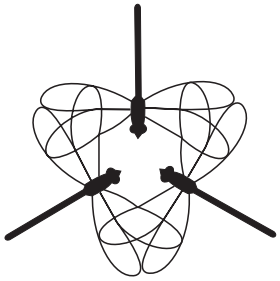

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EAST PALAEARCTIC *SOMATOCHLORA GRAESERI* SELYS OCCURS AS A POSTGLACIAL RELICT IN EUROPE WEST OF THE URALS (ANISOPTERA: CORDULIIDAE)

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The East Palaearctic *S. graeseri* is characterized by a current disjunct distribution. New data from northern European Russia significantly modify the earlier known pattern of its distribution. The first European record west of the Urals is reported from the environs of Pinega village (Arkhangelsk province, Pinega region). The distribution range of this sp. presented here is similar to that of *Coenagrion hylas* and *C. glaciale*. Like these spp., *S. graeseri* is a postglacial relict in Europe and representative of a cold-stenothermal fauna that probably colonized the continent during the late Pleistocene and early Holocene. During the Atlantic period they withdrew far to the East, remaining only as isolates in the Urals and in Europe. The survival of *S. graeseri* in the presumptive isolate of its distribution range in the Pinega region is probably a consequence of a specific combination of severe climate and habitat/microclimatic conditions, influenced by karst. The habitat conditions of the new locality are analysed in the context of the species' requirements. The spiny exuviae of *S. graeseri* and details of the female abdominal pattern are presented and compared with those of Siberian and Far Eastern individuals to show the morphological variation of the sp. The diagnostic features of the exuviae, such as the large and specifically shaped lateral and dorsal spines, the thoracic banded pattern and the laterosternal sclerites on the fourth to sixth segments of the abdomen, are described.

INTRODUCTION

Data from northern European Russia, collected in 2009, have significantly modified the known pattern of distribution of *Coenagrion glaciale* (Sel.) and *Coenagrion hylas* (Trybom), the East Palaearctic species which are characterised by a current disjunct distribution (BERNARD & DARAŻ, 2010). The first Euro-

pean records of *C. glaciale* and a new locality of *C. hylas* west of the Urals were reported from the environs of Pinega village in the Arkhangelsk province. These postglacial relicts in Europe are representatives of a cold-stenothermal fauna that probably colonised the continent during the late Pleistocene and early Holocene. During the Atlantic period they withdrew far to the East, remaining probably only as isolates in the Urals and in Europe. Considering these records, BERNARD & DARAŻ (2010) suggested that the European remains of the early Holocene distribution may be more numerous and extensive than previously believed and are most likely to be concentrated primarily in the almost unexplored northeast of the continent. *Somatochlora graeseri* Selys was suggested as another species that might belong to this group of East Palaearctic postglacial relicts and its discovery in northeastern Europe was assumed to be only a matter of time. This species had earlier been recorded as far west as the Yenisei and upper Ob Rivers and as isolates in the Urals (HARITONOV, 1976; YANYBAEVA et al., 2006).

Apart from *C. glaciale* and *C. hylas*, two enigmatic exuviae of corduliids were collected during my studies in 2009. The available literature was insufficient to determine the species with certainty though *S. graeseri* was considered one of possible options. To solve this puzzle, an intensive search was carried out in 2010 and 2011, both at this locality and many other sites in the broad environs of Pinega. This finally led to an identification of the species as *S. graeseri*, recorded west of the Urals for the first time. In this paper, I analyse this biogeographically important finding in the context of species distribution range, palaeogeography and biology. I also consider some morphological features useful in the determination of the species and their variation.

MATERIAL AND METHODS

Investigations on the odonate fauna were carried out between 2009 and 2011 in the broad environs of Pinega village (Pinega region, Arkhangelsk province, northwest Russia). More than one hundred localities with a broad spectrum of habitats were studied. The locality where two exuviae were initially found was visited twelve times at varying hours of the day and varying periods of the dragonfly flight season, i.e. on 3 and 7 July 2009, 18, 25 and 30 June and 7 July 2010, 4, 8, 10 and 17 June and 22 and 23 July 2011. Observations were made on the habitats and their odonate fauna and both adults and exuviae were collected.

The collected material (imagines, exuviae, photographs) is in the author's collection and in the Natural History Collections of the Adam Mickiewicz University in Poznań. The description of the study area has been included in an earlier publication (BERNARD & DARAŻ, 2010). Below, only the locality of *S. graeseri* is briefly presented. It is the same site as locality No. 2 in BERNARD & DARAŻ (2010). It will be called "Maletino" in the current paper.

STUDY SITE. – 64°36'17"N, 43°20'18"E, 1.1 km N of Maletino; a small (0.2 ha) lake (Fig. 1) situated in the complex of bogs and water bodies; partly surrounded by peaty pine forest, partly by pine, spruce and birch forest and partly by an open peat bog; the open water girdled by a narrow transition mire zone, i.e. by a 1-1.5 m wide belt of mosses (*Sphagnum* sp.) and helophytes such as diverse *Carex* spp. (*C. limosa*, *C. lasiocarpa*, *C. diandra*, *C. canescens*, *C. rostrata*) and *Menaynthes trifoliata*, *Comarum palustre*, *Equisetum fluviatile, Eriophorum gracile*; locally floating *Utricularia vulgaris* and

nymphaeids, *Nymphaea candida*, *Nuphar lutea* and *Potamogeton natans*; pH 6.76, conductivity 34 μS/cm; two fish species: frequently observed and collected *Rhynchocypris percnurus* (syn. *Phoxinus percnurus*) and one dwarf individual of *Carassius carassius*.

RESULTS

In this paper, only the results for *Somatochlora graeseri* are dealt with, although all species recorded at its locality are listed. Exhaustive faunistic and ecological data will be presented in a separate paper.

S. graeseri was recorded twice, 2 exuviae on 3 July 2009 and 1 teneral female and its exuviae on 17 June 2011 (leg. R. Bernard, B. Daraż and A.S. Mokhnatkin, det. R. Bernard). The female was alive but damaged. It could not fly away and remained in its place of emergence, i.e. in the vegetation belt girdling the open water. Despite a two year gap between findings, all the three exuviae and the imago were collected in approximately the same place, on the lake side bounded with a 'wall' of a dark taiga, in a short section of the shoreline separated from the forest by a narrow, several-metre-broad *Sphagnum* bog (Fig. 1).

Fig. 1. The spring aspect of the *Somatochlora graeseri* habitat at the locality near Maletino, Pinega region, Arkhangelsk province, NE European Russia. The section of the shoreline where the exuviae and imago were found in 2009-2011 is marked. – [Photograph by R. Bernard].

S. graeseri was accompanied by nine other species being autochthonous at the locality. Six of them occurred numerously or fairly numerously: *Coenagrion glaciale* (Sel.), *C. johanssoni* (Wallengren), *Aeshna crenata* Hag., *Aeshna juncea* (L.), *A. subarctica* Walker and *Cordulia aenea* (L.). Three other native species, *Coenagrion hastulatum* (Charp.), *Erythromma najas* (Hans.) and *Aeshna grandis* (L.), were rare. Additionally, single individuals of three other species were recorded: *Leucorrhinia rubicunda* (L.), observed at the adjacent bog and possibly originating from another small lake situated in the close neighbourhood, and certainly allochthonous at the locality, *Coenagrion armatum* (Charp.) and *Aeshna serrata* Hag., the last species foraging at the adjacent bog.

Exuviae of *S. graeseri* were characterised by the following combination of main features (Figs 2-3):

(1) strongly built, but significantly narrowed distally, lateral spines (LS) on segments 8 and 9 (Fig. 3c,d,e); LS8 medium-sized and LS9 large (twice as large as LS8) and reaching almost the end of the cerci (1 specimen), almost the end of the anal pyramid, i.e. paraprocts (1 specimen) and the very end of it (1 specimen), the ratio between the length of LS9 and the length of the anal pyramid was 0.75-1:1;
(2) dorsal spines (DS) on segments 4-9 and a rudimentary spine – in the form of a bulge with several thick and short bristles – on S3; already DS4 was medium-sized; DS5-DS9 (Fig. 3a,b) were large (DS7 the largest), with a narrowed fairly long distal part; they were distally oriented, to the greatest extent in DS7-DS9 which assumed a more or less horizontal position; DS8 and DS9 were also clearly curved ventrally, DS9 in one exuviae almost touched S10 with its tip;
(3) contrasting pattern on the thorax (Fig. 3g), similar to that of *Cordulia aenea* but slightly less intensive; two dark and fairly complete, more or less horizontal, stripes on the side of the thorax, a distinct upper stripe and a weaker lower stripe, the latter being darkest in its posterior section; a partial third stripe along the anterior section of the dorsal thoracic cavity;
(4) contrasting pattern on femora and tibiae, with three more or less recognisable dark bands on each element (Fig. 2);
(5) abdominal laterosternal sclerites, i.e. additional triangular lateral sclerites present on the ventral side of S4, S5 and S6 but completely absent from S7 and S8 (Fig. 3f);
(6) relatively broad abdomen, its width to length ratio 1:2.8 (Fig. 2a);

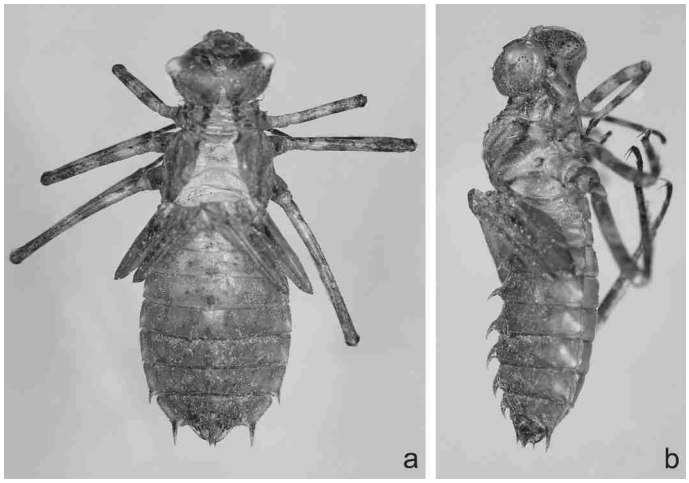

Fig. 2. *Somatochlora graeseri* exuviae from the locality near Maletino, Pinega region, Arkhangelsk province, NE European Russia: (a) dorsal view; – (b) lateral view. – [Photographs by J. Musiał].

(7) the total length of the body (measureable in two specimens) 22.8 and 23.3 mm, the maximum width 8.0 and 8.6 mm respectively.

The intensive amber spots on the basal parts of the wings, typical of *S. graeseri*, were rather large. In the forewings, they reached distally to the second antenodal crossvein and comprised the median and cubital space. In the hindwings,

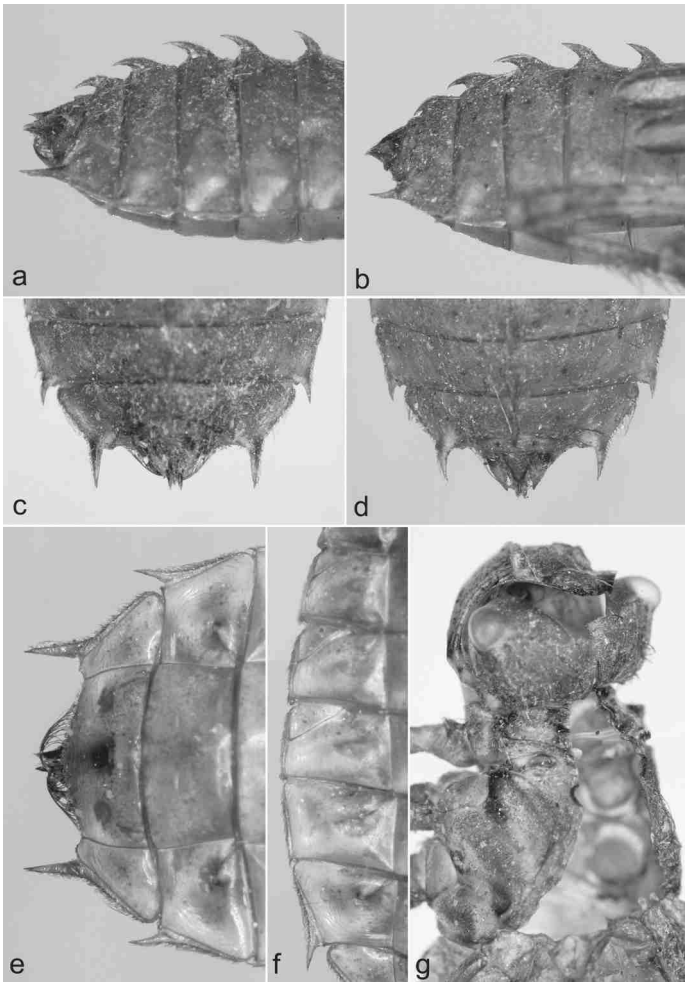

Fig. 3. Morphological details of the exuviae of *Somatochlora graeseri* from the locality near Maletino, Pinega region, Arkhangelsk province, NE European Russia: (a, b) lateral view of dorsal spines DS5-DS9 in two specimens; – (c, d) dorsal view of lateral spines in two specimens; – (e) ventral view of last abdominal segments with lateral spines; – (f) additional triangular laterosternal sclerites recognisable on S4-S6 and lacking in the next segments; – (g) dorsolateral view of thorax with the pattern of dark stripes. – [Photographs by J. Musiał].

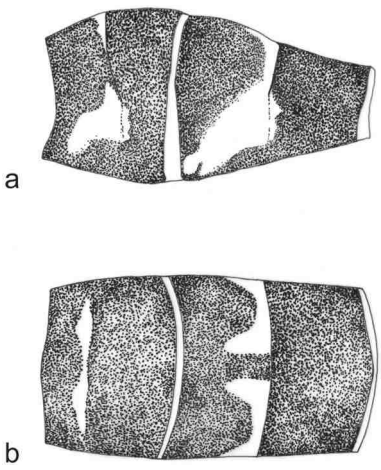

Fig. 4. Colour pattern on the second and third abdominal segments in the *Somatochlora graeseri* female collected near Maletino, Pinega region, Arkhangelsk province, NE European Russia: (a) lateral view; – (b) dorsal view. – [Drawn by K. Gawrońska].

the spots were larger and covered the whole wingbase, i.e. reached distally to the third antenodal crossvein and comprised the wing triangle and anal parts almost to the trailing wing edge. The juvenile female was also distinguished by dense yellowish-beige hair on the thorax and by a lemon yellow colour on various parts of the body. This especially occurred on the labium, foreleg coxa, some elements of the interalar part of the thorax and – in the form of rings and spots – on S2 and S3 of the abdomen. The pattern on S2 (Fig. 4) consisted of two elements which were situated in its anterior part, a larger anterolateral spot (AL) and a smaller mediodorsal spot (MD). The AL turned ventrally with its anterior arm and protruded dorsally with its posterior arm (Fig. 4a). On the extension of the posterior arm – but not connected with it – the narrow transverse MD was situated on the dorsal surface. It was connected with the twin spot reaching from the other side (Fig. 4b). Between S2 and S3 a yellow ring occurred. The large spot on S3 (Fig. 4), being a combination of AL and MD, was also situated in the anterior section of the segment but more in the distal part of this section, almost not crossing the additional transverse suture. The anterior lower section of this spot protruded into a specific, bulbous 'finger' (Fig. 4a). The spot was the broadest in its posterior section, then it narrowly ran upwards and turned back on the dorsal surface. A pattern of two broadly separated small triangles was recognisable from above (Fig. 4b).

DISCUSSION

MORPHOLOGY

Exuviae or larvae of *S. graeseri* have been illustrated and briefly described several times (BELYSHEV, 1959, 1973a; WILDERMUTH, 2008; SKVORTSOV, 2010; JUNG, 2011; http://www.odonata.jp). However, these descriptions and images may be insufficient for the species identification as some features are not presented and no reference is made to morphological variation. The exuviae described in the current paper (called "Maletino exuviae" below) are, for example, more spiny that all the exuviae described in the literature. This concerns both

dorsal and lateral spines. The large and distally oriented dorsal spines are certainly one of the most diagnostic features for this species (Figs 2b, 3a,b; cf. also BELYSHEV, 1959, 1973a; WILDERMUTH, 2008; SKVORTSOV, 2010). However, it seems that nobody has paid much attention to the details of their form, which also are diagnostic. The dorsal spines on S5-S9 are curved and strongly built. However, they have a narrowed fairly long distal part, giving them a hooked form. For comparison, this distinct narrowed section is much less recognisable, or almost absent, in *Somatochlora metallica* (Vander L.) and the dorsal spines of *S. flavomaculata* (Vander L.) are generally significantly 'lighter'. In the Maletino exuviae of *S. graeseri*, the smallest dorsal spine (DS4) is comparable in size with the generally largest dorsal spine in the compared exuviae of *S. flavomaculata* and with DS6 in the compared exuviae of *S. metallica*. When both the size and the details of the form are considered, the picture of dorsal spines in *S. graeseri* appears strikingly different to that of other European and Siberian *Somatochlora* species. It should be added here that the use of a key feature proposed by SKVORTSOV (2010) for differentiating from *S. metallica* – the complete lack of a spine on S3 – is doubtful to say the least. This suggestion certainly follows BELYSHEV's (1959) data, while WILDERMUTH (2008) has given two fairly similar options – either the absence of a spine or a barely perceptible vestigial spine, the latter being also recognisable on a Japanese website (http://www.odonata.jp). However, in all three Maletino exuviae there is a rudimentary spine on S3, in the form of a distinct bristled bulge. In the light of the data given above, it is much more reliable to use the size and form of DS5-DS9 than the absence of DS3. Even the DS4 in *S. graeseri* is described by BELYSHEV (l.c.) as a very small spine or a bulge rather than a spine, and by WILDERMUTH (l.c.) and the Japanese website (http://www.odonata.jp) as a small one. In the Maletino exuviae it is already medium-sized (Fig. 2a,b), which confirms some variation in the first dorsal spines.

This variation is even more pronounced in the lateral spines. According to all the above-mentioned literature sources, the lateral spines on S9 are large and reach the end or almost the end of the cerci. However, this is true only for one Maletino exuviae (Fig. 3d) as in two other exuviae LS9 is significantly longer, reaching the end or almost the end of the anal pyramid (Fig. 3c,e). In all three specimens it is twice as long as the medium-sized LS8. SKVORTSOV (2010) has given in his key other proportions: in an English text LS9 slightly shorter than LS8 [sic!] and in the Russian version LS8 only slightly shorter than LS9. While the former must be an error, the latter is worth considering. If these proportions have been correctly observed and presented by SKVORTSOV (2010), they broaden the range of variation in the LS8 length. Generally, the lateral spines in *S. graeseri* differ from those of European and Siberian congeners, not only in their greater length but also in their form and strong build, being rather similar to spines in *Epitheca* species.

Two other features – occurring in the Maletino exuviae and not mentioned or

not stressed sufficiently in the literature – are potentially diagnostic for *S. graeseri*, i.e. (a) a thoracic pattern of dark stripes à la *Cordulia aenea*, also well recognisable on a figure in JUNG (2011), and (b) abdominal laterosternal sclerites on S4-S6 versus their complete lack on S7 and S8. However, their value should be tested on a larger collection. The lack of this sclerite on S7 is shared with other congeners besides *S. arctica*. However, a small laterosternal sclerite on S8 occurs in *Somatochlora alpestris* (Sel.), *S. arctica* (Zett.), *S. metallica* and *S. flavomaculata* (SCHMIDT, 1951; NORLING & SAHLÉN, 1997; R. Bernard, unpubl. data). Also worth noting is a relatively broad abdomen in *S. graeseri* in comparison with the congeners mentioned above.

The length of *S. graeseri* exuviae according to WILDERMUTH (2008), ISHIDA et al. (1988) and the Japanese website (http://www.odonata.jp) ranges between 19 and 22 mm. The new data have extended this range up to 23.3 mm and have showed that the Maletino exuviae are the largest known in this species, despite their northern occurrence in the borderlands of the range. However, 24-26 mm given for larvae by JUNG (2011) suggests that an exuviae length greater than 23 mm may occur in various parts of the range.

BELYSHEV (1973a) stressed the high morphological variation of *S. graeseri* in Siberia appearing in the range of amber spots on the basal parts of wings, especially in females (cf. also KOSTERIN & ZAIKA, 2010). This is also known in Japan where two subspecies, *S. g. graeseri* with smaller spots and *S. graeseri aureola* Oguma with larger spots, were described on this basis (HIROSE et al., 2007). However, these subspecies will probably be merged as there are individuals that are intermediate with regard to this character (HIROSE et al., 2007; Kiyoshi Inoue, pers. comm.).The comparison between the female collected in NE European Russia and several females from Japan, sent to me, as well as photographs and drawings of Japanese and Korean individuals (ISHIDA et al., 1988; HIROSE et al., 2007; http://www.odonata.jp; http://blog.naver.com) has indicated some differences in the colour pattern of the abdomen, especially on the third segment. The large lateral spot on S3 in the Far Eastern females is either similarly broad along its length or is broader in its anterior part. Running up along the anterior margin of the segment it even reaches its dorsal parts in some individuals. If there are small anterodorsal spots there, they may be free or even connected with lateral spots. Additionally, a paired small free mediodorsal spot can also occur. In the European female described in this paper the large lateral spot is clearly the broadest in its posterior section and here it 'climbs' the dorsal surface where it is connected with a small mediodorsal spot; the anterodorsal spot is absent. This pattern seems to be similar to, or even the same as, that presented on a hardly readable figure in the description of *Somatochlora borealis*, i.e. the female of *S. graeseri*, from Siberia (BARTENEV, 1910a). Despite differences in the colour pattern, the bulbous 'finger' in the lower anterior section of the lateral spot occurs both in the European and in the Japanese females.

ZOOGEOGRAPHICAL AND PALAEOGEOGRAPHICAL ASPECTS

S. graeseri (syn. *S. sibirica* Trybom, *S. borealis* Bartenev) is an East Palaearctic species with a disjunct extent of occurrence (Fig. 5). Its main range includes large areas of central and eastern Siberia, almost the whole Russian Far East including the Kamchatka Peninsula and Sakhalin, the Kuril Islands, Hokkaido, rare localities in northern Honshu, North Korea, northern areas of South Korea and rare localities in its southern half, northeastern China (Manchuria) and northeasternmost Kazakhstan (BARTENEV, 1910a, 1910b, 1912a, 1912b, 1914, 1930; VALLE, 1932; SCHMIDT, 1957; ASAHINA, 1958; BELYSHEV, 1964, 1965, 1966a, 1966b, 1973a, 1973b; KOSTERIN, 1989; MALIKOVA, 1995; OU et al., 1998; HARITONOV & MALIKOVA, 1999 and unpubl. data; ZORINA et al., 2000; LEE, 2001; MALIKOVA & IVANOV, 2001; SUGIMURA et al., 2001; KOSTERIN, 2004; DUMONT et al., 2005; CHAPLINA et al., 2007; HIROSE et al., 2007; KIM et al., 2009; KOSTERIN & SIVTSEVA, 2009; SEO, 2009; KOSTERIN & GORBUNOV, 2010; KOSTERIN & ZAIKA, 2010). However, the core of the species range seems to be situated in the Far East of Russia and includes the Primorskii Krai, the Khabarovskii Krai and the Amur Province, where *S. graeseri* is really abundant (MALIKOVA, 1995; MALIKOVA & IVANOV, 2001).

The range limits (Fig. 5) are still mostly hypothetical. In some cases they more or less mirror the actual state but in others they will probably change with increased knowledge in the future. For example, there are no data on *S. graeseri* from Mongolia, although its occurrence is expected there (KOSTERIN, 2004). Indeed, a few widespread Russian records, close to the Mongolian borders (BARTENEV, 1912a; BELYSHEV, 1973a; KOSTERIN, 2004; KOSTERIN & ZAIKA, 2010), make the occurrence of *S. graeseri* in N Mongolia highly probable. SCHMIDT (1957) and OU et al. (1998) give the species localities only in northern and eastern Manchuria. However, it would seem likely that the range of *S. graeseri* in this region should reach much more west- and southwards, possibly even as far as 40°N. The distribution in NE China still remains highly unclear due not only to the rarity of published data, but also to the complication caused by a description of the very similar *Somatochlora shanxiensis* Zhu & Zhang, 1999 from Shanxi province (ZHU & ZHANG, 1999), situated more towards the south. The distribution range and morphological variation of *S. shanxiensis* are practically unknown and its taxonomic status in relation to *S. graeseri* seems to be still unsolved when the morphological variability of the latter species is considered. In South Korea, *S. graeseri* is mostly recorded from northern provinces, south to Mount Songni, but also from the more southern Gaya Mountains (Gayasan) and the southernmost Jeju Island (LEE, 2001; KIM et al., 2009). A local occurrence of the species in mountainous areas between these regions is quite possible.

The given northern limit (Fig. 5) reaches its northernmost localities near Dru-

zhina, 68°12' N, situated in the valley of the Indigirka River (BELYSHEV, 1973a), and in Talnakh, NNE of Norilsk, 69°30' N 88°23' E (31 July 1964, 1 male, leg. Zolotarenko, unpubl. data from Belyshev-Haritonov collections in Novosibirsk, available due to E.I. Malikova). The western limit of the main range (Fig. 5) probably runs along the Yenisei River – crossing it only locally and slightly – from the above-mentioned 69°30' N up to the river section situated to the south of Krasnoyarsk. Then it stretches to the southwest through the upper Ob River basin and the western Altai Mountains down to a few localities in their Kazakh part with the southernmost site at 48°47' N and 86°01' E (BARTENEV, 1910b; SCHMIDT, 1957; BELYSHEV, 1973a; KOSTERIN, 1989; KOSTERIN & GORBUNOV, 2010; CHAPLINA et al., 2007). It seems that, apart from small areas along the Yenisei River, the species does not penetrate the plains of the West Siberian Lowland from the East, being restricted to uplands and mountains there. However, it cannot be excluded that the main species range crosses this lowland in its northern part, along the Arctic Circle, reaching the Polar Urals.

Three presumable isolates of *S. graeseri* were previously known to the west of the main range (Fig. 5) (HARITONOV, 1976; YANYBAEVA, 2004; YANYBAEVA et al., 2006; HARITONOV & EREMINA, 2010). However, the situation and other details for two of them were not published earlier and are presented here due to the kindness of Anatolii Yurevich Haritonov. The first isolate, known as the Polar Urals (HARITONOV & EREMINA, 2010), is situated in westernmost Asia, at the border of the West Siberian Lowland and the foothills of the Polar Urals. One male of *S. graeseri* was collected there on 20 July 1974 by I.V. Volkov at a small forest lake close to the eastern shore of Varchaty (= Varchato) Lake, 66°07' N 64°08' E (collections of A.Yu. Haritonov). The second isolate, known as the Middle Urals and adjacent plains so far (HARITONOV, 1976), consists of two localities ca 78 km distant, but situated in the same river system. In the foothills of the Middle Urals, two males were collected by A.Yu. Haritonov on 12 July 1974 at an oxbow lake of the Kushaika River near Krasnouralsk (58°20' N 60°01' E). The second site is a group of localities situated next to Beregovaya, 8 km ESE of Verkhoture, 58°50' N 60°57' E. During A.Yu. Haritonov's field work, between 15 June and 15 July 1974, *S. graeseri* occurred fairly commonly there at small oxbow lakes, with the largest population on Krivoe (oxbow) Lake. The Beregovaya site is situated 50 km E of the Ural foothills, showing the possibility of a deep penetration by the species into the plains of the West Siberian Lowland from the West. The third isolate of *S. graeseri* is situated in the South Urals, in Bashkortostan, where the species was only recorded at some oxbows in the Bashkirskii Nature Reserve (YANYBAEVA, 2004; YANYBAEVA et al., 2006; HARITONOV & EREMINA, 2010). Three sites in this area were the only European localities of this species, situated at the easternmost margin of the continent. Additionally, SKVORTSOV (2010) has given an occurrence of *S. graeseri* in the Ilmen group of lakes in the Chelyabinsk province. However, there is

no data on this species in the publication which he refers to and in other papers concerning these areas and an expert, A. Yu. Haritonov (pers. comm.), is also unaware of these data. Therefore, both in his and my opinion this locality should be treated as erroneous.

