

Notes on the biology and distribution of the *damone* and *damocles* species-complexes of the subgenus *Polyommatus* (*Agrodiaetus*) (Lepidoptera: Lycaenidae)

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Abstract: The different allopatric populations of the species-complexes of *Polyommatus* (*Agrodiaetus*) *damone* and *P. (A.) damocles* are each treated as separate subspecies. The members of these two different species occur in pairs sympatrically in the Crimea and in the Volga-Ural regions, supposedly always combined with a special larval foodplant of the genus *Hedysarum* (Fabaceae) of a similar series of possibly parallel evolved species. *Polyommatus* (*Agrodiaetus*) *damone irinae* DANTCHENKO subsp. nov. from the lower Volga region (Ilov'la river basin, holotype in Zoologische Sammlungen des Bayerischen Staates, München) and *P. (A.) damone bogdoolensis* DANTCHENKO & LUKHTANOV subsp. nov. from the Mongolian Altai (holotype in Zoological Museum St. Petersburg) are described. New data on the biology of the subspecies of *P. (A.) damone* and *P. (A.) damocles* are reported.

Anmerkungen zur Biologie und Verbreitung der Artenkomplexe von *damone* und *damocles* aus der Untergattung *Polyommatus* (*Agrodiaetus*) (Lepidoptera: Lycaenidae)

Zusammenfassung: Die einzelnen allopatrischen Populationen der Artenkomplexe von *Polyommatus* (*Agrodiaetus*) *damone* und *P. (A.) damocles* werden als unterschiedliche Unterarten interpretiert. Die Mitglieder beider Arten kommen jeweils paarweise auf der Krim-Halbinsel und im Wolga-Ural-Bereich vor, offenbar vergesellschaftet mit jeweils einer Art aus einer parallel evoluierten Serie nah verwandter *Hedysarum*-Arten (Fabaceae). Die neuen Unterarten *Polyommatus* (*Agrodiaetus*) *damone irinae* DANTCHENKO subsp. nov. vom Unterlauf der Wolga (Ilovla-Flußbecken) und *P. (A.) damone bogdoolensis* DANTCHENKO & LUKHTANOV subsp. nov. aus dem Mongolischen Altai werden neu beschrieben. Neue Angaben zur Biologie einzelner Unterarten von *P. (A.) damone* und *P. (A.) damocles* werden vorgestellt.

Introduction

Recently it was shown (DANTCHENKO 1995) that the populations of the morphologically close taxa of the species-complex of *Polyommatus* (*Agrodiaetus*) *damocles* (HERRICH-SCHÄFFER, 1848) exhibit similar ecological features. The populations of these closely related taxa are monophagous

on plants of closely related species of the genus *Hedysarum* (Fabaceae). It was also shown that the subspecies of *P. (A.) damone* (EVERSMANN, 1841), belonging to another species-complex, inhabit the same biotopes; this species is monophagous on *Hedysarum grandiflorum* PALL. Assuming that the evolution of both the *damone* and the *damocles* species-complexes developed in line with the evolution of the genus *Hedysarum*, one might expect that the distribution areas of closely related *damone* and *damocles* taxa are fitting well with the distribution areas of closely related *Hedysarum* species used as larval foodplants by the blue butterflies. In order to test these assumptions, we studied the biology of populations of the *damone* and *damocles* species-complexes in various regions: Donetsk Plateau (Ukraine), Privolzhskaja Height (right bank of Volga river), South Ural, Khakassian steppes (Siberia, Minusinsk) in 1993–1996.

Abbreviations used

BMNH	The Natural History Museum (formerly British Museum (Natural History)), London
CB	collection of Gian BOZANO (Milan)
CD	collection of the author (Moscow)
CE	collection of Wolfgang ECKWEILER (Frankfurt)
CL	collection of Vladimir LUKHTANOV (St. Petersburg)
CR	collection of Klaus ROSE (Mainz)
EMEM	Entomological Museum of Dr. Ulf EITSCHBERGER, Marktleuthen
ZIMP	Zoological Institute and Museum, St. Petersburg
ZMHU	Zoological Museum of Humboldt University, Berlin
ZMKU	Zoological Museum of Kiev University
ZMMU	Zoological Museum of Moscow University
ZSBS	Zoologische Sammlungen des Bayerischen Staates, München

Results

Polyommatus (A.) damone tanais DANTCHENKO & PLJUSHTCH, 1993

TL: Belen'koe (vic. Kramatorsk, Donetsk Plateau, Ukraine).

