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ON TAXONOMIC STATUS OF SHIELD-HEAD VIPERS FROM TURKISH LESSER CAUCASUS AND EAST ANATOLIA

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ABSTRACT

A high morphological specialization is noted for vipers from the isolated populations of the Otlubekli Dağlari Ridge, Zekeriya Village, Ardahan pass, Mt. Ilgar-Dağ (Turkey), Javakheti Plateau (Armenia, Georgia). New forms of shield-head vipers are described from the Turkish Lesser Caucasus and east Turkey: *Pelias sakoi* sp. nov. (Otlubekli Dağlari Ridge), *Pelias darevskii uzumorum* ssp. nov. (Southern limestone part of the Yalnizçam Dağlari Ridge), *Pelias darevskii kumlutasi* ssp. nov. (Northern volcanic part of the Yalnizçam Dağlari Ridge). Keys to identification of species and subspecies of the *Pelias darevskii-olguni* complex are given, and ecological differences of its representatives are discussed. The cluster and discriminant analyses on morphological features allow us to consider these vipers as separate taxa, whereas the molecular analysis on *cytb* does not give significant differences for most populations. This result should not be perceived unambiguously in favor of conspecificity of the considered populations. In addition to the morphological differences of the vipers, we consider such ecological differences as biotope preference, age and size of the puberty, the history of landscapes and habitats, mezoclimatic habitat characteristics, etc. Given the southern location of the Otlubekli Dağlari Ridge and no signs of glaciation there, the vipers from the vicinity of Erzincan should be regarded as an ancient relic isolated form. The climate of this area has contributed to the conservation of ancient Eastern Mediterranean relics both among plants and animals.

Key words: new species – *Pelias sakoi,* new subspecies – *Pelias darevskii kumlutasi*, *Pelias darevskii uzumorum*, *Pelias*, Turkey, vipers

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О ТАКСОНОМИЧЕСКОЙ ПРИНАДЛЕЖНОСТИ ЩИТКОГОЛОВЫХ ГАДЮК ТУРЕЦКОГО МАЛОГО КАВКАЗА И ВОСТОЧНОЙ АНАТОЛИИ

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РЕЗЮМЕ

Отмечается высокая морфологическая специализация у гадюк из изолированных популяций с хр. Отлубекли, окр. дер. Зекерия, Ардаганского перевала, горы Илгар-Даг в Турции и с Джавахетского нагорья в Армении и Грузии. В статье описываются новые формы щиткоголовых гадюк из Турецкого Малого Кавказа и Восточной Турции: *Pelias sakoi* sp. nov. (хр. Отлубекли), *Pelias darevskii uzumorum* ssp. nov. (южная известняковая часть Арсианского хр.), *Pelias darevskii kumlutasi* ssp. nov. (северная вулканическая часть Арсианского хр.). Даны определительные ключи для видов и подвидов комплекса *Pelias darevskii-olguni*, а также обсуждаются экологические различия представителей этого комплекса. Кластерный и дискриминантный анализы по морфологическим признакам позволяют рассматривать гадюк из указанных изолированных популяций самостоятельными таксонами, тогда как молеклярный анализ по цитохрому *b* не показал существенных различий для большинства популяций. Подобный результат не должен рассматриваться однозначно в пользу конспецифичности животных из изученных популяций. В дополнение к морфологическим различиям гадюк учитывались такие экологические различия, как биотопическая приуроченность, возраст и размеры наступления половозрелости, история становления ландшафтов и формирования биотопов, мезоклимат биотопов и т.д. Учитывая южное положение хр. Отлубекли и отсутствие на нём следов оледенения, гадюки из окр. Эрзинджана должны рассматриваться, как древняя реликтовая изолированная форма. Климат этого района способствует сохранению древних Восточно-Средиземноморских реликтов, как среди растений, так и среди животных.

Ключевые слова: новые вид – *Pelias sakoi*, новые подвиды – *Pelias darevskii kumlutasi*, *Pelias darevskii uzumorum*, *Pelias*, Турция, гадюки

INTRODUCTION

Interest to shield-head vipers of Eastern and northeastern Turkey never wavered, but particularly intensified in recent years. The findings contributed to *Pelias darevskii* (Vedmederja et al., 1986) at a considerable distance from the type locality, in Turkey (Geniez and Teynie 2005; Tuniyev et al. 2009; Avcı et al. 2010; Göçmen et al. 2014; Tuniev et al.2014; Mebert et al. 2015), Georgia (Tuniyev S. et al. 2014), and new finds in Armenia (Aghasyan 2008), a description of a new species *P. olguni* Tuniyev S. et al., 2012, closely related to *P. darevskii*, became the base for the assumption of a taxonomic autonomy of vipers from Artvin in vicinity of Zekeriya Village (Tuniyev S. et al. 2012), which occur in different ecological conditions in comparison with those in the type locality of *P. olguni* and *P. darevskii* biotopes. We have expanded the geography of research in Eastern Anatolia and analyzed the geographic variability of "*P. darevskii* – *P. olguni*" complex from Turkey (including collection of P. Geniez and A. Teynié), Georgia and Armenia (Fig. 1).

MATERIALS AND METHODS

The material was collected in 2011–2012 in Eastern Turkey. *Pelias* cf. *darevskii* found in vicinity of Çilhoroz Village/Erzincan; in vicinity of Zekeriya Village/Artvin and above the old fortress at Bağdaşan Village/Ardahan. In addition, we examined collection of P. Geniez (Collection BEV) and A. Teynié (2005) from vicinity of Zekeriya Village, collection of *Pelias* cf. *darevskii* from Ardahan pass (collectors Y. Kumlutaş, K. Olgun, Ç. Ilgaz, F. Iret, A. Avcı), vicinity of Çilhoroz Village (C.V. Tok) and *Pelias eriwanensis* (Reuss, 1933) from different regions of Armenia (Appendix: Table 1).

A total 97 specimens of vipers from the Caucasian Ecoregion and Eastern Anatolia related to "*kaznakovi*" and "*ursinii*" complexes were examined. Pregnant females were kept in standard terrarium to birth of juveniles, which allowed getting additional materials on pholidosis and biology of reproduction. In statistical and canonical analyses, information was used for 46 adults and 51 subadult specimens from Turkey and Armenia.

The materials are kept in herpetological collection of the Sochi National Park, Russia (SNP); Adnan Menderes University Aydın, Turkey and Dokuz Eylül University, İzmir, Turkey (ZDEU); Scientific Center of Zoology and Hydroecology of National Academy of Sciences of Republic Armenia, Yerevan, Armenia (ZIRA); in the Muséum National d'Histoire Naturelle of Paris, in the "Alcide d'Orbigny" collection (MNHN), and in the Centre d'Ecologie Fonctionnelle et Evolutive, in Montpellier, France (BEV); Philippe Geniez's iconographical collection (PGe), Montpellier (Appendix: Table 1).

Snakes are united into six geographical samples: 1) *Pelias* sp. (Erzincan, Turkey); 2) *Pelias* cf. *darevskii* (Zekeriya Village, Turkey); 3) *Pelias* cf. *darevskii* (Ardahan pass + Bağdaşan Village, Turkey); 4) *Pelias olguni* (Mt. Ilgar-Dağ, Turkey); 5) *Pelias darevskii* (Mt. Sevsar, Armenia + Mt. Madatapa and Mt. Gumbati, Georgia); 6) *Pelias eriwanensis* (six different localities, Armenia).

The methods of traditional morphological analysis were used based on characters offered by Nilson and Andren (2001) with our modifications (Appendix: Table 2). To eliminate influencing of sexual and possible age variation, comparison of adult and young males and females was conducted separately, and then was presented in the generalized samples. Materials were studied using standard methods of variation statistics (Lakin 1990) and one of methods of multivariate statistics — Canonical Discriminate Analysis (CDA) (Tyurin et al. 2003) by the package of STATISTICA 6.0 for Windows. Geographical variability of morphological characters was analyzed using CDA, allowing make a comparison of the preliminary selected groups on the complex of characters (Tyurin et al. 2003).

DNA extraction, amplification and sequencing. 45 specimens sampled at 15 localities (Fig. 1) were analyzed. Ten sequences were taken from GenBank (*P. dinniki* KC 176731; *P. berus* JN 204721, KC 176730, FR 727104; *P. kaznakovi* KC 176736; *P. ebneri* KC 176745, FR 727093, FR 727094, FR 727095, FR 727096). Genomic DNA was isolated from tissues fixed with 96% ethanol using standard salt extraction protocol using a lysis buffer and proteinase K, deproteinized with NaCl and precipitated with 96% ethanol (Miller et al. 1988). A segment (1154 bp) of the cytochrome b (*cytb*) gene was amplified using primers Cytb_F1 and Cytb_RC, additional internal primer Cytb_F8 was used for sequencing (Stumpel 2012).

PCR conditions were as published in Zinenko et al. (2015). Each PCR included a negative control. The PCR products were purified on columns of an Omnix kit (Omnix, Saint Petersburg, Russia) and were sequenced in both directions using the BigDye Terminator Cycle Sequencing Ready Reaction Kit on an ABI PRISM 3130 (Applied Biosystems Inc., Foster City, CA, USA). Sequences were edited and assembled using program Sequencher 4.6 (Gene Codes Corporation, Ann Arbor, MI, USA http://www.genecodes.com) and aligned with CLUSTALW algorithm (Thompson et al. 1994) implemented in BioEdit (Hall 1999).

Phylogenetic analyses. Tree reconstructions were performed using 45 specimens and three specimens as outgroup (*Bitis arietans* JX114025, *Montivipera xanthina* KJ415303 and *Causus defilippi* AY223556). The final alignment comprised the 910 bp *cytb* fragment. To choose the best model of molecular evolution (GTR+G), we used Akaike's information criterion (AIC) in JMODELTEST 2.1.1 (Darriba et al. 2012). Phylogenies were reconstructed using Bayesian inference (BI) and maximum likelihood (ML) approaches. BI for *cytb* data performed in MRBAYES 3.2.2 (Ronquist and Huelsenbeck 2003). Each BI analysis started with random trees and performed two independent runs with four Markov chains Monte Carlo (MCMC) for 10 million generations with sampling every 1000th generation. Consensus trees constructed based on the trees sampled after the 25% burn-in. ML analysis calculated with TREEFINDER (Jobb 2011). Bootstrap analysis employed 1000 replicates. Final trees obtained in FIGTREE v1.4.0 (http://tree.bio.ed.ac.uk/software/figtree/).

RESULTS OF THE ANALYSES

1. Morphological characters

Morphological characteristics of vipers from the discussed populations are presented in Appendix: Tables 3–6. Basing on the results of the comparison of meristic characters between samples we found the following differences (see Appendix: Tables 7–8).

Comparison of meristic characteristics of males of all age groups showed diminishing of the number of scales around a neck (Sq.1) from *Pelias olguni* (22.2) to vipers from Zekeriya (21.6), Ardahan pass (20.5), Erzincan and *P. eriwanensis* (20.3), and to *P. darevskii* (19.9); diminishing of the number of scales around midbody (Sq.2) from vipers of Ardahan pass and *P. olguni* (21) to *P. eriwanensis* (20.7) and *P. darevskii* (19.9) with minimum at males of Erzincan (19). Number of preventral shields (Pr.) in males of Zekeriya (1.8), Ardahan pass (1.5), *P. olguni* (1.4), *P. eriwanensis* (1.7), Erzincan (2.3) much is lower than those in *P. darevskii* (3.2). Number of ventral shields (Ven.) in males of Erzincan (136.3) and Ardahan pass (134.5) is higher than in *P. olguni* (130.4).

The minimal number of crown shields of head (C.s.) is registered in males of Erzincan (5.25), and then increases in *P. eriwanensis* (6.9), *P. darevskii* (7.4), vipers from Zekeriya (8.4) and maximal in *P. olguni* (10.8). Number of apical shields (Ap.) in males from Erzincan (1), *P. eriwanensis* (1.2), *P. olguni* (1.4) is lower than in *P. darevskii* (1.6) and vipers from Zekeriya (2). The canthals (Can.) in males from Erzincan (5), *P. olguni* (5.4), vipers from Ardahan pass (5) and in *P. eriwanensis* (5.2) are lower than in *P. darevskii* (5.6) and vipers of Zekeriya (6).

The number of supralabial shields (Supralab.) in males from Erzincan (10.75) and Ardahan pass is (10) higher than in males from Zekeriya (8.8), *P. olguni* (9.8), *P. darevskii* (9.1) and *P. eriwanensis* (8.95). The number of sublabial shields (Sublab.) in males from Erzincan (8.75) and *P. olguni* (8.6) is lower than at *P. darevskii* (9.6). Number of loreal shields (Lor.) in males from Erzincan (2.5), Ardahan pass (2.75), *P. olguni* (2.9), *P. darevskii* (2.6) is lower than those in *P. eriwanensis* and males from Zekeriya (4.6).

The maximal number of wings of zigzag (ZZ.) observed in males from Ardahan pass (92.8) is gradually decreased in *P. darevskii* (88.7), vipers from Zekeriya (85.2), Erzincan (77), *P. eriwanensis* (73.45) and *P. olguni* (73.1).

As a result of the analysis of characters of males, we can summarize that for vipers from Erzincan the minimal number of scales around midbody, loreals, apicals and crown shields of head as well as comparatively high number of preventrals with maximal mean of number of supralabial shields are registered.

Comparison of meristic characteristics of females of all of age groups showed diminishing of the preventral shields (Pr.) from *P. darevskii* (3) to vipers of Zekeriya (2.3), Ardahan pass and Erzincan (2.2), *P. eriwanensis* (2.1), with minimal mean in *P. olguni* (1.4). The number of ventral shields (Ven.) in females from Erzincan (138.3) higher than those in *P. eriwanensis* (136.6) and *P. darevskii* (136.1), and much higher than in females from Ardahan pass (134) and *P. olguni* (133.1).

The number of subcaudal shields (S. c.) in females from Zekeriya (29.5) is higher than those in vipers from Ardahan pass (28.5), *P. olguni* (27.2), *P. eriwanensis* (26.5), *P. darevskii* (26).

The number of scales around a neck (Sq.1) in females from Zekeriya (20.3) is lower than that of *P. olguni* (21.7). The number of scales around midbody (Sq.2) is minimal in females from Zekeriya (19.7), in comparison with the samples as Erzincan (21), Ardahan pass (20.8), *P. olguni* (21.1), *P. darevskii* (20.6) and *P. eriwanensis* (20.8).

The number of apical shields (Ap.) is maximal in females from Zekeriya (1.8), lower in *P. olguni* (1.4), equal in females from Erzican and Ardahan pass and *P. darevskii* (1.3) and minimal at *P. eriwanensis* (1.1). The same pattern of decline of canthals (Can.): in females from Zekeriya (5.9), *P. olguni* (5.4), equal

Fig. 1. Localities of collecting of tissues for DNA analyses: 1. Vicinity of Erzincan, Çilhoroz Village/Turkey. 2. Zekeriya Village/Artvin/Turkey. 3. Ardahan pass and Bağdaşan Village/Turkey. 4. Posof, Mt. Ilgar-Dağ/Turkey. 5. Mt. Gumbati/Georgia. 6. Mt. Madatapa/Georgia. 7. Mt. Sevsar, Vil. Saragjuh/Armenia. 8. Mount Arailer/Armenia. 9. Sevan Lake, Vil. Drakhtik/Armenia. 10. Sisian/Armenia. 11. Vicinity of Vil. Verin Giratakh, Bargushat Ridge/Armenia. 12. Nagorno-Karabakh. 13. Lake Manych-Gudilo/Russia. 14. Settlement Bolshoy Kichmaj/Sochi/Russia. 15. Kamenny Klad Ridge/Abkhazia.

in specimens from Erzican and Ardahan pass with *P. darevskii* (5.3) and minimal in *P. eriwanensis* (5.1).

The number of supralabial shields (Supralab.) maximal in females from Erzincan (10.75), and then is gradually decreased in vipers from Ardahan pass (10.35), *P. olguni* (9.75), Zekeriya (9.4), with minimal means in *P. darevskii* (9.2) and *P. eriwanensis* (9.2). The number of sublabial shields (Sublab.) in females from Erzincan (8.6) is lower, than those of *P. olguni* (8.9), vipers from Ardahan pass (9.1), from Zekeriya (9.2), *P. darevskii* and *P. eriwanensis* (9.6). The shields around the eyes (F.c.) in females from Erzincan (7.65) is lower, than in females from Zekeriya (9.4), *P. olguni* (9.15) and *P. eriwanensis* (9.55). The number of loreal shields (Lor.) is minimal in females from Erzincan (2.9), *P. olguni* (3.5) and *P. darevskii* (3.45), whereas it is maximal in females from Zekeriya (4.75) and *P. eriwanensis* (5.45).

