IDF

International Dragonfly Fund - Report

Journal of the International Dragonfly Fund

1 - 65

Oleg E. Kosterin & Azam Ahmadi

Odonata observed in Central Zagros, Iran, in late May 2017

Published: 16.04.2018

117

ISSN 1435-3393

The International Dragonfly Fund (IDF) is a scientific society founded in 1996 for the improvement of odonatological knowledge and the protection of species.
Internet: http://www.dragonflyfund.org/

This series intends to publish studies promoted by IDF and to facilitate cost-efficient and rapid dissemination of odonatological data..

Editorial Work:	Milen Marinov, Martin Schorr, Rory Dow
Layout:	Martin Schorr
IDF-home page:	Holger Hunger
Printing:	Colour Connection GmbH, Frankfurt
Impressum:	Publisher: International Dragonfly Fund e.V., Schulstr. 7B, 54314 Zerf, Germany. E-mail: oestlap@online.de
Responsible editor:	Martin Schorr

Cover picture:	Sympetrum arenicolor
Photographer:	Oleg E. Kosterin

Published 16.04.2018

Odonata observed in Central Zagros, Iran, in late May 2017

Oleg E. Kosterin[1,2] & Azam Ahmadi[3]

[1]Institute of Cytology & Genetics SB RAS, Acad. Lavrentyev ave. 10, Novosibirsk, 630090, Russia;
[2]Novosibirsk State University, Pirogova str. 2, Novosibirsk, 630090, Russia.
E-mail: kosterin@bionet.nsc.ru

[3]Baran Plant Protection Institute, Arak, Markazi Province, Iran
E-mail: aezam.ahmadi@gmail.com

Abstract

In the period 18th – 31st May 2017, 33 localities were examined for Odonata in the Central Zagros area of Iran: 16 in Markazi Province, 14 in Lorestan Province and 3 in Esfahan Province; in 27 of those localities Odonata were found, 25 species in total. For Markazi Province, only one species, Calopteryx splendens, was previously reported (and also found by us), so of 17 species found there 16 are formally new provincial records (Epallage fatime, Lestes barbarus, Coenagrion ornatum, C. persicum, Enallagma cyathigerum, Ischnura elegans, I. intermedia, I. pumilio, Platycnemis kervillei, Anax imperator, Anaciaeschna isoceles, Caliaeschna microstigma, Libellula depressa, Onychogomphus lefebvrii, Orthetrum brunneum, Sympetrum fonscolombii). Of 17 species found in Lorestan, 5 are new for this province (L. barbarus, Aeshna mixta, Orthetrum taeniolatum, Sympetrum arenicolor, S. striolatum). Only two species were seen in Esfahan Province, in which little time was spent. Notes on variation and taxonomy are provided for Sympecma paedisca, C. ornatum (considered to be a senior synonym of C. vanbrinkae because of variation in the presumed main diagnostic character), E. cyathigerum, I. elegans, Gomphus schneideri (including discussion of G. amseli), as well as notes on habitats of most species and the general characteristics of the area.

Key words: Central Iran, Markazi Province, Lorestan, Esfahan Province, Odonata, dragonflies, damselflies, Coenagrion ornatum, Coenagrion vanbrinkae, Ischnura elegans subspecies, Gomphus schneideri, Gomphus amseli.

Introduction

Although Iran is not a very popular destination for scientific expeditions from abroad at present, a fair amount of information concerning its fauna has been accumulated from past expeditions and from numerous Iranian researchers who are currently active. Hence the Odonata fauna of Iran is rather well studied. The state of the art sixteen years ago was summarised by Heidari & Dumont (2002), but since then a number

of further valuable publications have appeared. Among them the most notable have resulted from the diligent exploration of Iran's Odonata by Thomas Schneider, Dietmar Ikemeyer and their colleagues (Schneider & Dumont 2015; Ikemeyer et al. 2015; Schneider & Ikemeyer 2016a,b; 2017; Schneider et al. 2013; 2015a,b; 2016; 2017a,b; 2018; Dumont et al. 2017). At the same time since 2009 Iranian authors have published a large number of papers with faunal data on Odonata (Sadeghi & Dumont 2004; 2014; Sadeghi 2008; 2010; Ebrahimi et al. 2009; 2014a,b; Ghahari et al., 2009; 2012; Kiany & Minaei 2009; Sadeghi & Mohammadalizadeh 2009; Sadeghi & Kiany 2012; Rasedgar et al. 2013; Yousuf Lafooraki et al. 2013; Kiany & Sadeghi 2014; 2016; Ghahari & Thipaksorn 2014; Dumont et al. 2011; Bakshi & Sadeghi 2014; Samin et al. 2015; Kiany et al. 2016. etc.), adding many country species records, although some of those publications included some misidentifications. Recently Schneider et al. (2018) has provided a critical compendium of all faunal and taxonomic information accumulated for Iran up to date. They compiled a country checklist containing 102 reliably reported species and 5 species requiring confirmation, and rejected 8 earlier reported species.

Iran is a huge country (the 17th largest in the world) situated at the crossroads of the Palaearctic, Afrotropical and Oriental biogeographical realms, but most of its area is arid and hostile for Odonata. Most of the species recorded are Palaearctic with only a minor admixture of Oriental and/or Afrotropical species; most of the species are shared with the eastern Mediterranean, mainly Turkey (Heidari & Dumont 2002; Kalkman 2006; Schneider et al., 2018).

On May 18-31, 2017, the second author and Igor Y. Grichanov from the All-Russian Institute of Plant Protection, Saint-Petersburg, Russia, undertook a dipterological expedition to the Iranian Provinces Markazi (Central), Lorestan and Esfahan (one-day visit) focussing on long-legged flies (Dolichopodidae) (Grichanov et al. 2017). Its base was at Arak City, the capital of Markazi (Central) Province, where the second author lives. The first author joined the expedition with a simultaneous personal aim of searching for populations of wild peas (Pisum sativum subsp. elatius (Bieb.) Aschers. et Graebn.), which was successful as two were found in Lorestan Province. Since the long-legged flies are mostly confined to the edges of water bodies, the expedition examined as many water bodies as possible in those arid areas. This allowed simultaneous observation of the spring occurence of Odonata. The results are presented in this paper.

Lorestan is rather well studied from an odonatological point of view, 25 species being known from there (Heidari & Dumont 2002 (a summary of the previous data); Sadeghi & Mohammadalizadeh 2009; Schneider & Ikemeyer 2016a; Schneider et al., 2018; see 'Discussion"). Almost the same number of species, 21, were reported from Esfahan Province (Heidari & Dumont 2002; Schneider & Ikemeyer 2016a). At the same time only one species, Calopteryx splendens (Harris, 1780), has been mentioned for Markazi Province, in a paper specially devoted to this species in the Zagros Mts. (Sadeghi & Kiany 2012). Our study did not increase the known Odonata fauna of Iran but added five species to the fauna of Lorestan while all Odonata records except C. splendens in Markazi Province were new for it.

The region

The three adjacent provinces examined are situated in the western part of Iran and approximately in the north central part of the great Zagros Mountains (Fig. 1), in the region of the ancient Media (the capital of which, Ecbatana, presently Hamadan, is in Hamadan Province adjacent to Lorestan and Markazi Provinces in the north-west). The Zagros Mountains are made of sedimentary rocks, mostly dolomite limestone, and comprise three parallel mountain chains, called (from south-west to north-east) the Folded Zagros, the Higher or Elevated Zagros, and the eastern chain without a recognized name (here called Inner Chain). Our studies were conducted partly on both sides of the Oshtorankuh [Farsi: 'mountain of camels'] Massif of the Higher Zagros (Fig. 2) and on the Inner Chain, mostly in the foothills of the Shakhboz [Farsi: 'Eagle King'] Range and its spurs (Fig. 3). The area is in general fairly arid but the valleys crossing the Higher Zagros are more humid (subarid).

The elevated plain adjacent to the Inner chain to the north-east, the Farmaha Depression stretching along Zagros, is the northwesternmost margin of the Central Iranian Plateau occupied by the Dasht-e Kavir or Great Salt Desert. It is covered by saline desert, with spiny Chenopodiaceae predominating in the vegetation. We had a chance

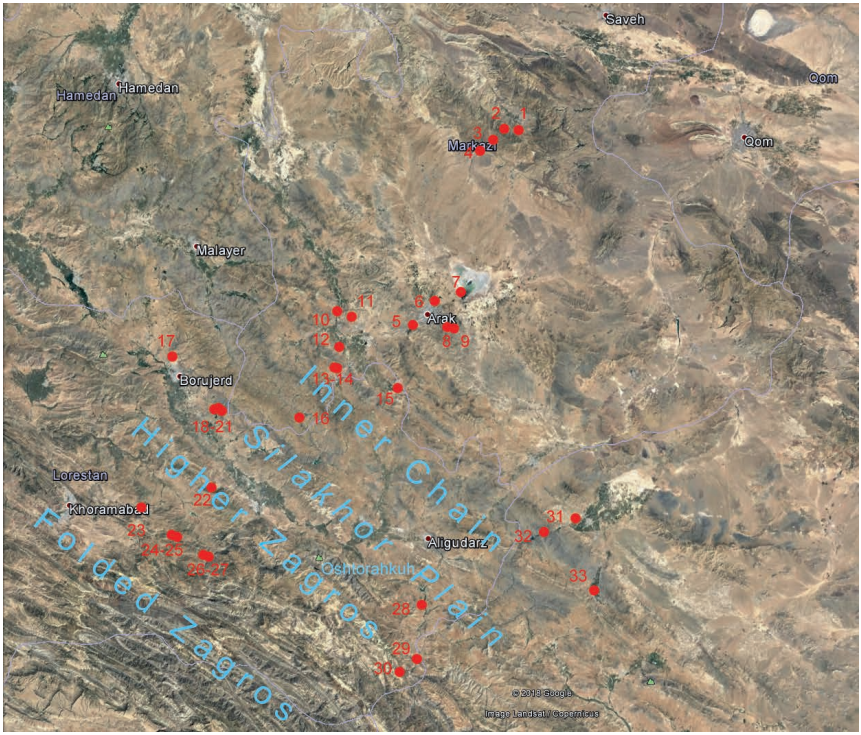

Fig. 1. Localities examined in Iran during May 18-31, 2017; for explanation of the numbers see the text. The map is from Google Earth.

Fig. 2. The Oshtorankuh Massif of the Higher or Elevated Zagros, Lorestan, seen from the northeast. 23.05.2017.

Fig. 3. Views of the Shakhboz Range and its spurs of the Inner Chain of Zagros and its foothills, Markazi Province, Shazand County. Note the red aspect due to flowering poppy (Papaver pavonium) on the foothills near Mohadjeran City in the lower photo (19.05.2017).

Fig. 4. A stream estuary at the salt Lake Kavir-e Meighan, S bank (Loc. 7), 30.05.2017. A habitat of Ischnura elegans and I. pumilio and an unexplected site for Coenagrion persicum.

to examine the large salt Lake Kavir-e Meighan 15 km NE of the city of Arak (Fig. 4), which is used for salt production and is popular as a site where grey cranes congregate during their winter migration.

The Higher Zagros (Fig. 2) virtually divides two different worlds. The Inner Zagros Chain is situated in the rain shadow of the Higher Zagros, so that the landscapes and vegetation of its foothills and slopes are arid and typically Central Asian. At the time of our visit the highest levels of the Inner Chain still had small patches of snow. The mountain slopes are steep and with a rather even gradient, seemingly hardly eroded. Neither are they scarred by numerous sheep pathways or dotted with bushes, unlike many other arid mountains elsewhere. Generally livestock is very scarce owing to shortage of grass for most of the year, so no dung or dung beetles were seen. The lower north-eastern foothills are covered with desert vegetation of sparse spiny herbs, among which Gundelia tournefortii L. was most conspicuous. At the time of our visit, the upper foothills and lower slopes were bright green, locally still with a strong crimson aspect due to the still flowering poppy (Papaver pavonium Fisch. ex C.A. Mey.) (Fig. 3 below). However, a closer look at that fine green grass revealed that it was formed by ephemeral annual grasses of the tribes Triticinae and Aveninae which would wither and die a month later, so the vegetation was an ephemeral grass rather than steppe. Wheat fields are not infrequent in the area but they all depend on drip irrigation. Although there are many trees, mostly walnut, in valleys, it would be safe to say that virtually almost all trees and bushes are planted, except for arboreal vegetation along large rivers. Only very locally (e.g. near Tafresh city) can one see small patches on slopes with scattered large bushes of Prunus scoparia (Spach) S.C. Schneid. or low spiny bushes of Astragalus sp. Birds were very scarce, the one most frequently seen in any environment, unexpectedly including open areas, being the common magpie.

Water is scarce in the valleys of the Inner Zagros Chain and is almost entirely regulated and exploited by people. As a rule a spring of ground water in the upper part of a valley is enclosed in a pipe from which it fills a small reservoir, often artificial, called 'chashmah', from where it is redistributed by a system of small canals, dzhui, to irrigate orchards and small areas of arable land. Many chashmaha (pl.) are popular places for local people's recreation so there are usually many cars nearby and the ground is heavily trampled. There is an ancient (up to 5 thousand years old) Iranian and Central Asian tradition of constructing underground channels, karizan (pl.). We had an opportunity to examine such a kariz in Hansar Town in Esfahan Province, with no Odonata in the outflow channel. There are some quite large rivers in the area studied. They are moderately rapid and have more or less extensive floodplains with temporary pools, and abundant and tall bush vegetation formed by tamarisk (Tamarix laxa Willd.) and willows.

The Silakhor Plain (Dasht-e Silakhor) between the Inner and Higher Zagros (Fig. 5) is still in the rain shadow of the Higher Zagros and is of the same nature as the north-eastern foothills of the Inner Chain but is more populated, irrigated and converted to arable land; the mountain slopes on both its sides are still mostly devoid of natural arboreal vegetation. In Lorestan, the Higher Zagros is highest at the snow-covered Oshtorankuh Massif (4050 m a.s.l.) (Fig. 2). We entered the valleys crossing the Higher

Fig. 5. The Silakhor Plain between the Higher and Inner Chains of Zagros, as photographed in Aligudarz County (above) and Borujerd (below) Counties, Lorestan, 23 and 25.05.2017.

Zagros in its lower parts both north-west and south-east of the Oshorankuh, so escaping its rain shadow, since the Folded Zagros Chain, which is at most 2000-2500 m a.s.l., cannot shield the Higher Zagros from moist air masses coming from the west. In both cases, already at 2000 m a.s.l. and lower, the slopes become densely scattered with open stands of Persian Oak (Quercus brantii Lindl., a low tree with several trunks and leaves resembling elm) giving the landscape a prettily, Mediterranean aspect (Fig. 6). Other low trees and tall bushes participating in this natural parkland are Acer

monspessulanum L., Crataegus sp., Prunus sp., Lonicera sp. etc., Paliurus spina-christi Mill.). On these slopes fairly numerous sheep are pastured. On gentle slopes and passes at 2000 m and higher elevations, low but dense thickets of bushy Astragalus sp. are common. The typical mountain rivers are rapid, and there are two famous waterfalls, Absefid (Fig. 7a) and Bisheh (Fig. 7b). Generally, the Higher Zagros, as a considerable barrier for air masses, serves as a border between the subarid climate with Mediterranean biota and arid climate with Central Asian biota.

Methods

The scarce water bodies were examined according to a schedule worked out by the second author and were accessed by car. Odonata were sought while walking along banks and/or by net sweeping. Easily recognisable common species were mostly recorded by sight, some individuals were captured, voucher specimens or small series of other species were collected, immersed in acetone overnight and preserved on cotton layers with paper covers. Odonata were photographed using Olympus Camedia C8080 and Canon EOS D350 cameras, the latter with Sigma AF-24-70 F2.8-70mm Macro lens, in purely natural conditions

Fig. 6. Persian Oak (Quercus brantii) open woodland on mountain slopes in the Sezar River basin, Khorramabad County, Lorestan. 26 and 31.05.2017.

