 m, Palaz Dağı, Taşkent, 31.VII.1985, leg. B. van Oorschot & W. De Prins; 11♂, Turkey, St. 1745, Konya 1500–1600 m, Palaz Dağı, Taşkent, 25.VII.1991, leg. W. De Prins, D. van der Poorten & A. Riems, 18♂ 7♀, Turkey, St. 1993, Konya 1500–1600 m, Palaz Dağı, Taşkent.

Phegea 27 (1) (1.III.1999): 5
5♀♀ (no. 293-297) (♀ (no. 301) (dried wings & testes fixations of all samples and remaining bodies stored in 96% ethanol for DNA analysis), Turkey, Konya 1450 m, Palaz Dağı, Taşkent, 4.VIII.1998 leg. M. Wiemers, all in coll. M. Wiemers.
14♂, Turkey, Konya, 1500 m, Taşkent, 20–21.VII.1994, leg. et coll. K. Larsen.
♂, Turkey, St. 276, Konya 1500–1600 m, Palaz Dağı, Taşkent, 31.VII.1985, leg. B. van Oorschot & W. De Prins, in coll. A. Rienis.

[All aforementioned material collected before 1992 bears an original red label “PARATYPUS | Polyommatus | (Agroiaeetus) | theresiae sp. nov. | Schurian/Oorschot/| Brink 1992”].

Description. ♂ Forewing length 16.0–19.5 mm (holotype 18.0 mm). Upperside sky blue with a violet tinge, often more so than in P. (A.) theresiae sp. rev., but there is much overlap, marginally with brownish scaling that varies in extension; fringes black basally, white distally; veins as a rule blackened distally, especially on hindwing; forewing with an extensive and conspicuous androconial patch. Underside light grey, with hardly noticeable yellowish green basal suffusion; spotting reduced, especially on hindwing, spots black with white occlusion; white streak on hindwing always discernible, but hardly contrasting with background, rarely well defined; submarginal row of markings very weakly expressed, almost of the ground-colour.
♀ Forewing length 16.5–18.0 mm. Upperside brown, discoidal spot on forewing clearly visible; hindwing occasionally with reduced to moderately developed blue basal suffusion; submarginal lunules on hindwing well developed, at least some traces on forewing. Underside light brown, spotting more developed than in ♂, white streak on hindwing always well defined; submarginal row of markings very weakly expressed and almost of ground-colour on hindwing, slightly more reddish on forewing.

Chromosome number and karyotype. Kandul & Lukhtanov (1997) described and figured the karyotype of P. (A.) “theresiae” [recte guezelnavi sp. n.] and counted from 41 to 42 bivalents in the stage MI, that form a series that gradually decreases in size. In July 1998 additional material was fixed (WDP, DVP, MW), whereby a karyotype carrying a haploid chromosome number of n = 41 was confirmed. The size of bivalents in the stage of metaphase I of spermatogenesis varies from relatively large ones (0.917 ± 0.257 μm²) to small ones (0.165 ± 0.066 μm²). The karyotype contains 10 large bivalents and 7 small ones. The other bivalents are of relatively medium size and form a gradient series. The position of the large bivalents is in the center of the metaphase plate I, while the smallest bivalents as a rule are situated at the edge of the plate.

Distribution. So far only known from the vicinity of Taşkent, Konya province, Turkey.

Phegea 27 (1) (1.III.1999): 6
Bionomics. In limestone areas, biotopes especially on small, open rocky plateaus on steep hillsides, that are quite humid in spring, but dried out at the time of emergence of the butterflies, also on humid spots on sandy roadsides, at altitudes between 1500 and 2000 m. Adults from mid-July to mid-August. Larval host-plant and early stages unknown.

Derivatio nominis. The name guezelmavi means “nice blue” (güzêl = nice, mavi = blue in Turkish).


ILLUSTRATIONS. Plates 1 & 2, figs. 4–6 (♀), 16–17 (♂); text figs. 5–6 (karyotype).

MATERIAL EXAMINED. 8♂♂ 16♀; as follows;


Further material:
♂, Turkey, Adana, vic. Saimbeyli, 1500–1600 m, 13–14.VIII.1993, leg. K. G. Schurian; 2♂♂, Turkey, St. 2004, Adana, 6–18 km N. Saimbeyli, 1600 m, 25.VII.1995, leg. W. De Prins & D. van der Poorten; ♂, Turkey, St. 2382, Adana, 8 km N. Saimbeyli, 1600 m, 6.VIII.1997, leg. W. De Prins, A. Olivier & D. van der Poorten; 1♂♂, Turkey, St. 2439, Adana, 5 km N. Saimbeyli, 1600 m, 28.VII.1998, leg. D. van der Poorten & W. De Prins, all in coll. VLCA.