The local occurrence of *S. graeseri* in other parts of the Urals and adjacent plains is also possible. In KOSTERIN (2005), the Ural isolate of the *S. graeseri* range is huge and comprises the whole mountain system. This far going supposition possibly mirrors the actual state, however, much more data are required to confirm the reliability of this extrapolation.

The newly described locality in northern European Russia (Fig. 5), also probably representing only a part of an isolate, is situated ca 1930 km W of the main range, ca 980 km WSW of the Polar Ural isolate and ca 1125 km NW of the Middle Ural isolate.

The known current distribution range of *S. graeseri* (Fig. 5) is strikingly similar to that of *C. hylas* and partly resembles that of *C. glaciale* (cf BERNARD & DARAŻ, 2010). Some of the differences between them, which are recognisable on the distribution maps, have been or will probably be proven false. For example, an earlier unavailable publication (BELYSHEV et al., 1978) and unpublished

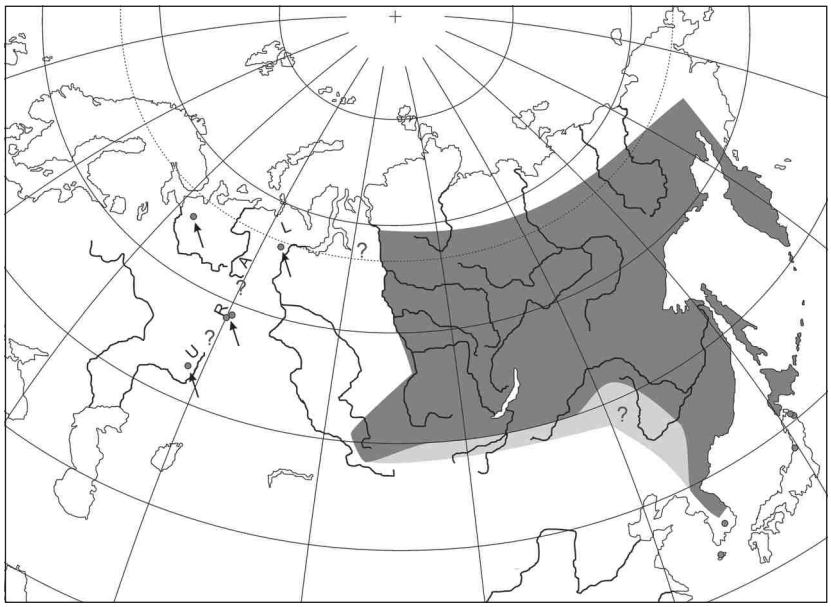

Fig. 5. Disjunct range of *Somatochlora graeseri*. Relict postglacial presumable isolates are indicated with arrows. The westernmost arrow shows the Maletino locality described in this study. Question marks show areas where the species is unknown, but possibly occurs. The light grey shade with the question mark refers to the hypothetical distribution range in Mongolia and China.

data of A.Yu. Haritonov and E.I. Malikova have shown that the ranges of *C. hylas* and *C. glaciale* reach much more northeastwards than described in BERNARD & DARAŻ (2010). They reach up to the river Anadyr in the Chukotka Autonomous District (Okrug), just as in the case of *S. graeseri*.

The significant similarity between these distribution ranges not only reflects their common postglacial genesis (for its detailed explanation see BERNARD & DARAŻ, 2010), but also indicates the occurrence of some common factors in the climatic and habitat requirements of these species. *S. graeseri*, like *C. glaciale* and *C. hylas*, is a representative of the Manchurian faunal element. Within this element, they form a northern cold-stenothermal group whose postglacial distribution was most probably the widest in the colder periods, i.e. near the end of the Pleistocene (in the Bølling-Allerød interstadial) and at the beginning of the Holocene, i.e. in the Preboreal and early Boreal, when it reached deep into Europe. In the subsequent periods, especially during the Atlantic, the distribution areas of these species shrank. They withdrew far to the east and survived only as rare isolates in Europe, probably mostly in the Northeast and in the Urals and their foothills (BERNARD & DARAŻ, 2010). In this context, *S. graeseri* is, as the coenagrionids *C. glaciale* and *C. hylas*, a postglacial relict in Europe.

ECOLOGICAL ASPECTS

All these three cold-stenothermal species prefer relatively low water temperatures, so they frequently occur in water bodies that are deeply frozen over long periods and/or fed by a cold inflow (for *C. glaciale* and *C. hylas* see BERNARD & DARAŻ, 2010). There are rare observations of *S. graeseri* flying above warm waters, e.g. from Kamchatka (DUMONT et al., 2005). However, an autochthonous occurrence in these waters has not been confirmed.

In *S. graeseri*, the preferences for colder waters are recognisable not only in its far north reaching distribution but also in its frequent occurrence in mountains or generally at higher elevations, especially in the southern parts of the range, for example in Altai, Tuva or Korea (KOSTERIN, 1989; KOSTERIN & ZAIKA, 2010; LEE, 2001). In this context, it is noteworthy that the winters are also severe and long in other southern parts of the distribution range, e.g. in northern Manchuria. These preferences also appear in habitat selection. According to BELYSHEV (1973a), the species inhabits a wide spectrum of habitats which are mostly lentic; in running waters, *S. graeseri* selects their more lentic, calm parts such as bays, side/dead river arms or flooded areas. However, an analysis of the literature shows some, possibly even significant, preferences for oxbow lakes and other small water bodies in the river valleys (e.g. BELYSHEV, 1966a, 1966b; KOSTERIN, 2004; DUMONT et. al., 2005; YANYBAEVA et al., 2006; KOSTERIN & ZAIKA, 2010; new data from Krasnouralsk and Beregovaya presented in the current paper). The river valleys are rather warmer than their surroundings, but

oxbow lakes and related water bodies are frequently cold and poor in nutrients. For example, BELYSHEV (1966a) stressed low temperatures of water and long periods of deep freezing for clearwater '*graeseri*' water bodies in the Tunka valley and, according to KOSTERIN & ZAIKA (2010), the species is mostly associated in Tuva with rather deep, nutrient-poor, cold waters. One of these water bodies has even been described as ice-cold due to its underwater springs.

The small lake described in this paper has almost neutral water despite the acidic, *Sphagnum* bog neighbourhood. This suggests the existence of an inflow, probably seepage waters, which could also create lower temperatures. In this area, highly influenced by karst (SHAVRINA & MALKOV, 2008), such inflows are frequent. This interpretation seems to be confirmed by the co-occurrence of *C. glaciale*, a species with similar habitat requirements, and also by the presence of *Rhynchocypris percnurus*. In the study area, this fish is frequently recorded in small water bodies with some mineral but not nutrient-rich inflows (R. Bernard, unpubl. data). Forest or bushes adjacent to the water body are, in BELYSHEV's (1973a) opinion, an obligatory component of the habitat of *S. graeseri*. The very limited and repeated zone of emergence of *S. graeseri* at the Maletino locality, being sunny but close to the forest 'wall', seems to confirm the association of this species with such a matrix. It certainly provides wind protection and needed shelter but also influences the local microclimate, making it slightly cooler and less variable.

Records made with a two-year-long interval and a complete lack of imagines between them may suggest that *S. graeseri* is a semivoltine species at the Maletino locality. However, extremely low numbers of *S. graeseri* indicate that this water body is inhabited by a satellite micropopulation and the stem locality of the species in the Pinega environs still awaits discovery. Possibly, it will be one of oxbow lakes in the Pinega River valley, whose edge is only 0.8 km distant. More than 100 localities with diverse habitats (oxbow lakes inclusive) have been studied in the research area so far. The elusiveness of *S. graeseri* shows how rare and stenotopic it is there.

As in the case of *C. glaciale* and *C. hylas* (BERNARD & DARAŻ, 2010), it remains unknown whether *S. graeseri* occurs in the European Northeast only in the 'Pinega' isolate or in a fragmented belt extending through the major part of the far Northeast. Therefore, it is difficult to assess the role of local conditions. However, in the context of the habitat requirements described above, it is assumed that a specific combination of continuous appropriately severe climatic conditions and habitat-microclimatic conditions influenced by karst has been crucial for the survival of *S. graeseri* in the study area from the Preboreal. Although the role of the karst may be slightly less important, as in the case of *C. glaciale* and *C. hylas*, it is certainly positive. The karst influence appears in: (1) a greater habitat diversity, not so dominated by boggy landscapes as in many other areas of the north, with such richness offering suitable conditions for species not restricted to boggy

waters; (2) contrasting and locally more severe microclimatic conditions both on land and in water, recognisable, e.g., in more persistent accumulations of cold air in land depressions and, what is especially important for cold-stenothermal dragonflies, in low water temperatures. As a consequence, the karst territories of the Pinega broad environs are distinguished from other taiga areas at these latitudes by their unusually rich flora and fauna. This also includes, besides taiga species, a much broader than expected representation of arctic, subarctic and arctic-alpine species as well as East Palaearctic species whose nearest localities are known far to the East, in northern Siberia (e.g. PUCHNINA, 2000a, 2000b, 2008; BABENKO, 2008).

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POSTEMBRIONARY DEVELOPMENT OF *ISCHNURA CHINGAZA* REALPE UNDER CAPTIVITY CONDITIONS (ZYGOPTERA: COENAGRIONIDAE)

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The larval stages were observed and characterized under controlled conditions. The larvae were measured and described in order to establish the differences between them, using morphometric characters such as head and premental width and length, number of premental and labial setae, the length of wing pads and legs, and total length without gills, also the growth ratio of different body parts was calculated. The most important character to distinguish larval stages was the head width. There was an increase in the number of premental setae during ontogeny. Comparisons in terms of size were made, showing that ♀♀ are larger than ♂♂ in all observed structures. *I. chingaza* has 11 larval stages; except for the prolarva, all of them were observed.

INTRODUCTION

The life cycles of *Ischnura verticalis* and *I. elegans* have been described by CORBET (2004) and MILLER (1995). To date, little is known about *I. chingaza* because it has only been described recently (REALPE, 2010).

I. chingaza individuals are of medium size (23.9 mm average), have two rounded pale blue spots behind the eyes (ESQUIVEL, 2006) a band of the same colour between the eyes and dorsal green stripes on the sides of thorax. The abdomen is usually black, pale laterally with dorsal blue marks on segments 8 and 9, and a bifurcated projection on the 10th abdominal segment. The larval body and gills are narrow and the gills are acuminate. The head is elongated transversally. The posterior margins of the head are rounded and the antennae are 7-segmented.

The body colour of the larvae varies from brown to olive green.

The objective of this research was to describe each of the larval instars of *Ischnura chingaza*, using morphometric parameters.

MATERIAL AND METHODS

Locality: COLOMBIA, Cundinamarca Dept., Municipality of Cogua, Rodamontal county, artificial permanent pond, (05º04'14"N, 0.74º00'0.2"W), 2842 m a.s.l. The average temperature was 14°C. Larvae were collected in December 2008 and March to July 2009. An aquatic mesh net with a 1mm pore size was used. The larvae were individually placed in numbered plastic 16 ounce containers, which were filled with fresh water from the collecting location. A twig for later emergence was provided. The larvae were fed on *Daphnia* sp, *Artemia salina*, and individuals from the families Corixidae and Notonectidae that were smaller than the *I. chingaza* larvae. To maintain the water level, dechlorinated water was used. Also, adult females were collected, in order to obtain eggs. These females were placed on humid filter paper (CORDERO, 1990b) and *Juncus* sp. twigs because the latter is where oviposition was observed in the field.

84 larvae and 62 exuviae were preserved in 70% alcohol. These were later measured and described using morphometric characters: head width and length, premental width at the base and apex, premental length along the medial line, number of premental and labial setae, length of the wing pads and which thoracic or abdominal segment they reach, overall length of the legs, length of the abdomen, width of the 1st and 10th abdominal segments, total length excluding the gills (Fig I). The sex was determined in F-0 to F-4. The growth ratio using various body measurements was calculated. The observation of the structures was made with an advanced 60X stereoscope and the measurements were performed with a mirror 16X stereoscope.

Instars were counted using MILLER's (1995) numeration system, in which F-0 is the final instar, F-1 the instar before the final one and so on.

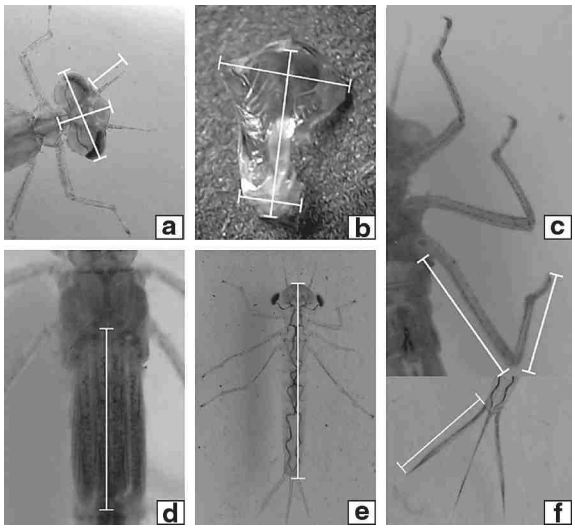

Fig. 1. Characters measured on *Ischnura chingaza* larvae: (a) head length and width, and antennal length; – (b) premental width at its base and apex, and premental length at the medial line; – (c) leg length; – (d) wing pads length; – (e) total length, excluding antennae and gills; – (f) gill length.

RESULTS

LIFE CYCLE DURATION

The average life cycle was calculated as 290.2 days (Tab. I), during which F-0 was the longest duration.

Table I
Average duration of each life cycle stage, in days

Instar	Duration
Egg	26.5
F-9	23.8
F-8	29
F-7	22.5
F-6	26
F-5	29.5
F-4	22.5
F-3	20.2
F-2	24.5
F-1	23.2
F-0	38
Adult	5

EGGS

Oviposition was achieved in captivity by two females. The eggs were laid on filter paper and *Juncus* sp. twigs, the latter being the preferred substrate. Oviposition lasted 30 minutes and was carried out by the female alone, as was observed in the field. The first female laid 38 eggs and all of them hatched, while the second female laid 61 eggs, 57 of them hatched. Most of the individuals hatched within 26 days. As in most of zygopterans, the eggs of *I. chingaza* are oval with a length of 0.89 mm and a width of 0.18 mm. The micropile is easily distinguished by its dark brown colour, which contrasts with the cream colour of the rest of the surface. Surface punctures were observed.

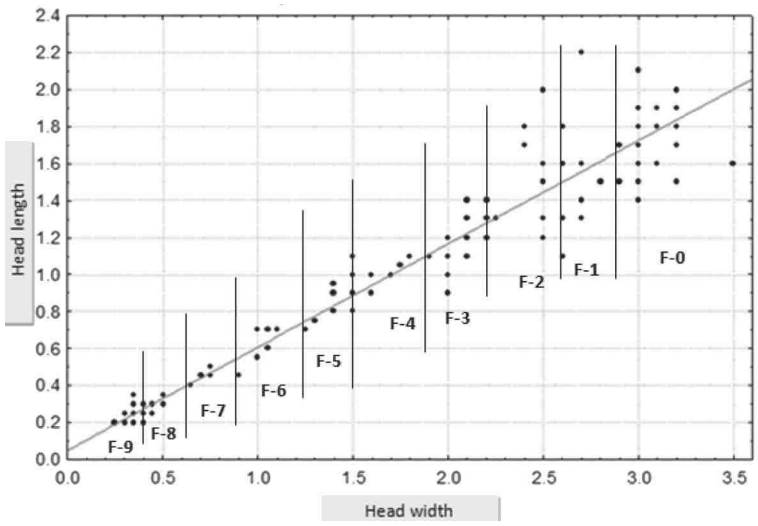

Fig. 2. *Ischnura chingaza*: scatter plot of head width and length in larvae.

LARVAE

The life cycle was completed after 11 instars, following CORBET (2004) who recommended that the prolarva should be counted as the first instar. The prolarva was not measured. The larval stage lasts, on average, for 259.2 days. All larval stages are of similar duration except for F-0, which is somewhat longer.

The most efficient measure for instar characterization was head width (Tab. II/A, Fig. 2), as BENKE (1979) and BROOKER (2002) noted. However, other measurements such as the length of the prementum give good discrimination between instars as do the number of premental setae, which increase with larval instar (Tab. II/A). The average gill length shows a clear increase form instar to instar but the Standard Deviation is too high for this measure to be of any use in discrimination.

External wings pads showed the highest growth ratio, with a change in the ratio

Table II
Summary of morphometric measurements (average ± sd, in mm) for all instars; − [A: head; − B thorax and abdomen measurements; − *: data missing]

A

Instar	N	Head		Prementum			Total antennae length	Premental setae
		Width	Length	Length	Width apex	Width base		
F-9	12	0.32+0.03	0.24+0.04	0.23+0.02	0.25+0	0.10+0	0.29+0.05	0
F-8	17	0.44+0.04	0.27+0.03	0.4+0	*	*	0.32+0.04	1+1
F-7	4	0.71+0.04	0.45+0.03	0.45+0	0.40+0	0.20+0	0.56+0.04	1+1
F-6	6	1.02+0.06	0.62+0.09	0.68+0.02	0.35+0	0.20+0	0.88+0.36	2+2
F-5	6	1.33+0.06	0.8+0.09	0.92+0.12	0.77+0.06	0.27+0.04	1.15+0.34	3+3
F-4	12	1.61+0.10	0.99+0.08	1.24+0.18	0.91+0.09	0.34+0.12	1.19+0.12	3+3, 4+4, 5+5
F-3	17	2.03+0.06	1.15+0.13	1.54+0.19	1.13+0.19	0.37+0.08	1.38+0.24	4+4, 5+5
F-2	24	2.42+0.12	1.43+0.21	1.91+0.36	1.36+0.15	0.50+0.13	1.78+0.29	4+4, 5+5
F-1	13	2.69+0.08	1.53+0.25	2.04+0.36	1.40+0.09	0.49+0.06	1.73+0.22	4+4, 5+5, 6+6
F-0	35	3.05+0.11	1.75+0.14	2.19+0.36	1.58+0.08	0.48+0.10	1.92+0.37	6+6, 5+5

B

Instar	Leg length			Wing pads length		Abdomen width		Gill lengths	
	1	2	3	Anterior	Posterior	1º segment	10º segment	Lateral	Medial
F-9	0.9+0	1.0+0	1.15+0.05	*	*	0.25+0	0.15+0	1+0	0.78+017
F-8	*	*	*	*	*	*	*	1.16+0.1	1.04+0.2
F-7	1.5+0	1.6+0	2.5+0	*	*	0.45+0	0.25+0	1.8+0.19	1.9+0.14
F-6	1.83+0.12	2.1+0.1	2.65+0.05	*	*	0.43+0.02	0.28+0.07	2.43+0.34	2.30+0.25
F-5	2.51+0.11	2.95+0.10	3.38+0.15	0.26+0.06	0.24+0.06	0.66+0.05	0.44+0.03	3.04+0.26	2.92+0.27
F-4	2.76+0.27	3.61+0.44	4.23+0.54	0.68+0.36	0.59+0.31	0.95+0.21	0.50+0.15	3.27+0.32	3.38+0.21
F-3	3.26+0.42	4.29+0.43	5.17+0.43	1.01+0.30	1.05+0.17	1.09+0.12	0.65+0.08	4.40+0.36	4.29+0.52
F-2	3.92+0.55	4.8+ 0.84	6.25+0.81	1.69+0.42	1.67+0.40	1.21+0.31	0.80+0.20	4.47+0.56	4.70+0.56
F-1	3.94+0.63	4.95+0.65	6.14+0.72	1.82+0.23	1.78+0.36	1.46+0.25	0.77+0.14	4.48+0.43	4.52+0.67
F-0	4.52+0.59	5.67+0.48	7.31+0.53	3.57+0.29	3.52+0.32	1.51+0.53	0.82+0.13	6.10+0.60	5.94+0.43

of 0.40 in F-5 to 0.88 in F-0. The colouration of the larvae could not be related to sex or any character.

The F-0 larvae show a variety of dorsal setae, which are more evident in this stadium. They increase in number from 5th to 10th abdominal segment, making this last segment appear darker than the anterior ones.

Common to all instars is the dorsal darkening of the head as its approaches ecdysis, the pigmentation progressing from anterior to posterior region. The F-0 larvae vary in colour from ochre to olive green. However, in previous instars the predominant colour is cream. Head width growth was linear (Fig. 3, Tab. III).

Comparison of the measurements between males and females were made from F-4 to F-0 instar (Tab. IV), these were the only instars where the sex could be distinguished externally.

ADULT

In the comparison between captivity (reared from larvae) and field adults (results not shown), the most relevant data were: head, wings, total length and abdominal length. Also two different colour females emerged in captivity, one similar (androchromotypic) and other different (gynochromotypic) from the male colour (CORDERO, 1992).

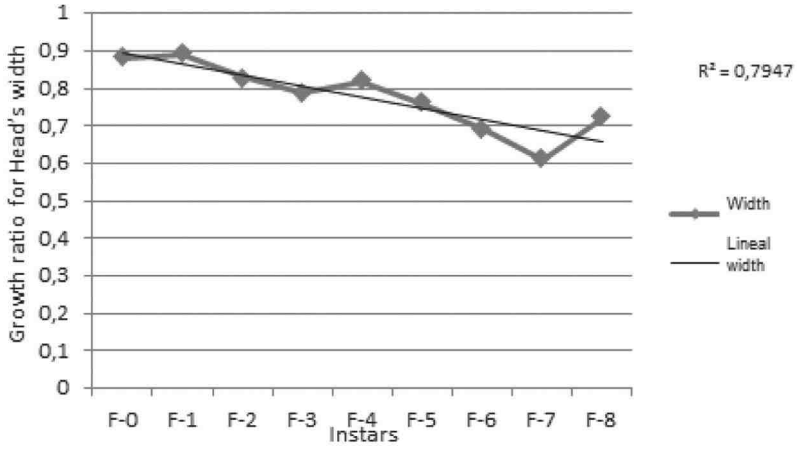

Fig. 3. *Ischnura chingaza*: linear regression of grow ratio for head width in larvae.

Table III
Growth ratio for each instar; – [*: data missing]

Organ		Instar								
		F-0	F-1	F-2	F-3	F-4	F-5	F-6	F-7	F-8
Head	width	0,88	0,89	0,83	0,79	0,82	0,76	0,69	0,61	0,72
	length	0,87	0,93	0,80	0,86	0,80	0,77	0,72	0,6	0,88
Prementum	length	0,93	0,93	0,80	0,80	0,74	0,73	0,66	0	*
	base width	1,02	1,02	0,74	0,91	0,79	0,74	1	0	*
	apex width	0,88	0,97	0,83	0,80	0,84	0,45	1,14	0	*
Antennae	total antenae	0,90	0,97	0,82	0,86	0,97	0,75	0,63	0,57	0,90
Wing pads length	anterior	0,78	0,71	0,51	0,65	0,38	0	0	0	*
	posterior	0,88	0,67	0,50	0,56	0,40	0	0	0	*
Legs length	anterior	0,87	0,98	0,83	0,87	0,87	0,72	0,81	0	*
	medium	0,86	0,96	0,89	0,88	0,77	0,71	0,76	0	*
	posterior	0,90	0,95	0,82	0,87	0,75	0,78	0,77	0	*
Abdominal segment width	1	0,96	0,82	0,90	0,87	0,69	0,65	1,04	0	*
	10	0,93	1,04	0,81	0,76	0,88	0,63	0,89	0	*
Abd. length		0,94	0,86	0,82	0,90	0,66	0		0	*
Lateral gill	length	0,64	1,09	0,95	0,79	0,89	0,83	0,78	0	*
Medium gill	length	0,70	0,87	1,06	0,82	0,91	0,75	0,78	0	*

DISCUSSION

LIFE CYCLE DURATION

The *I. chingaza* larva has 11 instars. CORBET (2004) reports 13 for *I. verticalis*, and MILLER (1995) 13-19 instars for *I. elegans.*

The overall average duration of the larval stage of the *I. chingaza* life cycle amounts to ca 8½ months (258.2 days), which is longer than that recorded for other species in the genus. Thus CORBET (2004) reported an average duration of 78.5 days for *I. verticalis*. MILLER (1995) recorded 1-6 months for *I. elegans* (depending on temperature and food), and CORDERO (1998) 4-7 months in *I. graellsii* (depending on the oviposition site).

EGGS

Unlike most *Ischnura* species, *I. chingaza,* like *I. graelsii* (GONZÁLEZ DE CASTRO, 2006), oviposits without any mate-guarding by the male. The duration of the egg phase was similar to that of *I. elegans*, with a range from 2 weeks to a month (VAN GOSSUM, 2003). In contrast to other zygopterans, in this case a pattern of oviposition could not be established. This is perhaps due to the circumstance that only a few females were used and the oviposition substrates were small.

LARVAE

The relatively longer antennae in early instars may indicate a greater reliance on chemoreception rather than on visual reception in locating prey items (CORBET, 2004). *I. chingaza* presents the shortest 3rd antennal segment of all *Ischnura* species studied (Tab. V).

The increase in number of premental setae during ontogeny may be linked to the effectiveness of prey capture. It is likely that the increase in prementum size close before emergence is due to the need for increased effectiveness in the capture of large and highly mobile prey in natural conditions. Indeed, CORBET (2004) noted that palpal or premental setae amputation decreases the capture success of individuals. However, the number of premental setae cannot be used to characterize a specific instar in *I. chingaza* (Tab. II/A), nor to discriminate the F-0 larvae of *Ischnura* species included in Table V. This holds true for almost all other measurements in Table V, except the internal palpal teeth, of which *I. chingaza* has an increased number (5).

