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17741. Abe, K.; Takahashi, D.; Hayakawa, K. (2019): Habitat use by the near-endangered dragonfly Aeshna mixta soneharai in reservoir ponds in Ueda, Nagano Prefecture, Japan. Japanese Journal of Conservation Ecology 24(2): 201-208. (in Japanese, with English summary) ["A. mixta soneharai mainly inhabits artificial reservoir ponds and is a natural monument protected by the regulations of Ueda, Nagano Prefecture, Japan. The habitat use of this species was investigated on the Shioda Plain, where there are many reservoir ponds. The percentage of shoreline covered by emergent water plants was higher in ponds with the dragonfly than in those without the dragonfly. In the generalised linear model, forest and apple orchard areas around the ponds positively contributed to the occurrence of this dragonfly, in addition to shoreline emergent plants. A route census at an orchard showed that A. m. soneharai used the orchard as habitat. These results are consistent with the reproductive ecology of the species, which uses emergent water plants as spawning sites. A. m. soneharai use forest habitat for sub-adult maturation. Similar to forest, sub-adult A. m. soneharai are likely to use orchards. This study suggests that restoration near reservoir ponds would be effective for the conservation of A. m. soneharai. When it is difficult to restore forest around ponds, apple orchards with economic potential might serve as an alternative habitat." (Authors)] Address: Abe, K., Graduate School of Horticulture, Chiba University, 648 Matsudo, Matsudo City, Chiba 271-8510, Japan. E-mail: ayxa5455@chiba-u.jp

17742. Adu, B.W.; Amusan, B.O.; Oke, T.O. (2019): Assessment of the water quality and Odonata assemblages in three waterbodies in Ilara-Mokin, south-western Nigeria. International Journal of Odonatology 22(2): 101-114. (in English) [„This study investigated the biological water quality and Odonata assemblages in three waterbodies in Ilara-Mokin, with the aim of determining the ecological integrity of the ecosystems. Sampling of Odonata specimens was carried out over April–August, 2017 between 9.00am and 4.00 pm under favourable conditions. Some physico-chemical parameters of the water such as dissolved oxygen, electrical conductivity, temperature, flow rate, pH, and water depth were also investigated. A total of 41 odonate species were recorded in this study and this was represented by 29 dragonfly and 12 damselfly species. These species are contained in seven families (Macromiidae, Gomphidae, Libellulidae, Calopterygidae, Coenagrionidae, Chlorocyphidae and Platycnemididae). The seven families were recorded at Aponmu River while Omifunfun River and Isokun River accounted for six and four families respectively. However, the highest number of individuals was collected at Isokun River. Libellulidae was the dominant family. Diversity indices revealed that Aponmu river was the richest in terms of species richness, diversity and taxa distribution (Shannon: 3.18, Simpson D: 0.95, Margalef: 7.38, evenness: 7.38, equitability: 0.93). Dragonfly Biotic Index (DBI) analysis indicated that Omifunfun River represented the best habitat condition in the study area while Isokun River was considered the most perturbed sampled site in the study area. Conservative efforts should be intensified to protect Omifunfun River in order to preserve all extant aquatic biota and other available resources therein." (Authors)] Address: Adu, B.W., Dept Biology, The Fed. Univ. Technology, Akure, Nigeria. E-mail: bwadu@futa.edu.ng

17743. Agboola, O.A.; Downs, C.T.; O'Brien, G. (2019): Macroinvertebrates as indicators of ecological conditions in the rivers of KwaZulu-Natal, South Africa. Ecological Indicators 106, November 2019, 105465: 10 pp. (in English) ["Highlights: • Macroinvertebrate multimetric assessment of ecological health was conducted. • 38 rivers in KwaZulu-Natal (KZN) Province, South Africa were assessed. • 9 of the selected metrics had strong correlations with environmental variables. • Increasing chemical deterioration along longitudinal gradients of rivers was found. • Macroinvertebrate community metrics could detect pollution and habitat degradation Abstract: This study examined the effectiveness of macroinvertebrate community-based multimetrics to assess the ecological health of 38 rivers in KwaZulu-Natal (KZN) Province, South Africa. The study area comprised of headwater to lowland rivers determined by their hydro-morphology. Of the 40 tested metrics, only 11 core metrics were

finally selected because of their ability to distinguish between reference and impaired sites, correlation strength with environmental variables and their reliability. Nine out of the selected metrics had strong correlations with environmental variables and these were total number of taxa, total number of Diptera taxa, total number of Plecoptera individuals, percentage of Ephemeroptera Plecoptera and Trichoptera taxa, percentage of Odonata taxa, total number of Trichoptera individuals, total number of Gastropoda individuals, total number of Oligochaeta individuals and total number of Coleoptera individuals. This study showed increasing chemical deterioration along longitudinal gradients of the rivers in KZN. We found that macroinvertebrate community metrics could detect nutrient pollution, organic pollution and physical habitat degradation in the rivers of KZN. We recommend more studies and validation of macroinvertebrate community-based metrics in the assessment of rivers in KZN, because they are relatively cheap and easy to use. The use of macroinvertebrate community metrics could be an effective alternative assessment method in the case of the lowland rivers where the lack of quality data often has negative impacts on the use of the biotic indices (South African Scoring System (SASS), Average Score Per Taxon (ASPT) and Macroinvertebrate Response Assessment Index (MIRAI))." (Authors)] Address: Agboola, O.A., School of Life Sciences, Univ. of KwaZulu-Natal, Private Bag X01, Scottsville, Pietermaritzburg 3209, South Africa

17744. Albab, A.U.; Leksono, A.S.; Yanuwiadi, B. (2019): Land use analysis with Odonata diversity and composition using the ArcGIS in Malang and Batu, East Java. Indonesian Journal of Environment and Sustainable Development 10(2): 73-83. (in English) ["This study aims to analyze the diversity, composition, and community structure of Odonata in the highland and lowland ecosystems and the type of lotic and lentic waters and analyze the description of land use and its relationship with diversity Odonata. There are 8 research locations namely Sumber Maron, Sumber Sirah, Sumber Taman, Bureng River, Umbul Gemulo, Arboretum, Coban Rais River, Coban Talun River. Measurement of biotic and abiotic factors in Odonata habitat and land use analysis using GPS and ArcGIS program ver 10.5, data analysis using the Shannon Wiener diversity index (H'), evenness index (E), Important Value Index (IVI), and similarity index Bray-Curtis. The results showed that the total number of Anisoptera in lotic aquatic ecosystems was 619 individuals divided into 13 species from 3 families, in the lenticular aquatic ecosystem was 533 individuals divided into 15 species from 3 families. The diversity of species in the highlands is higher than in the lowlands, and the diversity in the lentic ecosystem is higher than that of the lotic ecosystem and Odonata has its own tolerance to land use as their habitat especially with minimal human disturbances." (Authors)] Address: Albab, A.U., Dept. Biology, Univ. of Brawijaya, Veteran Malang, Malang 65145, Indonesia. E-mail: albertualbab@gmail.com

17745. Allgeier, S.; Friedrich, A.; Brühl, C.A. (2019): Mosquito control based on Bacillus thuringiensis israelensis (Bti) interrupts artificial wetland food chains. Science of The Total Environment 686: 1173-1184. (in English) ["Highlights: • Chironomidae are the non-target aquatic invertebrates most affected by Bti. • Development of newt larvae was indirectly affected in Bti treated food chains. • Aeshna cyanea decreased newt survival by 27% when Bti was applied. • Larval chironomids are a key component in the diet of aquatic predators. Abstract: The biocide Bacillus thuringiensis israelensis (Bti) has become the most commonly used larvicide to control mosquitoes in seasonal wetlands. Although Bti is considered non-toxic to most aquatic organisms, the non-biting chironomids show high susceptibilities towards Bti. As chironomids are a key element in wetland food webs, major declines in their abundance could lead to indirect effects that may be passed through aquatic and terrestrial food chains. We conducted two mesocosm experiments to address this hypothesis by assessing direct and indirect effects of Bti-modified availability of macroinvertebrate and zooplankton food resources on the predatory larvae of palmate and smooth newts (Lissotriton helveticus, Lissotriton vulgaris). We examined newt survival rates and dietary composition by means of stable isotope (δ15N and δ13C) analysis in the presence of Bti treatment and a predator (A. cyanea). We assessed palmate newts' body size at and time to metamorphosis while developing in Bti treated mesocosms. Chironomid larvae were the most severely affected aquatic invertebrates in all Bti treated food chains and experienced abundance reductions by 50 to 87%. Moreover, stable isotope analysis revealed that chironomids were preferred over other invertebrates and comprised the major part in newts' diet (56%) regardless of their availability. The dragonfly A. cyanea decreased survival of newt larvae by 27% in Bti treated mesocosms showing affected chironomid abundances. Increasing intraguild predation is most likely favored by the Bti-induced reduction of alternative prey such as chironomid larvae. The decreased food availability after Bti treatment led to slightly smaller L. helveticus metamorphs while their developmental time was not affected. Our findings highlight the crucial role of chironomids in the food webs of freshwater ecosystems. We are also emphasizing the importance of reconsidering human-induced indirect effects of mosquito control on valuable wetland ecosystems particularly in the context of worldwide amphibian and insect declines." (Authors)] Address: Allgeier, Stefanie, iES Landau, Institute for Environmental Sciences, Univ. of Koblenz-Landau, Fortstr. 7, 76829 Landau, Germany. E-mail: allgeier@uni-landau.de

17746. Aydin, D.D. (2019): Diyarbakir ili Odonata faunasi. MSc thesis, Dicle Üniversitesi, Fen Bilimleri Enstitüsü: 50 pp. (in Turkish, with English summary) ["In this study, 261 Odonata samples were collected in May, June, July and August 2017 surveys in Diyarbakir (Baglar, Kayapinar, Sur and Yenisehir). Among these samples, it was determined that they belong to 3 families, 5 genera and 7 species group taxa. The species and distribution areas of the Odonata order were investigated. The study was conducted in 2017 in

Diyarbakir. In the spring and summer, field studies were carried out once a week. As a result of the study, 7 species belonging to 3 families belonging to Odonata order were identified. Brachythemis fuscopalliata, Crocothemis erythraea, Orthetrum albistylum, O. brunneum, O. coerulescens, Platycnemis dealbata and Ischnura elegans. These species identified in the study are the first records for the Diyarbakir insect fauna." (Author)] Address: not stated

17747. Barmentlo, S.H.; Vriend, L.M.; van Grunsven, R.H. A.; Vijver, M.G. (2019): Environmental levels of neonicotinoids reduce prey consumption, mobility and emergence of the damselfly Ischnura elegans. Journal of Applied Ecology 56: 2034-2044. (in English) ["1. Freshwaters are among the most endangered ecosystems in the world as a result of anthropogenic interference such as pollution. Pollution in the form of neonicotinoids has been intensively studied, but data thus far is often conflicted by contrasting responses between laboratory and field experiments. In addition, toxicity data are scarce and contradictory for insects such as odonates and a potential risk to them may therefore be overlooked. 2. We investigate the potential risk of neonicotinoids to odonates by exposing nymphs of I. elegans to environmentally relevant concentrations of the neonicotinoid thiacloprid. We consider I. elegans as an indicator species for other Odonates as it is an abundant, widespread and eurytopic species. We analyse the effects of thiacloprid on multiple endpoints (survival, consumption, growth, molting, mobility and emergence), using cage-]experiments aswell as controlled field observations in naturally colonized experimental ditches. In addition, we assess sensitivity by either feeding the damselfly nymphs with lab-cultured prey or by letting them feed freely on natural aquatic invertebrates. 3. All sublethal endpoints of I. elegans are affected to some degree, and strongly depend on the food offered; free-feeding nymphs are more sensitive than culturefed nymphs. Environmental relevant concentrations of thiacloprid strongly reduce the emergence of I. elegans and this effect is more substantial in the natural populations compared to the caged damselflies. This is likely explained by exclusion of additional biotic pressures such as predation in the caged experiment. 4. Policy implications. Literature reports that one out of seven Odonates is threatened and 24% of the species have declining populations. Our observations show that current risks of neonicotinoids to Odonates are underestimated in laboratory experiments as the toxicity is governed by multiple biotic factors such as food quantity/quality and predation. Given the widespread abundance of I. elegans, the observed sensitivity to neonicotinoids and current population trends of this species, these results indicate neonicotinoids play a central role in the Odonate decline in general …. Conclusions: Clear effects of environmentally relevant concentrations of the neonicotinoid thiacloprid on the life cycle of I. elegans were shown. While no direct effects on mortality were observed at environmental relevant concentrations, all sublethal endpoints tested were affected. Our results strongly depended on the food offered, which indicates that current laboratory assessments performed at ad libitum food underestimate neonicotinoid toxicity in the actual environment. In addition, it appears that even our realistic exposure scenario using caged individuals in experimental ditches also underestimates toxicity as the emergence of natural populations was more strongly affected. This is likely because biotic pressures such as predation add to toxicity and these pressures are not included within the caged experiment nor the common laboratory approaches. Finally, our observed reduced fitness during the nymph stage and the strong decline in natural emergence can be indicative for neonicotinoids adding to the ongoing I. elegans decline." (Authors)] Address: Barmentlo, S.H., Inst. Environ. Sciences, Leiden Univ., Leiden, The Netherlands. E-mail: s.h.barmentlo@cml.leidenuniv.nl

17748. Basha, M. (2019): Microbial communities associated with dragonfly nymphs raised in varying concentrations of Amoxicillin. Undergraduate thesis, under the direction of Colin Jackson from Biological Sciences, The University of Mississippi: 27 pp. (in English) ["The bacteria on and within an organism make up that organism's microbiome. Given interest in the use of antibiotics in agriculture and the effect of microbes on human health, more studies are needed on the microbial community composition of different organisms and how it responds to antibiotic use. This study investigated changes in the amount of antibiotic resistant bacteria present in [the not identified] dragonfly nymphs exposed to differing concentrations of amoxicillin. Next generation sequencing of the 16S rRNA gene was used to identify cultures of these antibiotic resistant bacteria. Increasing the concentration of antibiotics the dragonfly nymphs were exposed to resulted in greater numbers of antibiotic resistant bacteria. From both amoxicillin + TSA and TSA-only plates, Proteobacteria was the most abundant phyla detected. Bacteroidetes was the major phyla detected in nymphs raised in 0% amoxicillin and plated on amoxicillin + TSA plates. There was a high relative proportion of members of the phylum Firmicutes in all samples plated on TSA plates. In the nymphs raised in 0% amoxicillin plated on TSA plates, members of Firmicutes made up the majority of their microbiome. This study demonstrates that the bacterial communities associated with dragonfly nymphs are affected by changes in the environment, and that exposure to antibiotic pollution likely increases the number of antibiotic resistant bacteria within aquatic insects." (Author)] Address: not stated

17749. Bechly, G. (2019): New fossil Odonata from the Upper Jurassic of Bavaria with a new fossil calibration point for Zygoptera. Palaeoentomology 2(6): 618-632. (in English) ["Three new taxa of odonates are described from the Upper Jurassic Solnhofen limestone from Eichstätt and Painten in Bavaria (Germany), including the first two genuine Zygoptera (Andrephlebia buergeri gen. et sp. nov. in fam. inc. sed. and Jurahemiphlebia haeckeli gen. et sp. nov. in Hemiphlebiidae) and a new taxon of Stenophlebioptera (Reschiostenophlebia koschnyi gen. et sp. nov. in Stenophlebiidae). With an age of about 152 million years, the holotype of Jurahemiphlebia from the Painten locality represents the oldest fossil record and thus a new calibration point for crown group Zygoptera, Lestoidea, and Hemiphlebiidae, and the oldest record for any living odonate family. Furthermore, the first relatively complete

specimen of the dragonfly Prohemeroscopus kuehnapfeli (Prohemeroscopidae) is described, which was previously known only from a pair of isolated hind wings. A revised diagnosis is provided for the species and genus." (Author)] Address: Bechly, G., Biol. Inst., 16310 NE 80th Street, Redmond, WA 98052, USA. E-mail: gbechly@biologicinstitute.org