The minimal number of wings of zigzag (ZZ.) observed in females of *P. eriwanensis* (65.35), then ascending in Erzincan (73.15), *P. olguni* (73.4), Zekeriya (75.6), Ardahan pass (80.15), toward maximal mean in *P. darevskii* (84.65).

As a result of the analysis of characters of females, we can summarize that for vipers from Erzincan the maximal values of ventral and supralabial shields was registered, whereas the minimal values of number of loreals, the shields around the eyes, and comparatively low value of number of wings of zigzag is shown.

Vipers from both sexes of Erzincan differ from all other vipers in minimal number of loreal shields and maximal number of supralabial shields.

Due to the heterogeneity and the low number of individual samples, as well as individual population variability, sexual dimorphism in populations studied was shown for each population (Appendix: Tables 9–19):

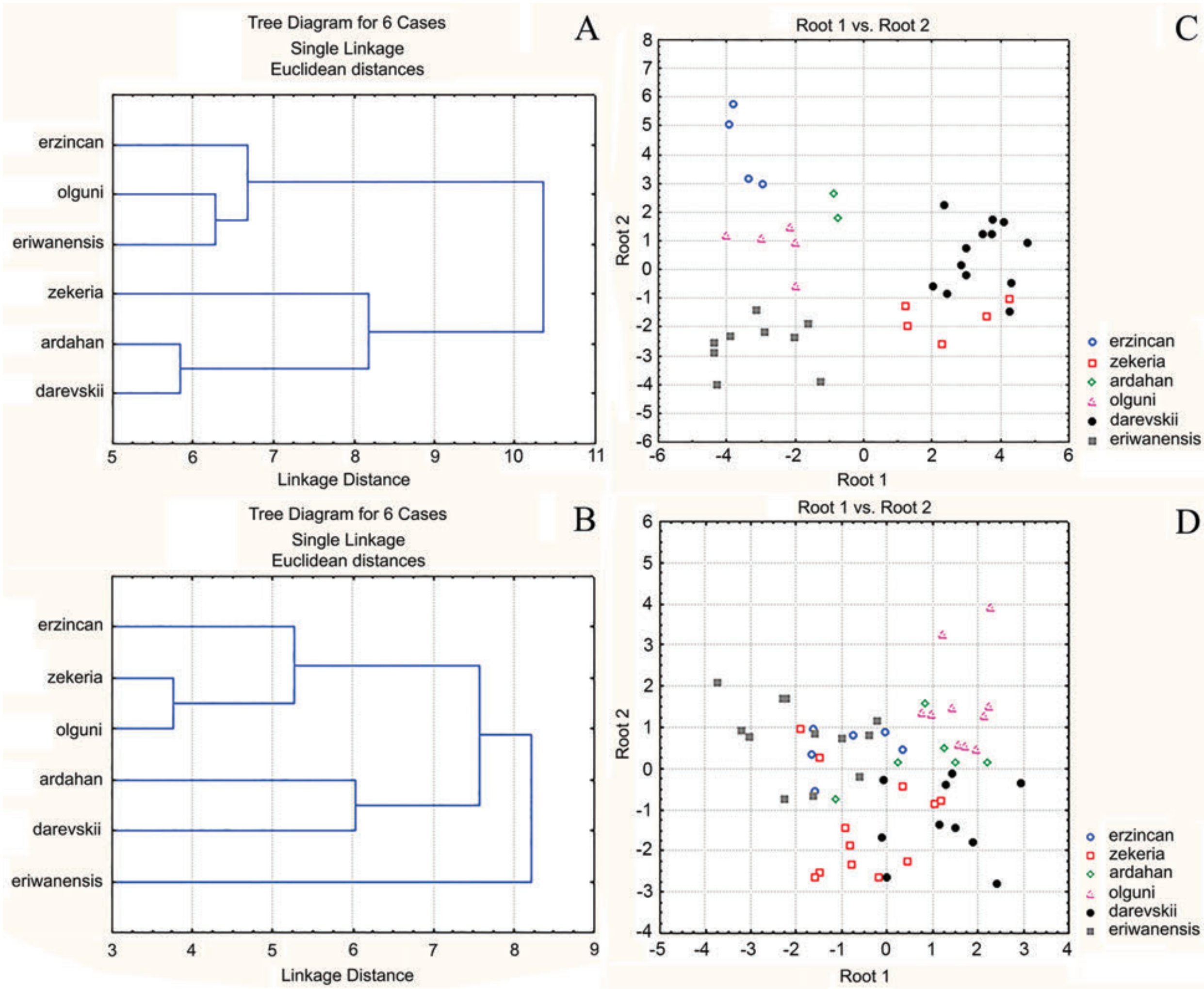

Fig. 2. A, B – Results of cluster analysis (UPGMA method) of five groups of vipers based on pholidosis characters: A – males, B – females; C, D – Two-dimensional scatterplot of samples of vipers in space of CDA function on the complex of morphometric characters: C – males, D – females.

Pelias sp., Erzincan (n=10). The number of subcaudals is higher in males than in females. The number of scales around midbody is higher in females than in males.

Pelias cf. *darevskii*, Zekeriya (n=17). The number of subcaudals and number of wings of zigzag is higher in males than in females. The upper preocular shield is in contact with the nasal shield in 20.8% of females.

Pelias cf. *darevskii*, Ardahan pass (n=5). The number of subcaudals, supralabials and number of wings of zigzag are higher in males than in females.

P. olguni, Posof, Mt. Ilgar-Dağ (n=16). The number of crown shields of the head and subcaudals are higher in males than in females, while the number of ventrals is lower in males than in females, also the size of the head is shorter in males than in females.

P. darevskii, Mt. Sevsar (n=25). The number of subcaudals is higher in males, while the number of ventrals and loreals are higher in females than in males.

P. eriwanensis, Armenia (n=21). The number of subcaudals and wings of zigzag are higher in males, while the number of ventrals is higher in females than in males.

As a result of the cluster analysis we have dendrograms from 14 meristic characteristic of pholidosis

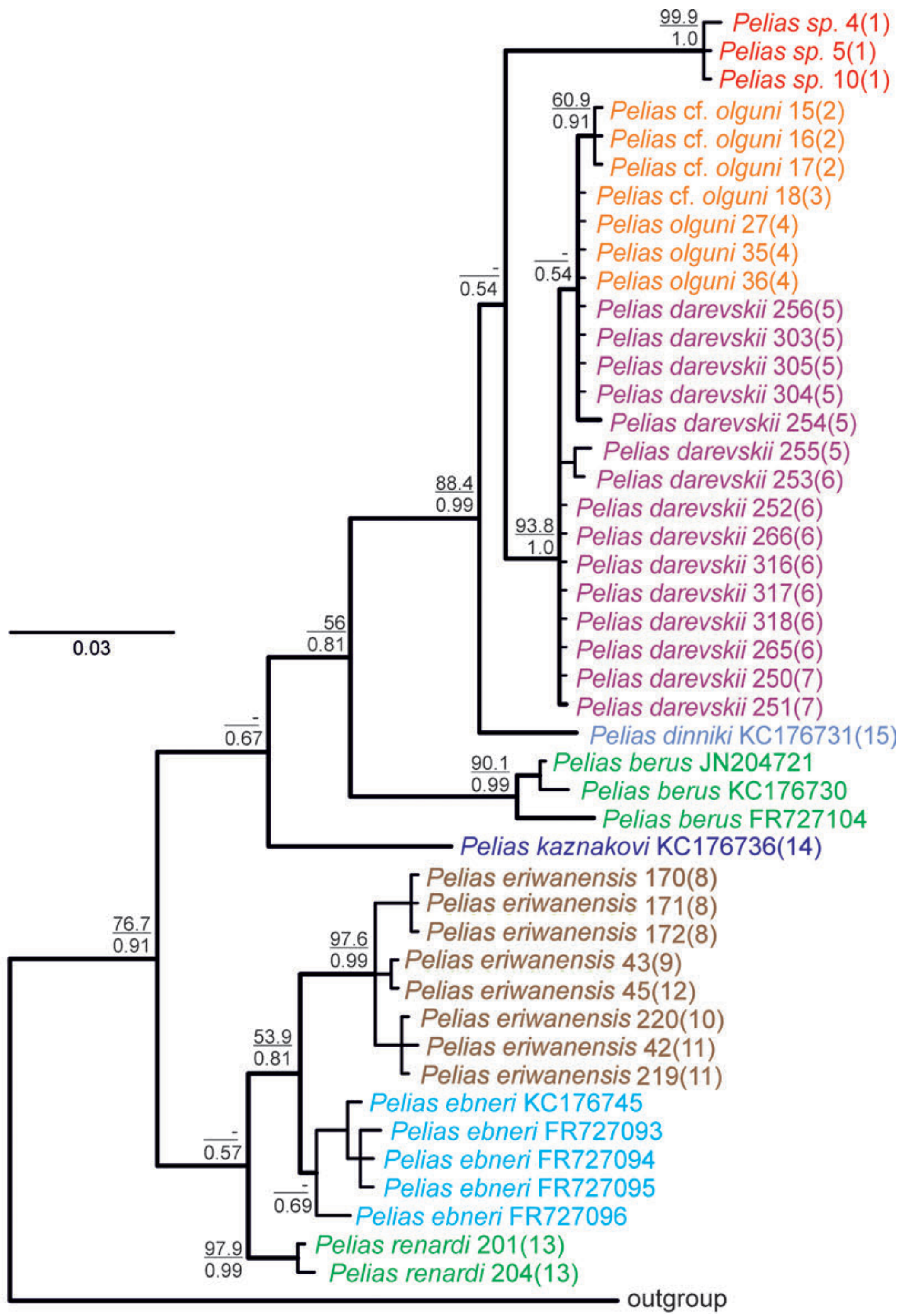

Fig. 3. BI tree for *Pelias* spp. built using *cytb* haplotypes. Bootstrap values are as follows: maximum likelihood bootstrap supports / Bayesian posterior probabilities. See Appendix: Table 1 and Figs. 4, 5 for specimen codes. Taxonomic groups are labeled. Numbers in brackets correspond to different stations in the map in Fig. 1.

Fig. 4. Dorsal coloration of *Pelias sakoi* sp. nov.: left – male (holotype); right – female (paratype: SNP 906).

forming two general clades: the earliest division happened between *P. eriwanensis* and all other forms with the subsequent division into five separate clades (Fig. 2A, B). The minimum distance is marked between clades of vipers from Ardahan pass and *P. darevskii*.

Geographical variability of morphological characters in populations of steppe vipers is considered also with the use of CDA, allowing a comparison of the preliminary selected groups in the complex of characters (Tyurin et al. 2003). For comparison, the *Pelias eriwanensis* was taken as an outgroup.

We use a complex of 14 meristic characters (Pr., Ven., S.c., Ap., Can., Cr., Sq.1, Sq.2, Sq.3, Supralab., Sublab., ZZ., F.c., Lor.), for which the reliable differences were obtained in statistical analysis. Apriori, all examined snakes were divided into twelve sexual and geographical groups.

The results of CDA showed the absolute accuracy of division of geographical groups. Accuracy for males is the following: Erzincan – 100%; Zekeriya – 100%; Ardahan pass – 100%, *P. olguni* – 100%, *P. darevskii* from Armenia – 100%, *P. eriwanensis* – 100%.

All females showed high enough accuracy of division of geographical groups: Erzincan – 83.3%, Zekeriya – 83.3%, Ardahan pass – 83.3%, *P. olguni* – 90%, *P. darevskii* – 100%, *P. eriwanensis* – 83.3%.

The results of CDA show that in space of discriminant functions males formed six groups (Fig. 2C): the first one with males from Erzincan, the second – from Zekeriya, the third – from Ardahan pass, the fourth – *Pelias olguni* from Posof, the fifth – *P. darevskii* originated from Armenia and the sixth – *P. eriwanensis* originated from Armenia. By the first discriminant function, animals were divided into two groups and by the second function – into six groups.

Distribution in space of discriminant functions of females (Fig. 2D) looks more heterogeneous with formation of six independent groups with varying degrees of overlap between the clouds.

Fig. 5. Ventral coloration of paratypes of *Pelias sakoi* sp. nov.: left – male; right – female (paratypes: ZDEU 59/2003).

The results obtained confirm the high degree of morphological separation of the compared samples of vipers. Degree of likeness between the selected samples in a CDA estimated on the size of distance of Makhalonobis (Tyurin et al. 2003). The distances between the centers of samples of males of vipers varied from 18.3 to 90.1. Minimum value was shown between males of *P. darevskii* and vipers from Zekeriya (18.3) and between *P. olguni* and *P. eriwanensis* (27.5); maximal (90.1) – between males from Erzincan and Zekeriya (Appendix: Table 20). For the females, this distance between the centers of samples varied from 7.8 to 20.6. Minimum (7.8) was recorded between the females of *P. olguni* and vipers from Ardahan pass and between the latter and Zekeriya (110.9); maximal (20.6, 18.8) – between females *P. darevskii* and *P. olguni* with females from Erzincan (Appendix: Table 21).

The contribution of different morphological characters to discrimination of groups is different. Because the first discriminant function takes into account the most percent of dispersion and dividing of animals into basic groups occurs exactly along it, we will describe the contribution of characters to the division of groups based on values of this function (Appendix: Tables 22, 23).

A maximal contribution to discrimination of groups of males (Appendix: Table 22) were made by the followings characters: numbers of supralabials, shields around an eye, ventral shields, crown shields, subcaudals, scales around the posterior part of body, apicals, loreals, canthals, scales around neck, scales around the midbody, preventrals, sublabials and wings of zigzag.

A maximal contribution to discrimination of groups of females (Appendix: Table 23) were made by the followings characters: numbers of subcaudals, suprelabials, scales around the posterior part of body, preventrals, scales around neck, shields around an eye, crown shields, scales around the midbody, loreals, sublabials, ventral shields and wings of zigzag.

During our study new information was obtained about the morphological peculiarities and geographical variability of shield-head vipers of *"darevskii-olguni"* and *"eriwanensis"* complexes from northeast of Asia Minor. Substantial differences in the mean values in a number of metric and meristic characters of snakes from Erzincan, Zekeriya, Ardahan pass in comparison with *P. olguni* (Posof), *P. darevskii* (Armenia), *P. eriwanensis* (Armenia) (Appendix: Tables 6–8) are most valuable as well as discrimination of twelve groups from six samples, selected on principle of geographical and sexual identity using the cluster analysis and CDA (Figs. 4, 5; Appendix: Tables 20 and 21).

2. Genetic analysis

Cytochrome *b* tree (Fig. 3) showed the division into several supported clusters. Highly supported clade (88.4% ML and 0.99 BI supports) includes *Pelias olguni*, *P. darevskii*, *P. dinniki* and the viper from the vicinities of Erzincan named as *Pelias* sp. Selfdependence of *Pelias* sp. is supported with maximum values (99.9 ML and 1.0 BI). *Pelias olguni*, *Pelias* cf. *olguni* and *P. darevskii* formed a uniform cluster. *P. eriwanensis*, *P. ebneri* and *P. renardi* formed another cluster (without statistical support), while clades of *P. eriwanensis* and *P. renardi* themselves are supported enough. *Pelias eriwanensis* cluster is subdivided into subclusters according to the local populations.

The values of genetic distances between species (Appendix: Tables 24, 25) are from 2% (within the group of *P. eriwanensis*, *P. ebneri* and *P. renardi*) to 8% (between *P. eriwanensis* and *Pelias* sp.).

The results obtained on the morphology and ecology of the studied vipers suggest taxonomic segregation of all six groups – from Erzincan, Zekeriya, Ardahan pass, *P. olguni* from Turkey, *P. darevskii* and

P. eriwanensis from Armenia. Based on morphological and molecular results, animals from Erzincan, in our view, deserve the status of a distinct species. While the low interpopulation molecular differences in snakes from Ardahan pass and Zekeriya allows considering them as subspecies of *P. darevskii*, solely based on the results of morphological analysis. In the light of the results obtained, *P. olguni* seems to be a subsepcies of *P. darevskii* as well.