Fig. 7. Waterfalls of the Higher Zagros in Lorestan: a - Absefid (at Loc. 28, Aligudarz County, 23.05.2017); b – Bisheh (Loc. 31, Khorramabad County, 26.05.2017).

without any restrictions. Photos kindly offered by Igor Grichanov are marked with "I.G." in captions, other photos are by O.K. Coordinates were recorded by Garmine eTrex H personal GPS navigator but ranges for the areas actually examined and elevations above sea level were provided as retrieved from Google Earth. The photos or specimen details were prepared from serial photographs obtained using a Zeiss Stemi 2000-C lens with digital camera Canon PowerShot A640. Images with broad focus zones were obtained from serial photos with shifted focus using Helicon Focus 6.0 software. Dates are provided in dd.mm.year format.

Localities examined

The localities examined, associated with water bodies, are enumerated below, grouped by province (ostan) and county (shakhrestan). At a few of them no Odonata were found, yet they are included in the list below with an appropriate note, to provide a more precise picture of Odonata occurrence in the region studied in May. Views of some localities important as habitats of certain species are placed in the text where those species are considered, but these figures are referenced in this section ahead of numeration.

Localities 5-15 and 31-33 are situated on the north-eastern slopes and foothills of the Inner Zagros Chain, localities 16-22 and 28 are on its south-western slopes and foothills facing the Silakhor Plain, and localities 23-27 and 29-30 are in valleys crossing the Higher Zagros.

Fig. 8. The ponds of Shilanevar valley (Loc. 1) in Tafresh City env., Markazi Province, 29.05.2017; a – the middle pond, a habitat of Enallagma cyathigerum risi and Sympetrum fonscolombii; b – the lower pond, a habitat of E. cyathigerum risi, Coenagrion persicum, Ischnura intermedia, I. elegans, Anax imperator, Libellula depressa, Orthetrum brunneum, S. fonscolombii.

Markazi Province

Tafresh County

Loc. 1. Tafresh City env., Shilanevar valley (Fig. 8), 34.6608-6654° N 50.0323-0402° E, 2036-2077 m a.s.l., 29.05.2017. Three ponds on a stream in an arid mountain valley. The lower pond small (25 × 19 m), with warm water filled with filamentous algae (no Chara), the middle and upper ponds larger (36 × 30 and 101 × 80 m), with azure water and barren banks; the stream downstream with filamentous algae in water and Scirpus sp. and spikerush (Eleocharis sp.) on banks.

Fig. 9. A stream at Tafresh City, Markazi Province (Loc. 2), 29.05.2017. A habitat of Epallage fatime and Onychogomphus lefebvrii.

Loc. 2. 4.4 km SW of Tafresh City, a stream (Fig. 9), 34.6683-6708° N 49.9820-9848° E, 2045-2084 m a.s.l., 29.05.2017. A roadside stream, Scirpus sp. on banks, several large bushes of Prunus scoparia.

Loc. 3. 8 km SW of Tafresh City, 34.6249-6269° N 49.9463-9469° E, 2300-2312 m a.s.l., 29.05.2017. A medium-sized rapid and very cold river with several concrete dams forming small waterfalls; a meadow on the right bank, an orchard on the left bank. No Odonata.

Loc. 4. 1.8 km WSW of Shahrob Town, 34.5880-5886° 49.8770-8784° E, 2067-2069 m a.s.l., 29.05.2017. A medium-sized river, rather shallow and moderately cool, half-shaded by willow trees. Examined at dusk.

Arak County

Loc. 5. Arak, Senjan estate, 34.037-038 N 49,615-616° E, 1862-1865 m a.s.l., 28.05.2017. A broad, flat, stony calcareous valley of a former river with low clay bluffs and only small shallow pools with filamentous algae and locally a tiny stream as a river remainder. No frogs. No Odonata.

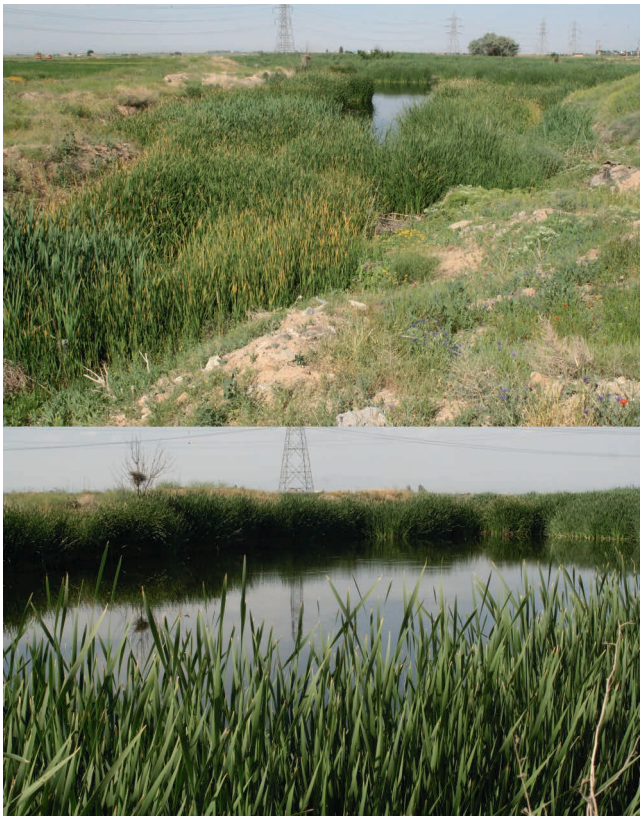

Fig. 10. A heavily polluted pond at a garbage site (Loc. 6) in Arak suburbs, Markazi Province, 18.05.2017. A habitat of Ischnura elegans and Anaciaeschna isoceles.

Loc. 6. Arak City NE suburbs, 34.1256-1271° N 49.7179-7198° E, 1704 m a.s.l., 18, 24 and 28.05.2017. A dirty, smelly, deep, stagnant, branched water body, ca 200 × 40 m (Fig. 10) at garbage site in a fold of open, rough, disturbed waste land; sticky muddy bottom, surrounded by tall, gapless cattail (Typha sp.) thickets. Enormous numbers of Ephydra sp. flies. No frogs. A moorhen, terns and numerous swallows were seen.

Loc. 7. Lake Kavir-e Meighan S bank, a rush swamp (Fig. 4), 34.1530-1536° N 49.8112-8131° E, 1657-1659 m a.s.l., 30.05.2017. The lower estuary of a rivulet entering the salt lake from the south, with a thick strip of tall cattail (Typha sp.) margined with Poaceae grass. Extremely shallow brackish water with algal patches, black muddy bottom and broad barren banks with scattered Cyperus sp.; saline flat area with Kalidium sp. and Salicornia sp. around. A smell characteristic of salt lakes; an enormous number of Ephydridae flies, and fairly numerous mosquitoes. Birds: black-winged stilts, reed warblers in cattail. No frogs.

Loc. 8. Baghdadi village, 34.0290-0321° N 49.7535-7543° E, 1967-2015 m a.s.l., 18.05.2017. Ground water appears from a pipe, fills to a small depth a small concrete reservoir with a muddy bottom and spikerush, then flows in a small channel to orchards. No frogs. No Odonata.

Loc. 9. Hosseinabad village, 34.0244-0256° N 49.7710-7724° E, 1967-2015 m a.s.l., 18.05.2017. As above, but the reservoir is larger and surrounded by tall willows. Intensive local recreation, and many cars. No Odonata.

Shazand County

Loc. 10. The Garehchay River at Gavigodar village (Fig. 11), 34.1078-1111° N 49.3627-3657° E, 1803-1805 m a.s.l., 19.05.2017. A relatively large river, with a broad left-bank floodplain, in a wide mountain valley. The river is cold, rapid, with stony bottom, with patches of spikerush and some larger Cyperaceae, some very shallow reaches with carpets of Chara ?kirghisorum C.F. Lessing, deep reaches with patches of Potamogeton sp. The banks are overgrown with tall poplars and willows. The floodplain (said to be still flooded by the river in early April) is covered with bushes of Tamarix laxa (ceasing flowering) alternating with numerous pools up to waist-deep with cold water and shallow swamplets with warm water, of variable size (Fig. 12). The pools are partly and the swamplets entirely covered with fine spikerush; the pools are filled with Chara gymnophylla A. Braun (Akram Ahmadi pers. comm.) and contain also Batrachium sp. Many frogs and tadpoles, one dice snake encountered.

Loc. 11. Baneh village, 34.0836-0858° N 49.4076-4103° E, 2105-2112 m a.s.l., 19.05.2017. Ground water appears from a pipe inside the village, filling a small (30 × 18 m) concrete reservoir with only some filamentous algae, spikerush on banks, and a grove at one side (Fig. 13), then flows as a stream in a narrow gorge, at first hidden in dense low elm thickets with an admixture of ash.

Loc. 12. Bolagh spring (Fig 14), 33.9875-9880° N 49.3606-3618° E, 1853-1861 m a.s.l., 20.05.2017. A powerful underwater spring flowing from under a vertical rock into a waist-deep, ice-cold pond (40 × 36 m), with some Chara sp. in the water and bunches of spikerush and bundles of Veronica sp. on banks, from which the water flows to a

Fig. 11. The Garehchay River at Gavigodar village (Loc. 10), Shazand County, Markazi Province, 19.05.2017. A habitat of Calopteryx splendens intermedia, Coenagrion ornatum, C. persicum, Platycnemis kervillei.

Fig. 12. The Garehchay River right-bank floodplain at Gavigodar village (Loc. 10), Shazand County, Markazi Province, 19.05.2017. A habitat of Coenagrion ornatum, Lestes barbarus, C. persicum, Ischnura elegans, Anax imperator, Libellula depressa, Sympetrum fonscolombii, a site for Calopteryx splendens intermedia, Platycnemis kervillei.

Fig. 13. A reservoir in Baneh village (Loc. 11), Shazand County, Markazi Province, 19.05.2017. A habitat of Ischnura elegans and Libellula depressa. Photo by I.G.

Fig. 14. Bolagh Spring (Loc. 12), Shazand County, Markazi Province, 20.05.2017. A habitat of Calopteryx splendens intermedia, Coenagrion ornatum, C. persicum, Ischnura elegans, I. pumilio and Libellula depressa. Photo by I.G.

shallow concrete basin (34 × 13 m) with abundant submerged vegetation and continues as a stream. Much local recreation around; some cattle grazing.

Loc. 13. Astaneh Town env., Seidan Chashmah, 33.9252-9262° N 49.3482-3491° E, 2277-2287 m a.s.l., 20.05.2017. Ground water flows from a pipe into a small cold and deep basin surrounded by huge willows, from where the water flows in three channels through a green irrigated area with walnut and ash trees.

Loc. 14. Astaneh Town env., Kaedan Chashmah, 33.9175-9177° N 49.3430-3434° E, 2158 m a.s.l., 20.05.2017. Resembles the previous site but the basin is larger (50 × 10 m), with clearer water and with the bottom covered with brown/whitish Chara sp.; the banks with spikerush and stumps remaining from the surrounding willows. Strong wind during our visit.

Fig. 15. A grassy swamp at Emarat village (Loc. 15), Shazand County, Markazi Province, 20.05.2017. A habitat of Calopteryx splendens intermedia, Coenagrion ornatum, C. persicum, Ischnura elegans, I. pumilio and Sympetrum fonscolombii. Photo by I.G. (above) and O.K. (below).

Loc. 15. Emarat village env., 33.8637-8667° N 49.5775-5795° E, 1995-2001 m a.s.l., 20.05.2017. Cold ground water appears in several powerful springs inside the village and fills a wide channel which is discharged below the village into a very large (207 × 170 m) grassy (mostly spikerush, some patches of young reed) swamp (Fig. 15) with shallow warm water and many frogs; a moorhen seen.

Loc. 16. The Hendudar River (Fig. 16) 1.8 km SW of Hendudar village, 33.7628-7665° N 49.2178-2198° E, 1993-1997 m a.s.l., 20.05.2017. (The site is in the Silakhor Plain, on the other side of the Shakhboz Range from the above sites in Shazand County). Resembles the Gharechay River (Loc. 10) but smaller and with a much narrower floodplain with very few pools; some sections of the banks stony, shallow riffles with brownish/whitish carpets of Chara kirghisorum (Akram Ahmadi, pers. comm.)

Fig. 16. The Hendudar River (Loc. 16) 1.8 km SW of Hendudar village, the Silakhor Plain, Shazand County, Markazi Province, 20.05.2017. A habitat of Calopteryx splendens intermedia, Coenagrion ornatum, C. persicum, Ischnura elegans, Platycnemis kervillei.

Lorestan Province

Borujerd County

Loc. 17. Borujerd City env., Goldargilan village, 33.9611-9654° N 48.7501-7555° E, 1745-1781 m a.s.l., 25.05.2017. A large stream flowing partly in the open, partly hidden in willow thickets; with abundant rush (Scirpus (Schoenoplectus) sp.) on banks, several very large elm trees; slopes of the valley with alternating orchards and grassland.

Loc. 18. Hayan village env., Emamzade Pirkamel, 33.8032-8042° N 48.9396-9418° E, 1819-1858 m a.s.l., 25.05.2017. A stream (Fig. 17) with slime algae in water, overgrown with thick Scirpus (Schoenoplectus) sp., flowing in a barren stony valley to a pond 20 × 150 m with Chara sp. in the water and several trees on banks.

Fig. 17. A stream (Loc. 18) at Emamzade Pirkamel, Borujerd County, Lorestan, 25.05.2017. A habitat of Epallage fatime, Coenagrion ornatum (many), Ischnura elegans (few).

Fig. 18. Chenar Chashmah (spring) (Loc. 19) at Hayan village, Borujerd County, Lorestan, 25.05.2017. A habitat of Coenagrion ornatum, Ischnura elegans, Crocothemis erythraea chaladeorum, Orthetrum brunneum, O. taeniolatum, Sympetrum striolatum striolatum.

Loc. 19. Hayan village env., Chenar Chashmah (Fig. 18), 33.7973-7981° N 48.9045-9052° E, 1688-1690 m a.s.l., 25.05.2017. A spring with a rather large pond (41 × 17 m) formed by a small stone dam, with clear cold water and some slime algae but without Chara, banks of detritus, one of which is overgrown with sedge and Scirpus (Schoenoplectus) sp. A small crab found in the water. The terrain is open but there is a wet orchard downstream.

Loc. 20. Hayan village env., 33.7965-7972° N 48.9270-9279° E, 1738 m a.s.l., 25.05.2017. A small shallow muddy pool overgrown with grass and Scirpus (Schoenoplectus) sp. and shaded by trees in the village ruins.

Loc. 21. Hayan village env., Gavimir Chashmah, 33.7908-7920° N 48.9398-9402° E, 1816-1829 m a.s.l., 25.05.2017. A small stream flowing to a large (30 × 15 m) pool, also overgrown with Scirpus (Schoenoplectus) sp. and fine grass, with little open water left, partly shaded by tall trees including a plane tree (Platanus orientalis L.).

Khorramabad County

Loc. 22. 1.5 km WSW of Abkot village, 33.5419-5475° N 48.8932-9039° E, 1820-2000 m a.s.l., 31.05.2017. Persian Oak (Q. brantii) parkland with some maple (A. monspessulanum) on a dry NNE slope overgrazed by sheep, a small narrow gorge with a dry stream bed with some remainder pools. A fair number of jays seen.

Fig. 19. A stream in the Abestan village env. (Loc. 23), Khorramabad County, Lorestan, 25.05.2017. A habitat of Calopteryx splendens intermedia, Coenagrion ornatum, Ischnura elegans, Platycnemis kervillei.

Loc. 23. Abestan (or Aghilabad?) village env., 33.4632-4635° N 48.6505-6514° E, 1783-1785 m a.s.l., 26.05.2017. A small stream (Fig. 19) flowing in an open valley with some wheat fields near the village, a patch of planted pyramidal poplars on the bank. The stream is heavily trampled by cattle and has swampy banks with rush (Scirpus (Schoenoplectus) sp.)

