HOLARCTIC LEPIDOPTERA, 5(1): 1-8

KARYOLOGY OF SPECIES OF *POLYOMMATUS* (*AGRODIAETUS*) FROM TURKEY: NEW DATA AND THEIR TAXONOMIC CONSEQUENCES (LEPIDOPTERA: LYCAENIDAE)

VLADIMIR A. LUKHTANOV[1], NIKOLAI P. KANDUL[1], WILLY O. DE PRINS[2] AND DIRK VAN DER POORTEN[3]

[1] Dept. of Entomology, Faculty of Biology, University of St. Petersburg, Universitet. nab. 7/9, RU-199034 St. Petersburg, Russia
[2] Diksmuidelaan 176, B-2600 Antwerp, Belgium
[3] Lanteernhofstraat 26, B-2140 Antwerp, Belgium

ABSTRACT.– The karyotypes of the following taxa of the subgenus *Polyommatus (Agrodiaetus)* from Turkey were investigated: *P.* (*A.*) *alcestis* (Zerny, 1932) (n=19), *P.* (*A.*) *demavendi* (Pfeiffer, 1938) (n=*ca.* 66-71), *P. (A.) antidolus* (Rebel, 1901) (n=39-41), *P. (A.) hopfferi* (Herrich-Schäffer, [1851]) (n=15), *P. (A.) kurdistanicus* (Forster, 1961) (n=ca. 56-60), *P. (A.) sp.* (? *huberti* Carbonell, 1993) (n=22), *P. (A.) merhaba* De Prins *et al.*, 1991 (n=16-17), *P. (A.) aserbeidschanus turcicola* (Koçak, 1977) (n=19-20), *P. (A.) elbursicus zapvadi* (Carbonell, 1993) (n=17-18), *P. (A.) firdussii pseudactis* (Forster, 1960) (n=22-25), *P. (A.) cyaneus* (Staudinger, 1899) (n=18), *P. (A.) turcicus* (Koçak, 1977) (n=24) and *P. (A.) iphigenia* (Herrich-Schäffer, [1851]) (n=13). The taxonomic position of the investigated taxa is discussed according to their karyotypes.

ZUSAMMENFASSUNG.– Die Karyotypen der folgenden Taxa der Untergattung *Polyommatus (Agrodiaetus)* aus der Türkei wurden untersucht: *P.* (*A.*) *alcestis* (Zerny, 1932) (n=19), *P.* (*A.*) *demavendi* (Pfeiffer, 1938) (n=*ca.* 66-71), *P. (A.) antidolus* (Rebel, 1901) (n=39-41), *P. (A.) hopfferi* (Herrich-Schäffer, [1851]) (n=15), *P. (A.) kurdistanicus* (Forster, 1961) (n=ca. 56-60), *P. (A.) sp.* (? *huberti* Carbonell, 1993) (n=22), *P. (A.) merhaba* De Prins *et al.*, 1991 (n=16-17), *P. (A.) aserbeidschanus turcicola* (Koçak, 1977) (n=19-20), *P. (A.) elbursicus zapvadi* (Carbonell, 1993) (n=17-18), *P. (A.) firdussii pseudactis* (Forster, 1960) (n=22-25), *P. (A.) cyaneus* (Staudinger, 1899) (n=18), *P. (A.) turcicus* (Koçak, 1977) (n=24) und *P. (A.) iphigenia* (Herrich-Schäffer, [1851]) (n=13). Die taxonomische Stellung der untersuchten Taxa wird Ihren Karyotypen entsprechend diskutiert.

KEY WORDS: Armenia, Asia Minor, chromosomes, distribution, genetics, Iran, Lebanon, Middle East, Near East, Palearctic, Rhopalocera, spermatogenesis, systematics, variation, taxonomy.

The diverse *Polyommatus* subgenus *Agrodiaetus* Hübner, [1822], is composed of several species, subspecies and forms, of which the exact taxonomic position is not always clear. Consequently, *Agrodiaetus* is one of the most difficult groups of *Polyommatus* among Palaearctic Rhopalocera. In some cases it is even impossible to separate sympatric species, because morphological differences amongst them are difficult to recognise. It is also difficult to understand whether allopatric populations belong to separate species or whether they constitute local forms of a species living in a wide area. In many cases, it is easy enough to describe such populations as subspecies, since most of them show constant differences and are geographically isolated, but at the same time it is virtually impossible to unite them into polytypic species using only morphological characters.

While external morphological characters in this subgenus are homogeneous, the karyotypes show many dissimilarities. The number of chromosomes can vary from n=8 in *P. (A.) nephohiptamenos* (Brown and Coutsis, 1978) to n=124-125 in *P. (A.) dolus* (Hübner, [1823]) (de Lesse, 1961) and this number is specific in most cases. A complete list of known chromosome numbers in the subgenus *Agrodiaetus* was recently published (Hesselbarth, van Oorschot and Wagener, 1995). Although some species have identical or only slightly different chromosome numbers (e.g., *P. (A.) damone sibirica* (Staudinger, 1899), and *P. (A.) morgani* (Le Cerf, 1909)), the structure of their karyotypes varies, i.e., in the number of macrochromosomes (Lukhtanov, 1989; Munguira *et al.*, 1995). As can be concluded from the cited work of de Lesse (1961), it is absolutely necessary (but not always enough) to examine the karyotypes of all the geographic forms in this subgenus in order to understand their taxonomic position.