SYSTEMATICS

Family Viperidae Laurenti, 1768

Genus *Pelias* Merrem, 1820

Pelias sakoi Tuniyev, Avcı, Ilgaz, Olgun, Petrova, Bodrov, Geniez et Teynié sp. nov.

Vipera eriwanensis (Reuss, 1933) [part.]: Baran et al. 2005: 2, 3

Holotype. SNP 911, adult male, Turkey, Gumuşhane District, vicinity of Erzincan, Çilhoroz Village (2000 m above sea level), 10.07.2012, collector A. Avcı (Fig. 6).

Paratypes. SNP 906, one adult female, four new-born females and two new-born males, born in terrarium (Fig. 7), Turkey, Gumushkhane District, vicinity of Erzincan, (2000 m above sea level), 10.07.2012, collector A. Avcı; ZDEU 59/2003, adult male and semiadult female (Fig. 5), Turkey, Gumuşhane District, vicinity of Erzincan, (2000 m above sea level), 05.06.2003, collector C.V. Tok.

Diagnosis. Small-sized snake, males have minimal value of midbody scales (19), loreals, apicals and crown shields, a relatively large number of preventrals, and maximum number of supralabials; females have maximum number of ventrals and supralabials, minimal value of sublabials, loreals and number of shields around an eye, a relatively small number of zigzag wings. Vipers of both sexes from Erzincan differ from all other vipers under comparison by minimum number of loreals and maximal number of supralabials. From above, males are painted in grey, females, in light brown tones (Fig. 4); zigzag consists of not numerous transversely elongated stains, united only in some places in males, the zigzag is well developed in females. The belly is light-grey in females and dark-spotted grey in males. Both sexes have a white throat (Fig. 5).

Description of the holotype. An adult male having the following morphological features: total length (T.l.) – 398 mm; snout-vent length (SVL.) – 351 mm; length of tail (L. cd) – 47 mm; head length – 18.7 mm, width – 10.4 mm, height – 6.1 mm; length of pileus (Pil.) –10.6 mm; rostral index – 58.65. Number of preventrals – 4, ventrals – 136, subcaudals (S.c.) – 34, apical – 1; number of crown shields (Cr) – 5; upper preocular shield separated from nasal by loreal (In.) in both sides; number of canthals – 5, rows of dorsal scales around neck – 20, at middle of body – 19, and at posterior part of body – 17, supralabial shields on right – 8, on left – 9 (3 shields below eye, supralabials b.u.eye), sublabials on right – 10, on left – 11, shields around eyes – 9 on each side, loreals – 5 on both sides; frontal and parietal shields are not divided; number of wings of zigzag – 136. Supralabials are white, on both sides, in upper part are painted by small dots in grey tones. Dorsal side is painted in a light-grey background, zigzag jerky black, wings are perpendicular to the axis of the body. Zigzag is not connected with a dark figurehead. Coloring of throat is light; belly and tail are grey-spotted without difference in coloration.

Description of the paratypes. The paratypes are corresponding to description of the holotype with insignificant variations in a size and meristic characters (Appendix: Table 26).

The basic background of adults and juveniles males is light grey, and of females is light brown. Zigzag in females are wider, almost continuous, painted in light-brown or dark-brown, in males, zigzag is jerky black. Zigzag of young and semiadult specimens differs from zigzag of animals from all other populations. It is very narrow with sharp, perpendicular to the axis of the body wings (Fig. 7). In coloring of pileus, there are light and dark colors, brighter picture pronounced in males. On the sides of the body, young express a number of spots, which in adult animals are represented by narrow dark spots, brighter expressed in males, the same color with zigzag. Stains with weakly pronounced streaks continue on the sides of the tail. The throat is light in all specimens, the belly is from light gray to dark-spotted; lower side of the tail does not differ in coloration from the belly in both sexes. There are grey tones in coloration of upper part of supralabial shields; on the sutures of supralabials, males have dark strips, poorly expressed, or completely absent. In the majority of specimens of both sexes, the upper preocular shield is separated from the nasal by

Fig. 6. Holotype of *Pelias sakoi* sp. nov.

Fig. 7. The young specimen of *Pelias sakoi* sp. nov. (paratype: SNP 906).

the loreal shield; 20.8% females have a contact of the preocular shield with the nasal shield.

Etymology. The species is named in honor of Sako Tuniyev – our colleague, friend and son, who studied fauna of shield-head vipers of the Caucasus and north-eastern Anatolia, generated the basis of this article, and tragically died in 2015 (Fig. 8).

Geographical distribution and biotopes. *Pelias sakoi* sp. nov. is at present known only from the type locality (Fig. 9): near Çilhoroz Village, vicinity of Erzincan, Turkey, between 1850 and 2200 m. above sea level.

Biotopes of the vipers are at present strongly destroyed from overgrazing sites with small outcroppings of limestone rocks and taluses among mountainous xerophyte vegetation types like phrygana with tragocanth astragals (Fig. 10).

Pelias darevskii uzumorum Tuniyev, Avcı, Ilgaz, Olgun, Petrova, Bodrov, Geniez et Teynié ssp. nov.

Holotype. SNP 904, adult female, Turkey, Artvin Province, the Yalnizçam Dağlari Ridge, vicinity of Zekeriya Village, (2000 m above sea level), 11.07.2012, collector S.B. Tuniyev (Fig. 11).

Paratypes. SNP 908, adult female, three new-born females born in the terrarium; Turkey, Artvin Province, the Yalnizçam Dağlari Ridge, vicinity of Zekeriya Village (2000 m above sea level), 11.07.2012, collector B.S. Tuniyev; SNP 909, two adult females; Turkey, Artvin Province, the Yalnizçam Dağlari Ridge, vicinity of Zekeriya Village (2000 m above sea level), 11.07.2012, collector S.B. Tuniyev; ZDEU 99/2011, adult female and new-born male born in terrarium; Turkey, Artvin Province, the Yalnizçam Dağlari Ridge, vicinity of Zekeriya Village (2000 m above sea level), 24.07.2011, collector A. Avcı; BEV.8369 and BEV.8855, juvenile male and adult female respectively; Turkey, Artvin Province, the Yalnizçam Dağlari Ridge, vicinity of Zekeriya Village (2000 m above sea level), 18.09.2000, collectors A. Teynié and P. Geniez; MNHN-RA-2002.410, adult male, Turkey, Artvin Province, the Yalnizçam Dağlari Ridge, vicinity of Zekeriya Village (2000 m above sea level), 18.09.2000, collectors A. Teynié and P. Geniez (Fig. 12 A, B; 13 A–F).

Diagnosis. Small-sized snake, back color is lighter than lateral background. Zigzag has winding, narrow, not interrupted with rounded wings in females, and interrupted with the transversely elongated spots in males. The supralabials are poorly pigmented or not pigmented. There are two (88.2%), rarely one (11.8%) apicals. The vipers of both sexes from Zekeriya differ from all other vipers under comparison by the maximum number of loreals, canthals and apicals, comparatively high number of preventrals and subcaudal shields. Females characterized by a minimal amount of supralabials, and males have the maximum. From above, males are painted in dark grey, whereas the female is reddish-brown in tone; zigzag consists of few transversely elongated spots in males and well-developed scalloped-continuous spots in females. The coloration in general is characterized by smoky figure. Belly is dark-spotted grey in females and almost black in males.

Fig. 8. Sako Tuniyev on the slope of Mt. Ilgar-Dağ (Turkey), 21.07.2011.

Fig. 9. Type locality of *Pelias sakoi* sp. nov. – near Çilhoroz Village, vicinity of Erzincan, Turkey.

Fig. 10. Habitats of *Pelias sakoi* sp. nov. represented by mountainous xerophyte vegetation types like phrygana with tragocanth astragals.

Fig. 11. Holotype of *Pelias darevskii uzumorum* ssp. nov.

Additional material. PGe 450-451, 453, 455-456, two adult males and three adult females; Turkey, Artvin Province, the Yalnizçam Dağlari Ridge, vicinity of Zekeriya Village (2000 m above sea level), 24.07.2011, collectors A. Teynié and P. Geniez.

Description of the holotype. An adult female having the following morphological features: total length (T.l.) – 440 mm, snout-vent length (SVL.) – 391.5 mm, length of tail (L. cd) – 48.5 mm, head length – 20.0 mm, width – 11.1 mm, height – 8.4 mm, length of pileus (Pil.) –12.5 mm, rostral index – 75.68. Number of preventrals – 3, ventrals – 130, subcaudals (S. c.) – 28, apicals – 2; number of crown shields (Cr) – 5; upper preocular shield separated from the nasal by loreal shield (In.) in both sides; number of canthals – 6, rows of dorsal scales around neck – 21, at middle of body – 20, and at posterior part of body – 17, supralabial shields on each side – 9 (3 shields below eye, Supralab b.u.eye), sublabials on each side – 10, shields around eyes – 8 on both sides, loreals on left – 3, on right – 4, frontal and parietal shields are not divided; number of wings of zigzag – 152. Supralabials are light, on both sides, the first one is completely grey, the second to the fifth are more than half colored in grey tones by small dots; posterior four supralabials with black stripe from above. It is light brown smoke with dark brown wavy continuous zigzag pairing with a dark figurehead. On the head, there are a X-shaped dark stain and a crown stain. Coloring of throat is light; belly is grey-dotted on a light background. Low part of the tail is grey-dotted; the tip of the tail is yellow.

Description of the paratypes. The paratypes are corresponding to description of the holotype with insignificant variations in size and meristic characters (Appendix: Table 27).

The main background is dark grey in adult males, and reddish-brown, smoky in females. Zigzag of females is wider, almost continuous, undulating, painted in dark-brown or red-brown; males zigzag is jerky black. Zigzag is connected or separated from a picture of the head. Young and semiadult specimens have zigzag wavy, relatively wide (Fig. 13F). In coloring of the pileus, there are light and dark grey tones in males and brown tones in females; brighter picture is evident in males. On the sides of the trunk in young and adults, there are stains, often blending in continuous lateral stripes,

Fig. 12. Part of the type series of *Pelias darevskii uzumorum* ssp. nov. (SNP): A – view from above; B – view from below.

Fig. 13. Some of the paratypes of *Pelias darevskii uzumorum* ssp. nov.: A, B – SNP 909; C – ZDEU 99/2011; D – MNHN-RA-2002.410; E – BEV 8855; F – SNP 908.

brighter expressed in males. The throat of all specimens is light, the belly is dark-speckled in females to almost black in males; bottom of the tail in both sexes is not different in coloration from the belly, tail tip is bright yellow. In coloration of supralabials grey tones are present or not, dark stripe in the middle, or upper edge of the shields can be weakly present in both sexes.

Etymology. The subspecies is named in honor of Prof. Dr. Nazan ÜZÜM and her husband Prof. Dr. Ömer Barış ÜZÜM, to acknowledge their prolific contribution to the herpetology of Turkey.

Geographical distribution and biotopes. This taxon distribution covers the southern part of the Yalnizçam Dağlari Ridge in its most warm calcareous part (Fig. 14).

Fig. 14. Type locality of *Pelias darevskii uzumorum* ssp. nov. – vicinity of Zekeriya Village, Artvin, Turkey.

Biotopes of *Pelias darevskii uzumorum* ssp. nov. in vicinity of Zekeriya Village is represented by subalpine hemixerophyt meadows close on edaphically signs to meadow-like steppes with juniper lying shrubs (*Juniperus oblonga* Bieb.) on limestones in altitudinal range 1990 – 2100 m a.s.l. Along all the habitats the stony areas, small talus, acanguares and rocky outputs of limestone are located (Geniez and Teynié 2005; Tuniyev et al. 2012) (Fig. 15).

Pelias darevskii kumlutasi Tuniyev, Avcı, Ilgaz, Olgun, Petrova, Bodrov, Geniez, Teynié ssp. nov.

Vipera eriwanensis (Reuss, 1933) [part.]: Baran et al. 2005: 2–3.

Holotype. SNP 910, adult female; Turkey, Ardahan Province, the Yalnizçam Dağlari Ridge, vicinity of Bağdaşan Village, 12.07.2012, collector B.S. Tuniyev (Fig. 16).

Paratypes. ZDEU 145/2001, three adult females, two juvenile females, two juvenile males, Turkey, Ardahan Province, Ardahan pass (2200 m above sea level), 04.07.2001, collectors Y. Kumlutaş, K. Olgun, Ç. Ilgaz, F. İret, A. Avcı (Fig. 17A, B).

Diagnosis. Small-sized broad-head snake, occupying an intermediate position in a number of characters between the northern and southern populations of *Pelias darevskii*. It differs from all other vipers under comparison by a maximum number of zigzag wings in males, which is less only than in females of the nominate subspecies; comparatively high number of sublabials. From above, males are painted in grey and yellowish-grey tones, and females, in yellowish-grey and light brown tones; zigzag in both sexes consists of numerous transversely elongated spots, interrupted only in some places. The belly is light grey to black in females and spotty black, or almost black in males.

Description of the holotype. An adult female having the following morphological characters: total length (T.l.) – 465 mm, snout-vent length (SVL) – 417 mm, length of tail (L. cd) – 48 mm, head

Fig. 15. Habitat of *Pelias darevskii uzumorum* ssp. nov. – subalpine hemixerophyt meadows.

Fig. 16. Holotype of *Pelias darevskii kumlutasi* ssp. nov.

length –20.6 mm, width – 12.7 mm, height – 6.9 mm, length of pileus (Pil.) – 12.6 mm; rostral index – 54.35. Number of preventrals – 2, ventrals – 134, subcaudals (S.c.) – 24, apicals – 2, number of crown shields (Cr) – 9, upper preocular shield separated from nasal by loreal (In.) in both sides; number of canthals – 6, rows of dorsal scales around the neck – 21, at mid-body – 21, and at posterior part of body – 17, supralabial shields on both sides – 9 (3 shields below eye, Supralab b.u.eye), sublabials on both sides – 10, shields around eyes – 9 on left and 10 on right, loreals – 4 on each side; the frontal and parietal shields are not divided; number of wings of zigzag – 176. Supralabials are light and covered by small grey dots in upper part. There are rather broad black stripes at sutures of shields in males. Color is light brown from above with a broad black zigzag consisting of transversely elongated spots, interrupted in anterior third, not connected with the drawing the head. The head is almost completely black. Lower side of the head and belly are black, not differ in coloration from the

Fig. 17. Paratypes of *Pelias darevskii kumlutasi* ssp. nov., ZDEU 145/2001: A – view from above; B – view from below.

Fig. 18. A – Habitat of *Pelias darevskii kumlutasi* ssp. nov. at Ardahan pass, Turkey; B – Type locality of *Pelias darevskii kumlutasi* ssp. nov. – the Yalnizçam Dağlari Ridge, vicinity of Bağdaşan Village, Ardahan, Turkey; C – Mezophilous relict broadleaf and dark-coniferous-broadleaf forests at southern part of the Yalnizçam Dağlari Ridge in vicinity of Zekeriya Village; D – Xerophilous pine forests at northern part of the Yalnizçam Dağlari Ridge in vicinity of Ardahan.

Fig. 19. East-Mediterranean xerophilous relict *Arnebia densiflora* (Nordm.) Ledeb., the Ridge Otlubekli Dağlari.

Fig. 20. Xerophilous relict *Heremites vittatus* (Oliver, 1804), the Ridge Otlubekli Dağlari.

Fig. 21. The characteristic staining evenly back and sides of *Pelias darevskii darevskii* from the type locality: left – light grey male; right – brownish female.

bottom of the tail. There is a bright spot on the throat and individual bright scales at the end of tail.

Description of the paratypes. The paratypes are corresponding to description of the holotype with insignificant variations in a size and meristic characters (Appendix: Table 28).

The main background of the young males is yellowish-grey, or grey, females are light brown, or yellowish-grey. Zigzag of females is painted in dark brown or black; in males, zigzag is black. In young and adult individuals, a wide zigzag is coupled with a picture of the head in males, and separated, less connected in females. In coloration of the pileus, the bright colors are expressed from weakly to entirely dark brown or black color. On the lateral sides of the trunk of young males, there are a number of dots, whereas in young females, there are spots, which are transformed into large dark spots in adult animals, tone of the same color or lighter than zigzag. These spots are continuing on the sides of the tail. The throat of all specimens is light, from dark-spotted light grey to total black; bottom of the tail in both sexes is not different from belly color. In coloration of the upper part of supralabials the grey tone prevails, narrow dark strips on sutures of supralabials are present in males and poorly expressed, or entirely absent in females.