Since the type locality of this taxon is nearly destroyed now (PLJUSHTCH pers. com. 1993), we investigated the Amvrosievka population (basin of the Mius river), a locality where paratype specimens were collected. The

biotope is stony steppe at the calcareous slope on the right banks of the Mius river. Only a small part of the hill, mostly in the areas adjacent to the gorge, was undisturbed (Fig. 1), whereas other parts were destroyed by agriculture. The foodplant occurred both in the steppe (Fig. 2) and in the calcareous outcrop. The first generation was observed in the field 26.–28. v. 1995. During this time, about a hundred of the specimens were collected (mostly fresh males). Thus, it is likely that the population was on the wings a few days before. Males were patrolling strictly near the *Hedysarum* stands preliminary determined as *Hedysarum argenteum* BIEB., 1808. Females were observed both copulating and egg-laying (Fig. 4). We have also observed other Rhopalocera in the *tanais* biotope: *Polyommatus icarus* (ROTTEMBURG, 1775), after peak of the flight; *Polyommatus bellargus* (ROTTEMBURG, 1775), peak of the flight; *Maculinea arion* (LINNAEUS, 1758), male; *Glaucopsyche alexis* (PODA, 1761), end of the flight; *Plebeius argus* (LINNAEUS, 1758), peak of the flight; *Plebeius argyrognomon* (BERGSTRÄSSER, 1779), male; *Coenonympha pamphilus* (LINNAEUS, 1758), males.

In the same year another *tanais*-population was observed in this region, near Lugansk town. A few mature larvae were collected on the *Hedysarum* stands 20–24 April. They pupated at 1 May and gave butterflies 21 May. In nature, the first males of the Lugansk population were on the wings on 25 May. The first males of the second generation were collected in the middle of July.

According to field observations concerning the population near Amvrosievka (22.–24. viii. 1993; 19.–24. viii. 1994; 11.–13. viii. 1995), the population peak of the second *tanais* generation is not well-defined. It is likely that the second generation (the first specimens of this population occur in the middle of July) overlaps partially with the third generation. Anyway, the specimens from Krementchug and Artemovsk collected 30 August–3 November 1943 (3 ♂♂, 3 ♀♀, deposited in ZSBS) should be regarded as third generation. The total amount of the specimens of the second generation was approximately the same as that of the first one.

In August, nearly all plants had finished their vegetation period in this locality. The only flowering plants where adults fed were *Centaurea diffusa*. Females laid eggs on the leaves and dry parts of the foodplant. We found a few first (Fig. 5), second and third instar larvae on the leaves, where they fed jointly with larvae of *Zygaena carniolica*. Third instar larvae were guarded by *Formica* spp. ants (Hymenoptera, Formicidae).

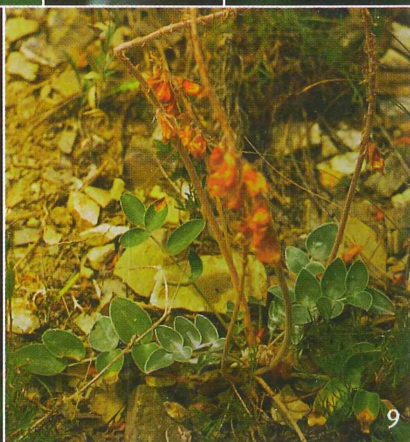
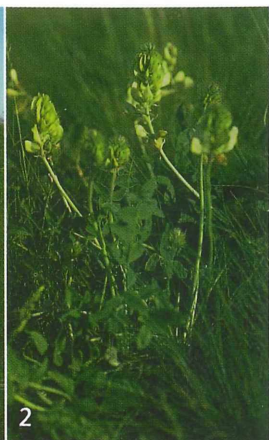
There was one second instar larva with a Diptera egg on its back. Two weeks later, *Aplomya confinis* FALL. (Diptera, Tachinidae) emerged from the mature, fifth instar, larva.

The specimens of the first and the second generations differ from each other to a large extent. The males of the second generation are more light grey in colour on the underside of the wings. The brown ground colour of the upperside of the wings in females of the first generation is darker, and the underside is coloured with strong greyish tint. The pattern on the wing underside of both males and females of the second generation was clearly distinguished and well-defined. The specimens of the second generation are smaller in size. Forewing length is 15.2 mm in ♂♂ and 15.3 mm in ♀♀ (vic. Amvrosievka, 26.-28. v. 1995) of first generation, and 14.2 mm in ♂♂ and 13.5 mm in ♀♀ (vic. Amvrosievka, 11.-13. viii. 1995) of the second generation, average of 20 specimens each.

It is of interest that a considerable fraction of the specimens of the first generation (15 % of males and 40 % of females) was represented by aberrant specimens, which had, on the forewings, one or few postdiscal spots connected with the top of the discal spot. A similar aberration known as *P. icarus* f. *digitata* COURVOISIER, 1907 was artificially obtained by cooling fresh *icarus*-pupae. The form was sex-controlled in this experiment (HOEGH-GULDBERG 1981). It seems to be logical to assume that a similar phenotype occurs in *tanais* first generation due to the effect of low night temperature on the pupae formed in nature during the end of April to beginning of May.