Many species of the subgenus *Agrodiaetus* occur in Turkey: Hesselbarth, van Oorschot and Wagener (1995) list 35 species. Fortunately, the karyotypes of many taxa in this region have been studied by de Lesse (1959a,b,c; 1960a,b,c; 1961; 1962; 1963b,c). Two species (*P.* (*A.*) *poseidon* and *P.* (*A.*) *theresiae*) have been studied by Kandul and Lukhtanov (1997).

Our own karyological studies have two aims. The first one is to establish the chromosome number of recently described taxa from Turkey; the second one is to study the taxonomic relationship through karyological analysis in some difficult species complexes: *demavendi - alcestis, antidolus - kurdistanicus* and *ninae - elbursicus - turcicola.* In the light of the new publication of Eckweiler and Häuser (1997), we would like to discuss the taxonomic position of *P.* (*A.*) *theresiae*, the karyotype of which was studied earlier (Kandul and Lukhtanov, 1997).

MATERIAL AND METHODS

Only males were used to establish the chromosome numbers because the karyological study of females is a more difficult problem. The abdomens, or only the testes, of living, fresh (not worn) adult specimens, were 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. After the expedition, the vials were put into a regular refrigerator at 4°C, where they could be kept for a long period. During the subsequent cytological studies, squash

TABLE 1. Chromosome numbers of the taxa of the subgenus *Polyommatus* (*Agrodiaetus* Hübner) examined from Turkey

Taxon, locality, collecting date	Specimen Codes	Chromosome Number	Number and stage of examined cells
***P.* (*A.*) *alcestis* (Zerny, 1932)**			
Hakkari: Dez Valley, 1500m			
19 July 1992	92024	n=19	53 M-I
***P.* (*A*). *demavendi* (Pfeiffer, 1938)**			
Hakkari: Dez Valley, 1500 m			
19 July 1992	92023	n=ca. 68-71	4 M-I
ibid.	92025	n=ca. 68-71	6 M-I
ibid	92026	n=ca. 68-71	2 M-I
ibid.	92027	n=ca. 68-71	5 M-I
Hakkari: 16 km N Bagishli, 2000m			
26 July 1992	92126	n=ca. 70	1 M-I
Bitlis: Kuzgunkiran Geçidi, 1900-2300m			
26 July 1992	92045	n=ca. 68-71	7 M-1
ibid.	92048	n=ca. 68-71	6 M-I
ibid.	92049	n=ca. 68-71	5 M-I
ibid.	92051	n=ca. 68-71	4 M-I
***P.* (*A.*) *antidolus* (Rebel, 1901)**			
Hakkari: 16 km N Bagishli, 2000m			
6 Aug 1992	92123	n=39	1 M-I
ibid.	id.	n=ca. 40-41	2 M-I
ibid.	id.	n=41	1 M-I
ibid.	92124	n=40	8 M-I
ibid.	id.	n=ca. 40-41	1 M-I
ibid.	92125	n=41	9 M-I, 1 Pr.
ibid.	id.	n=40+m	2 M-I
ibid.	92128	n=40	3 M-I
ibid.	id.	n=ca. 40-41	2 M-I
ibid.	id.	n=41	6 M-I
Van: 32 km N Catak, 2000-2200m			
10 Aug 1992	92140	n=ca. 40-41	2 M-I
***P.* (*A.*) *hopfferi* (Herrich-Schäffer, [1851])**			
Hakkari: Dez Valley, 1550-1800m			
6 Aug 1992	92134	n=15	6 M-I, 3 Pr
ibid.	92135	n=15	16 M-I
***P.* (*A.*) *kurdistanicus* (Forster, 1961)**			
Van: 32 km N Catak, 2000-2200m			
10 Aug 1992	92148	n=ca. 56-60	1 M-I
***P.* (*A.*) *sp.* (? *huberti* Carbonell, 1993)**			
Van: Güzeldere Geçidi, 2650-2850m			
4-5 Aug	92113	n=ca. 21-22	2 M-I
ibid.	id.	n=22	17 M-I
ibid.	92114	n=22	11 M-I, 2 Pr.
***P.* (*A.*) *merhaba* De Prins *et al.* 1991**			
Artvin: 10 km SW Yusufeli, 900m			
15 July 1992	92001	n=16	6 M-I
ibid.	id.	n=17	24 M-I, 1 Pr
***P.* (*A.*) *aserbeidschanus turcicola* (Koçak, 1977)**			
Van: 32 km N Catak, 2000-2300m			
28-30 July 1992	92060	n=20	3 M-I
ibid.	92061	n=20	7 M-I
ibid.	92062	n=20	31 M-I
Van: Zernek Baraji, 1900-220 m			
29 July-2 Aug 1992	92081	n=19	3 M-I
ibid.	id.	n=20	13 M-I
Van: Güzeldere Geçidi, 2650-2850m			
4-5 Aug 1992	92120	n=20	9 M-I
***P.* (*A.*) *elbursicus zapvadi* (Carbonell, 1993)**			
Van: Zernek Baraji, 1900-2200m			
29 July-2 Aug 1992	92080	n=17	6 M-I
ibid.	id.	n=18	9 M-I, 1 Pr.
ibid.	92090	n=17	9 M-I
ibid.	id.	n=18	3 M-I