Table IV
Comparison between male and female larvae; – [all measures in mm]

Sex	Instar	Head		Prementum length			Antennae length	Wing pads		Legs length		
		Width	Length	Length	Base width	Apex width		Anterior	Posterior	Anterior	Medium	Posterior
♀	F-0	3,08	1,77	2,26	0,48	1,6	1,9	3,7	3,68	4,57	5,59	7,44
♂	F-0	3,01	1,73	2,12	0,49	1,56	1,95	3,43	3,37	4,63	5,93	7
♀	F-1	2,71	1,55	2,04	0,49	1,41	1,78	3,08	3,5	4,23	5,21	6,89
♂	F-1	2,66	1,5	2,04	0,5	1,37	1,53	2,42	2,48	3,37	4,27	5,15
♀	F-2	2,47	1,49	1,88	0,47	1,4	1,58	2,14	2,28	3,93	4,91	6,26
♂	F-2	2,36	1,33	1,91	0,53	1,32	1,78	1,69	1,77	4	4,69	6,27
♀	F-3	2,06	1,21	1,68	0,42	1,24	1,38	1,13	1,12	3,4	4,46	5,3
♂	F-3	2,01	1,11	1,42	0,34	1,06	1,7	0,98	1,01	3,17	4,28	5,23
♀	F-4	1,63	1,07	1,30	0,40	0,90	1,18	0,75	0,60	2,67	3,53	4,47
♂	F-4	1,61	0,96	1,21	0,33	0,91	1,20	0,65	0,59	2,93	3,90	4,51

Table V
Morphological comparison of F-0 larvae of some *Ischnura* species, modified from VELÁSQUEZ et al.(2009)

Species	Total length	Setae on palps	Setae on mentum	External wing pads	Lateral ridge of prementum	Internal palpal teeth	Antennal segments
cruzi	17.7	5	4	Posterior ridge IV –S	9 setae	4	0.4:0.6:1:0.5:0.4:0.3:0.2
ramburii	19	6	5	Median III-S	8-9 setae	3	0.5:0.8:1.0.7:0.4.0.4:0.2
capreolus	11	5	3	Anterior ridge V-S	4-5 setae	3	0.4:0.7:1:0.7:0.4:0.4:0.2
ultima	--	6	5	--	7-8 setae	4	0.4:0.8:1:0.5:0.5:0.4:0.2
chingaza	12.3	6	5-6	Median IV-S	6-7 setae	5	0.2:0.3:0.4:0.2:0.2:0.2:0.1

ADULTS

Individuals collected in the field were larger than those reared in captivity, probably due to the availability of food, even though in captivity they were fed on other arthropods from the collecting location. However, the amount provided may not have been adequate.

During the life cycle under laboratory conditions it should be noted that CORBET (2004) mentions that the amount of food offered in each stage affects the size of the larvae after moult and, in the case of F-0, the availability of food affects the dimensions of the emerging adult.

Although two differently coloured females emerged in captivity, these adults did not survive to sexual maturity, therefore the colouration was not final. Thus it cannot be assumed that *I. chingaza* has polychromatic females, as reported in other species of the genus such as, e.g., *I. graellsii* (CORDERO, 1990), *I. ramburii* (CORDERO, 1992), *I. damula* (JOHNSON, 1964, 1975); the authors are conducting experiments in order to clarify this.

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Odonatologica 41(4): 337-345 *December 1, 2012*

AKROTHEMIS, A NEW LIBELLULID GENUS FROM PAPUA NEW GUINEA (ANISOPTERA: LIBELLULIDAE)

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The new genus is established for *Oda risi* Campion, 1915. Photos of the holotype of *O. risi* are presented, and the supposed ♀ of this sp. is described for the first time. A second sp., *Akrothemis bimaculata* sp. n., from Papua New Guinea is described as new. Holotype ♀: Papua New Guinea, Kaugumi Camp, E Sepik Prov., alt 60 m a.s.l., 4-X-2010 (NTM 1008589). *Akrothemis* appears to belong in Tetrathemistinae and may be most closely related to a group of genera around *Tetrathemis* Brauer, 1868.

INTRODUCTION

RIS (1909) erected the genus *Oda* for the single species *Nannophlebia Dohrni* Krüger, 1902. A second species, *Oda risi*, was added by CAMPION (1919). COWLEY (1934) replaced *Oda* Ris by *Risiophlebia* based on *Nannophlebia dohrni* and also included *Oda risi*.

Recently three female specimens have became available that appeared to belong to *Risiophlebia risi*, a species hitherto known only from the holotype male. Subsequent closer examination of these three females, the holotype of *R. risi* and of *R. dohrni* suggested that the two species presently united in *Risiophlebia* are not congeneric. The three females were, however, found to be congeneric with *R. risi*, one of them apparently representing its as yet undescribed female, the other two an as yet undescribed species. Moreover, study of the available tetrathemistine genera and the other libellulid subfamilies showed that *R. risi* does not fit any of

them. Below we establish a new genus, *Akrothemis,* for it and a hitherto undescribed species, and discuss its affinities. We also describe *Akrothemis bimaculata* sp. nov. and the supposed female of *A. risi.*

MATERIAL AND METHODS

The descriptive terminology largely follows CHAO (1953) and WATSON & O'FARRELL (1991). Coloration is given as detectable from the preserved material. Measurements are given in millimetres (mm). All illustrations were done with the aid of a camera lucida and are not to scale.

Material is deposited in the collection of Museum Naturalis (RMNH) in Leiden (The Netherlands) and of the Museum and Art Gallery of the Northern Territory (NTM).

AKROTHEMIS GEN. NOV.

E t y m o l o g y. – The generic name is a composite of "*akros*" and "*themis*". Akros is Greek for "pointed" and refers to the pointed basal angle between vein A and the margin of the basal section of the hindwing. Themis is the basis for the names of most supposedly closely allied genera.

DIAGNOSTIC CHARACTERS. – Small-sized, short-bodied, long-legged libellulids with clear wings. Eyes meeting broadly in midline. Head, thorax and abdomen with distinctive pattern of dark (black, possibly metallic) and light. Male secondary genitalia and anal appendages apparently simple and not prominent. Antenodal portion of wings, particularly forewing, distinctly longer than postnodal portion, thus twice as many or almost twice as many antenodals as postnodals; last antenodal of forewing complete; pterostigma elongate in both wings, 3-4 times as long as wide, overlying 2 crossveins; arculus at or close to (but beyond) Ax2, and sectors of arculus with long stalk in both wings; discoidal cell ("triangle") of forewing widely rhomboid with costal side broken at about midlength; hindwing triangle well beyond arculus; "triangles", hypertriangles and subtriangle of forewing free; in forewing subtriangle slightly directed posteriorly and with costal side in line or almost in line with proximal section of costal side of triangle, distal portion of bridge short and high; no additional crossveins to the bridge; CuP of forewing originating at or very close to posterior angle of triangle, CuP of hindwing originating between very close to posterior angle of triangle and halfway up the distal side of triangle; R4+5 and CuP in forewing running almost parallel to approximately the level of nodus, thence slightly and continuously converging, in hindwing almost parallel throughout; median space free, and 1 cuq in both wings; discoidal field of forewing beginning with 1 row of cells and almost parallel sided throughout, discoidal field of hindwing beginning with 1 row of cells for several (up to 6) cells, thence widening continuously (to up to 7 cells) towards wing margin; cubital field of both wings and anal field of forewing parallel sided and only 1 cell wide, anal field of hindwing 1-2 cells wide; anal loop not developed.

Type species: *Oda risi* Campion, 1915.

DISCUSSION

In his monumental monograph of the Libellulinae (now Libellulidae) RIS (1909) established ten groups of genera. In Libellulinae Gruppe I he described for *Nannophlebia Dohrni* Krüger, 1892, the genus *Oda*, listing it together with *Allorhizucha* Karsch, 1890, *Archaeophlebia* Ris, 1909, *Bironides* Förster, 1903, *Calophlebia* Selys, 1896, *Eothemis* Ris, 1909, *Hylaeothemi*s Ris, 1909, *Hypothemis* Karsch 1899, *Micromacromia* Karsch, 1890, *Microtrigonia* Förster, 1903, *Nannophlebia* Selys, 1878; *Neodythemis* Karsch, 1889, and *Tetrathemis* Brauer, 1868. After CAMPION (1915) added a second species, *risi*, to *Oda*, TILLYARD (1917) established the family group taxon Tetrathemistini for Ris' Libellulinae Gruppe I. COWLEY (1934) replaced the generic name *Oda* by *Risiophlebia* based on *dohrni* as type species. In comprehensive treatments of the order Odonata FRASER (1957), DAVIES & TOBIN (1985) and BRIDGES (1993) included, under Tetrathemistinae, a continuously growing list of genera. In BRIDGES (1993) this list included the additional genera *Celebophlebia* Lieftinck, 1936, *Malgassophlebia* Fraser, 1956, *Monardithemis* Longfield, 1947, *Notiothemis* Ris, 1919, *Pacificothemis* Asahina, 1940, *Palaeothemis* Fraser, 1923, *Risiophlebia* Cowley 1934, *Sleuthemis* Fraser, 1951, and *Tapeinothemis* Lieftinck, 1950. For the Tetrathemistinae DAVIES & TOBIN (1985) summarized the following characters: Small forms with narrow wings and short abdomen. Colouring often black and yellow. 6-9 antenodals; distal antenodal complete; arculus between antenodals 2 and 3; long fusion of sectors of arculus; costal side of triangle angulated; accessory crossveins to bridge and in cubital space; discoidal field usually a single row of cells; anal loop absent. It may be worth mentioning that many of the genera included in Tetrathemistinae by DAVIES & TOBIN (1985) do not possess all the characters listed. LIEFTINCK (1936, 1950), and VAN TOL (1987) pointed out that the Tetrathemistinae are united by symplesiomorphies only and considered this a serious handicap for a generic subdivision of the subfamily. Finally WARE et al. (2007), based on molecular evidence, showed that Tetrathemistinae in the recent concept are clearly polyphyletic. Only four out of the numerous genera were studied and even they were found scattered throughout Libellulidae, *Tetrathemis* and *Calophlebia* in Clade A, *Nannophlebia* in Clade C and *Neodythemis* in Clade H of eight recognized Clades. This suggested to them that a very restricted Tetrathemistinae, Clade A, may remain as the most basal Libellulidae but clearly its composition and delimiting characters are very different than previously defined.

In *Risiophlebia risi* the forewing triangle is distinctly rhombic and rather wide, the hindwing triangle not recessed, the bridge high and asymmetrical and the male abdomen base is hardly expanded, whereas in *R. dohrni* the forewing triangle is almost regular and markedly narrower, the hindwing triangle recessed to the level of arculus, the bridge low and symmetrical and the base of the male abdomen enormously laterally and ventrally expanded. All this suggests that

these two species should not be united in the same genus. It also suggests that the relationships of *R. risi* appear to lie with Clade A of WARE et al. (2007). At the present it is impossible to be certain about the systematic position of most potential members of this clade and to present the sister group of *R. risi*. The species appears, however, distinct enough from any available libellulid genus to justify its inclusion in a new genus. To discuss its affinities, relevant characters of its supposedly closest relatives are tabulated below. The extremely distal position of the nodus in the forewing is considered as a possibly synapomorphic linkage between *Akrothemis* gen. nov., proposed to contain *R. risi* and a new species described below, and *Hypothemis* Karsch from Fiji. *Akrothemis*, however, differs significantly even from *Hypothemis* by the more proximal position of the arculus and the lack of additional Cuq in both wings, by a definitely recognisable subtriangle in the forewing, and by the straighter proximal portion of the hind margin in the hindwing. Secondary genitalia somewhat similar to those of *Akrothemis* were found only in *Tetrathemis* which is considered close to both *Akrothemis* and *Hypothemis*.

Table I
Comparison of *Akrothemis* gen. n. with its possibly closest allies

Character	*Akrothemis*	*Hypothemis*	*Palaeothemis*	*Tapeinothemis*	*Tetrathemis*	*Risiophlebia*	*Celebophlebia*
antenodals/postnodals in forewing	11-12/6-7	12-13/6	12/10	8/12	9/6	9/7	9-1o/6-8
antenodals/postnodals in hindwing	9-10/5-6	9/7	10/9	8/10	7-8/6	8/6	8-9/7-8
position of arculus	close to Ax2	close to Ax3	halfway Ax2-Ax3	2/3 way Ax1-Ax2	at or near Ax2 Ax2	halfway Ax2-Ax3	A2-A3
position of hindwing triangle	well beyond arculus	well beyond arculus	well beyond arculus	well beyond arculus	well beyond arculus	at arculus	at arculus
hyper-triangles	free	free	crossed/free	free	generally crossed	free	free
distinct subtriangle formed	yes	no	yes	no	no	yes	no
accessory crossveins to bridge (Bq)	0/0	0/0	1/1	0/0	0/0	1/1	0/0
initial cells in discoidal field	1/1	1/1	1/1	1/1	1/1	1/1	2/2
cubital crossveins (Cuq)	1/1	3/3	4/3-4	1/2	1-4/2-5	1/2	1=2/2
origin of CuP in hindwing	between close to posterior angle of t and halfway on	about half-wa7 on distal side of t	at or close to posterior angle of t	about half-way7 on distal side of 6	at or close to posterior angle of t	at or close to posterior angle of 6	about halfway on distal side of t
proximal portion of hindmargin of hindwing	straight	almost straight	straight	almost concave	curved	slightly curved	curved
anal loop	absent	absent	absent	absent	developed	absent	absent/ developed
cell rows in anal field of hw	1-2	1-2	1-2	1	1-4	1-2	1-2 or 3
one row of cells for at least first 2 cells of anal field	no	yes	yes	yes	no	yes	yes

AKROTHEMIS RISI CAMPION

Figures 1-8

MALE. – In addition to the original description of CAMPION (1915) photos of the holotype (unique available male) appear useful. Even though the holotype is in rather poor condition the photos show some details of colour pattern and structures as follows: (1) head (frontal); (2) thorax (lateral); (3) pale pattern element on mesanepisternum; (4) wings; (5) secondary genitalia (lateral); (6) anal appendages (lateral); (7) anal appendages (ventral). It is stressed that even though much of the thoracic pattern appears to have faded in the holotype, a long pale patch can be detected each side across the whole length of the front of the synthorax along and close to the mesopleural suture.

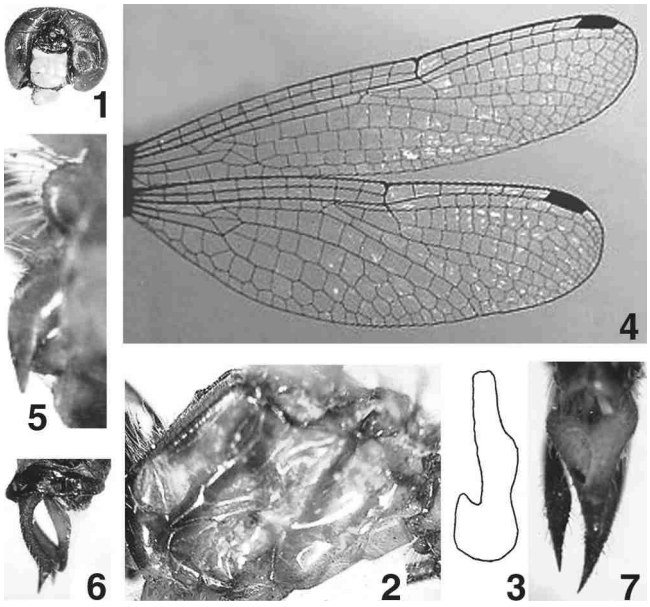
FEMALE (supposition).

M a t e r i a l. – 1 ♀ (RMNH): INDONESIA, Prov. Papua, Kab. Asmat – Vriendschap R., Jits River, 5º 20,20'S/138º 52,72'E, 23-VII-2009, Survey WWF-KEP: John Kaize (in RMNH).

DESCRIPTION (given from unique juvenile/subadult specimen):

H e a d. – Largely pale greenish white to greenish yellow with vertex, antennae, top of occiput and frons except for anterolateral corners shiny black; apex of mandible brownish yellow and most of postgenae and an ill-defined patch covering anteromedial portion of labrum dark brownish grey.

T h o r a x. – Pronotum with top surface of lobes yellow, along furrows extensively brownish grey; other sclerites, coxa and trochanter whitish to yellowish green and grey, femur black on outer, pale greyish yellow on inner, surface and rest of leg missing. Synthorac-



Figs 1-7. *Akrothemis risi* (Campion) [Figs 1-6: holotype male]: (1) head (frontal view); – (2) synthorax, lateral view; – (3) outline of pale pattern element on the left mesanepisternum; – (4) wings; – (5) secondary genitalia, lateral view; – (6) anal appendages, lateral view; – (7) same, ventral view.

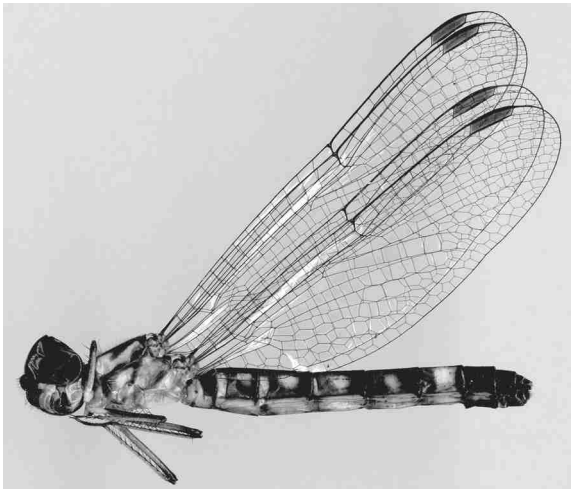


Fig. 8. *Akrothemis risi* (Campion), female (supposed).

ic pleura largely blackish grey with patches of pale greenish yellow as follows: a narrow subrectangular patch along the also pale basal 2/3 of middorsal carina and a large patch, wide and squarish in basal 1/3 and narrower in dorsal 2/3 of mesanepisternum, along and close to mesopleural suture; a large patch covering some of mesepimeron and much of metepisternum and another covering most of metepimeron including metapostepimeron; mesokatepisternum and metakatepisternum just tipped pale. Terga pale yellowish green and variably grey. Poststernum yellow. Legs with coxa and trochanter whitish yellow to pale brownish grey, femur and tibia pale greyish to brownish yellow and tipped greyish black, the mesofemur lined with black, particularly on outer face, and tipped greyish black, all spines and tarsi black and claws greyish black and brown.

Wings with basal sclerites grey and venation greyish black, membrane hyaline; 11-12/9-10 antenodals, 6-7/5 postnodals; pterostigma grey; CuP of hindwing originating approximately halfway up the distal side of the triangle.

A b d o m e n. – Terga 1-7 black, mostly with pale brownish yellow dorsal/lateral pattern and ventral edges. Terga 1 and 2 with a large patch each side; terga 3-5with a transverse anterolateral and a squarish mediodorsal patch each side; tergum 6 with just a mediodorsal patch each side; tergum 7 with broad ring covering medial 1/3 to 1/2. Tergum 8, except for ventral edge, tergum 9, segment 10, anal appendages, supra-anal plate and bipartite sternum 11 black. Sterna 1-9 variably pale greenish yellow to grey, vulvar scale almost black.

M e a s u r e m e n t s (in mm). – Hindwing 21.7; abdomen 17.0.

AKROTHEMIS BIMACULATA SP. NOV.

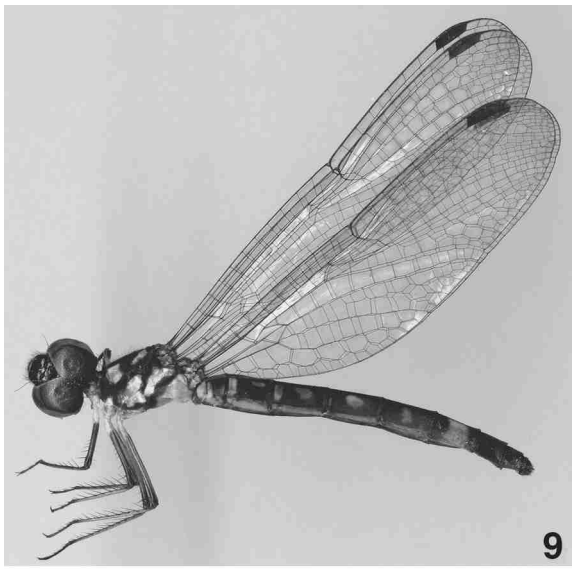
Figures 9-10

M a t e r i a l. – **Holotype** ♀ (NTM I008589): PAPUA NEW GUINEA, Kaugumi Camp, East Sepik Province (4°32.739S, 141°57.588E, 60 m asl), 4-X-2010, S.J. Richards leg. – **1 paratype** ♀ (NTM I008590), same data as holotype.

Etymology. – bimaculata from Latin(ized) *bimaculatus* (= with two marks) based on the presence of two separate pale marks each side of the front of the synthorax.

DESCRIPTION OF THE HOLOTYPE FEMALE which is somewhat subadult:

Head. – Face largely white to pale yellow; frons, except for yellow anterolateral corners, vertex, antennae and top of occiput shiny black; apex of mandible brownish yellow; postgenae, except for yellow spot each side next to ocular notch, and an ill-defined patch covering anteromedial portion of labrum dark brownish grey to black.



Figs 9-10. *Akrothemis bimaculata* sp. n., female: (9) holotype; – (10) live.

Thorax. – Pronotum and other prothoracic sclerites whitish yellow; coxa and trochanter pale yellow, femur greyish brown to black (darkest apically), tibia grey and lined with yellow, tarsus and claws black. Synthoracic pleura largely blackish grey with patches of pale greenish yellow as follows: a narrow subrectangular patch along the also pale basal 2/3 of mid-dorsal carina, a larger squarish basal patch and a much smaller subtriangular dorsal patch in mesanepisternum close to mesoplerural suture; a large patch covering some of mesepimeron and much of metepisternum and another covering most of metepimeron including metapostepimeron; mesokatepisternum and metakatepisternum just tipped pale. Terga pale yellowish and variably grey to black. Poststernum whitish yellow. Legs with coxa and trochanter whitish yellow to pale grey, femur pale yellowish and greyish brown to black (darkest apically), tibia brownish yellow to greyish brown

and tipped greyish black, all spines and tarsi black and claws greyish black and brown.

Wings with basal sclerites grey to black and venation black, membrane hyaline; 11/9 antenodals, 6-7/6 postnodals; pterostigma black; CuP of both wings originating close to posterior angle of triangle.

A b d o m e n. – Terga 1-7 black, mostly with dull yellow ventral edges and dull yellow dorsal/lateral pattern as follows: terga 1 and 2 with a large patch each side; terga 3 and 4 with a large transverse anterolateral and a smaller posterodorsal patch each side; tergum 5 with hardly an indication of a transverse anterolateral and a posterodorsal patch, tergum 6 with just a posterodorsal patch each side; tergum 7 with broad ring covering approximately medial ½. Tergum 8 with dull yellow ventral patch, otherwise, like tergum 9, segment 10, anal appendages, supra-anal plate and bipartite sternum 11, black. Sterna generally variably dull yellow to greyish brown and black, vulvar scale black.

M e a s u r e m e n t s (in mm). – Hindwing 21.6, abdomen 17.1.

VARIABILITY. – The paratype female is teneral and shrivelled. Its colours are generally somewhat paler with some of the yellow fading into a pale greenish white. There are 11/9 antenodals and 6/6 postnodals. The hindwing is 21.1 mm long, the abdomen only 15.5 mm.

MALE unknown.

HABITAT. – The two known specimens were found perched over small pools in lowland rainforest in an area that appears to be inundated during periods of high rainfall. While only known from the type locality, given the extent of suitable habitat in northern New Guinea the new species almost certainly has a broad distribution in the region.

AFFINITIES AND DIAGNOSIS. – The two species of *Akrothemis* are apparently very similar. Two widely separated pale patches each side on the front of the synthorax in at least the female of *A. bimaculata* clearly distinguish it from *A. risi* in which species the patches are fused in both sexes to form one large continuous patch across the whole length of the mesanepisternum. Number and shape of pale/bright pattern elements on the front of the synthorax are generally good specific characters in Odonata. The difference in the origin of the hindwing CuP in the available material, very close to posterior angle of triangle in *A. bimaculata*, approximately halfway up the distal side of triangle in *A. risi*, may or may not be diagnostic.

ACKNOWLEDGEMENTS

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KALKMAN (Naturalis, Leiden) is thanked for providing extensive information including photos of the holotype of *Akrothemis risi* and for making available the supposed and hitherto undescribed female of this species, and we are grateful to YVONNE VAN NIEROP for the associated curatorial work.

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Odonatologica 41(4): 347-348 *December 1, 2012*

SHORT COMMUNICATIONS

THE TYPE REPOSITORY OF *DREPANOSTICTA SIMUNI* SPEC. NOV. (ZYGOPTERA: PLATYSTICTIDAE)

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To ensure that the name *D. simuni*, described (2012) in *Odonatologica* 41: 283-291, is available, the type repository, omitted from the original description, is stated along with a diagnosis of the species.

INTRODUCTION

DOW & ORR (2012) recently described *Drepanosticta simuni* from Sarawak, Malaysian Borneo. Unfortunately the repository of the holotype was not stated; to ensure that the name *D. simuni* is available under article 16.4.2 of the International Code of Zoological Nomenclature [ICZN 2012] we repeat the details of the holotype and the diagnosis here, together with a statement of the type repository. The reader is referred to DOW & ORR (2012) for illustrations and a full description of the species.

DREPANOSTICTA SIMUNI SP. NOV.

M a t e r i a l. – **Holotype ♂:** (SAR05_PST1), Malaysia, Sarawak, Miri division, Gunung Mulu National Park, foot of Gunung Mulu, perched trailside near junction of Summit Trail with old trail to the Sarawak Chamber, leg. J. Simun, 24-IV-2005. Deposited in Naturalis Biodiversity Centre, Leiden (RMNH).

E t y m o l o g y. – Simuni, a noun in the genitive case. Named for J e f f r y S i m u n, who collected the holotype, a member of the staff at Gunung Mulu National Park and friend of the first author.

DIAGNOSIS. – A long bodied platystictid, readily distinguished from all other members of the family except *D. barbatula* Lieftinck, 1940 by the combination of size, lack of pale antehumeral markings and presence of a row of long setae arising directly from the underside of the apical half of the superior anal appendage. Distinguished from *D. barbatula* by the deep cleft in the tip of the superior anal appendage, and the more slender internal spine on the inferior anal appendage.

ACKNOWLEDGEMENTS

We are grateful to Dr JAN VAN TOL for pointing out the omission of the type repository in the original paper, and to Dr BASTIAAN KIAUTA for facilitating the rapid publication of this note.

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ARCHILESTES CHOCOANUS SPEC. NOV., A NEW DAMSELFLY FROM COLOMBIA (ODONATA: LESTIDAE)

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The new sp. is described and illustrated from the adults of both sexes. Holotype ♂: Colombia, Chocó dept., Salero alt. 129 m a.s.l., 10-VIII-2005. *A. chocoanus* sp. n. shows the following character combination: cercus with well developed medial tooth in basal third, distal portion of cercus elongate, curved inward and sharply pointed, paraproct vestigial, and color pattern of pterothorax close similar to *A. neblina* Garrison, except for metepisternum, metepimeron and metasternum largely yellow. The new sp. is closely related to *A. guayaraca* De Marmels, *A. latialatus* Donnelly and *A. tuberalatus* (Williamson).

INTRODUCTION

Archilestes is a small genus of large-sized, mainly tropical American species. To date eight species are known (GARRISON et al., 2010). In Colombia, only the presence of *A. grandis* was reported so far. These zygopterans live within forested areas near small streams, but might occasionally be observed away from water in the more arboreal areas of their habitats, as was reported for *A. guayaraca, A. neblina,* and is now again noted in the new species.