♀, [Turkey, Adana province], Hadjin [Saimbeyli], [leg. Manissadjian?], ex coll. Püngeler, in coll. Museum für Naturkunde der Humboldt-Universität zu Berlin.

Description. ♂ Upperside as in P. (A.) guezelmavi sp. n., but often slightly less vividly coloured, blackening of veins tends to be slightly more developed as in P. (A.) guezelmavi sp. n., in some specimens more so than in any P. (A.) guezelmavi sp. n. specimen. Underside hindwing warmer, more brownish grey than in P. (A.) guezelmavi sp. n.; white streak often better defined and more sharply contrasting with background as in P. (A.) guezelmavi sp. n. None of these differences appear absolutely constant, however. ♀ as P. (A.) guezelmavi sp. n., but in material examined never blue basal suffussion on upperside hindwing.

Phegea 27 (1) (1.III.1999): 7
Chromosome number and karyotype. In 1997, only one single specimen was collected. The tests were prepared by Mr. Zdravko Kolev, who found a haploid chromosome number of \( n = 65 - 66 \) (prep. nr. 97025). No photograph of this preparation is available for the present study, but Kolev (pers. comm.) confirms that there were excellent plates to substantiate this count. In July 1998, one of us (MW) fixed the tests of four specimens, but only three of them (nos. 240, 241 & 243) yielded successful preparations. One of them gave a quite unclear picture with \( n > 59 \); the other specimens, however, gave a picture that appeared clear enough to reveal unequivocally \( n = 63 \). The structure of the karyotype resembles the structure of *Polyommatus* (Agrodietaus) *guezelmavi* sp. n. However, the haploid chromosome number differs greatly. The observations of preparations nos. 240, 241 and 243 revealed that the karyotype of *Polyommatus* (Agrodietaus) *therosiae* sp. rev. carries \( n = 63 \). The karyotype contains 8 relatively large bivalents (\( 1.043 \pm 0.293 \mu m^2 \)) and 9 of median size (\( 0.574 \pm 0.160 \mu m^2 \)). The remaining bivalents are very small and situated at the edge of the metaphase plate.

Distribution. So far only known from the area immediately to the north of Saimbeylı, Adana province, Turkey.

Bionomics. In biotopes along sandy roadsides where the butterflies often sit on the humid soil (Obruq Ormani), higher up often in clearings in pine woods (*Pinus nigra*), the males flying in the open, while the females often hide in the shade under the pine trees, at altitudes between 1300 and 1750 m. Schurian (in Schurian, van Oorschot & van den Brink 1992) observed oviposition on an *Astragalus* species, that grew mainly in the shade of large pine trees. Adults from mid-July till August. Larval host-plant and early stages unknown.

Notes

1. The large difference in chromosome number between *P. thersiae* sp. rev. and *P. guezelmavi* sp. n. supports the specific distinctness of both taxa. Therefore, all previous literature records (including paratype designations) dealing with material from Taşkent presumably apply to the new species.

2. Recently, *P. (A.)* "therosiae" (including both Adana and Konya populations) has been ascribed to the "dana group" by Eckweiler & Häuser (1997), a species group with "(...)" well developed androconial patches on the forewing underside (...)" [there is no androconial patch at all in *P. (A.) dama*, however!], while Kandul & Lukhtanov (1997) and Lukhtanov et al. (1998) went even further suggesting that both taxa could possibly be subspecies, because of their similar chromosome number and allopatric distribution. Especially in the light of the new information now available, it appears quite improbable that *P. (A.)* *dana* would be conspecific with *P. (A.)* "therosiae" (see also below): the latter taxon *always* has both a white streak on underside hindwing and a striking androconial patch on male underside forewing, both features *always lacking* in *P. (A.)* *dana* that, the more, is a quite different insect with a distinct wing shape and colour. On the contrary, *P. (A.)* *therosiae* sp. rev. and *P. (A.)* *guezelmavi* sp. n. have a significantly different karyotype, while being impossible to distinguish on a constant basis phenotypically.

3. Staudinger (1892, 1899) mentions under “Lycaena Poseidon Led. var. Mesopotamica” two males from “Hadjin” [now Saimbeylı] that are somewhat larger, with a slightly different blue on the underside and a darker brownish underside and that, according to Schurian, van Oorschot & van den Brink (1992), refer to *P. (A.)* *therosiae*. During a visit to the Museum für Naturkunde der Humboldt-Universität zu Berlin by one of us (AO), quite unexpectedly, one specimen of *P. (A.)* *dana* was found that bears a
label “Hadjin / [18]84 Man.[issadjian]”. It bears no Staudinger’s “Origin.” label though placed immediately after the type series of “Lycaena Dama”, so it is best not considered part of the syntype series of that taxon, the more so as Staudinger (1892) does not mention this locality in his description of the species. A few days later, Dr. Y. P. Nekrutenko (pers. comm.) also found a genuine P. (A.) thesiae specimen from “Hadjin” in the Püngeler collection at the Museum für Naturkunde der Humboldt-Universität zu Berlin. These discoveries confirm the sympathy and hence specific distinctness of thesiae and dama!