Colour plate 1:

Fig. 1: The locality of *Polyommatus* (A.) *damone tanais*, spring aspect, Ukraine, Mius river, env. Amvrosievka, 26.-28. v. 1995. **Fig. 2:** *Hedysarum argenteum* (Fabaceae, preliminary determination), the larval food plant, same time and locality. **Fig. 3-6:** *Polyommatus* (A.) *damone tanais*. **Fig. 3:** Pair in copula, first generation, same time and locality. **Fig. 4:** Egg in flower brush, same time and locality. **Fig. 5:** Egg shell and first instar larva., same time and locality. **Fig. 6:** Mature larva. **Fig. 7-8:** Larva of *Polyommatus* (A.) *damone damone*: Volga region, environs of Khvalinsk, 10. viii. 1995, S. KUNITZIN leg. **Fig. 7:** Third instar before hibernation. **Fig. 8:** Mature fifth instar larva. **Fig. 9:** *Hedysarum argyrophyllum* (preliminary determination), the larval foodplant of *Polyommatus* (A.) *damone damone* and *Polyommatus* (A.) *damocles damocles*, South Ural, Kuvandyk, 1.-7. vii. 1995.



In the laboratory the *tanais* larvae emerged after seven days of incubation. They were fed in glass test-tubes under permanent illumination at 22° C. The larval development was finished in 24 days. I should note that *tanais* larvae show an extreme degree of cannibalism. Even when a mature larva (Fig. 6) had natural food in its container, it preferred to attack moulting larvae. The adults emerged after 16 days of pupal phase and were similar to the specimens of the second generation in the wild.

Polyommatus (A.) damone damone (EVERSMANN, 1841)

TL Sergievsk (110 km NE Samara, left bank of Volga river).

Until recently, specimens which I consider to be the nominotypical subspecies were known mainly from Khvalinsk, Samara region, right banks of Volga river (leg. CHR[ISTOPH], deposited in ZMHU) and from South Ural (leg. [HABERHAUER] and [BARTEL](?), deposited in ZIMP). Specimens collected 1974–1990 by MIGRANOV (1991) and determined as *P. (A.) damone damone* are unavailable for study. Most likely, these specimens are a mixture of *P. (A.) damocles damocles* and *P. (A.) damone damone*.

Several specimens of *P. (A.) damone damone* were collected in the vicinity of Borskoe village, Samara region (near the type locality of the species), in 1989. The biotope is a stony steppe along the banks of the small river (S. SACHKOV pers. comm. 1993).

In 1993–1995, we studied *P. damone* populations nearby Khvalinsk-Volsk (Volga region) and Kuvandyk (South Ural). The biotope near Volsk is on calcareous outcrops as described recently (DANTCHENKO 1995). Early in July we observed mainly females of *P. damone*. Males were on the wings likely at 15–20 June. Females of *P. damone* laid eggs on underside of the leaves of *Hedysarum grandiflorum*.

During August, a few *damone* larvae both of third instar hibernating (Fig. 7) and of fifth instar before pupation (Fig. 8) were collected near Khvalinsk. One male emerged 18 days after pupating and was similar to specimens collected in the wild at the same locality at the end of August. Other mature larvae yielded parasites: *Aplomya confinis* (Diptera, Tachinidae) and Ichneumonidae ssp. The wild second generation was represented by only a few specimens, which were very close in colour and pattern to those from the first generation, but much smaller in size. Forewing length of first generation is 17.0 mm in males, 16.5 mm in females (Khvalinsk, 7.–9. VII. 1994), average of 20 specimens; that of the

second generation is 13.8 mm in males (20.–28. VIII. 1995), average of 3 specimens.

The biotope near Kuvandyk is very similar to the Volsk biotope. Both species, *P. damone* and *P. damocles*, were collected in the same locality 26. VI.–10. VII. 1995. The peak of *damocles* imaginal flight activity was on 26–28 June in 1995. The *damone* population was on the wings from 15 June 1995 onward (V. ZURILINA pers. comm.). Both *damone* and *damocles* specimens flew near a stand of *Hedysarum* preliminarily determined as *H. argyrophyllum* LEDEB., 1843 (Fig. 9).