Species diagnosis is here essentially based on the morphology of the caudal appendages, and coloration of thorax and abdomen. The genus taxonomy has been dynamic and conflictive, and while genera such as *Superlestes* and *Cyptolestes* have been synonymized with *Archilestes* (see GLOYD, 1980), the LIEFTINCK (1960) proposal even considers a scenario in which all three are synonymized with *Lestes*. The possibility of synonymizing *Archilestes* with Lestes has been in consideration for at least three decades, to the overlap of several meristic characters in females and males, specifically in the proportions of the ptero-

stigma size, proximal and posterior sides of quadrangle, and body robustness (see also WESTFALL & MAY, 1996; GARRISON et al., 2010).

MATERIAL AND METHODS

The illustrations were made with the help of a camera lucida coupled to a Wild M-8 stereoscope, and are not to scale. General terminology was adopted from WESTFALL & MAY (1996), and wing vein nomenclature follows RIEK & KUKALOVÁ-PECK (1984). Abbreviations: Fw = forewing, Hw = hindwing, Ax = antenodal crossveins, Px = postnodal crossveins, Pt = Pterostigma. S1-S10 = Abdominal segments. Broadening ratio and elongation ratio of the first sub-quadrangular cell follow DONNELLY (1981).

ARCHILESTES CHOCOANUS SP. NOV.

Figures 1-3

M a t e r i a l. – **Holotype** ♂, COLOMBIA, Chocó Department, Salero (05°19¢01²N, 76°36¢52²W) alt. 129 m, 10-VIII-2005. L.A. Pérez leg. (UARC). – **Paratype** ♂, same data (MIZA). – **Allotype** ♀, same data (UARC). – Other species examined: *A. regalis* ♂, Tamazunchale, San Luís Potosí, Mexico 30-VIII-1958, Beatty leg. & Beatty det., 1959. JR- 08291. – *A. californicus* ♂, ♀ (in tandem) Calif: Stanislaus co., Del Puerto Cyn. at N. Fork of Del Puerto Creek about 14 mi. W. of Patterson, 21/23-IX-1978, R.W. Garrison leg. & det., 1978. – *A. tuberalatus* ♂, Choroní, La Rinconada, 350 m, AR, 18-XII-2003, J. De Marmels leg. & det. – *A. grandis* ♂, Rancho Grande, Aragua, Venezuela, 500 m, 16-IX-1951, Y. Fernandez leg., J. Racenis det., 1954. – *A. guayaraca* ♂ (holotype) Guayaraca, Auyantepuí, Bolivar, Venezuela, 25-IV-1956.

E t y m o l o g y. – The species name is dedicated to the amazing but endangered exuberant Chocoan Pluvial Forest.

MALE (**holotype**). – H e a d (Fig. 1a). – Labium yellow, base of mandible pale green, tip black; labrum pale green, margin rimmed with a thin black line; anteclypeus pale green, postclypeus entirely shiny black. Gena ochre; frons, vertex and top of head dark metallic green, antenna with scape and pedicel black, flagellum brown. A small, pale spot externally at each lateral ocellus. Rear of head yellow, black near maxillar insertion.

T h o r a x. – Anterior lobe of prothorax rounded, black (Fig. 1b), middle lobe metallic green with longitudinal mid line and lateral region yellow, posterior lobe dark metallic green with small central yellow spot; proepisternum and proepimeron yellow with pruinescense (Fig. 1c); procoxa largely yellow with pruinescence. Pterothorax largely yellow laterally with broad green metallic stripes bordered black. Mesepisternum in dorsal view largely metallic green, middorsal carina yellow, in lateral view green metallic with thin yellow stripe along humeral suture (Fig. 1d). Mesokatepisternum largely black with metallic green luster, inferior portion yellow. Mesepimeron entirely metallic green with a narrow, shiny black stripe along interpleural suture. Mesocoxae yellow with external black stripe (Fig. 1d). Metepisternum largely yellow with inferior margin along pleural suture with shiny black stripe extending to superior margin of metepimeron. Distal half

of paracoxal suture with shiny black stripe. Metepimeron and metasternum largely yellow with thin, black longitudinal line in middle, and with a lateral black spot. Metakatepimeron yellow and pruinose. Meso- and metascutum yellow, meso- and metascutellum yellow.

Legs (Fig. 2a). – Mainly dark brown to black. Trochanter with ventral surface yellow, and posterior side black; femur in proximal quarter with pale inner side, meso and metafemur with 8-10 spines of approximately the same size on its outer surface.

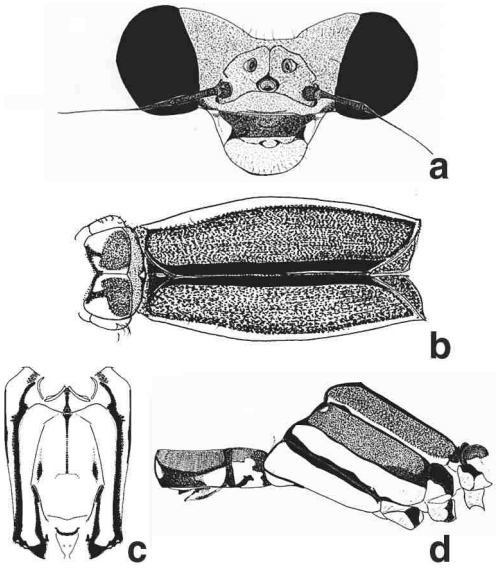

Fig. 1. *Archilestes chocoanus* sp. n., male holotype: (a) head, dorsal view; – (b) pterothorax, dorsal view; – (c) same, ventral view; – (d) pterothorax and abdominal segments 1 and 2 showing color pattern, right lateral view.

Wings (Fig. 2b). – Hyaline, veins black, pterostigma dark reddish brown, proximal side of quadrangle 0.87 mm (same in allotype and paratype); posterior side 1.87 mm (1.62 in allotype and 1.75 in paratype) and anterior side 0.75 mm (in paratype and allotype 0.62). Petiolation reaching level of arculus. First antenodal space 4.87mm (4.75 in paratype and same in allotype), third antenodal space 5.87 mm (5.62 in allotype and 5.37 in paratype). Broadening ratio 1.05 (1.1 in paratype, 1.05 in allotype). Radial side of pterostigma 2.5 mm (same in allotype and paratype). The elongation ratio of the first post-quadrangular cell, defined as the relative lengths of the anterior to the distal vein of that cell (sensu DONNELLY, 1981; GARRISON, 1982) ranges from 2.0 to 2.33 (1.79-2.0 in paratype). – Fw: Pt surmounting almost 4 crossveins; two complete Ax, 21 Px. RP_2 arising from RP_1 between Px 3 and 4. – Hw: Pt surmounting 4 crossveins, two complete Ax; 17 Px. RP_2 arising in RP_1 in 3 Px.

A b d o m e n. – Abdominal segments largely green, lateral sides of S1 and S2 partially yellow with dark spots (Fig. 1d), lateral side of S3 with a yellow oval spot close to posterior distal transverse carina, terga with a thin yellow line along the ventral margin, widest in S8; ventral pruinecense on S8-10, S10 black. Posterior hamule brown, lobulated and concave (Fig. 2c). Apical segment of genital ligula oval. (Fig. 2d-f).

Cercus entirely black, slightly directed upwards (Fig. 3a) and pointed with acute basal tooth mesally in the first third of its length (Fig. 3b), mid-

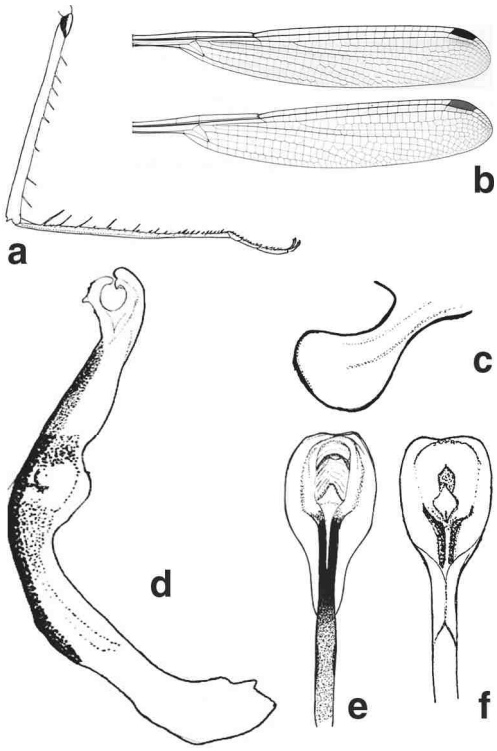

Fig. 2. *Archilestes chocoanus* sp. n., male holotype: (a) posterior right leg; – (b) left wings, ventral view; – (c) left posterior hamule, right lateral view; – (d) genital ligula, right lateral view; – (e) same, distal portion, ventral view; – (f) same, dorsal view.

dle region of cercus concave, followed by a post-median expansion armed with 7-8 strong spines on internal margin and dorsally with a prominent tubercle excavated, paraproct vestigial (Fig. 3c), in lateral view extending scarcely beyond at base of cercus, approximately 24% of cercus length; tips of cerci in natural position crossed.

Measurements (in mm). – Fw 38.3, Hw 36.7, abdomen (excluding appendages) 51.5, cercus 2.1 (61% longer than S10), paraproct 0.5.

FEMALE (**allotype**) (Fig. 3d). – Appearance and size as in male, ovipositor with a distintive color pattern, lateral valves armed with 12-14 small spines on ventral margin, all approximately the same size.

Measurements (in mm). – Abdomen without appendages 42.0, cercus 1.06, paraprocts 0.87. Elongation ratio of the first post-quadrangular cell 2.0-2.1.

VARIATION. – Male paratype as holotype, but RP_2 vein arising in 3 Px, in 4 Px and 3 Px in left and right Hw respectively.

DIAGNOSIS. – Morphologically the new species is closely related to *A. guayaraca* DE MARMELS, 1982, *A. latialatus* DONNELLY, 1981 and *A. tuberalatus* (WILLIAMSON, 1921). With this latter it shares the presence of an robust basal tooth (specimens examined from Choroní, Aragua), although in *A. tuberalatus* the basal tooth can be vestigial, visible just as a slightly rounded projection. GARRISON (1982) has suggested that the tooth can show variations in size and that these variations are geographical [i. e. *A. latialatus* (GARRISON, 1982: 10)]. The paraproct is, in *A. chocoanus*, underdeveloped, as in *A. guayaraca*, *A. tuberalatus* and *A. latialatus*. The character which most closely relates *A. chocoanus* with *A. latialatus* is, however, the acute and curved cercus (GARRISON, 1982: fig. 22), being notoriously longest in *A. chocoanus*. Marginal cell after quadrangle is in *A. chocoanus* longer and narrower than in all other species described to date, but most similar to *A. grandis* (RAMBUR, 1842) and *A. regalis* (GLOYD, 1944).

In color pattern, *A. chocoanus* comes close to *A. neblina* GARRISON, 1982, nonetheless it is important to note that on mesepisternum *A. chocoanus* has the green stripe complete, whereas *A. neblina* has a thin stripe bordered by the posterior pleural suture. Also in *A. neblina* the metasternum is largely black while in *A. chocoanus* it is mostly yellow, resembling *A. guayaraca*. Posterior hamule bear a short and rounded tip, as in *A. guayaraca.* The genital ligula of *A. chocoanus* (ligula ovate with ventral arm not touching tip) belongs to group 3 as proposed by GARRISON (1982), although the post-mortem variation of this structure is suspected to be particularly problematic when defining intrageneric groups. In the two *A. chocoanus* males examined, the ventral arm is in contact with the tip of the ligula.

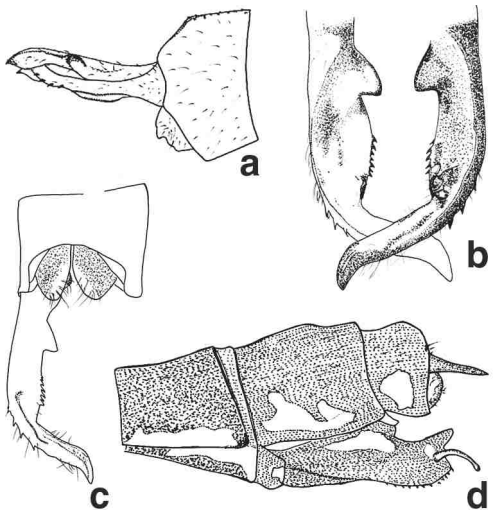

Fig. 3. Fig. 3. *Archilestes chocoanus* sp. n. [Figs a-c: male holotype, Fig. d: female allotype]: (a) distal portion of abdomen, lateral view; – (b) right cercus, dorsal view (right), ventral view (left); – (c) paraprocts and right cercus, ventral view; – (d) distal portion of abdomen, left lateral view.

FINAL REMARKS. – The specimens of this colorful species were collected in a secondary forest. Days before our visit to the locality, according to our guide, there was a bulldozer opening way through the dense forest. This destructive practice is conducted to determine locations of new platinum prospecting camps and for introducing machinery. We ingressed through one of these roads, and there we had the first sighting of *A. chocoanus*, perched on leaves, ca 2 m above ground, of about 10 m high Sapotaceae and Bombacaceae trees. The violent and powerful flight of this species is noteworthy, and detection of two males was possible thanks to the audible impact produced when they landed on leaves of woody vegetation. Their evasive behavior, flying to the tree tops when disturbed, is also uncommon in the genus.

In July 2007 and July 2010, two more expeditions were carried out to the area in order to find the larva, but without success. Adults were not seen either. Unfortunately, the progressive loss of forest, due to mining activities and timbering practiced by the “colonos”, makes the rediscovery of the species at the type locality most unlikely. Future efforts must be made to determine the extent of its distribution range. Provisionally it is considered here as an endemic element of biogeographic Chocó.

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The author expresses his gratitude to ELVIN ARLEY HUDGSON and family for their cooperation during the field campaigns, to the Salero community for their kindness and hospitality, and to my partner JENILEE MONTES for her assistance in translating and editing the manuscript. Warm thanks are due to my advisor, JÜRG DE MARMELS, for the revision of the manuscript and the illustrations, and his guidance in character interpretation.

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Odonatologica 41(4): 355-359 *December 1, 2012*

GYNACANTHA HEROS SPEC. NOV., A LARGE CREPUSCULAR SPECIES FROM PAPUA NEW GUINEA (ANISOPTERA: AESHNIDAE)

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The new sp. is described. Holotype ♂: Papua New Guinea, Sepik Basin, 31-V-2010, at light; deposited in the Museum & Art Gallery of the Northern Territory (NTM), Darwin, Australia. It is the 6th and the largest member of the genus recorded from the island of New Guinea. Characters of the adult ♂ are illustrated and the affinities of the new sp. are discussed.

INTRODUCTION

Dragonflies of the aeshnid genus *Gynacantha* are large, robust and they are active mostly at dawn and dusk. Only five species of the genus have previously been recorded from the island of New Guinea. They are *G. bayadera* Selys, 1891, *G. calliope* Lieftinck, 1953, *G. kirbyi* Krüger, 1898, *G. mocsaryi* Förster, 1898, and *G. rosenbergi* Brauer, 1867. Recent collections have revealed a species new to science that represents the largest *Gynacantha* known from New Guinea. It is described below as *G. heros* sp. nov.

MATERIAL AND METHODS

The descriptive terminology largely follows CHAO (1953) and WATSON & O'FARRELL (1991), and for the wing venation PETERS & THEISCHINGER (2007). Coloration is given as detectable

from the preserved material. Measurements are given in millimetres (mm). All illustrations were done with the aid of a camera lucida and are not to scale.

The holotype of *Gynacantha heros* sp. n. is deposited in the collection of the Museum and Art Gallery of the Northern Territory (NTM).

GYNACANTHA HEROS SP. NOV.

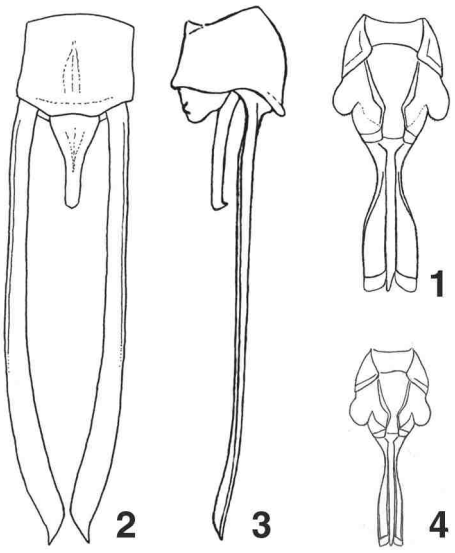
Figures 1-3, 5-6

M a t e r i a l. – **Holotype** ♂ (NTM I008587): Papua New Guinea, Sepik Basin (4°43'S, 141°56'E, 135 m a.s.l.), 31-V-2010, at light at 8:00 p.m., S.J. Richards leg.

E t y m o l o g y. – The specific name (Latin/Greek "*heros*" for hero) refers to the large size and robust build of the species.

MALE (**holotype**). H e a d. – Labium yellowish to blackish brown; face dark greyish brown merging into black along crest of frons; genae black; tips of mandibles shiny black; top of frons yellowish brown with distinct black T-mark; vertex black; antennae dark to pale brown; occipital triangle small, pale greenish yellow.

T h o r a x. – Pronotum brown, markedly darker medially than laterally. Synthoracic pleura dark to pale greyish brown, darkest along the black dorsal carina, spotted with six small black patches each side as follows: along mesopleural suture next to mesocoxa and immediately below subalar ridge, along the metapleural suture between metakatepisternum and metepimeron and somewhat below subalar ridge, narrowly around the metastigma and along ventral edge of metepimeron adjacent to anterior angle of metapostepimeron. Terga largely dark greyish brown. Poststernum pale greyish brown with anteromedian angle black. Legs brown with trochanters somewhat darker and knees very narrowly darkened.

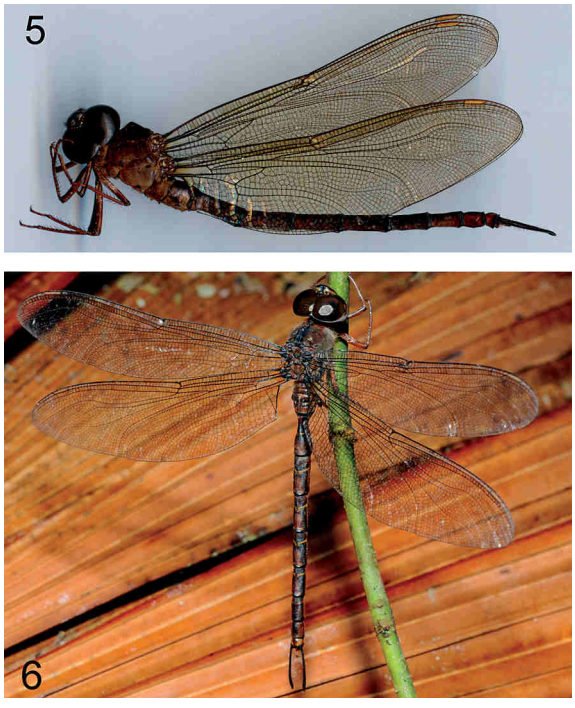


Figs 1-4. Male abdominal structures in *Gynacantha heros* sp. n. (Figs 1-3) and *G. kirbyi* Krüger (Fig. 4): (1) abdominal segments 1-3, ventral view; – (2) anal appendages, dorsal view; – (3) same, lateral view; – (4) abdominal segments 1-3, ventral view.

Wings. – Membrane hyaline, slightly suffused with pale brown; venation very dense, blackish brown; membranule very small, pale greyish to yellowish white. Antenodals 34-36/27-28; postnodals 35/37. Pterostigma yellowish to pale grey-

ish brown, 3.8 mm long in forewing, 3.5 mm long in hindwing, overlying 5 cells. Cuq 10/9; bq 11-12/8; 1 mq in one forewing 1-2 ¼-½ mq (attempts) in the other wings. Triangles with 9-10/7 cells; hypertriangles with 12/10-11cells. IR2 fork asymmetrical and well proximal of pterostigma; field between IR2 and Rspl and field between MA and Mspl up to 6 cells deep; only a single row of cells between MP and CuA in hindwing; anal loop 3 cells wide and up to 6 cells deep; anal triangle 4 cells in both wings. Other details as visible on photo.

A b d o m e n. – Segment 3 less than three times as long as wide at apex, after the constriction considerably expanded, attains at apex about one half the width of segment 2 across the auricles; segments 4-8, from base backwards considerably narrowed; waist approximately 1.6 mm wide. Terga largely brownish black dorsally and laterally with intersegmental membranes black and with sides of terga 1 and 2 and ventral edges of terga 3-8 paler greyish brown; also tergum 2 with pair of narrow pale brown transverse mediodorsal patches anterior to transverse carina, and pale brown paired subtriangular mediodorsal spots on transverse carina of terga 3-8, more distinct in terga 3-6, and indications of pale paired oval posterodorsal spots on 3-9; segment 10 brown with black mediodorsal smudge and posterior margin (dorsally and laterally). Sternum 1 brown with anterior margin largely black; secondary genitalia yellowish to greyish brown; sterna 3-7 greyish to brownish black; sterna 8 and 9 dull yellowish to greyish brown; bipartite sternum 11 black. Superior anal appendages 9.5 mm long, very slender, black, with inner margin very slightly and smoothly curved and without distinct sub-basal excavation or bulge; tips pointing laterally; inferior appendage, in dorsal view, narrow, tapering in basal half, thence narrowly finger-shaped, apex rounded, black. Superior anal appendages appearing in dorsal view mark-



Figs 5-6. *Gynacantha heros* sp. n., holotype male: (5) specimen; – (6) live.

edly more than four times as long as inferior appendage.

Measurements (in mm). – Hindwing 56.0; abdomen plus appendages 66.0.

FEMALE. – Unknown.

HABITAT. – Habitat associations are uncertain. This species was collected at night from a light in foothill rainforest on a low ridge in the upper Sepik Basin. While only known from the type locality, given the extent of suitable habitat in northern New Guinea the new species almost certainly has a broad distribution in the region.

DISCUSSION

The male anal appendages index of *Gynacantha heros* sp. n., as seen from dorsal aspect (length of app. sup. : length of app. inf. markedly> than 4), is unique in the known species of *Gynacantha* and distinguishes *G. heros* sp. n. from all other species known from Papua New Guinea. The differences in width between different sections of segments 1, 2 and 3 of *G. heros* sp. n. (Fig. 1) are much smaller than in *G. kirbyi* (Fig. 4) and *G. mocsaryi* and markedly larger than in *G. rosenbergi*. The male of *G. calliope* has an internal sub-basal excavation of the superior appendages (straight in *G. heros*) and *G. bayadera* is much smaller than *G. heros.*

The only illustration of male anal appendages of a *Gynacantha* species resembling those of *G. heros* sp. n. is given by MARTIN (1909) in fig. 205 labelled as *G. Mac Lachlani* Krüger. LAIDLAW (1923), however, pointed out that at least the measurements given in Martin's description of *G. Mac Lachlani* are not consistent with the original description of this species by KRÜGER (1899). *G. maclachlani* certainly is a species much smaller than indicated by the measurements given by Martin and than *G. heros* sp. n. MARTIN (1909) also records *G. maclachlani* from New Guinea. It is possible that he actually had a specimen of *G. heros* sp. n. for his re-description of *G. maclachlani*. Details in his description like lacking a T-spot on the frons and inferior anal appendage triangular, however, do not support this. According to LAIDLAW (1923) RIS rejected Martin's record of *G. maclachlani* from New Guinea, and the species has not been included in species lists from New Guinea since.

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The high scoring taxa, such as Odon., were correlated to dissolved oxygen and flow. A list of spp. is not provided.

(19113) PRATT, G., 2000. *Terrestrial invertebrates, Edwards Air Force Base, 1997*. U.S. Army Engineer Res. & Develop. Cent., Edwards/CA. 38 pp. – (Publishers: 3909 Halls Ferry Rd, Edwards, CA 93523, USA).
Records of Enallagma carunculatum, Sympetrum corruptum and Tramea onusta; – California, USA.

2002

(19114) KAUPPINEN, J., 2002. *Relative importance of different coloration, smell and shape in the predation on wasps: field experiments on hunting dragonflies (Odonata: Aeshna grandis)*. M.Sc. thesis, Dept Biol. & Envir. Sci., Univ. Jyväskyla. 18 pp. (With Finn. s.). – (Author's current address unknown).
4 field experiments were conducted with A. grandis adults in central Finland. When living wasps (Vespula norwegica) and black flies were made available, dragonflies generally avoided the wasps over the flies. When prey of different colouration was offered, the response to black items was significantly higher than that to the black-and-yellow models. There was no difference between the dragonfly reaction to the wasp-smelling and fly-smelling prey items. Finally, A. grandis were more (but not significantly) reluctant to attack wasp-shaped preys as compared to the fly-shaped models. In summary: it is the colour pattern (black-and-yellow stripes) that triggers the significant avoidance behaviour. Whether this is learned or it has a genetic basis still has to be investigated.

(19115) MARABINI, J., 2002. *Zwischenbericht zum ABSP-Umsetzungsproject „Lebensraumnetz Moorweiher und Niedermoore"*. Landkreis Erlangen-Höchstadt & Landschaftspflege Verband Mittelfranken, Höchstadt. 50 pp. – (Author & Publishers: Landratsamt Erlangen-Höchstadt, Schlossberg 10, D-91315 Höchstadt).
48 ponds (mostly fish- and carp ponds) were studied in the distr. of Erlangen-Höchstadt (S Germany). 15 odon. spp. are listed, among which are significant Coenagrion hastulatum, Lestes virens, Somatochlora flavomaculata, Leucorrhinia dubia, L. pectoralis and L. rubicunda.

2004

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2005

(19117) PARNIKOZA, I.Yu., E.V. GODLEVKAYA, M.S. SHEVCHENKO & D.N. INOZEMCEVA,

2005. *Fauna Ukrainy: ohrannye kategorii*. – [*Fauna of the Ukraine: conservation categories*]. Logos, Kiev. 59 pp. (Russ.). – (Publishers: Hmel'nickogo 10, UKR-01030 Kiev).
Lists 30 odon. spp.

(19118) TERNOIS, V., 2005. Coenagrion mercuriale (Charpentier, 1840): synthèse de trois années d'observations dans le Nord-est aubois et la frange haut-marnaise limitrophe (Odonata, Zygoptera, Coenagrionidae). *Naturale / Bull. Ass. Naturalistes Champagne-Ardenne* 2005(0) [sic!]: 46-53. – (22 Rte Sauvage-Magny, F-52220 Anglus).
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2006

(19119) BARRERA-ESCORCIA, H., M.P. VILLEDA-CALLEJAS & J.A. LARA-VAZQUEZ, 2006. The flight of the dragonflies and its technological uses. *Revta Chapingo* (Cienc. fores. & Ambiente) 12(1): 31-37. (Span., with Engl. s.). – (First Author: Lab. Biol. Celular, UNAM, Av. de los Barrios 1, MX--Los Reyes Iztacala).
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[Abstract not available].