4. Hesselbarth, van Oorschot & Wagener (1995) report both P. (A.) dama and P. (A.) thesiae from “Umgebung Kahramanmaraş, 600–900(1000) m” in the collection of the Zoologische Staatssammlung München, the latter species also from “10 km E. Kahramanmaraş, 1000 m”, leg. et coll. W. Eckweiler: they illustrate 2♂, 2♀ on plate 118 (resp. figs. 37, 39, 56 and 62) as “Polyommatus (Agrodiaetus) thesiae SCHURIAN et al., 1992” that obviously belong to P. (A.) poseidon (Herrich-Schäffer, [1851])! Eckweiler (pers. comm.) confirms that all his material from the aforementioned locality is referable to P. (A.) poseidon as well. It thus appears that P. (A.) thesiae has not been observed from this area at all so far. One ♂ from Turkey, Gaziantep province, 11 km SSW. Büyük Araplar, TV-Station, 1300 m, leg. et coll. Junge, illustrated by Hesselbarth, van Oorschot & Wagener (1995, plate 118, fig. 38) as “P. (A.) thesiae”, also belongs to P. (A.) poseidon.


Illustrations. Plates 1 & 2, figs. 7–8 (♂), 15 (♀); text fig. 1 (♂) and 7 (karyotype).


Description. ♂ Upperside light sky blue, lighter and without the violet tinge found in P. (A.) guezelmavi sp. n. and P. (A.) theresiae sp. rev., only single darker specimens overlapping with the lightest ones of both last-mentioned species, blackening of veins as a rule more extensive as in these species. Underside much like P. (A.) theresiae sp. rev., of a warmer, more brownish grey than in P. (A.) guezelmavi sp. n., also on forewing, with reduced bluish green basal suffusion; reduction of the blue colour in s7 under the costal vein; white streak always present, as a rule well defined and moderately to sharply contrasting with background.

♀ Upperside lighter brown than in P. (A.) guezelmavi sp. n. and P. (A.) theresiae sp. rev., without any blue basal suffusion on hindwing, submarginal lunules more extensive, especially on forewing. Underside light coffee brown, of a warmer tinge than in both last-mentioned taxa, submarginal row of markings better developed, slightly reddish, especially on forewing.

Chromosome number and karyotype. Larsen (1975) studied material (referred to by him as “Agrodiaetus poseidon ? mesopotamica Staudinger”) from Lebanon (Faraya, Les Cèdres [El Arz], Faraya Natural Bridge) and noted: “Many cells in a number of specimens

Phagea 27 (1) (1.III.1999): 10
studied showed \( n = 25 \). A single specimen from the Cedar Mountain unequivocally had \( n = 26 \), another had one cell of \( n = 25 \) with a supernumerary chromosome. He did not describe nor figure the karyotype, however. In July 1998, toptotypical material was fixed (AO). The variability in chromosome number was not found in two examined specimens, nor was the absence or presence of a supernumerary element. All 8 metaphase I plates of both specimens showed 25 bivalents. All the bivalents form a gradient series, where the first bivalent distinguishes to be somewhat bigger (1.254 ± 0.129 \( \mu \text{m}^2 \)) than the next in a row (1.232 ± 0.152 \( \mu \text{m}^2 \)).

**Distribution.** Lebanon, moderately widespread in the Lebanon range (El Arz (Les Cèdres), Hadet ej Jobbé, Laqlouq, Jabal Kesrouan, Faraya, Jabal Sannine) as well as in the Antilebanon range both in Lebanon (Nabi Sbat) and in the adjacent part of Syria (Bludan) (Ellison & Wiltshire 1939; Forster 1961; Larsen 1974, 1975; Carbonell 1994; Olivier unpubl.). Old material labelled “Beyrouth” certainly comes from the Lebanon range.

