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Contributions to the knowledge of *Polyommatus (Agrodiaetus) pfeifferi* (Brandt, 1938) and its relatives (Lepidoptera: Lycaenidae)

Pavel Skala

Ing. Pavel Skala, Trojanova 16, CZ-120 00 Praha 2, Czech Republic, email: aricia@volny.cz

Abstract: The author has collected a large quantity of comparative material and data pertaining to the ecology, distribution, external variability, genitalia morphology, and karyology of *Polyommatus (Agrodiaetus) pfeifferi* (Brandt, 1938), *eckweileri* ten Hagen, 1998, *shahrami* Skala, 2001, and *faramarzii* Skala, 2001. As a result, their mutual relationships and morphological differentiation from the externally similar Central Asian *iphigenides*-group are discussed in detail, and two additional taxa of the subgenus *Agrodiaetus* Hübner, 1822, namely *P. (A.) pfeifferi* **eclidius ssp. n.** from northern Fars and *P. (A.)* **achaemenes sp. n.** (holotypes ♂♂ in SMFL, Frankfurt am Main, Germany) from the southern part of the central Zagros Mts., are described.

Beiträge zur Kenntnis von *Polyommatus (Agrodiaetus) pfeifferi* (Brandt, 1938) und seiner Verwandten (Lepidoptera: Lycaenidae)

Zusammenfassung: Auf der Basis von großen Vergleichsserien und Daten über die Ökologie, Verbreitung, habituelle Variabilität, Genitalmorphologie and Karyologie von *Polyommatus (Agrodiaetus) pfeifferi* (Brandt, 1938), *eckweileri* ten Hagen, 1998, *shahrami* Skala, 2001 und *faramarzii* Skala, 2001 werden ihre Verwandtschaftsverhältnisse und morphologische Differenzierung von der äußerlich ähnlichen zentralsiatischen *iphigenides*-Gruppe im Detail diskutiert. Zwei zusätzliche Taxa des Subgenus *Agrodiaetus* Hübner, 1822 werden aus Iran beschrieben: *P. (A.) pfeifferi* **eclidius ssp. n.** aus dem nördlichen Fars und *P. (A.)* **achaemenes sp. n.** aus dem südlichen Teil des zentralen Zagrosgebirges (die Holotypen ♂♂ in SMFL, Frankfurt am Main, Deutschland).

Introduction

The recent discovery of five remarkably new taxa of the subgenus *Agrodiaetus* Hübner, 1822 in Central Iran, namely *Polyommatus (Agrodiaetus) eckweileri* ten Hagen, 1998, *P. shirkuhensis* ten Hagen & Eckweiler, 2001, *P. pfeifferi astyages* Skala, 2001, and especially *P. shahrami* Skala, 2001 and *P. faramarzii* Skala, 2001, raised many questions regarding their mutual relationships and their still unresolved taxonomical status, as well as their possible affinity to the Central Asian *iphigenides*-group. These questions were difficult to answer without additional material and data.

Thus, I devoted most of my Iran expedition in 2001 to the systematic search of additional closely related populations particularly in those areas, from which little or no material or data was available. In this challenging task, my Czech colleague Stanislav Nykl accompanied me.

New data concerning *P. (A.) pfeifferi*

Ecology and distribution

The above effort resulted, first of all, in the discovery of five previously unknown populations of *P. pfeifferi* (see distribution: Map 1). These populations occur at altitudes between 2900 and 4000 m, usually near the top of a northern slope made up of a light coloured, porous limestone and covered by an *Astragalus* steppe with *Onobrychis cornuta* (Fabaceae), on which I also observed several ovipositions. On this habitat *P. pfeifferi* is nearly always accompanied by *P. stempfferi* (Brandt, 1938).

In the years 2000 and 2001 I found 156 ♂♂ and 72 ♀♀ of *P. pfeifferi* in the following eight localities:

1. Fars, Kuh-e-Barm Firuz, 3100–3300 m (type locality of ssp. *pfeifferi*).
2. Boyer Ahmad, Kuh-e-Dinar, N Sisakht, 3200–3900 m.
3. Boyer Ahmad, 30 km NE Yasuj, 3200–3300 m.
4. Esfahan, 20 km N Fereidun Shahr, 3300–3900 m.
5. Bahtiari/Khuzestan, Kuh-e-Haft Cheshmeh, 3800–4000 m.
6. Esfahan, Golestan Kuh near Khounsar, 2900–3300 m (type locality of ssp. *astyages*).
7. Esfahan, Kuh-e-Dalan, 10 km E Daran, 3100 m.
8. Esfahan, Kuh-e-Dalan, 25 km E Daran, 3300–3500 m.

Individual and geographical variability

The analysis of the above material resulted in the first detailed study of the individual and geographical variability of *P. pfeifferi* comparing the following characters of both sexes:

Upperside: ground colour, discoidal and submarginal marking, marginal line, fringes.

Underside: ground colour, discoidal, postdiscal and submarginal marking, marginal line, fringes.

This study lead to the following main conclusions:

- The underside white streak is absent in approximately 3–5 % of all specimens (Fig. 31). Consequently, it does not represent a fully reliable differentiating character between *P. pfeifferi* and other taxa, especially *P. eckweileri.*
- The colour pattern of the upperside fringes of both sexes of *P. pfeifferi* is remarkably constant in all specimens. Thus, the fringes represent a highly reliable differentiating character, especially useful for the separation of the ♀♀ of *P. pfeifferi,* whose distal forewing fringes are white (Figs. 47, 48), from the ♀♀ of *P. eckweileri,* whose forewing fringes are always distally light brown (Fig. 49).

The occurrence of external features which are typical for ssp. *astyages* was reviewed with the following conclusions:

- The more violet ♂ upperside nearly always coincides with the characteristic underside pattern of ssp. *astyages,* but the reverse is not always true. Thus, ♂♂ with the characteristic greenish upperside colour of ssp. *pfeifferi* and the underside pattern of ssp. *astyages* (Figs. 27, 28) occur in localities 3, 4, 6, and 7. However, the ♂ upperside colour of *astyages* also varies considerably as illustrated by Fig. 20, which shows a particularly dark specimen. A similarly dark ♂, collected by G. Ebert in the Dorud area, is deposited in Staatliches Museum für Naturkunde in Karlsruhe, Germany. Finally, some specimens from locality 3 display an underside pattern which is clearly transitional between *pfeifferi* and *astyages* (Fig. 5). Thus, both forms occur sympatrically on localities 3, 4, 6, 7, and 8, where intermediates are also not uncommon. Localities 1 and 2 seem to be inhabited by the *pfeifferi* form only, and the two ♂♂ from locality 5 (Fig. 16) are externally very close to the typical *astyages* specimens.
- The same trend is also apparent in the ♀♀. The relationship between the upperside and underside features characteristic of *astyages,* and the sympatric occurrence of both underside forms in localities 3, 4, 6, 7, and 8 are the same as those of the ♂♂. However, there are three distinctive ♀ forms with respect to their upperside appearance, as shown by Figs. 9, 24, and 32. Again, localities 1 and 2 appear to be inhabited only by nominotypical ♀♀ as depicted in Figs. 9 and 32, and no ♀♀ were found in locality 5.

This distribution and variability pattern is not consistent with the treatment of *astyages* as a ssp. of *P. pfeifferi.* Instead, it suggests that *astyages* is probably a distinctive environmental form of *P. pfeifferi.* However, at present I cannot completely rule out the possibility that it represents a separate sympatric species with similar ecological requirements.

Karyology

In an attempt to further elucidate the above relationship, several testicle samples of apparent ♂ specimens of ssp. *astyages,* collected by me in 2001 on its type locality, were investigated by V. A. Luhktanov employing the refined techniques described by himself (Lukhtanov 1989, Lukhtanov & Dantchenko 2002a). Unfortunately, dividing cells were found in only 1 of the studied ♂♂. They revealed the chromosome number of n = 106–125. This reading corresponds to the chromosome number of n = 106 of the nominotypical *P. pfeifferi* determined by de Lesse (1960) from a confirmed nominotypical specimen collected in its type locality and deposited in the Muséum National d'Historie Naturelle, Paris. Thus, karyology did not provide a clear hint of the mutual relationship of both taxa.

Genital morphology

Contrary to a widespread belief, the ♂ genitalia of various *Agrodiaetus* taxa often differ from each other quite consistently, although the observed differences are typically rather subtle. Thus, Coutsis performed a detailed study of the ♂ genitalia samples on a series of confirmed and unquestionable specimens of the nominotypical *P. pfeifferi* and the form *astyages*. The techniques employed in obtaining the detailed genitalia drawings were the same as those previously described by him (Coutsis 2001).

The results showed indeed subtle, although consistent differences in the shape of the dorsolateral process of the valva between the five examined *P. pfeifferi* specimens (Fig. 33) and the 3 examined specimens of the taxon *astyages* (Fig. 35). This process is noticeably more pointed in the typical *P. pfeifferi* than in *astyages*, where its more blunt shape strikingly resembles the same character of *P. eckweileri* (Figs. 37, 38). However, this feature has been also observed in the transitional *P. pfeifferi* specimens whose underside pattern was of the *astyages* type, but the upperside displayed the lighter ground colour of *pfeifferi*. Despite their relatively constant occurrence in all specimens with the underside appearance of *astyages,* these differences are very subtle and should not be overestimated.

Discussion

Given the above evidence, the taxon *astyages* should be regarded probably as an ecological or individual form of *P. pfeifferi,* rather than as a separate species occasionally sympatric with it, especially in the light of the occasional occurrence of intermediates. However, additional biological and ecological data are necessary to assess this conclusion.

New data concerning *P. (A.) eckweileri*

Ecology and distribution

In July 2001, I found a very interesting new population of *P. eckweileri* in the Kuh-e-Bul/Kuh-e-Hatun range in northern Fars province.

The particularly strategic location of this isolated mountain chain, situated between the type localities of *P. shirkuhensis* to the East, *P. eckweileri* to the North, *P. pfeifferi astyages* to the Northwest, and *P. pfeifferi pfeifferi* to the South promised to hold the key to a proper understanding of the mutual relationships among these allopatric taxa. Indeed, the surprising discovery of a strong population of *P. eckweileri* on the Kuh-e-Hatun provided exactly such a key.