***P.* (*A.*) *firdussii pseudactis* (Forster, 1960)**			
Bitlis: Kuzgunkiran Geçidi, 1900-2300m			
26 July	92043	n=25	8 M-I
ibid.	id.	n=25+m	3 M-I
Van: 32 km NE Catak, 2000-2200m			
28 July 1992	92058	n=25	8 M-I
Van: Güzeldere Geçidi, 2650-2850m			
4-5 Aug 1992	92121	n=22	3 M-I
ibid.	id.	n=23	3 M-I
ibid.	id.	n=ca. 21-22	3 M-I
***P.* (*A.*) *cyaneus* (Staudinger, 1899)**			
Van: Zernek Baraji, 1900-2200m			
29 July-2 Aug 1992	92078	n=18	6 M-I
ibid.	id.	n=17+m	2 M-I
ibid.	id.	n=16+2m	1 M-I
ibid.	92079	n=18	2 M-I
ibid.	92082	n=18	15 M-I
***P.* (*A.*) *turcicus* (Koçak, 1977)**			
Erzurum: 30 km NNE Erzurum, 1900-2000m			
14-17 July 1992	92019	n=24	4 M-I
Van: 32 km NNE Catak, 2000-2200m			
28-30 July 1992	92065	n=24	7 M-I, 2 Pr.
ibid.	92066	n=24	5 M-I
ibid.	92067	n=ca. 24	1 M-I
ibid.	92069	2n=ca. 48-52	3 Mit.
ibid.	92071	n=24	4 Pr.
ibid.	92073	n=24	1 M-I
***P.* (*A.*) *iphigenia* (Herrich-Schäffer, [1851])**			
Bitlis: Kuzgunkiran Geçidi, 1900-2300m			
26 July 1992	92056	n=13	21 M-I and M-II
Van: 32 km NNE Catak, 2000-2200m			
28-30 July 1992	92057	n=13	12 M-I

preparations of the testes were made, after being stained with aceto-orcein. Haploid chromosome numbers (n) were determined in metaphase-I (M-I) of spermatogenesis, more rarely also in metaphase-II (M-II), the prophase of the first meiotic division (Pr.), or the metaphase of gonadial mitosis (Mit.)

Negatives and photographs of the studied metaphase preparations are kept in the Department of Entomology, University of St. Petersburg, Russia. The set specimens of the donor butterflies are kept in the collections of the Institute of Systematics and Population Biology (Zoological Museum), Amsterdam, the Netherlands, and the Flemish Lepidoptera Collection, Antwerp, Belgium.

RESULTS

The results of the karyological studies are summarized in Table 1 and in Fig. 1-15, with comments below. The taxa are listed (slightly modified) according to Eckweiler and Häuser (1997).

P. (A.) alcestis (Zerny, 1932) (Fig. 1). In metaphase-I, all bivalent chromosomes form a gradient series. The karyotype contains no exceptionally big or small bivalents.

P. (A.) demavendi (Pfeiffer, 1938) (Fig. 2). The chromosome numbers were only approximately established. They are similar in several examined populations (Table 1). The karyotype contains 2 very large and 2 median bivalents. All other bivalents are relatively small and form a gradient series in metaphase-I.

P. (A.) antidolus (Rebel, 1901) (Fig. 3). The number of chromosomes varies between individuals from n=39 to n=41. The bivalents are differently shaped, ranging from very small to large. In metaphase-I, 5 to 6 large bivalents can be recognized, from which the first is somewhat bigger than the other.

P. (A.) hopfferi (Herrich-Schäffer, [1851]) (Fig. 4). The variability in the chromosome numbers was not found in two examined specimens. The bivalents in metaphase-I are large and approximately of the same size.

P. (A.) kurdistanicus (Forster, 1961) (Fig. 5). The chromosome number was only approximately determined. The karyotype contains 3 very large bivalents.

P. (A.) sp. (? *huberti* Carbonell, 1993) (Fig. 8). In two examined specimens, no variability of the chromosome number was found. In metaphase-I, all bivalents form a gradient series.

P. (A.) merhaba de Prins, van der Poorten, Borie, van Oorschot, Riemis & Coenen, 1991 (Fig. 9-10). One specimen showed an intraindividual variability of n=16 to n=17. In metaphase-I, all bivalents in both karyotype variants (n=16 Fig. 10, n=17 Fig 9) are of the same size.

P. (A.) aserbeidschanus turcicola (Koçak, 1977) (Fig. 11). The most common chromosome number in this species is n=20. One specimen showed an intraindividual variability of n=19 to n=20. In metaphase-I, all bivalents form a gradient series.

P. (A.) elbursicus zapvadi (Carbonell, 1993) An intraindividual variability in the number of chromosomes was found, ranging from n=18 to n=19. In metaphase-I, all bivalents form a gradient series. The karyotype shows no extraordinary large or small bivalents.

P. (A.) firdussii pseudactis (Forster, 1960) (Fig. 12). In this species, not only variability in the number of bivalents was encountered, but also the absence or presence of a small extra element (m) was not