Etymology. The subspecies is named in honor of Prof. Dr. Yusuf KUMLUTAŞ who has been working on the herpetofauna of Turkey.

Geographical distribution and biotopes. Distribution is restricted to arid northern part of the Yalnizçam Dağlari Ridge within the limits of upper basin of Kura River from Bağdaşan Village to Ardahan pass (Fig. 18A).

The vipers' biotopes are stony mountain steppes with *Ferula ovina* (Bois.) Bois., *Papaver setiferum* Goldblatt, etc. under the conditions of sharply continental climate (Fig. 18B).

KEYS TO IDENTIFICATION OF SPECIES AND SABSPECIES

1(2) Lips are usually uniformly colored and pinkish .... ***Pelias eriwanensis***
2(1) Lips are usually grey or dirty white, uniform or spotted.
3(6) Background of the back and sides are uniformly colored; coloration of the belly is almost the same as those of the tip of the tail.

4(5) 19 rows of dorsal scales at mid-body in males, 21 in females; pigmentation of supralabials is missing or poorly expressed on the upper edge of the shields; 33–41 (36.8) subcaudals in males, 26–31 (27.7) in females; more often two preventrals (0–4) .... ***Pelias sakoi*** sp. nov.

5(4) 18–21 (19.9) rows of dorsal scales at mid-body in males, 19–23 (20.6) in females; 27–37 (33.3) subcaudals in males, 22–30 (26) in females, more often three (1–6) preventrals; lips are intensely pigmented .... ***Pelias darevskii darevskii***

6(3) Background of dorsal part is lighter than background of lateral parts. Tip of the tail is yellowish or diffuse pink, differing from the grey (black and white) coloration of the belly.

7(8) Zigzag winding is narrow, not interrupted with rounded wings, the belly is black and white with a predominance of light tone, the upper half of the supralabials is pigmented with grey; two apicals (88.2%), rarely one apical (11.8%) . . . ***Pelias darevskii uzumorum*** ssp. nov.

8(7) Zigzag is interrupted, often consisting of transversal elongated spots, zigzag wings are sharp; the belly is black and white with a predominance of black tones to entirely black.

9(10) 65–83 (73.1) zigzag wings in males, 68–83 (73.4) in females .... ***Pelias olguni***

10(9) 88–97 (92.8) zigzag wings in males, 72–89 (80.2) in females .... ***Pelias darevskii kumlutasi*** ssp. nov.

DISCUSSION

For vipers from the Otlubekli Dağlari Ridge, Zekeriya Village, Ardahan pass, Mt. Ilgar-Dağ (Turkey), Javakheti Plateau (Armenia, Georgia), it is necessary to emphasize their high morphological specialization in isolated populations. The cluster and discriminant analyses on morphological features allow us to consider them as separate taxa, but the molecular analysis on *cytb* does not give significant differences for most populations. This result should not be perceived unambiguously in favor of conspecificity of the considered populations. The method itself is debatable (Ananjeva 2013; Pavlinov 2014) and far from perfect. We agree with Pavlinov (2014: 147) in that: "from this point of view, the claim for the establishment of the final "true phylogenesis" on the molecular basis looks very naively. In any case, it will be only a small fragment of phylogenesis, and not too detailed." It cannot be excluded that the analysis of nuclear DNA will give completely different results. Ananjeva (2013:9) noted existing doubts about the infallibility of the results of the molecular phylogeny, noting in particular, "there is a need for more deep insight into the specificity of molecular evolution, which may be subjected to convergent similarities, such as in the morphological evolution." Anyway, in addition to the morphological differences of the vipers, we consider such life history patterns as different biotope preference, age and size of the puberty, the history of landscapes and habitats, mezoclimatic habitat characteristics, etc.

In addition, the discreteness of morphological features is observed among representatives of *P. eriwanensis* from various disjunctive populations. Molecular analysis on *cytb* also testifies to the existing differences, but this discussion will be given in a separate publication.

Ecological notes on the *Pelias "darevskii-olguni"* complex. Formation of the vipers of the *Pelias* "*darevskii-olguni*" complex occurred in an area directly connected with the southeast Colchis. Climate and landscape changes associated with glaciation, volcanic activity and the consequent desertification have contributed to the rupture of the range of the ancestral form to a number of isolates with contrasting conditions of biotopes formed subsequently. Along the Yalnizçam Dağlari Ridge, from the South to the North, the landscapes are dessicated and rocks are changed from limestones to volcanic rocks. So, in the vicinity of Zekeriya Village, in upper belts of the limestone ridge, there are subalpine meadows and, downward the slope, the deciduous and mixed spruce-hardwood forests (Fig. 18C), whereas behind the pass, near Bağdaşan Villagea, there is a contrast change to pine forests in middle-mountain belts of the ridge, and to mountain steppe in upper mountain belts of the ridge, on the underlying volcanic rocks (Fig. 18D). Near Zekeriya Village, there are such Tertiary relict species in vegetation as *Picea orientalis* (L.) Link., *Ostrya carpinifolia* Scop., *Acer laetum* C.A. Mey., *Corylus avellana* L., *Fraxinus excelsior* L., *Alnus barbata* C.A. Mey; in the upper belt of mountains, on the western long-snowy slopes, rhodorets of *Rhododendron caucasicum* Pallas are widely developed. Behind the Bağdaşan pass (the watershed of the rivers Kura and Çoruh) there is an abrupt change in rocks, and, under the influence of drying up climate of the Armenian Highlands, a xerophytisation from the mixed spruce-hardwood forest landscape to pine forests and non-forest landscape to mountain steppe is observed, that approximately corresponds to the Anatolian diagonal (Davis 1971), dividing the Sub-Euxine district of Euxine (Colchis) and

Armeno-Iranian botanical-geographical Provinces (Menitzky 1984).

Under the most severe conditions of sharply continental climate, the populations of the vipers inhabit the Ardahan pass and the Javakheti Plateau.

The locality of Erzincan vipers is located far to the West from the Yalnizçam Dağlari Ridge on the limestone Otlubekli Dağlari Ridge. At external resemblance of the high-mountain limestone landscapes of the Otlubekli Dağlari Ridge with the Yalnizçam Dağlari Ridge, the first one has developed mountain-xerophytic vegetation of the frigana type, which is much crymophylactic, but hot-preferable. The climate of this area has contributed to the conservation of ancient Eastern Mediterranean relics such as *Arnebia densiflora* (Nord.) Ledeb., among plants (Fig. 19), and *Heremites vittatus* (Oliver, 1804), among animals (Fig. 20).

Among the discussed vipers, the most distinguished by pattern and color are those from Zekeriya Village. Males and females have smoky coloring with a blurred picture; belly coloration dominated by dark-spotted grey tones in females and almost black in males.

It should be noted that all not bright-colored shield-head vipers of the Caucasian Isthmus and Asia Minor are characterized by brownish or reddish coloration of females and light grey contrast with a black zigzag staining males (Fig. 21). This rule is usually true for species living in the foothills of the Northern Caucasus, like *Pelias renardi*, eastern populations of *P. dinniki*, as well as *P. lotievi, P. schemakhensis, P. anatolica, P. darevskii, P. olguni,* and *P. eriwanensis*. This shows the channeling of the evolution, characteristic for the shield-head vipers of the Caucasian-Anatolian sector of the Alpides.

The lack of finds of vipers in the highlands of the Karadeniz Dağlari Ridge is, probably, explained by a weak knowledge about this territory. The Otlubekli Dağlari Ridge is located close to the Karadeniz Dağlari Ridge and separated from it by small ridges. Given the southern location of the Otlubekli Dağlari Ridge and no signs of glaciation there, the vipers from the vicinity of Erzincan should be regarded as an ancient relic isolated form. Perhaps, once it had a relationship with the ancestors of both *P. darevskii* and *P. anatolica* from Taurus mountains in the South of Asia Minor. The morphological distinctness of the vipers from the Otlubekli Dağlari Ridge is well supported by results of the molecular analysis. The finding of the vipers on the Otlubekli Dağlari Ridge allows taking a fresh look on the finding of *P. anatolica*, which for a long time remained a mystery, since the species was known far in the South, separated from all other shield-head vipers of Asia Minor, even after last finds of new localities (Göçmen et al. 2017).

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REFERENCES

Agasian L.A. and Agasian A.L. 2008. New information about distribution and conservation of the Darevsky's viper (*Vipera darevskii* Vedmederja, Orlov et Tuniyev, 1986). Problems of Herpetology. Proceedings of the Third International Conference of A.M. Nikolsky Herpetoljgical Society, St. Petersburg: 7–10. [In Russian].

Ananjeva N.B. 2013. The present state of the problems of phylogeny of Iguania lizards (Sauria, Reptilia). *Proceedings of the Ukrainian Herpetological Society,* **4**: 3–10. [In Russian].

Avcı A., Ilgaz Ç., Başkaya Ş., Baran I. and Yusuf Kumlutaş Y. 2009. Contribution to the distribution and morphology of *Pelias darevskii* (Vedmederja, Orlov & Tuniyev, 1986) (Reptilia: Squamata: Viperidae) in Northeastern Anatolia. *Russian Journal of Herpetology*, **16**(1): 1–7.

Baran İ., Tok C.V., Olgun K., İret F. and Avcı A. 2005. On viperid (Serpentes: Sauria) specimens collected from northeastern Anatolia, *Turkish Journal of Zoology*, **29**(3): 225–228.

Darriba D., Taboada G.L., Doallo R. and Posada D. 2012. jModelTest 2: more models, new heuristics and parallel computing. *Nature Methods*, **9**: 772.

Davis P.H. 1971. Distribution patterns in Anatolia with particular reference to endemism. Edinburgh: 15–27.

Geniez F. and Teynié A. 2005. Discovery of a population of the critically endangered *Vipera darevskii* Vedmederja, Orlov & Tuniyev, 1986 in Turkey, with new elements of its identification (Reptilia, Squamata, Viperidae). *Herpetozoa*, **18**(3/4): 1–9.

Göçmen B., Mebert K., İğcic N., Akman B., Yıldız M.Z., Oğuz M.A. and Altın Ç. 2014. New locality records for four rare species of vipers (Reptilia: Viperidae) in Turkey. *Zoology in the Middle East*, **60**(4): 306–313.

Göçmen B., Mebert K., Karış M., Oğuz M.A. and Ursenbacher S. 2017. A new population and subspecies of the critically endangered Anatolian meadow viper *Vipera anatolica* Eiselt and Baran, 1970 in eastern Antalya province. *Amphibia-Reptilia,* **38**: 289–305.

Hall E.R. 1943. Criteria for vertebrate subspecies, species and genera: the mammals. *Annals of the New York Academy of Sciences,* **44**: 141–144.

Jobb G. 2011. TREEFINDER, URL: http://www.treefinder.de/ (accessed on September 15, 2012).

Lakin G F. 1980. Biometry. Vysshaya Shkola, Moscow, 266 p. [in Russian].

Mebert K., Göçmen B., İğci N., Oğuz M., Kariş M. and Ursenbacher S. 2015. New records and search for contact zones among parapatric vipers in the genus *Vipera* (*barani*, *kaznakovi*, *darevskii*, *eriwanensis*), *Montivipera* (*wagneri*, *raddei*), and *Macrovipera* (*lebetina*) in northeastern Anatolia. *The Herpetological Bulletin*, **133**: 13–22.

Menitzky Yu. L. 1984. Oaks of Asia. Nauka, Leningrad, 284 p. [In Russian].

Miller S.A., Dykes D.D. and Polesky H.F. 1988. A simple salting out procedure for extracting DNA from human nucleated cells". *Nucleic Acids Research*, **16**: 1215.

Nilson G. and Andren C. 2001. The meadow and steppe vipers of Europe and Asia – the *Vipera* (*Acridophaga*) *ursinii* complex. *Acta Zoologica Academiae Scientiarum Hungaricae,* **47**(2–3): 87–267.

Pavlinov I.Ya. 2014. Review of the book "Modern problems of biological taxonomy." *Zhurnal Obshchey Biologii,* **75**(2): 144–148. [In Russian].

Ronquist F. and Huelsenbeck J.P. 2003. MrBayes 3: Bayesian phylogenetic inference under mixed models. *Bioinformatics*, **19**: 1572–1574.

Stümpel N. 2012. Phylogenie und Phylogeographie eurasischer Viperinae unter besonderer Berücksichtigung der orientalischen Vipern der Gattungen *Montivipera* und *Macrovipera*. Fakultät für Lebenswissenschaften der Technischen Universität Carolo-Wilhelmina zu Braunschweig, 244 p.

Thompson J.D., Higgins D.G. and Gibson T.J. 1994. CLUSTAL W: improving the sensitivity of progressive multiple sequence alignment through sequence weighting, position-specific gap penalties and weight matrix choice. *Nucleic Acids Research*, **22**: 4673–4680.

Tuniyev S.B., Avcı A., Tuniyev B.S., Agasian A.L. and Agasian L.A. 2012. Description of a new species of Shield-Head Vipers – *Pelias olguni* sp. nov. from basin of upper flow of the Kura River in Turkey. *Russian Journal of Herpetology*, **19**: 314–332.

Tyurin V.V., Morev I. A. and Volchkov V.A. 2003. Linear Discriminant Analysis. In: Selection of Genetic Research, Krasnodar [in Russian].

Tuniyev B.S., Tuniyev S.B., Avcı A. and Ilgaz Ç. 2014. Herpetological studies in Eastern and North-Eastern Turkey. *Current Herpetology*, **14**: 44–53.

Tuniyev S.B., Iremashvili G.N., Heras B. de las, and Tuniyev B.S. 2014. About type locality and finds of Darevsky's viper [*Pelias darevskii* (Vedmederja, Orlov et Tuniyev, 1986), Reptilia: Viperinae] in Georgia. *Russian Journal of Herpetology*, **21**(4): 281–290.

Tuniyev B.S., Orlov N.L., Ananjeva N.B. and Agasian A.L. 2009. Snakes of the Caucasus — Taxonomical Diversity, Distribution, Conservation. St. Petersburg – Moscow, 223 p. [In Russian].

Zinenko O., Stümpel N., Mazanaeva L., Bakiev A., Shiryaev K., Pavlov A., Kotenko T., Kukushkin O., Chikin Y., Duisebayeva T., Nilson G., Orlov N.L., Tuniyev S, Ananjeva N.B., Murphy R.W. and Joger U. 2015. Mitochondrial phylogeny shows multiple independent ecological transitions and northern dispersion despite of Pleistocene glaciations in meadow and steppe vipers (*Vipera ursinii* and *Vipera renardi*). *Molecular Phylogenetics and Evolution*, **84**: 85–100.

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APPENDIX

Table 1. Examined specimens of *Pelias* spp. Abbreviations: Mt. – Mountain; n – number; n/n – no number; V. – Village.