Polyommatus (A.) *damone altaica* (ELWES, 1899)

TL Ongodai (Altai)

= *sibirica* STAUDINGER, 1899 (primary homonym)

The specimens described by STAUDINGER (1899) as *Lycaena damone* var. *sibirica* were first mentioned in his early work (STAUDINGER 1879). In the same paper he reported the main differences between specimens from Zaisan collected in 1877 by HABERHAUER and those referred to as nominotypical *Lycaena damone* EVERS-MANN, 1841 (the specimens from Ural collected by HABERHAUER and specimens from Khvalinsk, collected by CHRISTOPH in 1875). In this case, *Lycaena damocles* HERRICH-SCHÄFFER, 1843 was considered by STAUDINGER as a synonym of *Lycaena damone* EVERS-MANN, 1841. In fact, the material from Khvalinsk collected by CHRISTOPH is a mixture of *P. damone damone* and the very different species recently described as *P. damocles rossicus* DANTCHENKO & LUKHTANOV, 1993. STAUDINGER did not publish *damone* specimens from Tarbagatai as a new variation, probably because the material from Khvalinsk was so heterogeneous. After obtaining specimens collected by JACOBSON in 1898 in the Altai (Ongodai, Altai Mts., 3000–5000 ft., 12 July [18]98, A. JACOBSON, deposited in ZMHU), STAUDINGER described these butterflies and his specimens from Tarbagatai in a revisional article as *Lycaena damone* var. *sibirica*, likely because of priority reasons.

ELWES got another part of the JACOBSON material collected during his famous trip in the Altai in 1898. This author described *Lycaena damone* var. *altaica* on the basis of specimens of his own collection and specimens collected by JACOBSON and BEREZOWSKY. It was not so difficult for ELWES to find differences between his new “variation” *altaica* and EVERS-MANN’s *damone* because ELWES use for comparison specimens of “*damone*” from Guberli (South Ural). These specimens (1 ♂ 3. VII. [18]91, 2 ♀♀ 24. VI. &

2. VII. [18]91, deposited in BMNH) without metallic dust basally which most likely are *P. damocles*. This latter description was published also in 1899, but two months later than the revision of STAUDINGER (DANTCHENKO & LUKHTANOV 1993). However, *Lycaena damone* var. *sibirica* is a primary homonym of *Lycaena optilete* var. *sibirica*. Therefore *altaica* should be used as the valid name.

We studied the population of *altaica* near Minusinsk (right banks of Jenissei river) on 10–20 July 1993. The biotope is a stony steppe at the calcareous slope. Males patrolled in the biotope near stands of *Hedysarum gmelini* LEDEB. (preliminary determination). Females laid eggs on the *Hedysarum* leaves. The peak of imaginal flight activity was 14–16 July. Specimens of the Minusinsk population are very close in colour and pattern of the wings to specimens from Altai and Zaisan region. Forewing length is 17.5 mm in males, 16.5 mm in females, average of 20 specimens each.

During my investigations of calcareous outcrops of the Ilov'la river basin (in the height of the right banks of the Volga river, about 120 km north of Volgograd), I found a very interesting *damone* population. This population exhibits very specific ecological and morphological features differing from those of the nearest *damone* populations of this region, such as *P. (A.) damone tanais* and *P. (A.) damone damone* and is described here as new:

***Polyommatus (Agrodiaetus) damone irinae* subsp. nov.**
(Figs. 14–17)

Holotype ♂: Russia, Kamyschin, (Volga region), vic. Olkhovka (Ilov'la river basin), 10.–12. v. [19]95, ex larva, leg. A. DANTCHENKO, in ZSBS.

Paratypes: 26 ♂♂, 28 ♀♀, same data and locality; 11 ♂♂, 8 ♀♀, 3.–10. v. [19]96, ex larva, same locality, leg. S. ANDREEV & L. NIKOLAEVSKY; 3 ♂♂, 2 ♀♀, same locality, 15. VIII. 1996, leg. A. DANTCHENKO (EMEM, ZMMU, CB, CD, CE, CL, CR).

Colour plate 2:

Fig. 10: The type locality and food plant of *Polyommatus (A.) damone irinae*, autumn aspect. Fig. 11–17: *Polyommatus (A.) damone irinae* Russia, Volga region Kamyschin, environs of Olkhovka, 10.–12. v. 1995. Fig. 11: Mature larva. Fig. 12: Paratype ♂. Fig. 13: Paratype ♀. Fig. 14: *Polyommatus (A.) damone irinae*, holotype ♂, e. l. leg. A. DANTCHENKO, upperside. Fig. 15: Dito, underside. Fig. 16: Paratype ♀, upperside. Fig. 17: Dito, underside. Fig. 18–19: *Polyommatus (A.) damone bogdoola*. Fig. 18: Holotype ♂, [Mongolian] Altai, leg. GR[UM]-GR[SHIMAILO], upperside. Fig. 19: Dito, underside.