17750. Black, K.L.; Fudge, D.; Jarvis, W.M.C.; Robinson, B.W. (2019): Functional plasticity in lamellar autotomy by larval damselflies in response to predatory larval dragonfly cues. Evolutionary Ecology 33(2): 257-272. (in English) ["Adaptive autotomy is the self-amputation of an appendage in response to external stimuli that benefits survival. Variation in the ease of appendage removal among populations suggests that autotomy performance is under selection, evolves, or is phenotypically plastic, although the latter has never been experimentally tested. We model an autotomy threshold that optimally balances how the benefits of surviving predator attack versus the costs of losing an appendage vary with predator presence. We test for functional plasticity in autotomy threshold in the caudal lamellae of Enallagma damselfly larvae [E. ebrium / E. hageni species-pair] by experimentally manipulating non-lethal cues from predatory dragonfly larvae. Predator cues lead to functional plastic responses in the form of smaller lamellar joints that required lower peak breaking force. This is the first experimental demonstration of functional plasticity in autotomy to cues from a grasping predator, a novel form of indirect predator effects on prey, realized through plasticity in morphological traits that govern the autotomy threshold. This supports the model of optimized autotomy performance and provides a novel explanation for variation in performance among populations under different predator conditions. Plastic autotomy responses that mitigate costs in the face of variation in mortality risks might be a form of inducible defense." (Authors)] Address: Black, Katherine, School of Geography & Earth Sciences, McMaster Univ., Hamilton, Canada

17751. Bora, A. (2019): A preliminary survey on odonate communities of Saipung Reserve Forest, Meghalaya, India. Biological Forum 11(2): 103-106. (in English) ["Odonate diversity of Saipung Reserve Forest was studied during 2016-2017. A total of 31 species belonging to 5 families, and 20 genera were recorded, which include 22 Anisoptera and 9 Zygoptera species. The genera Neurothemis, Orthetrum and Agriocnemis were found to be the most dominant contributing 3 species each. Being legally protected under state legislation, the forest faces high levels of human interference and anthropogenic activities. The study area therefore requires immense attention to be utilized as a prime site for odonate conservation of the state. The author hopes this study will provide the baseline information for future studies on odonates of the state and of north-east India." (Author)] Address: Bora, A., Meghalaya Biodiversity Board, Sylvan House, Lower Lachumiere, 793003 Shillong, Meghalaya, India

17752. Bos-Groenendijk, G.I. & Huskens, K. (2019): Dagvlinders, libellen en sprinkhanen in de Bruuk 2019. SNL-monitoring. Rapport VS2019.033, De Vlinderstichting, Wageningen: 24 pp. (in Dutch) [The study area consists of two objects: the Bruuk and the EVZ-Groesbeek, of which the Bruuk covers by far the largest surface. It was studied by De Vlinderstichting for butterflies, dragonflies and grasshoppers. The area covers 75 hectares, for which 4 field visits were made. The required coverage was achieved: 100% of the hectares were visited at least twice. … 14 species of dragonflies were observed. The species found are fairly common and the numbers are not high, but because only four small pools were involved, the species and numbers are in line with what would be expected based on the type of habitat. … Translated with www.DeepL.com/Translator (free version)] Address: De Vlinderstichting, Mennonietenweg 10, Postbus 506, 6700 AM Wageningen, The Netherlands. E-mail: info@vlinderstichting.nl

17753. Bota-Sierra, C.A.; Velasquez-Velez, M.I.; Realpe, E. (2019): A new species of Ischnura from the Colombian Central Andes (Odonata: Coenagrionidae). Odonatologica 48(1/2) 115-132. (in English) ["Eight species of Ischnura are known from Colombia; five of them are Andean endemics, four from the Eastern Cordillera and one from the Central Cordillera. Here, we describe a new species thus far known only from the Central Cordillera, Ischnura solitaria sp. nov. (Holotype ♂ from Belmira, Antioquia, Colombia, 6.711305°N, 75.628503°W, 2 615 m a.s.l.). Despite several searching efforts close to this locality, it has only been found at this wetlands site with few individuals. Due to the low population density of less than 50 individuals and the lack of action to protect the extremely small area where the species occurs, it matches the IUCN requirements to be considered ‚Critically Endangered'. A taxonomic key to males of Ischnura spp. in Colombia, a discussion on the type locality for the rare I. indivisa and the presence of I. fluviatilis in Colombia are included." (Authors)] Address: Velasquez-Velez, Maria Isabel, Lab. de Zoologia y Ecologia Acuatica LAZOEA, Depto de Ciencias Biologicas, Univ. los Andes, Bogota, Colombia. E-mail: mi.velasquez948@uniandes.edu.co

17754. Brown, T.A.; Fraker, M.E.; Ludsin, S.A. (2019): Space use of predatory larval dragonflies and tadpole prey in response to chemical cues of predation. The American Midland Naturalist 181(1): 53-63. (in Engish) ["Chemical cues are frequently a key source of information to aquatic organisms. Both predators (kairomones digestive metabolites) and prey (alarm and damage-released cues) may generate chemical cues during their interactions, and different cue types can have different informational values. How predators and prey use the information from chemical cues to make spatial movement decisions influences both their direct interaction rates and their interactions with other species. We measured the spatial response of predatory larval Anax junius and predator-naive green frog (Lithobates clamitans) tadpoles exposed to several types of chemical cues using experimental mesocosms. We found tadpoles only responded with spatial avoidance when exposed to both Anax kairomones and conspecific alarm cues together, whereas Anax did not exhibit consistent spatial responses to any cue type. Our results suggest tadpole prey selectively respond

to environmental information from chemical cues (possibly to minimize costly antipredator behavior due to responding to insufficient information or reflecting a need for associative learning). They also show predatory dragonflies may use non-chemical information to make space use decisions (possibly due to inability to detect the same chemical cues as tadpoles)." (Authors)] Address: Fraker, M: E-mail: mfraker2@gmail.com

17755. Buczyniski, P.; Goral, N.; Kusniers, A.; Polak, M.; Tarkowski, A.; Wrobel, A. (2019): New records of dragonflies (Odonata) from the Suwalki and Podlasie regions in north-eastern Poland. Odonatrix 15_10 (2019). 7 pp. (Polish, with English summary) [35 dragonfly spp. were recorded during an expedition to north-eastern Poland in the second half of July 2019. The most interesting ones were: Sympecma fusca, Erythromma viridulum, Aeshna affinis, A. subarctica, Cordulegaster boltonii, Somatochlora arctica, Orthetrum albistylum, Crocothemis erythraea and Leucorrhinia albifrons. These new data make an important contribution to the knowledge of the fauna of some valuable protected areas, e.g. the Mechacz Wielki Reserve, the Romincka Forest Landscape Park and the Suwalki Landscape Park. New sites of Cordulegaster boltonii in the Romincka Forest and in the valley of the River Czarna Hańcza lend support to the hypothesis regarding the existing of an island of the distribution area of this species in the Suwałki Region." (Authors)] Address: Buczynski, P., Dept of Zool., Maria Curie-Sklodowska University, Akademicka 19, PL-20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

17756. Buczynski, P.; Kusal, K.; Tonczyk, G.; Mikolajczuk, P.; Bobrek, M.; Bobrek, R.; Czechowski, P.; Dlugosz, I.; Dlugosz, M.; Dubicka, A.; Dumnicka, E.; Goc, M.; Golab, M.J.; Goral, N.; Hadwiczak, M.; Holnicki-Szulc, F.; Jedro, G.; Jirak-Leszczynska, A.; Kusal, B.; Milaczewska, E.; Miszta, A.; Morawski, M.; Raczynski, M.; Snigula, S.; Switala, M.; Tarkowski, A.; Sylwia Woniak, S. (2019): Dragonflies (Odonata) recorded in the Niepolomice Forest and in the valley of the River Raba during the 16th Symposium of the Odonatological Section of the Polish Entomological Society (June 20-23, 2019). Odonatrix 15_8 (2019): 16 pp. (Polish, with English summary) ["The Niepolomice Forest is the largest forest complex in the vicinity of Kraków. However, knowledge of its fauna is very incomplete and very out of date. This area was visited in late June 2019 during field sessions of the 16th National Odonatological Symposium of the Polish Entomological Society. 39 odonate spp. were recorded, including Leucorrhinia albifrons for the first time in the Province of Małopolska. This species richness is a function mainly of the natural and semi-natural habitats in the river valleys at the edge of the forest and of the anthropogenic water bodies in its interior (mainly fire protection ponds). Considering the location of the Niepolomice Forest and the diversity of its habitats, one can expect at least 50 spp. to occur here. Although these results are preliminary, they do permit an assessment of the condition of the habitats. The most valuable of the sites researched were the dystrophic Czarny Staw (Black Pond) in the centre of the forest and the adjacent peat bog. The tyrphophiles Leucorrhinia pectoralis and L. rubicunda were not found, although historical data indicate that they were present in the Niepołomice Forest 90-100 years ago; their non-discovery in 2019 may have been due to this research period being quite short and too late in the season. A short reconnaissance in the nearby valley of the River Raba yielded 18 species. Comparison of these data with data from the 1970s indicates that its fauna has changed: thermophilic spp. have appeared while some spp. typical of small permanent water bodies have probably disappeared." (Authors) Address: Buczynski, P., Uniwersytet Marii Curie-Skłodowskiej, Zakład Zoologii, ul. Akademicka 19, 20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

17757. Byrne, A. (2019): Constructing the global Irish woman traveller: Cynthia Longfield's scientific researches in South America, 1921-27. ABEI Journal - The Brazilian Journal of Irish Studies 21(2): 27-36. (in English) [" Irish-born Cynthia Longfield (1896-1991) became a leading entomologist after participating in three expeditions to South America in the 1920s. Working unpaid in the British Museum for 30 years, she catalogued Odonata (dragonflies and damselflies) from all over the world, published scientific papers, and collaborated with British, Irish and international scientists. While she made several other collecting expeditions to Africa and South-East Asia in the 1920s and 1930s, her early experiences of South American natural history are a crucial aspect of her formation as an internationally renowned scientist, and are an interesting chapter in the long history of Irish connections with the region. She was a migrant, a traveller, and a scientist, and was a person at once privileged by her class and denied basic equalities due to her gender. This article firstly considers her scientific career in the context of Irish women's migration in the first half of the twentieth century, before focusing on her three voyages to South America in 1921-7 and, finally, examining the ways in which her participation in the St George expedition– as one of just three women aboard ship – was reported in the Anglophone press." (Author)] Address: not stated

17758. Chelli, A.M.; Moulai, R. (2019): Diversity and ecological diagnosis of dragonflies of high-mountain temporary ponds in the Akfadou massif forest (Algeria). Zoology and Ecology 29(1). 10 pp. (in English) ["An Odonata study was carried out during six successive months at five high-mountain temporary ponds located in the Akfadou massif forest, northeast Algeria. These wetlands are virtually unexplored; some of these places are unknown to the general public. However, some of them appear to face numerous threats. The results obtained by this study gave us an idea of the odonatological settlement in this area. With 18 species of Odonata, this territory contains about 1/3 of the Algerian Odonata fauna, of which nine species reproduce in this forest massif. These study stations share in common three species, namely: Ischnura graellsii, Anax imperator, and Orthetrum cancellatum. These three species are omnipresent in more than 75% of the surveys and are distributed in a consistent way in various biotopes. The first species (I. graellsii)

together with Lestes virens and Chalcolestes viridis dominate in numbers, accounting for more than half of the total numbers recorded. The Shannon-Weaver index and Equitability index applied to odonatological fauna reveal that Agoulmime Ikher (AI) and Agoulmime Tala Guizane (AT) ponds are the best-structured and most stable in terms of stands in this massif." (Authors)] Address: Chelli, A.M., Laboratoire de Zoologie Appliquée et d'Ecophysiologie Animale, Faculté des Sciences de la Nature et de la Vie, Université de Bejaia, Alergia. Email: mchelli70@yahoo.fr

17759. Chovanec, A. (2019): Das Rhithron-Potamon-Konzept in der angewandten Odonatologie als Instrument zur Gewässertypisierung und -bewertung (Insecta: Odonata). Libellula Supplement 15: 35–61: 35-61. (in German, with English summary) ["The Rhithron-Potamon-Concept in applied Odonatology as an instrument for river typology and assessment – In the present paper, the increase in the number of Odonata species along the river continuum from the source to the lower course is documented. Analyses were done on the basis of valency points allocated to the biocenotic regions (crenon, rhithron, potamon) according to species-specific ecological requirements. A new procedure, based on this Rhithron-Potamon-Concept, for assessing the ecological status of the epipotamon zone of rivers is presented: Based on the allocated valency points, target reference species and accompanying reference species of first and second degree are defined with their respective weighted indicator potential. Differences between the status quo of the dragonfly fauna and the reference fauna are assessed in a new index, the Odonata-River-Zonation-Index. In 2018, this method was applied to the epipotamon of a river in Upper Austria, the River Naarn, in order to evaluate the effect of morphological rehabilitation measures." (Authors).] Address: Chovanec, A., Krotenbachgasse 68, 2345 Brunn am Gebirge, Austria. E-mail: andreas.chovanec@bmnt.gv.at

17760. Córdoba-Aguilar, A.; Rocha-Ortega, M. (2019): Damselfly (Odonata: Calopterygidae) population decline in an urbanizing watershed. Journal of Insect Science 19(3), 30. 6 pp. (In English) ["Reduction of terrestrial vegetation and degradation of water quality are among the factors driving insect population decline in growing cities. In this study, we investigated the extent of habitat deterioration, behavioral and physiological responses, and fitness of a Hetaerina americana population in a semitropical region in central Mexico. The study population was located in a riverine area that crosses a small urban area (Tehuixtla city). We related two habitat variables (tree/shrub covered area and numbers of wastewater outlets) to presumable damselfly responses (larval and adult abundance, duration of adults exposed directly to sunlight, lipid content and muscle mass, and egg survival) over the years 2002 and 2016. We detected a reduction in terrestrial vegetation cover, an increase in wastewater outlets, and a decrease in larval and adult abundance. Adults were more exposed to sunlight in 2016 than in 2002 and showed a reduced lipid content and muscle mass in 2016. Egg survival also decreased. Although correlative, these results suggest impairment of damselfly condition (via lipid and muscle reduction) and fitness as urbanization increases." (Authors) Address: Córdoba-Aguilar, A., Departamento de Ecología Evolutiva, Instituto de Ecología, Universidad Nacional Autónoma de México, Apdo. Postal 70-275, Ciudad Universitaria, 04510, México, D. F., México. E-mail: acordoba@ecologia.unam.mx

17761. Corso, A. (2019): Morphological variability of Cordulegaster trinacriae in Italy (Odonata: Cordulegastridae). Odonatologica 48(3/4): 175-201. (in English) ["This paper describes the most helpful features for field identification of C. trinacriae and the relevant morphological variability encountered. In C. trinacriae the yellow frons was without a dark horizontal marking in about 70 % of the sample or showed a barely patterned frons, while the remaining 30 % showed a more or less defined dark smudge, though always narrower and less bold than in C. boltonii. The percentage of unmarked versus marked frons was similar throughout the distributional range of C. trinacriae except in Sicily, where the unmarked yellow frons was much more common (87 %) and in Campania, where individuals with a dark mark on the frons were slightly more common than unmarked ones. In C. trinacriae the occipital triangle was almost always yellow with no or almost no dark markings, cleaner, and purer yellow than in C. boltonii from central Italy. The appendages of C. trinacriae always showed the characteristic form except for a few individuals, which might be hybrids. In C. boltonii they were found to be rather variable, especially on individuals from the southern part of its distributional range in central Italy, where intermediates and hybrids occur. Here, the appendages were sometimes similar (but not identical) to C. trinacriae, and therefore, this character is considered of limited use in the field. Individuals of C. trinacriae can be distinguished in areas of sympatry from intermediate C. boltonii and from hybrids when they show the following characters: i) unmarked yellow frons; ii) bright yellow, almost unmarked occipital triangle; ii) typical deeply notched lower appendages and long, sinuous upper appendages." (Author)] Address: Corso, A., MISC – Via Camastra, 10, 96100 Siracusa, Italy. E-mail: zoologywp@gmail.com

17762. Csercsa, A.; Krasznai-K., E.A.; Várbíró, G.; Szivák, I.; Tóth, M.; Árva, D.; Bódis, E.; Deák, C.; Mauchart, P.; Móra, A.; Eros, T.; Padisák, J.; Boda, P. (2019): Seasonal changes in relative contribution of environmental control and spatial structuring on different dispersal groups of stream macroinvertebrates. Hydrobiologia 828: 101-115. (in English) ["The role of environmental control and spatial structuring may vary depending on dispersal mode within a metacommunity in stream systems. However, as a result of high seasonal variation in environment conditions and phenological features, there might be considerable seasonal changes in the relative importance of structuring factors. The objective of this study was (i) to determine the relative role of structuring factors for aquatic macroinvertebrates with different dispersal mode groups which have seasonal variation in their dispersal capacity and (ii) to disentangle seasonal changes in metacommunity structuring. We sampled 50

stream sites of the Middle Danube Basin (Hungary) in spring and summer. We compared Distance–Decay Relationships between communities of different dispersal groups (including Odonata) and distance measures, and then we used variation partitioning analysis and Moran's eigenvector maps based on overland and watercourse distances to reveal structuring processes in both seasons. We found that metacommunities of all dispersal groups were influenced in both seasons mainly by environmental factors with additional impacts of the spatial components. Our findings suggest that metacommunities of taxa with temporally stable dispersal capacity have seasonally stable structuring processes, while the relative importance of structuring factors can vary seasonally in groups with seasonally changing dispersal capacity." (Authors)] Address: Csercsa, A., Dept of Limnology, Univ. of Pannonia, Egyetem u. 10, Veszprém 8200, Hungary. E-mail: csercsa.andras@okologia.mta.hu