(19121) NIJBOER, R.C., 2006. *The myth of communities. Determining ecological quality of surface waters using macroinvertebrate community patterns*. PhD Diss. Univ. Nijmegen. 187 pp. *Alterra scient. Contr.* 17. ISBN 90-3270351-x. (With Dutch s.). – (Alterra, P.O. Box 47, NL-6700 AA Wageningen).
Macroinvertebrate community patterns are often analysed and related to the ecological quality or conservation value of a water body, using an ecological typology or assessment system. The goal of this study was to determine the effect on the development or application of a typology or assessment system of different choices concerning (1) taxonomic adjustment of the data, (2) the data that are included in the analyses and the community variables focussed on, and (3) the techniques chosen. It appeared that it is very difficult to distinguish and characterise macroinvertebrate communities unambiguously. In developing a typology or assessment system the results depend on the taxonomic level used and on the completeness of the data. Also, the choice of the technique influences the final result. In applying a typology or assessment system it is of importance to use the same taxonomic level as the data used for development and to include all taxa collected. Even taxa with low abundances or small distribution ranges appeared to be important. The number of rare taxa was indicative for a high ecological quality, in contrast to the total number of taxa in a sample. Communities composed of a high number of characteristic species were easier to distinguish than communities composed of more generalists. In conclusion, community analysis is not an objective process, because of the large effect of small technical changes. This is also caused by the fact that any classification of species assemblages is artificial. A community only exists of a combination of populations at a moment on a site and it is impossible to collect the complete community in a sample. Communities are a continuum along an environmental gradient. Species are adapted to their environment (which is characterised by stability, favourability and impairment) by their life tactics. Therefore, water management should rather focus on these life tactics in relation to the environment to investigate the stressor(s) present and the possibilities for restoration. To establish the conservation value of a site, the number of rare species can be used.

(19122) TERNOIS, V., 2006. Orthetrum albistylum (Selys, 1848) dans le Parc naturel regional de la Forêt d'Orient et le Nord-Est aubois: quelques précisions. *Naturale / Bull. Ass. Naturalistes Champagne-Ardenne* 2006(1): 50-54. – (22 Rte Sauvage-Magny, F-52220 Anglus).
A commented list of the 2005 records from the Park (France).

(19123) WERNER, D. & A.C. PONT, 2006. New results on Diptera predators in the blackfly plague

areas of central Europe and the Caucasus. *Acta ent. serb.* (Suppl.): 131-140. – (First Author: Inst. Biol. & Cytogen., Humboldt Univ., D-10115 Berlin).
The work was carried out in a number of lowland rivers in various regions of Armenia, Germany, Poland and Serbia. The predation by the odon. on Simulidae is extremely difficult to prove. Nevertheless, it is shown here that Gomphus vulgatissimus larvae and adults are able to take advantage of the mass occurrence of Simulidae as a food resource. The locality of this observation is not stated.

(19124) ZHANG, B., D. REN, C. ZHOU & H. PANG, 2006. New genus and species of fossil dragonflies (Insecta, Odonata) from the Yixian formation of northeastern China. *Acta geol. sin.* 80(3): 327-335. – (First Author: State KeyLab. Biocontrol & Inst. Ent., Sun Yat-Sen Univ., Guangzhou, Guangdong-510275, China).
Sopholibellula eleganta gen. n., sp. n. and S. amoena sp. n. (Araripelibellulidae) are described and illustrated from the Late Mesozoic Yixian formation (Late Jurassic/Early Cretaceous) of Chaomidian village, Liaoning prov. The new gen. is closely related to Araripelibellula. The types are deposited in Coll. Life Sci., Capital Normal Univ., Beijing. The systematic position and the affinities of the new taxa are outlined.

(19125) ZHANG, Z., Y. HONG, L. LU, X. FANG & Y. JIN, 2006. Shenzhousia qilianshanensis gen. et sp. nov. (Protodonata, Meganeuridae) a giant dragonfly from the Upper Carboniferous of China. *Progress nat. Sci.* 16(3): 328-330. – (First Author: Dept Paleontol., Geol. Mus. China, Beijing-1000034, China).
The new sp. is described and illustrated from the Upper Carboniferous Tupo formation of Xisheyan, Ningxia Hui Autonomous Region. The holotype (No. 97X101) and paratypes are deposited in the Geol. Mus. of China, Beijing.

2007

(19126) BRIED, J.T. & G.N. ERVIN, 2007. Intraspecific models and spatiotemporal context of size-mass relationships in adult dragonflies. *Jl N. Am. benthol. Soc.* 26(4): 681-693 – (First Author: Albany Bush Preserve Commission, 195 New Karner Rd, Albany, NY 12205-4605, USA).
Length-mass equations are valued for their efficiency and reliability because many animals show predictable correlations between mass and linear body dimensions. This paper explores overlooked aspects of length-mass applications, including relationships for adult aquatic insects, intraspecific variation and spatiotemporal context based on the analysis of 5 libelulid spp., collected during 2 periods at 3 locations in N Mississippi, USA. Despite narrow ranges in body and wing length, and given that odon. gain postemergence mass without associated changes in skeletal size, both body and wing length showed potential for estimating individual dry mass ($R^2 \geq 0.5$ in most cases). We also found strong associations between dry and wet length and consistent variation in individual dry mass as a percentage of individual wet mass (~65% water content) in these samples. Species-level mass estimates from independently derived species-level equations were far more accurate than estimates based on previously published equations for use at higher taxonomic levels (family, order). Patterns of individual mass per unit length generally differed among study locations and, especially, collection periods. Regression models with similar slopes (i.e., similar individual differences in mass per unit length) were susceptible to length-adjusted location or time effects (i.e., elevation differences in the best-fit lines). The study underscores the importance of intraspecific variation, taxonomic resolution, and spatiotemporal context in length-based modelling of adult dragonfly mass.

(19127) DOLNÝ, A. & P. MATĚJKA, 2007. Contribution to population biology of Libellula fulva (Odonata: Libellulidae) on coal sludge sedimentation pond (Karviná, Czech Republic). *Ekológia*, Bratislava 26(4): 341-351. – (Dept Biol. & Ecol., Fac. Nat. Sci., Univ. Ostrava, Chittussiho 10, CZ-710-00 Slezká Ostrava).
The sp. was considered extinct in the Czech Republic during 1913-1999; the Karviná-Doly site (NE of the country) is currently its only known locality in the state. The habitat is here described and a report is provided on the population size, territoriality, time of occurrence, mating season etc. of the sp. The 33 spp. co-occurring at this locality are also listed.

(19128) JAVORSKI, N., 2007. *Einfluss der Gewässerstruktur auf die Schlupfabundanz von Gomphus vulgatissimus (Odonata) an der Lippe im Kreis Soest, Nordrhein-Westfalen*. Diplomarbeit Univ. Duisburg-Essen. vi+78 pp. – (Author's current address unknown).

The study was conducted at restored and non-restored sections of the Lippe rivulet in the district of Soest, North Rhine-Westphalia (Germany). A higher exuviae abundance occurred on moderately shadowed banks with southern exposition and moderate stream velocity. The kind of bank vegetation appeared of lesser importance, but the structure of the stream bottom played a role: sections with mud and sand were preferred. The optimal conditions may occur also in the non-restored sections of the stream, therefore G. vulgatissimus cannot be considered as an indicator of the restoration quality of the genuine conditions of a stream.

(19129) MANCI, C.-O., 2007. Inventory of the dragonfly collection from Iron Gate Museum, Drobeta Turnu-Severin. *Drobeta* (St. Naturii) 17: 172-183. − (Author's address not stated).
A list of 43 spp., with precise locality data, from Mehedinti co. and the Danube Delta, Romania. Noteworthy are the records of Coenagrion ornatum and Lestes macrostigma.

(19130) [MERIAN, M.S.] SCHMIDT-LOSKE, K., 2007. *Die Tierwelt der Maria Sibylla Merian (1647-1717): Arten, Beschreibungen und Illustrationen*. Basilisken-Presse, Marburg/Lahn. 238 pp., 91 pls incl. ISBN 978-3-925347-79-5. Hardcover (24.0 × 29.0 cm). With comprehensive Engl. synopsis on pp. 13-18. − (Publishers: Postfach 561, D-35017 Marburg/Lahn).
A (partial) overview and analysis of M.S. Merian's (1647-1717) representations of the animal world are presented along with her biography and bibliography. A brief section on Odon. appears on p. 27. A Gomphus vulgatissimus and its larva are included in her "*Studienbuch*" (see also *OA* 6428) along with her note on the insect, from which it seems apparent that she considered the exuviae as a chrysalis and was searching for the "worm" (= larva). Generally, in Merian's work, the odon. and their biology did not receive much attention and, apparently, she was not much interested in aquatic habitats and their insects. The impact of her work on the entomology and insect illustration of her time is discussed and a comprehensive bibliography on the subject is added. − (See also *OA* 12588).

(19131) SAHUQUILLO, M., J.M. POQUET, J. RUEDA & M.R. MIRACLE, 2007. Macroinvertebrate communities in sediment and plants in coastal Mediterranean water bodies (central Iberian peninsula). *Annls Limnol.* 43(2): 117-130. − (Dept Microbiol. & Ecol., Fac. Biol., Univ. Valencia, ES-46100 Burjassot, Valencia).
Sediment- and plant-associated macroinvertebrates were sampled in 6 shallow, freshwater and brackish water bodies in the Valencia area (Spain). Data on density (ind./m^2) and abundance (ind./sample) are presented for Ischnura elegans, Pyrrhosoma nymphula, Sympetrum fonscolombii, "Coenagrionidae", "Lestidae" and "Libellulidae" larvae.

(19132) SCHAPPERT, P., 2007. Rubyspot damsels return for third year, with surprises! *Lost Pines Nature Notes* 114: 1 p. − (Author's address unknown).
With reference to the note listed in *OA* 19021, Hetaerina titia and H. americana sightings are brought on record (2-VIII-2007), bringing the number of odon. spp. known from the Bastrop co, Texas (USA) up to 75.

(19133) SEVER, M., 2007. *Influence of hydrological characteristics on benthic invertebrate assemblage*. Graduation thesis, Biotech. Fac., Univ. Ljubljana. ix + 84 p. (Slovene, with Engl. s.). − (Author's current address unknown).
The study was conducted in the Ščavnica river, NE Slovenia. Calopteryx splendens, C. virgo, Platycnemis pennipes, Gomphus vulgatissimus and Onychogomphus forcipatus are among the taxa considered.

(19134) ZHAO, Y., J. TONG, J. SUN, D. CHEN & J. ZHANG, 2007. Property tests of nano-indentation of membraneous wings in dragonflies. *J. agric. Mechanization Res.* 11: 26-29. (Chin., with Engl. s.). − (First Author: Coll. Mechanical Power Engineering, Henan Polytechnic Univ., Jiaozuo-454000, China).
The nano-mechanical behaviour of the wings was investigated using a nano-indenter in Anax parthenope julius, Pantala flavescens and Sympetrum striolatum. The maximum of the reduced modulus and the hardness of the wing is at the position of 0.7 of the length of the wing in the former 2 spp. and at 0.5 in S. striolatum.

2008

(19135) ANDRADE, H.T.A., A.S. SANTIAGO & J.F. MEDEIROS, 2008. Structure of benthic invertebrate community with focus on the aquatic insects of the Piranhas-Assu river, state of Rio Grande do

Norte, Northeast Brazil. *EntomoBrasilis* 1(3): 51-56. (Port., with Engl. s.). – (First Author: Depto Microbiol. & Parasitol., Cent. Biocienc., Univ. Fed. Rio Grande do Norte, Brazil [full postal address not provided]).
Familywise information on the relative abundance of 7 odon. fam. is provided.

(19136) AUGUSTIN, G., 2008. Libella, die Südtiroler Arbeitsgruppe für Libellenkunde. *Naturschutzblatt Südtirol* 24(4): 3. – (c/o Publishers: Dachverband Natur- u. Umweltschutz Südtirol, Kornplatz 10, I-39100 Bolzano).
A short overview of some activities of the Dragonfly Working Group of Southern Tyrol (Italy).

(19137) BYBEE, S.M. T.H. OGDEN, M.A. BRANHAM & M.F. WHITING, 2008. Molecules, morphology and fossils: a comprehensive approach to odonate phylogeny and the evolution of the odonate wing. *Cladistics* 23: 1-38. – (First Author: Dept Ent. & Nematol., Univ. Florida, Gainesville, FL 32611, USA).
A comprehensive morphological and molecular phylogenetic analysis of odon. phylogeny is presented, examining both extant and fossil lineages in simultaneous analyses. The legitimacy of higher-level fam. groups and the phylogenetic relationship between families were tested. 13 fam. were supported as monophyletic (Aeshnidae, Calopterygidae, Chlorocyphidae, Euphaeidae, Gomphidae, Isostictidae, Lestidae, Libellulidae, Petaluridae, Platystictidae, Polythoridae, Pseudostigmatidae and Synthemistidae) and 8 as non-monophyletic (Amphipterygidae, Coenagrionidae, Corduliidae, Megapodagrionidae, Protoneuridae and Synlestidae), although Perilestidae and Platycnemididae were recovered as monophyletic under Bayesian analyses. 9 fam. were represented by 1 sp., thus monophyly was not tested (Epiophlebiidae, Austropetaliidae, Chlorogomphidae, Cordulegastridae, Macromiidae, Chorismagrionidae, Diphlebiidae, Lestoideidae and Pseudolestidae). Epiprocta and Zygoptera were recovered as monophyletic. Ditaxinerua is supported as the sister lineage to Odon., Epiophlebiidae and the lestid-like Zygoptera are sister to the Epiprocta and Zygoptera, respectively. Austropetaliidae + Aeshnidae is the sister lineage to the remaining Anisoptera. Tarsophlebia's placement as sister to Epiprocta or as sister to Epiprocta + Zygoptera was not resolved. Refinements are made to the current classification. Fossil taxa did not seem to provide signals crucial to recovering a robust phylogeny, but were critical to understanding the evolution of key morphological features associated with flight. Characters associated with wing structure were optimized revealing 2 wing character complexes: the pterostigma-nodal brace complex and the costal wing base & costal-ScP junction complex. In turn these 2 complexes appear to be associated; the pterostigma-nodal brace complex allowing for further modification of the wing characters comprised within the coastal wing base & costal-ScP junction complex leading the modern odon. wing.

(19138) CAMPERO, M., M. DE BLOCK, F. OLLEVIER & R. STOKS, 2008. Correcting the short-term effect of food deprivation in a damselfly: mechanisms and costs. *J. Anim. Ecol.* 77: 66-73. – (First Author: Lab. Aquat. Ecol., Univ. Leuven, Debériotstraat 32, B-3000 Leuven).
Mass at emergence is a life-history trait strongly linked to adult fitness. Therefore, when faced with transient food shortage in the larval stage, mass-correcting mechanisms are common. These correcting mechanisms may carry costs with them. On one hand, these costs may be overestimated because they can be confounded with the direct effects of the transient food shortage it self. On the other hand, costs may be underestimated by ignoring physiological costs. Another largely neglected topic is that correcting mechanisms and costs may critically depend upon other stressors that often co-occur. Here, the mass-correcting mechanisms and their associated costs at emergence in Coenagrion puella are identified, after being stressed by a transient period of starvation and a subsequent exposure to pesticide stress during the larval stage. Path analysis is introduced to disentangle direct costs of starvation and the mass-correcting mechanisms in terms of immune response. As predicted, no differences were found in mass at emergence. Starvation directly resulted in a costly delayed emergence and a decreased immune response at emergence. Mass-correcting mechanisms included a prolonged post-starvation period, reduced mass loss at emergence and compensatory growth, although the latter only in females under pesticide stress. The mass-correcting mechanisms were associated with beneficial effects on investment in immune response, but only in the absence of pesticide stress. Under pesticide stress, these beneficial effects were mostly undone or overruled, resulting in negative effects of the mass-correcting mechanisms in terms of immune

response. These results stress the importance of and introduce a statistical way of disentangling direct costs of starvation and the mass-correcting mechanisms themselves, and the importance of including physiological endpoints in this kind of studies.

(19139) CAMPERO, M., M. DE BLOCK, F. OLLEVIER & R. STOKS, 2008. Metamorphosis offsets the link between larval stress, adult asymmetry and individual quality. *Funct. Ecol.* 22: 271-277. − (First Author: Lab. Aquat. Ecol., Univ. Leuven, Debériotstraat 32, B-3000 Leuven).
It is poorly understood which traits translate larval stressors into adult fitness in animals, where larval and adult stages are separated by metamorphosis. Although fluctuating asymmetry (FA) is often assumed to do so, especially in insects the relationship between larval stress, adult FA and individual quality is often absent. One suggested hypothesis for this is the higher mortality of low quality (hence more asymmetric) animals during metamorphosis (i.e. developmental selection hypothesis). Here, this hypothesis is tested and an alternative hypothesis is proposed and tested, where metamorphosis is stressful but not lethal and increases FA of all animals up to a certain level (i.e. stressful metamorphosis hypothesis). Larval stress (food stress and pesticide stress) was manipulated and FA was measured before and after metamorphosis in Coenagrion puella. Additionally, the relationship between FA and individual quality variables measured at metamorphosis (age, mass and immune variables: phenoloxidase and haemocyte number) was assessed. Before metamorphosis, FA reflected the combination of food and pesticide stress and was negatively related with mass and both immune variables after metamorphosis. These patterns were, however, offset after metamorphosis. Low mortality, not linked to FA during metamorphosis, indicates that developmental selection cannot explain this. Instead, the strong increase in FA up to equal levels across treatments during metamorphosis supports the stressful metamorphosis hypothesis. Taken together, the developmental stage in which FA is measured may critically determine the reliability of FA as an indicator of stress and of individual quality in insects.

(19140) CARLE, F.L., K.M. KJER & M.L. MAY, 2008. Evolution of Odonata, with special reference to Coenagrionidae (Zygoptera). *Arthrop. Syst. Phylog.* 66(1): 37-44. − (First Author: Dept Ent., Rutgers Univ., New Brunswick, NJ 08901, USA).
A phylogeny, including 26 fam., is presented based on data from large and small subunit nuclear and mitochondrial ribosomal RNAs and part of the nuclear EF-1α. Data were analyzed using Bayesian methods. Extant Zygoptera and Anisoptera are monophyletic. The topology of Anisoptera is ((Austropetaliidae, Aeshnidae) (Gomphidae (Petaluridae ((Cordulegastridae (Neopetaliidae, Chlorogomphidae)) ((Synthemistidae, Gomphomacromiidae) (Macromiidae (Corduliidae s.s., Libellulidae))))))). Each of the major groups among anisopterans is well supported except the grouping of Neopetalia with Chloropetalia. Lestidae and Synlestidae form a group sister to other Zygoptera, and Coenagrionoidea are also monophyletic, with the caveat that Isostictidae, although well supported as a family, was unstable but not placed among other coenagrionoids. Calopterygoidea are paraphyletic and partly polytomous, except for the recovery of (Calopterygidae, Hetaerinidae) and also (Chlorocyphidae (Epallagidae (Diphlebiinae, Lestoidinae))). Support for Epallagidae as the sister group of a clade (Diphlebiinae, Lestoidinae) is strong. Within Coenagrionoidea, several novel relationships appear to be well supported. First, the Old World disparoneurine protoneurids are nested within Platycnemididae and well separated from the protoneurine, Neoneura. The remaining coenagrionids are divided into two well-supported subdivisions. The first includes Pseudostigmatinae, stat. nov., Protoneurinae, a group of coenagrionids mostly characterized by having an angulate frons, and Argiinae (Argia). The second division includes typical Coenagrionidae.

(19141) DYATLOVA, E.S., 2008. Ecogeographic analysis of dragonfly fauna (Insecta: Odonata) of southwestern Ukraine. *Gaz. Kharkov ent. Soc.* 15(1/2): 21-27. (Russ., with Engl. s.). − (Dept Zool., Biol. Fac., Odessa Natn. Univ., Shampansky 2, Odessa-65058, Ukraine).
The fauna has the greatest similarity (82-75%) with Serbia, Bulgaria, Bosnia & Herzegovina, Montenegro, Romania, SE Ukraine and Hungary, and the least similarity (58-49%) with Latvia, Sweden, Estonia and Finland. Among the Boreal species complex, 68.09% belong to the Euro-Siberian group and 29.79% to the Mediterranean group.

(19142) FERNÁNDEZ, L. & M. SPRINGER, 2008. The effect of coffee processing on aquatic insects

in three rivers from the Central Valley (Alajuela) of Costa Rica. *J. trop. Biol.* 56 (Suppl. 4): 237-256. (Span., with Engl. s.). – (Second Author: Escuela Biol., Univ. Costa Rica, 2060 San Pedro, San José, Costa Rica).
Hetaerina, Argia, Brechmorhoga and Perithemis are listed from the coffee-polluted rivers.

(19143) GROS, P., 2008. Erste Nachweise von Somatochlora arctica (Zetterstedt, 1840) und Lestes barbarus (Fabricius, 1798) aus dem Ibmer Moos (Inviertel, Oberösterreich) sowie aktuelle Libellenfunde aus diesem Europaschutzgebiet (Insecta: Odonata). *Beitr. Naturk. Oberösterr.* 18: 115-121. (With Engl. s.). – (Haus der Natur, Museumsplatz 5, A-5020 Salzburg).
The 2 spp. are recorded for the first time from Upper Austria, and 17 other spp. from the same locality are listed.

(19144) GRÜTTER-SCHNEIDER, E., 2008. Libellen im Oberaargau. Ein Beitrag zur Kenntnis der regionalen Fauna. *Jb. Oberaargaus* 51: 109-148. – (Author's address not provided).
A description of the odon. fauna of the Oberaargau region (43 spp.), canton Bern (Switzerland).

(19145) HASENFUSS, I., 2008. The evolutionary pathway in insect flight: a tentative reconstruction. *Arthrop. Syst. Phylog.* 66(1): 19-35. – (Kalsbader Str. 9, D-91083 Baiersdorf).
Studies on non-pterygotan Ectognatha revealed that the construction of the winged Pterygota is based on lepismatid organization and that the first steps of mastering the air were attained already in the common ancestor of Ectognatha by adaptations in the context of jumping which is still retained in Machilidae (Archaeognatha). In these, the terminalfilum and the ectognathan 3-segmented antenna permit attitude control of the body. The acquisition of the mandibular dicondyly led to climbing on vascular plants and exploitation of plant tips as food since the late Silurian. The problems of beginning sustained flight with flapping wings are discussed. A scenario with intermediate gliding and one without gliding are presented. The corresponding parts of the sclerites and muscles of the three subcoxal leg segments found in lepismatids are still recognizable in the pterygotan pterothorax. The wings are composed of the paranota and part of the most basal subcoxal leg segment. It is concluded that wing elongation was impossible without flexing the wings on the back already during early evolution and that the inability to flex the wings is secondary. Wing flexing nearly ab initio was possible by a mechanical switch between the states of flight and non-flight. This led to the neopterous construction of the wing base.

(19146) JACOBI, B., 2008. Neue und selten nachgewiesene Insekten in Oberhausen. *Electr. Publs biol. Stn W Ruhrgebiet* 1(8): 1-6. – (Dieckerstr. 26, D-46047 Oberhausen).
Sympecma fusca breeds in the Oberhausener Waldteichgelände (Germany); the 2003 and 2004 records are stated.

(19147) *OSOK REPORT*. Biennial of the Odonatological Research Society of Korea (OSOK), Vol. 1, 2008. 96 pp. ISBN 978-89-958060-7-4 93490. (Korean). – (c/o Dr K.-S. Jung, 6F, IBS Bldg, 1572-18 Seocho-Dong, Seocho-ku, Seoul 137-070, Korea).
Includes papers on biology and regional faunistics. Among these is a review of the Odonata distribution of Seoul.

(19148) TAFANGENYASHA, C. & L.T. DUBE, 2008. An investigation of the impacts of agricultural runoff on the water quality and aquatic organisms in a lowland sand river system in Southeast Zimbabwe. *Water Resour. Mngmt* 22: 119-130. – (Second Author: Dept Geogr. & Envir. Sci., Univ. Zululand, P.B. X1001, KwaDangezwa-3886, SA).
The study was conducted in the same area and the odon. inventory was the same as reported in *OA* 19149; – Zimbabwe.

(19149) TAFANGENYASHA, C. & L.T. DUBE, 2008. Evaluation of the usefulness of the South African scoring systems in a savanna river. *Trop. subtrop. Agroecosyst.* 8(2): 135-144. (With Span. s.). – (First Author: Dept Envir. Sci. & Health, Natn. Univ. Sci. & Technol., P.B. AC939, Bulawayo, Zimbabwe).
The study was conducted in the southern Highveld of Zimbabwe and includes the area drained by the Chiredzi, Mtirikwi, Tokwe and Runde rivers. 5 odon. gen., pertaining to Coenagrionidae, Chlorocyphidae, Aeshnidae and Libellulidae were identified in the samples.

(19150) TERNOIS, V., 2008. Boyeria irene (Fonscolombe, 1838): première mention pour le département de la Haute-Marne (Odonata, Anisoptera, Aeshni-

dae). *Bull. Soc. Sci. nat. Archéol. Haute-Marne* (N.S.) 2008(7): 11-13, 26 (figs). – (22 Rte Sauvage-Magny, F-52220 Anglus).
First records (VIII-2007) of B. irene from the dépt of Haute-Marne (France).

(19151) WEITZEL, M., 2008. Untersuchungen zur Libellenfauna des NSG „Matheiser Wald" in Trier. *Dendrocopos* 35: 75-79. – (Graf-Reginar Str. 43, D-54294 Trier).
Records of 34 spp. (2001-2007); – Trier (Germany).

(19152) ZASYPKINA, I.A., 2008. Examination of the amphibiotic insect fauna of the Taiskaya Bay coasts. *Vest. SVNC dal'nevost. Otd. ross. Akad. Nauk* 2008(4): 35-44. (Russ., with Engl. s.). – (Inst. Biol. Probl. Severa, Ross. Akad. Nauk, ul. K. Marksa 24, RUS-685000 Magadan).
The paper deals mainly with the Ephemeroptera, Plecoptera and Trichoptera. In the Taiskaya Bay, 22 odon. spp. were recorded, but a list is not provided.

2009

(19153) DARVIZEH, M., A. DARVIZEH, H. RAJABI & A. REZAEL, 2009. Free vibration analysis of dragonfly wings using Finite Element Method. *Int. J. Multiphysics* 3(1): 101-110. – (Dept Mechan. Eng., Guilan Univ., P.O. Box 3756, Rasht, Iran).
The investigations on microstructure and mechanical properties of the dragonfly wing were carried out, and a numerical modelling based on Finite Element Method (FEM) is developed.

(19154) DARWALL, W.R.T., K.G. SMITH, D. ALLEN, M.B. SEDDON, G. McGREGOR REID, V. CLAUSNITZER & V.J. KALKMAN, 2009. Freshwater biodiversity: a hidden resource under threat. *In*: J.C. Vié, C. Hilton-Taylor & S.N. Stuart, [Eds], *Wildlife in changing world: an analysis of the 2008 IUCN Red List of threatened species*, pp. 43-53, IUCN, Gland. – (Last Author: Naturalis, P.O. Box 9517, NL-2300 RA Leiden).
As part of an effort to expand the taxonomic coverage of the IUCN Red List, 1500 odon. spp. were assessed through the sampled approach. About 10% of these were found to be threatened, which is a relatively low number compared to some other groups. The centres of species richness are the Neotropical and Indo-Malayan regions, which support about two thirds of the known spp. The main areas of threatened spp. are in the Indo-Malayan and Australian regions. The high proportion of threatened spp. in the Indo-Malayan area is mainly accounted for by the high number of restricted-range spp. in the Indonesian and Philippine archipelagos, which are threatened by large-scale logging of lowland forest. In Australia the main threat is climate change, which is already resulting in the loss or degradation of freshwater ecosystems. Two maps of distribution patterns of odon. species richness in E and S Africa, and of threatened odon. spp. in S Africa, respectively are also provided.