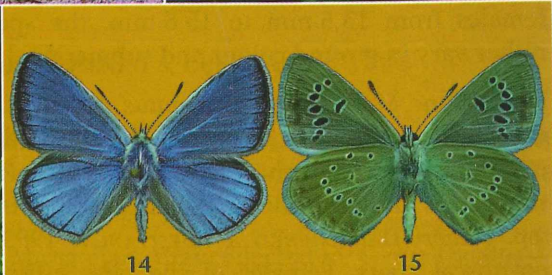
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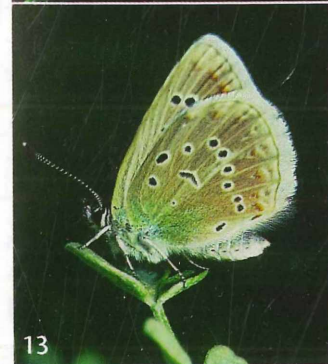
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Description

Male. Forewing length 15,4 mm. Upperside: ground colour is light blue; forewings have a narrow white line costally, wings' marginal obscuration nearly indistinct, inner part of marginal fringe is black, outer part is white, black marginal border fine, distal ends of veins are blackened, a little more on hindwings. Underside: ground colour of forewings is grey, hindwings with beige tint, postdiscal and submarginal pattern like in other *damone* subspecies, reddish submarginal markings and basal dust on hindwings is well developed, white stripe not well developed.

Female. Forewing length 15,5 mm. Upperside: ground colour is dark brown, forewings black discal stroke is very sharp, inner part of marginal fringe is brown, outer part is white, reddish crescent submarginal markings are well developed. Underside: general pattern and design like in the male, but ground colour is light brown.

Variation: Forewing length males ranges from 13,9 mm to 16.0 mm, females from 13,5 mm to 15,8 mm, the specimens of the type series rather vary in ground colour and submarginal pattern of wings underside.

Definition: Males of *Polyommatus (Agrodiaetus) damone irinae* differ from other subspecies of *damone* by the well developed and contrasting marginal patterns of the underside. They differ from the nominotypical subspecies and ssp. *sibirica* by the smaller size and from ssp. *tanaïs* and ssp. *walteri* DANTCHENKO & LUKHTANOV, 1993 by the bigger size of the postdiscal spots. Females of the new subspecies are closer to *sibirica* females, but the ground colour of the underside is darker and basal metallic dust is not so strong.

Bionomy: Specimens of the type series were bred from mature larvae (Fig. 11) (not very close in colour to *tanaïs* or *damone* larvae) and few pupae collected 10–12 May 1995 from *Hedysarum cretaceum* FISCH. (Fabaceae), which is the foodplant of this subspecies. The adults emerged after 15–17 days of pupal phase (Figs. 12, 13).

A few mature larvae yielded parasites: *Aplomya confinis* (Diptera, Tachinidae) and Ichneumonidae ssp.

The biotope of the new subspecies is a steppe on the top of the calcareous outcrop (Fig. 10). Similar steppe localities populated with *Hedysarum cretaceum* occur on the height of the right bank of Ilov'á river along several kilometres.

The following other Rhopalocera species were also collected in this locality during these two days: *Glaucopsyche alexis*, after peak of the flight; *Polyommatus coelestinus* (EVERSMANN, 1843), peak of the flight; *Polyommatus icarus*, males; *Plebeius pylaon* (FISCHER VON WALDHEIM, 1832), peak of the flight; *Plebeius sareptensis* (CHAPMAN, 1917), male; *Coenonympha leander* (ESPER, [1784]), beginning the flight; *Melitaea trivia fascelis* (ESPER, [1783]), after peak of the flight; *Melitaea arduinna* (ESPER, [1783]), male; *Euphydryas sareptensis* (STAUDINGER, 1878), beginning the flight.

The specimens (3 ♂♂ and 2 ♀♀) of the second generation show no differences in colour and pattern from those of the first, but the former specimens are smaller in size.

Discussion

I suppose that the following taxa belong to the *damone* species-complex in the area from Mongolia to the Crimean peninsula:

P. (A.) damone walteri DANTCHENKO & LUKHTANOV, 1993

TL: South Tuva

The type series of this species consists of specimens from Northwest Mongolia (Ureg-Nur lake), South Tuva (Naryn river) and West Mongolia (Mongolian Altai).

In fact, the specimens from Mongolian Altai collected by GRUM-GRSHIMAILO exhibit very specific morphological features differing from those of other specimens of the type series and of the specimens of the nearest populations of *P. (A.) damone altaica* from the Northeast Altai region. We think that this is new subspecies in the *damone* complex:

P. (A.) damone bogdoolensis DANTCHENKO & LUKHTANOV subsp. nov. (Figs. 18, 19)

Holotype ♂, [West Mongolia], [Mongolian] Altai, [Khovd region], [the mountain North to Kobdo river], [5.-18. vii. 1903], leg. GR[UM]-GR[SHIMAILO], in ZIMP.