This population was found near the top of a high mountain, located several kilometres south of the town of Suriyan. Its biotope represents a small pocket of a relatively vital *Astragalus* steppe among the mostly harsh and stony environment, which prevails in the area. It is characterized by an abundant growth of *Acantholimon* sp. (Plumbaginaceae), on which the imagines of *P. eckweileri* often take nectar. These plants are usually found at considerably lower altitudes than those of typical *P. pfeifferi* habitats. Further, *Onobrychis cornuta* is very rare in this biotope, which strongly contrasts with the mass occurence of *P. eckweileri*, suggesting that this species may not share the same habitat and food plant requirements as *P. pfeifferi*.

Individual and geographical variability

The observed individual and geographical variability of *P. eckweileri* affects mostly its discoidal and submarginal marking. Therefore, it is largely limited to the upperside of its ♀♀, and the underside of both sexes, where this marking is developed.

♂ upperside: The upperside ground colour and the colouration of the fringes are nearly constant in all specimens of both populations. The marginal black line is somewhat wider in the Kuh-e-Hatun specimens (Fig. 7) than in the nominotypical ones (Fig. 3).

♀ upperside: The intensity of the blue rims around the discoidal spots and of the blue suffusion of the submarginal lunules on the hindwings varies considerably. The upperside fringes are always distally light brown in both populations (Fig. 49).

Underside (both sexes): The submarginal lunules are generally darker and more contrasting in the Kuh-e-Hatun specimens (Figs. 7, 11) than in the nominotypical ones (Fig. 3). However, the specimens of both populations are not always clearly recognizable by this character due to a considerable individual variability in each population.

Karyology

The chromosome number of *P. eckweileri* was determined by V. A. Lukhtanov from two testicle samples taken by me from the above population. Dividing cells were found in one of them, resulting in n = 106. Thus, the chromosome number of *P. eckweileri* seems to be identical with that of *P. pfeifferi* and the taxon *astyages*. Of course, this result does not necessarily imply that *P. pfeifferi* and *eckweileri* are conspecific (see further below).

Genital morphology

The ♂ genitalia of *P. eckweileri* are quite similar to those of *P. pfeifferi*, and especially to those of the taxon *astyages*. Very slight, although consistent differences between the nominotypical *P. eckweileri* (Fig. 37) and its Kuh-e-Hatun population (Fig. 38) were observed with respect to the dorsolateral process of the valva. The examined ♂ genitalia of 3 specimens of the Kuh-e-Hatun population seemed virtually identical with those of 3 confirmed *astyages* specimens taken from their type locality.

Discussion

The specimens of the Kuh-e-Hatun population are remarkably similar to the nominotypical *P. eckweileri* from the Kashan area. However, the intermittent areas between these two places are inhabited by profoundly different populations of *P. pfeifferi*, and the nearby Shir Kuh is the type locality of *P. shirkuhensis* (see Map 1). The distribution ranges of *P. pfeifferi* and *eckweileri* overlap in the mentioned area, where both taxa appear to inhabit somewhat different biotopes. Hence, retaining both taxa as two separate species seems to be more logical than the possible treatment of *P. eckweileri* as a geographical race of *P. pfeifferi*.

For similar reasons, I also propose to retain the specific rank of *P. shirkuhensis*. The character of its fringes, which are markedly different from those of *P. pfeifferi* and *eckweileri* (see figs. 47–50), also points in this direction. The fringes, whose colour pattern may play a role in the sexual selection, represent a probably important and often underestimated differentiating feature, which has already been successfully applied to separate morphologically bare distinguishable taxa both within the genus *Polyommatus* (see Carbonell 1991) and in other Rhopalocera (e.g., Gross 1978).

Thus, it is hardly surprising that the fringe colouration allows a more reliable separation of the ♀♀ of *P. pfeifferi* and *eckweileri* than the occasionally variable underside white streak.

New data concerning *P. (A.) shahrami* and *P. (A.) faramarzii*

Ecology and distribution

During the 2001 Iran expedition, we also continued the systematic research in the remote areas of the central Zagros Mountains, initiated during my first Iranian trip in July 2000. This effort, aimed primarily at finding further populations of *P. shahrami* and *P. faramarzii*, eventually produced ample additional data concerning both species.

A renewed search in the Zarde Kuh massif eventually lead to the discovery of the reproductive area of *P. faramarzii*, located much higher in the mountains than its type locality, where a few apparently strayed specimens were taken in July 2000.

This breeding area is situated at the altitude of nearly 4000 m near the bottom of a shallow, but steep canyon. This canyon, located immediately below one of the crests of the main Zarde Kuh range, has been apparently ground in the porous limestone by the abundant water from the melting snow. In late July its bottom was still partly filled by a 5–10 m deep layer of permanent snow, while its slopes were covered by an extraordinarily lush vegetation, among which very prominent were large growths of an *Onobrychis* sp., thus suggesting that *P. faramarzii* is also an *Onobrychis* feeder. Although *P. faramarzii* is an exceptionally vigorous flier, the blowing chilly wind usually prevailing at this habitat limits its daily flight time to no more than 3–4 hours, mostly in the mid to late afternoon.

I also identified the breeding area of *P. shahrami* (Fig. 54) on a nearly flat plain situated at approximately 3000–3300 m and overgrown mostly with its apparent foodplant, a low *Astragalus* sp., often hidden in the lush growth of thistles and undetermined Apiaceae. However, even here the density of its population was quite low. It seems that *P. shahrami* probably represents a typical low population density species, whose distribution pattern markedly differs from that encountered in *P. pfeifferi* and *P. faramarzii*, but closely resembles that of *P. stempfferi* (see Skala 2002).

Individual variability and diagnosis

In the above biotopes, I collected a sufficient number of specimens of both taxa to conduct a detailed study of their individual variability. Thus, I obtained the following comparative data:

Polyommatus (A.) faramarzii:

♂ upperside: The ground colour of *P. faramarzii* is remarkably constant (Figs. 15, 19), unlike that of *P. pfeifferi*. No distinctly lighter or darker ♂ form has been observed. Its distal fringes are snow-white and very short. This provides an excellent diagnostic tool for distinguishing it from even the darkest and most aberrant ♂♂ of *P. pfeifferi* (Fig. 20).

♀ upperside: The apical light blue submarginal lunules on the forewings of ♀♀ of *P. faramarzii* often spread into the median area of their forewings (Fig. 23). The very light bluish colour of its basal suffusion and submarginal marking does not correspond to the ground colour of its ♂ counterpart. In fact, the colour of this suffusion is often nearly the same as that of ♀ *P. shahrami* (Figs. 22, 29). The ♀♀ of *P. faramarzii* then reflect the characteristic ground colour of their ♂♂ only on a few scales on their thorax, and/or near the base of their hindwings. These scales may be absent owing to variability or being worn. Thus, the ♀♀ of the two species may not be distinguishable by this feature. Instead, I recommend the following highly reliable differentiating criteria:

- The distal parts of the fringes, especially on the forewings, are very dark, nearly black in *P. faramarzii* (Fig. 51) and very light grey in *P. shahrami* (Fig. 52).
- The antemarginal spots on the hindwings of *P. faramarzii* are integrated within its wide marginal line, while those of *P. shahrami* are nearly or completely separated from its narrow marginal line.

Both of these characters appeared to be 100% constant in the 33 evaluated ♀♀ of *P. faramarzii* and 24 ♀♀ of *P. shahrami*.

Underside (both sexes): The size of the postdiscal spots and the width and contrast of the submarginal lines of *P. faramarzii* (Figs. 15, 19, 23) are somewhat variable. In addition, the ground colour of *P. faramarzii* and the contrast of the white median streak on its hindwings vary considerably.

Polyommatus (A.) shahrami:

♂ upperside: The ground colour of *P. shahrami* and the colour and extent of its submarginal suffusion vary approximately in the range illustrated by the depicted specimens (Figs. 14, 18). The basal fringes on its hindwings are very dense and snow-white. When observed without magnification, this feature makes the impression of a narrow white marginal line.

♀ upperside: The light rims around the discoidal spots and the light submarginal lunules are occasionally reduced, as illustrated by Fig. 29. The above mentioned characteristic fringe pattern also occurs in the ♀♀. This provides an additional and very reliable tool for the distinction between the ♀♀ of *P. shahrami* and *P. faramarzii*.

Underside (both sexes): As with *P. faramarzii*, the ground colour and the contrast of the white streak vary considerably. However, this variability has no taxonomical or diagnostic implications.

Karyology

The determination of the chromosome numbers of both species carried out by Lukhtanov gave the following results:

Polyommatus (A.) faramarzii:

The testicles of four ♂♂ were analyzed. Dividing cells were found in two of them, resulting in n = 88–92 and n = 90, respectively. This number clearly differs from those of *P. pfeifferi* obtained by de Lesse (1960; n = 106) and Lukhtanov (see above; n = 106–121).

Polyommatus (A.) shahrami:

The testicles of two ♂♂ were analyzed. Dividing cells were found in one of them, resulting in n = 128–131.

Genital morphology

The detailed drawings of the nearly identical ♂ genitalia of both taxa obtained by Coutsis confirm their high morphological similarity inferred from their nearly indistinguishable females and virtually identical underside patterns of both sexes. Also, the morphological similarity of both taxa to *P. pfeifferi* and *P. eckweileri* is obvious.

The only, and indeed very subtle, morphological difference between *P. shahrami* (Fig. 43) and *P. faramarzii* (Fig. 42) appears to be the slightly more slender and pointed labides of the latter, when observed in ventral view. However, the genitalia of *P. sharami* are much larger relative to the overall size and forewing length of the insect than those of *P. pfeifferi* and *faramarzii*.

Interestingly, the ♂ genitalia of *P. shahrami* and *P. faramarzii* differ noticeably from those of their central Asian counterparts, e.g., *P. actinides* (Staudinger, 1886) and *P. iphigenides* (Staudinger, 1886) (Figs. 39 and 40), thus clearly demonstrating not only their specific distinction from these taxa, but also the apparent morphological differences between both groups. In *P. iphigenides* and *P. actinides* the labides are much narrower and more pointed in ventral view, and less bulged in lateral view than those of *P. shahrami* and *P. faramarzii*. The ♂ genitalia of *P. pfeifferi*, *P. eckweileri* and *P. shirkuhensis* (Fig. 36) further confirm that the mentioned Iranian taxa are morphologically much more closely related to each other than to the *iphigenides*-group sensu Häuser & Eckweiler (1997), thus answering the question of their possible affinity to this group.

Discussion

The well-known fact that chromosome rearrangements involved in the cross-breeding of morphologically compatible taxa with different karyotypes usually result in sterile hybrids, thus effectively functioning as a means of reproductive isolation (de Lesse 1957, King 1993), has been often solely relied upon in lepidopterological literature. However, certain types of these rearrangements have no effect on offspring fertility (Vorontsov 1999), and well-documented cases of fertile cross-breeding of taxa with widely different chromosome sets are known in Lepidoptera. Thus, in the absence of any clearly formulated rule or any case study allowing accurate predictions of the effects of chromosome rearrangements on offspring fertility, the karyological data alone cannot be taken as an absolute measure of reproductive isolation.