Loc. 24. A pass 5 km NW of Chenar Gerit village (Fig. 50), 33.4053° N 48.7437° E, 2150 m a.s.l., 26.05.2017. A flat pass with thorny knee-high bushes of Astragalus sp. covering ca 50% of the area, some taller bushes and large patches of open ground seemingly only recently free from snow.

Loc. 25. 6.2 km NE of Chenar Gerit village, 33.3977-4028° N 48.7638-7703° E, 1990-2058 m a.s.l., 31.05.2017. Persian Oak (Q. brantii) parkland with fine green in a broad valley of a small stream; a rocky gorge upstream.

Loc. 26. 2.2 km WNW of Pasil village, 33.3504-3544° N 48.8513-8571° E, 1461-1496 m a.s.l., 26.05.2017. A small rapid river with a rocky bottom in a narrow gorge; the river itself is hidden and deeply shaded by tall and dense plane (P. orientalis) trees; slopes dry with open stand of oak (Q. brantii) trees and flowering Christ's Thorn (P. spina-christi); a small pine plantation. A small smelly trout farm with a pond from which several small streams gather into a small channel. An astonishing number of large wingless catydids.

Loc. 27. The Sezar River (Fig. 20) from Bisheh Waterfall (Fig. 7b) to 2 km downstream, 33.3287-3368° N 48.8785-8960° E, 1176-1213 m a.s.l., 26.05.2017. A large river mostly with shingle bottom, large boulders, and quite steep, occasionally gentle banks with open stand of oak (Q. brantii) trees and flowering Christ's Thorn (P. spina-christi). Large crabs in water and near it; enormous number of catydids on banks.

Fig. 20. The Sezar River downstream from the Bisheh Waterfall (Loc. 27), Khorramabad County, Lorestan, 26.05.2017. A habitat of Calopteryx splendens intermedia, Epallage fatime, Gomphus kinzelbachi, Platycnemis kervillei, a site for Sympecma paedisca and Sympetrum arenicolor.

Aligudarz County

Loc. 28. The Golbahar River at Golbahar-e Seykh Miri village, 33.1925-1938° N 49.6671-6709° E, 2042-2079 m a.s.l., 23.05.2017. A small river on the Silakhor Plain surrounded by dense willows upstream of the bridge; open, with abundant spikerush, downstream of it.

Loc. 29. 700 m NWN of Kagelestan-e Bar Aftad village, 33.0369° N 49.6564° E, 1842 m a.s.l., 23.05.2017. A steep NE slope of the Rudarb-e Aligudarz River valley with sparse Prunus scoparia bushes and cattle paths. The river itself not examined (although promising).

Loc. 30. The Absefid Waterfall env. (2.9 km W of Bisheh Khazan village), 32.9966-9996° N 49.5799-5857° E, 2281-2375 m a.s.l. , 23.05.2017. A locality in the Higher Zagros mountain chain. A rapid small river with a very narrow gorge formed by high cliffs, with a large waterfall (Fig. 7a) at its right tributary, on account of which the air is cold and humid; sparse walnut trees on banks, bushes of maple (A. monspessulanum) and Prunus sp. on steep detritus slopes. No Odonata.

Esfahan (Isfahan) Province

Golpayegan County

Loc. 31. Golpayegan City, the Ghomrood (Anaarbar) River, 33.4567-4614° N 50.2609-2652° E, 1820-1826 m a.s.l., 21.05.2017. A large, moderately rapid river with shingle banks, locally with dried whitish mud; shingle floodplain with patches of Poaceae grass; the valley bordered with clay/shingle bluffs of variable height.

Loc. 32. The Ghomrood (Anaarbar) River left bank (Fig. 44) just upstream of the lower reservoir, 16 km WSW of Golpayegan City, 33.4171-4205° N 50.1189-1200° E, 1924-1931 m a.s.l., 21.05.2017. The same river between two large water reservoirs, cold, rapid and powerful but with narrow strips of young reed along its banks; the left bank with fine grass and open stand of tall walnut trees.

Khansar County

Loc. 33. Khansar (Khwansar) City, the Sarcheshmeh River and a channel flowing from a kariz along its left bank, 33.2398-2434° N 50.3149-3160° E, 2172-2183 m a.s.l., 21.05.2017. A cold, rapid and narrow river with fresh meadows on banks flowing through a kind of city park; the channel flows through lush grass under sparse walnut and apple trees. A steep mountain range of the Inner Zagros Chain is nearby, with snow patches at quite low altitudes at the time of our visit. No Odonata.

Results

Annotated species list

Occurrence of each species is given under its name with the province abbreviated to an italicised letter (M: Markazi; L: Lorestan; E: Esfahan) followed by the locality numbers from the above list, preceded by "Loc.", and the number and sex of collected specimens and approximate abundance of observed individuals. Then follow remarks (if any) and observations.

1. Calopteryx splendens intermedia Selys, 1887

M: Loc. 10: 4 ♂♂, 2 gynochromatic ♀♀ collected, fairly many ♂♂, ♀♀ seen, 1 teneral ♂ photographed (Fig. 21b); Loc. 12: 1 ♂ seen; Loc. 15: 1 teneral ♂ seen; Loc. 16: 1 ♂♂, 1 androchromatic ♀, 1 gynochromatic ♀ collected, several more ♂♂, ♀♀ seen.

L: Loc. 17: 2 ♂, 1 ♀ (gynochromatic) collected, several ♂♂, ♀♀ seen; Loc. 23: 1 ♂ collected, several ♂♂, ♀♀ seen, 1 androchromatic ♀ photographed (Fig. 21a); Loc. 28: 1 teneral ♂ collected, several ♂♂, ♀♀ seen.

Fig. 21. Calopteryx splendens intermedia: a – an androchromatic female at a stream at Abestan village (Loc. 23), 26.05.2017; b – a teneral male, Garehchay River right floodplain (Loc. 10), 19.05.2017.

Observations. Occurs at medium-sized rivers where it keeps to rushes on banks. At Loc. 15, in windy weather, some mature individuals were found also in small ravines several dozen metres from water. Teneral individuals, with glittering and incompletely melanised wings, were often found at shallow lentic water apart from streams, e.g. in the spikerush swamplets of the Garehchay River floodplain (Loc. 10, many) or in a large and also spikerush swamp below Emarat village

2. Epallage fatime(Charpentier, 1840)

M: Loc. 2: 1 ♂, 2 ♀♀ collected, quite many ♂♂, ♀♀ seen.

L: Loc. 17: 1 ♀ collected, 1 ♂, several ♀♀ seen; Loc. 18: 2 ♂♂, 2 ♀♀ collected, many ♂♂, ♀♀ and several tandems seen, several ♂♂ (Fig. 22a), 1 tandem (Fig. 23a) and 1 ♀ (Fig.

Fig. 22. Males of Epallage fatime: a – at Emamzade Pirkamel (Loc. 18, Fig. 17), 25.05.2017; b – at a mountain rivulet near Pasil village (Loc. 26), 26.05.2017.

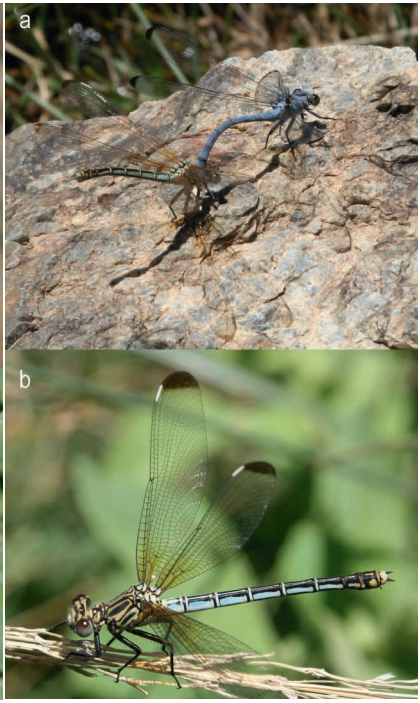

Fig. 23. Epallage fatime: a tandem (a) and female (b) at Emamzade Pirkamel (Loc. 18, Fig. 17), 25.05.2017.

23b) photographed; Loc. 26: 1 ♂ collected, 1 ♂ photographed (Fig. 22b), several ♂♂, ♀♀ seen; Loc. 27: several ♂♂, ♀♀ and exuviae seen; Loc. 29: 1 ♀ seen.

Observations. Found by small streams at Loc. 2 and 18, a larger stream at Loc. 17, at a rapid small river at Loc. 26 and by the large Sezar River at Loc. 27; at the same time was not found by medium-sized and medium-fast rivers such as the Garehchay, Hendudar and Golbahar. At Loc. 18, where the species was numerous, males perched either on rush stems (Fig. 22a) or stones with females more frequently on rushes (Fig. 23b). At Loc. 26 males perched mostly on sunlit leaves of plane trees shading the stream beneath (Fig. 22b).

3. Lestes barbarus (Fabricius, 1798)

M: Loc. 10: 7 ♂♂, 1 ♀ (all teneral) collected, 1 ♂, 2 ♀♀ photographed (Fig. 24); enormous numbers of tenerals seen.

L: Loc. 20: 1 ♂ collected.

Fig 24. Teneral Lestes barbarus at pools of the Garehchay River right floodplain (Loc. 10, Fig. 12), 19.05.2017: a, b – females, c – male.

Observations. Enormous numbers of freshly emerged individuals, still with glittering wings (Fig. 24) which they often kept closed while resting, occupied dense spikerush by shallow warm pools and swamplets (a typical habitat of the species) of the Garehchay River floodplain (Loc. 10, Fig. 12). A male in the Hayan village environs was most probably on pre-reproductive dispersal from water.

4. Sympecma paedisca (Brauer, 1877)

L: Loc. 26: 2 ind. seen; Loc. 27: 1 ♂, 1 ♀ collected (Fig. 25).

Remarks. Our two specimens approach the most extreme reduction of the bronze pattern yet observed within the range of variation known for the species (Jödicke 1997): the antehumeral stripe is reduced to one (in the female; Fig. 25a) or three (in the male; Fig. 25b) tiny dots; and in the female the prominence of the prothoracic dorsal stripe is reduced to an isolated dot (Fig. 25a). The abdominal segments S3-S7 have distinct spots only on their distal parts while the rest is reduced to vague linear traces; and on all abdominal segments the spots are divided by a dorsal line of the ground colour (Fig. 25). The structural features, e.g. the anal appendages (Fig. 25d), are typical for S. paedisca (Dumont & Borisov 1993; Schneider et al. 2018). Also our Iranian pair is about the maximum size of the species: hindwing 21 mm, abdomen without appendages 29 mm in the

male and 30 mm in the female. In specimens from Russia these measurements are 18-22 and 25-29 mm, respectively (Skvortsov 2010); and our specimens from Siberia are at the lower end of these ranges.

Observations. Found in dry grass among an open Persian Oak and Christ's Thorn stand near Bisheh and Pasil villages (Locs. 26 and 27); in the first case on a bank of a large river and in the second case not far from a small river. However, this may reflect the positions of the observers near the rivers, and the damselflies were most probably on their pre-reproductive dispersal (Borisov 2005; 2009; 2010).

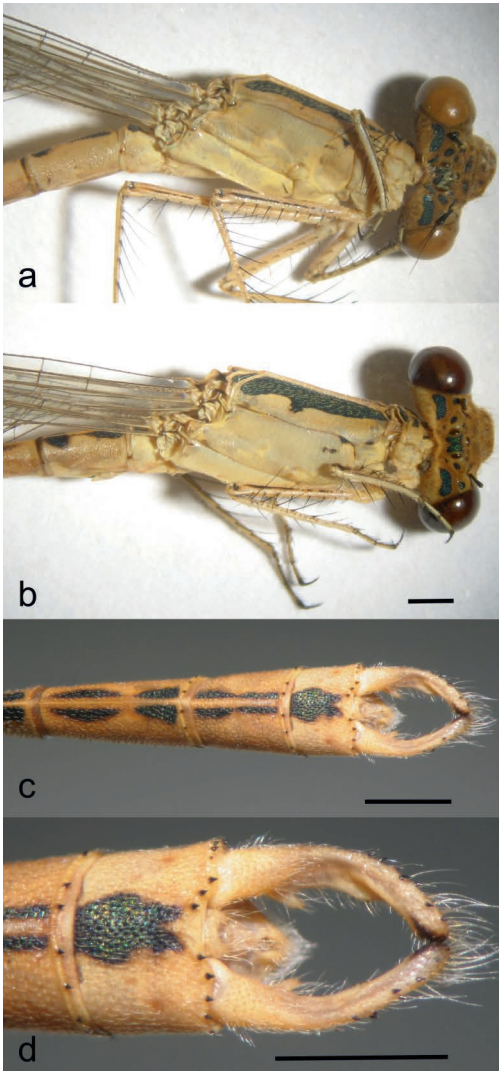

Fig 25. Details of specimens of Sympecma paedisca collected at the Sezar River banks downstream of Bisheh Waterfall (Loc. 27, Fig. 20) 26.05.2017: a – female (mirrored); b-d – male; a-b – head and thorax, lateral view; c-d – end of abdomen, dorsal view. Scale bar 1 mm.

5. Coenagrion ornatum (Selys, 1850)

M: Loc. 4: 3 ♂♂ collected, several more seen; Loc. 10: 11 ♂♂, 3 ♀♀ collected, many ♂♂ and copulae seen; Loc. 12: 8 ♂♂, 6 ♀♀ collected, several more ovipositing tandems photographed (Fig. 26) and seen; Loc. 14: 1 ♂ seen; Loc. 15: 3 ♂♂ collected; Loc. 16: 4 ♂♂ collected, 1 ♂ photographed (Fig. 27a), very many ♂♂, many ♀♀ seen.

Fig 26. Ovipositing tandems of Coenagrion ornatum at a shallow reservoir below the Bolagh Spring (Loc. 12; Fig. 14), Shazand County, Markasi Province, 20.05.2017.

Fig 27. Coenagrion ornatum: a – a male at the Hendudar River (Loc. 16; Fig. 16) 20.05.2017; b – a tandem at the stream at Emamzade Pirkamel (Loc. 18, Fig. 17), 25.05.2017.

L: Loc. 17: 3 ♂♂, 6 ♀♀ collected, very many ♂♂, ♀♀ seen; Loc. 18: very many ♂♂, ♀♀ seen, 1 tandem photographed (Fig. 27b); Loc. 19: 2 ♂♂ collected, many seen; Loc. 21: 1 ♀ collected, several ♂♂ seen; Loc. 23: 3 ♂♂, 1 ♀♀ collected, many seen; Loc. 28: 3 ♂♂ collected, many seen.

Remarks. Lohmann (1993) described Coenagrion vanbrinkae Lohmann, 1993 (originally as "Coenagrion vanbinki") from Iran and eastern Turkey (with the type locality "Iran, Prov. Lorestan, Dow Rud [Doroud, früher Bahrain], 33°28'N 49°05'E, 70 km E Khoramabad"; presently the town name is spelled "Dorud") as very close to C. ornatum and differing from it by widely separated tips of the cerci versus nearly touching each other in C. ornatum. As additional characters, very fine differences in the female morphology were claimed, presumed to be correlated with the differences in the male cerci position, namely a broader and not so explicitly notched median protrusion of the pronotum hind lobe and a greater median space between the transverse grooves of the mesostigmal plate. Since that description, all Iranian specimens similar to C. ornatum were identified as C. vanbrinkae without comment (see e.g. Heidari & Dumont 2002; Schneider et al. 2018), and never as C. ornatum. Skvortsov & Snegovaya (2015) doubted that ornatum and vanbrinkae are separate species but did not came to any decisive conclusion. Their specimens from Azerbaijan, which is neighbouring to Iran, have the cerci tips touching or nearly touching in the dorsal view, that is correspond to what is believed to be the ornatum s.str. type. They found the appendage outline in lateral view more resembling vanbrinkae. But their analysis of the appendage lateral view does not seem relevant, as it was based on just one drawing of vanbrinkae in the original description which could reflect individual peculiarities of the holotype. The species' author did not claim any diagnostic character of the appendage lateral view and just noted: "Die laterale Auslenkung der Cerci variiert. Die Außenäste der Paraprokte haben wie bei ornatum eine klobige Form und sind meist unterhalb der Mitte des 10. Segm. nach hinten gebogen [The lateral deflection of the cerci varies. The outer branch of the paraprocts have a chunky shape as in ornatum and are usually below the middle of the 10th segment, bent backwards]." (Lohmann 1993: 205).