17763. Dal Cortivo, M.; Roncen, N. (2019): Nuovi dati sulle Libellule della Provincia di Belluno (Insecta: Odonata). Bollettino del Museo Civico di Storia Naturale di Verona 43: 5-12. (in Italian, with English summary) ["Ten years after the previous work on the Odonata of the Province of Belluno (Dal Cortivo et al., 2009), here is presented an update of the checklist, with the reporting of a new species for the provincial territory, together with additional data for the distribution of some relevant species, for the majority of which only rather dated bibliographic records were previously known. The finding of Hemianax ephippiger (Burmeister, 1839) brings to 48 the number of species of Odonates reported for the Province of Belluno. Among these, in Dal Cortivo et al. (2009), 12 were present in the provincial territory thanks to the bibliographic reports of Marcuzzi (1956), Bucciarelli (1972, 1978) and Marcuzzi e Dalle Molle (1976), no longer confirmed later. It is therefore possible to confirm the presence in Belluno for 9 species. The first confirmed breeding site for Cordulegaster boltonii, in the territory of Belluno, inside the Vincheto di Celarda Nature Reserve is reported, where the presence of Aeshna mixta was also confirmed 37 years after the last report for the protected area." (Authors)] Address: Roncen, Nicola, Via Calcin, 25 – I-32032 Feltre (BL), Italy. E-mail: nic.roncen@libero.it

17764. De Knijf, G.; Ledegen, H.; Westra, T. (2019): Monitoringsprotocol Libellen. Versie – 2.0. Rap-porten van het Instituut voor Natuur- en Bosonderzoek 2019 (49). Instituut voor Natuur- en Bosonderzoek, Brussel. DOI: doi.org/10.-21436/inbor: 30 pp. (in Dutch, with English summary) ["This report describes the protocol for the dragonfly monitoring network in Flanders (Belgium). We list the species that need to be monitored and the methods to do so. Three easily observed species (Calopteryx virgo, Coenagrion pulchellum and Aeshna isoceles) are counted using dragonfly-transects. We explain how the sampling frame was compiled and how we applied a GRTS sampling procedure to determine the monitoring localities in the network. By means of site counts all populations will be counted from the following six rare species in Flanders: Coenagrion hastulatum, C. lunulatum, Somatochlora arctica, Leucorrhinia pectoralis, L. caudalis and Sympetrum depressiusculum. Adults of these species will be counted in an area around the breeding locality during one hour visit. Gomphus vulgatissimus and G. flavipes will be monitored by counting the exuviae along transects by the watercourse. Per species, we give the number of monitoring sites, the frequency with which and the period in which they need to be monitored. Finally, we refer to the data portal and the mobile application in which the collected records will be stored for further analysis and where the locations of the monitoring sites can be consulted." (Authors)] Address: Knijf, G. de, Inst. voor Natuurbehoud, Kliniekstraat 25, 1070 Brussel, Belgium. E-mail: geert.deknijf@inbo.be

17765. Deacon, C.; Samways, M.J.; Pryke, J.S. (2019): Aquatic insects decline in abundance and occupy low-quality artificial habitats to survive hydrological droughts. Freshwater Biology 64(9): 1643-1654. (in English) [" 1. Hydrological extremes have negative impacts on natural, agricultural, and urban landscapes and place substantial ecological pressure on freshwater habitats. However, the role of artificial freshwater habitats during hydrological drought is poorly understood. Insects make up much of total aquatic fauna (including Odonata) and lend themselves to understanding how drought impacts freshwater ecosystems. 2. Using the Greater Cape Floristic Region as an example of a drought-prone area, we determined the effects of a severe drought on a subset of insects occupying lentic habitats in terms of their species richness, diversity, and assemblage composition. Here, we: (1) calculated the percentage change in average precipitation between a record dry season and the last consistently wet decade; (2) identified the environmental variables driving aquatic insect species richness, diversity and composition; (3) identified the environmental differences between natural ponds and artificial reservoirs; (4) determined whether artificial reservoirs act as suitable habitats for focal taxa during drought; and (5) compared these results to other, pre-drought studies. 3. Environmental variables related to water chemistry and physical characteristics were drivers of species richness, diversity, and composition, yet vegetation cover remained a major driver. In terms of marginal vegetation cover, most artificial reservoirs did not resemble natural ponds, yet overall 38.4% of sampled aquatic insect species were shared between natural ponds and artificial reservoirs. We found some rare endemic species in artificial reservoirs that had never before been recorded in this habitat during wet years. When our drought findings were compared to earlier, wet years, species richness did not change significantly, although abundance was much lower during the drought year. 4. We postulate that historically, these aquatic insects, which have been through many ecological filters such as drought, must have sought low-quality habitats to survive water stress periods. Artificial reservoirs, being novel landscape features, cannot fully replace natural ponds, but enable some aquatic insects to survive drought. Artificial reservoirs can be attractive habitats to aquatic insects when they resemble natural ponds, with specific reference to their marginal vegetation characteristics." (Authors)] Address: Deacon, C., Dept Conserv. Ecol. & Entom., Stellenbosch Univ., South Africa. E-mail: charldeacon@sun.ac.za

17766. Dehane, H. (2019): Contribution à l'étude de l'inventaire des Odonates à Oued Djedi (Biskra). Mém. de Master, Univ. de Biskra: 53 pp. (in French, with Arabian and English summaries) ["The study of the number and distribution of Odonate gives us an important idea of the health and vitality of its environmental system. In this work we studied the dragonflies in Oued Djedi which passed from Sidi Khaled to the State of Biskra for a period of 9 months (from September 2018 to May 2019). We collected 7 species of dragonflies, including 7 Anisoptera. We have also studied the phenology of these species with a comparison with the model of Samraoui and Corbet (2000). And we did a study on their ecology (life cycle, flight period and reproduction).A comparison of our results with other studies carried out in different regions with different climates (different bioclimatic stages: humid, semihumid, semi-arid, arid and Saharan) shows the influence of climate on the distribution of Odonata species (low specific richness in our region of study)." (Author) Anax ephippiger, A. imperator, Orthetrum chrysostigma, Crocothemis erythreae, Sympetrum fonscolombii, Trithemis annulata, T. kirbyi] Address: not stated

17767. Delnat, V.; Tran, T.T.; Janssens, L.; Stoks, R. (2019): Daily temperature variation magnifies the toxicity of a mixture consisting of a chemical pesticide and a biopesticide in a vector mosquito? Science of The Total Environment 659: 33-40. (in English) ["Highlights: •The influence of temperature on the toxicity of mixtures has largely been ignored. •Mosquitoes were exposed to two pesticides under daily temperature variation (DTV). •DTV did not increase the toxicity of the single pesticides. •DTV increased the toxicity of the pesticide mixture. •DTV is omnipresent in nature, hence important for risk assessment of mixtures. Abstract: While many studies on the toxicity of pesticides looked at the effects of a higher mean temperature, effects of the realistic scenario of daily temperature variation are understudied. Moreover, despite the increasing interest for the toxicity of pesticide mixtures how this is influenced by temperature has been largely ignored. We tested whether daily temperature variation (DTV) magnifies the toxicity of two pesticides with a different mode of action, the organophosphate pesticide chlorpyrifos (CPF) and the biopesticide Bacillus thuringiensis var. israelensis (Bti), and of their mixture in the vector mosquito Culex pipiens. Single exposure to CPF and Bti increased mortality and reduced female development time, and exposure to CPF also increased female wing length. DTV was not lethal and did not change the toxicity of the individual pesticides. Yet, a key novel finding was that high DTV increased the mortality of the mixture by changing the interaction between both pesticides from additive to synergistic. Given that in nature daily temperature variation is omnipresent, this is important both for vector control and for ecological risk assessment. The higher toxicity of the mixture at high DTV compared to the typically used constant test temperatures in the laboratory urges caution when evaluating the environmental impact of pesticide mixtures." (Authors)] Address: Stoks, R., Lab. voor Aquatische Ecol., K.U.Leuven, De Beriotstraat 32, 3000 Leuven, Belgium. E-mail: robby.stoks@bio.kuleuven.ac.be

17768. Delpon, G.; Vogt-Schilb, H.; Munoz, F.; Richard, F.; Schatz, B. (2019): Diachronic variations in the distribution of butterflies and dragonflies linked to recent habitat changes in Western Europe. Insect Conservation and Diversity 12(1): 49-68. (in English) ["1. In the context of ongoing global changes, it is crucial to characterise and understand the species distribution dynamics. Despite increasing emphasis on insects' conservation issues, evidence of distribution changes in insects over a wide range of bioclimatic conditions remains scarce in Western Europe. 2. We examined distribution changes in butterflies and dragonflies in three European countries over 34 years, determined the influence of environmental changes, especially land cover, and assessed how of species ecology related to distinct responses. We analysed the diachronic variations by compiling occurrence data in France, Belgium, and Luxembourg for 240 butterfly and 95 dragonfly taxa. 3. We found contrasting patterns of diachronic variation in butterfly and dragonfly distributions, i.e. a strong gradient of disappearance for butterflies (from northwest to southeast with significantly higher rate of disappearance in urbanised and intensive agriculture areas of north-western France), whereas dragonflies showed lower and heterogeneous variation in occurrences, mainly related to alteration and regression of aquatic habitats. 4. Species responses appeared closely linked to their ecological preferences, with greater decline in habitat specialist species. Butterfly and dragonfly species are constrained by their dependence to host plant species and to aquatic habitats, respectively, and proved to convey complementary insights on the influence of environmental changes in biodiversity dynamics. 5. Conservation priorities were identified across species and administrative units, revealing that almost 80% of the declining taxa were not listed on the current protection lists. Our results support the need to update current French policies in terms of insect conservation." (Authors)] Address: Schatz, B., Centre d'Ecol. Fonctionnelle et Evolutive (CEFE), UMR CNRS 5175, 1919 route de Mende, 34293 Montpellier Cedex 5, France. E-mail: bertrand.schatz@cefe.cnrs.fr

17769. Devillers, P.; Lafontaine, R.-M.; Pasau, B.; Daems, V.; De Boeck, B.; Boeckx, A.; Boon, L.; Devillers-Terschuren, J. (2019): La friche Josaphat à Bruxelles, Schaerbeek. Un site urbain enclavé d'une richesse odonatologique exceptionnelle, 1-22. Les Naturalistes belges 100(3): 1-22. (in French, with English summary) ["The site of the former Schaerbeek-Josaphat railway station, locally referred to as friche Josaphat, is a post-industrial wasteland enclosed within the urban fabric of north-eastern Brussels. The inventories that have been conducted there for the last seven years reveal the exceptional richness of its dragonfly fauna. The factors of this richness are the juxtaposition of extensive feeding grounds harbouring a very diverse flora and entomofauna, and small aquatic environments particularly favourable to reproduction, as well as the location of the site in a plain which historically represented a migration and dispersal route for many organisms. Alteration of the site, and in particular a reduction in the area and the continuity of the feeding grounds, would make it lose its high biological, recreational and educational value. Preserved, the site has an

exceptional capacity to fulfill a number of complementary functions, essential for the promotion of the natural heritage in the city of tomorrow, haven of biodiversity, support of leisure activities, teaching and research facility." (Authors)] Address: Pierre Devillers, I.R.S.N.B. E-mail: sphegodes@-hotmail.com

17770. Díaz, A.; Rodríguez-Flores, D.J.; Rivera-Vega, A.G.; Cruz-Marcano, E.; Velázquez-Oliveras, I.M.; Villanueva-Cubero, L.A. (2019): Ecological factors and the distribution of adult Odonata in Puerto Rico. Life: The Excitement of Biology 7(3): 115-147. (in English) ["Puerto Rico's dragonfly and damselfly (Odonata) fauna, while abundant and diverse, is not well known, with the most recent surveys being over 80 years old. This work reports on sampling conducted on the island between late 2015 and early 2017. A total of 1,754 specimens in 19 genera and 30 species were collected, representing 61.2% of the species reported for the island. The number of individuals, number of genera, and number of species were higher on sites with a mean annual precipitation between 1300 mm and 1900 mm and a mean maximum annual temperature between 28.51ºC and 32.50ºC. Similarly, the number of individuals, number of genera, and number of species were higher on the woodland and shrubland cover types than on any of the other cover types. While some inferences can be made from our data, an increased collection effort in less sampled areas is necessary." (Authors)] Address: Díaz, A., Dept of Biology, University of Puerto Rico at Humacao, Call Box 8690, Humacao, Puerto Rico 00792. E-mail: ariel.diaz@upr.edu

17771. Do, Y.; Choi, M.B. (2019): Identifying adult dragonfly prey items using DNA barcoding and stable isotope analysis. Entomological Research 49(4): 165-171. (in English) ["Using DNA barcoding and stable isotope analysis, we identified adult dragonfly prey items from the fecal pellets of five dragonfly species — Nannophya pygmaea, Ischnura asiatica, Sympetrum eroticum, Orthetrum albistylum, and Anax parthenope — collected from a mountain bog located in south-eastern South Korea. Twelve operational taxonomic units (OTUs) belonging to four orders, Coleoptera, Diptera, Hemiptera, and Lepidoptera, were identified as prey items of adult dragonflies using DNA barcoding. Among prey items, Dipterans were the most common, comprising seven of the 10 OTUs. Based on stable isotope analysis, adult dragonflies and their nymphs were among the most numerous predators in both aquatic and terrestrial habitats. Additionally, dragonfly species with smaller adult sizes had different isotopic compositions to those reaching larger adult sizes. Both δ15N and δ13C values were significantly lower in smaller species than in larger species, indicating differences in their trophic levels and carbon sources." (Authors)] Address: Choi, M.B., School Applied Biosciences,College of Agriculture & Life Sciences, Kyungpook National Univ., Daegu, 41566, Republic of Korea. E-mail: kosinchoi@hanmail.net

17772. Drury, J.P.; Anderson, C.N.; Cabezas Castillo, M.B.; Fisher, J.; McEachin, S.; Grether, G.F. (2019): A general explanation for the persistence of reproductive interference. The American Naturalist 194(2): 268-275. (in English) ["Reproductive interference is widespread, despite the theoretical expectation that it should be eliminated by reproductive character displacement (RCD). A possible explanation is that females of sympatric species are too similar phenotypically for males to distinguish between them, resulting in a type of evolutionary dilemma or catch-22 in which reproductive interference persists because male mate recognition (MR) cannot evolve until female phenotypes diverge further, and vice versa. Here we illustrate and test this hypothesis with data on Hetaerina spp.. First, reproductive isolation owing to male MR breaks down with increasing interspecific similarity in female phenotypes. Second, comparing allopatric and sympatric populations yielded no evidence for RCD, suggesting that parallel divergence in female coloration and male MR in allopatry determines the level of reproductive isolation on secondary contact. Whenever reproductive isolation depends on male MR and females of sympatric species are phenotypically similar, the evolutionary catch-22 hypothesis offers an explanation for the persistence of reproductive interference." (Author)] Address: Drury, J.P. Dept of Biosciences, Durham Univ., Durham DH1 3LE, UK. E-mail: jonathan.p.drury@durham.ac.uk.