On the other hand, when dealing with the subgenus *Agrodiaetus,* I cannot disregard the highly conspicuous coincidence between the particularly low interspecific morphological differentiation and the exceptionally high interspecific karyological diversity (and intraspecific stability) within this group, where sympatric occurrences of morphologically barely distinguishable species of markedly different karyotypes are particularly frequent. This indicates that within *Agrodiaetus,* karyological differentiation is probably more vital to maintain reproductive isolation than in other Lepidoptera (Lukhtanov & Dantchenko 2002a, 2002b).

Hence, although I may be somewhat skeptical of the convenient usage of incomplete karyological data (only chromosome numbers) as the ultimate taxonomical tool in lepidopterology, I must admit that the number, type, size, and spatial arrangement of the chromosomes in the metaphase I plate of any *Agrodiaetus* taxon nearly always provide a good indication of its status. However, this indication must be also compatible with other available data, such as ecology, distribution, genital morphology, and DNA sequencing in order to be fully trusted.

In the case of *P. pfeifferi* and *faramarzii,* additional details concerning their karyotypes, as well as those of some other Iranian *Agrodiaetus,* will be published in a separate report.

However, the discoveries of additional populations of *P. pfeifferi* in various parts of the Zagros mountains (see Map 1) and the newly obtained ecological data of both species suggest that they populate very similar or identical habitats in the same geographical region, and their known localities are not mutually separated by any noticeable distribution barriers. This observation, together with the above karyological differences, already strongly suggest that *P. pfeifferi* and *faramarzii* represent two separate and potentially sympatric species.

Additional closely related taxa

The above definition of the individual variability of *P. pfeifferi, P. eckweileri,* and *P. shahrami* enabled me to recognize the two new closely related taxa described below.

A new subspecies of *P. (A.) pfeifferi* from Eqlid

The systematic search of the above mentioned Kuh-e-Hatun/Kuh-e-Bul range uncovered not only the above population of *P. eckweileri,* but also another apparently closely related population on the Kuh-e-Bul, located near the town of Eqlid, only 60 km further west from the former locality. However, the specimens of this population exhibit some of the above mentioned external characters typical of *P. pfeifferi.* Thus, I decided to describe the population as:

Polyommatus (Agrodiaetus) pfeifferi ***eclidius*** **ssp. n.**

Holotype: ♂ (Fig. 2), Iran, Fars, Kuh-e-Bul, 3300–3500 m, 13. vii. 2001, leg. Skala, coll. Lepidopterensammlung des Senckenberg-Museums (SMFL), Frankfurt am Main, SMFL no. 4211.

Paratypes (in total 18 ♂♂, 13 ♀♀): 8 ♂♂, 5 ♀♀, same data as holotype, leg. et coll. Skala; 1 ♂, 1 ♀, sama data as holotype, leg. Skala, coll. Eckweiler; 1 ♂, same data as holotype, leg. Skala, coll. Schurian; 1 ♀, same data as holotype, coll. SMFL, Frankfurt am Main; 8 ♂♂, 6 ♀♀, same data as holotype, leg. Nykl, coll. Eckweiler.

Etymology: This subspecies is named after the latinized form of the name of the town of Eqlid, the only access point to the Kuh-e-Bul massif. The name is to be treated as a noun in appoosition.

Colour plate 1 (uppersides) **and colour plate 2 (**undersides):
P. pfeifferi pfeifferi. **Fig. 1:** ♂, Iran, Fars, Kuh-e-Barm Firuz, 3100 m, 6.–7. vii. 2000, leg. et coll. Skala. **Fig. 5:** ♂, Iran, Boyer Ahmad, 30 km NE Yasuj, 3200–3300 m, 15. vii. 2001, leg. et coll. Skala. **Fig. 9:** ♀, same data as Fig. 1. **Fig. 32:** ♀, same data as Fig. 1. ***P. pfeifferi astyages.*** **Fig. 16:** ♂, Iran, Bakhtiari, Kuh-e-Haft Cheshmeh, 3800–4000 m, 19.–22. vii. 2001, leg. et coll. Skala. **Fig. 20:** ♂, Iran, Esfahan, Fereidun Shahr, 3700–3900 m, 30. vii.–1. viii. 2001, leg. et coll. Skala. **Fig. 24:** ♀, paratype, Iran, Esfahan, Khounsar, 3000 m, 16. vii. 2000, leg. et coll. Skala. **Fig. 27:** ♂, Iran, Esfahan, Khounsar, 3100–3300 m, 23. vii. 2001, leg. et coll. Skala. **Fig. 28:** ♂, paratype, same data as Fig. 24. **Fig. 31:** ♀, same data as Fig. 20. ***P. pfeifferi eclidius* ssp. n. Fig. 2:** ♂, holotype, Iran, Fars, Kuh-e-Bul, 3300–3500 m, 13. vii. 2001, leg. Skala, in SMFL. **Fig. 6:** ♂, paratype, same data as Fig. 2, coll. Skala. **Fig. 10:** ♀, paratype, same data as Fig. 2, coll. Skala. ***P. eckweileri.*** **Fig. 3:** ♂, Iran, Esfahan, Kashan, Qamsar, W Qahrud, 2500–2700 m, 10. vii. 1998, leg. Eckweiler, coll. Skala. **Fig. 7:** ♂, Iran, Fars, Suriyan, 3200–3300 m, 10. vii. 2001, leg. et coll. Skala. **Fig. 11:** same data as Fig. 7. ***P. baltazardi.*** **Fig. 4:** ♂, Iran, Kerman, Sar-e-Siab, N Kuhpayeh, 2800–3000 m, 23.–25. vi. 2000, leg. Eckweiler, coll. Skala. ***P. shirkuhensis.*** **Fig. 8:** ♂, Iran, Yazd, Deh Bala, 3000 m, 28.–29. vi. 2001, leg. et coll. Skala. **Fig. 12:** ♀, same data as Fig. 8. ***P. achaemenes* sp. n. Fig. 13:** ♂, paratype, Iran, Bakhtiari, Kuh-e-Haft Cheshmeh, 3800–4000 m, 19.–22. vii. 2001, leg. et coll. Skala. **Fig. 17:** ♂, paratype, same data as Fig. 13. **Fig. 21:** ♀, paratype, same data as Fig. 13. **Fig. 25:** ♂, holotype, same data as Fig. 13, in SMFL. ***P. shahrami.*** **Fig. 14:** ♂, Iran, Bakhtiari, Zarde Kuh massif, 3000–3300 m, 26.–28. vii. 2001, leg. et coll. Skala. **Fig. 18:** ♂, same data as Fig. 14. **Fig. 22:** ♀, same data as Fig. 14. **Fig. 29:** ♀, same data as Fig. 14. ***P. faramarzii.*** **Fig. 15:** ♂, Iran Bahtiari, Zarde Kuh massif, 3800–4000 m, 26.–28. vii. 2001, leg. et coll. Skala. **Fig. 19:** ♂, same data as Fig. 15. **Fig. 23:** ♀, same data as Fig. 15. ***P. bogra.*** **Fig. 26:** ♂, Pakistan, Baluchistan, Quetta, Ziarat, 14.–19. vi. 1992, leg. Weidenhoffer, coll. Skala. **Fig. 30:** ♀, same data as Fig. 26.


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Description, diagnosis, and variability

♂♂: Forewing length 12,5–15 mm (holotype 13 mm).

Upperside: The ground colour and overall appearance of *P. pfeifferi eclidius* ssp. n. (Figs. 2, 6) are similar to those of the nominotypical *P. pfeifferi,* including the occasional black suffusion of its veins near the margins of both fore- and/or hindwings, and the constant colouration of the fringes, which are basally dark grey on the forewings, and mostly medium grey on the hindwings and distally white on both fore- and hindwings. The ♂♂ of *eclidius* are noticeably deeper blue than the more greenish ♂♂ of both populations of *P. eckweileri,* and nearly indistinguishable by their dorsal appearance from the ♂♂ of the nominotypical *P. pfeifferi* as well as from the taxon *astyages.*

Underside: The ground colour of ♂ *eclidius* ssp. n. (Figs. 2, 6) is light brownish grey, and its hindwings are distinctly darker and more brownish than its forewings. The bluish green basal suffusion on its hindwings is well-developed, but not as widespread as in ssp. *pfeifferi.* The black basal spots are present on its hindwings and absent on its forewings. Just as in the nominotypical *P. pfeifferi,* its discoidal marking is well-developed and contrasting, and its fringes are basally mostly light grey and distally all white. But the black spots of its postdiscal rows on both fore- and hindwings are even larger than those of the taxon *astyages* and comparable in size to those of *P. eckweileri,* and the development of its submarginal lunules follows the same trend.

The characteristic white streak on the underside of its hindwings is usually completely absent, which clearly differentiates *eclidius* ssp. n. from ssp. *pfeifferi.* Only in approximately 10% of the collected specimens the streak is faintly marked. The occasional aberrant ♂♂ of ssp. *pfeifferi* without the white streak can be also clearly distinguished from *eclidius* by their noticeably smaller postdiscal spots, and especially by their much less contrasting submarginal lunules.

Genitalia: The ♂ genitalia of *eclidius* ssp. n. (Fig. 34), studied in two specimens, seem virtually identical to those of the nominotypical *P. pfeifferi,* studied in five specimens. This means that the dorsolateral processes of their valvae are more slender and pointed than the more blunt ones of the three studied ♂♂ of ssp. *astyages,* and the five studied ♂♂ belonging to *P. eckweileri.* Due to the higher number of specimens involved in this comparative study, the above observations are unlikely to stem from a random individual variability or any interference, such as deformations of the valvae during their study.

♀♀: Forewing length: 12,5–14 mm.

Upperside: The overall appearance of ♀ *eclidius* ssp. n. (Fig. 10) resembles the ♀♀ of *P. eckweileri* and of the taxon *astyages.* Its ground colour is medium to dark brown, and its veins are somewhat darker. The basal and anal areas of its hindwings are covered by a profound suffusion of the same colour as the upperside of the corresponding male, which contrasts with the more greenish suffusion of ♀ *P. eckweileri* (Fig. 11).