At the same time Kalkman (2006: 31) in his Turkish guide noted: "Differentiation from C. ornatum is unclear to the author," and in the recent European Atlas Boudot & Kulijer (2015: 109) repeated almost the same: "The relationship of C. vanbrinkae Lohmann, 1993 with C. ornatum and its putative range are unclear hence this taxon is here considered a synonym of C. ornatum".

In view of this controversy, we have checked cerci in 37 of 40 males from our collection, enumerated above (the abdomen tip was missing in three specimens) and discovered that:

(i) the converged vs diverged tips of the cerci are alternative states (Fig. 28a-b vs c-e), so that each specimen can be unequivocally assigned to either class in spite of some expected slight variation of the cerci position (regardless if this is just a matter of position of movable appendages or a genetic polymorphism), and

(ii) the cerci tips are widely divergent (as in Fig. 28a-b) in 22 specimens (59.5%) and touching each other or nearly so (as in Fig. 28c-e) in 15 specimens (40.5%), without any trace of local specificity or correlated characters.

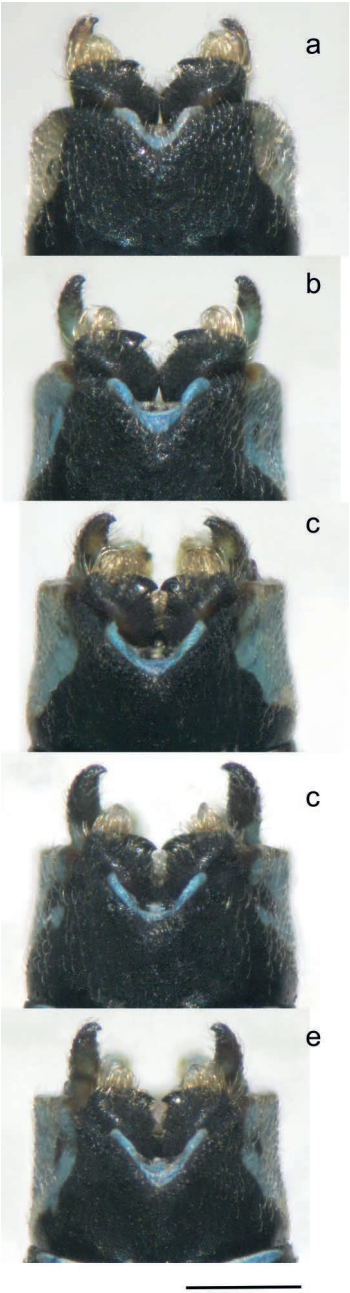

Fig 28. Anal appendages (dorsal view) of five males of Coenagrion ornatum collected at the Garehchay River (Loc. 10) on 19.05.2017 showing variability of the character claimed to be diagnostic for C. vanbrinkae Lohmann, 1993 (the cerci tips diverging, a-b) and C. ornatum (Selys, 1850) s. str. (the cerci tips almost touching, c-e). Scale bar 0.5 mm.

Hence at least in the examined populations in the Central Zagros, these close to equal frequencies of the alternative states of the only easily recognisable characters, claimed to be diagnostic for vanbrinkae versus ornatum, do not persuade us that this character has any taxonomic value, or that the former taxon is even a subspecies. So we follow Boudot & Kulijer (2015) and assume C. vanbrinkae to be a pure junior synonym of C. ornatum.

The type series of Coenagrion vanbrinkae contained 6 male specimens from Iran: 3 (including the holotype) from the type locality (Dorud Town) and 3 from Bisheh (our Loc. 27 where we did not find these damselflies) (Lohmann, 1993). This is probably insufficient to assess the variation. Note that our Locs. 19 and 21 at Hayan village are just 35 km NNE of the type locality.

Observations. These damselflies were very numerous by any medium-sized rivers with a moderately rapid current, such as Garehchay, Hendudar and Golbahar, and large streams. At the Garehchay River (Loc. 10) these damselflies were numerous both by the cold and rapid river (Fig. 11) and by its floodplain pools of various depth (Fig. 12) but always by open water. They were also found in rush at most of the small mountain chashmaha with cold spring water. For some reason not a single individual was found in the Shilanevar valley. At the Bolagh Spring (Loc. 12), many tandems oviposited to brownish submerged plants with pennate leaves (Fig. 26) which filled a shallower concrete basin (Fig. 14 below). Not found at major Ghomrood (Anaarbar) (Locs. 31-32) and Sezar (Loc. 27) Rivers and at smaller rivers with rapid current (Locs. 26, 33).

Fig 29. A copula (a) and female of the 'blue' morph (b) of Coenagrion persicum at the Garehchay River right floodplain (Loc. 10, Fig. 12), 19.05.2017.

6. Coenagrion persicum Lohmann, 1993

M: Loc. 1 (the lower pond): 1 ♂ collected; Loc. 7: 1 'dark' ♀ collected to alcohol; Loc. 10: 2 ♂♂, 4 ♀♀ (3 'blue', 1 'dark') collected, 1 copula and 1 'blue' ♀ photographed (Fig. 29); Loc. 12: 1 ♂, 1 'dark' ♀ collected; Loc. 14: 1 ♂ collected, 1 more seen; Loc. 15: 1 ♂ collected; Loc. 16: 1 ♂ collected, 1 ♂ photographed (Fig. 30), several more seen.

Fig 30. A male of Coenagrion persicum at the Hendudar River (Loc. 16; Fig. 16), 25.05.2017.

L: Loc. 17: 2 ♂♂, 1 'blue' ♀ collected; Loc. 21: 1 ♂ and 1 'dark' ♀ collected in tandem.

Remarks. Schneider at al. (2016) revealed two female morphs of this species, which they called respectively 'dark', with S3-S7 completely black dorsally, and 'blue', with much blue on the dorsum of S3-S5 and some on that of S6-S7. There are four 'blue' and three 'dark' females in our collection.

Note that Loc. 22 at Hayan village is just 66 km NW of the species type locality. Azna Town (Lohmann, 1993).

Schneider et al. (2016: 572) noted: "All C. persicum females identified by us have a marking on S2 like a spearhead, reminiscent of C. hastulatum males ... Such marking on S2 is absent in other Coenagrion females of the Western Palaearctic, although something distantly similar can be found in C. armatum and in some females of C. hylas ...." This claim is not correct, since in West Siberia (e.g. at Novosibirsk) and North Kazakhstan, which are in the Western Palaearctic rather than the Eastern Palaearctic both geographically and biogeographically, such an S2 mark is found in predominating female morph (coloured as the 'dark' females of C. persicum) of Coenagrion pulchellum (Fig. 31b) – the species closest to C. persicum and formerly considered conspecific with it. Moreover, in West Siberian males the antehumeral stripe is reduced as in C. persicum (noted by Schneider et al. 2016), at the same time they have much more black on the abdomen (Fig. 31a). Hence C. persicum may be genetically related to

the West Siberian representatives of C. pulchellum, provisionally known as C. pulchellum sibiricum Belyshev, 1964 or the simultaneously described C. pulchellum saissanicum Belyshev, 1964 (Belyshev 1964). They were not involved in molecular analysis by Schneider et al. (2016), and the taxonomic status of both C. persicum and the West Siberian C. pulchellum is still to be reconsidered.

Fig 31. Coenagrion pulchellum from Russia, West Siberia, Novosibirsk [sic!], the Lake Maloe oxbow between Nizhnyaya El'tsovka and Pravye Chyomy estates, 18.06.2016 (a) and 9.07.2017 (b); a – a typical male with the synthorax coloured as in C. persicum; b – a female coloured as 'dark' females of C. persicum.

Observations. This species was a regular but less numerous admixture to the previous one, as earlier noted by Schneider et al. (2016). It was not found among C. ornatum at Locs. 18, 23 and 28, and that could be due to insufficient search. The only two places where C. persicum was found without C. ornatum were the lower pond in the Shilanevar valley (Loc. 1; Fig. 8) and the Lake Kavir-e Meighan S bank (Loc. 7; Fig. 4). The finding of a female in the saline environment of the latter was striking: most probably that individual emigrated downstream to the estuary where it was collected.

Fig 32. Males and exuviae of Enallagma cyathigerum risi at the lower pond in the Shilanevar valley (Loc. 1; Fig. 8b), 29.05.2017.

7. Enallagma cyathigerum risi Schmidt, 1961

M: Loc. 1: 7 ♂♂ (1 teneral), 2 ♀♀ collected, several males and exuviae photographed (Fig. 32); very many teneral and mature individuals, many tandems and exuviae seen at the lower pond, few ♂♂ and tandems at the upper ponds; ?Loc. 12: 1 ♂ tentatively seen.

Remarks. The main difference in the subspecies of E. cyathigerum is the position of a yellowish blade ('lip') on the male cerci: it is positioned apically of the robust terminal apical tooth in E. cyathigerum cyathigerum (see e.g. Kosterin & Zaika 2010: fig. 4a) versus ventrally, below the apical tooth, in E. cyathigerum risi (Kosterin 2004: fig. 5; Kosterin & Zaika 2010: fig. 4c). Perhaps to match that version of the structure of the male cerci, females of E. cyathigerum risi also have more erect ridges of the mesostigmal plate (Seidenbusch 1997) (not considered in Iran). The drawing of the male appendages of E. cyathigerum risi from a desert lake of Kerman Province of Iran by Schneider et

al. (2018: fig. 11c) does not show the yellowish lip below the apical tooth. The differences in the length and direction of the paraprocts as shown for this specimen and a specimen of Enallagma cyathigerum risi from Mazandran Province (Schneider et al. 2018: fig. 11) are curious but may be individual variations of no taxonomic value; at least they were not discussed.

In Siberia, E. cyathigerum risi occupies forest-steppe and steppe plains, often occurring at large lakes, including brackish ones, while E. cyathigerum cyathigerum inhabits the forest zone and prefers small ponds (Kosterin & Zaika 2010; Bernard & Kosterin 2010). In forested mountains intruding into the steppe zone, such as the Urals, Altai and Sayans, there are populations containing males with both types of the cerci and also with the intermediate types, with the yellow lip protruding both apicad and ventrad of the terminal tooth (Kosterin 2004; Kosterin & Zaika 2010: fig. 4b). In our series from the Shilanevar valley ponds, 6 males show the typical risi-type cerci (Fig. 33a) but one teneral male has the cerci transitory to the nominotypical subspecies similar to the above mentioned Siberian intermediate specimens, with the yellowish lips (indicated with 'L') present both at the tip and below the apical tooth (Fig. 33b).

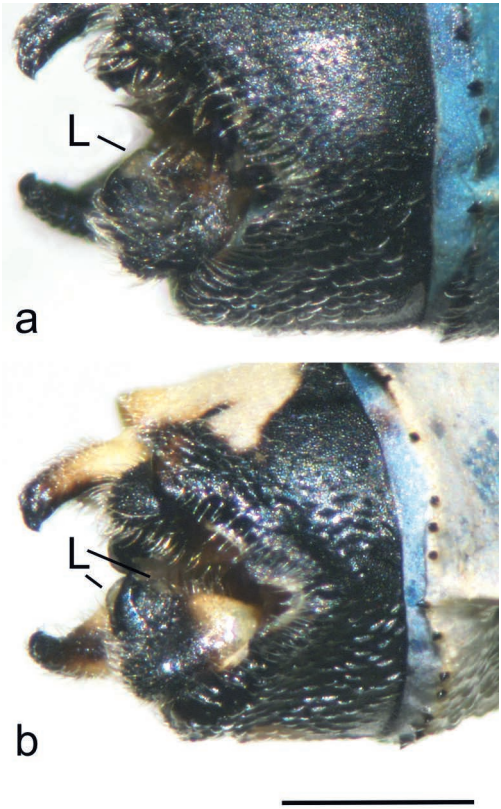

Fig 33. The right cercus (dorsolateral view) of two male specimens of Enallagma cyathigerum from the lower pond at the Shilanevar valley in Tafresh County of Markazi Province, 29.05.2017 (Loc. 1), : a – a typical cercus of E. cyathigerum risi, with the yellowish lip (L) situated below the apical tooth; b – a cercus intermediate between E. cyathigerum cyathigerum and E. cyathigerum risi, with the yellowish lips (L) both at the tip and below the apical tooth. Scale bar 0.5 mm.

Observations. Schneider & Dumont (2015) and Schneider & Ikemeyer (2016a) suggested that this subspecies occurs in W Iran above 2 000 m a.s.l., and our finding at 2036-2077 m fits this expectation (curiously, in South Siberia E. c. risi occurs in subarid plains while E. c. cyathigerum and intermediate forms can occur in the same regions higher in wooded mountains, see Kosterin 2004; Kosterin & Zaika 2010). This species was found by us only in the Shilanevar valley (Loc. 1), and there it was extremely numerous, already ovipositing and still emerging at the lowest pond (Fig. 8b) and only a few at the higher ponds (Fig. 8a). The lower pond was very rich in damselflies and dragonflies and warm, as judging by the amount of slime algae. It was not excluded that individuals at the upper ponds had come from the lower pond as well. We expect that later in the season this not-so-early species could be found at more localities. A large light-blue damselfly flying fast and low over open water at Bolagh Spring (Loc. 12; Fig. 14 below) might be this species as well.

Fig 34. Ischnura elegans: a-b – copulae; c – a male perching on slime algae; a – the polluted pond at a garbage site near Arak (Loc. 6), 28.05.2017; b – the Garehchay River right-bank floodplain (Loc. 10), 19.05.2017; c – a small reservoir in Baneh village (Loc. 11), 19.05.2017.

8. Ischnura elegans (Vander Linden, 1820)

M: Loc. 1: 1 ♀ collected; Loc. 2: 2 ♂♂, 1 ♀ checked and released; Loc. 6: 18.05.2017: 2 ♂♂, 3 ♀♀ collected, several copulae photographed (Fig. 34a), extremely numerous seen on 18, 24 and 28.05.2017; Loc. 7: 3 ♂♂, 4 ♀♀ collected into alcohol, extremely numerous ♂♂, ♀♀ seen; Loc. 10: 12 ♂♂, 8 ♀♀ collected, a copula photographed (Fig. 34b), numerous ♂♂, ♀♀ and copulae seen; Loc. 11: 1 ♂ photographed (Fig. 34c), several more seen; Loc. 12: 3 ♂♂ collected, several more ind. seen; Loc. 14: 3 ♂♂, 1 ♀ collected; Loc. 15: 1 ♂ collected, several seen; Loc. 16: 2 ♂♂, 3 ♀♀ collected;

L: Loc. 17: 1 ♀ collected, many ♂♂, ♀♀ seen; Loc. 18: 1 ♂ seen; Loc. 19: 1 ♂ collected, many ♂♂, ♀♀ seen; Loc. 21: 1 ♀ seen; Loc. 23: several ♂♂, ♀♀ seen.