No.	Tree No.	Genbank accession No.	Species	n	Sam-ple	Collection locality	Date	Collector
SNP 906	4 5 10	MG543294 MG543295 MG543296	*P. sakoi* sp. nov.	1	1	Turkey, Çilhoroz V., Erzincan	10.07.2012	A. Avcı
ZDEU 59/2003			*P. sakoi* sp. nov.	2	1	Turkey, Çilhoroz V., Erzincan	05.06.2003	C.V. Tok
SNP 911			*P. sakoi* sp. nov.	7	1	Turkey, Çilhoroz V., Erzincan	10.07.2012	A. Avcı
SNP 904			*P. darevskii uzumorum* ssp. nov.	1	2	Turkey, Zekeria V.	11.07.2012	S. Tuniyev
SNP 908	15	MG543297	*P. darevskii uzumorum* ssp. nov.	4	2	Turkey, Zekeria V.	11.07.2012	B. Tuniyev
SNP 909	16 17	MG543298 MG543299	*P. darevskii uzumorum* ssp. nov.	2	2	Turkey, Zekeria V.	11.07.2012	S. Tuniyev
ZDEU 99/2011			*P. darevskii uzumorum* ssp. nov.	2	2	Turkey, Zekeria V.	24.07.2011	B. and S. Tuniyev, A. Avcı
PGe 449			*P. darevskii uzumorum* ssp. nov.	1	2	Turkey, Zekeria V.	18.09.2000	A. Teynié, P. Geniez
PGe 453			*P. darevskii uzumorum* ssp. nov.	1	2	Turkey, Zekeria V.	18.09.2000	A. Teynié, P. Geniez
BEV 8855			*P. darevskii uzumorum* ssp. nov.	1	2	Turkey, Zekeria V.	18.09.2000	A. Teynié, P. Geniez
PGe 456			*P. darevskii uzumorum* ssp. nov.	1	2	Turkey, Zekeria V.	01.06.2002	A. Teynié, P. Geniez .
PGe 451			*P. darevskii uzumorum* ssp. nov.	1	2	Turkey, Zekeria V.	18.09.2000	A. Teynié, P. Geniez
MNHN-RA-2002 410			*P. darevskii uzumorum* ssp. nov.	1	2	Turkey, Zekeria V.	18.09.2000	A. Teynié, P. Geniez
PGe 450			*P. darevskii uzumorum* ssp. nov.	1	2	Turkey, Zekeria V.	18.09.2000	A. Teynié, P. Geniez
PGe 455			*P. darevskii uzumorum* ssp. nov.	1	2	Turkey, Zekeria V.	01.06.2002	A Teynié, P. Geniez
SNP 910	18	MG543300	*P. darevskii kumlutasi* ssp.nov.	1	3	Turkey, Bağdaşan V.	10.07.2012	B. Tuniyev
ZDEU 145/2001			*P. darevskii kumlutasi* ssp.nov.	7	3	Turkey, Ardahan pass	04.07.2001	K. Olgun, Y. Kumlutaş, Ç. Ilgaz, F. Iret, A. Avcı
ZDEU 270/2005			*P. olguni*	2	4	Turkey, Türkgözü Plateau, Posof, Ardahan	21.05.2005	Ş. Başkaya
SNP 866			*P. olguni*	1	4	Turkey, Çamyazı V., Posof, Ardahan	21.07.2011	B. and S. Tuniyev, A. Avcı
SNP 874	27	MG543301	*P. olguni*	3	4	The same locality	21.07.2011	B. and S.Tuniyev, A. Avcı
SNP 875			*P. olguni*	3	4	The same locality	21.07.2011	B. and S.Tuniyev, A. Avcı
SNP 876			*P. olguni*	3	4	The same locality	21.07.2011	B. and S.Tuniyev, A. Avcı
SNP 877			*P. olguni*	1	4	The same locality	21.07.2011	B. and S.Tuniyev, A. Avcı
SNP 878	35	MG543302	*P. olguni*	1	4	The same locality	21.07.2011	B. and S.Tuniyev, A. Avcı

Table 1. *Continued.*

No.	Tree No.	Genbank accession No.	Species	n	Sam-ple	Collection locality	Date	Collector
SNP 879	36	MG543303	*P. olguni*	1	4	The same locality	21.07.2011	B. and S.Tuniyev, A. Avcı
SNP 880			*P. olguni*	1	4	The same locality	21.07.2011	B. and S.Tuniyev, A. Avcı
SNP 804	250 251	MG543304 MG543305	*P. darevskii*	3	5	Armenia, Shirak Marz, Ashotsk District, Mt. Sevsar, Saragyukh V.	07.2009	A.L.Agasian
ZIRA 27936			*P. darevskii*	1	5	The same locality	15.09.2006	A.L. Agasian
ZIRA n/n			*P. darevskii*	1	5	The same locality	15.09.2006	A.L. Agasian
ZIRA 27937			*P. darevskii*	1	5	The same locality	09.2006	A.L. Agasian
ZIRA 27939			*P. darevskii*	1	5	The same locality	09.2006	A.L. Agasian
ZIRA 27944			*P. darevskii*	1	5	The same locality	09.2006	A.L. Agasian
ZIRA 27941			*P. darevskii*	1	5	The same locality	09.2006	A.L. Agasian
ZIRA 27946			*P. darevskii*	1	5	The same locality	15.09.2006	A.L. Agasian
ZIRA 27548			*P. darevskii*	10	5	The same locality	15.09.2006	A.L. Agasian
ZIRA 27920			*P. darevskii*	3	5	The same locality	15.09.2006	A.L. Agasian
ZIRA 27922			*P. darevskii*	1	5	The same locality	15.09.2006	A.L. Agasian
ZIRA 27943			*P. darevskii*	1	5	The same locality	09.2006	A.L. Agasian
ZIRA 27945			*P. darevskii*	1	5	The same locality	09.2006	A.L. Agasian
ZIRA 27942			*P. darevskii*	1	5	The same locality	09.2006	A.L. Agasian
ZIRA 27940			*P. darevskii*	1	5	The same locality	09.2006	A.L. Agasian
ZIRA 27933			*P. darevskii*	1	5	The same locality	15.09.2006	A.L. Agasian
ZIRA 27550			*P. darevskii*	1	5	The same locality	15.09.2006	A.L. Agasian
ZIRA 27947			*P. darevskii*	1	5	The same locality	15.09.2006	A.L. Agasian
SNP 945	254 255 256	MG543306 MG543307 MG543308	*P. darevskii*	5	5	Georgia, Mt. Gumbati	11.07.2014	G.N. Iremashvili, B. de-las Heras, S.B. Tuniyev
SNP 946	252 253	MG543312 MG543313	*P. darevskii*	2	5	Georgia, Mt. Mada-Tapa	07.07.2014	B. de-las Heras
SNP 949	265 266	MG543314 MG543315	*P. darevskii*	2	5	Georgia, Mt. Mada-Tapa	12.07.2014	S.B. Tuniyev

Table 1. *Continued.*

No.	Tree No.	Genbank accession No.	Species	n	Sam-ple	Collection locality	Date	Collector
SNP 972	316 317 318	MG543316 MG543317 MG543318	*P. darevskii*	4	5	Georgia, Mt. Mada-Tapa	07.07.2014	S.B. Tuniyev
SNP 962	303 304 305	MG543309 MG543310 MG543311	*P. darevskii*	3	5	Georgia, Mt. Gumbati	11.07.2014	S.B. Tuniyev
ZIRA 40715			*P. eriwanensis*	1	6	Armenia, Ararat Marz, “Khosrov Forest” Reserve, above Kakavaberd Castle, place Tapchan Elakh	06.2011	A. Malkhasjan
ZIRA 40717			*P. eriwanensis*	1	6	The same locality	06.2011	A. Malkhasjan
ZIRA 40713			*P. eriwanensis*	1	6	The same locality	06.2011	A. Malkhasjan
ZIRA 40718			*P. eriwanensis*	1	6	The same locality	06.2011	A. Malkhasjan
ZIRA 40714			*P. eriwanensis*	1	6	The same locality	06.2011	A. Malkhasjan
ZIRA 40716			*P. eriwanensis*	1	6	Armenia, Sjunik Marz, Sisian, vicinity of Getatakh and Lor V.s, place Jabrail	12.05.2006	A. Malkhasjan
ZIRA 40721			*P. eriwanensis*	1	6	The same locality	12.05.2006	A. Malkhasjan
ZIRA 40719			*P. eriwanensis*	1	6	The same locality	12.05.2006	A. Malkhasjan
ZIRA 40720			*P. eriwanensis*	1	6	The same locality	12.05.2006	A. Malkhasjan
ZIRA n/n			*P. eriwanensis*	1	6	The same locality	12.05.2006	A. Malkhasjan
SNP 890	43	MG543319	*P. eriwanensis*	2	6	Armenia, Areguni Ridge, vicinity of Drakhtik V.	19–20.05.2012	S. Tuniyev
SNP 894	42	MG543320	*P. eriwanensis*	1	6	Armenia, Sjunik Marz, Khustup-Katarsky Ridge, branch of Mt. Katar above Verin Giratakh V.	11.05.2012	B. Tuniyev
ZIRA n/n	219	MG543321	*P. eriwanensis*	3	6	The same locality		A. Malkhasjan
ZIRA 708			*P. eriwanensis*	2	6	Armenia, Ararat Marz, southern slope of Urtz Ridge	8 and 18.05.1939	S.K. Dal
ZIRA 812			*P. eriwanensis*	2	6	Armenia, Ararat Marz, Urtz Ridge, near Asni V.	10.5.1950	P.P. Gambarjan
ZIRA 615			*P. eriwanensis*	1	6	Armenia, Akhtynsky (Razdan) District, Sukhoy Fontan Settlement	03.06.1936	Izmailov

Table 1. *Continued.*

No.	Tree No.	Genbank accession No.	Species	n	Sample	Collection locality	Date	Collector
SNP 797	170 171 172	MG543322 MG543323 MG543324	*P. eriwanensis*	3	6	Armenia, Mt. Arai-Ler	08.2008	S. Balajan
SNP 1049	45	MG543325	*P. erwanensis*	1	6	Nagorno-Karabakh	07.2012	A.L. Agasjan
ZIRA n/n	220	MG543326	*P. eriwanensis*	1	6	Armenia, Sjunik Marz, Sisian	?	A.L. Agasjan
SNP 782	201 204	MG543327 MG543328	*P. renardi*	2	–	Russia, Kalmyk Republic, Manych-Gudilo Lake	18/05/2009	S.B. Tuniyev
SNP 716	KC176736	KC176736	*P. kaznakovi*	1	–	Russia, Sochi, vicinity of Maly Kichmay Settlement	07.09.2006	S.B. Tuniyev
SNP 652	KC176731	KC176731	*P. dinniki*	1	–	Abkhazia, Kamenny Klad Ridge	20.09.2004	B.S. Tuniyev

Table 2. Abbreviations for morphological characters and indexes of vipers.

No.	Abbreviation	Description
1	T.l.	Total length
2	SVL	Snout-vent length
3	L.cd.	Distance from cloaca to tail tip
4	Pr.	Number of preventral shields
5	Ven.	Number of ventral shields
6	S.c.	Number of subcaudal shields
7	Ap.	Number of apical shields
8	R.	Rostral index: ratio of height to width
9	Pil.	Distance from tip of snout to posterior margin of parietal shields
10	Crown scales (C.s.)	Number of shields, limited by frontals, canthals and supraoculars
11	In	Upper preoculars in contact with nasal, left/right (+/–)
12	Can.	Number of canthal shields
13	Sq.1	Number of dorsal scales around neck
14	Sq.2	Number of dorsal scales around midbody
15	Sq.3	Number of dorsal scales around posterior part of body
16	Supralab	Number of supralabial shields
17	Sublab	Number of sublabials shields
18	F.c.	Number of shields around eye (left/right)
19	ZZ	Number of zigzag windings (left/right)
20	Lor.	Number of loreal shields (left/right)
21	L.c.	Head length
22	Lt.c	Biggest width of head
23	Al.c.	Height of head in parietal area
24	Par.	Parietals (hel/delad)
25	Front.	Frontal (hel/delad)
26	Nas.	Nasal (hel/delad)
27	Supralab. u.eye	Number of subralabial shields below eye

Table 3. Morphological characters of specimens of *Pelias sakoi* sp. nov. from Erzincan, Turkey. See Table 2 for abbreviations.

Character	♀ Adult (n = 1)	♀♀ Juv. (n = 4) min–max ± m	♀ Subadult (n = 1)	♂♂ Adult (n = 2) min–max ± m	♂♂ Juv. (n = 2) min–max ± m
L.t.	475	113–132 122.8 ± 4.4	246	398–410 404 ± 6	136–141 138.5 ± 2.5
L.	423	100–119 109.5 ± 4.4	229	351–353 352 ± 1	120–126 123 ± 3
L.cd.	52	12–15 13.3 ± 0.6	17	47–57 52 ± 5	15–16 15.5 ± 0.5
Pr.	2	0–5 2.3 ± 1	2	2–4 3 ± 1	1–2 1.5 ± 0.5
Ven.	140	137–141 138.3±1	137	136–137 136.5 ± 0.5	135–137 136 ± 1
S.c.	31	26–28 26.8±0.5	28	34–41 37.5 ± 3.5	33–35 34 ± 1
Ap.	2	1–2 1.3±0.3	1	1	1
R.	64.1	64.5–67.7 66.1 ± 0.7	73	58.7–60.6 59.6 ± 1	58.6–71 64.8 ± 6.2
Pil.	12.4	6.7–7.5 7.1 ± 0.2	8.6	10.6–11 10.8 ± 0.2	7.5–7.9 7.7 ± 0.2
Crown scales	6	5–6 5.5 ± 0.3	9	3–5 4 ± 1	6–7 6.5 ± 05
Can.	6	5–6 5.3 ± 0.3	5	5	5
Sq.1	21	21	21	19–20 19.5 ± 0.5	21
Sq.2	21	21	21	19	19
Sq.3	17	17–18 17.3 ± 0.2	17	17	17
Supralab	11	9–11 10.9 ± 0.2	10	10–11 10.3 ± 0.3	10–12 11.3 ± 0.3
Sublab	9/8	8–9 8.5 ± 0.2	9	8–9 8.3 ± 0.3	9–10 9.3 ± 0.3
F.c.	10	5–7 6.5 ± 0.4	10	9–10 9.3 ± 0.3	5–10 7.5 ± 1.75
ZZ	70	71–76 73.3 ± 1.1	76	68–90 79 ± 11	72–78 75 ± 3
Lor.	3/2	1–4 2.5 ± 0.4	5	2–3 2.5 ± 0.5	2–3 2.5 ± 0.3
L.c.	21.7	9.2–10.3 9.7 ± 0.2	14.9	18–18.7 18.4 ± 0.4	10.5–11.4 11 ± 0.4
Lt.c	13.1	6–6.8 6.4 ± 0.2	7.4	10.4	6.2–7 6.6 ± 0.2
Al.c.	8.4	4–4.6 6.3 ± 0.2	5.4	6.1–6.3 6.2 ± 0.1	4.1–4.4 4.3 ± 0.2
In	–/–	–62.5% +37.5%	–/–	–100%	–100%

Table 4. Morphological characters of specimens of *Pelias darevskii uzumorum* ssp. nov. from Zekeriya Village, Turkey. See Table 2 for abbreviations.

Character	♂♂ Adult (n = 3) min–max ± m	♂♂ Juv. (n = 2) min–max ± m	♀♀ Adult (n = 9) min–max ± m	♀♀ Juv. (n = 3) min–max ± m	♂♂Adult + Juv. (n = 5) min–max ± m	♀♀ Adult + Juv. (n = 12) min–max ± m
L.t.	405–450 421.7 ± 14.2	131–131.9 131.5 ± 0.5	365–459.2 404.2 ± 11.3	112–127 120.3 ± 4.4	–	–
L.	345–390 365 ± 13.2	109–115.3 112.2 ± 3.2	328–408.8 360.4 ± 9.7	100–114 107.3 ± 4.1	–	–
L.cd.	50–60 56.7 ± 3.3	16.6–22 19.3 ± 2.7	35–50.4 43.9 ± 1.8	12– 14 13 ± 2.8	–	–
Pr.	1–3 2 ± 0.6	1–2 1.5 ± 0.5	2–3 2.4 ± 0.2	1–3 2 ± 0.6	1–3 1.8 ± 0.4	1–3 2.3 ± 0.2
Ven.	129–138 134.3 ± 2.7	133–137 135 ± 2	130–144 136.9 ± 1.6	130–137 134 ± 0.6	129–138 134.6 ± 1.6	130–144 136.2 ± 1.3
S.c.	33–38 35.3 ± 1.5	34–39 36.5 ± 2.5	26–33 29.6 ± 0.8	27–31 29.3 ± 1.2	33–39 35.8 ± 1.2	26–33 29.5 ± 0.6
Ap.	2	2	1–2 1.8 ± 0.1	2	2	1–2 1.8 ± 0.1
R.	–	71.7	66.7–80.3 72.6 ± 2.6	60.3–61.1 63.8 ± 1.8	–	–
Pil.	–	7.9–9 8.5 ± 0.5	11.4–12.5 12.1±0.2	6.3–6.9 6.7 ± 0.2	–	–
Crown scales	7–8 7.3 ± 0.3	9–11 10 ± 1	2–12 7.8 ± 0.2	8–10 9 ± 0.6	7–11 8.4 ± 0.7	2–12 8.1 ± 0.9
Can.	6	6	5–6 5.8 ± 1.2	6–7 6.3 ± 0.3	6	5–7 5.9 ± 0.2
Sq.1	20–23 21.3 ± 0.9	21–23 22 ± 1	18–23 20.2 ± 0.1	20–21 20.3 ± 0.3	20–23 21.6 ± 0.6	18–23 20.3 ± 0.4
Sq.2	19–21 19.7 ± 0.7	19–21 20 ± 1	19 – 21 19.7±0.1	19–20 19.7 ± 0.3	19–21 19.8 ± 0.5	19–21 19.7 ± 0.2
Sq.3	16–17 16.7 ± 0.3	17	16–19 16.7 ± 0.5	17–18 17.3 ± 0.3	16–17 16.8 ± 0.2	16– 19 16.8 ± 0.3
Supralab	9	8–9 8.5 ± 0.5	7–11 9.2 ± 0.15	9 –11 10 ± 0.3	8 –11 8.8 ± 0.2	7–11 9.4 ± 0.3
Sublab	9–10 9.5 ± 0.3	9–11 9.75 ± 0.8	9–10 9.2 ± 0.35	9–10 9 ± 0.3	9–11 9.6 ± 0.3	8–10 9.2 ± 0.1
F.c.	9	8–11 9.3 ± 1.3	8–12 9.35 ± 0.3	8–10 9.4 ± 0.5	8–11 9.1 ± 0.4	8–12 9.4 ± 0.5
ZZ	82–86 84 ± 1.2	85–89 87 ± 2	63– 90 78.5 ± 2.1	55–74 67 ± 5.6	82–89 85.2 ± 1.2	55–90 75.6 ± 2.4
Lor.	4–6 4.65±1.3	4–5 4.5 ± 0.5	2–7 4.9 ± 0.5	3–6 4.4 ± 0.9	4–6 4.5 ± 0.4	2–7 4.8 ± 0.9
L.c.	–	10.3–13.7 12 ± 1.7	15.4–20 18.6 ± 0.7	7.1–10.8 9.3 ± 1.1	–	–
Lt.c	–	5.3–6.3 5.8 ± 0.5	8.2–11.8 10.3 ± 0.5	6–6.8 6.3 ± 0.2	–	–
Al.c.	–	3.8–4.7 4.3 ± 0.5	6.6–8.4 7.3 ± 0.3	3.9–4.1 4.03 ± 0.1	–	–
In	–100%	–100%	–77.7% +33.3%	–83.3% +16.7%	–100%	–79.2% +20.8%

Table 5. Morphological characters of specimens of *Pelias darevskii kumlutasi* ssp.nov. from Ardahan pass and Bağdaşan Village, Turkey. See Table 2 for abbreviations.