**Bionomics.** In grassy, sometimes swampy, spots in limestone areas, especially common at the type locality, where it was found mainly in the vicinity of the Cedar Grove, adults often visiting flowers of mint (*Mentha* sp.) as well as an unidentified yellow Asteraceae species, that attracted good numbers of it, along with *P. (A.) alceis* (Zerny, 1932); at Laqlouq and Nabi Sbat, single specimens were observed on mint (Olivier, pers. obs.). At night it congregates in communal roosts with several other lycaenid species on grasses and *Achillea sulphurea* (Larsen 1973). The butterfly is usually encountered in subalpine and montane areas at altitudes between 1500 and 2100 m, but there is a single report from as high as the very summit of the Cedar Mountain at about 3000 m (Ellison & Wiltshire 1939). Adults usually from mid-July through August, in the Antilebanon (and occasionally in the Lebanon range) from late June onwards. Carbonell (1994) reports it till early October, which seems doubtful. Larval host-plant and early stages unknown.

**Note.** This species has been ascribed to many different (groups of) taxa by different authors. Staudinger (1899) saw one single ♂ (illustrated here on text fig. 1) stating “steht der typischen Damone näher als der var. Damonides” while Staudinger & Rebel (1901) ascribed it to “Lycaena Damone v. Damonides ?Libanon var.”: its upperside ground-colour indeed recalls very much *P. (A.) damonides* (see below) as well as *P. (A.) elbursicus*, as noted by Carbonell (1994). Subsequent authors ascribe it to *P. (A.) poseidon* (Elwes in Nicholl 1901; Fountaine 1902; Graves 1910; Zerny 1932; Ellison & Wiltshire 1939) or, more precisely, *P. (A.) poseidon mesopotamica* (Staudinger, 1892) (Forster 1961; Larsen 1973, 1974, 1975). It was formally described by Carbonell (1994) as a subspecies of *P. (A.) therestiae*, based on phenotypical similarity, a combination which was repeated by both Hesselbarth, van Oorschot & Wagener (1995) and Eckweiler & Häuser (1997): the former authors, however, seriously question that status, while placing it in the “*P. (A.) transcaspicus*” species group, the latter authors situate it in the “*P. (A.) dama* group”. Kandul & Lukhtanov (1997) use the combination “*P. poseidon larseni*” and place the Lebanese taxon in the “second subgroup”, along with *P. (A.) poseidon krymaeus* (Shejzuzhko, 1928) and *P. (A.) poseidon* ssp. from Ağrı (NE Turkey), based on its comparable chromosome number. For a similar reason, however, as well as purported agreement in colour and wing shape, Dantchenko (1997), Lukhtanov, Dantchenko & Kandul (1997) and Lukhtanov et al. (1998) associate it rather with *P. (A.) damocles* (Herrich-Schäffer, [1844]). Dantchenko (1997) for the first time used the binomen *Polyommatus larseni*. After comparison with good numbers of *P. (A.) guezelmavi* sp. n., *P. (A.) therestiae* sp. rev., *P. (A.) elbursicus*, *P. (A.) poseidon* (including
material from near Malatya, the type locality of "mesopotamica", currently considered a synonym of nomenclotypical *poseidon*, cf. Schurian, van Oorschot & van den Brink 1992; Hesselbarth, van Oorschot & Wagener 1995), small series of both *P. (A.) damoecles* and *P. (A.) damonides* and one single *P. (A.) poseidon krymaeus*, we have no hesitation in placing it in the *P. (A.) transcaspicus* group, nearest to *P. (A.) guezelhavni* sp. n., *P. (A.) theresiae* sp. rev., *P. (A.) elbursicus* and *P. (A.) damonides*, but as a distinct species. It differs from these other four taxa by (nearly) constant, be it subtle, differences in the external phenotype, as well as, when known, in its chromosome number and karyotype.

### 4.4. Polyomma (Agrodiaceus) elbursicus (Forster, 1956)


**Illustrations.** Plates 1 & 2, figs. 10–12 (♂), 18 (♀).

**Material examined.** 70♂ 10♀.

1859, Van, Zernek Baraji, 65 km N Başkale, 1900–2200 m, 29.VII.1992, leg. H. van Oorschot & H. van den Brink; all in coll. Institut voor Systematiek en Populationbiologie, Zoölogisch Museum Amsterdam.


Iran, Tehran, mountain pass between Zangan and Gilvan, loc. 90, 2200 m, 2.VII.1973, leg. Wagener & Schmitz; Iran, Tehran, 1 km NE Gatschar, 2300 m, 19.VII.1996, leg. W. ten Hagen; all in coll. S. Wagener.

Description. ♂ Upperside light sky blue, much as in P. (A.) larseni, to sky blue with a violet tinge, though hardly ever as bright as in some P. (A.) guazelmavi sp. n.; blackening of veins as a rule even more accentuated as in P. (A.) larseni; androconial patch distinctly less extensive and conspicuous as in P. (A.) guazelmavi sp. n., P. (A.) theresiae sp. rev. and P. (A.) larseni stat. rev. Underside cold grey, much darker than in the previous three taxa, spotting and submarginal row of markings more prominent and always clearly visible; hindwing with reduced bluish basal suffusion, white streak on hindwing always sharply contrasting with background.