Remarks. Erich Schmidt (1938) described four subspecies of I. elegans, including I. elegans ebneri Schmidt, 1938 from a series from Crete, Cyprus, Palestine and Syria, and I. elegans pontica Schmidt, 1938 ranging from Lake Neusiedl and Carinthia through Hungary to the northern Balkans and the Caspian Sea, without type series enumerated. In his "Odonata Iraniens", he (Schmidt 1954) attributed specimens from Astrabad (Gorgan) and Tahergurab, Northern Iran, to I. elegans pontica and a male, with the abdomen missing from S5, from Ghom (Qom), Central Iran, to I. elegans ebneri Schmidt 1939, to which he provisionally attributed also five females from Qom, Hableh Rud, Baluchestan and 4 km N of Siwand: "Die Bestimmung bleibt so lange unsicher, als kein ♂ mit erhaltenen Analanhängen vorliegt. Nach der Form des Prothoraxfortsatzes des ♂ ist Zugehörigkeit zu subsp. Ebneri m. am wahrscheinlichsten, da diese von den bisher bekannten Formen mit höherem als breitem Prothoraxfortsatz am weitesten nach Osten (bisher Syrien— Palästina) bekannt ist. Die ♀♀ sind alle fraglich und nur aus geographischen Gründen nicht zu I. e. pontica m. gezogen." ["The determination remains uncertain as long as there is no ♂ with the appendages preserved. According to the shape of the prothorax process of ♂, subsp. ebneri m. is the most likely option, since, of the known forms with a higher than broad prothorax process, subsp. ebneri extends furthest to the east (up to now Syria/Palestine). The ♀♀ are all questionable and are identified as I. e. pontica for geographical reasons"] (Schmidt 1954: 234). That is, in 1954 the subspecific attribution of specimens from Central Iran was unclear even for the author of those subspecies.

The same author (Schmidt 1967) in his revision of the Ischnura elegans group attributed to I. e. ebneri only two Iranian male specimens from Persepolis (that is near the present day Shiraz, Fars Province); moreover in his Table 3 he indicated that only one of them was typical I. e. ebneri while the other was transitory to I. e. elegans. He mentioned "Kaspisch Persien" in the range of I. elegans pontica, and, while discussing I. elegans ebneri, also noted: "Ein Gefälle zeigt sich dann für I. e. pontica in Nord-Iran (18 mit ♂ mit Abd. 24.43) und weiter in Afghanistan (50 mit ♂ mit Abd. 23.65), wo die Form bisher ihre Ostgrenze erreicht hat, vorbehaltlich des ♂ aus Irkutsk in coll. Selys, falls es hierher gehört. Im wesentlichen wäre dann I. e. pontica aus S.O.-Europa über Iran nach Afghanistan, also rückwärts wieder nach dem Osten-gewandert." ["There is a gradient to I. e. pontica in northern Iran (18 with ♂ with Abd. 24.43) and further in Afghanistan (50 with ♂ with Abd. 23.65), where the form has so far reached its eastern border, substantiated by ♂ from Irkutsk in coll. Selys, if it belongs here. In essence, I.

e. pontica would have wandered eastwards from S.E. Europe via Iran to Afghanistan, so returning once more to the east"] (Schmidt 1967: 210).

Schmidt (1954) assumed the following diagnostic differences between the two subspecies reported for Iran:

"d. Prothoraxfortsatz beim ♂ und blauen ♀ hinten tiefgesattelt, mit einer Vorderzwiesel, d. i. ein auf gerichteter Grat am distalen Teil, durch den der Fortsatz länger wird als breit; in Seitenansicht ist die orale Begrenzung meist gerade. App. inf. des ♂ zugespitzt; Innenäste der App. sup. gekreuzt. [The prothoracic protrusion of ♂ and blue ♀ deeply saddled, with a front pommel, that is the distally directed process looks longer than wide; in lateral view its fore margin is usually straight; the lower appendages pointed and their inner processes crossed] ... – elegans Ebneri m, 1939

dd. Prothoraxfortsatz beim ♂ und blauen ♀ hinten flach gesattelt, ohne Vorderzwiesel, im ganzen nicht höher als breit; in Seitenansicht ist die orale Begrenzung meist gebogen. App. inf. der ♂♂ am distalen Ende stumpfer, die Innenäste der App. sup. nicht gekreuzt. ... [The prothoracic protrusion of ♂ and blue ♀ flatly saddled, without front pommel, in general no longer than wide; in lateral view its fore margin is usually curved; the lower appendages of the males blunt and their inner processes not crossed.] ... – elegans pontica m, 1939" (Schmidt 1954: 232).

One can note that Schmidt's concept of subspecies differed from what is accepted by most present day taxonomists. He considered subspecies as entities connected with gradients, clines and transitions. For instance, in his Table 3 (Schmidt 1963) he provides his evaluation of phenotype frequencies over 153 male specimens from 10 distant localities from the range of his I. elegans ebneri, of which 84 appeared 'typical I. e. ebneri', 59 'transitory' and 8 corresponded to 'typical I. e. elegans'. Moreover, transitory specimens were found in all localities but one, Hokkaido, represented just by one 'typical I. e. ebneri' male. That is, Schmidt himself did not encounter any series of 'pure' ebneri! At present, a vague subspecies concept such as that of E. Schmidt would be alone sufficient to reject the validity of his subspecies of I. elegans. Nevertheless, most later authors just reported I. elegans ebneri for Central and Southern Iran without comment, for instance Heidari & Dumont (2002) for Kurdistan, Tehran, Qom, Fars and Sistan & Baluchestan Provinces, Rastegar et al (2013) for West Azerbaijan Province, Scheider & Ikemeyer (2016a) for Khuzhestan, Ilam, Kermanshah, Lorestan and Chaharmahal-va-Bachtiyari Provinces and Scheider & Ikemeyer (2016b) for Khorasan-e-Razavi and Khorazan-e-Shomali Provinces.

Eventually Schneider et al. (2018: 18) explicitly and quite reasonably rejected the subspecies I. elegans ebneri and I. e. pontica "because they cannot be accurately defined due to uncertain and unstable diagnostic characters". The same was earlier done for the presumed subspecies of I. elegans in West Asia (Kalkman 2006), Central Asia (Borisov & Haritonov 2007) and Europe (Boudot & Šalamun 2015).

Of the characters claimed by Schmidt, the crossed (see Taf. VI-1 in Schmidt 1963 and fig. 9.1 in Kalkman 2006) versus not crossed position of the inner cercal processes is easiest to score. We examined 27 males from our collection and found the lower processes of the cerci crossed in only 6 (3 from Loc. 10, and by 1 from Locs. 7, 12 and 16), that is in ca 22% of males. Hence this claimed diagnostic subspecific character

is irrelevant, at least in West Iran, and we agree with Schneider et al. (2018) (and actually with Schmidt (1963) himself) that isolation of subspecies in I. elegans is not justified.

Observations. The most common and numerous damselfly. On one hand, it reached incredible abundance in cattail at the brackish stream estuary at Lake Kavir-e Meighan (Loc. 7.; Fig. 4) and at a garbage swamp with heavily polluted water in the Arak suburbs (Loc. 6; Fig. 10). On the other hand, this species also accompanies C. ornatum and occurs in abundance in rushes at moderately rapid medium-sized rivers and streams and at the mountain chashmaha with cold spring water. As well as C. ornatum, for some reason it was absent from the Shilanevar valley (Loc. 1).

At the Garehchay River (Loc. 10) these damselflies were very abundant in spikerush floodplain swamplets but scarce in rushes by the cold and rapid river.

9. Ischnura intermedia Dumont, 1974

M: Loc. 1 (the lower pond): 1 ♂, 1 ♀ collected.

Remarks. This species, described from Turkey, was expected to occur only in the northwesternmost part of Iran (Heidari & Dumont 2002) but then was found to extend as far south-east as Yazd Province (Kiany & Sadeghi 2016).

Observations. Found only once at a pond with slime algae and diverse and abundant Odonata. Interestingly, only one female of the elsewhere common I. elegans was collected there.

10. Ischnura pumilio (Charpentier, 1825)

M: Loc. 7: 2 ♂♂ collected, Loc. 12: 1 ♂ collected; Loc. 14: 1 copula collected; Loc. 15: 1 ♂ collected.

Observations. Found as an admixture to I. elegans in any of its habitats: in cattail at a brackish estuary at Lake Kavir-e Meighan (Loc. 7), in rushes at three localities above 1800 m in Shazand County: two chashmaha with cold spring water (Locs. 12 and 14), and one shallow swamp with warm water (Loc. 15). Everywhere it was far less abundant than I. elegans; this is not reflected in the relative numbers of specimens collected, for we specially searched for damselflies appearing different from I. elegans in the field.

11. Platycnemis kervillei (Martin, 1909)

M: Loc. 10: 4 ♂♂ (3 teneral), 3 ♀♀ (teneral) collected, 1 mature ♂ (Fig. 35b), 1 teneral ♀ (Fig. 35a) photographed, several mature ♂♂ and many tenerals seen; Loc. 16: 1 ♂, 2 ♀♀ (teneral) collected, a fair number seen.

L: Loc. 17: 3 ♂♂ (2 teneral), 2 ♀♀ (teneral) collected, a few more seen; Loc. 23: 2 ♂♂ (1 teneral), 1 ♀ collected, 1 ♂ photographed (Fig. 35c), several seen; Loc. 27: 1 ♀ collected, 1 mature ♂, several immature ♂♂, several ♀♀ seen.

Observations. Found by larger streams (Locs. 17, 23; Fig. 19), and medium-sized (Loc. 10, 16; Figs. 11, 16) and large (Loc. 27; Fig. 20) rivers. Not found by the large Ghomrood (Anaarbar) River in Esfahan Province (Locs. 31-32). By the Garehchay River (Loc. 10; Fig. 11), mature males perched on rushes and willow branches by a deeper reach and

Fig 35. Platycnemis kervillei: a – a teneral female in a spikerush swamplet of the Garehchay River right floodplain (Loc. 10, Fig. 12), 19.05.2017; b – a mature male on the Garehchay River right bank, the same date; c – a mature male at a stream at Abestan village (Loc. 23, Fig. 19), 26.05.2017.

were absent by riffles, while much more numerous young and still white individuals of both sexes were abundant in grass at some distance from water near that reach and, surprisingly, in spikerush in shallow warm floodplain swamplets. They could have emigrated there out of their breeding river before maturity or, alternatively, could even breed there, since some 45 days previously those swamplets were still inundated by a river.

12. Aeshna mixta Latreille, 1805

L: Loc. 22: 1 immature ♂ seen; Loc. 25: 1 immature ♂ photographed (Fig. 36), numerous immature ind. seen; Loc. 26: 1 immature ♂ collected, many immature individuals seen.

Observations. Immature darners of this species were observed in open Persian Oak stand covering slopes of the gorge open to the Sezar River valley at Bisheh, in great

number and obviously without connection to any water, in the upper part of the same valley 6.2 km NE of Chenar Gerit village (Loc. 25), and somewhat fewer in its lower part 2.2 km WNW of Pasil village (Loc. 26). They rested on oak branches (Fig. 36) or swarmed over small open glades near a small river (at Loc. 26). At the same time in the analogous landscape of Loc. 22, behind the pass separating this site from the valley mentioned, only one individual was observed. There was little doubt that the darners at Locs. 25-26 had dispersed from lower levels down the Sezar River valley, as pre-reproductive migration to the mountains is well known for this species in Central Asia (Borisov 2006).

Fig 36. Aeshna mixta, an immature male in shade of Persian Oak branches in the upper part of a valley 6.2 km NE of Chenar Gerit village (Loc. 25), Khorramabad County, Lorestan, 31.05.2017.

Fig 37. A male of Anaciaeschna isoceles resting on a cattail leaf at a heavily polluted pond (Loc. 6; Fig.) in the Arak suburbs, 28.05.2017.

Fig 38. A male of Anax imperator patrolling the lower pond in the Shilanevar valley (Loc. 1; Fig. 8b), 29.05.2017.

13. Anaciaeschna isoceles (Müller, 1767)

M: Loc. 6: 1 ♂ photographed (Fig. 37) on 28.05.2017.

Observations. A male for quite a long time ranged over extremely polluted, dirty and smelly water and rested for a short while on cattail leaves (Fig. 37) at the boggy garbage swamp on waste land near Arak City (Loc. 6; Fig. 10). This species was not observed on visits to this locality four and ten days previously.

14. Anax imperator Leach, 1815

M: Loc. 1 (the lower pond): 1 ♀ collected, 1 ♂ photographed (Fig. 38), not less than 1 ♂, 1 ♀ seen; Loc. 10: 1 ♂ seen.

Observations. At the Garehchay River (Loc. 10), a cautious male was observed to range over deeper and colder floodplain pools with Chara gymnophylla. In the Shilanevar valley (Loc. 1) near Tafresh City, several males patrolled (Fig. 38) a small warm pond filled with slime algae (Fig 8b).

15. Caliaeschna microstigma (Schneider, 1845)

M: Loc. 4: 1 ♂ seen.

L: Loc. 17: 1 ♀ collected, 1 more ind. seen; Loc. 18: 1 ind. seen; Loc. 26: 1 ♂ photographed (Fig. 39); Loc. 29: 1 ind. seen.

Fig 39. Caliaeschna microstigma, a male resting on a lower branch of a Persian Oak in a rivulet gorge 2.2 km WNW of Pasil village (Loc. 26), Khorramabad County, Lorestan, 31.05.2017.

Observations. Observed sporadically flying above small rivers or along their riparian thickets, or landing on tree or bush branches in deep shade (Fig. 39).

16. Gomphus kinzelbachi Schneider, 1984

E: Loc. 27: 3 broken exuviae collected, 2 photographed (Fig. 40), many seen.

Remarks. The only exuvia which had a labium (Fig. 41) and unbroken body was 29 mm long and had the evenly rounded outer margin of the palpus (Fig. 41), that corresponds to G. kinzelbachi according to Schneider et al. (2017b). (The number of flattened teeth in the palpus inner margin is difficult to count because the proximal ones are poorly defined, but seems to be 7.) Although these differences from G. schneideri Selys, 1850 are very subtle, the identification is most probably correct, for G. kinzelbachi was collected for the first time in Iran on May 23, 1937 at exactly this locality (Lohmann 1992).

Observations. A fair number of old exuviae, which fell to pieces during collection, were found (together with fewer those of E. fatime) on large boulders (Fig. 40) on the Sezar right bank just downstream from a vehicle bridge, itself 1.8 km downstream from the Bisheh Waterfall, with more exact coordinates 33.3358-3369° N 48,8926-2960° E. It was unclear if the dragonflies had emerged this or the previous year.

Fig 40. Exuviae of Gomphus kinzelbachi collected from the Sezar River 1.8 km downstream of the Bisheh Waterfall (Loc. 27; Fig. 20), Khorramabad County, Lorestan, on 26.05.2017.

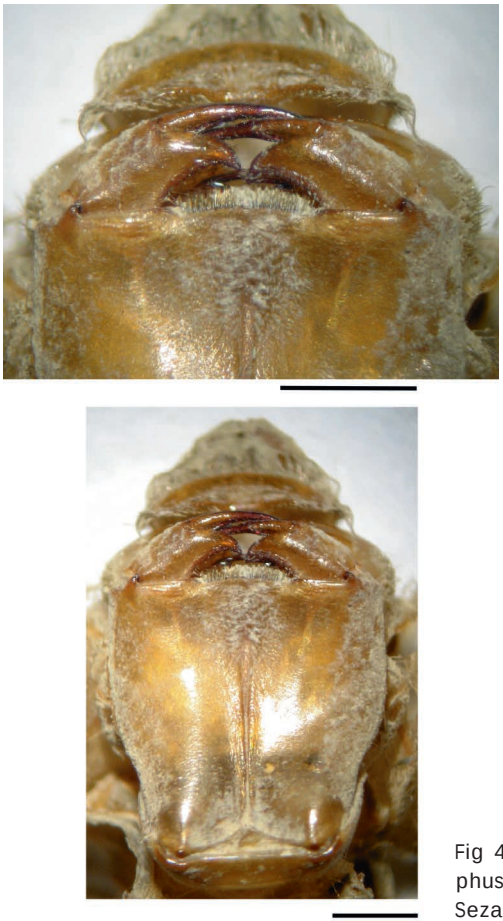

Fig 41. Labium of an exuvia of Gomphus kinzelbachi collected from the Sezar River (Fig. 40). Scale bar 1 mm.

17. Gomphus schneideri Selys in Selys & Hagen, 1850

E: Loc. 32: 1 ♂, 1 ♀ collected during maiden flight (Fig. 42), 1 ♂ photographed (Fig. 43), 1 more ♂ seen.