Character	♀♀ Adult (n = 4) min–max ± m	♀♀ Subad. (n = 2) min–max ± m	♀♀ Adult + Subad. (n = 6) min–max ± m	♂♂ Subad. (n = 2) min–max ± m
L.t.	372–465 426 ± 20.02	225–263 244 ± 19	–	265–270 267.5 ± 2.5
L.	330–417 382.5 ± 18.6	199–237 218 ± 19	–	232–234 233 ± 1
L.cd.	35–49 43.5 ± 3.2	26	–	33–36 34.5 ± 1.5
Pr.	2–3 2.3 ± 0.3	2	2–3 2.2 ± 0.2	1–2 1.5 ± 0.5
Ven.	131–134 133 ± 0.7	135–137 136 ± 1	131–137 134 ± 0.8	134–135 134.5 ± 0.5
S.c.	24–31 28.3 ± 1.6	28–30 29 ± 1	24–31 28.5 ± 1.02	36
Ap.	1–2 1.3 ± 0.3	1–2 1.5 ± 0.5	1–2 1.3 ± 0.2	1–2 1.5 ± 0.5
R.	54.3–67.8 60.03 ± 2.9	61–64.1 62.6 ± 1.6	–	58–62.5 50.2 ± 2.3
Pil.	11.7–13.1 12.5 ± 0.3	9.3– 9.8 9.6 ± 0.3	–	9– 9.3 9.2 ± 0.2
Crown scales	6–9 7.3 ± 0.8	5–8 6.5 ± 1.5	5–6 5.3 ± 0.6	5–10 7.5 ± 2.5
Can.	5–6 5.3 ± 0.3	5–6 5.5 ± 0.5	5–7 6 ± 0.2	5
Sq.1	21–22 21.3 ± 0.3	20–21 20.5 ± 0.5	20–22 21 ± 0.3	20–21 20.5 ± 0.5
Sq.2	20–21 20.8 ± 0.3	21	20–21 20.8 ± 0.2	21
Sq.3	17	17	17	17
Supralab	10–11 10.3 ± 0.2	10–11 10.5 ± 0.5	10–11 10.4 ± 0.2	10
Sublab	9	9–10 9.3 ± 0.3	9–10 9.1 ± 0.1	9–10 9.8 ± 0.3
F.c.	8–11 9.5 ± 0.4	9–10 9.3 ± 0.3	8–11 9.4 ± 0.3	9
ZZ	72– 83 78.9 ± 3.5	78–89 82.8 ± 3.8	72–89 80.2 ± 5.2	88–97 92.8 ± 2.8
Lor.	3–5 4.4 ± 0.4	2–7 4.5 ± 2.5	2–7 4.4 ± 0.7	2–3 2.8 ± 0.3
L.c.	19.7–22.4 20.9 ± 0.6	14.4–15.2 14.8 ± 0.4	–	15.4–15.7 15.6 ± 0.2
Lt.c	11.4–12.7 12.2 ± 0.3	8.2–9.2 8.7 ± 0.5	–	8.8
Al.c.	6.9–8 7.3 ± 0.2	5–5.9 5.5 ± 0.5	–	5.1–5.5 5.3 ± 0.2
In	–75% +25%	–100%	–83.3% +16.7%	–50% +50%

Table 6. Average values of morphological characters of samples of *Pelias* spp. See Table 2 for abbreviations.

Characters	Sample 1 Erzincan *P. sakoi* sp. nov.		Sample 2 Zekeriya Village *P. darevskii uzumorum* ssp. nov.		Sample 3 Ardahan pass and Bağdaşan Village *P. darevskii kumlutasi* ssp.nov.		Sample 4 Mt. Ilgar-Dağ *P. olguni*		Sample 5 Mt. Sevsar *P. darevskii*		Sample 6 Armenia *P. eriwanensis*	
	♂♂ (n = 4)	♀♀ (n = 6)	♂♂ (n = 5)	♀♀ (n = 12)	♂♂ (n = 2)	♀♀ (n = 6)	♂♂ (n = 5)	♀♀ (n = 11)	♂♂ (n = 13)	♀♀ (n = 12)	♂♂ (n = 9)	♀♀ (n = 12)
Pr.	2.3 ± 0.6	2.2 ± 0.7	1.8 ± 0.4	2.3 ± 0.2	1.5 ± 0.5	2.2 ± 0.2	1.4 ± 0.2	1.4 ± 0.3	3.2 ± 0.3	3 ± 0.3	1.7 ± 0.3	2.1 ± 0.2
Ven.	136.3 ± 0.5	138.3 ± 0.7	134.6 ± 1.6	136.2 ± 1.3	134.5 ± 0.5	134 ± 0.8	130.4 ± 0.9	133.1 ± 0.6	132.5 ± 1.1	136.1 ± 1.1	132.8 ± 1.5	136.6 ± 1
S.c.	36.8 ± 1.8	27.7 ± 0.8	35.8 ± 1.2	29.5 ± 0.6	36	28.5 ± 1.02	31.4 ± 0.7	27.2 ± 0.6	33.3 ± 0.8	26 ± 0.6	34.6 ± 0.6	26.5 ± 0.6
Ap.	1	1.3 ± 0.2	2	1.8 ± 0.1	1.5 ± 0.5	1.3 ± 0.2	1.4 ± 0.2	1.4 ± 0.2	1.6 ± 0.1	1.3 ± 0.1	1.2 ± 0.2	1.1 ± 0.1
C.s.	5.3 ± 0.9	6.2 ± 0.6	8.4 ± 0.7	8.1 ± 0.9	7.5 ± 2.5	5.3 ± 0.6	10.8 ± 1.6	7.5 ± 0.7	7.4 ± 0.7	6.5 ± 0.7	6.9 ± 0.6	6.5 ± 0.5
Can.	5	5.3 ± 0.2	6	5.9 ± 0.2	5	6 ± 0.2	5.4 ± 0.2	5.4 ± 0.2	5.6 ± 0.1	5.3 ± 0.1	5.2 ± 0.2	5.1 ± 0.1
Sq.1	20.3 ± 1.5	21	21.6 ± 0.6	20.3 ± 0.4	20.5 ± 0.5	21 ± 0.3	22.2 ± 0.7	21.7 ± 0.5	19.9 ± 0.3	20.6 ± 0.3	20.3 ± 0.3	20.9 ± 0.1
Sq.2	19	21	19.8 ± 0.5	19.7 ± 0.2	21	20.8 ± 0.2	21 ± 0.3	21.1 ± 0.3	19.9 ± 0.2	20.6 ± 0.2	20.7 ± 0.2	20.8 ± 0.1
Sq.3.	17	17.2 ± 0.2	16.8 ± 0.2	16.8 ± 0.3	17	17	17 ± 0.6	17.1 ± 0.3	16.6 ± 0.1	16.8 ± 0.2	17	17.1 ± 0.1
Supralab	10.8 ± 0.4	10.8 ± 0.2	8.8 ± 0.2	9.4 ± 0.3	10	10.4 ± 0.2	9.8 ± 0.5	9.8 ± 0.3	9.1 ± 0.1	9.2 ± 0.2	9 ± 0.1	9.2 ± 0.2
Sublab	8.8 ± 0.4	8.6 ± 0.2	9.6 ± 0.3	9.2 ± 0.1	9.8 ± 0.3	9.1 ± 0.1	8.6 ± 0.4	8.9 ± 0.2	9.6 ± 0.2	9.6 ± 0.2	9.4 ± 0.2	9.6 ± 0.2
F.c.	8.5 ± 0.9	7.7 ± 0.8	9.1 ± 0.4	9.4 ± 0.5	9	9.4 ± 0.3	9.6 ± 0.5	9.2 ± 0.3	8.9 ± 0.2	8.9 ± 0.3	9.6 ± 0.3	9.6 ± 0.2
ZZ	77 ± 4.8	73.2 ± 1	85.2 ± 1.2	75.6 ± 2.4	92.8 ± 2.8	80.2 ± 5.2	73.1 ± 3.3	73.4 ± 3.2	88.7 ± 2.1	84.7 ± 24	73.5 ± 1.6	65.4 ± 2.9
Lor.	2.5 ± 0.1	2.9 ± 0.5	4.5 ± 0.4	4.8 ± 0.9	2.8 ± 0.3	4.4 ± 0.7	2.9 ± 0.2	3.5 ± 0.5	2.6 ± 0.2	3.5 ± 0.3	4.6 ± 0.4	5.5 ± 0.3
In.	−100%	−83.3% +16.7%	−100%	−79.2% +20.8%	−50% +50%	−83.3% +16.7%	−60% +40%	−68.2% +31.8%	−57.1% +42.9%	−40.9% +59.1%	−94.4% +5.6%	−87.5% +12.5%

Table 7. Significance levels (*P*) of differences between samples of all age groups of males of *Pelias* spp. See Table 2 for abbreviations and Table 6 for average values of the samples. Designations: * – $P < 0.05$; ** – $P < 0.01$; *** – $P < 0.001$; "–" – no significant differences.

Character	♂♂ 1/2 n = 9	♂♂ 1/3 n = 6	♂♂ 1/4 n = 9	♂♂ 1/5 n = 17	♂♂ 1/6 n = 13	♂♂ 2/3 n = 7	♂♂ 2/4 n = 10	♂♂ 2/5 n = 18	♂♂ 2/6 n = 14	♂♂ 3/4 n = 7	♂♂ 3/5 n = 15	♂♂ 3/6 n = 11	♂♂ 4/5 n = 18	♂♂ 4/6 n = 14	♂♂ 5/6 n = 22
Pr.	–	–	–	–	–	–	–	**	–	–	*	–	***	–	***
Ven.	–	–	***	–	–	–	–	–	–	*	–	–	–	–	–
S.c.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ap.	***	–	–	*	–	–	*	–	**	–	–	–	–	–	–
Crown scales	*	–	*	–	–	–	–	–	–	–	–	–	*	**	–
Can.	***	–	–	*	–	***	–	–	**	–	–	–	–	–	–
Sq.1	–	–	–	–	–	–	–	*	–	–	–	–	**	*	–
Sq.2	–	***	***	*	***	–	–	–	–	–	–	–	**	–	*
Sq.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	*
Supralab	***	–	–	***	***	**	–	–	–	–	**	***	*	*	–
Sublab	–	–	–	*	–	–	–	–	–	–	–	–	*	–	–
F.c.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
ZZ	–	–	–	*	–	*	**	–	***	**	–	***	***	–	***
Lor.	**	–	–	–	**	*	**	***	–	–	–	–	–	**	***

Table 8. Significance levels (P) of differences between samples of all age groups of females of *Pelias* spp. See Table 2 for abbreviations and Table 6 for average values of the samples. Designations: * – $P < 0.05$; ** – $P < 0.01$; *** – $P < 0.001$; "–" – no significant differences.

	Character	♀♀ 1/2 n = 18	♀♀ 1/3 n = 12	♀♀ 1/4 n = 17	♀♀ 1/5 n = 18	♀♀ 1/6 n = 18	♀♀ 2/3 n = 18	♀♀ 2/4 n = 23	♀♀ 2/5 n = 24	♀♀ 2/6 n = 24	♀♀ 3/4 n = 17	♀♀ 3/5 n = 18	♀♀ 3/6 n = 18	♀♀ 4/5 n = 23	♀♀ 4/6 n = 23	♀♀ 5/6 n = 24
1	Pr.	–	–	–	–	–	–	**	–	–	–	–	–	***	*	**
2	Ven.	–	**	***	–	–	–	–	–	–	–	–	–	–	**	–
3	S.c.	–	–	–	–	–	–	**	***	***	–	*	–	–	–	–
4	Ap.	*	–	–	–	–	*	*	**	***	–	–	–	–	–	–
5	Crown scales	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
6	Can.	*	–	–	–	–	*	**	**	***	–	–	–	–	–	–
7	Sq.1	–	–	–	–	–	–	*	–	–	–	–	–	–	–	–
8	Sq.2	***	–	–	–	–	**	**	**	***	–	–	–	–	–	–
9	Sq.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
10	Supralab	**	–	*	***	***	–	–	–	–	–	***	***	–	–	–
11	Sublab	**	**	–	**	**	–	–	*	–	–	–	–	*	*	–
12	F.c.	**	–	*	–	**	–	–	–	–	–	–	–	–	–	–
13	ZZ	–	*	–	**	–	–	–	**	**	*	–	**	***	*	***
14	Lor.	**	–	–	–	***	–	*	**	–	–	–	–	–	***	***

Table 9. Comparison of morphological characters of all age groups of males and females of *Pelias sakoi* sp. nov. (Erzincan, Turkey). See Table 2 for abbreviations.

Character	♂♂ (n = 4) min–max ± m	♀♀ (n = 6) min–max ± m	t	*P*
Pr.	1–4 2.3 ± 0.6	0–3 2.2 ± 0.7	0.08	>0.05
Ven.	135–137 136.3 ± 0.5	137–141 138.3 ± 0.7	2.14	>0.05
S.c.	33–41 36.8 ± 1.8	26–31 27.7 ± 0.8	4.7	<0.001
Ap.	1	1–2 1.3 ± 0.2	1.26	>0.05
Crown scales	3–7 5.25 ± 0.9	5–9 6.2 ± 0.6	0.9	>0. 05
Can.	5	5–6 5.3 ± 0.2	1.26	>0.05
Sq.1	19–21 20.3 ± 1.5	21	1.98	>0.05
Sq.2	19	21	0.2	<0.001
Sq.3	17	17–18 17.2 ± 0.2	0.8	>0.05
Supralab	10–12 10.8 ± 0.4	10–12 10.8 ± 0.2	–	–
Sublab	8–10 8.8 ± 0.4	8–9 8.6 ± 0.2	0.5	>0.05
F.c.	5–10 8.5 ± 0.9	5–10 7.7 ± 0.75	0.7	>0.05
ZZ	65–91 77 ± 4.8	69–77 73.2 ± 1	0.36	>0.05
Lor.	2–3 2.5 ± 0.1	1–5 2.9 ± 0.5	0.7	>0.05
In	–100%	–83.3% +16.7%	–	–

Table 10. Comparison of morphological characters of all age groups of males and females of *Pelias darevskii uzumorum* ssp. nov. (Zekeriya Village, Turkey). See Table 2 for abbreviations.