The black discoidal spots, clearly noticeable on its fore- and hindwings, are nearly always lighter rimmed, just as those of *P. eckweileri* and the taxon *astyages.* However, the well-developed lighter submarginal lunules on its hindwings do not contain bluish scales. This clearly differentiates the ♀♀ of *eclidius* from those of *P. eckweileri.* As in all other ♀♀ of *P. pfeifferi,* the fringes of *eclidius* are basally light brown and distally white on the forewings (Fig. 48), and nearly all white on the hindwings. This feature also clearly differentiates the ♀♀ of *eclidius* from ♀♀ of *P. eckweileri,* in which the distal parts of the upperside fringes are light brown.

Underside: The ground colour of *eclidius* ssp. n. (Fig. 10) is light to medium grayish brown. The hindwings are distinctly darker and browner than the forewings. The greenish basal suffusion on the hindwings is contrasting. The marking pattern of ♀ *eclidius* and its differentiation from related taxa are the same as those of the corresponding ♂♂. Its fringes are very light brown on the forewings, and nearly white on the hindwings.

Ecology and distribution

Because of severe time pressure and unfavourable weather conditions, only limited observations were possible regarding the true preferred biotope and behaviour of the studied population.

Most of the observed specimens were found at sunset on the stalks of tall grasses and thistles near the bottom of a valley, located just below a steep limestone slope. On this slope, partly covered by an *Astragalus* steppe with abundant growths of an *Onobrychis* sp., several specimens were observed during the day. Here I also recorded the following accompanying species: *Pseudochazara mamurra schahrudensis* (Staudinger, 1881) and *P. pelopea persica* (Staudinger, 1878), *Hyponephele shirazica* Carbonell, 1997, *H. davendra latistigma* (Moore, 1893), and *H. cadusia brandti* (Gross & Ebert, 1975), *Melitaea persea persea* (Kollar, 1850) and *M. trivia robertsi* (Butler, 1880), *Polyommatus (Agrodiaetus) cyaneus damalis* (Riley, 1921), *P. (P.) icarus persica* (Bienert, 1870), *Satyrium sassanides* (Kollar, 1949), *Celastrina argiolus hypoleuca* (Kollar, 1850), *Pontia callidice chrysidice* (Herrich-Schäffer, 1843), *Pieris (Artogeia) ergane ergane* (Geyer, 1828), and *P. (A.) krueperi* (Staudinger, 1860) ssp.

It is worthwhile to mention that this locality is one of only two places where I did not observe *P. stempfferi* together with *P. pfeifferi.* However, this may be due to the unfavourable weather conditions, rather than to its true absence in the locality.

Discussion

The assignment of this taxon as a subspecies to *P. pfeifferi* was based primarily on the forewing fringe colouration of its ♀♀ and the upperside ground colour of the ♂♂.

Both of these have been confirmed by the above analysis as very constant and characteristic external features which differentiate *P. pfeifferi* from *P. eckweileri* more reliably than any other external character, including the underside white streak.

A new species from the Kuh-e-Haft Cheshmeh massif

In a quest to explore additional new areas further south from the Zarde Kuh range, we made a hiking trip through the Kuh-e-Haft Cheshmeh massif, located near the border of the Khuzestan and Cahar Mahall-o-Bahtiyari provinces. This mountain represents the highest part of the southern flank of the central Zagros Mountains, and the highest massif between the Zarde Kuh range further northwest and the Dena (Kuh-e-Dinar) range further southeast.

During this trip we climbed the highest peak of this massif. Here we found a dispersed, low-density population of the subgenus *Agrodiaetus* which was so unique that I decided to describe it as a new species:

Polyommatus (Agrodiaetus) ***achaemenes*** **sp. n.**

Holotype: ♂ (Fig. 25), Iran, Cahar Mahall-o-Bakhtiyari, Kuh-e-Haft Cheshmeh massif, 3800–4000 m, 19.–22. vii. 2001, leg. Skala, coll. SMFL, Frankfurt am Main, SMFL no. 4212.

Paratypes (in total 34 ♂♂, 9 ♀♀): 4 ♂♂, 1 ♀, same data as holotype, leg. et coll. Skala; 4 ♂♂, 1 ♀, same data as holotype, leg. Nykl, coll. Eckweiler; 26 ♂♂, 7 ♀♀, Iran, Bakhtiari Gardaneh ye Cheri, 2800–3000 m, 21. vii. 2002, leg. et coll. Eckweiler # 849, 1 ♂ of this series in coll. Skala, 1 ♂ in coll. ten Hagen.

Etymology: This spectacular new lycaenid receives its name after Achaemenes, the predecessor of the Achamenians, the first ruling dynasty of ancient Persia. The name is a noun in apposition.

Description, diagnosis and variability

♂♂: Forewing length 14–17 mm (holotype 14,5 mm).

Upperside: The external appearance of *P. achaemenes* sp. n. (Figs 13, 17, 25) resembles that of *P. iphigenia* (Herrich-Schäffer, 1847) both by its plume-blue ground colour and by its upperside marking. Its characteristic ground colour varies within the range illustrated by the two depicted paratypes (Figs. 13, 17). However, this colour is generally so much darker and more deeply blue than that of *P. shahrami* that both ♂♂ can be instantly separated on its account regardless of any individual variability. Additionally, the inconspicuous bluish grey androconia of *P. achaemenes* differ markedly from the contrasting brownish grey ones of *P. shahrami*.

A contrasting dark grey or black suffusion appears on the submarginal parts of the veins and in the antemarginal areas, especially on the forewings of *P. achaemenes*. The more widespread suffusion of *P. shahrami* usually covers the whole submarginal area. The black antemarginal spots, occasionally quite prominent on the hindwings of *P. achaemenes,* are virtually identical to those of *P. shahrami*. A well-developed black marginal line runs along its fore- and hindwings. Its fringes are basally light grey and distally white on the forewings, and basally and distally white on the hindwings.

Underside: The brownish grey ground colour of *P. achaemenes* (Figs. 13, 17, 25), its bluish green basal suffusion on the hindwings, the basal black spots on its forewings, the discoidal and postdiscal black marking on its fore- and hindwings, the submarginal polyommatine pattern and the contrasting white streak on its hindwings are developed in the same way as those of its apparent relatives *P. shahrami* and *P. faramarzii*. The fringes are white both basally and distally, but there is usually a light grey line separating the basal and distal parts of the fringes. Since *P. achaemenes* is so easily separated from its closest relative *P. shahrami* by its upperside ground colour, the two taxa do not need any subtle underside differentiation. *P. iphigenides,* more similar on the upperside, can be easily separated from *P. achaemenes* by the orange spots in the submarginal lunules on its underside. These are always absent in *P. achaemenes* and its Iranian relatives.

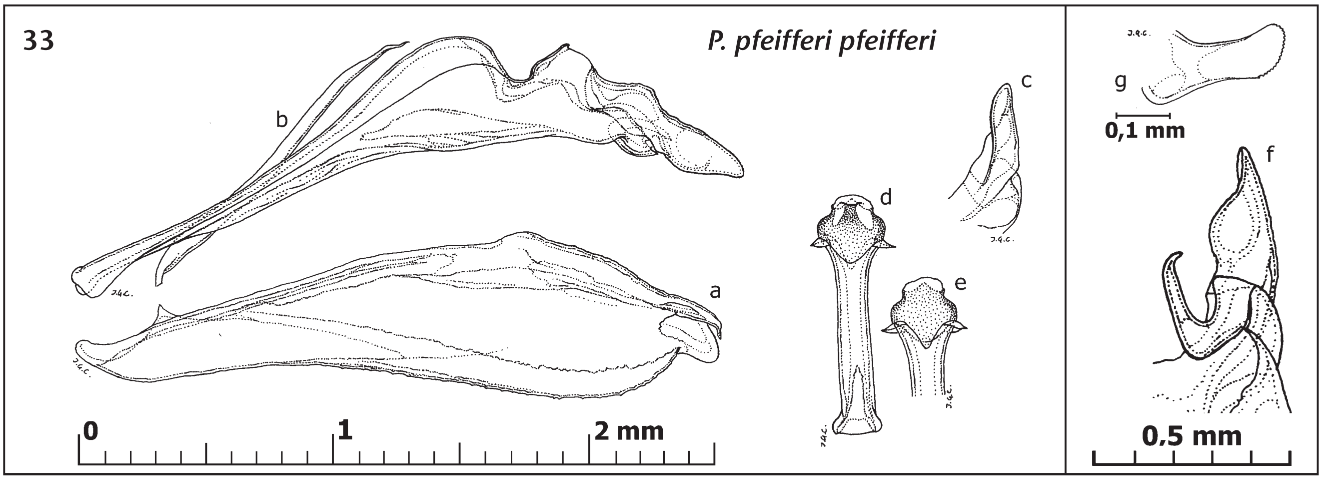
Genitalia: The ♂ genitalia of *P. achaemenes* sp. n. (Fig. 44) are structurally very similar to those of its above mentioned relatives, especially *P. shahrami* and *P. faramarzii*. The labides of *P. achaemenes,* which were studied in two specimens, appear slightly more slender than those of the two studied ♂♂ of *P. shahrami*.

♀♀: Forewing length 13–14 mm.

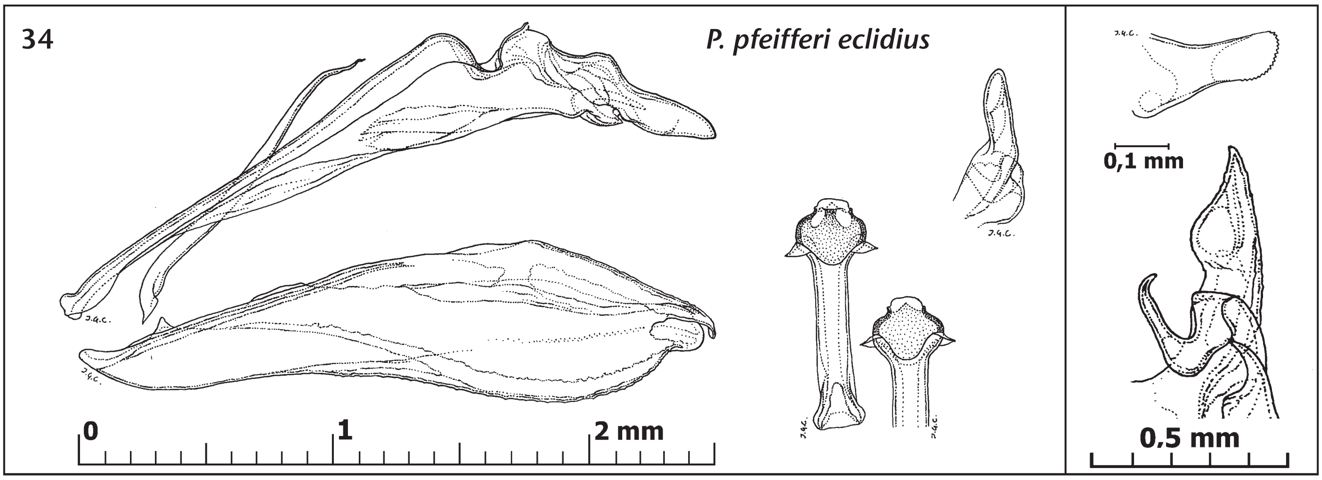
Upperside: The external appearance of the ♀♀ of *P. achaemenes* sp. n. (Fig. 21) strongly resembles that of the ♀♀ of *P. shahrami,* especially the somewhat aberrant specimens of the latter, characterized by the reduced discoidal and submarginal marking. Their ground colour is dark brown.