(19155) GROSSER, N. & K. HAHN, 2009. Brachytron pratense (Müller, 1764) im Werratal bei Sallmannshausen (Thüringen) im Jahre 2008 (Odonata, Aeshnidae). *Mitt. thüring. Entomologenverb.* 16(1): 16-18. (With Engl. s.). – (Fachricht. Landschaftsarchitektur, Fachsch. Erfurt, Leipziger Str. 77, D-99085 Erfurt).
A new record of B. pratense from the Werra floodplain, Thuringia (Germany) is discussed in the light of a river restoration project.

(19156) HENRIQUES-OLIVEIRA, A.L. & J.L. NESSIMIAN, 2009. Phoresy and commensalism of Chironomidae larvae (Insecta: Diptera) in the state of Rio de Janeiro, Brazil. *Lundiana* 10(1): 11-18. – (Lab. Ent., Dept Zool., Inst. Biol., Univ. Fed. Rio de Janeiro, Ilha do Fundão, BR-21944-970 Rio de Janeiro, RJ).
Rheotanytarsus larvae were found in association with Rhionaeschna punctata, Brechmorhoga sp. and Elasmothemis cannacroides.

(19157) JANA, S., P.R. PAHARI, T.K. DUTTA & T. BHATTACHARYA, 2009. Diversity and community structure of aquatic insects in a pond in Midnapore town, West Bengal, India. *J. envir. Biol.* 30(2): 283-287. – (First Author: Dept Zool., Vidyasagar Univ., Midnapore-721102, India).
Agriocnemis pygmaea, Enallagma parvum and Urothemis signata are recorded from the Poultry Pukur pond.

(19158) LEBAR P., 2009. *Boating activities on Ljubljanica river within the context of Natura 2000 environmental protection programme*. Graduation thesis No. 121, Fac. Architect. & Geodesy, Univ. Ljubljana. xi+138 pp. (Slovene, with Engl. title). – Address of the Faculty: Jamova 2, P.O. Box 3422, SI-1115 Lju-

bljana).
Includes brief information on Coenagrion ornatum and Cordulegaster heros; − Slovenia.

(19159) McLACHLAN-TROUP, T.A., C.R. DICKMAN & T.R. GRANT, 2009. Diet and dietary selectivity of the platypus in relation to season, sex and macroinvertebrate assemblages. *J. Zool.* 2009: 10 pp.; − DOI: 10.1111/j.1469-7998.2009.00645.x − (First Author: Inst. Wildl. Res., Sch. Biol. Sci., A08, Univ. Sydney, Sydney, NSW 2006, AU).
The Gomphidae were among the most frequently found macroinvertebrate taxa in cheek pouch samples from duckbills (= platypus, Ornithorhynchus anatinus; Mammalia: Monotremata) from Kangaroo Valley, ca 160 km N of Sydney (Australia). Dietary differences between the sexes were not detected, but some dietary selection occurs with respect to both foraging habitat and season.

(19160) MECHORA, Š., 2009. *Environmental assessment and macrophytes in streams Bloščica and Cerkniščica*. Graduation thesis, Univ. Ljubljana. x+83 pp. (Slovene, with Engl. s.). − (Author's current address unknown).
Coenagrion ornatum is mentioned from the Bloščica stream (p. 16), central Slovenia.

(19161) NAGORSKAYA, L.L., M.D. MOROZ, T.M. LAENKO & V.V. VEZHNOVEC, 2009. *Fauna vremennyh vodoemov Belarusi* − [*Fauna of the temporary water bodies of Belarus*]. Nac. Akad. Nauk Belarusi, Minsk. 182 pp. ISBN 978-985-08-1109-7. (Russ.)
A monograph on the ecology and fauna of the temporary water bodies of Belarus, incl. an exhaustive catalogue of the spp. inhabiting these habitats, in which Lestes dryas, L. viridis, Sympetrum flaveolum and S. sanguineum are listed.

(19162) NAUMKIN, V.P. & N.I. VELKOVA, 2009. Specific structure of the insects at white mustard crops. *Nauk.-tehn. Byll. Inst. oliynih Kul'tur UAAN* 14: 188-195. (Russ., with Ukr. & Engl. s's). − (OGOU VPO, Orlov St. Agrar. Univ., Orlov, Ukraine).
Lestes dryas is listed from the white mustard fields in Orlov, the Ukraine.

(19163) POBOLJŠAJ, K., B. TRČAK, B. FRAJMAN, A. ŠALAMUN, M. CIPOT & M. REBEUŠEK, 2009. *Izvedba monitoringa (ekspertni naravovarstveni nadzor za monitoring habitatov, dvoživk, kačjih pastirjev in agregat narave) skladno z GD na strelišču Mlake: letno poročilo 2009* − [*Monitoring of … dragonflies … at the shooting-grounds of Mlake …: annual report 2009*]. CKFF, Miklavž-na-Dravskem-polju. 36 pp. (Slovene). − (CKFF, Klunova 3, SI-1000 Ljubljana).
36 odon. spp. are listed from Mlake, Vipava valley (W Slovenia). Erythroma viridulum is new to the locality.

(19164) POST, M., 2009. Libellen im Raum Neustadt an der Weinstrasse. *Pollichia-Kurier* 25(2): 47-49. − (Frühlingstr. 25, D-67434 Neustadt a.d. Wstr.).
A commented checklist of 40 spp.; − Neustadt area (Germany).

(19165) POST, M., 2009. Weitere Libellenbeobachtungen im Raum Neustadt. *Pollichia-Kurier* 25(4): 40. − (Frühlingstr. 25, D-67434 Neustadt a.d. Wstr.).
Notes on Coenagrion mercuriale, C. scitulum, Aeshna affinis, Brachytron pratense, Gomphus vulgatissimus, Ophiogomphus cecilia, Libellula fulva and Sympetrum fonscolombii in the Neustadt area (Germany).

(19166) SCHEIN, V. & I. LIKAR, 2009. Cerkniško jezero, mokrišče mednarodnega pomena − [Cerknica lake, a wetland of international importance]. *Novice notranjskega regijskega Parka* 3(1): 1-13. (Slovene). − (Tabor 42, SI-1380 Cerknica).
Includes a chapter on odon. fauna of the Notranjski Regional Park (Slovenia). Out of the 45 recorded spp., 36 spp. occur in the Cerknica lake area, 11 of those most abundant are listed.

(19167) SONNENBURG, F. & K. BÖHM, 2009. Libellenfauna der Ohligser Heide. *Jber. naturw. Ver. Wuppertal* 61: 101-124. (With Engl. s.). − (First Author: Biol. Stn Mittlere Wupper, Vogelsang 2, D-42653 Solingen).
The area is situated nr the city of Solingen, North Rhine-Westphalia (Germany). A survey is presented of the fauna (40 spp.), with annotations on the habitats and local status of all spp.

(19168) VON HOLDT, E., 2009. Bemerkenswerte Libellen im Raum Hannover 2007 und 2008. *Info hannover. Vogelschutzver.* 2009(1): 29-30. − (Offensteinstr. 13, D-30451 Hannover).
Annotations on the occurrence of Paracercion linde-

nii, Aeshna isosceles, Anax parthenope, Leucorrhinia albifrons, L. caudalis, L. pectoralis, Orthetrum brunneum, O. coerulescens, Sympetrum fonscolombii and S. pedemontanum in the Hannover area, Germany.

(19169) WEITZEL, M., 2009. Bemerkenswerte Spätherbst- und Winterbeobachtungen von Köcherfliegen und Libellen im extrem milden Winter 2006/2007 aus dem Moselgebiet. *Dendrocopos* 36: 81-85. – (Grad-Reginar-Str. 43, D-54294 Trier).
In the Trier area (Germany), the 2006/2007 winter was extremely mild. Here, the sightings are presented of 14 odon. spp. (Nov.-March) along with the respective air temperatures. Among these are the emerging of Calopteryx splendens in March, Sympetrum striolatum on wings in Jan. & March, Enallagma cyathigerum on wings in Nov., Aeshna cyanea on wings in Dec. & Jan. etc.

(19170) WRIGHT, I.A. & S. BURGIN, 2009. Comparison of sewage and coal-mine wastes on stream macroinvertebrates within an otherwise clean upland catchment, southeastern Australia. *Water Air Soil Pollut.* 204: 227-241. – (Coll. Health & Sci., Univ. W. Sydney, Locked Bag 1797, South Penrith Distr. Cent., Sydney, NSW-1797, AU).
Field work was carried out on waterways in the upper Grose river catchment in the Blue Mountains. Aeshnid larvae occurred in all samples, but the gomphids were missing at the points of the organic pollution outflow.

(19171) WU, Y.-T., C.-H. WANG, X.-D. ZHANG, B. ZHAO, L.-F. JIANG, J.-K. CHEN & B. LI, 2009. Effects of saltmarsh invasion by Spartina alterniflora on arthropod community structure and diet. *Biol. Invasions* 11: 635-649. – (Last Author: Coastal Ecosyst. Res. Stn of Yangtze River, Inst. Biodiv. Sci., Fudan Univ., Shanghai-200433, China).
Spartina is a global plant invader in coastal wetlands that can modify abiotic and biotic environments. In the Yangtze estuary, it replaced locally native Phragmites, threatening therewith the native insects feeding on Phragmites. The % abundance of coenagrionids in Dongtan saltmarsh of the Yangtze estuary, however, remained about the same (< 1%) in Phragmites monoculture, Phragmites-Spartina mixture and in Spartina monoculture.

(19172) XIAO, T. & H. ANG, 2009. Numerical study of unusual phase relationships and aerodynamic interaction between forewing and hindwing of dragonfly model. *Acta aeronaut. astronaut. sin.* 30(7): 1165-1175, (Chin., with Engl. s. & fig. captions). – (Coll. Aerospace Eng., Nanjing Univ. Aeronautics & Astronautics, Nanjing-210016, China).
A dragonfly has the ability to control the aerodynamic forces for flight by modulating the phase relationship between their forewings and hindwings. Here, unsteady flows of a dragonfly model in hovering (advance ratio J = 0) and in forward flight with medium-speed (J = 0.3) were simulated by solving unsteady Navier-Stokes (N-S) equations on dynamic overset unstructured grids. At each advance ratio, 13 phases from 0º to 360º with intervals of 30º each were considered. The variation of aerodynamic force and power with phase as well as the aerodynamic perturbation between the forewing and hindwing were studied. It was found that the period average vertical force and power varies in a "U" shape as a function of the phase. The vertical force generated by the model is enough to balance the weight, and the data for aerodynamic power also agree with the statistical data of real dragonflies. In the wide phase region of 90º-270º, aerodynamic interaction between the wings is relatively strong and stable. The vertical force and power is relatively small and stay roughly constant. The results may be useful for explaining the unusual phase relationships between the wings of dragonflies.

2010

(19173) ALLEN, K.A., M.G. LE DUC & D.J. THOMPSON, 2010. Habitat and conservation of the enigmatic damselfly Ischnura pumilio. *J. Insect Conserv.* 14: 689-700. – (Sch. Biol. Sci., Univ. Liverpool, Liverpool, L69 7ZB, UK).
I. pumilio is threatened in the UK and its habitat requirements are not well understood. This study tests previously held notions of the habitat requirements of I. pumilio, investigates the features of a habitat influencing odon. spp. composition and provides recommendations for habitat creation and management for I. pumilio persistence. 31 sites across SW England with past I. pumilio records were surveyed in 2006. Environmental variables and odon. abundance were recorded. Odon. spp. composition and I. pumilio abundance were related to environmental variables using multivariate techniques and GLM. I. pumilio was found at a wide variety of habitat types; key habitat features were a muddy substrate with some open

ground, turbid water, and low levels of shade. It was associated with increased structural diversity of vegetation away from water but low maximum height; characteristic of early-successional sites. The variables predicting odon. composition were location, shade, level of disturbance, water depth, and cover of terrestrial dwarf shrubs and Sphagnum species. Vegetation height and structure were also highly influential to at least 20 m from water. This study indicates that odon. habitat management should include adjacent hinterland. Management for I. pumilio may be complicated by the species' use of 2 habitat types, each with associated problems. Furthermore, odon. spp. diversity was negatively associated with I. pumilio abundance, which may cause conflict of interest when managing habitats.

(19174) BARTA, D., 2010. Rocker Dan Bárta lovi kačje pastirje – [Rocker Dan Bárta is catching dragonflies]. *Readers's Digest Slovenija* 10(10): 64-71. (Slovene). – (Author's address not stated).
General, with portraits of 8 spp.

(19175) DAS, S.K., H.K. SAHU & S.D. ROUT, 2010. Odonates of Baripada division of Similipal Biosphere Reserve, including North Orissa University Campus, Orissa, India. *Tigerpaper* 24(2): 13-16. – (P.-G. Dept Wildlife & Conserv. Biol., North Orissa Univ., Sri Ramchandra Bihar, Takatpur, Baripada, Orissa-757003, India).
A commented list of 31 spp.

(19176) FIGUEIREDO LACERDA, C.H., C. HAYASHI, C. MARTINS SOARES & C.E. BENTO FERNANDES, 2010. Influence of aquatic plants on the predation of Piaractus mesopotamicus larvae by Pantala flavescens. *Acta Scientiarum* (Biol.), Maringa 32(2): 147-151. (With Port. s.). – (First Author: Lab. Ecol. & Mngmt Estuarine and Coastal Ecosyst., Dept Oceanogr., Univ. Fed. Pernambuco, Cidade Universitaria, Av. Arquitetura s/n, BR-50740-550 Recife, Pernambuco).
It is shown experimentally that the presence of the submerged Egeria najas promotes the reduction of predation by P. flavescens larvae on those of the fish, P. mesopotamicus.

(19177) GANDER, A., 2010. Nehalennia speciosa (Charpentier, 1840) dans la Grande Cariçaie: une population singulière d'importance internationale (Odonata: Coenagrionidae). *Entomo helvetica* 3: 189-203. (With Engl. & Germ. s's). – (Grande Cariçaie, ch. de la Cariçaie 3, CH-1400 Cheseaux-Noréaz).
The population is situated on the southern shore of Lake Neuchâtel (Switzerland) and it was discovered in 2007. Ca 30 ha of the Cariçaie Nature Reserve were examined, 391 N. speciosa individuals were sighted within an area of 9 ha, 94% of these occurred within the flooded stands of large sedges (Magnocaricion). The unmaintained marsh allotments were not colonized. The peculiarities of the sp. local ecology and the modalities of conservation are discussed.

(19178) GORDON, D.P., [Ed.], 2010. *New Zealand inventory of biodiversity*, Vol. 2: *Kingdom Animalia (Chaetognatha, Ecdysozoa, Ichnofossils)*. Canterbury Univ. Press, Canterbury. 528 pp. ISBN 978-1--877257-93-3.
In New Zealand the odon. are represented by 15 (plus 2 non-breeding migrant) spp. Thus, the diversity is low compared with e.g. Tasmania (26 spp.), with 7 times more spp. per square km. Nevertheless, 3 gen. and 10 spp. are endemic.

(19179) INEICHEN, S. & M. RUCKSTUHL, 2010. *Stadtfauna: 600 Tierarten der Stadt Zürich*. Haupt, Bern-Stuttgart-Wien. 446 pp. Hardcover (14.2 × 21.2 cm). ISBN 978-3-258-07561-7. Price: euro 49.- net.
The odon. are dealt with on pp. 124-143. Out of ca 80 spp. known to occur in Switzerland, 43 were recorded in the Zürich city area (91 km^2), of which 35 spp. are probably there autochthonous. The habitats of all spp. are described, the status of each sp. is stated, their known localities within the city area are mapped and in case of rare taxa the names of localities are listed. Photographs are provided of all spp. but the regional bibliography is not supplied.

(19180) KJAERSTAD, C., T. ANDERSEN, H.A. OLSVIK & J.E. BRITTAIN, 2010. Ephemeroptera, Odonata, Plecoptera, Trichoptera. *In*: J.A. Kålås et al., [Eds], *The 2010 Norwegian Red List of species*, pp. 227-234, Biodiv. Inf. Cent., Trondheim, ISBN 13: 978-82-92838-26-6. (Bilingual: Norw./Engl.). – (Distributed by Norw. Biodiv. Inf. Cent., N-7491 Trondheim).
17 odon. spp. are listed in various IUCN categories and the main habitats are stated.

(19181) *OSOK REPORT*. Biennial of the Odonatological Research Society of Korea (OSOK), Vol.

2, 2010. 56 pp. (Korean). – (c/o Dr K.-S. Jung, 6F, IBS Bldg, 1572-18 Seocho-Dong, Seocho-ku, Seoul 137-070, Korea).
Papers on regional faunistics, including „A list of Odonata from Yougjong island".

(19182) RAMIREZ, A., 2010. Odonata [larvae of Puerto Rico]. *Int. J. trop. Biol.* 58 (Suppl. 4): 97-136. – (Inst. Estud. Ecosist. trop., Univ. Puerto Rico).
Generic keys to the larvae of Costa Rica, with a tab. of their habitats and tolerance to contamination.

(19183) RANSDALE, N., 2010. *Dragonflies of La Brenne and Vienne*. Naturetrek Tour Report, 23-30 June 2010, Alresford/UK. 13 pp. – (Naturetrek, Cheriton Mill, Cheriton, Alresford, Hamps., SO24 0NG, UK).
Records of 41 spp.; – France.

(19184) RANTALA, M.J., J. HONKAVAARA & J. SUHONEN, 2010. Immune system activation interacts with territory-holding potential and increases predation of the damselfly Calopteryx splendens by birds. *Oecologia* 163: 825-832. – (Sect. Ecol., Dept Biol., Univ Turku, FIN-20014 Turku).
Activation of the immune system in insects has been shown to be costly in the laboratory setting, but experimental studies in the field are lacking. The costs of immunity in the wild may be different to those in the laboratory because animals in the wild are simultaneously subjected to a suite of selective agents. Here, the costs of immune system activation were measured in a wild population of the territorial C. splendens. Immune-challenged ♂♂ were found to be less likely to be territorial and had lower overall survival rates than control or sham-manipulated ♂♂. Because territorial ♂♂ have a higher mating success than nonterritorial ♂♂, this result suggests that immune-challenged ♂♂ are also likely to suffer reduced mating success. However, the activation of the immune system as such did not increase predation risk; this occurred due to a combination of the former with a reduced territory-holding potential. As such, immune-challenged ♂♂ not holding a territory were most susceptible to predation by birds. The size of the wing spots, a known sexually selected ♂ trait, predicted territorial behaviour in control and sham-manipulated ♂♂, but not in immune-challenged ♂♂. These data show that immune system activation can have several costs acting in unison and that ubiquitous ecological interactions, such as predation, may affect trade-offs between immunity and other life history traits.

(19185) STURM, B., 2010. *Die Libellen des Lavanttales: ökologische Ansprüche und Verbreitung*. Masterarbeit Univ. Graz, Graz. ii + 107 pp. – (Author's current address unknown).
During 2 yr, the odon. fauna was surveyed on 34 stagnant water bodies (incl. fish ponds) in the Lavanttal (Austria). 31 spp. were recorded, of which 23 are autochthonous. Lestes dryas and Sympetrum depressiusculum are listed in the Austrian Red List as threatened with extinction. Ecological requirements and vertical distribution are stated for all spp. St Andrä lake is the species-richest habitat, and the lowland fish ponds harbour an unexpectedly high species diversity. 10 spp. are recorded for the first time from the Lavanttal.

(19186) TOŃCZYK, G., 2010. Dragonflies and damselflies (Odonata) of the Tatra mountains: history and present day. *Nauka Zarzadzanie Obszarem Tatr* 2: 101-105. (Pol., with Engl. s.). – (Dept Invert. Zool. & Hydrobiol., Univ. Lódź, Banacha 12/16, PO-90-237 Lódź).
Studies on the Odon. of the Tatra Mts have a tradition of almost 150 yr. and up to 39 spp. were recorded, including Somatochlora alpestris and S. arctica. however, it is likely that only 26 spp. are breeding there. Recently, the Tatra region is receiving but little attention and only 14 spp. were recorded since 1990.

(19187) WOLFFRAM, L., 2010. Libellen auf einer Wiese in Issum-Sevelen. *NatSchutz Kreis Kleve* 2010 (Herbst/Winter): 20-21. – (Author's address not stated).
A commented list of 26 spp.; – Kleve distr., North Rhine-Westphalia (Germany).

(19188) YUM, J.W., H.J. LEE & Y.J. BAE, 2010. Taxonomic review of the Korean Zygoptera (Odonata). *Ent. Res. Bull.* 26: 41-55. – (Third Author: Div. Life Sci., Coll. Life Sci. & Biotechnol., Korea Univ., 5-ga, Anam-dong, Seongbuk-gu, Seoul 136-701, Korea).
A catalogue of 35 nominal spp., with synonyms, information on types, Korean localities, distributions, taxonomic remarks and bibliographic information. Due to the inappropriate information available, Calopteryx cornelia, Agriocnemis pygmaea, Platycnemis foliacea sasakii and Lestes hanllimensis are deleted from the list.

2011

(19189) BODA, R., G. ROZNER, A. CZIROK, I. SZIVÁK & Z. CSABAI, 2011. New data on the distribution of Cordulegaster heros Theischinger, 1979 in Mecsek mountains and its surroundings. *Acta biol. debrecina Oecol. Hung.* 26: 21-28 (With Hung. s.). – (First Author: Dept Ecol. & Hydrobiol., Univ. Pécs, Ifjúság ut. 6, HU-7624 Pécs).
The records are presented from 69 sites in the region (2008, 2010); – Hungary.

(19190) CANO-VILLEGAS, F.J., 2011. An update of the catalogue of the Odonata (Insecta) of Córdoba province (Andalusia, Spain). *Boln Soc. ent. aragon.* 48: 479-483. (Span., with Engl. s.). – (c/Isla Mallorca 2/Portal 6/4ºA, Córdoba, Spain).
Data on 6 spp. not recorded previously from Córdoba.

(19191) CONZE, K.-J., N. MENKE & M. OLTHOFF, 2011. Libellen und Klimawandel in Nordrhein-Westfalen. *Natur in NRW* 2011(4): 20-26. – (First Author: Listerstr. 13, D-45147 Essen).
An analysis is presented of the effects of the change of climate on 73 spp. in North Rhine-Westphalia, Germany.

(19192) CRESPO, J.G., 2011. A review of chemosensation and related behaviour in aquatic insects. *J. Insect Sci.* 11(62): 1-39, 5 App. excl. – (Dept Biol., Univ. Utah, Salt Lake City, UT 84112, USA).
Antennal morphology and types of sensilla, brain morphology and odon. response to invertebrate and vertebrate predators are described for adults and larvae (pp. 8-12) and, in App. 2, all hitherto identified sensilla in Odon. are listed along with their locations, functions and references to the respective literature.

(19193) ESCH, A., 2011. *Die Libellen der Fliessgewässer und ihre Begleitfauna im FFH-Gebiet Kottenforst bei Bonn (Insecta: Odonata)*. Diplomarbeit Univ. Bonn. vi + 71 pp. – (Author's current address unknown).
A study on the odon. fauna (10 spp.) and ecology at 6 small streams in the Kottenforst area, SW of Bonn (Germany).

(19194) HANEL, L., 2011. Šidlo červené znovu na Podblanicku. – [Aeshna isosceles in Podblanik again]. *Pod Blanikem* 15(3): 5. (Czech). – (Správa Chráněné krajinné oblasti Blanik, CZ-25706 Louňovice pod Blanikem 8).
Several individuals were sighted at 2 localities (alt. 470-480 m), 5/16-VI-2011; – Czech Republic.

(19195) HASUMI, M., T. HONGORZUL & K. TERBISH, 2011. Animal species diversity at a land-water ecotone in Mongolia. *Limnology* 12: 37-45. – (First Author: Biol. Inst., Fac. Sci., Niigata Univ., Niigata, 950-2181, JA).
"Cercion" and 3 aeshnid and libellulid spp. are familywise listed from Shaamar, Selenge prov. (Mongolia).

(19196) *IDF-REPORT*. Newsletter of the International Dragonfly Fund (ISSN 1435-3393), Vols 40-42 (2011). – (c/o M. Schorr, Schulstr. 7/B, D-54314 Zerf).
[Vol. 40]: *Kosterin, O.E.*: Odonata of the Cambodian coastal regions revisited: beginning of dry season in 2010 (pp. 1-108); – [Vol. 41]: *Schröter, A.*: Review of the distribution of Somatochlora sahlbergi (Odonata: Corduliidae) (pp. 1-27); – [Vol. 42]: *Kosterin, O.E. & J. Holden*: Some photographic records of Odonata in Cambodia (pp. 1-6); – *Day, L.*: Odonata seen in Tatai, Koch Kong province, Cambodia (pp. 7-10).

(19197) INFANTE-RODRIGUEZ, D.A., R. NOVELO-GUTIÉRREZ, G. MERCADO & T. WILLIAMS, 2011. Spinosad toxicity to Simulium spp. larvae and associated aquatic biota in a coffee-growing region of Veracruz state, Mexico. *J. med. Ent.* 48(3): 570-576. – (Inst. Ecol. AC, Apartado Postal 63, Xalapa, MX-91070 Xalapa, Veracruz).
Spinosad is a naturally derived insecticide that has shown potential as a mosquito larvicide. After its application, Brechmorhoga was the sole dominant odon. genus (78%).

(19198) JEONG, J.-C., J.-Y. CHA, J.-M. KWON, J.-K. CHOI, S.-H. NAM, M. CHOI, Y. KIM & Y. CHO, 2011. Historical review of the insect fauna and protected species in Byunsanbando National Park. *J. natn. Park Res.* 2(2): 85-128. (Korean, with Engl. s.). – (Last Author: Dept Biol., Daejeon Univ., Daejeon 300-716, Korea).
Lists 24 odon. spp. from the Park (Korea).

(19199) KAIZE, J. & V.J. KALKMAN, 2011. Records of dragonflies (Odonata) from Kabupaten Asmat and Kabupaten Mappi (Papua, Indonesia). *Suara*

Serangga Papua 5(3): 99-107. (With Bahasa Indonesian s.). – (Second Author: Naturalis, P.O. Box 9517, NL-2300 RA Leiden).
Commented records of 47 spp.

(19200) KÁLMÁN, A., R. BODA, Z. KÁLMÁN, P. MAUCHART, G. ROZNER, I. SZIVÁK, N. SOÓS & Z. CSABAI, 2011. Contribution to the aquatic macroinvertebrate fauna of the Szelic hilly region, SW Hungary. *Acta biol. debrecina Oecol. Hung.* 26: 98-115. (With Hung. s.). – (Fifth Author: Balaton Uplands Natn. Park, Kossuth u. 16, H-8229 Csopak).
Records of 9 odon. spp.