17773. Encinias, M. (2019): Reproductive character displacement in Calopteryx aequabilis and C. maculata: Improving species recognition through the divergence of male mating preferences. MSc. thesis, Department of Biology, James Madison University. VI + 25 pp. (in English) ["An ongoing evolutionary question is how co-occurring species maintain reproductive barriers when they are morphologically, behaviorally, and ecologically similar. Without geographic isolation, traits involved in species recognition may be under selection to enhance reproductive barriers. Exaggerated trait differences between species in sympatric populations may reflect selection to reduce misdirected mating between species, or reproductive character displacement. While this phenomenon is widely recognized as an important stage in the speciation process, there is little direct evidence of this process in nature. In two North American damselfly species, Calopteryx aequabilis and C. maculata, wing pigmentation is sexually dimorphic and also shows exaggerated differences in sympatric populations, particularly in female wings. When these species occur together, they occupy the same mating territories and the potential for misdirected mating is high. I hypothesize that female wing pigmentation is under selection for species recognition. In this study, I conducted male mate choice experiments in which I altered female wings by switching them within and between species. I measured male mating preference of both species in allopatric and sympatric populations by giving males a choice of two female types in a natural setting. Results supported the hypothesis that male preferences in sympatry diverge corresponding to female wing pigmentation. Sympatric C. aequabilis males preferred lighter-winged females, which significantly differed from the dark wing preferences of C. maculata males and allopatric C. aequabilis males. By manipulating the female wing pigmentation directly, I identified that this is the specific trait under selection. These findings

indicate that male mating preferences and female wing pigmentation diverged in sympatry to reduce misdirected mating of two closely related species." (Author)] Address: not stated

17774. Favret, C.; Normandin, E.; Cloutier, L. (2019): The Ouellet-Robert Entomological Collection: new electronic resources and perspectives. The Canadian Entomologist 151(4): 423-431. ["The Ouellet-Robert Entomological Collection (Université de Montréal, Montréal, Québec, Canada) is one of the largest and most important university collections in Canada. Although officially dedicated in 1984, much of the material in the collection dates to the 1930s and 1940s work of the Clerics of Saint Viator, Joseph Ouellet and Adrien Robert. In order to establish curatorial priorities, a collection profile was conducted grading eight criteria on a scale of 1–4, the most important being the conservation status of the specimens. A taxonomic inventory of the collection was also conducted, including the number of pinned specimens and alcohol vials, as well as a brief geographic description: whether or not at least one specimen of each species was collected in Québec or in North America. Finally, the specimen metadata for Odonata, Ephemeroptera, and Trichoptera were digitised. The inventory and specimen data can be downloaded at Canadensys.net. The collection houses approximately 1.5 million specimens, of which one-third are pinned, representing 20 000 species. Half of those species are recorded from Québec. The inventory and profile will be updated and the specimen database grown as portions of the collection are re-curated by personnel and volunteers, including the student-run organisation, “Club QMOR”." (Authors)] Address: Favret, C.: E-mail: ColinFavret@AphidNet.org

17775. Feindt, W. (2019): Conservation genomics: speciation of the Neotropical damselfly species Megaloprepus caerulatus – as a model for insect speciation in tropical rainforests. PhD thesis, Naturwissenschaftliche Fakultät der Gottfried Wilhelm Leibniz Universität Hannover: 270 pp. (in English, with German summary) ["The Neotropics are the most diverse ecoregion on earth. This remarkable biological diversity is associated with a great variety of speciation events through a complex geological history and habitat structure. Unfortunately, current changes to climate and habitat are erasing species at shocking rates. Consequently, modern evolutionary and ecological research must combine basic scientific research with state-of-the-art conservation genetics. In evolutionary biology, the study of speciation processes and how phenotypic novelties arise is of central interest. To approach this task in flying insects, the world’s largest living odonate species, Megaloprepus caerulatus (Odonata: Zygoptera, Pseudostigmatidae) is an excellent model organism. Megaloprepus caerulatus, which is the only representative of its genus, has a wide distributional range, from Mexico to Peru, but a narrow and conserved ecological niche. As a forest specialist Megaloprepus is dependent on intact old growth rain forests and water filled tree holes to maintain stable but small population sizes. In the last 150 years’ speciation processes in this genus were often under discussion. Because of small but regionally restricted morphological differences, the narrow ecological niche and the continuous conversion of the Neotropical ecoregion over time, speciation seems probable. The central focus of this thesis is to study the effects of paleogeography and ecological changes over time on speciation and phenotypic changes in Megaloprepus. Therefore, the population genetic structures and species boundaries are studied, and new insights into RNA-Sequencing (RNA-Seq) are presented as a foundation for large-scale comparative studies. A first study uses two mitochondrial sequence markers and a panel of microsatellites to investigate the population genetic structure of four Megaloprepus populations ranging from Mexico to Panama. The results showed relatively low genetic diversity within populations, but a strong differentiation among populations, supporting a speciation hypothesis. A comprehensive biogeographic study followed to falsify or verify this hypothesis. Samples from 11 museum collections and newly collected material across 14 populations from Mexico to Peru were analyzed simultaneously by applying phylogenetics, population genetics, species distribution models, niche comparisons and morphometrics. The results unambiguously proved the speciation hypothesis and revealed that the genus Megaloprepus consists of four species. Hereby the estimated diversification times suggest that the species splits were associated with the Andean uplift (10-8 Mya) and migration events following the closure of the Isthmus of Panama (3-2 Mya). The current distribution ranges of the four Megaloprepus species are restricted and can be explained by Pleistocene climatic variations as well as by today habitat structure. Even more interesting is the underlying mode of speciation. A strong niche similarity indicates phylogenetic niche conservatism and consequently sets the speciation mode to ‘non-adaptive’. However, currently observable divergence in wing patterns is an evolutionary novelty, which are most likely related to the environment but now under sexual selection. The final species description covers all four species, including wing coloration patterns, and variation of shape in the male secondary sexual organs and the prothorax. In a first attempt to approach the great variety of speciation patterns among odonates and to reveal the significantly different radiation patterns of the two sister genera Megaloprepus (4 species) and Mecistogaster (8 species), three mitochondrial genomes were generated as a valuable resource for future speciation and phylogenetic studies. Hereby, the focus will be on the genes involved oxidative phosphorylation. These results are a solid prerequisite to study speciation, the evolution of taxonomic/genomic key characters and radiation patterns within the family of the Pseudostigmatidae in detail. RNA-Seq is the method of choice for studying ecologically important organisms that lack genomic resources. Consequently, the transcriptome of a single larval thorax is presented. This transcriptome has a high level of completeness (93%) and provides the first reported wing gene sequences for odonates and supplies a valuable resource for future studies on wing coloration and wing development. Furthermore, because RNA-Seq is a frequently used method and for publication it is obligatory to upload raw reads to a public database, a submission guideline for

this process was developed. This guideline includes two all-inclusive protocols explaining all necessary steps to upload data to the National Center for Biotechnology Information (NCBI). RNA-Seq has already revolutionized the understanding of adaptation, speciation, phenotypic variability and population structures, and will continue to contribute to the understanding of evolution. Novel transcript identification and differential expression analyses (also in dependence of environmental conditions) are the most promising approaches. In a race against extinction, flying insects own a significant role for studying speciation and the genomic patterns of diversity." (Author)] Address: Feindt, Wiebke, ITZ, Ecology & Evolution, TiHo Hannover, Bünteweg 17d, 30559, Hannover, Germany. E-mail: feindt.wiebke@gmail.com

17776. Fischer, I.; Chovanec, A. (2019): Bewertung des libellen-ökologischen Zustands der Retentionsbecken an Wienfluss und Mauerbach (Wien) (Insecta: Odonata). Beiträge zur Entomofaunistik 20: 161-176. (in German, with English summary) ["Assessment of the ecological status of the retention basins at Wienfluss and Mauerbach. – In the present study the ecological status of seven retention basins at Wienfluss and Mauerbach (Austria, Vienna) has been assessed by an investigation of the dragonfly fauna. The assessment is based on a comparison of the rivertype-specific reference species with the status quo, considering the Rhithron-Potamon-Concept. For metarhithron waterbodies, such as the investigated water sections of Wienfluss and Mauerbach, three first-degree indicator species (Calopteryx virgo, Onychogomphus forcipatus and Cordulegaster heros) and four second-degree indicator species (Pyrrhosoma nymphula, Ophiogomphus cecilia, Orthetrum brunneum and O. coerulescens) have been defined. The investigations revealed 24 dragonfly species, 21 of them autochthonous, including species of the reference fauna and species characteristic of epipotamon waterbodies. Thus, the species inventory indicates a transitional zone between rhithron and potamon. Due to the autochthonous occurrence of first- and second-degree species, the retention basins have been classified as a “high” and “good ecological status”. (Authors)] Address: Fischer, Iris, Vogtgasse 5/2/18, 1140 Wien, Austria. E-Mail: Fischer.Iris89@gmx.at

17777. Fischer, S.; Winter, M.; Siegel, S.; Hering, J.; Boudot, J.-P. (2019): Odonata records from Lake Nasser, Egypt. Notulae odonatologicae 9(3): 116-123. (in English) ["Records of seven Odonata species, including one Zygoptera and six Anisoptera, from a boat trip on Lake Nasser, Egypt (from Aswan to Abu Simbel), are listed. The record of Selysiothemis nigra at two localities is the first ever sighting of this species at Lake Nasser, that of Paragomphus pumilio the first record in 35 years." (Authors)] Address: Fischer, S., Unter den Eichen la, 14641 Paulinenaue, Germany. E-mail: fischer@dda-web.de

17778. Fischer, S. (2019): Massenauftreten von Libellula quadrimaculata im Linumer Teichgebiet/Brandenburg (Odonata: Libellulidae). Libellula 38(1/2): 103-109. (in German, with English summary) ["Large concentrations of at least 5,500, 3,000 and 5,800 individuals of L. quadrimaculata were estimated on three days from the end of April to the beginning of May 2018 in the ponds of Linum in the Brandenburg federal state. In the early morning the dragonflies sat close together on reed stems. During the morning they dispersed in the pond area. As only part of the area was surveyed, the number of dragonflies could be much higher. It was not determined if the masses of L. quadrimaculata also emerged in the pond area. The estimated numbers are presumably the highest documented numbers of the species in the federal state of Brandenburg and maybe even in north-eastern Germany in the last 100 years." (Authors)] Address: Fischer, S., Unter den Eichen 1 a, 14641 Paulinenaue, Germany. E-mail: fischer@dda-web.de

17779. Flint, P. (2019): Observations of dragonflies (Odonata) from northern Cyprus. Libellula 38(1/2): 1-28. (in English, with German summary) ["During observations by two resident observers in northern Cyprus from June 2003 to September 2004 21 species of dragonfly were recorded. These included nine species not previously recorded from the north of the island, two of which, Erythromma viridulum and Trithemis arteriosa, were not previously mentioned in the island's literature; the former being a new species for the island. These observations were the first long-term observations on the island and were made during a period of rapid climate and habitat change; the results for Diplacodes lefebvrii, Anax parthenope, Orthetrum chrysostigma, O. sabina, Selysiothemis nigra, T. annulata, and T. arteriosa appear to reflect these environmental changes. Other significant records include: Lestes macrostigma (early records and migration/dispersal), Sympecma fusca (early records), Erythromma lindenii (recorded in only one previous year), A. ephippiger (mass migration) and Sympetrum striolatum (winter mating and ovipositing). Thirty two of the wetlands/water bodies we monitored were not mentioned in the earlier literature. The composition of the island's dragonfly fauna is discussed in relation to island biogeography, climate, and habitat diversity. It is suggested that the low species richness and the narrow species range are due to island biogeographical factors, particularly (in the case of the latter) to the island's poor habitat diversity; and that the surprising absence of endemics may be due to the island's aridity and recurrent drought year clusters. From this it is further suggested that the fauna may be relatively high in species which are quick to colonise and which have generalist habitat preferences." (Author)] Address: Flint, P., 14 Beechwood Avenue, Deal, Kent, CT14 9TD, UK. E-mail: peterflint123@btinternet.com

17780. Gabela-Flores, M.V.; Sanmartín-Villar, I.; Rivas-Torres, A.; Encalada, A.C.; Cordero-Rivera, A. (2019): Demography and territorial behaviour of three species of the genus Hetaerina along three tropical stream ecosystems (Odonata: Calopterygidae). Odonatologica 48(1/2): 79-100. (in English) "We studied the demography and territorial behaviour of three species of the damselfly genus Hetaerina, H. aurora, H. caja and H. fuscoguttata, along three lowland streams in western Ecuador: Tabuga, Buenaventura and

Moromoro. We measured recapture rates of marked individuals and estimated survival, longevity, sex ratio and population size of the most abundant species at each location. We found male-biased sex ratios in two out of three populations and high recapture rates of H. fuscoguttata on the Tabuga river and H. aurora at the Moromoro stream. We recorded male territorial behaviour and reproductive behaviour of the three Hetaerina species by direct observation. At all study sites we recorded few reproductive events. Conversely, we registered a high number of male-male agonistic interactions confirming that all species behaved in a territorial manner. We identified three clear behavioural strategies in males: territoriality, site fidelity and non-territoriality. However, we found no phenotypic correlates of males' strategies." (Authors)] Address: Gabela-Flores, María Virginia, Laboratorio de Ecología Acuática, Instituto BIOSFERA, Univ. San Francisco de Quito, Diego de Robles y Vía Interoceánica, Campus Cumbayá, 17-12-841, Quito, Ecuador

17781. Gallesi, M.M.; Sacchi, R. (2019): Voltinism and larval population structure of Calopteryx splendens (Odonata: Calopterygidae) in the Po Valley. International Journal of Odonatology 22(1): 21-30. (in English) ["Adaptation of life-history traits is an important factor for the success of insects. Voltinism is a feature that descends from several life-history traits and, given that the latter depend on the specific environment of growth, voltinism can vary between populations across latitudes or habitats. In addition, some insects, like many odonates, have developed different patterns of voltinism within the same population, due to mechanisms of cohort splitting. C. splendens is a widespread damselfly in Europe that has been extensively studied regarding its evolutionary ecology, but detailed studies about its voltinism are relatively scarce and confined to the central and northern areas of Europe. So we investigated the voltinism and larval development of a population of C. splendens both by captive rearing and in the field in Northern Italy, the southernmost area in which its voltinism has been studied so far. We found an earlier start of larval growth, with respect to previous studies. Additionally, the head-width of larvae of the same instar decreased with the cohort ageing. Finally, the results are consistent with a two-groups emerging pattern that may support partial semivoltinism or partial bivoltinism of C. splendens in Northern Italy." (Authors)] Address: Gallesi, M.M., Dipto di Scienze della Terra e dell'Ambiente, Lab. di Acque Interne, Univ. degli Studi di Pavia, Pavia, Italy

17782. Garfield, E.; Kang, T.; Kolding, I.; Mayo, J. (2019): Odonate communities across a desert development gradient. CEC Research | https://doi.org/10.21973/N35W97 Fall 2019: 9 pp. (in English) ["Deserts are changing rapidly due to urbanization and climate change. Although human development can destroy habitat, it can also create novel environments that organisms may use or adapt to. In this study we compared artificial ponds to natural oases to determine whether artificial water sources differ in the odonate communities they support, as odonate species are indicators of aquatic habitat quality. We found that odonate community composition differed markedly based on water source characteristics such as size, human presence, aquatic plant presence, and substrate. This clear difference in odonate species composition indicates that disturbed water sources support different communities than natural springs and oases. Our results may be used to inform development and management of artificial water sources to promote biodiversity in desert ecosystems." (Authors)] Address: Garfield, Ezra, University of California, Berkeley, USA

17783. Garrouste, R.; Nel, A. (2019): Alaskan Palaeogene insects: a challenge for a better knowledge of the Beringian 'route' (Odonata: Aeshnidae, Dysagrionidae). Journal of Systematic Palaeontology 17(22): 1939-1946. (in English) ["Four 'routes', Beringian, De Geer, Thulean and Turgai Strait, are currently considered to explain Cenozoic continental interchanges between Eurasia and North America. These 'routes' had a crucial importance for vertebrates and insects. While vertebrates are not infrequent in these zones, there is very little direct evidence of insects to date the migrations and justify particular 'routes'. A 'route' is generally chosen on the basis of indirect evidence, such as molecular dating of clades. Alaska, on the Beringian 'route', is especially poor in fossil insects. Here we describe the first two Paleocene–Eocene insects from the Chickaloon Formation in Alaska, viz. Basiaeschna alaskaensis sp. nov., the first accurate fossil of this extant Nearctic aeshnid genus, and a representative of the extinct damselfly family Dysagrionidae, distributed in the Palaeogene of Eurasia and North America. These fossils provide direct evidence of the role of Beringia as a land bridge for insects during the Palaeogene. They are also evidence for a warm temperate climate in Alaska during this period of global warmth." (Authors)] Address: Nel, A., Lab. Ent.. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: anel@cimrs1.mnhn.fr

17784. Geene, P. (2019): Observations during emergence of Epitheca bimaculata, 8-11 May 2017. Brachytron 20(1): 26-31. (in Dutch, with English summary) ["In spring 2017 I studied the emergence of E. bimaculata at the Etangs de la Forge, France. Based on my observations, I found that the species prefers Large Nettle (Urtica dioica) for emerging as the leaves hide them from the view of birds and at the same time provide enough space for unfolding the wings during ecdysis." (Author)] Address: Geene, P.: E-mail: famgeene-@zeelandnet.nl