Remarks. The species was reported by Bartenev (1916) for Astrabad (now Gorgan) and by Schmidt (1954) for Tahergurab (Gilan Province in North Iran) (1 ♂) and two ♂♂ collected much further south, from Esfahan Province: "Österr. Iran-Exped.: Pirbakran, 27. V. 50, 2 ♂ juv., etwas fraglich" [2 juv[enile] ♂, somewhat questionable]. "Noch kleiner sind die mäßig erhaltenen 2 ♂ Pirbakran, das Abd. unter 30, ebenso Vdfl., und überhaupt etwas fraglich zugehörig." [Even smaller are 2 ♂, in poor condition, from Pirbakran, abd[omen] less than 30 [mm], as well as f[ore] wing, and generally of somewhat doubtful attribution.] (Schmidt 1954: 248-249). Pir Bakran is a town in Falavarjan County, near Esfahan, at 32.47° N 51.56° E.

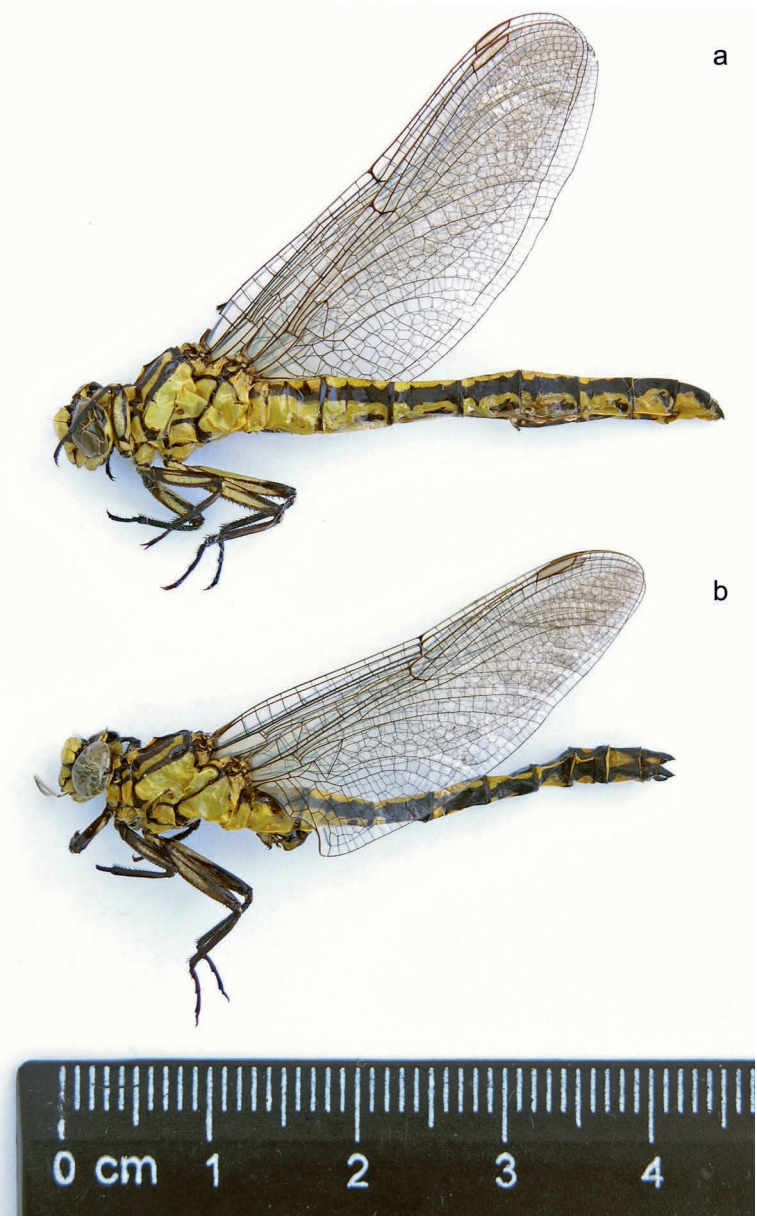

Fig 42. A female (a) and male (b) of Gomphus schneideri collected on the Ghomrood (Anaarbar) River left bank 16 km km WSW of Golpayegan City (Loc 32), Esfahan Province, 21.05.2017.

Fig 43. A male of Gomphus schneideri on the Ghomrood (Anaarbar) River left bank 16 km WSW of Golpayegan City (Loc 32.), Esfahan Province, 21.05.2017.

It is noteworthy that since that all newer records of the species were made in North Iran, where it is presently known from Azarbayejan-e-Garbi, Azarbayejan-e-Sharqi, Gilan, Mazandran, Tehran, Golestan and Razavi Khorasan Provinces (Heidari & Dumont 2002; Scheider et al. 2018), so the record from Pir Bakran remained the only one so far south. Schneider et al. (2018: 29) noted that "Gomphus schneideri occurs in different colour variations in Iran. Typical dark forms inhabit the northern slopes of the Alborz Mountains. The typical yellow basal central spots on the dorsal abdomen on S8-S9 are sometimes absent in individuals from the Caspian Sea region. South of the Alborz more yellow forms can be found (Fig. 20, left)." It is however unclear which localities were implied by "south of the Elborz", as Schmidt (1954) did not illustrate the specimens from Pir Bakran while their mentioned fig. 20, left, refers to Azarbayejan-e-Garbi Province, which is at the same latitude as the Elborz. Perhaps the southern principal slope of the Elborz was implied. So our finding of this species is the second one made in fact south of the Elborz and the second in Esfahan Province, 170 km NW from Pir Bakran.

Our male specimen shows the structural characters typical for G. schneideri as shown by Schneider et al. (2017b: Fig. 7), namely the posterior hamulus with a pointed apex

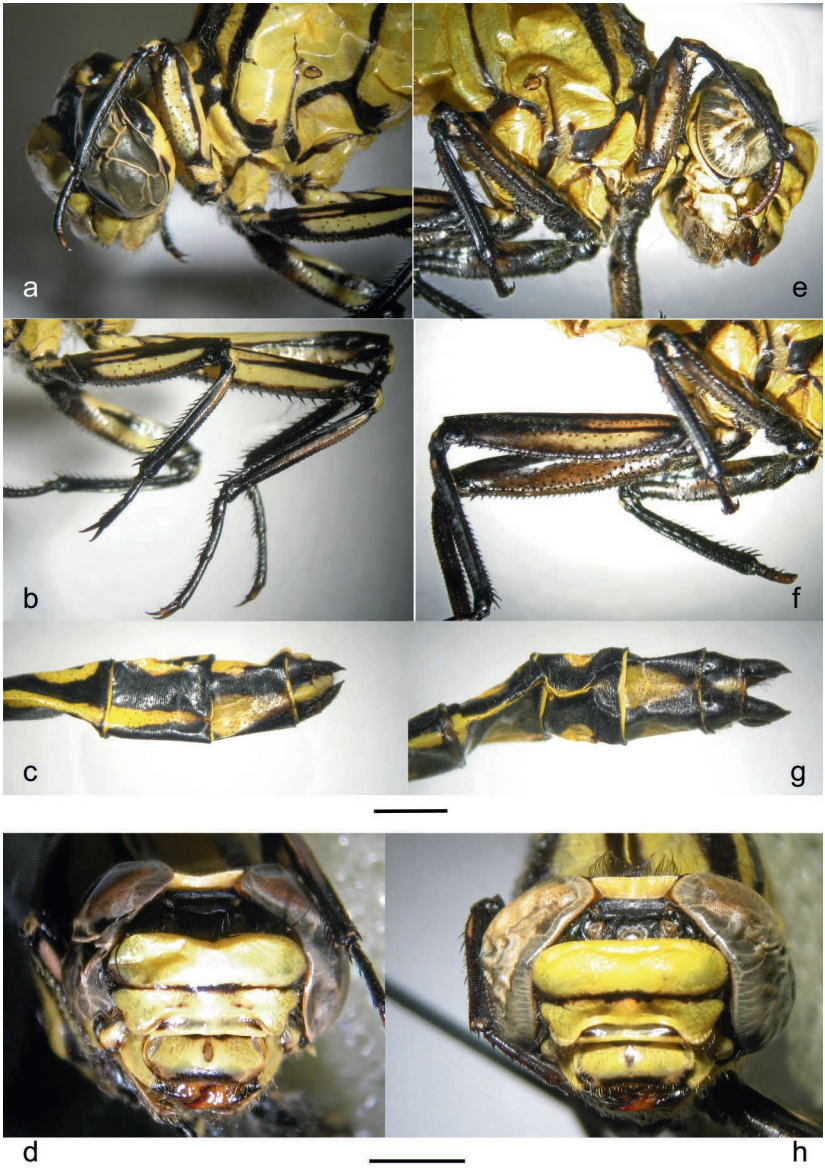

Fig 44. Details of the female (a-d) and male (e-h) of Gomphus schneideri collected on the Ghomrood (Anaarbar) River left bank: a,e – head, fore legs and thorax in lateral view; b,f – mid- and hind legs in lateral view; c,g – end of abdomen, approximately dorsal view; d,h – head, frontal view. Scale bar 2 mm.

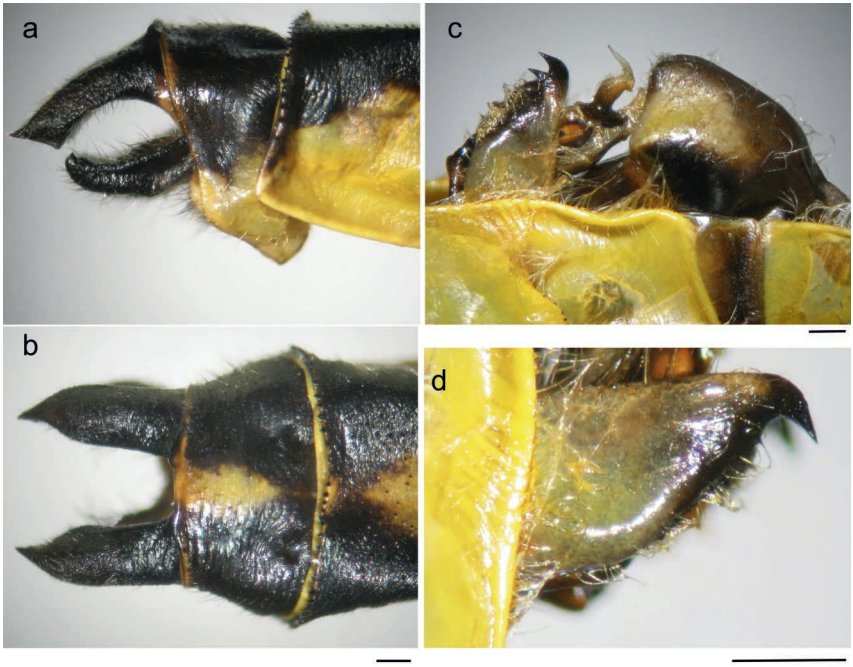

Fig 45. Abdominal details of the male of Gomphus schneideri collected on the Ghomrood (Anaarbar) River left bank: a – anal appendages, dorsal view; b – ditto, lateral view; c – accessory genitalia, lateral view; d – hamulus posterioris, lateral view. Scale bar 0.5 mm.

and a subapical ledge (Fig. 45d) and a short pointed cercus with a distinct ventrosubapical knob (Fig. 45a). The valvula vulvae is folded in the female so that its shape cannot be evaluated. The specimens of our pair are small, with measurements as follows (male/female): hind wing 30/32 mm, abdomen 29/31 mm, total length 41/45 mm.

Our specimens are strikingly pale (much paler than that shown in fig. 10, left, in Schneider et al. (2018), said to represent a "yellower form"), approaching in coloration to G. kinzelbachi (Figs. 42-45). There is more yellow than black on the femora (Fig. 44a-b,e-f), the extensor surface of tibia is also yellowish in the female (Fig. 44a-b) and has yellowish patches in the male (Fig. 44e-f). Although S10 of G. schneideri is described as entirely black (Kalkman 2006; Schneider et al 2017), our specimens have there a large yellow dorsal spot throughout (in the female, Fig. 44c) or almost throughout (in the male, Fig. 44g) the segment length. The yellow dorsal spots on S8 and S9 reach (in the female, Fig. 44c) or almost reach (in the male, Fig. 44g) the segments' distal margin. In the male accessory genitalia, the outer half of the vesica and most of the posterior hamulus are yellow (Fig. 45c-d).

Schmidt (1961) described Gomphus amseli Schmidt 1961 from Herat, Afghanistan, which is presently considered a synonym of G. schneideri (Schneider et al. 2018), representing its pale form. It is hard to infer the actual diagnostic characters implied for G. amseli by its author, who did not illustrate such important features as the anal appendages and secondary genitalia. It was said to resemble G. vulgatissimus (Linnaeus, 1758) and G. schneideri but compared mostly with the West European G. simillimus Selys, 1840, sharing the similar shape of the male anal appendages and the vesica being pale below. Schmidt (1961) obviously overestimated significance of the number of cells in the male anal triangle, said to be 5-6 in G. amseli, 4-7 in G. vulgatissimus and 3-4 in G. schneideri. (5 in our male). For both structural and biogeographical reasons it is safe to agree with the synonymy of G. schneideri and G. amseli. However, some features of the type series of G. amseli are interesting with respect to our specimens. The type specimens were also very pale. The thoracic black pattern was not illustrated but described as narrow as in G. pulchellus Selys, 1840, while in our specimens the

Fig. 46. The Ghomrood (Anaarbar) River left bank just upstream of the lower reservoir, 16 km WSW of Golpayegan City (Loc. 32), 21.05.2017.

black stripes are not as narrow as this. The femora were described as yellow, with one black stripe on the flexor side and two distal more or less interconnected black longitudinal stripes on the extensor side, the tibiae and tarsi black. In our specimens the legs are even paler, with a yellow stripe present also on the female tibiae. The abdomen in the G. amseli types is said to have the yellow dorsal side throughout segments S1-S10, as in our specimens. Hence our specimens are generally as pale as the type series of G. amseli.

Observations. In total four individuals were observed, two of which, still not fully coloured, were caught on their maiden flight from a narrow strip of reed on the powerful and rapid Ghomrood (Anaarbar) River left bank (Loc. 32; Fig. 46) and were allowed to harden in captivity. Two still teneral but already coloured individuals were startled from bushes (Fig. 43) under sparse walnut trees near the river and were not caught.

Fig. 47. A teneral male of Onychogomphus lefebvrii at an open stream with rushes (Loc. 2; Fig. 9) near Tafresh City, Markazi Province, 29.05.2017.

18. Onychogomphus lefebvrii (Rambur, 1842)

M: Loc. 2: 2 ♂♂, 2 ♀♀ (all teneral) collected, 1 teneral ♂ photoraphed (Fig. 47).

Observations. The species was found at only one locality, an open stream with rush (Loc. 2; Fig. 9), near Tafresh City, where only tenerals of both sexes were met.

19. Crocothemis erythraea chaldaeorum Morton, 1920

L: Loc. 19: 2 ♂♂ collected, 1 more seen; Loc. 20: 1 ♂ seen.

Remarks. Schneider et al. (2018) rejected subspecies division in C. erythraea, nevertheless we may note that our two males have the diagnostic character of the taxon chaldaeorum according to Schneider (1986), that is, the basal amber spots in the hind wings not extending beyond the cubitoanal zone, 8½ antenodals and two rows of cells at the beginning of the discoidal field. Absence of basal spots in the fore wings is also claimed as such a character, but our specimens show traces of amber, occupying one cell at the hind wing margin in one and less in the second. The diagnostic characters of the taxon chaldaeorum are nevetherless minor so we follow Borisov & Haritonov (2008) to consider it in a subspecific rank.

Observations. Only three males were found at only two chashmaha (Fig. 18) (of eight examined in total).

20. Libellula depressa Linnaeus, 1758

M: Loc. 1 (the lower pond): 2 ♂♂ seen; Loc. 10: 1 ♂ photographed (Fig. 48b), 2 more seen; Loc. 11: 1 ♂, 2 ♀♀ seen; Loc. 12: 1 ♂ seen; Loc. 13: 1 ♂ seen; Loc. 14: 1 ♂ seen.