(19201) KALNINŠ, M., 2011. Spāru (Odonata) dienvidu sugu izplatiba Latvijā un blakus teritorijās. *Latvijas Univ. zinātniskā Konf.* (Biol.) 69: 1 p. (Latvian). – (Dept Zool. & Anim. Ecol., Fac. Biol., Univ. Latvia, Kronvalda Bulv. 4, LV-1586 Riga).
[Abstract not provided].

(19202) KALNINŠ, M., 2011. The distribution of southern dragonfly (Odonata) species in Latvia and adjacent territories. *Envir. exp. Biol.* 9: 43-52. – (Dept Zool. & Anim. Ecol., Fac. Biol., Univ. Latvia, Kronvalda Bulv. 4, LV-1586 Riga).
The published and unpublished data on the occurrence of 19 spp. during the past 2 decades in Latvia are summarized with reference to the changes of the fauna. 5 of these were newly discovered during this period.

(19203) KISHE-MACHUMU, M.A., F. WITTE, J.H. WANINK & E.F.B. KATUNZI, 2011. The diet of Nile perch, Lates niloticus (L.) after resurgence of haplochromine cichlids in the Mwanza Gulf of Lake Victoria. *Hydrobiologia* 2011: 8 pp.; – DOI 10.1007/s10750-011-0822-1. – (First Author: Tanzania Fish. Res. Inst., P.O. Box 78850, Dar es Salaam, Tanzania).
The highest frequencies (10-11%) of odon. larvae in the perch diet were occurring in the fish of intermediate size (16-35 cm). A list of spp. is not provided; – Tanzania.

(19204) KOVÁCS, T., P. OLAJOS & G. SZILÁGYI, 2011. Records of Ephemeroptera, Odonata and Plecoptera from Lithuania, with notes on aquatic arthropods. *Folia hist.-nat. Mus. matraensis* 35: 21-32. – (First Author: Mátra Mus., Kossuth Lajos ut. 50, HU-3200 Gyöngyös).
Records of 19 odon. sp., from various localities (May 2010, July 2011).

(19205) KRIŽNAR, M., 2011. Srednjemiocenski fosili iz Radoboja (Hrvaška) v paleontoloski zbirki Prirodoslovnega muzeja Slovenije. – [Middle Miocene fossils from Radoboj (Croatia) in paleontology collection of the Natural History Museum of Slovenia]. *Geol. Zb.*, Ljubljana 21: 68-70. (Slovene). – (Nat. Hist. Mus. Slovenia, Prešernova 20, SI-1000 Ljubljana).
The Radoboj collection was probably initiated by H. Freyer (1802-1866), about 1844, when he was associated with the "Landes-Museum im Herzogtume Krain" (now Nat. Hist. Mus. Slovenia) in Ljubljana, and was subsequently supplemented (1853, 1855) by H. Harmel and L. Urbas, both of Idria (Slovenia). Among ca 180 specimens, 63 are referable to insects, incl. several adult and larval Odon. Here, a photograph of the hw of an adult, unidentified libellulid is reproduced (Inv. No. PMS 900).

(19206) LAMBERTZ, M. & H. SCHMIED, 2011. Records of the exotic damselfly Ischnura senegalensis (Rambur, 1842) from Bonn (Germany). *Bonn zool. Bull.* 60(2): 211-213. (With Germ. s.). – (First Author: Inst. Zool., Univ. Bonn, Poppelsdorfer Schloss, D-53115 Bonn).
An adult ♂, an exuviae and a dead larva were found in a house. They clearly originate from imported tropical aquarium plants, incl. Ludwigia repens, which genus is well known from I. senegalensis habitats.

(19207) LOOS, G., 2011. Libellen mit Migrationshintergrund im Landkreis Nürnberger Land. *Themen Informationen Landkr. Nürnberger Land* 2011(1): 1-17. – (Heidkamp 32, D-59174 Kamen).
The northward expansion during the past 2 decades is shown for Erythromma lindenii, Gomphus pulchellus, Crocothemis erythraea and Sympetrum fonscolombii; – Nürnberger Land distr., Germany.

(19208) MOSER, I., 2011. *Bestandesaufnahmen der Kleinen Binsenjungfer, der Sumpfgrille und der Sumpfschrecke im Feuchtland ausserhalb der Naturschutzgebiete Bannriet, Spitzmäder, Eich und Burst. Ergebnisse 2011*. Ver. Pro Riet Rheintal, Altstätten. 21 pp., 2 maps excl. – (Ver. Pro Riet Rheintal, Schwalbenweg 16, CH-9450 Altstätten).
On the habitat and status of Lestes virens at a locality

in the Rhine valley nr Altstätten, canton St Gallen, Switzerland.

(19209) MOSER, I., 2011. *Biomonitoring gefährdeter Tierarten in den Naturschutzgebieten Bannriet und Spitzmäder (Gemeinden Altstätten und Oberriet, SG). Bericht 2008-2011*. Ver. Pro Riet Rheintal, Altstätten. 38 pp. – (Ver. Pro Riet Rheintal, Schwalbenweg 16, CH-9450 Altstätten).
The results are reported and discussed of the Sympetrum depressiusculum monitoring; – canton St Gallen, Switzerland.

(19210) MUÑOZ, J.D. & M. FERRERAS-ROMERO, 2011. High presence of Lestes macrostigma (Eversmann, 1836) (Odonata, Lestidae) in Doñana area (southern Spain) in 2010. *Boln Asoc. esp. Ent.* 35(1/2): 281-287. (Span., with Engl. title). – (Second Author: Depto Sistemas Fisicos, Quimicos & Naturales, Univ. Pablo de Olavido, A 376 km 1, ES-41013 Sevilla).
In 2010, the L. macrostigma population in the Guadalquivir marshes was estimated at over 10.000 adults. The details of its occurrence are described and discussed.

(19211) NAGY, H.B., Z. LÁSZLÓ, S. KÖVÉR, N. SZÁLLASSY & G. DÉVAI, 2011. Population size effects on the behaviour of Libellula fulva (Odonata: Libellulidae) males, a five year study. *NWest. J. Zool.* 7(1): 39-46. – (Dept Hydrobiol., Univ. Debrecen, Egyetem tér 1, H-4032 Debrecen).
The hypothesis that population density alters ♂ territorial and mating behaviour in odon. was tested. The study was conducted at 2 small lowland creeks in E Hungary. At higher population densities the number of matings per ♂ decreased, but population size had no effect on the frequency of intraspecific fights.

(19212) NAKAMURA, T. & K. SHORT, 2011. Land-use and distribution of threatened wildlife in a city of Japan. *Landscape urban Plann.* 59: 1-15. – (First Author: Dept Ecol. Sci., Nat. Hist. Mus. & Inst., Chuou-ku, Aoba-chou 955-2, Chiba, 260-8682, JA).
From Chiba city, 15 odon. spp. are listed.

(19213) NEW, T.R., 2011. Strategic planning for invertebrate species conservation: how effective it is? *J. threatened Taxa* 3(9): 2033-2044. – (Dept Zool., Trobe Univ., Victoria-3086, AU).
Activities for invertebrate conservation range from single species programmes to those spanning habitats or landscapes, but at any scale are often largely isolated and not integrated effectively with other efforts. Problems of promoting invertebrate conservation and synergies by effective cooperation are discussed. The rationale of species-level conservation is outlined briefly, with suggestions of how some of the apparent limitations of this approach may be countered in ways that benefit a greater variety of invertebrate life. This essay is intended to promote debate on some of the complex issues involved and implies the need for careful and well-considered integration of individual conservation tactics into enhanced strategies to increase the benefits from the very limited resources devoted to invertebrate conservation.

(19214) OUTOMURO, D. & F. JOHANSSON, 2011. The effect of latitude, body size, and sexual selection on wing shape in a damselfly. *Biol. J. Linn. Soc.* 102: 263-274. – (Second Author: Dept Ecol. & Envir. Sci., Umeå Univ., S-90187 Umeå University).
Under natural selection, wing shape is expected to evolve to optimize flight performance. However, other selective factors besides flight performance may influence wing shape. One such factor could be sexual selection in wing sexual ornaments, which may lead to alternative variations in wing shape that are not necessarily related to flight performance. In the present study, wing shape variations were investigated in Calopteryx virgo meridionalis along a latitudinal gradient using geometric morphometrics. Both sexes show wing pigmentation, which is a known signal trait at intra- and interspecific levels. Wing shape differed between sexes and, within the same sex, the shape of the hindwing differed from the frontwing. Latitude and body size explained a high percentage of the variation in wing shape for ♀ fore- and hindwings, and ♂ forewings. In ♂ hindwings, wing pigmentation explained a high amount of the variation in wing shape. On the other hand, the variation in shape explained by pigmentation was very low in ♀♀. It is suggested that the conservative morphology of forewings is maintained by natural selection operating on flight performance, whereas the sex-specific differences in hindwings most likely could be explained by sexual selection. The observed sexual dimorphism in wing shape is likely a result of different sex-specific behaviours.

(19215) PAN, B.-Z., Z.-Y. WANG & K.-B. HE, 2011. Studies on assemblage characteristics of macro-

zoobenthos in the West river. *Acta hydrobiol. sin.* 35(5): 1-6. (Chin., with Engl. s.). – (First Author: St. Key Lab. Hydrosci. & Engin., Tsinghua Univ., Beijing-100084, China).
Lamelligomphus sp. and Megalogomphus sp. are listed; – the West river, China.

(19216) PATTERSON, R.J. & K.E. SMOKOROWSKI, 2011. Assessing the benefit of flow constraints on the drifting invertebrate community of a regulated river. *River Res. Applics* 27: 99-112. – (Second Author: Great Lakes Lab. Fish. & Aquat. Sci., Fisheries & Oceans Canada, 1219 Queen St. East, Sault Ste. Marie, ON, P6A 2E5, CA).
Among other taxa, the odon. were used in correspondence analysis of the cumulative amount of variation in invertebrate communities of the Magpie and Batchawana rivers (Ontario, Canada), but no other reference is made to the order and a list of the encountered spp. is not provided.

(19217) PAVITT, A., 2011. *The future of British Odonata. Determining temporal range dynamics from distribution patterns and dispersal*. M.Sc. thesis, Imperial Coll., London. vi + 69 pp. – (Author's address not stated).
Temporal range dynamics (range shift and change index), dispersal morphometrics (wing length, wing aspect ratio and thoracic volume), and distribution pattern (residual D) were investigated in British Odon. Initial analyses discounted range shift from this study due to the absence of evidence that the data were showing directional shift rather than non-directional expansion. A significant proportion of change index was described by combining the three dispersal traits and residual D. Species with increasing range size were those with long, broad wings, large thoracic volumes and a more aggregated distribution. This morphology is found in the Anisoptera, which showed a substantially greater increase in occupancy than the smaller and weaker Zygoptera. In a preliminary investigation into the extant representativeness of museum collections, there was found to be no differences in wing length with recently caught, fresh specimens.

(19218) PAWLOWSKI, J., 2011. Polish Carpathian mts as a refugium of the endangered species of invertebrates. *Roczn. bieszczadzkie* 19: 231-245. (Pol., with Engl. s.). – (Inst. Biol., Acad. Pomorska, Arciszewskiego 22/B, PO-76-200 Słupsk).
The occurrence of Nehalennia speciosa, Somatochlora alpestris and S. arctica is emphasized.

(19219) PIATTI, L. & F.L. SOUZA, 2011. Diet and resource partitioning among anurans in irrigated rice fields in Pantanal, Brazil. *Braz. J. Biol.* 71(3): 653-661. (With Port. s.). – (Second Author: Depto Biol., Cent. Cien. Biol., Univ. Fed. Mato Grosso do Sul, BR-79070-900 Campo Grande, MS).
The study was conducted (May 2007-March 2008) in Miranda, Mato Grosso do Sul. Odon. are reported in the diet of Leptodactylus chaquensis and L. podicipinus, but not in that of L. elenae and Rhinella bergi. The identified qualities were low, the Index of Relative Importance of Odon. is zero.

(19220) PILON, J.-G., 2011. Phylogénie des odonates: aperçu et réflexion. *Naturaliste can.* 135(2): 26-29. – (Dépt Sci. Biol., Univ. Montréal, C.P. 6128, Montréal, QC, H3C 3J7, CA).
The changes in generic affiliation of some Anisoptera occurring in Quebec (Canada), triggered by the results of the recent molecular studies, are pointed out.

(19221) PRUNIER, F., 2011. Contribution to the knowledge of the dragonflies (Insecta: Odonata) of the Cazorla, Segura y Las Villas mountain range (Jaén, southeastern Spain). *Boln Soc. ent. aragon.* 48: 472-474. (Span., with Engl. s.). – (Asoc. Educ. Ambiental El Bosque animado, c/Maestro Priego Lopéz 7/2D, ES-14004 Córdoba).
Records of 34 spp.

(19222) RADEMACHER, M., [Ed.], 2011. *Libellen in Kiesgruben und Steinbrüchen*. Inst. NatSchutz & Landschaftsanalyse, Freiburg i.Br. 96 pp. [Biodiversität in Abbaustätten, Vol. 1]. – (Alte Eppelheimer Str. 38/A, D-69115 Heidelberg).
A review of the gravel- and stone pit habitat structures in Germany and of their odon. fauna, with chapters on habitat protection and management.

(19223) RAJABI, H., M. MOGHADAMI & A. DARVIZEH, 2011. Investigation of microstructure, natural frequencies and vibration modes of dragonfly wing. *J. Bionic Engin.* 8: 165-173. – (First Author: Fac. Engineering, Islamic Azad Univ., Lahijan, Iran).
A thorough investigation on the microstructural and morphological aspects of libellulid wings was carried out using scanning electron microscope. Then,

based on this study and the previous reports, a precise 3-dimensional numerical model was developed and natural frequencies and vibration modes of dragonfly forewing were determined by finite composite structure. This bio-composite fabrication has some unique features and potential benefits. Furthermore, the numerical results show that the first natural frequency of dragonfly wings is about 168 Hz and bending is the predominant deformation mode in this stage. The accuracy of the present analysis is verified by comparison of calculated results with experimental data. This paper may be helpful for micro aerial vehicle design concerning dynamic response.

(19224) ŠÁCHA, D., 2011. Addition to the knowledge of dragonflies (Insecta: Odonata) of the Turiec region. *Folia faun. slovaca* 16(3): 151-155. (Slovak, with Engl. s.). – (Podtatranského 31, SK-031-01 Liptovský Mikuláš).
The records are presented of 25 spp. Coenagrion ornatum, Ophiogomphus cecilia and Leucorrhinia pectoralis are of regional interest; – N Slovakia.

(19225) ŠÁCHA, D. & M. BEDJANIČ, 2011. Rediscovery of the endangered Gomphus flavipes (Charpentier, 1825) in Slovenia after half a century (Odonata: Gomphidae). *Natura Sloveniae* 13(2): 37-43. (Slovene, with Engl. s.). – (Second Author: Kolodvorska 21/B, SI-2310 Slovenska Bistrica).
The sp. was for the first time recorded from Slovenia (Ljubljana area, VII) by B. Kiauta (1959, *Contribution to the knowledge of the odonate fauna of Slovenia*, M.Sci. thesis, Univ. Ljubljana) and was subsequently considered as probably extinct. Here, its rediscovery along the Mura side arm channel E of Petišovci (NE Slovenia, 15-VII-2011) is brought on record. Its known distribution in Slovenia and the neighbouring countries is presented and the need for preservation of its habitats is emphasized.

(19226) SÁNCHEZ-GUILLÉN, R.A., M. WELLENREUTHER, A. CORDERO-RIVERA & B. HANSSON, 2011. Introgression and rapid species turnover in sympatric damselfies. *Evol. Biol.* 2011, 11: 210, 17 pp. – http//www.biomedcentral.com/1471-2148/11/210 – (First Author: Dept Biol. & Anim. Ecol. E.U.E.T. Forestry, Vigo Univ., ES-36005 Pontevedra).
Studying contemporary hybridization increases the understanding of introgression, adaptation and, ultimately, speciation. The sister spp., Ischnura elegans and I. graellsii, are ecologically, morphologically and genetically similar and hybridize. Recently, I. elegans has colonized northern Spain, creating a broad sympatric region with I. graellsii. Here, a review is presented of the distribution of both spp. in Iberia and the degree of introgression of I. graellsii into I. elegans is evaluated using 6 microsatellite markers (442 individuals from 26 populations) and 5 mitochondrial genes in sympatric and allopatric localities. Furthermore, the effect of hybridization on the frequencies of the genetically controlled colour polymorphism in ♀♀ of both spp. is quantified. In a principal component analysis of the microsatellite data, the first 2 principal components summarised almost half (41%) of the total genetic variation. The first axis revealed a clear separation of I. graellsii and I. elegans populations, while the second axis separated I. elegans populations. Admixture analyses showed extensive hybridization and introgression in I. elegans populations, consistent with I. elegans backcrosses and occasional F1-hybrids, suggesting hybridization is on-going. More specifically, approximately 58% of the 166 Spanish I. elegans individuals were assigned to the backcross with I. graellsii. The mitochondrial genes held little genetic variation, and the most common haplotype was shared by the 2 spp. The results suggest rapid species turnover in sympatric regions in favour of I. elegans, corroborating previous findings that I. graellsii suffers a mating disadvantage in sympatry with I. elegans. Examination of morph frequency dynamics indicates that hybridization is likely to have important implications for the maintenance of multiple ♀ morphs, in particular during the initial period of hybridization.

(19227) SHARAPOVA, T.A., 2011. Zooperiphyton in the lakes of Tobol-Ishim forest-steppe (Tyumen oblast). *Vest. Ekol. Lesoved.* 2011(12): 119-123. (Russ., with Engl. s.). – (Inst. Problem Osvoeniya Severa, Siber. Branch, Russ. Acad. Sci., Tyumen, Russia).
Erythromma najas is recorded from freshwater lakes, having the mineralization below 1g/l; – Tyumen prov., Russia.

(19228) SHERRATT, T.N., C. HASSALL, R.A. LAIRD, D.J. THOMPSON & A. CORDERO-RIVERA, 2011. A comparative analysis of senescence in adult damselflies and dragonflies (Odonata). *J. evol. Biol.* 24: 810-822. – (First Author: Dept Biol., Carleton Univ., 1125 Colonel By Dr., Ottawa, ON,

K1S 5B6, CA).
Any population whose members are subject to extrinsic mortality should exhibit an increase in mortality with age. Nevertheless, the prevailing opinion is that populations of adult odon. do not exhibit such senescence. Here, this contention is challenged by fitting a range of demographic models to the data on which these earlier conclusions were based. It is shown that a model with an exponential increase in age-related mortality (Gompertz) generally provides a more parsimonious fit than alternative models including age-independent mortality, indicating that many odon. do indeed senesce. Controlling for phylogeny, a comparison of the daily mortality of 35 spp. indicates that although ♂ and ♀ mortalities are positively correlated, mortality tends to be higher in males of those spp. that exhibit territoriality. Hence, it is shown for the first time that territoriality may impose a survivorship cost on ♂♂, once the underlying phylogenetic relationships are accounted for.

(19229) SHIBAEVA, M.N., Y.P. MATVEEVA & Y.A. MASYUTKINA, 2011. Vidovoe raznoobrazie zoobentosa, bioindikaciya i ekologicheskoe sostoyanie ozer Kaliningradskoy oblasti – [Zoobenthos species diversity, bioindication and ecological composition in lakes of the Kaliningrad province]. *Vest. balt. fed. Univ. "I. Kant"* 2011(7): 91-96. – (Russ., with Engl. s.). – (Kaliningrad St. Techn. Univ., RUS-236000 Kaliningrad).
The zoobenthos composition in 12 lakes of the Kaliningrad (= Königsberg) province (Russia) was examined. 7 odon. spp. are listed.

(19230) SHIN, I.K., H.B. YI & Y.J. BAE, 2011. Colonization and community changes in benthic macroinvertebrates in Cheonggye stream, a restored downtown stream in Seoul, Korea. *J. Ecol. Field Biol.* 34(2): 175-191. – (Last Author: Lab. Anim. Syst. & Ecol., Div. Life Sci. & Biotechnol., Korea Univ., 1 Anam-dong, Seongbuk-gu, Seoul, 136-701, Korea)
Includes records of 9 odon. spp. from the Cheonggye, Gapyeong and Bukaksan streams.

(19231) SOLUK, D.A., D.S. ZERCHER & A.M. WORTHINGTON, 2011. Influence of roadways on patterns of mortality and flight behaviour of adult dragonflies near wetland areas. *Biol. Conserv.* 144: 1638-1643. – (Last Author: Dept Ecol. Evol. & Organismal Biol., Iowa St. Univ., Ames, IA 50010, USA).
The relatively low population size and long adult lifespan of Anisoptera makes them one of the few non-vertebrate groups likely to be impacted by direct roadway mortality. Here, adult dragonfly mortality and behaviour associated with roadways were studied for a number of spp. Daily mortality rates were estimated from standardized surveys along predetermined lengths of roads. Relative abundance and flight behaviour around and across roadways, a potentially important mortality factor, was determined from timed roadside observations. Observed flight behaviour provided no evidence that roads act as significant barriers to dispersal for adult dragonflies. Estimated mean number killed ranged from 2 to 35 dragonflies/km/day. Spp. varied greatly in their susceptibility to motor vehicles. Plathemis lydia and Libellula luctuosa made up more than 70% of the dead dragonflies collected, but only represented 14% and 31% of live dragonflies observed, respectively. The relatively low flight heights of these 2 spp. over roads (typically under 2 m) may explain their susceptibility; however, another common species (Tramea lacerata) also exhibited low flight height but did not experience high mortality, possibly because of its increased flight agility. Large numbers of adult dragonflies were killed over the entire flight season by motor vehicle collisions, exhibiting the need for assessing the long-term impact of roadway mortality on dragonfly population dynamics.

(19232) STANTON, D.J. & J.A. ALLCOCK, 2011. Habitat characteristics and odonate communities at selected sites used by Mortonagrion hirosei Asahina (Zygoptera: Coenagrionidae) in Hong Kong. *J. threatened Taxa* 3(12): 2242-2252. (With Chin. s.). – (Asia Ecol. Consultants, 127 Commercial Centre, Palm Springs, Yuen Long, Hong Kong, China).
This is a Near Threatened sp., recorded from several isolated sites across its entire range in E Asia. Previous research has indicated a strong affinity for brackish wetlands, including reedbeds and marshes, where potential predation or competition by other odon. is reduced. Results from surveys conducted in Hong Kong during 2009-2011 provide information on the habitat at a number of sites occupied by M. hirosei and report on the presence of populations in mangrove and mangrove-mosaic habitats as well as brackish marsh, often in association with a diversity of other odon. Information is also provided on two previously unreported sites in Hong Kong. These new findings indicate that the sp. uses a greater

diversity of habitats than the odonate-poor Phragmites reedbeds in which it has been well-studied in Japan, and consequently may be more widespread than previously supposed. Given that coastal habitats are threatened throughout its range, it is hoped this broader understanding of the species' habitat requirements will encourage others to explore other coastal sites and to aid in its conservation.

(19233) SUĆESKA, S. & J. KARAČIĆ, 2011. Balkan goldenring, Cordulegaster heros Theischinger, 1979 (Odonata: Cordulegastridae), a new species of Odonata in the fauna of Bosnia and Herzegovina. *Acta ent. serb.* 16(1/2): 1-7. – (Dept Biol., Fac. Sci., Univ. Sarajevo, Zmaja od Bosne 33-35, BA-71000 Sarajevo).
5 ♂ were collected in the Boračko Lake area (11-VII, 13-VIII, 29-VIII). The other 24 odon. spp. gathered there are also brought on record.

(19234) *SYMPOSIUM INTERNATIONALE ENTOMOFAUNISTICUM EUROPAE CENTRALIS*, 22, Varaždin, Croatia, 2011. ii+68 pp.
[Abstracts of odonatol. presentations]: *Dijkstra, K.-D.B., V.J. Kalkman & J.-P. Boudot*: The first atlas of European dragonflies and damselflies (Odonata) (p. 30); – *Franković, M., T. Bogdanović & R. Španić*: Does spatial and temporal distribution of records enable production of Atlas of dragonflies (Odonata) of Croatia? (pp. 30-31); – *Krčmar, S., T. Bogdanović, A. Mikuska, M. Jukić & Z. Zahirović*: Contribution to the knowledge of the insect fauna on the Bansko Hill area: horseflies (Diptera: Tabanidae) and dragonflies (Odonata) (pp. 58-59); – *Kulijer, D.*: Identifying important areas for conservation of Odonata in Bosnia and Herzegovina (p. 60); – *Španić, R., A. Cipčić, T. Bogdanović & M. Franković*: State of research of dragonflies (Odonata) of the Karlovac county, Croatia, with special reference to the Natura 2000 species (p. 64); – *Štih, A., T. Koren, M. Zadravec & D. Hlavati*: Contributions to the knowledge of the dragonfly fauna (Insecta, Odonata) of Vugrovec area, Zagreb (pp. 64-65).

(19235) THOMAS, M., 2011. *Untersuchungen zum Vorkommen der Helm-Azurjungfer Coenagrion mercuriale in einem Kalkflachmoor bei Köln (NRW) als Grundlage für Pflege und Entwicklung*. Bachelorarbeit, Hochschule Osnabrück, Osnabrück. 92 pp., Append. excl. (with Engl. s.). – (Author's address not stated).
The calcareous low level bog, Katharinenkammer nr Köln, is probably the last remaining primary C. mercuriale habitat in North Rhine-Westphalia (Germany). The occurrence, ecology and biology of the sp. are reported. Ceriagrion tenellum, Cordulegaster boltonii and Orthetrum coerulescens are among the other 16 spp. recorded from the locality.

(19236) TOMAZELLI, O., G.M.S. FRANCO, J.M. CASACA, A.C. MUNARINI & J. DAL MAGRO, 2011. Effect of the Melia azedarach L. on the predation of common carp fingerlings (Cyprinus carpio) by larvae of Neuraeschna (Odonata: Aeshnidae). *Braz. J. aquat. Sci. Technol.* 15(1): 19-25. (Port., with Engl. s.). – (First Author: Centro de Pesquisa para Agricultura familiar, C.P. 791, BR-89801-970 Chapecó, SC).
In the treatments with and without the introduction of the Melia extract, Neuraeschna larvae consumed on everage 5.2 and 7.2 carp fingerlings, respectively. A list of the other 9 gen. of aeshnid and libellulid larvae present in the pond is also provided.

(19237) VAN DAMME, K. & L. BANFIELD, 2011. Past and present human impacts on the biodiversity of Socotra island (Yemen): implications for future conservation. *Zool. Middle East* (Suppl) 3: 31-88. – (First Author: Dept Biol., Univ. Gent, Ledeganckstraat 35, B-9000 Gent).
The first comprehensive review is provided of potential human impact on Socotra before the 21st century and an updated discussion is presented of some of the principal threats to its biodiversity in recent times. As an example: Rhyothemis semihyalina was not recorded on Socotra since 1953 and it is probably locally extinct.