Paratypes: 2 ♂♂, same data, in ZIMP

Description

Male. Forewing length 14,8 mm. Upperside: ground colour is light blue, but not bright, with clear grey tint, forewings have a white narrow line costally, wings marginal obscuration wide and very strong, distinct, cilia

are white, distal ends of veins are blackened on the hindwings. Underside: ground colour is grey, with brown tint, submarginal pattern nearly indistinct, basal dust on underside of hindwings is very strong, white stripe is clearly distinguished from basal to marginal part.

Variation: The specimens of the type series do not vary in colour pattern and size.

Definition: Males of the *P. (A.) damone bogdoolensis* differ from other subspecies of *damone* by the very specific colour of the upperside: a very dusk blue colour without violet tint. The row of the postdiscal spots on the underside of the wings is shifted strongly basally. The basal metallic green dust on the underside of the hindwings is very strong and broad.

The type specimens have the hand-written label: "Altai, GR.-GR." The collecting site of these specimens and other data were taken from the description of the expedition of GRUM-GRSHIMAILO to the Mongolian Altai in 1903 (KERZHNER 1972).

Etymology: Bogdo-Ola (Tabyn Bogdo-Ola) is the main peak of the Mongolian Altai.

***P. (A.) damone altaica* (ELWES, 1899)**

Khakassia, Altai, Tarbagatai, Kazakhstan Plateau

Agrodiaetus carmon altaensis FORSTER, 1956, described from a specimen with darker underside of the hindwings from the Minusinsk population of *altaica* (Minussinsk, Grjady, 25. VII. 1932, leg. KOZHANTCHIKOV, deposited in ZSBS) is probably a synonym of *P. (A.) damone altaica*.

***P. (A.) damone damone* (EVERSMANN, 1841)**

Volga-Ural region (from Orenburg to Volsk)

***P. (A.) damone irinae* DANTCHENKO, 1997**

Low Volga (Ilov'ya river basin)

***P. (A.) damone tanais* DANTCHENKO & PLJUSHTCH, 1993**

Donetzk Plateau (including region of Low Don river)

***P. (A.) damone pljushtchi* LUKHTANOV & BUDASHKIN, 1993 n. stat.**

Crimea (Ai-Petri mountain).

When *P. pljushtchi* was described, I had only scant material for understanding the taxonomic position of this taxon. Now doubtlessly this species should be regarded as a subspecies of *damone*. From morphologi-

cal point of view, *pljushtchi* specimens (especially females) are close to the specimens of the first *tanaïs* generation.

The species-complex of *P. (A.) damocles* is represented in this area by the following taxa:

P. (A.) damocles damocles (HERRICH-SCHÄFFER, 1843)

South Ural (Orenburg, Guberli, Spask, Kuvandyk, Orsk, Kizilskaja)

P. (A.) damocles rossicus DANTCHENKO & LUKHTANOV, 1993

Height of left bank Volga river (Volsk, Khvalinsk)

P. (A.) damocles krymaeus (SHELJUZHKO, 1928) n. comb.

TL [Agarmysch], see text

Crimean peninsula (Jalta, Kara-dag, Kertsch [?– A. DANTCHENKO])

My investigation of the *krymaeus* specimens deposited in ZIMP, ZMKU, ZSBS and ZMMU collected up to 1912 (including material collected by PLIGNINSKY and KIRITCHEKO, deposited in ZIMP) allows me to conclude firmly that the specimen designed by J. NEKRUTENKO as the lectotype of *krymaeus* (deposited in ZMKU) was not collected in Kertsch (NEKRUTENKO 1985, SHELJUZHKO 1928) but exactly on the Agarmysch mountain near Star Krym village. Therefore, Agarmysch should be the type locality of *P. (A.) damocles krymaeus*. This seems to be important for elaborating the caryotype of the type population in future. There is only one biotope in Kertsch – Opuk mountain – which could be potentially suitable for a *krymaeus* population, taking into account the ecological fittings (WULF 1960). However, no sure specimens from this locality are known up to now.

I do not discuss here *P. (A.) poseidon poseidon* (HERRICH-SCHÄFFER, 1851), which was previously included by me into the *damocles* species-complex (DANTCHENKO 1995). This species should be considered separately for two reasons:

P. (A.) poseidon poseidon (TL: Anatolia: Amasia) is not very closely related to *krymea* of the *damocles* species-complex. The Crimea Peninsula is zoogeographically closer to South Ural than to Anatolia.