17785. Godwin, C.M.; Barclay, R.M.R.; Smits, J.E.G. (2019): Tree Swallow (Tachycineta bicolor) nest success and nestling growth near oilsands mining operations in Northeastern Alberta. Journal of Zoology 97(6): 547-557. (in English) ["Industrial development and contaminant exposure may affect reproductive success and food quality for birds. Tree swallows (Tachycineta bicolor (Vieillot, 1808)) nesting near oilsands development in northern Alberta potentially experience elevated environmental stressors that could influence reproduction. We measured reproductive and growth endpoints in tree swallows, predicting reduced reproductive success and nestling growth near oilsands operations compared to reference sites. We also identified

the invertebrate prey in the stomach contents of nestlings to understand variability in the diet and its potential effect on growth and survival of nestlings. From 2012 to 2015, clutch initiation varied among years but was not influenced by proximity to oilsands operations. Hatching and fledging success decreased in response to increased precipitation, regardless of location. Measurements of nestling growth reflected the variation associated with nestling sex and possibly asynchronous hatching. The composition of the nestling diet was significantly different; birds near oil sands development consumed Odonata, while birds at reference sites consumed Ephemeroptera. Nestlings from all sites consumed relatively high quantities of terrestrial insects. Our results demonstrate that factors such as weather conditions, diet, hatching order, and nestling sex are important when interpreting the potential effects of oilsands development on nest success and nestling growth." (Authors)] Address: Godwin, Christine, 324 Killdeer Way, Fort McMurray, AB T9K 0R3, Canada. E-mail: cgodwin@owlmoon.ca

17786. Goertzen, D.; Suhling, F. (2019): Urbanization versus other land use: Diverging effects on dragonfly communities in Germany. Biodiversity and Distributions 25: 38-47. (in English) ["Aim: Land use change, such as urbanization and intensification of agricultural practices, poses major threats for biodiversity. We examined whether the composition of freshwater species differs between landscapes dominated by urban, agricultural or more natural structures in a region with a long history of landscape transformation. We determined the differences and characteristics of the dragonfly fauna in relation to major land use categories. We particularly focused on urban land use, as it generally induces a high level of landscape transformation. Location: Germany. Methods: We used distribution data of dragonflies derived from a citizen science database, which was compiled for the German distribution atlas. To analyse whether different land use categories are associated with distinct species compositions, we performed the classification method random forest. Results: Based on dragonfly abundance per grid cell, we identified distinct land use-related assemblages that were separated by two gradients, that is, the level of transformation and a gradient from open land to forest. In particular, urban landscapes possessed a distinct species composition with specific species, all of which were opportunistic and supported by warm climate. They also comprised significantly higher a-diversity than intensive agricultural landscapes. Similar values of ?-diversity over all land use categories implied a countrywide homogenized dragonfly fauna, which is probably caused by historic land use. Main conclusions: Our results indicate that land use is a relevant driver for the composition of freshwater species at the landscape scale. Urban landscapes maintain species diversity better than agricultural landscapes, but they modify the species composition. Additional research on the effects of land use change is required to understand species responses and predict future distributions in a changing world in order to plan sustainable conservation strategies." (Authors)] Address: Goertzen, Diana, Institute of Geoecology, Technische Universität Braunschweig, Langer Kamp 19c, 38106 Braunschweig, Germany. E-mail: d.goertzen@tu-braunschweig.de

17787. Gomes Pereira, D.F.; Barbosa de Oliveira Junior, J.M.; Juen, L. (2019): Environmental changes promote larger species of Odonata (Insecta) in Amazonian streams. Ecological Indicators 98: 179-192. (in English) ["Highlights: • The relationship between environmental factors and functional characters of Odonata is tested. • Type of oviposition and thorax width are the most affected functional characters. • The more impactful environmental factors for the Odonata were habitat integrity and macrophytes cover. Abstract: Species occurrence can be affected by the availability of environments that fit within the limits of variation of its niche and by interaction with other species. Modifications in the environment, especially those caused by mankind, are considered the leading cause for species extinction. Such a response from the species is not random, with patterns that can follow functionality and/or morphology of each taxa. In this context, the objective of this study was to assess how environmental factors affect adult Odonata species, testing the hypotheses: a) that the environment acts as a filter upon the species by means of facilitating or excluding specific characteristics and b) that because of the order's requirements for thermoregulation and reproduction, thorax width and oviposition type are the variables most affected in the group. A total of 97 streams were sampled in eastern Amazonia, distributed along a gradient of different states of preservation, from completely preserved to heavily impacted by plantations and livestock. Six functional characteristics and seven environmental descriptors were selected, and to assess their relationships, a combination of Fourth Corner and RLQ analysis was used. The Habitat Integrity Index was the descriptor with the biggest impact on the Odonata community, presenting a negative correlation with wing width, thorax width and exophytic oviposition, and a positive correlation with endophytic oviposition. Macrophyte cover was the next most relevant environmental descriptor, showing a negative correlation with abdomen length, and positive correlation with thorax width and exophytic oviposition. The results show that poorly preserved environments favour the occurrence of organisms with a wider thorax and the substitution of endophytic oviposition with the exophytic type. Since changes to the environment do not usually alter Odonata richness but rather the composition, these results show a favouritism for groups with mentioned characteristics, such as Libellulidae, to the detriment of other groups (especially Zygoptera), which can result in community homogeneity and both biodiversity and functional loss. The maintenance of well-preserved environments is therefore indispensable in assuring Odonata biodiversity, as well as the best way to preserve the different behavioural and ecophysiological groups in the order. The Odonata community's response, directed through its morphological and behavioural characteristics, sheds light on ecological patterns, and thus the addition of oviposition habits in conservation measures aimed at preserving the order can render them more adequate, as this is a critical aspect of population maintenance and colonization of new sites." (Authors)]

Address: Gomes Pereira, D.F., Programa de Pós-graduação em Ecologia, Univ. Federal do Pará/Embrapa Oriental, Caixa Postal 399, CEP 66040-170 Belém, Pará, Brazil

17788. Graham, S.R. (2019): Do Enallagma exsulans from streams and lakes show patterns of divergence? M.Sc. thesis, University of Arkansas. 53 pp. (in English) ["Divergent selection across heterogenous environments could lead to adaptive divergence in populations resulting in potential local adaption. These populations have phenotypic differences that are fitness related and make native individuals more fit than non-native individuals. My research focuses on a species of damselfly, Enallagma exsulans, to explore local adaptation and morphological differences as a result of divergent selection or plasticity. My first study explored potential local adaptation of wild caught stream and lake E. exsulans using a reciprocal transplant design, a classic approach for this objective. The stream and lake sites chosen were on a small spatial scale allowing for potential gene flow among populations, a process that could hinder local adaptation. In the second part of my research, I reared stream and lake E. exsulans in a common garden and transplanted them into stream and lake environments. I expected to find that native individuals had higher fitness, measured as growth rates, than non-native individuals indicating local adaptation. Unfortunately, I was unable to collect any results due to a storm damaging my experimental set-up. There are still important questions about local adaptation occurring at small spatial scales with potential for gene flow, and if plasticity is another mechanism for coping with changing environments. In the next part of my study, I used individuals raised in a common garden environment for a small scale mesocosm reciprocal transplant replicating the field study. All larvae lost body mass, no matter the origin of the individual or the condition under which it was tested. I also completed geometric morphometric analyses of wild caught individuals from both stream and lake environments and common garden reared individuals to determine if morphological differences are the result of divergent selection between populations. In wild-caught individuals, I found significant differences in body and lamellae shape between lake and stream populations suggesting divergent selection. In common garden individuals, I did not detect significant differences, suggesting morphological divergence is not genetically based. Last, I completed behavioral assays with common garden individuals placing larvae into stream and lake conditions and scoring behavior, but no results were significant between lake and stream populations." (Author)] Address: not stated

17789. Haak, N. (2019): Identifcation of indivual dragonflies. Brachytron 20(1): 3-17. (in Dutch, with English summary) ["Individual dragonflies can be identified from a large number of individuals using a picture of their wing venation, similar to identification of humans based on fingerprints or facial recognition. This offers interesting opportunities for dragonfly research although lack of suitable identification software can still be a challenge. In a small city park in the middle of Middelburg (Zeeland, the Netherlands), every summer a relatively large group of Aeshna mixta can be seen that hunt or rest in the park but do not originate there. Using photographs of wing patterns, I registered which individuals were present in the park from day to day. During the research period from July to October 2018, 1008 different Migrant hawkers were identified of which the large majority visited the park just once and left within one day after arrival. Only 9.4% of identified individuals were seen on more than one (two or three) days and just 1.9% visited the park on days that were more than one week apart. The observations suggest that A. mixta that visit the park are part of a migratory stream or at least show directional swarming." (Author)] Address: Haak, N.: E-mail: nh@zeelandnet.nl

17790. Haase, P.; Pilotto, F.; Li, F.; Sundermann, A.; Lorenz, A.W.; Tonkin, J.D.; Stoll, S. (2019): Moderate warming over the past 25 years has already reorganized stream invertebrate communities. Science of The Total Environment 658: 1531-1538. (in English) ["Highlights: •We studied stream invertebrate communities over 25 years in central Europe. •Temperature increased by 0.5°C. Total abundance and richness increased. •Cold-adapted species declined while warmer-adapted species increased. •Community temperature index increased at a similar pace as physical temperature. •Results raise conservation concerns in view of the stronger future warming. Climate warming often results in species range shifts, biodiversity loss and accumulated climatic debts of biota (i.e. slower changes in biota than in temperature). Here, we analyzed the changes in community composition and temperature signature of stream invertebrate communities over 25 years (1990–2014), based on a large set of samples (n = 3782) over large elevation, latitudinal and longitudinal gradients in central Europe. Although warming was moderate (average 0.5°C), we found a strong reorganization of stream invertebrate communities. Total abundance (+35.9%) and richness (+39.2%) significantly increased. The share of abundance (TA) and taxonomic richness (TR) of warm-dwelling taxa (TA: +73.2%; TR: +60.2%) and medium-temperature-dwelling taxa (TA: +0.4%; TR: +5.8%) increased too, while cold-dwelling taxa declined (TA: -61.5%; TR: -47.3%). The community temperature index, representing the temperature signature of stream invertebrate communities, increased at a similar pace to physical temperature, indicating a thermophilization of the communities and, for the first time, no climatic debt. The strongest changes occurred along the altitudinal gradient, suggesting that stream invertebrates use the spatial configuration of river networks to track their temperature niche uphill. Yet, this may soon come to an end due to the summit trap effect. Our results indicate an ongoing process of replacement of cold-adapted species by thermophilic species at only 0.5°C warming, which is particularly alarming in the light of the more drastic climate warming projected for coming decades." (Authors) The paper includes a passing reference to Odonata.] Address: Pilotto, Francesca, Department of River Ecology and Conservation, Senckenberg Research Institute and Natural History Museum Frankfurt, Gelnhausen, Germany. E-mail address: francesca.pilotto@senckenberg.de

17791. Haley, S. (2019): How does aquatic invertebrate community structure and abundance relate to brook trout (Salvelinus fontinalis) habitat quality? Honours Bachelor of Environmental Management, Natural Resources Management: (in English) ["67 streams located south-west of Lake Nipigon, Ontario, were sampled for brook trout and macroinvertebrate orders. Sixteen orders were used to determine if their community structure significantly changed in different brook trout habitat and different brook trout densities (no brook trout, one to fifteen brook trout or more than 15 brook trout). Though the orders Odonata, Oligochaeta, Trichoptera, Chironomidae, Nematoda, Simuliidae, Gastropoda and Plecypoda varied in response to brook trout habitat quality and abundance, the community structures did not change significantly. Pollutant sensitive orders, Trichoptera, Ephemeroptera, and Plecoptera that are used as indicators and share similar habitat to brook trout did not significantly change in response to brook trout densities. Future direction may involve identifying macroinvertebrates to family or genus level to detect community changes, or analyzing further data such as invertebrate biomass, diversity or richness in these streams." (Authors)] Address: not stated

17792. Hashimoto, K.; Eguchi, Y.; Oishi, H.; Tazunoki, Y.; Tokuda, M. Sánchez-Bayo, F.; Goka, K.; Hayasaka, D. (2019): Effects of a herbicide on paddy predatory insects depend on their microhabitat use and an insecticide application. Ecological Applications 29(6), 2019, e01945. 11pp. (in English) ["Indirect effects of agrochemicals on organisms via biotic interactions are less studied than direct chemical toxicity despite their potential relevance in agricultural landscapes. In particular, the role of species traits in characterizing indirect effects of pesticides has been largely overlooked. Moreover, it is still unclear whether such indirect effects on organisms are prevalent even when the organisms are exposed to direct toxicity. We conducted a mesocosm experiment to examine indirect effects of an herbicide (pentoxazone) on aquatic predatory insects of rice paddies. Because the herbicide selectively controls photosynthetic organisms, we assumed that the effects of the herbicide on predatory insects would be indirect. We hypothesized that phytophilous predators such as some Odonata larvae, which cling to aquatic macrophytes, would be more subject to negative indirect effects of the herbicide through a decrease in abundance of aquatic macrophytes than benthic, nektonic, and neustonic predators. Also, we crossed-applied an insecticide (fipronil) with herbicide application to examine whether the indirect effects of the herbicide on the assembling predators act additively with direct adverse effects of the insecticide. The herbicide application did not decrease the abundance of phytoplankton constitutively, and there were no clear negative impacts of the herbicide on zooplankton and prey insects (detritivores and herbivores). However, the abundance of aquatic macrophytes was significantly decreased by the herbicide application. Although indirect effects of the herbicide were not so strong on most predators, their magnitude and sign differed markedly among predator species. In particular, the abundance of phytophilous predators was more likely to decrease than that of benthic, nektonic, and neustonic predators when the herbicide was applied. However, these indirect effects of the herbicide could not be detected when the insecticide was also applied, seemingly due to fipronil's high lethal toxicity. Our study highlights the importance of species traits such as microhabitat use, which characterize biotic interactions, for predicting indirect effects of agrochemicals. Given that indirect effects of the chemicals vary in response to species traits and direct toxicity of other chemicals, efforts to explain this variation are needed to predict the realistic risks of indirect effects of agrochemicals in nature." (Authors) Indolestes peregrinus, Cercion calamorum, Aciagrion migratum, Lestes temporalis, Ischnura senegalensis, Zygoptera spp., Anax parthenope, Crocothemis servilia, Orthetrum albistylum, Libellulidae spp.] Address: Hashimoto, K., Faculty of Agriculture, KINDAI University, Nakamachi 3327-204, Nara, 631-8505 Japan. E-mail: atrophaneura4@gmail.com

17793. Hefler, C. (2019): Inherent aspects of root flapping tandem wing arrangements in nature: forewing - hindwing interactions in dragonfly flight. Ph.D. thesis, Mechanical and Aerospace Engineering, Hong Kong University of Science and Technology: xxi, 164 pp.- (in English) ["Micro air vehicles (MAVs) are operate in the size region under the same environmental conditions as natural flyers. Insects are a prime target for bioinspired designs of MAVs, as their wing-root fixed musculature is simpler than the flight muscles of birds and bats. Dragonflies are highly aerobatic insects having high aspect ratio wings in tandem; they control individual wings to utilize wake elements of the forewings by their hindwings. This thesis contains my effort to characterize the unique interactions between the wings of dragonflies. I use a spanwise resolved approach to address the gradual change of wing geometric relations in the root fixed flapping wing system. With the use of in-vivo flow measurements two characteristic regions with distinct flow features, and two transient regions delimiting these, were identified. The dimensionless arc length was introduced to describe the effect of interaction in the wings spanwise direction. This parameter includes not only the phasing relations of the wings, but the ventral or dorsal shift in a wing's flapping, thus it is more generally applicable. Additionally, the flight direction was found to affect the inter-wing interactions. Secondly, a multilayer wing is proposed that generates lift with simple flapping motion. The wing takes up a different shape during the downstroke and during the upstroke; that mimics the asymmetric wing pitching of dragonflies. The wing generates an additional trailing edge vortex between its layers during upstroke that can boost thrust. The characteristic parameter defining the performance of the double layer wing is the difference between the dynamic shape deformation during the upstroke and the downstroke. It relates to the ratio of the chord length of the wing's layers. A chord ratio of 0.5 resulted in the best performance. I hope that my work will inspire further scientific research on dragonflies as well as MAV engineering." (Author)] Address: not stated