L: Loc. 21: several ♂♂, ♀♀ seen, 1 ♀ photographed (Fig. 48a);

Observations. As common for this species, a single male usually guards a pool or basin of clear water, which may be fairly cool because immediately appearing from a ground source high in the mountains, e.g. at 2100-2300 m

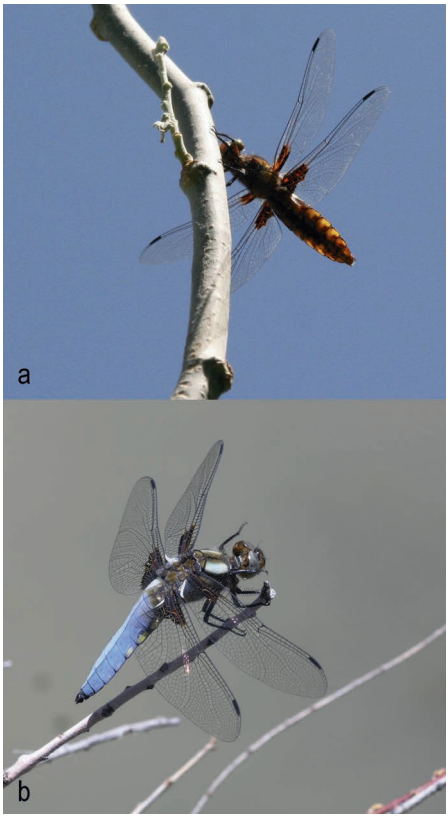

Fig. 48. Libellula depressa: a – a female at Gavimir Chashmah (Loc. 21, Borujerd County, Lorestan; 25.05.2017); b – a male at a shallow pool at the Gharehchay River left floodplain (Shazand County, Markazi Province; Loc. 10; Fig. 12; 19.05.2017.

a.s.l. at Locs. 15-16 near Astaneh Town. Although the Garehchay River floodplain (Loc. 10; Fig. 13) was at a lower altitude of 1800 m a.s.l. and looked quite a different habitat, males still guarded cold clear pools with Chara gymnophylla. However, at the Gavimir Chashmah (Loc. 21) several males chased each other and kept above a boggy pond with scarce open water at about the same altitude (1826 m a.s.l.), and in the Shilanevar valley (Loc. 1) two males were found at a shallow pond with slime algae (ca 2050 m a.s.l.).

21. Orthetrum brunneum (Fonscolombe, 1837)

M: Loc. 1 (the lower pond): 4 ♂♂ (2 immature), 2 ♀♀ collected, many mature ♂♂, several ♀♀ and many immature individuals seen.

L: ?Loc. 18: tentatively 1 ♂ seen; Loc. 19: 1 ♂ collected; Loc. 26: 1 ♀ collected; Loc. 27: 1 immature ♂ collected, ?1 ♂ tentatively seen.

Observations. Very numerous at the lower pond in the Shilanevar valley, sporadic elsewhere.

22. Orthetrum taeniolatum (Schneider, 1845)

L: Loc. 20: 1 ♂ collected and photographed (Fig. 49); Loc. 26: 1 ♀ collected;

Observations. A male was in the habit of landing on barren detritus banks (Fig. 49) of the Chenar Chashmah (Loc. 20; Fig. 18), apparently lacking caution. The female was collected in an open place at a seepage from a trout farm.

Fig. 49. A male of Orthetrum taeniolatum at Chenar Chashmah (Loc. 20; Fig. 18) near Hayan village, Borujerd County, Lorestan; 25.05.2017.

Fig. 50. A bushy pass 2150 m a.s.l., 5 km NW of Chenar Gerit village (Loc. 24), where Sympetrum arenicolor concentrates, Khorramabad County, Lorestan; 26.05.2017.

Fig. 51. Sympetrum arenicolor concentrating on taller bushes at the pass of 2150 m a.s.l., 5 km NW of Chenar Gerit village (Loc. 24, Fig. 50), 26.05.2017.

Fig. 52. Sympetrum arenicolor perching on twigs at a gorge 2.2 km WNW of Pasil village (Loc. 25), Khorramabad County, Lorestan; 25.05.2017.

23. Sympetrum arenicolor Jödicke, 1994

L: Loc. 17: several ind. seen; Loc. 20: 1 ♂ collected; Loc. 22: very many seen; Loc. 23: several seen; Loc. 24 (Fig. 50): enormous number seen (Fig. 51); Loc. 25: very many seen; Loc. 26: 4 ♂♂, 1 ♀ collected, 1 ♂, 1 ♀ photographed (Fig. 52), very many ♂♂ seen; Loc. 27: many seen.

Observations. This species was found on 26 and 31.05.2017 to be extremely numerous in an open oak stand covering the mountains slopes in valleys crossing the Higher Zagros to the north-west of the Oshtorankuh Mt., mostly in Khorramabad County (Locs. 22-27). Taking into account the great area occupied by this landscape and lack of association of these dispersed dragonflies with water, their number was truly extraordinary. They were found to concentrate (Fig.

51) in especially great number in the uppermost shrubby vegetation at the pass (2150 m a.s.l.) of Loc. 24 (Fig. 50). For some reason, males predominated overwhelmingly. These dragonflies had probably migrated to the upper limit of the arboreal vegetation in the mountains from the lower sections of the Sezar/Dez River valley. Such migration of immature individuals of this species up to the mountains is well known from Central Asia (Borisov 2006; 2008; 2009).

Similar landscapes were seen by us also in Aligudarz County to the south-east of the Oshtorankuh Mt. on our way to Absefid Waterfall (Loc. 30). They were examined for only about half an hour on 25.05.2017 (not in the locality list), and no Odonata were seen. The absence of S. arenicolor could be ascribed either to some local barrier for vertical migration from lower levels or to an earlier date of observations in the Aligudarz County (half an hour in the analogous landscape in Khorramabad County on 26.05.2017 would have provided a great many of these dragonflies).

The Higher Zagros Chain seems to be a barrier to the upward migration of this species, since behind it, on the barren south-western foothills of the Inner Chain (Shakhboz Range), at Gondargilan and Hayan villages (Loc. 17 and 20) in Borujerd County, only few individuals were found. This species either scarcely breeds in the elevated Silakhor Plain between the two mountain chains, or its emergence is delayed there. The species was not seen at all to the north-east of the Inner Chain, in Markazi Province.

Fig. 53. A male of Sympetrum fonscolombii at a shallow pool at the Ghareh-chay River left floodplain (Loc. 10; Fig. 12), Shazand County, Markazi Province, 19.05.2017.

24. Sympetrum fonscolombii (Selys, 1840)

M: Loc. 1: 6 ♂♂, 2 ♀♀ collected; Loc. 10: 1 ♂ photographed (Fig. 53), 1 more seen; Loc. 15: 1 ♂ seen.

E: Loc. 31: 1 ♂, 1 ♀ collected; Loc. 32: 1 ♀ collected.

Observations. This species was found to be abundant in the Shilanevar valley (Loc. 1; Fig. 8), both at the rich lowermost pond but also at the two large upper ponds where it was the only zygopteran. Occurrence at other localities seemed erratic, and for some reason the species was not found in Lorestan.

25. Sympetrum striolatum striolatum (Charpentier, 1840)

L: Loc. 19: 1 teneral ♂ collected.

Observations. Curiously, this elsewhere common species was one of only two (with A. isoceles) of which only one individual was met on our trip.

Addendum

The following Odonata were observed in Tehran and its environs in the first days of June:

Tehran env., Lavasan Town, Zard-e Band village, a river, 35.8240-8254° N 51.5727-5741° E, 1680-1704 m a.s.l., 2.06.2017: O. brunneum, a female on a bush on a steep eastern mountain slope.

Iran, Tehran, Chitgar estate, 'Persian Gulf' reserve (a very large artificial lake with concrete banks, ducks and intense recreation), 35.7461-7509° N 51.2054-2083° E, 1267-1272 m a.s.l., 3.06.2017: 20. Orthetrum cancellatum (Linnaeus, 1758), numerous males ranging along the water and resting (with a few females) on the concrete nearby (Fig. 54).

Fig. 54. Orthetrum cancellatum. A female (left) and male (right) resting on a concrete bank of the artificial 'Persian Gulf' reservoir in Chitgar estate, Tehran, 3.06.2017.

Discussion

Of our 33 localities with promising water bodies, six produced no Odonata. However, the lack of dragonflies at some of them could be explained by our visits being too early; after all we checked the area at the very beginning of the dragonfly and damselfly season. This surely explained the absence of many species but did allow us to witness the best flight season of early species such as C. ornatum, C. persicum, L. depressa. In total we found 24 species of Odonata representing their spring aspect in Central Iran (G. kinzelbachi not counted as not observed on the wing). From a biogeogaphical point of view, they include 12 (exactly half) Euro-Siberian species in a broad sense (all those not listed below in this sentence), 3 species with a broad West Palaearctic/Afrotropical distribution (A. imperator, C. erythraea, S. fonscolombii), 1 European+Near Eastern species (C. ornatum), 3 East Mediterranean+Near Eastern species (E. fatime, C. microstigma, G. schneideri), 2 Near Eastern species (I. intermedia, P. kervillei), 2 Irano-Turanian species (O. lefebvrei, S. arenicolor) and 1 Iranian endemic (C. persicum).

A. mixta and S. arenicolor were the most numerous dragonflies observed during our trip, but in mass quantities only in one particular valley (Locs. 24-27). They were found only in Lorestan, in open Persian Oak woodland on mountain slopes at 1450-2000 m; S. arenicolor also somewhat above its upper limit, in shrubbery at a pass at 2150 m a.s.l. (Loc. 24). Curiously, neither of these two species has been reported for Lorestan before. This may be due to the fact that we witnessed their concentration at the upper limit of their pre-breeding dispersal to the mountains, while at the breeding period they probably disperse over breeding sites in a larger area at lower levels (Borisov 2006; 2008; 2009). S. paedisca was scarce but most probably observed also at its pre-breeding dispersal to the mountains, as common for this species (Borisov 2005; 2006; 2009; 2010). Other species were found on our trip most probably at their breeding habitats.

We recorded 17 species during a total of seven days of searching in Markazi Province, 16 species during four days in Lorestan Province (10 species in both) and 2 species on one day in Esfahan Province.

Having summarised all faunal data on Odonata existing up to 2002, Heidari & Dumont (2002) reported 9 species for Lorestan (their localities 2, 8, 17, 20, 30, 48, 60, 79): C. splendens intermedia, Sympecma paedisca, C. persicum, 'C. vanbrinkae', Platycnemis dealbata Selys, 1863, Gomphus kinzelbachi, Onychogomphus assimilis (Schneider, 1845), Crocothemis servilia (Drury, 1773), O. brunneum. Sadeghi & Mohammadalizadeh (2009) added to this province (their localities 31 and 33) 5 species: Diplacodes lefebvrii (Rambur, 1842), O. cancellatum (Linnaeus, 1758), C. erythraea, Sympetrum sanguineum (Müller, 1764), S. fonscolombii. Schneider & Ikemeyer (2016a) added for Lorestan (their localities 19-21), as a result of their extensive search for Odonata in south-western Iran in June 2015, 9 more species: I. elegans, I. pumilio, P. kervillei, A. imperator, C. microstigma, O. lefebvrii, Cordulegaster nobilis (Morton, 1916), L. depressa, Orthetrum coerulescens anceps (Schneider, 1845). Schneider et al. (2018) added E. fatime and Orthetrum chrysostigma (Burmeister, 1839) as a result of their 2016 expedition. So the number of species so far reported from Lorestan is 25. Here we add to this province 5 more species: L. barbarus, A. mixta (very numerous), O. taeniolatum, S. arenicolor (extremely numerous), S. striolatum, so the number of species known for this province is now 30.

The data from Lorestan, including in this paper, mostly came from the Silakhor Plain and the adjacent mountain slopes, which are in the rain shadow of the Higher Zagros. Of the previously reported localities, only Bisheh (Loc. 17 by Heidari & Dumont 2002; Loc. 32 by Schneider et al., 2018; our Loc. 27), Khorramabad (Loc. 60 by Heidari & Dumont 2002 and Loc. 20 by Schneider & Ikemeyer 2016a), Hossenieh-e-Balarood (Loc. 31 by Sadeghi & Mohammadalizadeh 2009), the Zirkhaki env. (Loc. 19 by Schneider & Ikemeyer 2016a) and Ahmadabad (Khorramabad County) env. (Loc. 31 by Schneider et al. 2018), as well as our Locs. 22-27 and 30, are situated beyond that rain shadow and offer Mediterranean-type landscapes. A search in the south-western parts of Lorestan, especially in Kudasht and Poldokhtar Counties, would add to the list of Odonata species. So far there exist some data from only one locality in each, respectively the Zirkhaki env. (Schneider & Ikemeyer 2016a) and Hossenieh-e Balarood (Sadeghi & Mohammadalizadeh 2009).

Esfahan Province has a hotter and drier climate than Lorestan and is expected to be occupied by fewer Odonata species. The number of species known from there is indeed less than from Lorestan but both figures are provisional. Heidari & Dumont (2002) in their compendium listed for Esfahan Province (their locaities 52, 56, 82, 94) only four species: Diplacodes lefebvrii, G. schneideri, Sympetrum fonscolombii, S. meridionale (Selys, 1841). Schneider & Ikemeyer (2016a; localities 22-24) found neither of those but added 12 more, C. splendens intermedia, 'C. vanbrinkae', C. persicum, I. elegans, P. kervillei, A. imperator, C. microstigma, C. nobilis, C. erythraea, L. depressa, O. brunneum, S. sanguineum. Schneider et al., (2018) added further 5 species: P. dealbata, Anax parthenope (Selys, 1839), A. ephippiger (Burmeister, 1839), Orthetrum sabina (Drury, 1773) and Pantala flavescens (Fabricius, 1798), So the total number of species known from Esfahan Province has reached 21. In a day-long visit we found only two of those.

Sixteen (with the exception of C. splendens orientalis reported by Sadeghi & Kiany 2012) of 17 species (found at 17 localities) here reported for the odonatologically unexplored Markazi Province are formally new findings for it. These are E. fatime, L. barbarus, C. ornatum, C. persicum, E. cyathigerum risi, I. elegans, I. intermedia, I. pumilio, P. kervillei, A. imperator, A. isoceles, C. microstigma, L. depressa, O. lefebvrei, O. brunneum, S. fonscolombii.

Hamadan Province (adjacent to and west of Markazi Province) where Ecbatana, the ancient capital of Media and later of Parthia, was situated and which is a promising province, still remains almost unexplored for Odonata, with only 6 species reported for two localities: C. splendens, A. imperator and O. brunneum by Sadeghi & Mohammadalizadeh (2009) and Aeshna affinis Vander Linden, 1820, C. erythraea and Trithemis annulata (Palisot de Beauvois, 1807) by Schneider et al. (2018).

Acknowledgements

The work of the first author was partly supported by Nikita Vikhrev. We are indebted to Martin Schorr for exhaustive information on the Iranian odonatological literature and to Sergey Borisov who provided further literature. Geoffrey Harper kindly undertook the labour of linguistic editing of the text.

References

Bakhshi, Y. & Sadeghi, S. 2014. Odonata fauna of Khuzestan province (Iran) with a note on an Oriental species Trithemis aurora (Burmeister, 1839) as a new record for the south-west of Iran. Zoology in the Middle East 60(4): 372-374.

Bartenev, A.N. 1916. Contributions à la faune des Odonates du Nord de Perse. Revue russe d' Entomologie 16: 38–45 (in Russian).

Belyshev, B.F. 1964. Odonatologicheskaya fauna Verkhnego Priobya [Odonatological fauna of the Upper Ob' Basin]. In: V.N. Skalon (ed.) Strekozy Sibiri [Dragonflies of Siberia]. Trudy Vostochno-sibirskogo filiala Akademii Nauk SSSR [Proceedings of East Siberian Branch of the Academy of Sciences of the USSR] 40: 4-17 (in Russian)

Borisov S.N. 2005. Summer migration of species of Sympecma Burmeister, 1839 (Odonata, Lestidae) in Northern Tian Shan. Eurasian Entomological Journal 4(3): 256.