- The type specimens of *poseidon* are lost and a neotype was not designed. Therefore, the caryotype cannot be assigned precisely to one population, because members of different – but closely related – species-groups occur in the area from Lebanon to Iran. Every group in-

cludes also allopatric populations of allied „species“. Members of different groups may occur sympatrically – sometimes in the same biotope. I recognise the following three groups:

1. “*elbursicus* group”: *P. (A.) deebi* LARSEN, 1974 (CN = haploid chromosome number: 17); *P. (A.) poseidon* (CN: 21–22, Amasia; CN: 19, Maraş; CN: 19, Van); *P. (A.) elbursicus* FORSTER, 1956 (CN: 17, Elburs), *P. (A.) damonides* STAUDINGER, 1899 (CN: unknown).
2. “*larseni* group”: *P. (A.) larseni* CARBONELL, 1994 (CN: 25, 26); *P. (A.) poseidon?* (sensu A. DANTCHENKO) from Ağrı (CN: 24–27). These populations may possibly belong to *damocles* (LUKHTANOV, pers. communication)
3. “*dama* group”: *P. (A.) dama* STAUDINGER, 1892 (CN: 41, 42); *P. (A.) mesopotamicus* STAUDINGER, 1892 (CN: unknown); *P. (A.) theresiae* SCHURIAN, VAN OORSCHOT & VAN DEN BRINK, 1992 (CN 42).

According to the haploid chromosome number, typical *P. (A.) poseidon* is probably close to *elbursicus*. To clarify these groups, it is at first necessary to designate a neotype of *poseidon* and thereby define a specific wild population as “topotypical” for caryotypic research.

Unfortunately, I am not aware of any attempt to summarize the recent data collected after the publication of the revision of *Hedysarum* by FEDTSCHENKO (1901). Therefore there is no reliable data available regarding the number and identity of *Hedysarum* species and their distribution areas. Strong polymorphism inside *Hedysarum* populations complicates the assignment of specimens from South Russia and Kazakhstan. Nevertheless, we can assume that *Hedysarum* is represented by the following taxa inhabiting steppe biotopes and calcareous outcrops from Crimean peninsula to North Mongolia:

Hedysarum candidum BIEB., 1808

TL Karasubazar (Crimea)

Crimea peninsula, western part of northern Caucasus

Hedysarum argenteum BIEB., 1808

TL North Caucasus

Stavropol region, Kislovodsk, Donetz plateau, lower Don river

Hedysarum grandiflorum PALL., 1773

TL “rarius ad Irтин” (Volga region)

Voronezh and Balaschov regions (Central Russia), Saratov, Volsk, Samara

Hedysarum argyrophyllum LEDEB., 1843

TL Guberlinsk
South Ural

Hedysarum splendens FISCH., 1825

TL Altai
southeastern Kazakhstan, southwestern Siberia, Altai, Dzhungaria

Hedysarum dagestanicum RUPR. in BOISS., 1872

TL Dagestan
northeastern Caucasus

All these taxa can probably be interpreted as a closely related complex of allopatric species. Another such complex is as follows:

Hedysarum tauricum PALL., 1802

TL Krym
Krym, western part of northern Caucasus

Hedysarum cretaceum FISCH., 1825

TL Serotinsk (Don river, right banks to the West of Volgograd)
lower Volga basin, right banks

Hedysarum razoumovianum HELM. et FISCH. 1825

TL Orenburg (South Ural)
lower Volga basin, right banks; South Ural

Hedysarum gmelini LEDEB., 1815

TL "Sibiriae montosis"
North and East Kazakhstan, southwestern Siberia, Altai

Hedysarum setigerum TURCZ., 1835

TL Tzakir river (South Buriatia)
Altai, Buriatia, North Mongolia

Hedysarum dahuricum TURCZ ex FEDTSCH. 1948

TL Onon-Borzia (Dauria)
Dauria steppe

According to my field observation, the taxa of these two plant species-complexes occur sympatrically in the European part of their distribution.

I do not consider here the following taxa:

Hedysarum ucrainicum KASCHM., 1905

TL Aidar river (Central Russia)

Hedysarum minusinense FEDTSCH., 1902

TL Potroschilovo (vic. Minusinsk)

Hedysarum chaiyrakanicum KURBATSKY, 1990

TL Chaiyrakan (Siberia)

Hedysarum zunduki PESCHKOVA, 1972

TL Zunduk (env. Baikal lake)

Hedysarum turczaninovi PESCHKOVA, 1979

= *Hedysarum microphyllum* TURCZ.

TL Balagansk, Siberia

These taxa are acceptable from the viewpoint of ecological features, but show a very narrow areal.

The areas of the *damone* and *damocles* taxa under consideration correlate well with the areas of their foodplants of the genus *Hedysarum*.