17794. Henze, M.J.; Lind, O.; Kohler, M.; Kelber, A. (2019): Seeing and (not) being seen: Sensory ecology of the blue-

tailed damselfly Ischnura elegans. Frontiers in Physiology. Conference Abstract: International Conference on Invertebrate Vision. doi: 10.3389/conf.fphys.2013.25.00068: 2 pp. (in English) ["Adult I. elegans are colourful insects. Males turn bright green after emergence and become blue over the days. Females show a red or purple colouration first and, when sexually mature, either mimic the blue colour of the males or are camouflaged by an inconspicuous olive-green or brown. In the past, the mating system and the underlying genetics and population ecology of I. elegans have been studied intensively. However, the sensory basis of their colour polymorphism for (1) intraspecific and (2) predator-prey interactions have not been explored. We quantified backgrounds in the natural habitat and the body colouration of the damselflies by spectral reflectance measurements, including time series documenting the animals' colour change. (1) To understand the function of the colours for mate and rival detection, we determined the angular, spectral and polarization sensitivity of photoreceptors in the compound eyes of males. Four spectral types of receptors maximally sensitive in the UV (370 nm), blue (440 nm), green (540 nm) and red (600 nm) region of the spectrum were found by intracellular recordings (Fig. 1). The sensitivity curve of the red receptor is narrower than an opsin template indicating spectral filtering, likely by the green receptor. Combining spectral reflectance and spectral sensitivity data in a model enables us to reconstruct the saliency of the different colour morphs to conspecific males searching for mates or trying to chase off rivals. (2) The functions of the colours for predator avoidance are also largely unknown. In similar models, we therefore incorporate known spectral sensitivities of passerines, potential predators on I. elegans. This allows us to judge which colour morphs are best camouflaged for the birds. Our goal is a physiologically based understanding of the reasons for colour polymorphism, a common phenomenon in damselflies." (Authors)] Address: not stated

17795. Hunger, H.; Benken, T.; Watts, P. (2019): Untersuchungen zur Auswirkung der Habitatfragmentierung auf Coenagrion mercuriale mit genetischen Methoden und GIS-Modellen. Mercuriale 18/19: 59-95. (in German, with English summary) ["Studies on the impact of habitat fragmentation on Coenagrion mercuriale using genetic methods by microsatellite analysis and GIS models in Baden-Württemberg – Microsatellites are highly variable non-coding genomic regions that are inherited like alleles and therefore can be used for population studies. Genomic DNA, taken from 32 occurrences of the species, was isolated from leg samples of C. mercuriale and amplified by the polymerase chain reaction (PCR). Thirteen microsatellite loci were synthesized by use of specific primers flanking these microsatellite regions according to a standard protocol. These amplification products were separated by length by capillary electrophoresis and assigned to discrete „alleles“. The variability of these DNA sections at the investigated occurrences forms the basis for the statistical evaluations. A range from 0.425 to 0.591 was determined for the expected heterozygosity (He) as a degree for genetic diversity in the study area. The allele number per locus (Na) fluctuated between 2.71 and 4.86. The values within the core zone (patch 2) were relatively constant (He = 0.482-0.541; Na = 4.0-4.8), whereas larger fluctuations were measured in the isolated patches. There was no clear evidence of a bottleneck. The genetic differentiation (calculated as FST/1–FST) is small overall in the study area but increases with distance (isolation by distance; IBD). Values from 0.002 to 0.071 were determined for populations less than five km, and values between 0.006 and 0.205 over 20 km apart. The proportion of migrants was estimated using the MCMC algorithm. Based on the genetic studies, the gene flow between the populations was calculated and potential migration routes were described. Dispersal models supplied by the Cost-Distance extension in ArcView Spatial Analyst were calculated for a 54.2 km² area in the “Freiburger Bucht”, comprising nine genetics sampling sites. First, Euclidean distances were calculated. Following this, three cost matrices were created für the study area: “historic land use” – based on a historic map from the 1850s – “generalised recent land use” – based on ATKIS land use data scaled down to the historic land use map – and “recent land use”, a more sophisticated model. All three models were combined with topographic surface data. The “Isolation by Distance Web Service” was then used to quantify the level of correlation between genetic distances and Euclidean respectively cost distances. The level of correlation rose in the order given above, with only the “recent land use” cost matrix yielding cost distances that were correlated with genetic distances on a significant level." (Authors)] Address: Hunger, H., INULA – Institut für Naturschutz und Landschaftsanalyse, Wilhelmstr. 8, 79098 Freiburg, Germany. E-mail: holger.hunger@inula.de

17796. Iannella, M.; D’Alessandro, P.; Biondi, M. (2019): Entomological knowledge in Madagascar by GBIF datasets: estimates on the coverage and possible biases (Insecta). Fragmenta Entomologica 51(1): 1-10. (in English) ["Although Madagascar is one of the world’s most important biodiversity hotspots, the knowledge of its faunistic diversity is still incomplete, notwithstanding many field campaigns were organized since the 17th century until nowadays, leading to a huge number of vertebrate and invertebrate records. In this contribution, taking into consideration the geographic distribution by a GBIF dataset including 286,764 records referred to nine insect orders (Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Neuroptera, Odonata, Orthoptera, Trichoptera), we tried to supply some observations on the spatial distribution and to point out some possible biases in the entomological knowledge of Madagascar. Hymenoptera, Coleoptera and Diptera were the most represented orders in the dataset, respectively. Some orders show many “coupled” sampling, with peaks of shared sampled localities between Diptera with Hymenoptera (98.07%) and Hemiptera with Coleoptera (64.21%). Considering the geographic location and the extension of the vegetation macrogroups in Madagascar, the entomological data result unevenly distributed. Current Protected Areas’ (PAs) network covers about the 70% of the total of the collecting localities for the nine insect orders considered, even though some, such as Trichoptera, Odonata, and Neuroptera

seem significantly less protected than others. However, the possible new PAs planned for Madagascar could greatly increase in the future the protection level for all 9 insect orders analyzed, especially for Neuroptera, Odonata and Lepidoptera. A percentage of 82.3% of the whole sampling localities falls inside the PAs themselves or within 1000 m from their borders. A similar pattern is observed for the road network: the 62.9% of the localities fall at least at 1000 m from a road, with no sampling localities observed further than 10 km from a road; statistically significant clusters were observed in evaluating these biases, coinciding with major towns or PAs." (Authors)] Address: D'Alessandro, Paola, Univ. of L'Aquila, Dept of Health, Life & Environ. Sciences, Section of Environ. Sciences, Italy. E-mail: paola.dalessandro@univaq.it

17797. Ingley, S.J. (2019): Digest: Ecomorphological convergence across the Atlantic. Evolution 2019: 1-2.["Did the remarkable helicopter damselflies (family Pseudostigmatidae) evolve their unique feeding and oviposition behaviors independently on two continents? In this issue, Toussaint et al. use molecular phylogenetic approaches to provide convincing evidence that these ‚forest giants' are in fact an example of ecomorphological convergence across the Atlantic Ocean." (Author)] Address: Ingley, S.J., Faculty of Science, Brigham Young University. Hawaii, Laie, Hawaii, USA. E-mail: ingley@byuh.edu

17798. Iorio, E. (2019): Résultats d'un suivi odonatologique orienté sur Lestes dryas Kirby, 1890 et L. virens (Charpentier, 1825) (Odonata: Lestidae) dans les landes de Lessay (Manche). Invertébrés Armoricains 20: 28-52. (in French, with English summary) ["An ecologic study of Lestes dryas and of L. virens has been made on several stations in the humid heaths of Lessay, between 2015 and 2017. The results give precious informations on favourable and unfavourable factors for these species. Measures are given to make favourable ponds for L. dryas and L. virens as well as for a higher species richness of Odonata." (Author)] Address: Iorio, E., Entomologie & Myriapodologie, 522 chemin Saunier, F-13690 Graveson, France

17799. Jêdro, M.; Jêdro, G.; Goc, M. (2019): Coastal dune slacks – a distinctive dragonfly (Odonata) habitat in the Slowiñski National Park. Przeglad Przyrodniczy 30(2): 58-67. (in Polish, with English summary) ["Research conducted in the Slowiñski National Park in 2017-2019 has shown that the coastal dune slack in forest compartment 29gy of the Park is an important habitat for odonates, including species well adapted to sparsely vegetated, astatic water bodies. The odonate assemblage typical of this habitat includes the yellow-winged darter Sympetrum flaveolum (L.), migrant spreadwing Lestes barbarus (Fabr.) and robust spreadwing Lestes dryas Kirby. The specific nature of this water body is determined not only by its location in the dune slack, but also by its proximity to the sea, which favours colonization by nomadic and dispersive species." (Authors)] Address: Jêdro, Magdalena, Slowiñski Park Narodowy, ul. Bohaterów Warszawy 1A, 76-214 Smoldzino, Poland. E-mail: m.jedro@slowinskipn.pl

17800. Kemabonta, K.A.; Adu, B.W.; Nwabueze, O.F.; Ogbogu, S.S.; Ohadiwe, A. (2019): The diversity and distribution of dragonflies and damselflies (Odonata) in University of Lagos, Akoka, Lagos, south-west Nigeria. The Zoologist 17: 1-5. (in English) ["The presence of Odonata may be taken as an indication of good ecosystem quality. The greatest numbers of species are found at sites that offer a wide variety of microhabitats. A survey of Odonata fauna inhabiting the University of Lagos, Akoka Lagos, south-west Nigeria was carried out between July and December 2014, with a view of determining its diversity and distribution. Four study sites used were Distance Learning Institute (DLI), Lagoon, Faculty of Science, and High Rise Area. Data collected were subjected to inferential statistics and analysis of variance (ANOVA). Diversity indices were used to compare the odonate species in the study sites. Seven hundred and fifty (750) individuals representing 39 species in 22 genera and four families (Aeshnidae – 3%, Coenagrionidae – 13%, Libellulidae – 81% and Calopterygidae – 3%) were recorded. Orthetrum (18%) was the most dominant genus, followed by Ceriagrion (10%) while Palpopleura and Trithemis (8%) were the least dominant genera. The site with most diverse Odonata fauna (H' = 2.70, E = 0.27), was High Rise Area while the least was the Lagoon Area (H' = 1.97, E = 0.27). Odonata in High Rise Area were significantly lower ($p>0.0128$) than those in DLI and Science Area which were not significantly different from each other (0.00039 and 0.00368 respectively). The paucity of species with narrow range of adaptation at the university especially at Lagoon Area where they were expected to occur is an indication that the forested part of the campus is under considerable human disturbance. Urgent measures are needed to preserve the natural the natural habitats of these Odonata species." (Authors)] Address: Kemabonta, K.A., Department of Zoology, Faculty of Science, University of Lagos, Lagos State, Nigeria. E-mail: kkemabonta@unilag.edu.ng

17801. Khelifa, R. (2019): Females 'assist' sneaker males to dupe dominant males in a rare endemic damselfly: sexual conflict at its finest. Ecology 100(12), e02811: 4 pp. (in English) ["Sneaky mating tactic has fascinated scientists for decades, and the mechanisms behind its evolution remains unclear. In many taxa, sneaker males are thought to outsmart the dominant males because they can secure fertilization of eggs either through pre-copulatory or post-copulatory processes (Shuster and Wade 2003). For instance, sneaker males of a fish mimic the female's appearance to dupe the dominant male (Todd et al. 2017) whereas in some insects sneaker males steal females from male's territories and force copulation (Cordero and Andrés 2002)." (Authors)] Address: Khelifa, R., Biodiversity Research Centre, University of British Columbia, Vancouver, British Columbia V6T 1Z4 Canada. E-mail: rassimkhelifa@gmail.com

17802. Khelifa, R. (2019): Sensitivity of biodiversity indices to life history stage, habitat type and landscape in Odonata community. Biological Conservation 237: 63-69. (in English) ["Highlights: • Improving our understanding of species distribution is key for effective management. • The distribution

of odonates in Northeast Algeria based on adult, oviposition, larvae and exuviae was analyzed. • Combining different life history stages improves the accuracy of species distribution. • The diversity of odonates was influenced by habitat and landscape configuration. Abstract: Assessing biodiversity and prioritizing the conservation of sites requires a robust methodology that minimizes the estimation errors of biodiversity indices and thus maximizes management efficiency. In aquatic insects, while there is still a debate about the use of different life history stages to increase the reliability of the biodiversity estimates, little is known about the effect of habitat and landscape characteristics. Here, odonates are used to assess the sensitivity of important biodiversity indices to the use of different life history stages (adult, oviposition, exuvia, and larva) and the influence of habitat type (lotic vs. lentic) and freshwater landscape complexity (proximity to a diversity of wetlands). Unlike exuvia and larvae, the use of adults gave inaccurate estimates of species richness, Relative Taxonomic Distinctness (RTD), Conservation Priority Index (CPI), but was quite reliable for Dragonfly Biotic Index (DBI). Interestingly, recording the mating state (oviposition) of the adult improved the accuracy of RTD and CPI by ˜40 and 60%, respectively. The estimation bias was higher in lotic than in lentic habitat and it increased with the freshwater landscape complexity. Our study shows that applying a multi-life stage approach in biodiversity indices reveals site connectivity at the landscape level." (Authors)] Address: Khelifa, R., Dept Zoology & Biodiversity, Research Centre, Univ.y of British Columbia, Vancouver, BC, Canada

17803. Kietzka, G.J. (2019): Dragonflies as bioindicators and biodiversity surrogates for freshwater ecosystems. Dissertation, Doctor of Philosophy (Conservation Ecology) at Stellenbosch University, Department of Conservation Ecology and Entomology, Faculty of AgriSciences: 191 pp. (in English) ["Biological indicators (bioindicators) are useful for rapid and cost-effective ecosystem assessments. Dragonflies are valued for their potential as bioindicators in freshwater ecosystems. My dissertation aims to assess and expand on their use as bioindicators in transformed landscapes and as surrogates for other aquatic biodiversity. Of the three bioindicator categories (environmental, ecological and biodiversity), biodiversity indicators and their application are poorly understood. The umbrella species concept is a biodiversity surrogacy method that aims to conserve a large number of species in an ecosystem by focusing on a select group of co-occurring species. I used the umbrella index, which quantitatively identified a group of seven dragonfly species and a group of eight Ephemeroptera, Plecoptera and Trichoptera (EPT) species, any of which could be used as biodiversity surrogates (Chapter 2). Adult dragonflies can only be surveyed on warm, windless days during summer, but are easily identifiable. On the other hand, their larvae can be sampled under any weather conditions and are also sensitive bioindicators. I showed that the interchangeability of the life stages for assessments was dependent on landscape spatial scale, coupled with the specific question asked (Chapter 3). Comprehensive biodiversity surveys at fine ecological scales should sample both adults and larvae. However, at larger spatial scales with coarser ecological questions, either adults or larvae can be used. To mitigate the detrimental effects caused by forestry, ecological networks (ENs) are integrated into plantation landscapes. These comprise grassland corridors connected to protected areas (PAs), which often include rivers. They aim to conserve biodiversity by creating habitats or facilitating dispersal of grassland species. I showed that water quality and adult dragonfly diversity did not differ between EN corridors and PAs (Chapter 4). Therefore, the EN approach is an effective method for conserving dragonfly diversity and river ecosystem integrity in plantation landscapes. In the Pietermaritzburg Botanical Gardens, an insect conservation pond was built along a degraded stream. Dragonfly species richness and abundance significantly increased, as both lentic and lotic species were able to colonize the area. Over time, the pond became overgrown and siltation reverted it back to a stream, which negatively affected dragonfly diversity. Shortly after extensive restoration efforts, the dragonfly assemblage had almost completely recovered and closely resembled that of the original pond. This was linked to alien plant removal, decreased vegetation cover and the inclusion of a range of microhabitats. This indicates that conservation ponds need to be actively maintained to keep their function as biodiversity reservoirs. This highlights the value of dragonflies as indicators of habitat quality in aquatic restoration projects. Throughout the thesis, adult dragonflies continuously demonstrated their success as bioindicators. The umbrella index validated the use of dragonflies as biodiversity indicators and surrogates for some of the most sensitive aquatic taxa (the EPT). Although dragonfly larvae and adults are both indicators of water quality, they are not always interchangeable, in terms of sampling at the species level. Their interchangeability depends on the specific question asked and the scale used. I also successfully monitored dragonfly assemblage responses in agricultural lotic and urban lentic environments, which highlighted their benefits for good aquatic conservation planning in transformed landscapes." (Author)] Address: Kietzka, Gabriella, Department of Conservation Ecology and Entomology, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa. E-mail: gabikietzka@gmail.com