(19238) VENKATARAMAN, K., K. CHANDRA, P. BOHRA & G. SHARMA, 2011. *National Seminar on Biodiversity and Intangible Natural History & Exhibition on Biodiversity of Western India: Abstracts*. Natn. Mus. Nat. Hist., New Delhi & Zool. Surv. India, New Delhi. 82 pp. – (c/o Dr G. Sharma, Desert Regn. Cent., Zool. Surv. India, Jhalamand Pali Rd, Jodhpur-342005, Rajasthan, India).
[Odonatol. titles]: *Sharma, G. & M. Singh Choudhary*: Status of dragonflies and damselflies (Odonata) in North India, with a note on the swarms of Pantala flavescens (Fabricius) in Rajasthan, India (pp. 10-11); – *Sharma, G.*: Law to protect entomofauna in India (p. 12); – *Sivaperuman, C. & S. Kumar Shah*:

Species diversity and abundance of Odonata in Richie's Archipelago, Andaman & Nicobar Islands (pp. 17-18); – *Sharma, G.*: Diversity analysis studies of Odonata fauna in selected four lakes of Udaipur, Rajasthan (pp. 18-19); – Studies on the reproductive behaviour of Ischnura senegalensis (Rambur) (Odonata) at Rajsamand lake, Rajasthan, India (p. 20); – *Andrew, R.J., N. Thaokar & A.A. Dhamani*: Eggshell ultrastructure of the damselfly Ceriagrion coromandelianum (Zygoptera: Coenagrionidae) (p. 23); – *Bakare, S.S. & R.J. Andrew*: The genital ducts of the male dragonfly Anax guttatus (Anisoptera: Aeshnidae) (pp. 23-24); – *Andrew, R.J.*: Diversity in the egg shell ultrastructure of dragonflies (Odonata) (pp. 24-25); – *Sharma, G.*: Studies on the reproductive behaviour of Trithemis festiva (Rambur) at Fateh Sagar Lake, Udaipur, Rajasthan (pp. 26-27); – *Suri Babu, B. & G. Sharma*: On some aspects of territoriality and reproduction of Pseudagrion microcephalum (Rambur) (Zygoptera: Coenagrionidae) (p. 54); – *Sharma, G. & S.N. Dhadeech*: Comparative studies on the reproductive behaviour of damselfly Neurobasis c. chinensis (L.) at Ravi river, Chamba (H.P.) and of dragonfly Orthetrum s. sabina (Drury) at Kailana Lake, Jodhpur (Rajasthan) (pp. 64-65); – *Husain, A.*: Odonate species common to Indian Quatar and Uae deserts (p. 66); – *Singh, M.P.*: Species richness of predators in some arid production systems (p. 68); – *Sharma, K. & S. Bishnoi*: The line transect method for estimating densities of odonates in Anasager Lake (p. 69); – *Ojha, A.P., R. Kumawat, T. Kumar, V. Kumar & V. Vaishnav*: Preliminary studies on fauna of Desert National Park Jaisalmer (pp. 74-75).

(19239) WASCHER, M., 2011. De kleine vliegers – [The small flyers]. *Vakbl. Bos Natuur*, Suriname 2011(7): 22-23 (Dutch). – (Minstraat 15 bis, NL-3582 Utrecht).
A brief "introduction" to Surinam dragonflies, with reference to the potentially endangered endemic Micrathyria coropinae, and to the small Surinam odon. collection in the National Zoological Collection of Surinam (NZCS) at the Anton de Kom Univ. of Surinam. Dutch nicknames are proposed for all spp. mentioned in the text.

(19240) WINKLER, C., A. DREWS, T. BEHRENDS, A. BRUENS, M. HAACKS, K. JÖDICKE, F. ROBBELEN & K. VOSS, 2011. *Die Libellen Schleswig-Holsteins: Rote Liste*. Landesamt Landwirt., Umwelt & ländliche Räume Schleswig-Holstein, Flintbek. 85 pp. ISBN 978-3-937937-52-8. – (Publishers: Hamburger Chaussee 25, D-24220 Flintbek).
The status of 65 spp. is assessed; – Schleswig-Holstein, Germany.

(19241) YU, W.-y., Z.-h. LI, C. HUANG, Q. WANG & J. LI, 2011. Odonata fauna and its diversity in Jiangsu province of China. *Chin. J. Ecol.* 30(7): 1375-1381, (Chin., with Engl. s.). – (First Author: Inst. Appl. Ecol., Nanjing Xiaozhuang Univ., Nanjing-211171, China).
A commented and analysed list of 53 spp.

2012

(19242) BEDJANIČ, M., 2012. [On Aeshna viridis, Stratiotes aloides, Sympetrum flavipes and on other species in the "Far East" of Slovenia]. *Trdoživ* 1(1): 18-19. (Slovene). – (Kolodvorska 21/B, SI-2310 Slovenska Bistrica).
In Slovenia, A. viridis is known solely from 3 oxbows at Petišovci, Prekmurje (Kapitany Lap, Nagy Parlag and Csiko Legelo). In 2011, the population was estimated at 600 individuals. In the same area and in the same yr, Gomphus flavipes was rediscovered in Slovenia. The other spp. mentioned are Coenagrion pulchellum, Aeshna grandis, Brachytron pratense, Ophiogomphus cecilia, Epitheca bimaculata and Leucorrhinia pectoralis.

(19243) BORISOV, S.N., 2012. Migrant dragonflies in Middle Asia, 3: Pantala flavescens (Fabricius, 1798) (Odonata, Libellulidae). *Euroasian ent. J.* 11(1): 37-41. (With Russ. s.). – (Inst. Anim. Syst. & Ecol., Sib. Br. Russ. Acad. Sci., ul. Frunze 11, Novosibirsk-630091, Russia).
The spring generation is represented by immigrant individuals from the southern part of the range. Larval development lasts ca 8 months. After emergence, the adults can accumulate locally, but in the late summer or early autumn the second generation probably migrates in southerly direction. Directional flights were recorded in E Pamir during early August.

(19244) ENDERSBY, I., 2012. Watson and Theischinger: the etymology of the dragonfly (Insecta: Odonata) names which they published. *J. Proc. R. Soc. N.S.W.* 145 (443/444): 34-53. – (56 Looker Rd, Montmorency, VIC-3094, AU).
At present, the odon. fauna of Australia comprises

325 spp. in 114 gen. & sgen. J.A.L. Watson (1935--1993) and G. Theischinger (1940-) have been prolific publishers on the taxonomy of Australian Odon. since the late 1960s. Between them they have named ca 12% of the Australian gen. and 28% of the spp. The etymology of the scientific names of each of their taxa is given as quoted in the original description or deduced.

(19245) FUTAHASHI, R., R. KURITA, H. MANO & T. FUKATSU, 2012. Redox alters yellow dragonflies into red. *Proc. natn. Acad. Sci. USA*, early Edn 2012 (July): 6+3 pp.; – www.pnas.org/cgi/doi/10.1073/pnas.1207114109 – (First Author: Bioprod. Res. Inst., Natn. Inst. Advanced Indust. Sci. & Technol., Tsukuba, 305-8566, JA).
Body colour change associated with sexual maturation, so-called nuptial colouration, is commonly found in diverse vertebrates and invertebrates, and plays important roles for their reproductive success. In some dragonflies, whereas ♀♀ and young ♂♂ are yellowish in colour, aged ♂♂ turn vivid red upon sexual maturation. The ♂-specific colouration plays pivotal roles in, for example, mating and territoriality, but molecular basis of the sex-related transition in body colouration of the dragonflies has been poorly understood. Here the authors demonstrate for Crocothemis servilia, Sympetrum darwinianum and S. frequens that yellow/red colour changes in the dragonflies are regulated by redox states of epidermal ommochrome pigments. Ratios of reduced-form pigments to oxidized-form pigments were significantly higher in red mature ♂♂ than yellow ♀♀ and immature ♂♂. The ommochrome pigments extracted from the dragonflies changed colour according to redox conditions in virtro: from red to yellow in the presence of oxidant and from yellow to red in the presence of reductant. By injecting the reductant solution into live insects, the yellow-to-red colour change was experimentally reproduced in vivo in immature ♂♂ and mature ♀♀. Discontinuous yellow/red mosaicism was observed in body colouration of gynandromorphic dragonflies, suggesting a cell-autonomous regulation over the redox states of the ommochrome pigments. This finding extends the mechanical repertoire of pigment-based body colour change in animals, and highlights an impressively simple molecular mechanism that regulates an ecologically important colour trait. – [A Dutch summary has appeared in *NRC Handelsblad* (Wetenschap) 42(238): 16; issue of 16 July 2012.]

(19246) HEPENSTRICK, D., R. HOLDEREGGER & D. KELLER, 2012. Monitoring von Populationen der Helm-Azurjungfer Coenagrion mercuriale (Odonata: Coenagrionidae): was taugen zwei Begehungen pro Saison? *Entomo helvetica* 5: 139-145. (With Engl. & Fr. s's). – (First Author: ZHAW Inst. Umwelt & Natürliche Resourcen, Grüental, Postfach, CH-8820 Wädenswil).
Conservation measures of endangered Zygoptera are frequently accompanied by minimal monitoring. Such a monitoring comprises 2 censuses/yr, in which the number of imagines is determined. Here, for C. mercuriale it was evaluated whether minimal monitoring results in a reliable assessment of population size. Therefore, 2 different datasets, collected from the same populations on the Swiss Plateau (Oberaargau, canton Bern) in 2009, were studied. One dataset represented minimal monitoring with 2 censuses/yr. The other one presented a more profound estimation of real population sizes. For this latter dataset, counts were conducted on every day with suitable weather conditions during the reproductive phase. Statistical evaluation showed a high agreement of the 2 methods.. Therefore, it is concluded that even minimal monitoring results in a reliable assessment of population size. This result may also hold true for other zygopteran spp.

(19247) HOF, C., M. BRÄNDLE, D.M. DEHLING, M. MUNGUIA, R. BRANDL, M.B. ARAÚJO & C. RAHBEK, 2012. Habitat stability affects dispersal and the ability to track climate change. *Biol. Lett.* 2012 (Feb.): 25 pp., incl. electronic supplementary material. – DOI: 10.1098/rsbl.2012.0023 – (First Author: Cent. Macroecol., Evol. & Climate, Dept Biol., Univ. Copenhagen, Copenhagen, Denmark).
Habitat persistence should influence dispersal ability, selecting for stronger dispersal in habitats of lower temporal stability. As standing (lentic) freshwater habitats are on average less persistent over time than running (lotic) habitats, lentic spp. should show higher dispersal abilities than lotic spp. Assuming that climate is an important determinant of species distributions, it is hypothesized that lentic spp. should have distributions that are closer to equilibrium with current climate, and should more rapidly track climatic changes. These hypotheses are tested here using the 1988 and 2006 datasets containing all European odon. spp. Bioclimatic envelope models showed that lentic spp. were closer to climatic equilibrium than lotic spp. Furthermore, the models over-predicted

lotic spp. ranges more strongly than lentic spp. ranges, indicating that lentic spp. track climatic changes more rapidly than lotic spp. These results are consistent with the proposed hypothesis that habitat persistence affects the evolution of dispersal.

(19248) JUNG, K.-S., 2012. *The dragonflies and damselflies of Korea*. Illgongyuska, Seoul. 272 pp. Softcover, with flappers (15.0×20.8 cm). ISBN 978-89-97429-02-8. Price: 27.000,-- Won. – (Korean, with Engl. title & taxonomic nomenclature). – (Author: 6F, IBS Bldg, 1572-18 Seocho-dong, Seocho-ku, Seoul 137-070, Korea).
An extensively illustrated field guide for the adults, with phenology graphs and brief characterisation of each spp.

(19249) [KIAUTA, B.] SITAR, S., 2012. [The knight and dragonflies: Boštjan Kiauta (1937-)]. *In*: S. Sitar, *Slovenci, državljani sveta*, pp. 174-181. Kmečki Glas, Ljubljana. Hardcover (21.5×26.4 cm), ISBN 978-961-203-414-6. Price: Euro 26.-- net. (Slovene). – (Publishers: Železna c. 14, SI-1000 Ljubljana; – Author: Štihova 15, SI-1000 Ljubljana).
A biography of Dr B. Kiauta, with emphasis on his odonatol. and cytogenetics work and on his studies of invertebrate speciation in high mountain and cave habitats. Some biographic information on his consort, Mrs M.A.J.E. Kiauta-Brink, is also provided and a recent portrait (2012) is included. – (For a book review, see *Delo*, Ljubljana, issue of 2nd Oct. 2012, p. 13).

(19250) KIRAN, C.G. & D.V. RAJU, 2012. Checklist of Odonata of Kerala with their Malayalam names. *Malabur Trogon* 9(3): 31-35. – (First Author: Mayooram, Pulari Nagar, Thittamangalam, Kodunganoor, P.O. Thiruvananthapuram, Kerala, India).
A checklist of 147 spp., along with their Engl. and Malayalam names; – Kerala, S India.

(19251) KLECKA, J. & D.S. BOUKAL, 2012. Who eats whom in a pool? A comparative study of prey selectivity by predatory aquatic insect. *PLoS ONE* 7(6): 13 pp. e37741. DOI: 10.1371. – (First Author: Dept Ecosyst Biol., Univ. South Bohemia, České Budějovice, Czech Rep.).
10 larval and/or adult Coleoptera, Heteroptera and Odon. spp. were studied in multiple-choice predation experiments. The results suggest a highly interconnected food web, with several modules, in which similarly sized predators from the same microhabitat are likely to compete strongly for resources in the field. The results also imply that ontogenetic diet shifts are common but not general: individuals may or may not shift between food web modules during ontogeny.

(19252) MANCI, C.-O., 2012. *Dragonfly fauna (Insecta: Odonata) from Romania*. PhD thesis: Abstract. Univ. Cluj-Napo 62 pp. – (Author: Acad. Remus Radulet 13, bl. 119, ap. 7, RO-300281 Temisoara).
The subjects covered, methodology and the organization of text of the original (Romanian) dissertation are briefly outlined, distribution maps of 70 spp. (out of the 84 spp. ever recorded from Romania) are produced, some comments on the occurrence of some spp. are provided, and Author's personal odonatol. bibliography (20 titles) is appended.

(19253) NATUURHISTORISCH GENOOTSCHAP IN LIMBURG, 2012. De libellen bij uw tuinvijver. – [Dragonflies at your garden pond]. *Maas- en Niersbode* 2012(26): 19. (Dutch). – (NGL, Godsweederstraat 2, NL-6041 GH Roermond).
A call for dragonfly photographs from garden ponds in Limburg (The Netherlands), to be assessed in preparation of the regional odon. atlas.

(19254) *NORTH WALES DRAGONFLY NEWSLETTER* (ISSN none), Nos 60 (8 March), 61 [not available], 62 (20 May), 63 (21 June 2012). Produced by A. Brandon. – (Bryn Heilyn, Rowen, Conwy, LL32 8YT, UK).
News and events from across the vice counties of Anglesey, Merionethshire, Caernarvonshire, Denbighshire and Flintshire; – N Wales, UK.

(19255) OTT, J., 2012. *Dragonfly species in the rice fields of South-East Asia*. Ges. angewandte Landschaftsökologie & Umweltplanung, Trippstadt. 14 pp. ISBN none. – (L.U.P.O., Friedhofstr. 28, D-67705 Trippstadt).
A review of 23 spp. occurring commonly in the regional rice fields, each sp. with a brief descriptive note and statement on its habitat, most spp. with a portrait.

(19256) [OTT, J. / KUHN, M.] MÜLLER, J., 2012. Rückenwind für Libellen: einst rare Arten tauchen in der Pfalz häufiger auf. *Rheinpfalz*, issue of 6 June. – (c/o Dr J. Ott, Friedhofstr. 28, D-67705 Trippstadt).

General, on the Palatinate (W Germany) dragonflies, based on interviews with Dr J. Ott and M. Kuhn, in a regional newspaper.

(19257) PAUW, I., 2012. Juffers en libellen. – [Damselflies and dragonflies]. *Naar buiten* 15(2): 12-13. (Dutch. – (Publishers: Staatsbosbeheer, P.O. Box 1300, NL-3970 BH Driebergen).
General, with photographs of 8 spp., and reference to the 2 Dragonfly Reserves managed by the Netherlands State Forestry Service, viz. "Wyldemark" (FR) and "Kuinderbos" (FL), with respectively 34 and 45 spp.

(19258) *PROGRAM AND ABSTRACTS [of the] 2012 INTERNATIONAL CONGRESS OF ODONATOLOGY: "DRAGONFLIES IN THE CHANGING WORLD"*, Odawara, Japan; 28 July-2 Aug. 2012. 64 pp. – [Originally announced as the 2011 Congress; actually No. 19 in the original sequence of the Int. Symp./Congr. of Odonatol., and the first one organized jointly by SIO and WDA]. – (c/o K. Inoue, 5-9, Fuminosato 4-chome, Abeno-ku, Osaka, 545-0004, JA).
PUBLIC TALKS: *Nagahata, Y.*: Satoyama Landscape as habitat for dragonflies in Japan and Primorsky krai (Russia) (p. 10); – *Cordero Rivera, A.*: Reproduction without sex: the origin and status of Ischnura hastata in the Azores archipelago (p. 11); – *Samways, M.J.*: Future landscapes for conservation (pp. 12-14); – ORAL PRESENTATIONS & PLENARY TALKS: *Sasamoto, A. & R. Futahashi*: Revision of some Japanese odonate taxonomy inferred from the results of DNA analyses; the cases of Japanese Rhipidolestes species and Orthetrum melania and its allies (p. 15); – *Guan, Z., B.-P. Han & H.J. Dumont*: Atrocalopteryx melli on Hainan island, southern China (p. 16); – *Inoue, K. & R. Futahashi*: Thoracic pattern analysis of dragonflies in relation to molecular phylogeny (p. 17); – *Hayashi, F.*: Slight but significant modification of male genitalia in Calopterygidae (p. 18); – *Nagahata, Y.*: Effects of the tsunami disaster on Odonata assemblages (p. 19); – *Yamanaka, T., R. Futahashi, T. Kadoya, A. Sasamoto, Y. Morioka & T. Osawa*: Reconstruction of the past: effective exploitation of historical records of odonate species (p. 20); – *Dumont, H.J.*: Pyrrhosoma and its relatives (p. 21); – *Tsubaki, Y.*: Species interaction and character divergence (p. 22); – *Van Tol, J.*: The origin and evolution of forest damselflies (Odonata: Platystictidae) (p. 23); – *Rowe, R.J.*: Larvae: what we ought to know (p. 24); – *Koyama, T., T. Yokoyama & Y. Hirose*: Micropores in the vitelline layer of the eggs of the dragonfly Oligoaeschna pryeri: preliminary observation from the view point of oxygen uptake (p. 25); – *Combes, S., D. Rundle & J. Iwasaki*: Dragonfly predation flight dynamics and ecological insights (p. 26); – *Ishizawa, N.*: Ground effect of patrol flight of Anotogaster sieboldii males (p. 27); – *Kadoya, T. & I. Washitani*: Use of multiple habitat types with asymmetric dispersal affects patch occupancy of the damselfly Indolestes peregrinus in a fragmented landscape (p. 28); – *Sahlén, G.*: Dragonflies in managed forests: survival in those most adaptable? (p. 29); – *Sánchez-Guillén, R.A., D.I. Galicia-Mendoza & A. Cordero-Rivera*: Males learn to prefer gynochrome females in a polymorphic damselfly (p. 30); – *Naraoka, H.*: Reproductive behaviour of Mortonagrion hirosei Asahina, with special reference to intra-male sperm translocation just after copulation (Coenagrionidae) (p. 31); – *Ishizawa, N.*: Analysis of flight of Odonata by using a high-speed video camera in relation to responses of Odonata to a rotating dummy (p. 32); – POSTER PRESENTATIONS: *Tsuchiya, K. & F. Hayashi*: Left-handed sperm removal by male calopterygid damselflies (p. 33); – *Okayama, H. & Y. Tsubaki*: Light-oriented and shade-oriented microhabitat segregation in two closely related Mnais damselflies (p. 34); – *Karube, H. & S. Suwabe*: Nothing of Aciagrion migratum in Kanagawa prefecture, Japan (p. 35); – *Ohtsu, K.*: Sensitivity to some paddy field insecticide of Japanese common meadow hawk, Akiakane (Sympetrum frequens), larvae (p. 36); – *Feriwibisono, B. & N. Christian*: The diversity of Odonata (Insecta) in the water spring area of Wendit Malang Regency, East Java, Indonesia (p. 37); – *Tang, H.-C. & S.-L. Chen*: Dragonfly fauna of Taipei Zoo, Taipei, Taiwan (p. 38); – *Lee, I.-L., T.-L. Tung & K.-C. Wong*: An overview of the family Coenagrionidae (Odonata: Zygoptera) of Taiwan (p. 39); – *Tone, K. & T. Katoh*: Morphological and molecular difference between two species of the dragonfly genus Somatochlora in Hokkaido, Japan (p. 40); – *Sharma, G.*: Studies on the reproductive behaviour in selected species of damselflies and dragonflies (Odonata: Insecta) in India (p. 41); – *Rowe, R., R. Jones & R. Gilliver*: Dragonflies: a web-based system (p. 42); – ADDITIONAL ORAL PRESENTATIONS & PLENARY TALKS: *Samways, M.J.*: Loss of 60 million years of odonatological evolution narrowly averted by controlling invasive aliens (p. 43); – *Karube, H.*

& M. Fukui: Serious impact on the domestic dragonflies by invasive alien species: the case in Japan (p. 44); – *Kadoya, T., M. Akasaka, T. Aoki & N. Takamura*: Exploring an integrated biodiversity indicator for agricultural ponds (p. 45); – *Vivas-Santelitz, J.*: Odonata from the National Park Sierra de Perijá, Zulia, Venezuela: preliminary results (p. 46); – *Jinguji, H.*: Recent decline of rice-field dwelling Sympetrum spp.: verification of pesticide application impacts (p. 47); – *Ott, J.*: Dragonflies in rice fields of Southeast Asia: first results of the LEGATO project (p. 48); – *Watanabe, M.*: Mitigation project of the endangered brackish water damselfly Mortonagrion hirosei in estuarine landscape (p. 49); – *Ubukata, H. & Y. Kurauchi*: Comparison of efficiency and fidelity among sampling methods using different life stages for monitoring the odonate community of a large pond (p. 50); – *Sahlén, G.*: Causes of a changing species composition in Swedish lakes: agriculture, climate change and forestry acting together (p. 51); – *Ott, J.*: Dragonflies and global change: effects of climate change, land use change and alien invasive species on dragonflies (p. 52); – *Kiyoshi, T.*: Geographical variation in the wing morphology of the golden-ringed dragonfly, Anotogaster sieboldii (Selys, 1854), detected by landmark-based geometric morphometrics (p. 53); – *Tam, T.-W.*: Community structure of the dragonflies in Nankunshan Nature Reserve, Huizhou, Guangdong, China (p. 54); – *Futahashi, R.*: Mechanisms of color pattern formation and evolution in dragonflies (p. 55); – *Büsse, S., P. von Grumkow, S. Hummel, D.N. Shah, R.D.T. Shah, J. Li, K. Zhang, K. Yoshizawa, S. Wedmann & T. Hörnschemeyer*: Only one species of Epiophlebia?: first DNA analysis of all Epiophlebia species (Insecta: Odonata) (pp. 56-57); – *Wong, K.-C., T.-W. Chan & T.-Y. Chuang*: Taxonomic studies of the larval stage of Aeshnidae (Odonata) in Taiwan (p. 58); – *Inoue, K.*: Problems in the female dimorphism of Deielia phaon (p. 59); – WORKSHOPS: *Karube, H.*: How to make people become odonatologists (p. 60); – *Odajima, T., S. Odajima & K. Odajima*: Faunal research in Sagamihara city (p. 61); – *Ishii, M.*: Mark and re-capture research on Planaeschna milnei (p. 62); – *Suwabe, A.*: What did the four-year route census elucidate? : surveys in "Oyama-kôchi", Aikawa-machi, Kanagawa prefecture (p. 63); – *Machida, M. & M. Machida*: Conservation of dragonflies and their habitats in northern part of Minami-ashigara-shi, Kanagawa prefecture (p. 64).

(19259) SARKAR, A., 2012. Bioindicators of river Yamuna at Agra. *Int. J. Geol. Earth envir. Sci.* 2(1): 16-21. – (Dept Zool., Agra Coll., Agra, Uttar Pradesh-282002, India).
The macroinvertebrate samples were taken at 6 sites and during all seasons. The odon. were represented by Lestidae, Gomphidae and Aeshnidae (spp. not stated). At the 2 most heavily polluted sites, the lestids were missing.

(19260) SCHMIDT, E.[G.], 2012. Sicherung der Karpfenanzucht in Teichgut Hausdülmen, Naturschutzobjekt Karpfenstreckteiche. *Naturzeit im Münsterland* 9(2): 14-15. – (Coesfelderstr. 230, D-48249 Dülmen).
In North Rhine-Westphalia (NW Germany), the carp breeding ponds exist only in Hausdülmen, on the border between the districts of Coesfeld and Recklinghausen. The effect of this breeding on Sympetrum depressiusculum is emphasized. For details, see *Notul. odonatol.* 7: 5-10; 2008.

(19261) [SCHMIDT, E.G.] UNIVERSITÄT ESSEN, 2012. *Natur erleben im Ballungsraum: das Schlüpfen einer Kleinlibelle am Gartenteich*. Neugestaltung der Schautafel Univ. Essen. 6 pp. – (c/o Prof. Dr E.G. Schmidt, Coesfelder Str. 230, D-48249 Dülmen).
The garden pond habitat (2 × 1 m) and the events associated with ecdysis of a Lestes larva to adult are documented on 22 photographs.

(19262) *3rd SLOVENIAN ENTOMOLOGICAL SYMPOSIUM: BOOK OF ABSTRACTS*, 2012. (Edited by V. Klokočovnik). Slovenian Ent. Soc., Ljubljana & Univ. Maribor, Maribor. 65 pp. ISBN 978-961-6657-32-7. (Bilingual: Engl./Slovene). – (Available from: Dept Biol., Fac. Nat. Hist. & Mathem., Univ. Maribor, Koroska 160, SI-2000 Maribor).
[Odonatol. paper]: *Bedjanič, M.*: Diversity, distribution and threat status of dragonflies of Sri Lanka (Insecta: Odonata) (p. 12).

(19263) VINKO, D., 2012. Report of the Odonata Working Group. *In*: S. Borko, [Ed.], *Ekosistemi Jadrana: Makedonija, 2010*, pp. 10-16, Društ. Štud. Biol., Ljubljana. ISBN 978-961-93251-0-0. (Slovene, with Engl. s.). – (Slovenska 14, SI-1234 Mengeš).
A commented list of 32 spp. from 33 localities in SE Macedonia. Among the noteworthy records are those of Epallage fatime, Aeshna cyanea and Somatochlora flavomaculata.

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ASANA, J.J. & S. MAKINO, 1935. A comparative study of the chromosomes in the Indian dragonflies. *J. Fac. Sci. Hokkaido Univ*. (VI) 4: 67-86.

COWLEY, J., 1935. Remarks on the names of some odonates. *Entomologist* 26: 154-156.

FRASER, F.C., 1957. *A reclassification of the Odonata*. R. zool. Soc. N.S.W., Sydney.

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Odonatologica	Vol. 41	No. 4	pp. 309-384	December 1, 2012

CONTENTS

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