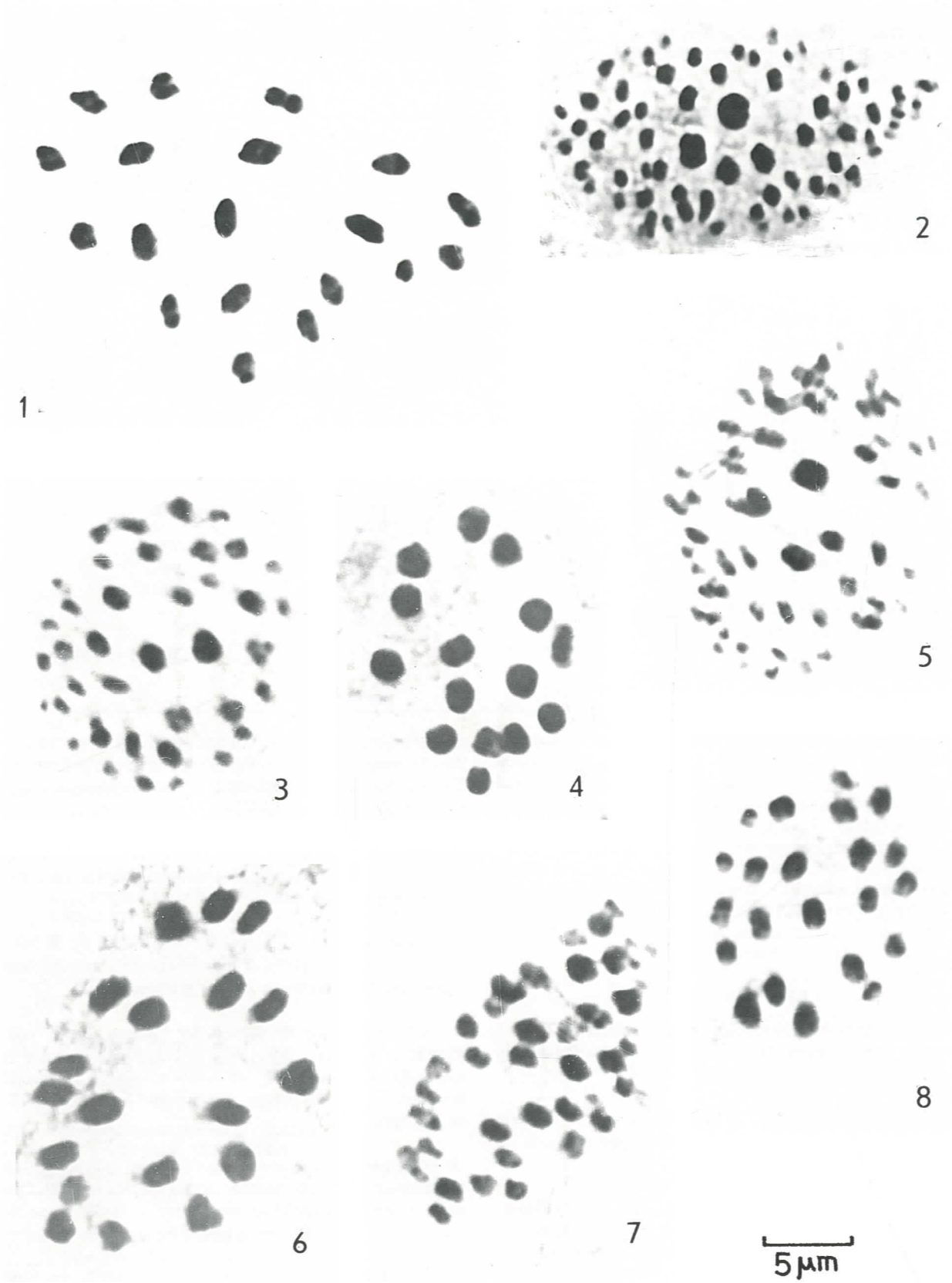

Fig. 1-8. Karyotypes of certain *Polyommatus* (*Agrodiaetus*) taxa: **1**. *P. alcestis* (Zerny, 1932), specimen Nr 92024, M-I, n=19, Hakkari, Dez valley, 1500m, 19 July 1992; **2**. *P. demavendi* (Pfeiffer, 1938), specimen Nr 92048, M-I, n=ca. 68-71, Bitlis, Kuzgunkiran Geçidi, 1900-2300m, 26 July 1992; **3**. *P. antidolus* (Rebel, 1901), specimen Nr 92124, M-I, n=40, Hakkari, 16 km N Bagishli, 2000m, 6 Aug 1992; **4**. *P. hopfferi* (Herrich-Schäffer, [1851]), specimen Nr 92135, M-I, n=15, Hakkari, Dez valley, 1550-1800m, 6 Aug 1992; **5**. *P. kurdistanicus* (Forster, 1961), specimen Nr 92148, M-I, n=ca. 56-60, Van, 32 km N Catak, 2000-2200m, 10 Aug 1992; **6**. *P. poseidon* (Herrich-Schäffer, [1851]), specimen Nr 92002, prophase of the first division, n=19, Artvin, 10 km SW Yusufeli, 900m, 15 July 1992 (according to Kandul and Lukhtanov, 1997: fig. 1,1); **7**. *P. theresiae* Schurian, van Oorschot & van den Brink, 1992, specimen Nr 94033, M-I, n=ca. 41-42, Konya, Taskent, July 1994 (according to Kandul and Lukhtanov, 1997: fig. 1,6); **8**. *P. sp.* (?*huberti* Carbonell, 1993), specimen Nr 92114, M-I, n=22, Van, Güzeldere Geçidi, 2650-2850m, 4-5 Aug 1992.