The discoidal spots on the fore- and hindwings of ♀ *P. achaemenes* are barely visible. They may contain a few bluish scales, especially on the hindwings. The submarginal pattern is barely noticeable and without bluish scales. This separates ♀ *P. achaemenes* from nearly all of the lighter brown ♀♀ of *P. shahrami,* which usually display very contrasting discoidal spots and distinctive light submarginal lunules. However, darker ♀♀ of *P. shahrami* with reduced upperside marking may also occur, as illustrated in Fig. 29.

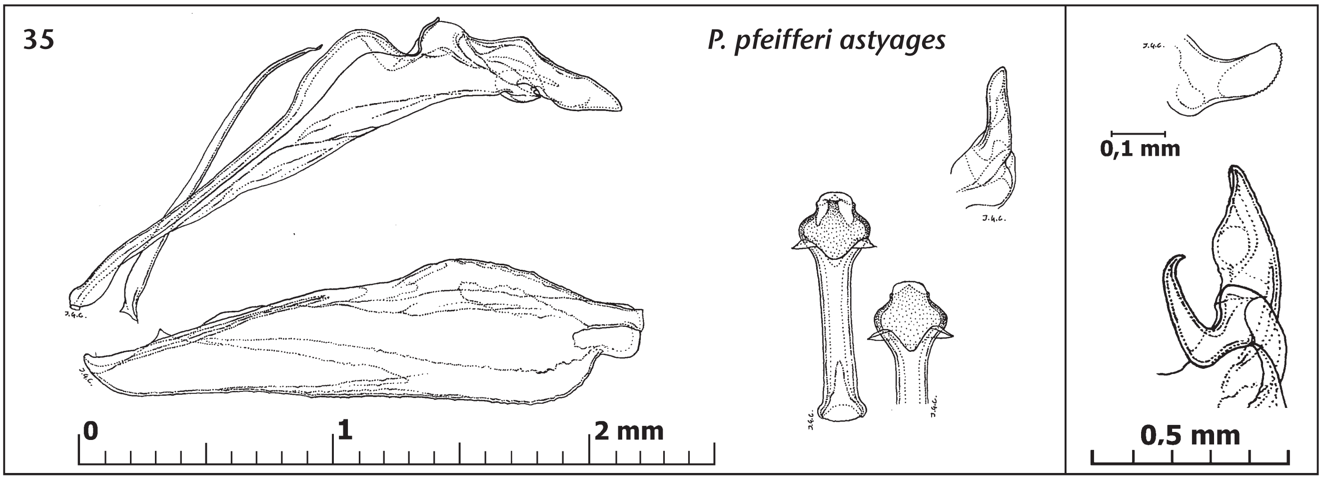
In such cases, ♀♀ of the two species can be recognized by the colour of the few bluish scales found around their discoidal spots and in the upperside basal area of their hindwings. In ♀♀ of *P. achaemenes* sp. n. the colour of these scales is the same as the upperside colour of its ♂ counterpart. Although sometimes barely visible by the naked eye, this feature becomes apparent under slight magnification. The same character separates ♀♀ of *P. achaemenes* also from the similar ♀♀ of *P. faramarzii, P. shirkuhensis* and *P. pfeifferi,* whose suffusion reflects the markedly different colours of their ♂♂, and from ♀♀ of