Character	♂♂ (n = 5) min–max ± m	♀♀ (n = 12) min–max ± m	t	P
Pr.	1–3 1.8 ± 0.4	1–3 2.3 ± 0.2	1.4	>0.05
Ven.	129–138 134.6 ± 1.6	130–144 136.2 ± 1.3	0.7	>0. 05
S.c.	33–39 35.8 ± 1.2	26–33 29.5 ± 0.6	5.1	<0.001
Ap.	2	1–2 1.8 ± 0.1	0.9	>0.05
Crown scales	7–11 8.4 ± 0.7	2–12 8.1 ± 0.9	0.2	>0. 05
Can.	6	5–7 5.9 ± 0.2	0.4	>0.05
Sq.1	20–23 21.6 ± 0.6	18–23 20.3 ± 0.4	2.02	>0.05
Sq.2	19–21 19.8 ± 0.5	19–21 19.7 ± 0.2	0.2	>0.05
Sq.3	16– 17 16.8 ± 0.2	16– 19 16.8 ± 0.3	0.07	>0.05
Supralab	8 –11 8.8 ± 0.2	7 –11 9.4 ± 0.3	1.1	>0.05
Sublab	9–11 9.6 ± 0.3	8–10 9.2 ± 0.1	2.1	>0.05
F.c.	8–11 9.1 ± 0.4	8–12 9.4 ± 0.5	0.6	>0.05
ZZ	82–89 85.2 ± 1.2	55–90 75.6 ± 2.4	2.4	<0.05
Lor.	4–6 4.5 ± 0.4	2–7 4.8 ± 0.9	0.2	>0.05
In	–100%	–79.2% +20.8%		

Table 11. Comparison of morphological characters of all age groups of males and females of *Pelias darevskii kumlutasi* ssp. nov. (Ardahan pass and Bağdaşan Village, Turkey). See Table 2 for abbreviations.

Character	♂♂ (n = 2) min–max ± m	♀♀ (n = 6) min–max ± m	t	P
Pr.	1–2 1.5 ± 0.5	2–3 2.2 ± 0.2	1.7	>0.05
Ven.	134–135 134.5 ± 0.5	131–137 134 ± 0.8	0.3	>0. 05
S.c.	36	24–31 28.5 ± 1	4.00	<0.01
Ap.	1–2 1.5 ± 0.5	1–2 1.3 ± 0.2	0.4	>0.05
Crown scales	5–10 7.5 ± 2.5	5–9 7 ± 0.6	0.3	>0. 05
Can.	5	5–6 5.3 ± 0.2	0.9	>0.05
Sq.1	20–21 20.5 ± 0.5	20–22 21 ± 0.3	0.9	>0.05
Sq.2	21	20–21 20.8 ± 0.2	0.5	>0.05
Sq.3	17	17	–	–
Supralab	10	10–12 10.4 ± 0.2	1.1	>0.05
Sublab	9–10 9.8 ± 0.3	9–10 9.1 ± 0.1	3.5	<0.01
F.c.	9	8–11 9.4 ± 0.3	0.8	>0.05
ZZ	88–97 92.8 ± 2.8	72–88 80.2 ± 2.6	2.57	<0.05
Lor.	2–3 2.8 ± 0.3	2–7 4.4 ± 0.7	1.3	>0.05
In	–50% +50%	–83.3% +16.7%	–	–

Table 12. Comparison of morphological characters of adult males and females of *Pelias olguni* (Posof, Mt. Ilgar-Dağ, Turkey). See Table 2 for abbreviations.

Character	♂♂ (n = 3) min–max ± m	♀♀ (n = 6) min–max ± m	t	*P*
L.t.	288–482.9 360.3 ± 61.6	332–496 413.4 ± 24	0.9	>0.05
L.	253–426.2 315.4 ± 55.6	300–445 370.8 ± 21.4	1.2	>0.05
L.cd.	35–56.7 44.9 ± 6.3	32– 51 42.6 ± 2.8	0.4	>0.05
Pr.	1–2 1.3 ± 0.3	1–3 1.7 ± 0.3	1	>0.05
Ven.	127–132 130 ± 1.5	131–136 133.7 ± 0.7	2.5	<0.05
S.c.	31–35 33.3 ± 1.2	25–31 27.3 ± 0.8	4.1	<0.01
Ap.	1	1–2 1.2 ± 0.2	0.7	>0.05
R.	67.4–83.5 74 ± 4.9	59.7–89.8 66.5 ± 4.7	1	>0.05
Pil.	11–13.7 11.9 ± 0.9	10.9–13.02 12 ± 0.4	0.05	>0.05
Crown scales	6–15 10.7 ± 2.6	7–12 8.7 ± 0.8	1	>0.05
Can.	5	5–6 5.2 ± 0.2	0.7	>0.05
Sq.1	20–23 22 ± 1	21–24 22 ± 0.5	0	0
Sq.2	20–21 20.7 ± 0.3	21–22 21.2 ± 0.2	1.5	>0.05
Sq.3	16–19 17.3 ± 0.9	15–19 17 ± 0.6	0.3	>0.05
Supralab	8–11 9.5 ± 0.6	7–11 9.8 ± 0.6	0.3	>0.05
Sublab	8–10 9 ± 0.6	9–10 9.4 ± 0.2	0.7	>0.05
F.c.	8–11 9.85 ± 0.8	8–12 9.4 ± 0.5	0.5	>0.05
ZZ	71– 83 77.4 ± 3.4	68–79 72.7 ± 2.05	1.3	>0.05
Lor.	2–4 3.15 ± 0.6	3–6 3.9 ± 0.4	0.9	>0.05
L.c.	12.4–18.5 15.8 ± 1.8	18.2–21.3 20 ± 0.6	2.9	<0.05
Lt.c	8.5–9.5 9 ± 0.3	8.4–13.7 11.4 ± 0.8	2	>0.05
Al.c.	6.4–7.1 6.6 ± 0.2	6.5–8.2 7.4 ± 0.3	1.7	>0.05
In	–33.3% +67.7%	–67.7% +33.3%		

Table 13. Comparison of morphological characters of immature males and females of *Pelias olguni* (Posof, Mt. Ilgar-Dağ, Turkey). See Table 2 for abbreviations.

Character	♂♂ (n = 2) min–max ± m	♀♀ (n = 5) min–max ± m	t	*P*
L.t.	159–160 159.5 ± 0.5	81–163 123.2 ± 15.2	1.4	>0.05
L.	139–144 141.5 ± 2.5	73–146 110.2 ± 13.5	1.4	>0.05
L.cd.	16–20 18 ± 2	8–17 13 ± 1.7	1.6	>0.05
Pr.	0–3 1.5 ± 0.5	0–2 1.2 ± 0.4	1	>0.05
Ven.	130–131 130.5 ± 0.5	130–136 132.4 ± 1	1.7	>0.05
S.c.	33–34 33.5 ± 0.5	24–29 27 ± 0.9	4.3	<0.01
Ap.	2	1–2 1.6 ± 0.2	1	>0.05
R.	64.9–71.2 68.1 ± 3.2	60–79.7 69.2 ± 3.3	0.2	>0.05
Pil.	7.9–11.2 9.6 ± 1.7	6–9.2 7.6 ± 0.6	1.5	>0.05
Crown scales	9–13 11 ± 2	4–8 6.2 ± 0.7	3	<0.05
Can.	6	5–6 5.6 ± 0.2	1	>0.05
Sq.1	21–24 22.5 ± 1.5	19–24 21.4 ± 0.9	1.4	>0.05
Sq.2	21–22 21.5 ± 0.5	19–23 21 ± 0.6	0.6	>0.05
Sq.3	16–17 16.5 ± 0.5	17–18 17.2 ± 0.2	0.5	>0.05
Supralab	9–11 10.25 ± 0.75	9–11 9.8 ± 0.25	1.6	>0.05
Sublab	8	8–9 8.4 ± 0.25	0.8	>0.05
F.c.	9–10 9.25 ± 0.25	8–10 8.8 ± 0.25	1	>0.05
ZZ	65–68.5 66.75 ± 1.75	70–83 74.5 ± 2.7	1	>0.05
Lor.	2–3 2.5 ± 0.5	3–4 3.1 ± 0.1	1.9	>0.05
L.c.	11.4–11.7 11.6 ± 0.2	8.7–11.4 10.4 ± 0.5	1.5	>0.05
Lt.c	7.3–7.4 7.35 ± 0.1	5.1–8 6.2 ± 0.5	1.4	>0.05
Al.c.	4.8–5.2 5 ± 0.2	3.7–4.8 4.3 ± 0.2	1.9	>0.05
In	–100%	–90% +10%		

Table 14. Comparison of morphological characters of all age groups of males and females of *Pelias olguni* (Posof, Mt. Ilgar-Dağ, Turkey). See Table 2 for abbreviations.

Character	♂♂ (n = 5) min–max ± m	♀♀ (n = 11) min–max ± m	t	*P*
Pr.	1–4 1.4 ± 0.2	0–3 1.4 ± 0.3	0.08	>0.05
Ven.	127–132 130.4 ± 0.9	130–136 133.1 ± 0.6	2.5	<0. 05
S.c.	31–35 31.4 ± 0.7	24–31 27.2 ± 0.6	6.3	<0.001
Ap.	1–2 1.4 ± 0.2	1–2 1.4 ± 0.2	0.1	>0.05
Crown scales	6–15 10.8 ± 1.6	4–12 7.5 ± 0.7	2.3	<0. 05
Can.	5–6 5.4 ± 0.2	5–6 5.4 ± 0.2	0.3	>0.05
Sq.1	20–24 22.2 ± 0.7	19–24 21.7 ± 0.5	0.5	>0.05
Sq.2	20–22 21 ± 0.3	19–23 21.1 ± 0.3	0.2	>0.05
Sq.3	16–19 17 ± 0.6	15–19 17.1 ± 0.3	0.2	>0.05
Supralab	8–11 9.8 ± 0.45	7–11 9.75 ± 0.3	0.04	>0.05
Sublab	8–10 8.6 ± 0.4	8–10 8.9 ± 0.2	0.7	>0.05
F.c.	8–11 9.6 ± 0.45	8–12 9.15 ± 0.25	0.9	>0.05
ZZ	65–83 73.1 ± 3.25	68–83 73.4 ± 3.2	0.09	>0.05
Lor.	2–4 2.9 ± 0.2	3–6 3.5 ± 0.5	1.3	>0.05
In	–60% +40%	–68.2% +31.8%		

Table 15. Comparison of morphological characters of adult males and females of *Pelias darevskii* from Armenia. See Table 2 for abbreviations.

Character	♂♂ (n = 2) min–max ± m	♀♀ (n = 4) min–max ± m	t	*P*
L.t.	359–380 369.5 ± 10.5	335–517 457.8 ± 42	1.4	>0.05
L.	302–323 312.5 ± 50.5	300–475 414.5 ± 39.6	1.7	>0.05
L.cd.	57	35–48 43.3 ± 3.1	2.3	<0.05
Pr.	3–6 4.5 ± 1.5	3–5 3.5 ± 0.5	1.2	>0.05
Ven.	125–135 130 ± 3.5	134–139 135.3 ± 1.3	2.4	>0.05
S.c.	37	24–30 26.3 ± 1.3	5.5	<0.01
Ap.	1–2 1.5 ± 0.5	1–2 1.5 ± 0.3	–	–
R.	66.3–74 70.2 ± 3.8	56.1–82.3 66.6 ± 6.3	0.4	>0.05
Pil.	11–11.9 11.5 ± 0.5	11.2–13.8 12.5 ± 0.5	1.2	>0.05
Crown scales	5	5–7 6 ± 0.6	1.2	>0.05
Can.	5–6 5.5 ± 0.5	5–6 5.5 ± 0.3	–	–
Sq.1	21	19–23 20.8 ± 0.9	0.2	>0.05
Sq.2	20	19–21 20.5 ± 0.5	0.7	>0.05
Sq.3	16–17 16.5 ± 0.5	16–17 16.8 ± 0.3	0.5	>0.05
Supralab	8–10 9.3 ± 0.8	9–10 9.7 ± 0.3	0.6	>0.05
Sublab	9–10 9.25 ± 0.25	9–10 9.4 ± 0.25	0.3	>0.05
F.c.	8–9 8 ± 0.5	7–10 9 ± 0.5	0.6	>0.05
ZZ	79–85 82.25 ± 2.8	76–88 81.35 ± 3.9	0.2	>0.05
Lor.	1–3 2 ± 0.5	2–5 3.5 ± 0.4	2.2	>0.05
L.c.	18.5–18.6 18.55 ± 0.1	18.9–23.3 21.9 ± 1	2.2	>0.05
Lt.c	9.8–10 9.9 ± 0.1	10.2–12.9 11.7 ± 0.6	2.03	>0.05
Al.c.	6.5–7.4 7 ± 0.5	5.8–10.2 7.9 ± 1.1	0.6	>0.05
In	+100%	+62.5 % –37.5%		

Table 16. Comparison of morphological characters of immature males and females of *Pelias darevskii* from Armenia. See Table 2 for abbreviations.

Character	♂♂ (n = 12) min–max ± m	♀♀ (n = 7) min–max ± m	t	*P*
L.t.	158–183 170.2 ± 1.7	146–172 166.1 ± 3.6	1.1	>0.05
L.	137–159 148.1 ± 1.6	130–155 147.7 ± 3.1	0.1	>0.05
L.cd.	18–25 22.1 ± 0.6	15– 21 18.4 ± 0.9	3.6	<0.01
Pr.	2–4 2.9 ± 0.2	1–4 2.8 ± 0.4	0.6	>0.05
Ven.	126–136 132.5 ± 1	128–142 136.6 ± 1.6	4.1	<0.001
S.c.	26–36 32.1 ± 1	22–27 26 ± 0.7	4.5	<0.001
Ap.	1–2 1.6 ± 0.2	1–2 1.3 ± 0.2	1.2	>0.05
R.	46.7–71.2 58.1 ± 2	59.2–73.8 61.5 ± 3.3	0.9	>0.05
Pil.	5.2–8.8 8 ± 0.3	7.2–8.7 7.8 ± 0.2	0.4	>0.05
Crown scales	2–11 7.4 ± 0.8	5–11 7.2 ± 1.1	0.1	>0.05
Can.	5–6 5.6 ± 0.1	5–6 5.3 ± 0.2	1.2	>0.05
Sq.1	18–21 19.8 ± 0.3	19–21 20.4 ± 0.4	1.1	>0.05
Sq.2	19–21 20 ± 0.2	19–21 20.6 ± 0.3	1.4	>0.05
Sq.3	16–17 16.6 ± 0.1	16–18 16.9 ± 0.3	1	>0.05
Supralab	8–10 9 ± 0.1	8–10 8.95 ± 0.15	0.6	>0.05
Sublab	9–11 9.65 ± 0.2	9–11 9.65 ± 0.25	0.1	>0.05
F.c.	7–10 8.75 ± 0.3	8–11 9.15 ± 0.25	0.9	>0.05
ZZ	79–102 89.1 ± 2.25	78–104 86.5 ± 3.25	0.6	>0.05
Lor.	2–4 2.65 ± 0.15	2–5 3.65 ± 0.3	3.5	<0.01
L.c.	11–15.4 13.1 ± 0.4	11.9–12.8 12.2 ± 0.1	2	>0.05
Lt.c	6.6–9.9 8.2 ± 0.3	6.2–9.4 7.6 ± 0.4	1.2	>0.05
Al.c.	4.2–5 4.7 ± 0.1	4.3–5 4.6 ± 0.1	0.7	>0.05
In	–67.6% +33.3%	–42.9% +57.1%		

Table 17. Comparison of morphological characters of all age groups of males and females of *Pelias darevskii* from Armenia. See Table 2 for abbreviations.

Character	♂♂ (n = 13) min–max ± m	♀♀ (n = 12) min–max ± m	t	*P*
Pr.	2–6 3.2 ± 0.3	1–5 3 ± 0.3	0.4	>0.05
Ven.	125–136 132.5 ± 1.1	128–142 136.1 ± 1.1	2.4	<0.05
S.c.	27–37 33.3 ± 0.8	22–30 26 ± 0.6	7.1	<0.001
Ap.	1–2 1.6 ± 0.1	1–2 1.3 ± 0.1	1.4	>0.05
Crown scales	2–11 7.4 ± 0.7	3–11 6.5 ± 0.7	0.8	>0.05
Can.	5–6 5.6 ± 0.1	5–6 5.3 ± 0.1	1.4	>0.05
Sq.1	18–21 19.9 ± 0.3	19–23 20.6 ± 0.3	1.4	>0.05
Sq.2	19–21 19.9 ± 0.2	19–21 20.6 ± 0.2	2.1	<0.05
Sq.3	16–17 16.6 ± 0.1	16–18 16.8 ± 0.2	0.6	>0.05
Supralab	8–10 9.1 ± 0.1	7–10 9.15 ± 0.15	0.3	>0.05
Sublab	9–11 9.6 ± 0.2	9–11 9.55 ± 0.15	0.02	>0.05
F.c.	8–10 8.9 ± 0.2	6–11 8.9 ± 0.3	0.9	>0.05
ZZ	79–102 88.7 ± 2.05	76–102 84.65 ± 2.35	1.3	>0.05
Lor.	1–4 2.6 ± 0.15	2–5 3.45 ± 0.25	3	<0.01
In	−57.1% +42.9%	−40.9% +59.1%		

Table 18. Comparison of morphological characters of adult males and females of *Pelias eriwanensis* from Armenia. See Table 2 for abbreviations.