♀ Upperside tends to be darker brown than in the other taxa studied, occasionally with reduced blue basal suffusion on hindwing, submarginal lunules vestigial on hindwing, absent on forewing. Underside darker brown than in the other taxa studied, submarginal row of markings rather well developed, though without any reddish tinge.

Chromosome number and karyotype. The haploid chromosome number of topotypical P. (A.) elburicus was established as n = 16, 17 by de Lesses (1963), who also figured its karyotype (fig. 3e, f). Material of “A. poseidon ssp. de Van”, now known to be referable to P. (A.) elburicus (cf. Carbonell 1993; Hesselbarth, van Oorschot & Wagener 1995), as already implicitly suggested by de Lesses (loc. cit.) himself, has n = 18–19 and recently, material originating from Turkey, Van, Zernek Baraji, 1900–2000 m, showed n = 17, 18 (Lukhtanos et al. 1998). The latter authors further state “An intraindividual variability in the number of chromosomes was found, ranging from n = 18 to n = 19. In metaphase-1, all bivalents form a gradient series. The karyotype shows no extraordinary large or small bivalents”. Unfortunately they do not figure the karyotype.


Bionomics. In the Elburz (Iran), at the mountain pass between Zangan and Gilvan, at the Kendevan pass and in the area of Tacht-i Suleiman, butterflies occur along humid gullies, at altitudes between 1900 and 3000 m, on the Demavend as high as 3600 m, in

Phegea 27 (1) (1.III.1999): 13
July. In SE. Turkey in similar biotopes, but at altitudes from 1100 to 2200 m, from late June till the second week of August (Forster 1956; Carbonell 1993; Hesselbarth, van Oorschot & Wagener 1995; Wagener, pers. comm.). Larval host-plant and early stages unknown.

Notes
1. This taxon cannot be mistaken for any of the preceding taxa reviewed, differing constantly both phenotypically and in karyotype. Though originally described as a subspecies of P. (A.) transcaucasicus, and still considered as such by de Lesse (1963), while Lukhtanov (1989) lists it as a subspecies of P. (A.) aserbeidschanus (Forster, 1956), it was finally elevated to species rank by Carbonell (1993). P. (A.) transcaucasicus has a haploid chromosome number of n = 52–53 and an entirely different karyotype (de Lesse 1963), thus precluding conspecificity with P. (A.) elbursicus. The latter taxon differs significantly from P. (A.) ninae (Forster, 1956) as well, that has n = 33–37, 2n = 66, 68 (de Lesse 1960, 1963, but see Carbonell 1993; Lukhtanov 1989; Olivier, De Prins & van der Poorten, unpublished data; Carbonell in litt., 31.XII.1998). Karyological differences with P. (A.) aserbeidschanus aserbeidschanus (with n = 22–23 sensu Lukhtanov 1989) and especially P. (A.) aserbeidschanus turcicus (Koçak, 1977) (with n = 19–20, cf. de Lesse 1960; Lukhtanov et al. 1998) are far less pronounced, but the latter taxon is syntopic and synchronous with P. (A.) elbursicus in SE. Turkey (e.g. at the Zernik Baraj in Van province, cf. Lukhtanov et al. 1998), from which it can be distinguished by external features (see Hesselbarth, van Oorschot & Wagener 1995). These data compel us to conclude, on karyological evidence, that P. (A.) aserbeidschanus turcicus cannot be conspecific with P. (A.) ninae as suggested by Hesselbarth, van Oorschot & Wagener (1995): its current status, as established by Lukhtanov (1989), Carbonell (1993) and Lukhtanov et al. (1998) seems to be the most appropriate solution for the time being.

2. Wagener (pers. comm.) found both P. (A.) elbursicus and P. (A.) ?aserbeidschanus together at the mountain pass between Zangan and Gilvan, in the western Elburs.

3. We agree with Hesselbarth, van Oorschot & Wagener (1995) that the taxon “Agrodiaetus elbursica zapvad” cannot be separated morphologically from P. (A.) elbursicus and there is no support neither from the karyological point. Therefore we agree with the synonymy as established by these authors.

4. P. (A.) poseidon is not known at all from Bitlis, Van and Hakkari provinces (cf. Hesselbarth, van Oorschot & Wagener 1995: map 199), though this was assumed to be the case due to the erroneous report of P. (A.) elbursicus by de Lesse (1963) as “A. poseidon sspp. de Van”.

4.5. Polyommatus (Agrodiaetus) damonis (Staudinger, 1899)

ILLUSTRATIONS. Plates 1 & 2, fig. 9 ($\delta$); lectotype $\delta$: text fig. 2.