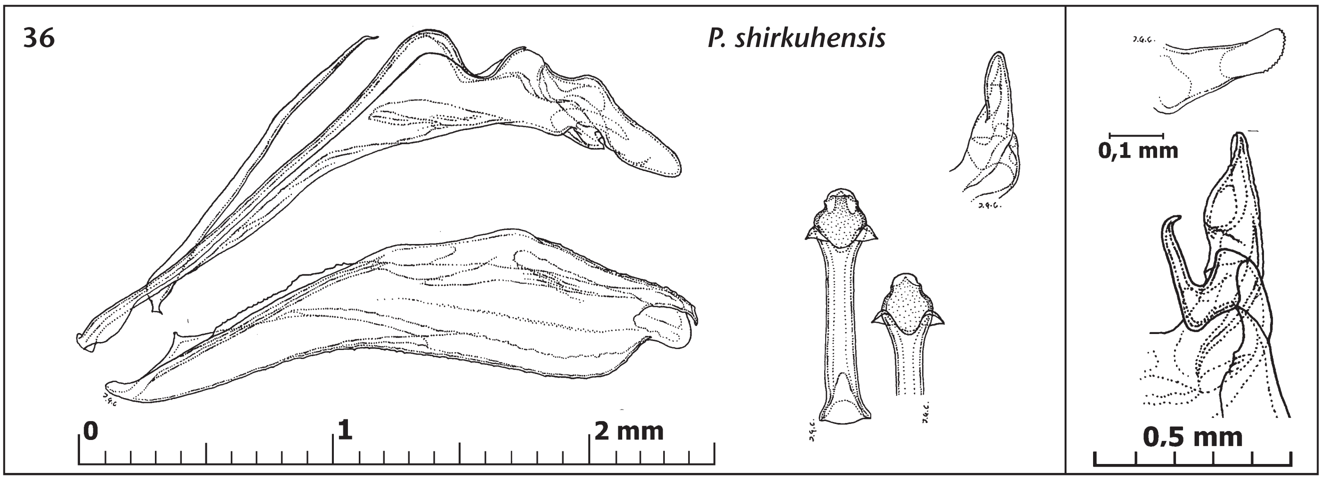
33 *P. pfeifferi pfeifferi*



34 *P. pfeifferi eclidius*

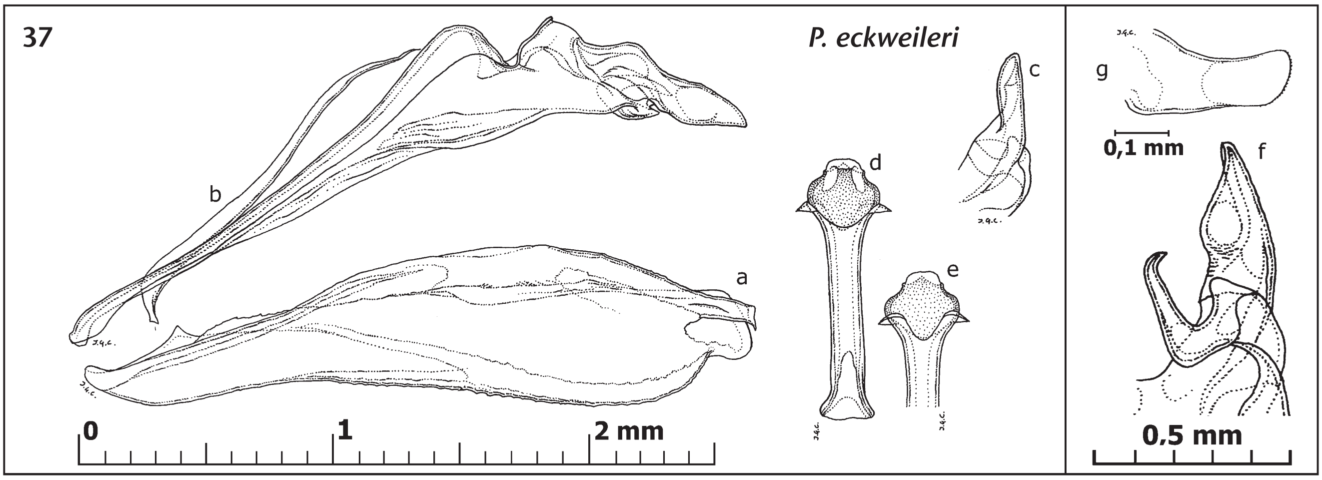


35 *P. pfeifferi astyages*

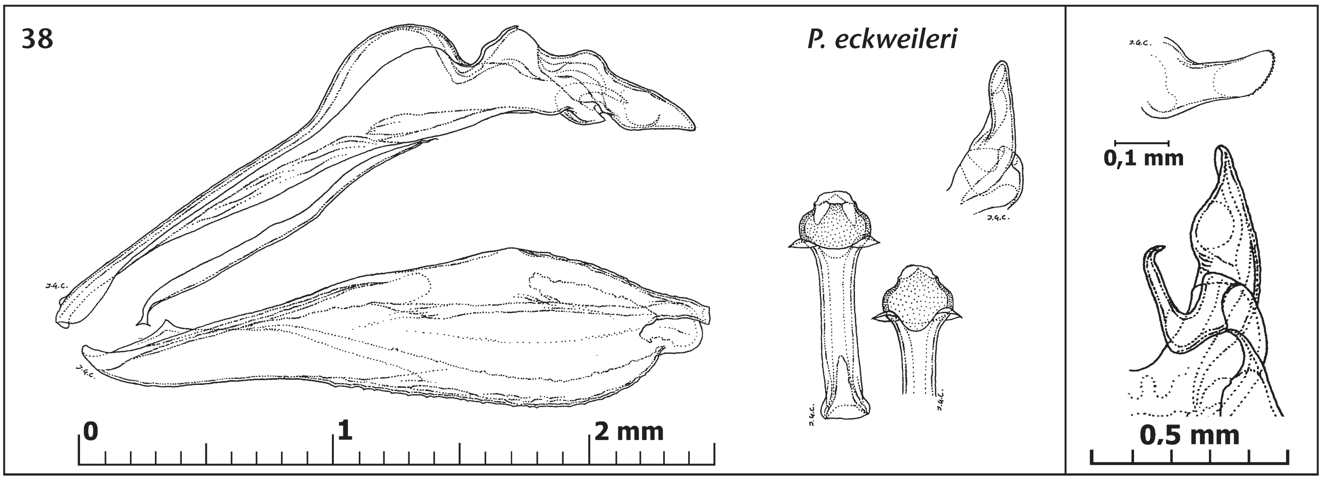


36 *P. shirkuhensis*

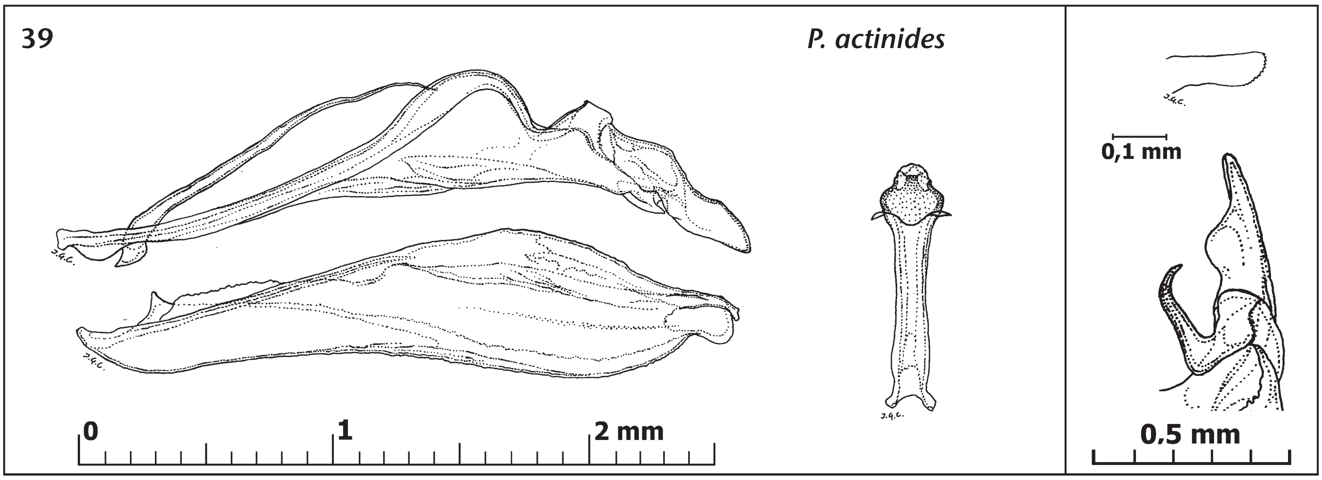
37 *P. eckweileri*



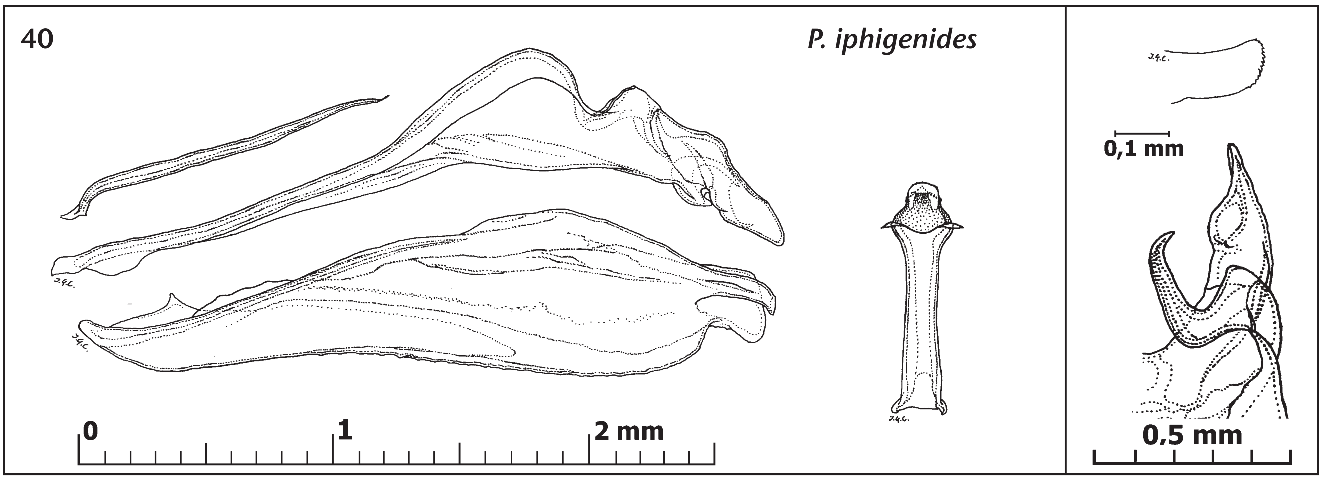
38 *P. eckweileri*

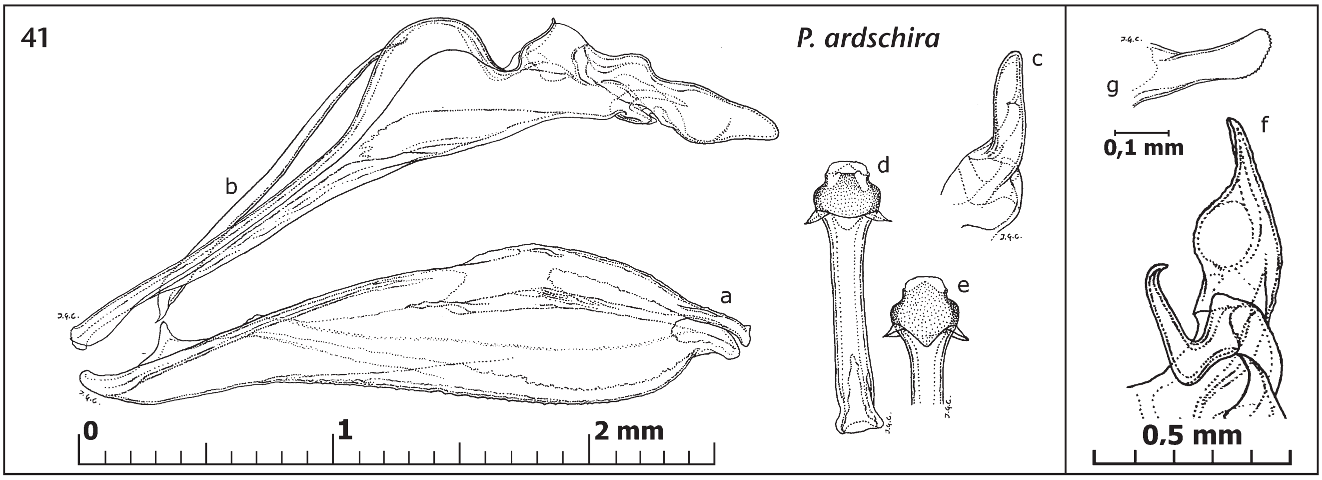


39 *P. actinides*



40 *P. iphigenides*

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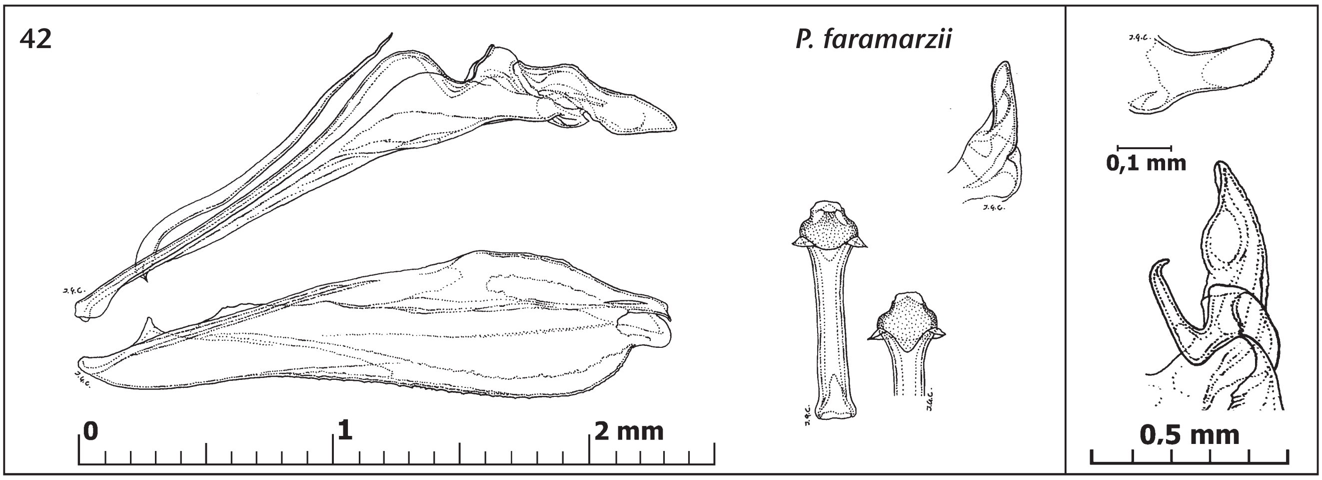
P. ardschira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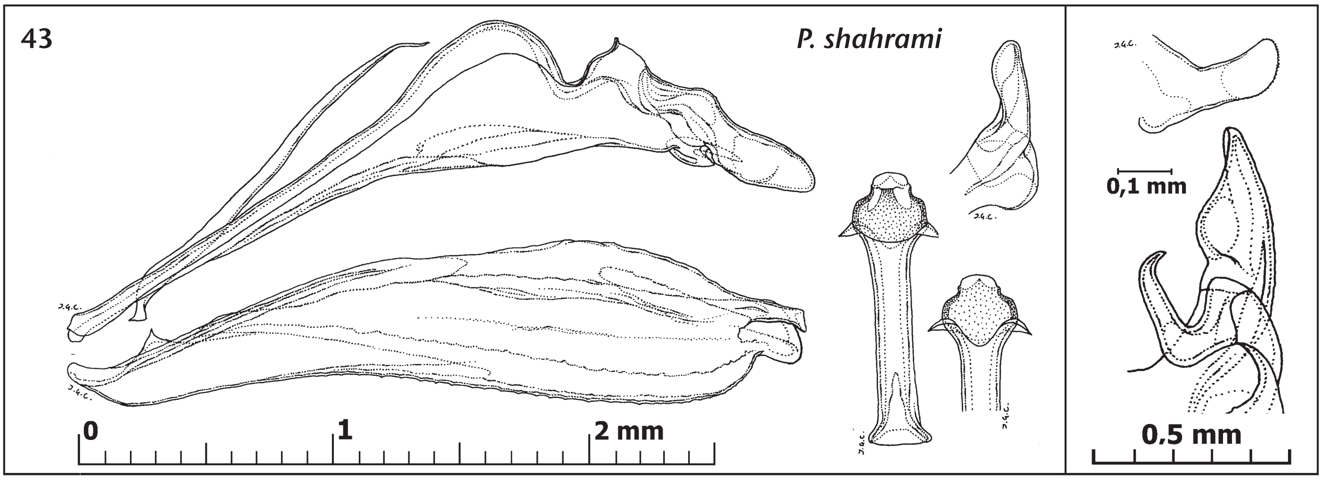
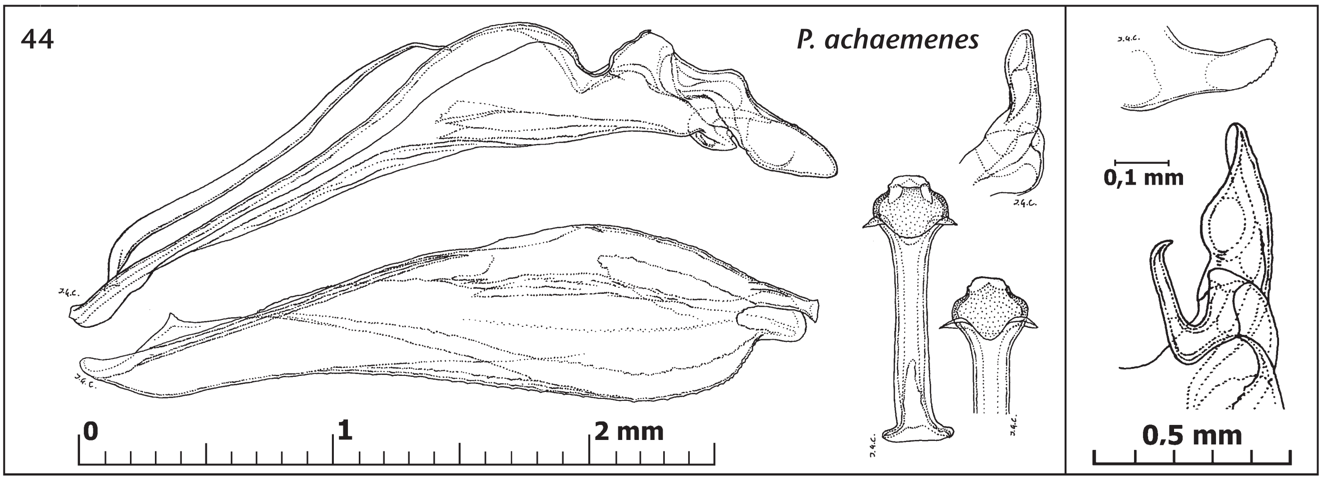
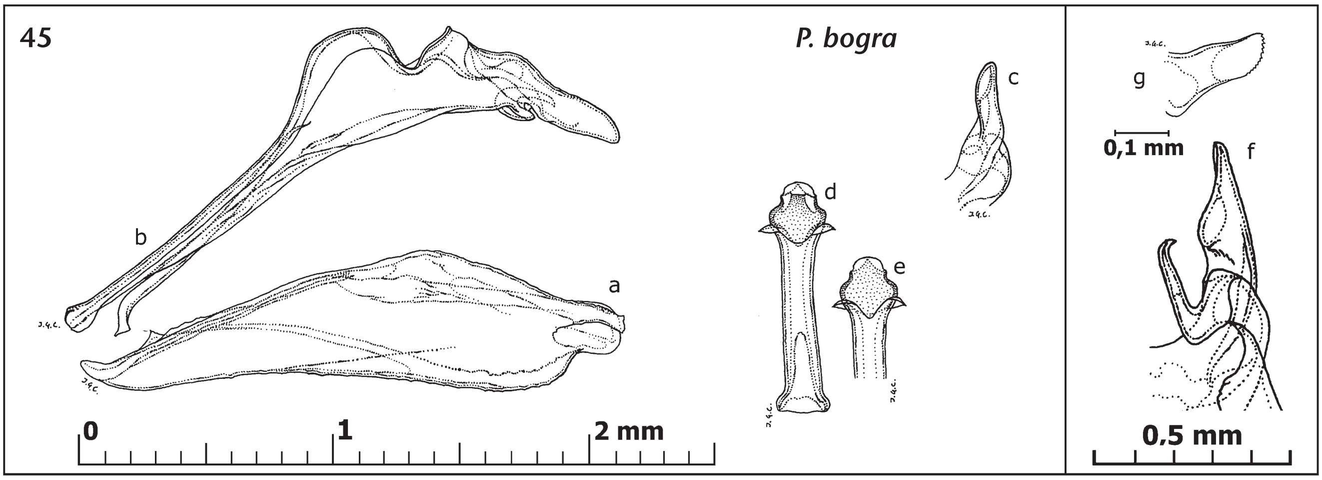
P. faramarzii

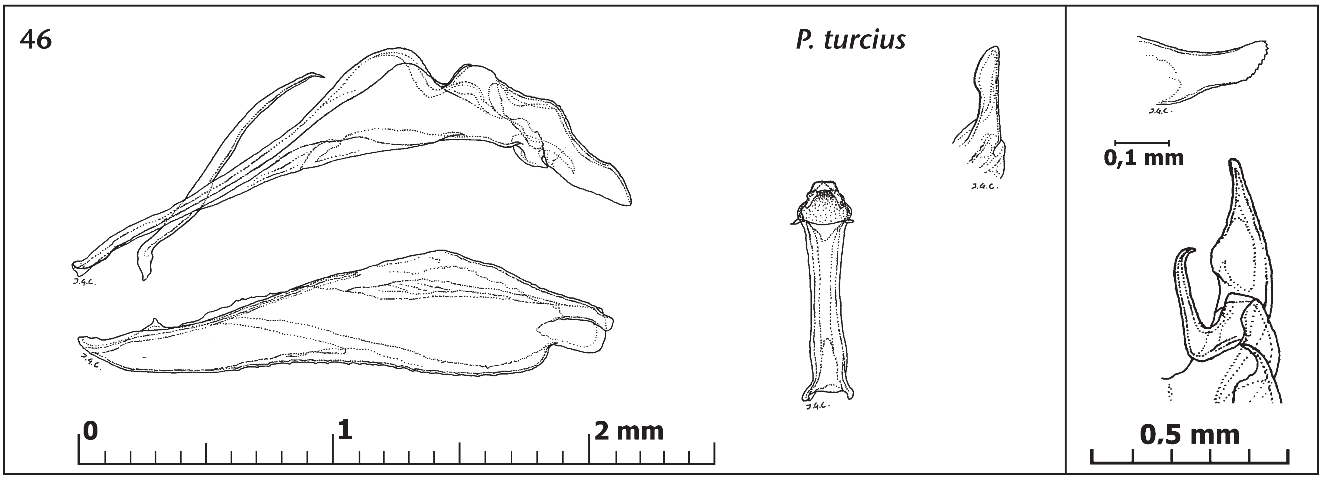

43

P. shahrami


44

P. achaemenes





P. ardschira (Brandt, 1938) which lack the basal bluish suffusion altogether.

If doubt persists, the fringes of the forewing upperside enable a very reliable diagnosis: these are basally and distally light brown in ♀♀ of *P. achaemenes* sp. n. (Fig. 53), distally nearly snow white in the ♀♀ of *P. pfeifferi* (Figs. 47, 48) and *P. faramarzii* (Fig. 51), and basally light greyish brown, and distally white in ♀♀ of *P. shahrami* (Fig. 52). Additionally, the narrow and very dense white basal fringes, which characterise the hindwings of ♀♀ of *P. shahrami*, also occur in ♀♀ of *P. achaemenes* sp. n.

Underside: The ground colour of ♀♀ of *P. achaemenes* sp. n. (Fig. 21) is light greyish brown on the forewings and somewhat darker and more brown on the hindwings. Its basal suffusion is green, and its marking pattern is similar to that of the corresponding ♂♂. Its fringes are basally white and distally very light greyish brown.

It can be easily separated from the ♀♀ of all members of the *iphigenides*-group in the same way as the ♂♂.

Ecology and distribution