Character	♂♂ (n = 5) min–max ± m	♀♀ (n = 7) min–max ± m	t	*P*
L.t.	355–463 400.6 ± 20	313–525 446.3 ± 26.2	1.3	>0.05
L.	303–405 347.4 ± 18.9	280–475 398.6 ± 24.4	1.5	>0.05
L.cd.	51–58 53.2 ± 1.2	33–50 41.6 ± 2.2	4.1	<0.01
Pr.	0–3 1.6 ± 0.5	1–3 2.1 ± 0.3	1.03	>0.05
Ven.	128–139 132.8 ± 2.4	132–143 137.7 ± 1.4	1.9	>0.05
S.c.	33–35 34 ± 0.5	22–29 26.3 ± 0.9	6.8	<0.001
Ap.	1–2 1.2 ± 0.2	1–2 1.1 ± 0.1	0.2	>0.05
R.	66.4–88.9 74.4 ± 4	59.5–72.8 67 ± 1.8	1.9	>0.05
Pil.	10–12.3 11.2 ± 0.4	9.9–14 12.1 ± 0.5	1.3	>0.05
Crown scales	5–9 6.6 ± 1	4–9 6.1 ± 0.6	0.4	>0.05
Can.	5–6 5.2 ± 0.2	5–6 5.1 ± 0.1	0.2	>0.05
Sq.1	19–21 20.2 ± 0.5	20–21 20.9 ± 0.1	1.5	>0.05
Sq.2	19–21 20.6 ± 0.4	20–21 20.9 ± 0.1	0.7	>0.05
Sq.3	17	17	–	–
Supralab	8–9 8.9 ± 0.1	9–11 9.2 ± 0.2	1.2	>0.05
Sublab	8–10 9.1 ± 0.25	8–11 9.6 ± 0.3	1.7	>0.05
F.c.	9–11 9.9 ± 0.25	9–10 9.5 ± 0.2	1.5	>0.05
ZZ	69–84 75.5 ± 2.45	60–82 69.6 ± 3.1	1.4	>0.05
Lor.	3–6 4.7 ± 0.4	4–7 5.5 ± 0.4	1.4	>0.05
L.c.	16.7–20 18.4 ± 0.5	17.2–23 20.5 ± 0.8	2.02	>0.05
Lt.c	8.6–11.3 10.3 ± 0.5	8.5–14 11.3 ± 0.7	1.1	>0.05
Al.c.	6.6–8.8 7.6 ± 0.4	6–9 7.5 ± 0.4	0.1	>0.05
In	−90% +10%	−67.1% +42.9%		

Table 19. Comparison of morphological characters of all age groups of males and females of *Pelias eriwanensis* from Armenia. See Table 2 for abbreviations.

Character	♂♂ (n = 9) min–max ± m	♀♀ (n = 12) min–max ± m	t	*P*
Pr.	0–3 1.7 ± 0.3	1–3 2.1 ± 0.2	1.4	>0.05
Ven.	128–139 132.8 ± 1.5	131–143 136.6 ± 1	2.22	<0.05
S.c.	32–37 34.6 ± 0.6	22–30 26.5 ± 0.6	9.4	<0.001
Ap.	1–2 1.2 ± 0.2	1–2 1.1 ± 0.1	0.9	>0.05
Crown scales	5–9 6.9 ± 0.6	4–9 6.5 ± 0.5	0.5	>0.05
Can.	5–6 5.2 ± 0.2	5–6 5.1 ± 0.1	0.9	>0.05
Sq.1	19–21 20.3 ± 0.3	20–21 20.9 ± 0.1	1.9	>0.05
Sq.2	19–21 20.7 ± 0.2	20–21 20.8 ± 0.1	0.7	>0.05
Sq.3	17	17–18 17.1 ± 0.1	0.9	>0.05
Supralab	8–9 8.95 ± 0.05	7–10 9.2 ± 0.2	1.2	>0.05
Sublab	8–10 9.4 ± 0.2	8–11 9.6 ± 0.2	0.5	>0.05
F.c.	8–11 9.55 ± 0.25	7–11 9.6 ± 0.2	0.05	>0.05
ZZ	68–84 73.5 ± 1.6	46–82 65.4 ± 2.85	2.26	<0.05
Lor.	2–6 4.6 ± 0.35	4–8 5.5 ± 0.3	1.8	>0.05
In	−94.4% +5.6%	−87.5% +12.5%		

Table 20. Mahalonobis distances (right) and significance levels (left) between samples of males of *Pelias* spp. according to CDA results (see Fig. 2C). See Table 6 for average values of the samples.

Samples	*Pelias sakoi* sp. nov.	*P. darevskii uzumorum* ssp. nov.	*P. darevskii kumlutasi* ssp. nov.	*P. olguni*	*P. darevskii*	*P. eriwanensis*
Pelias sakoi sp. nov.	–	90.1	56.9	35.3	78.9	60.2
P. darevskii uzumorum ssp. nov.	0.000124	–	70.7	55.9	18.3	48.6
P. darevskii kumlutasi ssp. nov.	0.113438	0.038569	–	57.03	57.1	61.9
P. olguni	0.028790	0.001048	0.090001	–	51.8	27.5
P. darevskii	0.000029	0.043914	0.051935	0.000120	–	62.1
P. eriwanensis	0.0000373	0.000407	0.043346	0.111475	0.000001	–

Table 21. Mahalonobis distances (right) and significance levels (left) between samles of females of *Pelias* spp., according to CDA results (see Fig. 2D). See Table 6 for average values of the samples.

Sample	*Pelias sakoi* sp. nov.	*P. darevskii uzumorum* ssp. nov.	*P. darevskii kumlutasi* ssp. nov.	*P. olguni*	*P. darevskii*	*P. eriwanensis*
Pelias sakoi sp. nov.	–	15.3	14.5	18.8	20.6	16.3
P. darevskii uzumorum ssp. nov.	0.006545	–	10.9	15.6	13.7	13.4
P. darevskii kumlutasi ssp. nov.	0.057321	0.049592	–	7.8	9.2	12.6
P. olguni	0.002331	0.000306	0.243999	–	15.1	17.4
P. darevskii	0.001117	0.000930	0.139795	0.000913	–	16.7
P. eriwanensis	0.004148	0.000465	0.022203	0.000110	0.000159	–

Table 22. Contribution of different morphological characters in separation of males of *Pelias* spp., according to CDA results (see Fig. 2C). See Table 2 for abbreviations.

Character	Standardized coefficient of the first discriminant function	Character rank
Pr.	0.40	12
Ven.	0.84	3
S.c.	0.79	5
Ap.	0.56	7
C.s.	0.80	4
Can.	0.52	9
Sq.1.	0.49	10
Sq.2.	0.45	11
Sq.3.	0.75	6
Supralab.	0.38	13
Sublab.	0.89	1
F.c.	0.85	2
ZZ	0.33	14
Lor.	0.55	8

Table 23. Contribution of different morphological characters in separation of females of *Pelias* spp., according to CDA results (see Fig. 2D). See Table 2 for abbreviations.

Character	Standardized coefficient of the first discriminant function	Character rank
Pr.	0.83	7
Ven.	0.6	13
S.c.	0.81	8
Ap.	0.96	1
C.s.	0.88	4
Can.	0.95	2
Sq.1.	0.80	9
Sq.2.	0.85	6
Sq.3.	0.90	3
Supralab.	0.76	12
Sublab.	0.86	5
F.c.	0.79	10
ZZ	0.54	14
Lor.	0.77	11

Table 24. Uncorrected p-distances between samples. See Table 6 for samples. Abbreviations: Mt. – Mountain; V. – Village; n/c – not calculated.

	P. d. uzumorum	*P. d. kumlutasi*	*P. olguni*		*P. d. darevskii*		*P. dinniki*
	Zekeriya V.	Bağdaşan V.	Mt. Ilgar-Dağ	Mt. Gumbati	Mt. Madatatpa	Saragjukh V.	
Zekeriya V.	0.000						
Bağdaşan V.	0.001	n/c					
Mt. Ilgar-Dağ	0.001	0.000	0.000				
Mt. Gumbati	0.002	0.001	0.001	0.001			
Mt. Madatapa	0.003	0.002	0.002	0.002	0.000		
Saragjukh V.	0.003	0.001	0.001	0.002	0.000	0.000	
P. dinniki	0.021	0.019	0.019	0.020	0.018	0.018	n/c

Table 25. Uncorrected P-distances between populations of *Pelias* spp. See Fig. 1 for locality codes (numbers in brackets).

	Pelias sakoi sp. nov	*P. olguni+* *P. darevskii* sspp.	*P. darevskii*	*P. eriwanensis*	*P. eriwanensis* (8)	*P. eriwanensis* (9, 12)	*P. eriwanensis* (10, 11)	*P. renardi*	*P. ebneri*	*P. berus*
Pelias sakoi sp. nov.	0.0010									
P. olguni+P. darevskii sspp.	0.0326	0.0010								
P. darevskii	0.0304	0.0022	0.0002							
P. eriwanensis	0.0806	0.0653	0.0635	0.0048						
P. eriwanensis (8)					0					
P. eriwanensis (9, 12)					0.0057	0				
P. eriwanensis (10, 11)					0.0076	0.0048	0.0009			
P. renardi	0.0626	0.0487	0.0466	0.0236				0.0014		
P. ebneri	0.0757	0.0594	0.0578	0.0200				0.0196	0.0060	
P. berus	0.0598	0.0414	0.0431	0.0600				0.0465	0.0576	0.0105

Table 26. Morphological characters of the paratypes of *Pelias sakoi* sp. nov. (Erzincan, Turkey). See Table 2 for abbreviations.

No.	Sex	L.t.	L.	L.cd.	Pr.	Ven.	S.c.	Ap.	R	Pil.	C.s.	Can.	Sq.1	Sq.2	Sq.3	Supr.	Sublab	F.c.	ZZ	Lor.	L.c.	Lt.c.	Al.c.
SNP 906	♀	475	423	52	2	140	31	2	64.12	12.4	6	6	21	21	17	22	17	20	140	5	21.7	13.1	8.4
ZDEU 59/2003	♀	246	229	17	2	137	28	1	72.97	8,6	9	5	21	21	17	20	18	20	152	10	14.9	7.4	5.4
SNP 906	♀	132	119	13	2	138	27	1	65.67	7,5	6	5	21	21	18	22	16	11	147	6	10.3	6.7	4.4
SNP 906	♀	128	113	15	0	141	28	1	67.65	6,7	5	5	21	21	17	22	18	14	145	5	9.8	6.8	4.6
SNP 906	♀	118	106	12	5	137	26	2	64.52	7,1	6	6	21	21	17	22	17	13	142	6	9.6	6.2	4
SNP 906	♀	113	100	13	2	137	26	1	66.67	7	5	5	21	21	17	21	17	14	152	3	9.2	6	4
ZDEU 59/2003	♂	410	353	57	2	137	41	1	60.58	11	3	5	19	19	17	20	16	19	180	5	18	10.4	6.3
SNP 906	♂	141	126	15	2	137	35	1	58.57	7,9	6	5	21	19	17	23	19	19	156	5	11.4	7	4.1
SNP 906	♂	136	120	16	1	135	33	1	70.97	7,5	7	5	21	19	17	22	18	12	144	5	10.5	6.2	4.4

Table 27. Morphological characters of the paratypes and additional material (*) of *Pelias darevskii uzumorum* ssp. n. (Zekeriya Village, Turkey). See Table 2 for abbreviations.

No.	Sex	L.t.	L.	L.cd	Pr.	Ven.	S.c.	Ap	R	Pil.	C.s	Can.	Sq.1	Sq.2	Sq.3	Supr	Sublab	F.c	ZZ	Lor.	L.c.	Lt.c.	Al.c.
ZDEU 99/ 2011	♀	459	409	50	2	140	27	2	80.29	12.5	12	6	23	21	19	18	19	18	159	8	18.5	8.22	6.6
PGe.453*	♀	440	390	50	–	143	31	2	–	–	6	6	–	19	–	16	–	20	158	12	–	–	–
BEV.8855	♀	365	330	35	–	133	26	2	–	–	–	6	–	19	–	16	–	20	–	–	–	–	–
PGe 456*	♀	380	340	40	–	139	31	2	–	–	5	6	–	21	–	16	–	20	–	–	–	–	–
PGe 451*	♀	393	353	40	–	144	33	1	–	–	12	5	–	19	–	18	–	20	–	–	–	–	–
SNP 908	♀	397	349	48	2	135	31	2	73.2	12.1	11	6	20	19	17	20	18	17	157	12	19.4	9.7	7.1
SNP 909	♀	394	353	41	2	135	28	2	66.67	11.8	8	6	20	20	16	21	18	22	131	12	19.2	10.8	7.2
SNP 909	♀	370	328	42	3	133	31	1	67.31	11.4	2	5	18	19	16	20	18	17	159	4	18.8	10.4	7
SNP 908	♀	122	108	14	2	137	31	2	60.29	6.9	9	6	20	20	17	21	19	17	148	7	10.8	6.8	4.1
SNP 908	♀	112	100	12	1	135	30	2	66.13	6.3	10	6	20	20	17	21	18	20	142	12	10	6.2	4.1
SNP 908	♀	127	114	13	3	130	27	2	65.00	6.9	8	7	21	19	18	18	17	19	112	7	7.1	6	3.9
MNHN–RA–2002 410	♂	405	345	60	–	138	38	2	–	–	7	6	–	19	–	18	–	18	168	12	–	–	–
PGe 450*	♂	410	360	50	–	136	33	2	–	–	7	6	–	19	–	18	–	18	172	8	–	–	–
PGe 455*	♂	450	390	60	–	129	29	2	–	–	–	6	–	21	–	18	–	18	–	–	–	–	–
BEV.8369	♂	131	109	22	–	137	39	2	–	–	9	6	–	21	–	16	–	20	178	10	–	–	–
ZDEU 99/2011	♂	132	115	16.5	1	133	34	2	71.70	7.9	11	6	21	19	17	16	18	16	170	8	10.3	5.3	3.8

Table 28. Morphological characters of the paratypes of *Pelias darevskii kumlutasi* ssp. nov. (Ardahan pass and Bağdaşan Village, Turkey). See Table 2 for abbreviations.

No.	Sex	L.t.	L	L.c	Pr	Ventr	Sc	Ap	Rostr	Pil	Cs	Can	Sq1	Sq2	Sq3	Supralab	Sublab	F.c.	ZZ	Lor	Lc	Ltc	Alc
ZDEU 145/2001	♀	422	387	35	3	134	31	1	67.79	13.1	6	5	21	21	17	20	18	17	145	7	22.4	11.8	8
ZDEU 145/2001	♀	445	396	49	2	133	28	1	60.53	12.4	8	5	22	21	17	21	18	19	148	10	20.7	11.4	6.9
ZDEU 145/2001	♀	372	330	42	2	131	30	1	57.48	11.7	6	5	21	20	17	21	18	21	162	10	19.7	12.7	7.3
ZDEU 145/2001	♀	225	199	26	2	135	28	1	60.98	9.3	5	5	21	21	17	22	18	18	158	4	14.4	8.2	5
ZDEU 145/2001	♀	263	237	26	2	137	30	2	64.13	9.8	8	6	20	21	17	20	19	19	173	14	15.2	9.2	5.9
ZDEU 145/2001	♂	270	234	36	1	134	36	2	62.50	9	10	5	21	21	17	20	19	18	180	5	15.4	8.8	5.5
ZDEU 145/2001	♂	265	232	33	2	135	36	1	57.95	9.3	5	5	20	21	17	20	20	18	191	6	15.7	8.8	5.1