P. (A.) damone altaica – *Hedysarum gmelini*

In spite of good overlapping of these areas, the foodplant is actually known only for a single population from Minusinsk. From morphological point of view, the specimens of *altaica* from Kazakhstan appear not to be so uniform as those from Altai, Tarbagatai and Minusinsk regions. The study of the biology of *altaica* populations from these regions seems to be very important.

P. (A.) damone damone – *Hedysarum grandiflorum* and *H. argyrophyllum*
for the eastern part of the distribution

All known localities of *P. damone damone* correlate well with the areal of *Hedysarum grandiflorum*. At present, the southern limit of the area of nonotypical *damone* is not clear. The taxonomic position of *Hedysarum argyrophyllum* requires specific consideration since some botanical authors treat it as the southern variation of *Hedysarum grandiflorum*.

P. (A.) damone irinae – *Hedysarum cretaceum*

The single population is known from Ilovl'a river basin.

P. (A.) damone tanais – *Hedysarum argenteum*

The biology and distribution of *P. (A.) damone tanais* are the best studied now. This subspecies inhabits stony steppe from Low Don region to Kremenchug region (basin of Dnepr river) and is represented by the local isolated populations. The distance between these populations can be calculated from the maps of the areas of *Hedysarum argenteum*.

However, the taxonomic position of the *Hedysarum* populations from the Donetsk Plateau requires specific treatment. TALIEV (1901) treats these populations as transitions between *Hedysarum grandiflorum* and *H. argenteum*. The western limit of the distribution of *tanais* is not yet determined precisely. The biotopes acceptable from their ecological features are known further west to Bulgaria; however, no specimens were collected from this region (and from the North Caucasus region).

P. (A.) damocles damocles – *Hedysarum argyrophyllum*

All specimens collected up to now are from the South Ural area, where *Hedysarum argyrophyllum* is distributed.

P. (A.) damocles rossicus – *Hedysarum grandiflorum*

All populations known up to now from the Volga region are monophagous on *Hedysarum grandiflorum*.

P. (A.) damocles krymaeus – *Hedysarum candidum*

The ecological features of this subspecies which populates the Crimean peninsula were discussed in recent papers (DANTCHENKO 1995).

Conclusions

Generally speaking, it is evident that the subspecies of *damone* as well as the subspecies of *damocles* occurring in the same locality should require different ecological niches. Either these taxa can be monophagous on different *Hedysarum* taxa. Or they should have different life-cycles while using the same foodplant. The latter case is observed for the subspecies-pairs *P. damocles rossicus* – *P. damone damone* in the Volsk-Khvalinsk area (middle Volga region) and, even more likely, for *P. damocles damocles* – *P. damone damone* in South Ural. Similar cases are known for the European blues *P. bellargus* – *P. daphnis* – *P. coridon* (the foodplant is *Coronilla varia*, Fabaceae) and *P. thersites* – *P. damon* – *P. ripartii* (the foodplant is *Onobrychis arenaria*, Fabaceae).

It appears logical to expect that *P. damone walteri*, *P. damone bogdoolensis* and *P. damone pljushtchi* will be trophically connected with *Hedysarum* species and inhabit the steppes or calcareous outcrops, just like the *damone* taxa already studied. Probably *Hedysarum sangilense* KRASNOB. et TIMOCH., 1975 (TL Naryn, South Tuva) or *Hedysarum setigerum* (TL Tzakir river, South Buriatia) may be the foodplant of *walteri* and *bogdoolensis* populations.

Up to now, not a single specimen of *P. damone pljushtchi* was collected in biotopes of *P. damocles krymaeus*, according to many years of field experience. Thus, *Hedysarum tauricum* (rather than high altitude populations of *Hedysarum candidum*) may be the foodplant for *P. damone pljushtchi*. If *Hedysarum tauricum*, which is widespread over the Crimean peninsula, actually is the foodplant of *P. damone pljushtchi*, the question arises why there is only one population of this taxon (from the top of Mt. Ai-Petri) known up to now.

Summarizing, there are two different species-complexes (of *P. damone* and *P. damocles*) in the area from Crimea to Mongolia. The areas of the allopatric populations of the *damone* as well as of the *damocles* species-complexes correlate well with the areas of their respective foodplants of the plant genus *Hedysarum*. The members of the different complexes occur sympatrically (and sometimes in the same biotope) in the Crimea and the Volga-Ural regions. All taxa of these two species-complexes appear to be separate species when taking into account ecological and morphological features. However, as we do not have complete knowledge about the taxa under consideration, the concept of biospecies cannot be applied to solve this taxonomic problem unless on the basis of complete biological data. Therefore, I treat each population of these two species-complexes as separate subspecies until further data, especially data concerning the interaction between the taxa of each complex, are obtained.

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