17804. Kosterin, O.E. (2019): Amendments and updates to F.C. Fraser's key to Indian Lestes spp. (Odonata: Lestidae) to resolve confusion of L. patricia Fraser, 1924 and L. nigriceps Fraser, 1924, with notes on L. nodalis Selys 1891 and L. garoensis Lahiri, 1987. Zootaxa 4671(2): 297-300. (in English) ["Last year I reported the rediscovery in Cambodia of Lestes nigriceps Fraser, 1924, described from Pusa, India (Fraser 1924a) but never reported since that time from India (Kosterin 2018). In my paper I presumed non-conspecificity of the male and females of the type series and made critical comments on Fraser's appendage drawing (Fraser 1924a: plate IX: 6) and verbal descriptions (Fraser 1924a; 1933) of this species but did not consider his key for Lestes Leach, 1815 in the 1st volume of "Fauna of British India including Ceylon and Burma. Odonata" (Fraser 1933). Later I found a considerable corruption in this key, which could lead

to misidentifications. (It is noteworthy to stress that Fraser explicitly provided keys for males only)." (Author)] Address: Kosterin, O.E., Institute of Cytology & Genetics SB RAS, Acad. Lavrentyev Ave. 10, Novosibirsk, 630090, Russia. E-mail: kosterin@bionet.nsc.ru

17805. Kosterin, O.E. (2019): Description of a female and variation of Microgomphus alani Kosterin, 2016 (Odonata: Gomphidae) in Cambodia, with a note on sexual dimorphism in Microgomphus spp.. Zootaxa 4701(3): 276-290. (in English) ["M. alani was described from two teneral males from the Cardamom Mts. in SW Cambodia; it turned out that the description was based on the holotype with the anal appendages not fully expanded. Further specimens of M. alani (all mature) are reported: a male and two females from the Phnom Kulen Mts, NW Cambodia and five males and one female from Mondulkiri Province, E Cambodia. The appendage shape in mature males is illustrated and discussed and the female is described for the first time. The specimens from E Cambodia are ca 15-20% larger than those from SW and NW Cambodia and exhibit some differences in the shapes of the male epiproct and anterior hamulus and face maculation, however evaluated as insufficient to erect a new taxon. A hitherto neglected manifestation of sexual dimorphism in probably most Microgomphus spp. and at least some Heliogomphus spp. is pointed out. It concerns the mid- and metafemur, in males armed with numerous, dense and small spinulets but with two rows of long, sparse spines in females. An earlier report of Microgomphus jurzitzai Karube, 2000 for Cambodia was based on a misidentified M. alani specimen and is cancelled. A female specimen earlier identified and described from Thailand as Heliogomphus selysi Fraser, 1925 most probably was M. alani as well." (Author)] Address: Kosterin, O.E., Institute of Cytology and Genetics, Siberian Branch, Russian Academy of Sciences, Lavrentiev Ave 10, RUS-630090 Novosibirsk, Russia. E-mail: kosterin@bionet.nsc.ru

17806. Kumar, A.; Kumar, N.; Das, R.; Lakhani, P.; Bhushan, B. (2019): In vivo structural dynamic analysis of the dragonfly wing: the effect of stigma as its modulator. Philosophica Transactions of the Royal Society A. Mathematical, Physical and Engineering Sciences 377(2150): 14 pp. (in English) ["The flapping of the dragonfly (Lyriothemis elegatissima) forewing under in vivo condition has been analysed by image correlation technique to get an insight of its structural dynamics. The modal parameters such as flapping frequency, natural frequencies, mode shapes and modal strain have been obtained that will facilitate the biomimetic design of wings for micro air vehicles. The stigma, which is a pigmented spot at the leading edge of the wing near the tip having heavier mass, takes an active role in the real-time flapping by shaping its trajectory as eight-shaped, which enhances the drag coefficient and stroke efficiency. The extra mass on it and its removal transformed the trajectory into two different elliptical and oval shapes, respectively, which reduced the drag coefficient and stroke efficiency of the flapping wing by altering the flapping kinematics." (Authors)] Address: Kumar, N. E-mail: nkumar@iitrpr.ac.in

17807. Kutsarov, Y. (2019): Dragonflies and damselflies (Odonata: Insecta) from the Bulgarian stretch of the Danube River and adjacent territories. In: Biodiversity of the Bulgarian-Romanian Section ISBN: 978-1-53615-663-8 Editor: Shurulinkov, Hubenov et al.: 119-153. (in English) ["This study intends to collect and present all available information on seasonal and habitat distribution of Odonata in the Bulgarian stretch of the Danube River between chainages 845 (at the Timok River estuary) and 375 (town of Silistra) and adjoining wetlands,(up to 20 km from the river bank) included in 109 MGRS UTM 10x10 km quadrants. To date, 52 species of Odonata have been recorded in the study area, 51 of which were identified in previous publications, including by this study's author, who recorded 46 of the 51 species. From the total number of species, four have not been confirmed as present around the Danube River, one has been removed because of change in taxonomy, and one new species has been recorded in the study area." (Authors)] Address: Kutsarov, Y., Kalimok-Brushlen Ltd., Tutrakan, Bulgaria

17808. LeNaour, A.; Baeta, R.; Sansault, E.; Deville, M.; Pincebourde, S. (2019): Telemetry reveals the habitat selected by immature dragonflies: implications for conservation of the threatened dragonfly Leucorrhinia caudalis (Odonata: Anisoptera). Journal of Insect Conservation 23(1): 147-155. (in English) ["Determining how species use different habitats during critical phases of their development is one of the crucial challenges that conservation biology meets. However, habitat requirements remain unknown for most species, in particular for the rarest and most threatened which by definition are difficult to study. Here, we used animal-borne telemetry to identify the habitat of the sexually immature adults in the threatened dragonfly Leucorrhinia caudalis. We used an harmonic radar with customized tags fixed on the back of the abdomen of flying immature dragonflies to monitor their position within an area composed of various types of habitats including open areas, forest and water bodies. From 62 tagged individuals, we obtained 23 detections, all within a quite restricted area around the pond of emergence. About 75% of the detections happened in the forest canopy and the individuals were likely positioned at the top of the trees. The relatively low detection rate was probably due to high predation within the study area during the maturation phase in this dragonfly but long-range dispersal cannot be excluded. The use of forest canopy as a maturation habitat is an important knowledge for planning conservation strategies in this endangered species, especially for populations living in areas without any protection status. Although technological constraints are still limiting its efficiency, animal-borne telemetry appears to be useful to determine precisely habitat selection by rare species." (Authors)] Address: Pincebourde, S., Inst. Recherche sur la Biol. de l'Insecte (IRBI), UMR 7261 CNRS, Univ. de Tours, Tours, France. E-mail: sylvain.pincebourde@univ-tours.fr

17809. Lohmann, A. C., Corcoran, A. J. and Hedrick, T. L. (2019): Dragonflies use underdamped pursuit to chase conspecifics. J. Exp. Biol. 222, jeb190884. http://jeb.biologists.org/content/222/11/jeb190884: 8 pp. (in English) ["Pursuit is

a common behavior exhibited by animals chasing prey, competitors and potential mates. Because of their speed and maneuverability, dragonflies are frequently studied as a model system for biological pursuit. Most quantitative studies have focused on prey pursuits in captive environments. To determine whether a different pursuit strategy is used when chasing conspecifics of nearly equal speed and agility, we recorded 3D flight trajectories from nine territorial chases between male Erythemis simplicicollis dragonflies in natural field conditions. During chases, dragonflies used an interception strategy with an unusually high-magnitude gain (k=-10.03 s-1 horizontal; -8.86 s-1 vertical) and short time delay (t=50 ms). The product kt determines how aggressively a pursuer corrects course to achieve interception. Previous studies of prey pursuit have found kt values close to -1/e (-0.37), the time-optimal value for achieving pursuit without overshooting. However, we found that dragonflies chasing conspecifics use more negative kt (-0.50 horizontal; -0.44 vertical), resulting in pursuits with a high degree of overshooting (i.e. moving past the target and alternating position from side to side). We confirmed via simulation that the observed gain and delay produce overshooting. We propose that overshooting is an adaptive feature of conspecific chases that can be achieved with only slight modification of the strategy used for intercepting prey. Overshooting might help avoid potentially damaging collisions while exhibiting the pursuing animal's flight performance and competitive ability. Repeated close approaches might also evoke evasive responses from the other dragonfly, effectively herding the competitor out of the territory." (Authors)] Address: Lohmann, Amanda, Dept Biol., Univ. North Carolina, Chapel Hill, NC 27514, USA. E-mail: amanda.lohmann@duke.edu

17810. Lu, K.; Wu, H.; Xue, Z.; Lu, X.; Batzer, D.P. (2019): Development of a multi-metric index based on aquatic invertebrates to assess floodplain wetland condition. Hydrobiologia 827: 141-153. (in English) ["The construction of levees breaks the connection of floodplains with river channels. Few assessments have examined the impacts on aquatic ecosystems. We developed a multi-metric index (MMI) based on aquatic invertebrates (including Odonata and treated at the family level) to assess floodplain wetland condition in the Wusuli River, northeastern China. We sampled the aquatic invertebrate communities in 18 floodplain wetlands along the Wusuli River including wetlands from headwater, middle river, and downstream reaches. Each site included paired wetlands with a wetland connected to the river floodplain and a wetland isolated from the floodplain by levees. Metrics related to the aquatic invertebrate community were selected as candidate metrics for the MMI. Then, a range test, discrimination analysis, and correlation analytics were used to select the candidate metrics based on their ability to distinguish reference and isolated wetlands. Four core indicators were selected to build the MMI: total number of taxa, %Gastropoda, Pielou's index, and %Collector-Gatherers. Four ordinal rating categories were defined: poor, fair, good, and excellent condition. The results showed 88.9% of the leveeisolated wetlands, which were identified as being in poor or fair condition. Levee construction has a consistent negative impact on floodplain wetland condition. Our MMI provides a biomonitoring way to determine the success of restoration strategies." (Authors)] Address: Batzer, D.P., Dept of Entomology, Univ. Georgia, Athens, GA 30602, USA. E-mail: dbatzer@uga.edu

17811. Mackiewicz, K.; Tonczyk, G. (2019): Records of dragonflies (Odonata) near Sejny (north-eastern Poland) in 2016-2017. Odonatrix 15_9 (2019). 28 pp. (Polish, with English summary) ["59 dragonfly spp. were recorded in north-eastern Poland (near Sejny) during 2016-2017. Protected and southern species were the most interesting ones: Sympecma paedisca, Nehalennia speciosa, Ophiogomphus cecilia, Aeshna subarctica, A. viridis, Orthetrum albistylum, O. brunneum, O. coerulescens, Sympetrum depressiusculum, Leucorrhinia albifrons, L. caudalis, L. pectoralis, Sympetrum fonscolombii and Crocothemis erythraea." (Authors)] Address: Mackiewicz, K. E-mail: borsuk68@o2.pl

17812. Manger, R.; Mekkes, J.-J. (2019): Discovery of populations of Somatochlora arctica in Drenthe and its distribution in the Netherlands. Brachytron 20(1): 18-25. (in Dutch, with English summary) ["For the first time Somatochlora arctica was observed in the province of Drenthe in 2017. Four locations were discovered that year. A year later the species was also found in Bargerveen, another site in Drenthe. The province contains many potential peat bog areas where the species can settle or has already established. Various studies in Drenthe have shown that most peat areas have improved in quality in recent decades. Since 2006, more new populations of Somatochlora arctica have been discovered in the Netherlands. It is difficult to indicate whether the species has expanded in the Netherlands in recent years or whether it has not been observed before due to the lack of knowledge of recognition in the field. The increase in sightings of the species is probably due to a combination of improve habitat quality and a better knowledge of recognition in the field that has been obtained." (Authors)] Address: Manger, R., Stoepveldsingel 55, 9403 SM Assen. The Netherlands. E-mail: rene@mangereco.nl

17813. Marquez-Rodriguez, J. (2019): Observations of swarming behaviour in Anax parthenope on the island of Formentera, Spain (Odonata: Aeshnidae). Libellula 38(1/2): 111-116. (in English, with German summary) ["On 31-viii-2018 a group of several hundred adults of Anax parthenope was observed in the surroundings of Calò Des Mort in southeast Formentera. The group consisted of both sexes and flew in a space of 2,000 × 200 m from the cliff and in adjacent forest areas. It is suggested that the aggregation was part of a migrating swarm." (Author)] Address: Márquez-Rodríguez, J., Zoology Department of Physical, Chemical and Natural Systems, Faculty of Experimental Sciences, University of Pablo de Olavide, A-376, Km 1, 41013 Seville, Spain. E-mail: jmarrod1@upo.es

17814. Márquez-Rodríguez, J. (2019): New records of Odonata from La Altagracia. Revista Chilena de Entomología 45(3): 503-506. (in English, with Spanish summary) ["This

paper reports six new faunistic records from La Altagracia, Dominican Republic increasing the knowledge of the diversity of Odonata within the province to 15 species. Thus records extend the known geographic range of these species east of Hispaniola." Brachymesia herbida, Erythrodiplax fervida, E. justiniana, Micrathyria aequalis, M. hagenii, Perithemis domitia (Authors)] Address: Márquez-Rodríguez, J., Zoology. Dept of Physical, Chemical & Natural Systems, Fac. of Experimental Sciences, Univ. of Pablo de Olavide, A-376, Km 1, 41013 Seville, Spain. E-mail: jmarrod1@upo.es

17815. Martin, A.R. (2019): Análisis preliminar de los odonatos (Insecta: Odonata) de Sierra Nevada (Espana): distribución, abundancia y estatus de conservación. Boletín de la Sociedad Entomológica Aragonesa (S.E.A.) 64: 229-241. (in Spanish, with English summary) ["Preliminary analysis of the odonates (Insecta: Odonata) from Sierra Nevada (España): distribution, abundance and conservation status: This article presents the study carried out in the Sierra Nevada mountains from 2012 to 2014. Our main objective is to know the composition of the Odonata of this mountain range. The reproduction of 29 out of 31 species found has been verified. The most frequent species found are Cordulegaster boltonii in watercourses and Libellula depressa in lentic habitats. This study provides information on how these species are distributed geographically in the said mountains and on their abundance by basin, province and in general, providing relevant information on their distribution patterns. We have analyzed taxonomic and faunistic data, determined the conservation status of less frequent species and identified the priority areas for their conservation." (Author)] Address: Martín, A.R., Centro administrativo del Espacio Natural Sierra Nevada. C/ Carretera antigua de Sierra Nevada, km 7. 18191-Pinos Genil, Granada, Spanin

17816. Martin, A.R. (2019): Evidencia de la reproducción de Zygonyx torridus (Kirby, 1889) (Odonata, Libellulidae) en un tramo de río de carácter geotermal. Arquivos Entomoloxicos 21: 133-144. (in Spanish, with English summary) ["Evidence of reproduction of Z. torridus on a stretch of river characterized by geothermalism. The reproduction of Z. torridus in a section of the Adra River with clear geothermal influence is verified, undocumented behaviour in this rare threatened species. The environmental characteristics of the locations where it has been reported from are analyzed in the Ibero-Maghrebian area, observing concurrence in the values of the selected parameters to approach the characterization of the breeding habitat of the species in this vast territory." (Author)] Address: Martín, A.R., Centro Administrativo del Espacio Natural Sierra Nevada. Ctra. antigua de Sierra Nevada, km 7. E-18191 Pinos Genil (Granada). Spain. E-mail: arm6869@hotmail.com

17817. Martin, R.; Maynou, X. (2019): The Odonata community of a Mediterranean stream in the Catalan Pre-Coastal mountain range, NE Iberian Peninsula. Boletín de la Sociedad Entomológica Aragonesa (S.E.A.) 65: 195-206. (in English, with Spanish summary) ["We describe the composition, structure and seasonal variation of the adult Odonata community of a Mediterranean stream in the Catalan Pre-Coastal mountain range (NE Iberian Peninsula) and assess the stream's conservation value using a multimetric approach based on measurements of species richness, diversity and abundance, presence of bioindicator species and taxa deserving protection status. The species assemblage was comparatively rich –26 species recorded as adults, 22 of them with breeding confirmed– and composed mainly of generalist univoltine taxa typical of slow-flowing and standing waters adapted to a riffle-pool sequence in a seasonal environment. Western Mediterranean, Ibero-Maghrebine and Holomediterranean elements were dominant with 17 species (65%). Analysis of community structure revealed small differences between pools and riffles but the seasonal variation was more pronounced, with diversity and abundance values being maximum in June and July. The most widely represented families were Coenagrionidae and Libellulidae, together including 54% of the species detected. The riverine habitat health indicator species Boyeria irene and Cordulegaster boltonii had a limited occurrence at the studied stream because the seasonal hydrological fluctuations reduce habitat suitability for these rheophilous taxa. Although we did not find any species categorized as vulnerable or threatened at a regional level, one of the stream inhabitants, Coenagrion mercuriale, enjoys protected status under the Habitats Directive (92/43/EEC), which entails the legal obligation to develop and implement appropriate measures for its conservation. The ISOI index, which assesses habitat ecological integrity based on the analysis of the dragonfly community, achieved a score of 18 out of 20, indicating that the environmental quality of the sampled stretch was excellent. Our results show that this type of mid-mountain stream offers an interesting combination of habitats for aquatic invertebrates and is worth protecting from human-caused alterations. Management should focus on the preservation of suitable conditions for running water specialists, since it is their habitats that are becoming increasingly threatened." (Authors)] Address: Martín, R, Martí Julià, 19-23, 08911 Badalona, Spain. ricardo.martin@cllicenciats.cat