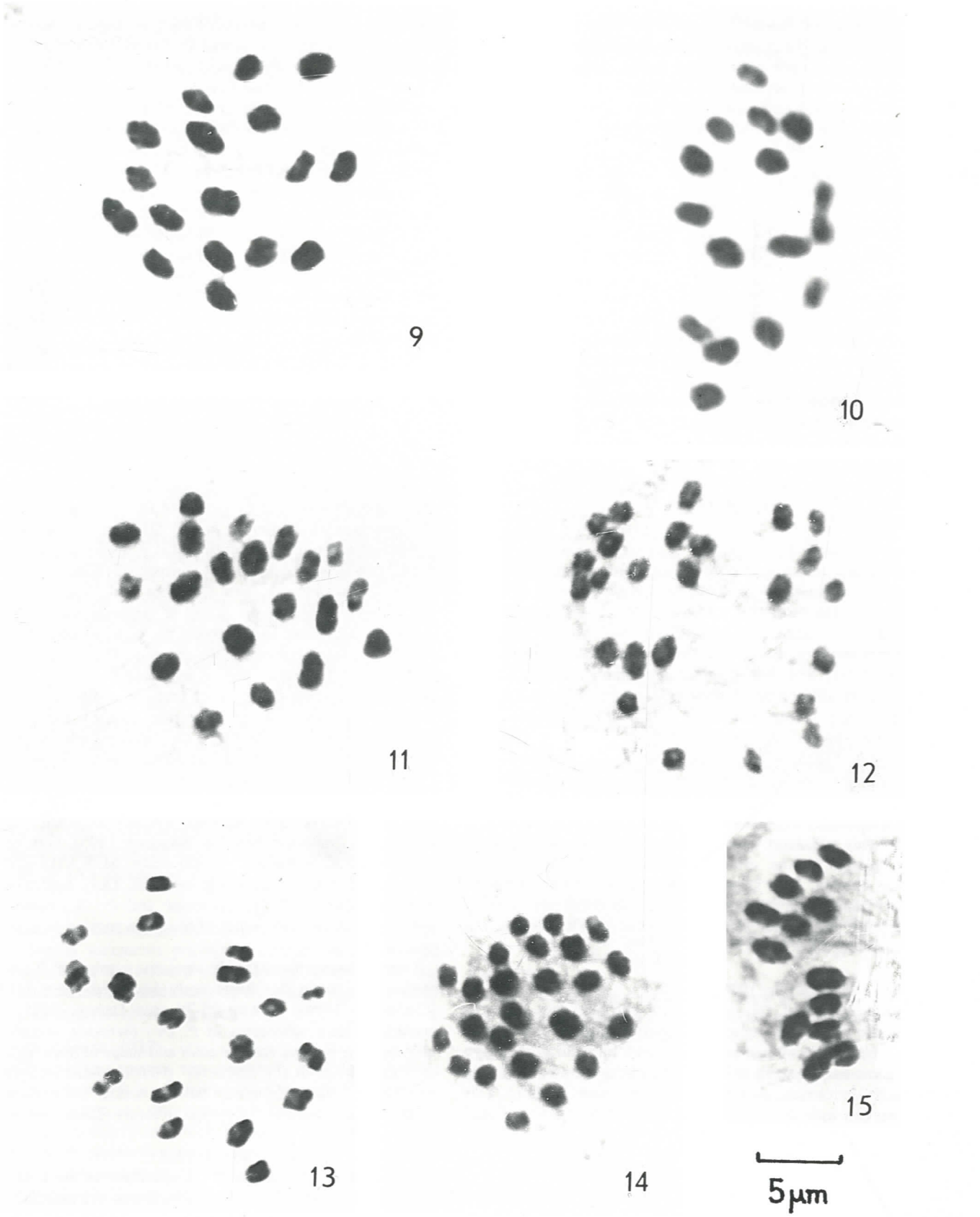

Fig. 9-15. Karyotypes: **9**. *P. merhaba* De Prins *et al.* 1991, specimen Nr 92001, M-I, n=17, Artvin, 10 km SW Yusufeli, 900m, 15 July 1992; **10**. *P. merhaba* De Prins *et al.* 1991, specimen Nr 92001, M-I, n=16, Artvin, 10 km SW Yusufeli, 900m, 15 July 1992; **11**. *P. aserbeidschanus turcicola* (Koçak, 1977), specimen Nr 92081, M-I, n=20, Van, Zernek Baraji, 1900-2200m, 29 July-2 Aug 1992; **12**. *P. firdussii pseudactis* (Forster, 1960), specimen Nr 92043, M-I, n=25, Bitlis, Kuzgunkiran Geçidi, 1900-2300m, 26 July 1992; **13**. *P. cyaneus* (Staudinger, 1899), specimen Nr 92082, M-I, n=18, Van, Zernek Baraji, 1900-2200m, 29 July-2 Aug 1992; **14**. *P. turcicus* (Koçak, 1977), specimen Nr 92019, M-I, n=24, 30 km NNE Erzurum, 1900-2000m, 14-17 July 1992; **15**. *P. iphigenia* (Herrich-Schäffer, [1851]), specimen Nr 92057, M-I, n=13, Van, 32 km NNE Catak, 2000-2200m, 28-30 July 1992.

constant. Furthermore, variability in specimens from different localities is significant. Because from every locality studied, only one butterfly produced suitable preparations in metaphase, we can not conclude at this moment whether this phenomenon is due to geographical or to indiviual variability. The bivalents in metaphase-I are all of approximatively the same medium size.

P. (A.) cyaneus (Staudinger, 1899) (Fig. 13). In one specimen the chromosome number was stable, whereas in another one, a variability in the number of bivalents and the presence of a small, extra, probably univalent element (m), was found. In the variant of the karyotype with n=18, all bivalents show a gradient series in metaphase-I.

P. (A). turcicus (Koçak, 1977) (Fig. 14). The chromosome number of n=24 was identical in all examined specimens from two populations. In metaphase-I, all bivalents form a gradient series.

P. (A.) iphigenia (Herrich-Schäffer, [1851]) (Fig. 15). The chromosome number of n=13 was identical in both specimens from two populations. All bivalents in metaphase-I and chromosomes (in phase M-II) form a gradient series.