P. achaemenes sp. n. seems to be a genuine and very local inhabitant of the montane zone directly adjoining to the area covered only by stones and/or permanent snow. We found it only near the crests of the highest ridges of the Kuh-e-Haft Cheshmeh massif at a fairly narrow range of altitudes between 3800 and 4000 m. Here it prefers the flat stony mountain tops covered by a very specific type of *Astragalus* steppe growing on a highly porous limestone (Fig. 49). Thus, its habitat sems to be markedly different from that of *P. sharami*. Its only three accompanying species on the Kuh-e-Haft Cheshmeh are *Melitaea trivia robertsi*, *P. pfeifferi* and *P. stempfferi*. After I had submitted the present manuscript, W. Eckweiler (Frankfurt am Main) found a new population of *P. achaemenes* even closer to the Zarde Kuh, which is very similar to the specimens from Kuh-e-Haft Cheshmeh.

Discussion

P. achaemenes sp. n. represents another example of a very local montane *Agrodiaetus* species. It is interesting to note that the other two typical inhabitants of the high montane zone, *P. pfeifferi* and *P. stempfferi*, which also occur at the type locality of *P. achaemenes*, are much more widespread in the south-central Zagros than *P. shahrami*, *P. faramarzii* and *P. achaemenes*. Each of the latter is so far known from only one mountain top.

This is more likely due to their highly specific ecological requirements than to a possible mutual isolation of their biotopes. The small distances between these biotopes present no serious distribution barrier to *P. stempfferi* and *P. pfeifferi*, which are apparently restricted to at least equally high altitudes. For example, the Zarde Kuh range, inhabited by *P. shahrami* and *P. faramarzii*, and the Kuh-e-Haft Cheshmeh massif, inhabited by *P.*

pfeifferi and *P. achaemenes*, are practically joined into one continuous mountain chain via the intermittent Kuh-e-Mili range. Thus, *P. shahrami* and *P. achaemenes* are very close geographical neighbours and should be regarded as two potentially sympatric species with markedly different ecological requirements. Therefore, it is not logical to treat *P. achaemenes* sp. n. as a subspecies of *P. shahrami*, to which it is morphologically quite similar, as indicated by the same appearance of the characteristic fringe pattern of both taxa and their nearly identical ♂ genitalia.