Phegea 27 (1) (1.III.1999): 14
Fig. 2. *Polyommatus (Agrodiaetus) damonides* (Staudinger, 1899), lectotype ♂,[Azerbaijan, Nachichevan], Ordubad [recte Ordubad], 10.VI.1881, Chr.[stoph leg.], ex coll. Staudinger, in coll. Museum für Naturkunde der Humboldt-Universität zu Berlin (also figured in colour in Hesselbarth, van Oorschot & Wagener 1995: Taf. 121, fig. 67 and in Eckweiler & Häuser 1997: 138, pl. 5). — a) underside; b) underside; c) labels.

*Paralectotypes:* 3♂ 2♀, all with circles of the same as locality label green paper, ♂ bearing also handwritten (unknown hand) label “Ordub.[ad] 22.6.[18]81” and pink printed label “Origin”; ♀ with handwritten label “Ordub.[ad] 25.6.[18]81”; ♀ bearing also handwritten (unknown hand) label “Ordub.[ad] 22.6.[18]81”; ♀ bearing also handwritten (unknown hand) label “Ordub.[ad] 10.6.[18]81”.

Further material: ♂ Azerbaijan, Nachichevan, Ordubad, 18.VI.1985, ex coll. L. Mets, in coll. VLCA.

**Description.** ♂ and ♀ as *P. (A.) elbursicus* from northern Iran.

**Chromosome number and karyotype.** Unknown.
Distribution. Only known with certainty from the type locality.

Bionomics. Known material was collected in June. No further data.

Notes
1. Staudinger (1899) described this taxon from “In den Gebirgen Nordpersiens, besonders bei Hadschyabad und Schahkuh, sowie in südöstlichen Transcaucasiens (bei Ordubad, auch bei Kasikoparan)” and, most probably, as his description suggests, his material covers more than one taxon (see also Forster 1956: 77). Among the “cotypes” that appear heterospecific, Forster designated formally only one male specimen as lectotype, thus restricting the type locality to Ordubad. This specimen has recently been figured both by Hesselbarth, van Oorschot & Wagener (1995: pl. 121, fig. 67) and by Eckweiler & Häsuer (1997: 138, pl. 5).
2. We have seen one male specimen in coll. VLCA, while one of us (AO), during a visit to the Museum für Naturkunde der Humboldt-Universität zu Berlin, compared short series of P. (A.) elbursicus and P. (A.) ninae (both from coll. VLCA), as well as the VLCA specimen of P. (A.) damonides, to the lectotype of the latter species, as well as a further 3♂ 2♀ paralectotypes [designated here Olivier, Puplessiene, van der Poorten, De Prins & Wiemers] in that museum bearing an original label “Ordubat”. We recognize the striking similarity with material of P. (A.) elbursicus (see also de Lesse 1960: 1871)). Lukhtanov (in Hesselbarth, van Oorschot & Wagener 1995: 735) suggested that damonides is probably identical to elbursicus, while Hesselbarth, van Oorschot & Wagener (op. cit.: 735) consider the possibility of conspecificity between damonides and ninae, an alternative we at present discount with no hesitation. As the chromosome number and karyotype of material from Ordubad is unknown at present, and considering the great variation in this group in this respect, we consider it unjustified to speculate on the conspecificity of damonides and elbursicus. The wisest approach seems to maintain damonides as a distinct species for the time being. In any case, the name damonides would become the oldest available name (unless it would prove to be conspecific with P. (A.) transcaspicus, what seems very unlikely).

Fig. 3. Karyotype of Polyommatus (Agrodiaetus) guezelmavi sp. n., paratype ♂, prep. 98031, M I, n = 41, Turkey, Konya province, Palaz Dağı, Taşkent, 1500–1600 m, 4.VIII.1998, leg. D. van der Poorten & W. De Prins, in coll. VLCA. 5 μ = 17 mm.

Fig. 4. Karyotype of Polyommatus (Agrodiaetus) guezelmavi sp. n., paratype ♂, prep. 98032, M I, n = 41, Turkey, Konya province, Palaz Dağı, Taşkent, 1500–1600 m, 4.VIII.1998, leg. D. van der Poorten & W. De Prins, in coll. VLCA. 5 μ = 17 mm.


Fig. 7. Karyotype of Polyommatus (Agrodiaetus) larsseni (Carbonell, 1994) stat. rev. ♂, prep. AO 9816, M I, n = 25, Lebanon, Mohafazat Beirut, Les Cedres [El Arz], 1950–2000 m, 17.VII.1998, leg. A. Olivier, in coll. VLCA. 5 μ = 17 mm.