Borisov S.N. 2006. Adaptation of dragonflies (Odonata) under desert conditions. Entomological Review 86(5): 534–543.

Borisov S.N. 2008. Distribution and ecology of Sympetrum arenicolor Jödicke, 1994 (Odonata, Libellulidae) in Middle Asia. Eurasian Entomological Journal 5(4): 278-284.

Borisov S.N. 2009. Pattern of dragonfly (Odonata) distribution in Central Asia. Zoologicheskii Zhurnal 88(1): 11-17

Borisov S.N. 2010. Geographic variation in the life style of Sympecma paedisca (Brauer, 1877) (Odonata, Lestidae) in the plains of Central Asia. Eurasian Entomological Journal 9 (2): 249-254.

Borisov S.N. & Haritonov A.Y. 2007. The dragonflies (Odonata) of Middle Asia. Part 1. Calopteра. Zygoptera. Eurasian Entomological Journal 6(4): 343-360.

Borisov, S.N. & Haritonov, A.Yu. (2008): The Dragonflies (Odonata) of Middle Asia. Part 2 (Anisoptera). Eurasian entomological journal 7(3): 97-123.

Boudot, J.-P. & Kulijer, D. 2015. Coenagrion ornatum (Selys, 1850). In: Boudot, J.-P. & Kalkman, V.J. (eds) Atlas of the European Dragonflies and Damselflies. KNNNV Publishing, the Netherlands, pp. 109-111.

Boudot, J.-P. & Šalamun, A. 2015. Ischnura elegans (Vander Linden, 1820). In: Boudot, J.-P. & Kalkman, V.J. (eds) Atlas of the European Dragonflies and Damselflies. KNNNV Publishing, the Netherlands, pp. 125-126.

Dumont, H.J., Borisov, S.N. 1993. Three, not two species in the genus Sympecma (Odonata: Lestdae). Bulletin & annales de la Société entomologique de Belgique 129: 31-40.

Dumont, H.J., Ikemeyer, D. & Schneider, T. 2017. Lestes concinnus and L. pallidus: the non-metallic species with wide, complementary ranges (Odonata: Lestdae). Odonatologica 46 (1/2): 99-110.

Dumont, H.J., Kiany, M. & Sadeghi, S. 2011. First record of Rhodischnura nursei (Morton) from Iran (Zygoptera: Coenagrionidae). Odonatologica 40(3): 251-254.

Ebrahimi, A., Madjdzadeh, S.M. & Mohammadian, H. 2009. Dragonflies (Odonata) from South-Eastern Iran. Caspian Journal of Environmental Science 7: 107–112.

Ebrahimi, A., Mohammadian, H. & Madjdzadeh, S.M. 2014a. A note on libellulid dragonflies (Odonata: Libellulidae) of Khabr National Park (Kerman Province, South-East Iran). International Dragonfly Fund Report 69: 1-9.

Eslami, Z., Pashaei, R.S. & Dumont, H.J. 2014b. Sympetrum flaveolum (Odonata: Libellulidae) a new species for Iran. Journal of Entomological Society of Iran 34: 71–73.

Ghahari, H., Tabari, M., Sakenin, H., Ostovan, H. & Imani, S. 2009. Odonata (Insecta) from Northern Iran, with comments on their presence in rice fields. Munis Entomology & Zoology 4: 148–154.

Ghahari, H. & Thipaksorn, A. 2014. A preliminary checklist of Odonata (Insecta) from the Arasbaran Biosphere Reserve and vicinity, northwestern Iran. The Journal of Tropical Asian Entomology 3(1): 48-54.

Ghahari, H., Thipaksorn, A., Naderian, H., Sakenin, H. & Tajali, A.A. 2012. A faunistic study on the Odonata (Insecta) from Kurdistan province and vicinity, western Iran. Linzer biologische Beiträge 44/2: 1079-1085.

Grichanov, I.Y., Ahmadi, A. & Kosterin O.E. 2017. New records of long-legged flies (Diptera, Dolichopodidae) from Central and North-Eastern Iran. Acta Biologica Sibirica 3(4): 99-112.

Heidari, H. & Dumont, H.J. 2002. An annotated check-list of the Odonata of Iran. Zoology in Middle East 26: 133-150.

Ikemeyer, D., Schneider, E., Schneider, J. & Schneider, T. 2015. Records of Odonata in North-and North-East Iran including Sympecma gobica (Förster, 1900) as a new species for Iran. Entomologische Zeitschrift 125: 147–152.

Jödicke R. 1997. Die Binsenjungfern und Winterlibellen Europas: Lestidae. Die Neue Brehm-Bucherei. Bd.631. Magdeburg: Westarp-Wissenschaften. 277 pp.

Kalkman, V.J. (2006): Key to the dragonflies of Turkey including species known from Greece, Bulgaria, Lebanon, Syria, the Trans-Caucasus and Iran. Brachytron 10(1): 3-82.

Kiany, M. & Minaei, K. 2009. The Dragonfly Family Libellulidae (Insecta: Odonata: Anisoptera) of Shiraz and its vicinity (Fars Province, Iran). Iran Agricultural Research 27/28: 65-78.

Kiany, M. & Sadeghi, S. 2014. A preliminary study on Odonata fauna of Yazd province. The 17th National & 5th International Iranian Biology Confrence, At Shahid Bahonar University of Kerman, Kerman, Iran, 2 pp.

Kiany, M. & Sadeghi, S. 2016. Odonata from southwest of central desert of Iran with occurrence notes on Ischnura intermedia Dumont, 1974. Iranian Journal of Animal Biosystematics 12(1): 67-76.

Kiany, M.; Sadeghi, S. & Ehteshami, F. 2016. New record of Platycnemis kervillei and Lestes dryas (Odonata: Platycnemididae & Lestidae) from Iran. 19th National and 7th International Congress of Biology, 30 Aug-1 Sep 2016, University of Tabriz, Iran: 94.

Kosterin, O.E. 2004. Odonata of the Daurskii State Nature Reserve area, Transbaikalia, Russia. Odonatologica 33(1): 41–71.

Kosterin, O.E. & Zaika, V.V. 2010. Odonata of Tuva, Russia. International Journal of Odonatology 13: 277–328.

Lohmann, H. 1993. Coenagrion vanbrinki spec. nov. and C. persicum spec. nov. aus Vorderasien (Zygoptera: Coenagrion). Odonatologica, 22, 203–211.

Lohmann, H. 1992. Gomphus kinzelbachi Schneider in Iran (Anisoptera: Gomphidae). Notulae odonatologicae 3: 169–169.

Rastegar, J., Havaskary, M., Khodaparast, S. & Rafeii, A. 2013 A contribution to the knowledge of Odonata (Insecta) from West Azarbaijan province, northwestern Iran. Entomofauna 34: 369–375.

Sadeghi, S. 2008. Aspects of infraspecific phylogeography of Calopteryx splendens. Dissertation. Ghent University, IV + 166 pp.

Sadeghi, S. 2010. An introduction to faunal study and checklist improvement of Fars Province Odonata. Taxonomy and Biosystematics 2(5): 49-60.

Sadeghi, S. & Dumont, H.J. 2004. First record of Libellula fulva pontica Selys, 1887 (Odonata, Anisoptera) from Iran. Zoology in the Middle East. 32: 116-117.

Sadeghi, S. & Dumont, H.J. 2014. Variation in the shape of the wings and taxonomy of Eurasian populations of the Calopteryx splendens complex (Odonata: Calopterygidae). European Journal of Entomology 111(4): 575-583.

Sadeghi, S. & Kiany, M. 2012. Wing shape variation in Calopteryx splendens (Harris) populations in the Zagros mountains, Iran (Zygoptera: Calopterygidae). Odonatologica 41(2): 123-134.

Sadeghi, S. & Mohammadalizadeh, J.. 2009. Addition to the Odonata Fauna of Iran. Iranian Journal of Science & Technology, Transaction A 33: 255–359.

Samin N., Sakenin, H. & Thipaksorn, A. 2015. The species of Odonata (Insecta) from the Arasbaran Biosphere Reserve and vicinity, northwestern Iran. Wuyi Science Journal 31(1): 85-92.

Schmidt, E. 1939. Odonata aus Syrien und Palästina. Sitzungsberichte der österreichischen Akademie der Wissenschaften, Wien, Kl. 1, 147, 135–150.

Schmidt, E. 1954. Die Libellen Irans. Sitzungsberichte der österreichischen Akademie der Wissenschaften, Wien, Kl. 1 163: 223–260.

Schmidt, E. 1960. Ergebnisse der Deutschen Afghanistan-Expedition 1956 der Landessammlungen für Naturkunde Karlsruhe sowie der Expeditionen J. Klapperich, Bonn 1952-53 und Dr. K, Lindberg, Lund (Schweden) 1957-60. Libellen (Odonata). Beiträge zur naturkundlichen Forschung in Südwestdeutschland 19: 399–435.

Schmidt, E. 1967. Versuch einer Analyse der Ischnura elegans-Gruppe (Odonata, Zygoptera). Entomologiske Tidskrift 88: 188-225.

Schneider, T. & Dumont, H. J. 2015. Odonata records from southern Iran. Notulae Odonatologicae 8: 137–146.

Schneider, T. & Ikemeyer, D. 2016a. Notes on Odonata species in South-West Iran including Platycnemis kervillei (Martin, 1909) as a new species for Iran. Entomologische Zeitschrift 126: 3–8.

Schneider, T. & Ikemeyer, D. 2016b. Records of Odonata species from Khorãsãn-e-Razavi and Khorãzãn-e-Shomãli in Northeast-Iran. Entomologische Zeitschrift 126: 211–216.

Schneider, T. & Ikemeyer, D. 2017. Late summer observations on Odonata from the Armenian Highland to the Talysh Mountains in north-western Iran. Entomologist's Monthly Magazine 153: 1–10.

Schneider T., Schneider E., Schneider J. & Müller O. 2013. Rediscovery of Cordulegaster vanbrinkae in Iran (Odonata: Cordulegastridae). Odonatologica 43: 25-34

Schneider, T., Ikemeyer, D. & Dumont, H. J. 2015a. New records of Dragonflies (Odonata) from Belutschistan-e-Sistan province Iran. Zoology of the Middle East 62: 288–290.

Schneider, T., Schneider, E., Schneider, J., Vierstraete, A. & Dumont, H. J. 2015b. Aeshna vercanica spec. nov. from Iran (Anisoptera: Aeshnidae) and a new insight into the Aeshna-cyanea group. Odonatologica 44: 81–106.

Schneider, T., Ikemeyer, D., Ferreira, S. & Müller, O. 2016. Rediscovery and redescription of Coenagrion persicum (Lohmann 1993) with description of the female, and some notes on habitat selection (Odonata: Coenagrionidae). Zootaxa 6: 561–573.

Schneider, T., Ikemeyer, D., Ferreira, S. & Müller, O. 2017a. Gomphus kinzelbachi Schneider, 1984, in Iran: identification, habitat and behaviour (Odonata: Gomphidae). Zootaxa 4216 (6): 572–584.

Schneider, T., Schneider, E., Ikemeyer, D., Seidenbusch, R. & Müller, O. 2017b. Description of last instar larva of Gomphus kinzelbachi Schneider, 1984 and new aspects on distribution and habitats in Iran: (Odonata: Gomphinae). Zootaxa 4365 (4): 455–466.

Schneider, T., Ikemeyer, D., Müller & Dumont, H.J. 2018. Checklist of the dragonflies (Odonata) of Iran with new records and notes on distribution and taxonomy. Zootaxa 4394 (1): 1–40.

Schneider W. 1986. Systematik und Zoogeographie der Odonata der Levante unter besonderer Berucksichtigung der Zygoptera. Dissertation. Universität Mainz. 202 pp.

Seidenbusch, R. 1997. Morphological imaginal comparison in the Enallagma deserti-complex: Enallagma deserti Selys, 1871, Enallagma boreale Selys, 1875, Enallagma circulatum Selys, 1883, Enallagma belyshevi Haritonov, 1975, Enallagma risi Schmidt, 1961. Sulzbach-Rosenberger Libellerundbrief 6: 10-15.

Skvortsov, V.E. 2010. The Dragonflies of Eastern Europe and Caucasus: an Illustrated Guide. KMK Scientific Press Ltd., Moscow.

Skvortsov, V.E. & Snegovaya, N.Yu. 2015. A second addition to the Odonata fauna of Aserbaijan. International Dragonfly Fund Report 87: 1–38.

Yoosefi Lafooraki, E.Y., Rasekhi, F. & Shayanmehr, M. 2013. Introduction of some Odonata species (Insecta) from northern Iran. Taxonomy and biosystematics 5(17): 3-12.

INSTRUCTION TO AUTHORS

Faunistic studies of South-East Asian and Pacific islands Odonata is a journal of the International Dragonfly Fund (IDF). It is referred to as the journal in the remainder of these instructions. Transfer of copyright to IDF is considered to have taken place implicitly once a paper has been published in the journal.

The journal publishes original papers only. By original is meant papers that: a) have not been published elsewhere before, and b) the scientific results of the paper have not been published in their entirety under a different title and/or with different wording elsewhere. The republishing of any part of a paper published in the journal must be negotiated with the Editorial Board and can only proceed after mutual agreement.

Papers reporting studies financially supported by the IDF will be reviewed with priority, however, authors working with Odonata from the focal area (as defined on the back page of the front cover) are encouraged to submit their manuscripts even if they have not received any funds from IDF.

Manuscripts submitted to the journal should preferably be in English; alternatively German or French will also be accepted. Every manuscript should be checked by a native speaker of the language in which it is written; if it is not possible for the authors to arrange this, they must inform the Editorial Board on submission of the paper. Authors are encouraged, if possible, to include a version of the abstract in the primary language of the country in which their study was made.

Authors can choose the best way for them to submit their manuscripts between these options: a) via e-mail to the publisher, or b) on a CD, DVD or any other IBM-compatible device. Manuscripts should be prepared in Microsoft Word for Windows.
While preparing the manuscript authors should consider that, although the journal gives some freedom in the style and arrangements of the sections, the editors would like to see the following clearly defined sections: Title (with authors names, physical and e-mail addresses), Abstract, Introduction, Material & Methods, Results, Discussion, Acknowledgments and References. This is a widely used scheme by scientists that everyone should be familiar with. No further instructions are given here, but every author should check the style of the journal.

Authors are advised to avoid any formatting of the text. The manuscripts will be stylised according to the font type and size adopted by the journal. However, check for: a) all species names must be given in italic, b) the authority and year of publication are required on the first appearance of a species name in the text, but not thereafter, and c) citations and reference list must be arranged following the format below.

Reference cited in the text should read as follows: Tillyard (1924), (Tillyard 1924), Swezey & Williams (1942).

The reference list should be prepared according to the following standard:
Swezey, O. & F. Williams, 1942. Dragonflies of Guam. Bernice P. Bishop Museum Bulletin 172: 3-6.
Tillyard, R., 1924. The dragonflies (Order Odonata) of Fiji, with special reference to a collection made by Mr. H.W. Simmonds, F.E.S., on the Island of Viti Levu. Transactions of the Entomological Society London 1923 III-IV: 305-346.

Citations of internet sources should include the date of access.

The manuscript should end with a list of captions to the figures and tables. The latter should be submitted separately from the text preferably as graphics made using one of the Microsoft Office products or as a high resolution picture saved as a .jpg .tif or .ps file. Pictures should be at least 11 cm wide and with a minimum 300 dpi resolution, better 360 dpi. Line drawings and graphics could have 1200 dpi for better details. If you compose many pictures to one figure, please submit the original files as well. Please leave some space in the upper left corner of each picture, to insert a letter (a, b, c...) later. Hand-made drawings should be scanned and submitted electronically. Printed figures sent by the post could be damaged, in which case authors will be asked to resubmit them.

Manuscripts not arranged according to these instructions may also be accepted, but in that case their publication will be delayed until the journal's standards are achieved.