General discussion

The apparent close taxonomic affinities among a group of mostly recently discovered *Agrodiaetus* taxa including *P. pfeifferi*, *eckweileri*, *shirkuhensis*, *baltazardi* (de Lesse, 1962), *shahrami*, *faramarzii*, and *achaemenes* sp. n., all of which are restricted to southern and central Iran, is now becoming clear. All of these share a remarkably similar underside wing pattern consisting of prominent discoidal and postdiscal spots and distinct submarginal lunules without orange dots. The white streak on the underside of their hindwings, whose presence or absence is sometimes not constant even within one population, represents a taxonomically redundant character, although its conspicuous absence in all the Kuhhaye Qouhrud populations deserves further attention.

The male genitalia of all these taxa are very similar to each other. They differ noticeably from those of most other *Agrodiaetus* particularly by their labides, which are more bulged from the side view and less slender from the ventral view. The latter feature also differentiates these taxa from the Central Asian *iphigenides*-group, and indicates that both groups are perhaps not as closely related as their external similarity may have previously suggested. Thus, it seems natural to treat the above taxa as a distinct group within the subgenus *Agrodiaetus*. I propose to refer to it as the *pfeifferi*-group after its first known taxon.

P. ardschira, another species with a similar underside pattern, was described simultaneously with *P. pfeifferi*. However, its genital morphology (Fig. 41) differs considerably from that of the *pfeifferi*-group taxa. Its labides are even more bulged from the side view and extremely slender from the ventral view. Thus, I do not suggest the inclusion of *P. ardschira* in the *pfeifferi*-group.

Additionally, the ♂ genitalia of *P. bogra* (Evans, 1932) (Fig. 45) indicate that although externally similar to *P. baltazardi* (Fig. 4), this species is morphologically much closer to the taxa of the *erschoffi*-group sensu Häuser & Eckweiler (1997). A detailed comparison of the shape of its underside submarginal lunules (Figs. 26, 30) with those of *P. baltazardi* (Fig. 4) and *P. erschoffi* (Lederer, 1869) indicates this affinity quite clearly.

Within the *pfeifferi*-group, all data available so far suggest a clear relationship between the external characters of its members, and their respective distribution ranges:

- All pairs of sympatric taxa share a virtually identical underside pattern, while their upperside appearance differs dramatically (relationship 1). Typical examples of this relationship are *P. pfeifferi* and *achaemenes* sp. n. on the Kuh-e-Haft Cheshmeh, or *P. shahrami* and *faramarzii* on the Zarde Kuh massif.
- All mutually allopatric taxa differ noticeably by the details of their underside pattern and/or ground colour, but their upperside appearance is much more similar. Their upperside colour may be either identical (relationship 2), or just similar (relationship 3).

Typical examples of the former relationship are the two populations of *P. eckweileri*, or the eight known populations of *P. pfeifferi*. Typical examples of the latter relationship are the known populations of *P. eckweileri*, *pfeifferi*, *shirkuhensis*, and *baltazardi* (see Map 1).

Although the aforementioned examples of relationship 1 may seem striking, they probably represent a natural and predictable outcome of the external differentiation of two or more sympatrically occurring close relatives, driven by the necessity to maintain their reproductive isolation aided by upperside male wing colours. These colours were shown to play an important role in the proper mate recognition by the opposite sex (Silberglied 1984, Smith 1984, Vane-Wright 1984, Nijhout 1991, Burghardt et al. 2001 and additional references contained there).

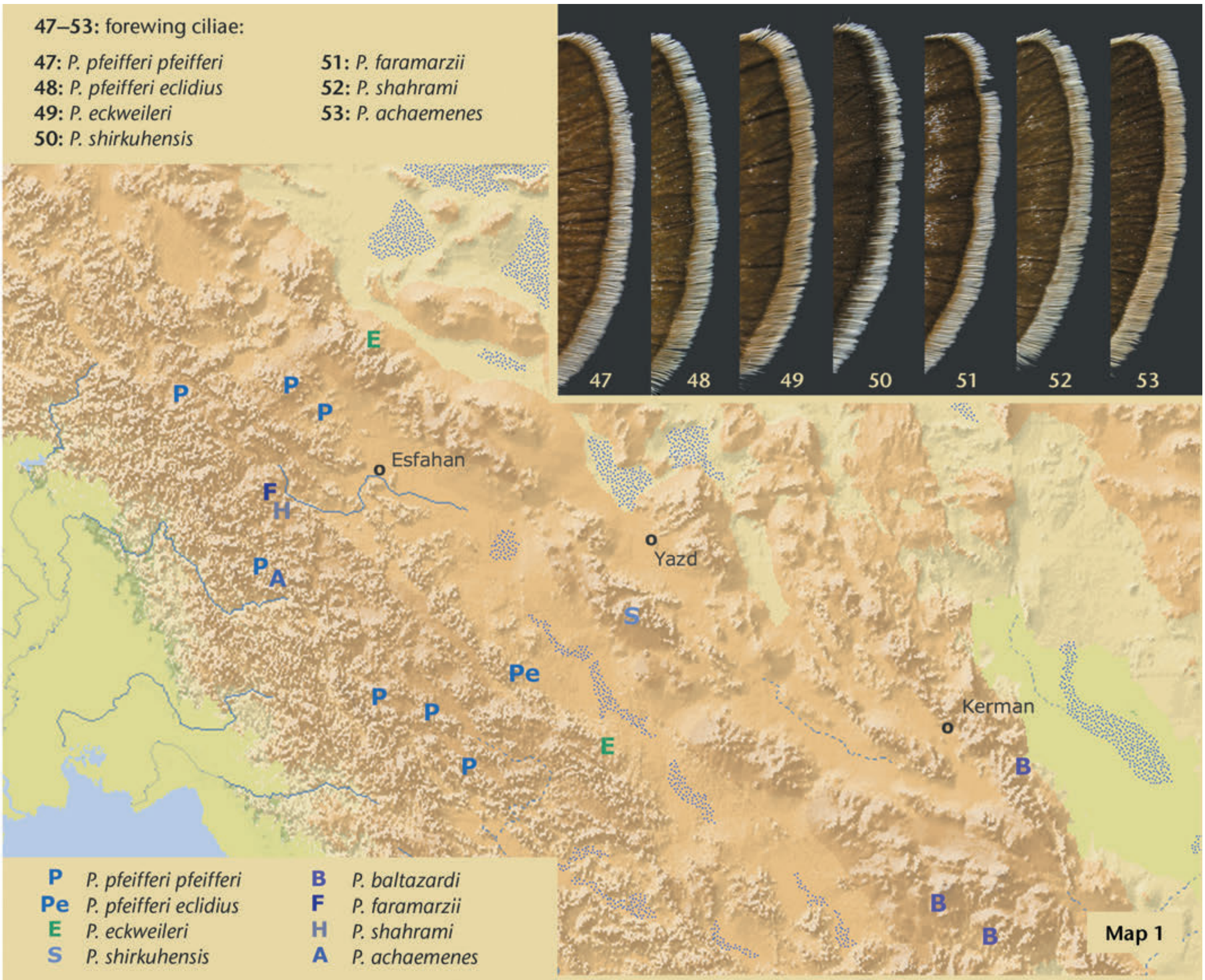
Thus, the degree of external differentiation of a given *Polyommatus* ♂ from its sympatrically occuring relatives is likely to affect the efficiency of its proper mate recognition by conspecific ♀♀. The fact that it is the active ♂ sex that has the conspicuous brilliant blue colours, extending far into the UV spectrum, is itself a clear indication that the profound differences of these colours evolved through sexual selection. Therefore, I presume the driving force for wing colour differentiation of the ♂♂ of related and sympatric *Polyommatus* taxa to be particularly strong, resulting in a rapid and profound differentiation of their conspicuous upperside colours.

Although the inconspicuous underside pattern may be also ocassionally involved in the mate recognition, its main function is camouflage. Hence, drastic changes of the underside pattern of the ♂♂ can only be expected if the colour environment of a given species changes very markedly. It is therefore logical to presume that the underside pattern of the *Polyommatus* populations generally changes much more slowly in the course of their evolution than the upperside appearance of their ♂♂. It is then hardly surprising that the *Polyommatus* taxa of similar underside pattern are nearly always distributed over continuous geographical areas, while the similarities of their upperside colours and appearance occur in a rather haphazard manner over the whole range of the genus.

Colour plate 3, Figs. 47—53 and map see included legends. **Figs. 54–55:** Habitats. **Fig. 54:** Reproductive area of *P. shahrami*, Iran, Bakhtiari, Zarde Kuh massif, 3000–3300 m. **Fig. 55:** Type locality of *P. achaemenes* sp. n., Iran, Bakhtiari, Kuh-e-Haft Cheshmeh, 3800–4000 m.

47–53: forewing ciliae:

47: *P. pfeifferi pfeifferi*
48: *P. pfeifferi eclidius*
49: *P. eckweileri*
50: *P. shirkuhensis*
51: *P. faramarzii*
52: *P. shahrami*
53: *P. achaemenes*



P	*P. pfeifferi pfeifferi*	**B**	*P. baltazardi*
Pe	*P. pfeifferi eclidius*	**F**	*P. faramarzii*
E	*P. eckweileri*	**H**	*P. shahrami*
S	*P. shirkuhensis*	**A**	*P. achaemenes*


54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Under this scenario, the more conservative underside markings provide a much more accurate cue to the phylogenetic affinities of a given *Polyommatus* taxon than the evolutionarily more plastic ♂ upperside colours. The results of the above detailed comparison of the ♂ genitalia of the *pfeifferi*-group taxa with the members of other groups of the subgenus *Agrodiaetus* seem consistent with this statement.

The above hypothesis can be tested by studying the relationships between the underside patterns of various *Agrodiaetus* taxa and the fine details of their genital structures, and/or their relevant DNA data. If the hypothesis is correct, marked similarities of ♂ genitalia and DNA data will be found among *Agrodiaetus* taxa with similar underside markings, regardless of their upperside appearance.

Thus, for example, the taxa *P. dama* (Staudinger, 1882), *karindus* (Riley, 1921), *larseni* (Carbonell, 1994), *lycius* (Carbonell, 1998), *theresiae* (Schurian et. al., 1992) and *hamadanensis* (de Lesse, 1959) would turn out to be closely related not only to each other, but also to *P. antidolus* (Rebel, 1901), *femininoides* (Eckweiler, 1987), or *peilei* (Bethune-Baker, 1921), previously treated as close relatives of *P. dolus* (Hübner, 1823) and *menalcas* (Freyer, 1837) on the basis of their similar ♂ upperside appearance (Häuser & Eckweiler 1997).

If the hypothesis is indeed confirmed by further studies, it may provide a useful tool in finding the mutual phylogenetic affinities among various *Agrodiaetus* taxa.

Acknowledgement

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