DISCUSSION

P. (A.) alcestis (Zerny, 1932)

Our statements about the number of chromosomes and the structure of the karyotypes completely conform to those of de Lesse (1960a, b). From the studies of de Lesse (1960a,b), Larsen (1975) and our data, it is clear that the populations of *P. (A.) alcestis* can be divided into two groups with different chromosome numbers. The western group has a stable chromosome number of n=20 and contains the populations from Turkey (except southeastern Turkey) and Lebanon. Only in very few specimens does the number n=21 occur (de Lesse, 1960b). As can be seen from the figures given by de Lesse (1960b: Fig. 5c,d), this fact can be ascribed to a very small extra element, which occurs at the edge of the metaphase plate and can best be regarded as a B-chromosome. The oriental group also has a stable chromosome number of n=19 and includes the populations of Iran. The only specimen we examined from southeastern Turkey (Hakkari) belongs to the oriental subspecies, according to its chromosome number. This is not surprising, since in southeastern Turkey more Iranian taxa are found which do not occur further to the west or the north in the other Turkish provinces (cf. Hesselbarth, van Oorschot and Wagener, 1995).

P. (A.) demavendi (Pfeiffer, 1938)

Our statements about the number of chromosomes and the structure of the karyotypes completely agree with those of de Lesse (1960a,b; 1963a), who studied butterflies from Iran and Turkey. We found the same karyotype in several areas of the Transcaucasus: in Azerbaijan (Nakhichevan) and Armenia (Lukhtanov, unpubl.). This demonstrates the wide distribution of the species in the Near East.

P. (A.) antidolus (Rebel, 1901)

P. (A.) kurdistanicus (Forster, 1961)

These species belong, according to Eckweiler and Häuser (1997), to a group of closely related taxa: *P. (A.) antidolus* (Rebel, 1901), *P. (A.) kurdistanicus* (Forster, 1960), *P. (A.) morgani* (Le Cerf, 1909) and *P. (A.) femininoides* (Eckweiler, 1987). According to de Lesse (1960a, 1961), this group contains at least three different species: sp. 1 with n=60-62 (Turkey: Van), sp. 2 with n=42 (Turkey: Pertek), and sp. 3 with n=25-26 (Iran: Sanandaj). During our studies of this group, we found two variants of the karyological types: n=ca 56-60 and n=39-41, both encountered in the region of Lake Van. These karyotypes are very similar, and probably identical to those of "sp. 1" and "sp. 2" of de Lesse in regard to the number of chromosomes and the number of large bivalents. Wagener and his colleagues (Hesselbarth, van Oorschot & Wagener, 1995) ascribed these three karyotypes to the following taxa: *kurdistanicus* (n=60-62), *antidolus* (n=42) and *morgani* (n=25-26). This looks logical but needs confirmation, in the first place by examining the karyotypes of *kurdistanicus* and *morgani* from the type-localities. The first author examined the specimens in the Muséum National d'Histoire Naturelle, Paris, for which de Lesse established n=25-26, and found out that they differed considerably in characters of external morphology (more blue and darker scaling) from the type-specimens of *morgani*. Furthermore, they were collected far to the north of the type-locality of *morgani*.

P. (A.) hopfferi (Herrich-Schäffer, [1851]

P. (A.) iphigenia (Herrich-Schäffer, [1851]).

Our statements about the karyotypes of these two species conform with the studies of de Lesse (1959a,b,c; 1960a,c).

P. (A.) theresiae Schurian, van Oorschot and van den Brink, 1992

This species was recently separated from the similar, sympatric *P. (A.) poseidon* (Schurian *et al.*, 1992). Our statements about the number of chromosomes confirm that *P. (A.) theresiae* (Fig. 7) and *P. (A.) poseidon* (Fig. 6) are not conspecific (Kandul and Lukhtanov, 1997). In Hesselbarth, van Oorschot and Wagener (1995), this species was placed in the group of *transcaspicus* and *elbursicus*. However, according to the recent study of Eckweiler and Häuser (1997), this taxon belongs to the group of *P. (A.) dama* (Staudinger, 1892). *P . (A.) theresiae* can be separated from *P. (A.) dama* by the presence of a white stripe on the underside of the hindwings, by its brighter blue color of the upperside, and by the presence of a concentrated androconial patch on the upperside of the forewing, which is absent in *P. (A.) dama dama. P. (A.) theresiae* shows no significant karyological differences to *P. (A.) dama*, of which the chromosome number was established by de Lesse (1959c) as n=41-42 (Malatya). Both taxa are probably allopatric. According to Hesselbarth, van Oorschot and Wagener, 1995), both occur in the "Umgebung Kahramanmaras, 600-900m: M.-E.VII.1929". But this information is based upon old material. Only further studies can establish whether *P. (A.) theresiae* and *P. (A.) dama* should be considered as two subspecies of the same species or as two separate species.

Our statements about the chromosome number of *P. (A.) theresiae* furthermore prove that the recently described taxon *P. (A.) larseni* (Carbonell, 1994), with n=25-26 (see Larsen, 1975) cannot be considered as a subspecies of *P. (A.) theresiae*. According to the chromosome number and the color and shape of the wings, it belongs to the group of *P. damocles* (Herrich-Schäffer, [1844]). The members of the latter group have a similar chromosome number (n=24-26) and a similar karyotype structure (Lukhtanov *et al.*, 1997).

P. (A.) sp. (*?huberti* Carbonell, 1993)

Carbonell (1993) designated a specimen as the holotype of this taxon from a series from Agri, which was determined by de Lesse (1960a, 1963c) as "*transcaspica ninae*" and for which chromosome numbers n=33 and n=34 were established. Two specimens from the Güzeldere Geçidi (Van) that were studied, which were mentioned in Hesselbarth, van Oorschot and Wagener (1995) as *P (A.) huberti*, have n=22. Probably, we can conclude from this result that two different taxa are involved under the name *P. (A.) huberti*.