Phegea 27 (1) (I.III.1999): 16
Legend of plates 1 (uppersides) and 2 (undersides)

1–3: *Polyommatus (Agrodiaetid* guezelmavi sp. n.
2. Paratype ♀, same data as 1, but in coll. VLCA.
3. Paratype ♀, same data as 1, but in coll. VLCA.

4. ♂, Turkey, Adana province, 8 km N. Saimbeyli, 1500 m, St. 2382, 6.VIII.1997, leg. W. De Prins, A. Olivier & D. van der Poorten, in coll. VLCA [specimen karyologically examined by Mr. Zdravko Kolev, nr. 97025].
5. ♂, Turkey, Adana province, 5 km N. Saimbeyli, Obruk Ormani, 1200 m, St. 2439, 28.VII.1998, leg. D. van der Poorten & W. De Prins, in coll. VLCA.
6. ♂, same data as 5.

7–8: *Polyommatus (Agrodiaetid* larseni (Carbonell, 1994) stat. rev.
8. ♂, same data as 7.

9: *Polyommatus (Agrodiaetid* damonides (Staudinger, 1899)
9. ♂, Azerbaijan, Nachichevan, Ordubad, 18.VI.1985, ex coll. L. Mets, in coll. VLCA.

10–12: *Polyommatus (Agrodiaetid* elbursicus (Forster, 1956)
10. ♂, Turkey, Van province, Zernek Baraj, 65 km N. Başkale, 2000 m, St. 1851, 23.VII.1992, leg. D. van der Poorten & W. De Prins, in coll. VLCA.
11. ♂, Turkey, Van province, 30–33 km NE Çatak, 2000–2100 m, St. 2330, 5.VIII.1996, leg. W. De Prins, A. Olivier & D. van der Poorten, in coll. VLCA.
12. ♂, Iran, Elburs Mts., Dizin, E. Gatchsar, 2400–2600 m, 28.VI–11.VII.1975, leg. K.G. Schurian, in coll. VLCA.

13–14: *Polyommatus (Agrodiaetid* guezelmavi sp. n.
13. Paratype ♀, same data as 1, but in coll. VLCA.
14. Paratype ♀, same data as 1, but in coll. VLCA.

15. ♂, same data as 7.

16. ♂, Turkey, Adana province, vic. Saimbeyli, 1500–1600 m, 13–14.VIII.1993, leg. K.G. Schurian, in coll. VLCA.
17. Paratypus ♀, Turkey, Adana province, 8–18 km N. Saimbeyli, 1600–1750 m, St. 196, 26.VII.1984, leg. B. van Oorschot, in coll. VLCA.

18: *Polyommatus (Agrodiaetid* elbursicus (Forster, 1956)
18. ♀, Turkey, Van province, Zerniek Baraj, 65 km N. Başkale, 2000 m, St. 2331, 6.VIII.1996, leg. W. De Prins, A. Olivier & D. van der Poorten, in coll. VLCA.

Table 2. Differentiating phenotypical characters of *Polyommatus (Agrodiaetid* guezelmavi sp. n., *P. (A.) therestiae* Schurian, van Oorschot & van den Brink, 1992 sp. rev., *P. (A.) larseni* (Carbonell, 1994) stat. rev. and *P. (A.) elbursicus* (Forster, 1956). *P. (A.) damonides* (Staudinger, 1899) is not listed as it appears to be indistinguishable from *P. (A.) elbursicus*.

*Phegea* 27 (1) (1.III.1999): 20
<table>
<thead>
<tr>
<th>guezelmavi</th>
<th>theresiae</th>
<th>larseni</th>
<th>elburricus</th>
</tr>
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<tbody>
<tr>
<td><strong>upperside♂</strong></td>
<td></td>
<td></td>
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<tr>
<td>-ground-colour sky blue with a violet tinge</td>
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<tr>
<td>-veins as a rule blackened distally, especially on hindwing</td>
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<tr>
<td>-androconial patch on forewing extensive and conspicuous</td>
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<tr>
<td><strong>underside♂</strong></td>
<td></td>
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<td></td>
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<tr>
<td>-ground-colour light grey</td>
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<td></td>
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<tr>
<td>-spotting reduced, especially on hindwing</td>
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<td></td>
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<tr>
<td>-white streak on hindwing rarely well defined and hardly contrasting with background</td>
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<tr>
<td>-submarginal row of markings very weakly expressed, almost of ground-colour</td>
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<tr>
<td><strong>upperside♀</strong></td>
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<td></td>
</tr>
<tr>
<td>-ground-colour brown</td>
<td></td>
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<tr>
<td>-hindwing occasionally with reduced to moderately developed blue basal suffusion</td>
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<tr>
<td>-submarginal lunules well developed on hindwing, at least some traces on forewing</td>
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<tr>
<td><strong>underside♀</strong></td>
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<td></td>
</tr>
<tr>
<td>-ground-colour light brown</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>-submarginal row of markings very weakly expressed and almost of ground-colour on hindwing, slightly more reddish on forewing</td>
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</table>