P. (A.) merhaba De Prins *et al.*, 1991
P. (A.) cyaneus (Staudinger, 1899)

Our statements on the chromosome number of *P. (A.) cyaneus* completely agree with those of de Lesse (1963b), taken from the populations of Lake Van. Typical for this species is a significant geographical variability in the chromosome numbers ranging from n=16-17 to n=22 (Lukhtanov, 1989). *P. (A.) merhaba*, which is taxonomically very close to and as far as known allopatric with *P. (A.) cyaneus*, has n=16-17. Because the chromosome number of *P. (A.) merhaba* falls within the known range of *P. (A.) cyaneus*, we cannot propose any definitive statements about the taxonomic position of *P. (A.) merhaba* (species or subspecies) from the karyological point of view. The morphological differences, however, are clear: *P. (A.) merhaba* is of a brighter blue color and it lacks the black venation in the marginal area of the upperside.

P. (A.) aserbeidschanus turcicola (Koçak, 1977)
P. (A.) elbursicus zapvadi (Carbonell, 1993).

Both of these taxa belong to the *P. (A.) transcaspicus* (Heyne, [1895]) group. In earlier studies, this group was divided into three subgroups (Lukhtanov, 1989): an oriental subgroup (*P. transcaspicus* sensu Lukhtanov, 1989) with n=52-53, a central subgroup. *P. aserbeidschanus* sensu Lukhtanov, 1989) with chromosome numbers ranging from n=16 to n=22 in different populations, and an occidental subgroup (*P. ninae* sensu Lukhtanov, 1989) with n=33-37. Each of these subgroups was given specific status, though it was supposed that the central subgroup was heterogeneous and contained several separate species. Field studies during the last few years showed that *P. (A.) aserbeidschanus* (Forster, 1956) and *P. (A.) ninae* (Forster, 1956) (Dantchenko, pers. comm.; see also Hesselbarth, van Oorschot and Wagener, 1995: 737) therefore should be considered specifically distinct. Subsequent studies also confirm that the central subgroup consists of several species. So, Carbonell (1993) showed that the taxon from Van with n=18, and determined by de Lesse (1963c) as *P. (A.) poseidon*, morphologically and karyologically belongs to *P. (A.) elbursicus* (Forster, 1956) and occurs sympatrically with *P. (A.) aserbeidschanus turcicola*. This proves that these taxa of the central subgroup are not conspecific. Our current karyological studies confirm and verify the conclusion that in the region of Lake Van, two karyological and morphological distinguishable taxa of the *P. aserbeidschanus* complex occur: *P. (A.) turcicola* (Koçak, 1977) with n=19-20 and *P. (A.) elbursicus zapvadi* (Carbonell, 1993) with n=17-18.

P. (A). firdussii pseudactis (Forster, 1960)

Our karyological statements principally conform to those of de Lesse (1960a, 1962), who found chromosome numbers for this subspecies in different localities ranging from n=24 to n=30. Only one male in our material showed n=22-23.

P. (A.) turcicus (Koçak, 1977)

The karyotype of this species was previously not known, but we were able to establish it. It is interesting from two aspects. First, the karyotype is very stable and shows no variation at all in the number of chromosomes, a condition which is known only from a few species with a wide distribution range, e.g. *P. (A.) ripartii* (Freyer, 1830), *P. (A.) menalcas* (Freyer, [1839]) and *P. (A.) damon* ([Denis & Schiffermüller], 1775) (see Hesselbarth, van P. Oorschot and Wagener, 1995). Furthermore, *P. (A.) turcicus* is the only species in the subgenus *Agrodiaetus* with the chromosome number of n=24, which is the mean and probably ancestral number for all non-tropical groups of Lycaenidae (Lukhtanov, 1993). If this number is a plesiomorphic character state and not evolved secondarily, *P. (A.) turcicus* can be considered as a primitive species in *Agrodiaetus*.

ACKNOWLEDGEMENTS

The authors would like to thank the following colleagues: Dr. J.-P. Borie, F. Carbonell, A. Dantchenko, Dr. W. Eckweiler, H. van Oorschot and Dr. P. S. Wagener, for the fruitful discussions about taxonomical and karyological problems within the subgenus *Agrodiaetus*; Dr. W. Dierl (Zoologische Staatssammlung München), Prof. Dr. G. Bernardi and Dr. M. J. Pierre (Muséum National d'Histoire Naturelle, Paris), for the opportunity to study the types of the taxa described by Dr. W. Forster and H. de Lesse, and the specimens of which the chromosomes were studied by H. de Lesse. The first two authors furthermore would like to thank the Russian Fund for Pure Research (Grant Nr 93-04-6298), for financial support.

REFERENCES

Brown, J., and J. G. Coutsis
1978. Two newly discovered lycaenid butterflies (Lepidoptera, Lycaenidae) from Greece, with notes on allied species. *Ent. Gaz.* (Wallingford), 29:201-213.

Carbonell, F.
1993. Contribution à la connaissance du genre *Agrodiaetus* Hübner (1822): le complexe ultraspécifique d'*A. transcaspica* Staudinger, (1899) (Lepidoptera: Lycaenidae). *Linn. Belg.* (Vilvoorde), 14:89-116.
1994. Le complexe d'*Agrodiaetus poseidon* Herrich-Schäffer, (1851) en Turquie en au Liban. Description d'une nouvell sous-espíce d'*A. theresiae* (Lepidoptera: Lycaenidae). *Linn. Belg.* (Vilvoorde), 14:291-302.

Dantchenko, A., and V. A. Lukhtanov
1993. Zur Systematik und Verbreitung der Arten der *Polyommatus (Agrodiaetus) damone*-Gruppe Südosteuropas und Südwestsibiriens (Lepidoptera, Lycaenidae). *Atalanta* (Munich), 24:75-83, 324-325.

De Prins, W., D. van der Poorten, J. P. Borie, H. van Oorschot, A. Riemis, and F. Coenen
1991. Rhopalocera of Turkey. 7. On a new species of *Polyommatus* Latreille, 1804 subgenus *Agrodiaetus* Hübner, [1822] from north-eastern Turkey (Lepidoptera: Lycaenidae). *Phegea* (Antwerp), 19:141-148.

Eckweiler, W., and C. Häuser
1997. An illustrated checklist of *Agrodiaetus* Hübner, 1822, a subgenus of *Polyommatus* Latreille, 1804 (Lepidoptera, Lycaenidae). *Nachr. Ent. Ver. Apollo* (Frankfurt), Suppl. 16:113-168.

Hesselbarth, G., H. van Oorschot, and S. Wagener
1995. *Die Tagfalter der Türkei unter Berücksichtigung der angrenzenden Länder*. Bocholt: S. Wagener. 1. Bd:1-753. 2. Bd:754-1354. 3. Bd:1-847.

Kandul, N. P., and V. A. Lukhtanov
1997. Karyotype variability and systematics of the blue butterflies of the species groups *Polyommatus* (*Agrodiaetus*) *poseidon* and *P.* (*A.*) *dama* (Lepidoptera, Lycaenidae). *Zool. Zhurn.* (Moscow), 76(1):63-69. [in Russian]

Larsen, T. B.
1975. Chromosome numbers and notes on testicular morphology of some Lebanese Rhopalocera (Insecta: Lepidoptera). *Ent. Scand.* (Copenhagen), 6:253-260.

Lesse, H. de
1959a. Nouvelle étude chorologique et cytologique conduisant à changer l'application du nom d'*Agrodiaetus iphigenia* H.S. (Lep. Lycaenidae). *Lambill.* (Tervuren), 59:56-61.
1959b. Description d'une nouvelle sous-espèce d'*Agrodiaetus hopffferi* H.S. (Lep. Lycaenidae) et de la formule chromosomique particulière. *Bull. Mens. Soc. Linn. Lyon.* 28:149-151.
1959c. Sur la valeur spécifique de deux sous-espèces d'*Agrodiaetus* (Lep. Lycaenidae) récemment décrites. *Bull. Mens. Soc. Linn. Lyon*, 28:312-315.
1960a. Spéciation et variation chromosomiques chez les Lépidoptères Rhopalocères. *Ann. Sci. Nat., Zool* (Paris), (12) 2:1-223.
1960b. Les nombres de chromosomes dans la classification du groupe d'*Agrodiaetus ripartii* Freyer (Lepidoptera, Lycaenidae). *Rev. Fr. Ent.* (Paris), 27:240-264.

1960c. *Agrodiaetus iphigenia* H.S. et son espèce jumelle *A. tankeri* n. sp. séparée d'après sa formule chromosomique (Lepid. Lycaenidae). *Bull. Soc. Ent. Mulhouse*, 1960:75-78.

1961. Les nombres de chromosomes chez *Agrodiaetus dolus* Hübner et les espèces voisines (Lycaenidae). *Alexanor* (Paris), 2:57-63.

1962. Variation chromosomique chez *Agrodiaetus actis* H.S. et *A. altivagans* Forst. (Lep. Lycaenidae). *Rev. Fr. Ent.* (Paris), 29: 66-77.

1963a. Lépidoptères Lycaenidae récoltés en Iran en 1961 (suite et fin). *Alexanor* (Paris), 3:33-38.

1963b. Variation chromosomique chez *Agrodiaetus carmon* H.S. et *A. cyanea* Stgr. (Lep. Lycaenidae). *Rev. Fr. Ent.* (Paris), 30: 177-181.

1963c. Variation chromosomique chez les *Agrodiaetus* (Lep. Lycaenidae). *Rev. Fr. Ent.* (Paris), 30:182-189.

Lukhtanov, V. A.

1989. Karyotypes of some blue butterflies of the *Agrodiaetus* species groups (Lepidoptera, Lycaenidae). *Ann. Ent. Fenn.* (Helsinki), 55:137-144.

1993. A possible mechanism of the origin of the great differences in chromosome numbers in the close species of the Lepidoptera (Insecta). *Karyosystematics of the Invertebrate Animals* (St. Petersburg), 2:28-32. [in Russian]

Lukhtanov, V. A., A. Dantchenko, and N. P. Kandul

1997. Die Karyotypen von *Polyommatus* (*Agrodiaetus*) *damone damone* und *P.* (*A.*) *damocles rossicus* nebst einigen Problemen bei *Agrodiaetus* (Lepidoptera: Lycaenidae). *Nachr. Ent. Ver. Apollo* (Frankfurt), Suppl. 16:43-48.

Munguira, M. L., J. Martin, and M. Perez-Valiente

1995. Karyology and distribution as tools in the taxonomy of Iberian *Agrodiaetus* butterflies (Lepidoptera: Lycaenidae). *Nota Lepid.* (Basel), 17:125-140.

Schurian, K. G., H. van Oorschot, and H. van den Brink

1992. *Polyommatus (Agrodiaetus) poseidon* (H.-S.) und *Polyommatus (Agrodiaetus) theresiae* sp. nov. aus der Türkei (Lepidoptera, Lycaenidae). *Nachr. Ent. Ver. Apollo* (Frankfurt), 12:217-232.