Phegea 27 (1) (1. III. 1999): 21
5. Discussion

The present study has shown that taxa believed to be conspecific, i.e. P. (A.) guezelmavi sp. n., P. (A.) theresiae sp. rev. and P. (A.) larseni, and that are sometimes hardly distinguishable phenotypically, appear to have a quite different chromosome number and karyotype. Other analogous cases are known in the subgenus Agrodiaetus, where taxa appearing very similar at the same time sharing a characteristic phenotype (and therefore likely to form a monophyletic group), exhibit great differences in chromosome number and karyotype. One such instance occurs in the group of P. (A.) antidolus (Rebel, 1901), P. (A.) kurdistanicus (Forster, 1961) and P. (A.) morgani (Le Cerf, [1910]), that have respectively n = 39–42, n = ca. 56–62 and n = 25–26 (de Lesse 1961; Hesselbarth, van Oorschot & Wagener 1995; Lukhtanov et al. 1998). We therefore cannot agree with Lukhtanov and colleagues when they group taxa, that obviously look quite dissimilar phenotypically, solely on similarity in karyotype. It is clear for us that, for instance, P. (A.) dama is not conspecific with or even most closely related to any of the taxa treated in the present study, nor that P. (A.) larseni is very closely related to and possibly conspecific with P. (A.) damocles, a taxon from the southern Ural in Russia (also biogeographically quite un paralleled in any other group). We would rather consider that the following general tendencies occur in the subgenus Agrodiaetus:

- groups of closely related taxa often remain relatively similar in external phenotype;
- on the contrary, speciation is often accompanied by rather radical changes in chromosome number and karyotype: the role of fusion or fission is still an unresolved matter (Lorković 1990);
- chromosome numbers and karyotypes are quite reliable taxonomic characters for the identification of distinct species. On the contrary, there is no current evidence for any usefulness of these features for phylogenetic reconstructions;
- in supposed absence of reliable morphological characters enabling the application of cladistic methods, the pragmatic grouping on phenotypical similarity seems to be the most useful method of classification so far;
- biochemical and molecular techniques appear worthy of large attention if one is to hope that we will ever improve our insights into the interrelationships between “natural groups” among “difficult” higher taxa like Agrodiaetus.

The value of chromosome numbers as absolute proof of complete reproductive isolation, and thus as a valid criterion for recognising specific distinctness, has been questioned on more than one occasion (e.g. Hesselbarth, van Oorschot & Wagener 1995; Eckweiler & Häuser 1997). We consider that allopatric populations are not conspecific if the geographical differences in chromosome number (and karyotype) considerably exceed the level of variability inside each form.

The chromosome numbers are fixed in the great majority of Lepidoptera: however, in 13% of the recorded species, numerical inconsistencies do occur (Robinson 1971, 1990). Intrapopulational variation is rather frequent in Lycaenidae and in Polyommatus (Agrodiaetus) in particular (de Lesse 1959, 1962, 1963; Lukhtanov 1989, 1993; Kandul 1997; Kandul & Lukhtanov 1997; Lukhtanov et al. 1997, 1998). The numerical inconsistency in the karyotypes of Polyommatus (Agrodiaetus) served as the argument in the discussion, which is basically: genetic isolation based on chromosomal rearrangements or the differentiation of the taxa based on geographical or ecological isolation, resulting subsequently in the fixation of one or another karyotype (Lorković 1990; Lukhtanov 1993). It was revealed that in Polyommatus (Agrodiaetus) the intrapopulational variability up to 1–4 pairs of chromosomes is a normal phenomenon and could be commonplace in populations. The progressive changes in chromosome number are based on gradual change in their frequencies with the following elimination of rare

*Phegea* 27 (1) (1.III.1999): 22
and unadapted karyotypes and the forming of the species with great differences in chromosome numbers (Lukhtanov 1993).

We consider that the difference in 22 elements between the karyotypes of Polyommatus (Agrodiaetus) guezelmavi sp. n. and Polyommatus (Agrodiaetus) theresiae sp. rev. is the evident argument in favour of two species, since in the opposite case the conjugation of bivalents in meiosis cannot take place. While observing the preparations of Polyommatus (Agrodiaetus) theresiae sp. rev. nos. 240, 241 and 243, no disruptions in the course of meiosis were found.

6. Acknowledgments

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7. References


*Phegea* 27(1) (1.III.1999): 24