17818. Mauffray, W.F.; Tennessen, K.J. (2019): A catalogue and historical study of the Odonata of Ecuador. Zootaxa 4628(1): 1-265. (in English) ["We present a list of 425 valid Odonata species from Ecuador, providing a brief overview of each genus, a photograph of a representative species of each genus, and all records known to us for each species. Thirty-eight of the 425 species were previously unrecorded from Ecuador. Data were derived from published records, public and private collections, and field records accumulated since the 1960's by the authors and others who have contributed specimen information to this study. A historical study and a comprehensive list of synonyms are presented, and questionable species records are discussed. The physiography of the country, including the general climate of each subregion and current pressures on the environment, is briefly discussed. At present, 44 species of Odonata are considered endemic to Ecuador, and eight species are considered endangered, vulnerable, or near threatened on the IUCN Red List." (Authors)] Address: Tennessen, K.J.,

Research Associate, Florida State Collection of Arthropods, PO Box 585, Wautoma, WI 54982, USA. E-mail: ktennessen@centurytel.net

17819. Maynou, X.; Martín, R. (2019): Phenology of the Odonata assemblage in a Mediterranean stream in the northeastern Iberian Peninsula. Odonatologica 48(1/2): 27-48. (in English) ["We investigated the Odonata species composition of larvae, final instar (F-0) exuviae, and adults occurring in a sequence of two different mesohabitats - pool and riffle - in a short stretch of a Mediterranean stream running down the Catalan Pre-Coastal Range (north-eastern Iberian Peninsula). We sampled them during the period 2017–2018 and recorded adults of 26 taxa and confirmed by the presence of final instar exuviae that at least 21 were breeding successfully in that environment. We describe, for the first time for this region and habitat type, larval growth patterns, timings of adult emergence, and flight periods of the most abundant species and characterize the life cycles of some of them. These life cycles can be classified into three types: i) univoltine with overwintering in the larval stage and emergence taking place in spring or summer of the following year (Coenagrion mercuriale, C. puella, Ceriagrion tenellum, and Pyrrhosoma nymphula); ii) predominantly univoltine of the previous type with a small fraction of the population being semivoltine (Anax imperator and Orthetrum coerulescens, tentative conclusion); and iii) univoltine with overwintering in the egg stage, a short larval growth period in the following spring, emergence in early summer, a long maturation period, and reproduction postponed until late summer or early autumn (Chalcolestes viridis and Sympetrum striolatum). Our results may contribute to fill in gaps in the knowledge of voltinism and phenology of the life cycles of Odonata in correlation with latitude, geographical area, and habitat type." (Authors)] Address: Maynou, X., Institució Catalana d'Història Natural, carrer del Carme 47, 08001 Barcelona, Spain. E-mail: xavier.maynou@gmail.com

17820. Meland, S.; Gomes, T.; Petersen, K.; Håll, J.; Lund, E.; Kringstad, A.; Grung, M. (2019): Road related pollutants induced DNA damage in dragonfly nymphs (Odonata, Anisoptera) living in highway sedimentation ponds. Scientific Reports 9, Article number: 16002 (2019). doi:10.1038/s41598-019-52207-4: 15 + 12 pp. (in English) ["Nowadays, stormwater sedimentation ponds are popular in stormwater management because of their ability to mitigate flooding and treat polluted runoff from e.g. roads. In addition, they may provide other ecosystem services such as biodiversity. These man-made habitats will inevitably be polluted and the organisms living therein may be negatively affected by the chemical cocktail present in both the water and sediment compartments. The present study explored DNA damage in dragonfly nymphs (Odonata, Anisoptera) living in highway sedimentation ponds in comparison with natural ponds. The concentrations of Polycyclic aromatic hydrocarbons (PAHs), alkylated PAHs and metals were also determined in sediment samples from the different ponds. The results showed that DNA damage was significantly higher in dragonfly nymphs living in sedimentation ponds compared to nymphs living in natural ponds. DNA damage was also highly and significantly correlated with the pollution levels in the sediment, i.e., PAH and Zinc. Finally, we report the concentrations of various alkylated PAHs which appeared to be very dominant in the sedimentation ponds. Our results show that there may be a conflict between the sedimentation ponds' primary function of protecting natural water bodies from polluted runoff and their secondary function as habitats for organisms. Overall, we suggest that this must be considered when planning and designing stormwater measures." (Authors)] Address: Meland, S., Norwegian Institute for Water Research (NIVA), Gaustadalléen 21, 0349, Oslo, Norway. E-mail: sondre.meland@niva.no

17821. Melo Carneiro, F.; de Souza, J.P.F.; Silva, K.; Nogueira, D.S.; Bichsel, D.; Pinto, N.S.; Bispo de Oliveira, A.A.; Carvalho, P.; Pereira Bastos, R.; Oertli, B.; De Marco Júnior, P. (2019): Low cross-taxon congruence among aquatic organisms in artificial tropical ponds: implications for biomonitoring. Annales de Limnologie - International Journal of Limnology 55(21): 9 pp. (in English) ["The use of biodiversity surrogates is often suggested to increase the cost-effectiveness of biomonitoring programs, as this demands less time and taxonomic expertise. In addition, the detection of multi-taxon associations is a first step toward a better understanding of how organisms interact with each other. Such a multi-taxon association is termed a congruence, and can be detected through measuring the similarity in the distributional patterns shown by different biological groups. To assess the ability of different taxa to serve as surrogates for others, we carried out a Procrustes analysis on the beta diversity patterns of seven biological groups (aquatic birds, Amphibians, Macrophytes, Coleoptera, Odonata, Heteroptera and phytoplankton) in 35 ponds of the Cerrado biome. We found that: (i) the values of congruence in the studied ponds were weak; (ii) among all the biological groups compared, the highest congruence was found between amphibians and macrophytes; (iii) amphibians were congruent with the Coleoptera, Heteroptera, and macrophytes; (iv) the different taxa studied had different responses to environmental conditions; and (v) although they showed relatively weak congruence with the other taxa in each pond environment, amphibian communities were the most strongly influenced by environment variables. Almost all the communities observed in these systems showed unique pattern and thus should be studied and monitored in their entirety.] Address: Melo, Fernanda, Laboratório de Ficologia, Campus Goiânia-Laranjeiras, Universidade Estadual de Goiás, Goiânia, Brasil. E-mail: fernanda.carneiro@ueg.br

17822. Mey, D. (2019): Erster Reproduktionsnachweis der Schabrackenlibelle, Anax ephippiger (Burmeister, 1839) (Insecta: Odonata: Aeshnidae) in Thüringen. Thüringer Faunistische Abhandlungen 24: 81-94. (in German, with English summary) ["The first record of reproduction by A. ephippiger in Thuringia was recorded in August 2019 on the Seebach agricultural reservoir, which has an area of 105 ha. The species was found on reeds on all shores around the agricultural reservoir. In total, 85 exuvia were collected, especially

from Schoenoplectus reeds. A freshly emerged female and an immature male were photographed. The number of species of Odonata in the Seebach agricultural reservoir is increased to at least 32." (Authors)] Address: Mey, D., Meisenweg 4, 99891 Bad Tabarz, Germany

17823. Mrazovac-Kurilic, S.; Abulsba, K.S.; Roljevic-Nikolic, S. (2019): Application of mathematical modeling in ecology. Economics of Sustainable Development 3(2): 13-19. (in English, with Serbian summary) ["The aim of this paper was implementation of mathematical modeling in ecological research on the example of the prevalence of odonates in Serbia. For research purposes six areas were selected for which the number of species of odonants was given, a similarity coefficient was calculated, and based on the data as the number of species and environmental variables of the place (altitude, temperature and precipitation), multiple linear regression (MLR) model was presented describing the number of species odonants depending on altitude, temperature and precipitation. The areas studied were the rivers Tisa, Sava-Danube, Velika Morava, Južna Morava, as well as the mountain areas Zlatibor and Golija. The occurrence of the species was highest at the Sava-Danube site, followed by the Tisa. Odonates occurrence was lowest in the Golija site. The results of the study showed that environmental variables are significantly associated with odonates distribution. The MLR model based on the species dependence of altitude, temperature, and precipitation showed an extremely high degree of agreement." (Authors)] Address: Mrazovac Kuriliæ, Sanja, Fac. of ecology & environmental protection, University “Union-Nikola Tesla, Serbia. E-mail: mrazovac@gmail.com,

17824. Müller, Z.; Szabó, T.; Gáspár, A.; Juház, P.; Ludány, M.; Málnás, K.; mihaliczku, E.; Olajos, P.; Polyák, L.; Kiss, B. (2019): Contribution to the Hungarian dragonfly fauna, based on the nationwide surveys (Odonata: Anisoptera). Folia historico-naturalia Musei Matraensis 43: 33-80. (in English) ["Between 1996 and 2017 dragonfly larvae, exuviae and imagoes were collected from 1846 different sampling locations in Hungary. The published 38 species of Anisoptera belong to 5 families (10 Aeshnidae, 2 Cordulegasteridae, 4 Gomphidae, 4 Corduliidae and 18 Libellulidae). Larval data for the following species are the most important faunistic results: Aeshna viridis, Anax ephippiger, Cordulegaster bidentata, C. heros, Leucorrhinia caudalis and L. pectoralis." (Authors)] Address: Müller, Z., BioAqua Pro Ltd., 4032 Debrecen, Hungary, Soó Rezsõ u. 21. E-mail: mullerz@bioaquapro.hu

17825. Nagy, H.B.; László, Z.; Szabó, F.; Szocs, L.; Dévai, G.; Tóthmérész, B. (2019): Landscape-scale terrestrial factors are also vital in shaping Odonata assemblages of watercourses. Scientific Reports volume 9, Article number: 18196 (2019): 8 pp. (in English) ["Habitat loss and fragmentation causes a decline in insect populations. Odonata are especially threatened by the destruction of both aquatic and terrestrial environment. Moreover, effects of large-scale habitat heterogeneity on Odonata assemblages are poorly studied. In a two years study along East-European lowland watercourses both aquatic and terrestrial environment were studied to reveal the importance of local (e.g. water depth, macrovegetation cover, etc.) and landscape-scale (e.g. farmland patch size, forest patch proportion, etc.) variables to Odonata (as well as to dragonflies and damselflies separately) through increasing spatial sampling scales. The specimens were sampled using 500m long transects from May to September. Results, both on local and landscape scales emphasized the importance of terrestrial environment on Odonata. Local variables influence damselflies, while dragonflies are more sensitive to landscape variables. Damselfly's diversity decreased with increasing macrovegetation cover, while dragonfly's diversity decreased with the increasing degree of land use intensification, but increased with the length of watercourses. It is thus vital to stress the importance of partial watercourse clearing, and moderate maintenance of traditional farm management based on small parcel farming near watercourses to maintain diverse and healthy Odonata assemblages.] Address: László, Z., Hungarian Dept Biol. & Ecology, Babes-Bolyai Univ., str. Clinicilor nr. 5–7, 400006, Cluj-Napoca, Romania. E-mail: laszlozoltan@gmail.com

17826. Notteghem, P. (2019): Une libellule nommée Boyeria irene. Revue scientifi que Bourgogne-Franche-Comté Nature 29: 112-117. (in French, with English summary) ["Historic investigations allow to support an interpretation of the origin of the scientific name of Boyeria irene (Boyer de Fonscolombe, 1838), Odonata, and to argue in favour of a French name susceptible to be retained as normalized name. ... As a tribute to Etienne BOYER DE FONSCOLOMBE and his daughter, Irène DE SAPORTA, Boyeria irene a French name referring to Irène, daughter of its describer. This beautiful dragonfly, endemic to south-western Europe and North Africa, could be given its original French name "L'Aeschne Irène", formulated by Edmond DE SELYS-LONGCHAMPS in 1840. But it could also be called "L'Aeschne d'Irène" or more simply: "L'Irène". There is nothing to prevent us from thinking that the beautiful Irène DE SAPORTA, well named, was a calm and peaceful person, as is indeed the beautiful "libelluline" discovered by her father! Translated with www.DeepL.-com/Translator (free version)" (Author)] Address: Notteghem, P., Groupe Odonates Bourgogne - Société d'Histoire Naturel du Creusot - 15 rue de Pommard - 71200 Le Creusot, France. E-mail: patrice.notteghem@orange.fr

17827. Ohba, S.-y.; Murakami, R.; Watanabe, R.; Jun, B. (2019): Factors affecting a fauna of aquatic insects in swimming pools of schools in the southern part of Nagasaki, Japanj. Jpn. J. Appl. Entomol. Zool. 63: 163-173. (in Japanese, with English summary) ["Aquatic insects colonize the swimming pools of schools during the off-season. The present study aimed to investigate 30 swimming pools in southern Nagasaki Prefecture in spring (middle April to middle May) and autumn (late October to early November) 2014. We found 11 families of aquatic insects … The community composition of aquatic insects was divided into spring and autumn, and its variance was related to the water temperature and organic matter. The major environmental factor related to the number of red list species was considered to be location

near the potential natural habitat of the species. The organic matter falling into the pools affected the existence of Orthetrum species nymphs. Odonata nymphs, Notonecta trignttata (Heteroptera: Notonectidae), Anisops ogasawaraensis (Heteroptera: Notonectidae), Aquarius pafudum paludum (Heteroptera: Gerridae), and Eretes griseus (Coleoptera: Dytiscidae) were found from most of the pools studied, indicating that these species may be used as teaching materials for science in most schools irrespective of their location." (Authors)] Address: Ohba, S.-y., Biological Laboratory, Faculty of Education, Nagasaki University, Japan

17828. Oliveira-Junior, J.M.B.; Dias-Silva, K.; Teodósio, M.A.; Juen, L. (2019): The response of Neotropical dragonflies (Insecta: Odonata) to local and regional abiotic factors in small streams of the Amazon. Insects 10, 446: 19 pp. (in English) ["Since the relative role of local and regional abiotic factors on the Odonata diversity in rainforest streams is still poorly understood, we evaluated the effects of these factors on adult Odonata from preserved and altered streams in the Amazonian region. Adult Odonata were sampled in 98 streams in the Eastern Amazon, Pará, Brazil. Six variables were used to measure local environmental factors: habitat integrity index; mean canopy over the channel; and four physical and chemical descriptors of the water. To measure regional environmental factors, six variables were also used: altitude gradient, three bioclimatic variables and two percentage forest variables. In partial redundancy analysis, both abiotic factors (local and regional) were important to explain the variation in the Odonata community. The Odonata community can be influenced by regional and local factors. The relationship between Odonata and the local (e.g., integrity, canopy cover, and physical and chemical descriptors of the water) and regional (e.g., bioclimatic and forest cover variables) environmental variables recorded in this study has important implications for the use of these organisms to monitor small streams of the Eastern Amazon. The scale at which habitat is measured is an important issue in community structuring studies considering the rapid environmental changes. It is of great importance to consider the different scales in studies assessing community structure, once an adequate habitat must meet the ecological needs of all stages of the life of the Odonata."(Authors)] Address: Oliveira-Junior, J.M.B., Programa de Pós-Graduação em Zoologia (PPGZOOL), Programa de Pós-Graduação em Ecologia (PPGECO), Lab. de Ecologia e Conservação (LABECO), Universidade Federal do Pará (UFPA), Rua Augusto Correia, N.1, Bairro Guamá, Belém 66075-110, Pará, Brazil

17829. Ortega Salas, H. (2019): Sistemática y distribución del género Paraphlebia Sélys in Hagen, 1861 (Odonata: Thaumatoneuridae) en México y Centroamérica. M.Sc. thesis, Universidad Nacional Autónoma de México, Posgrado en Ciencias Biológicas, Instituto de Biología Sistemática: VI + 108, 2 app. (in Spanish, with English summary) ["For over a century, the genus Paraphlebia has remained one of the least known in Mexico and Central America. The use of alar coloration and the relative position of the RP3 vein, have so far been the only diagnostic characters available to separate the species of this genus. This work provides a taxonomic revision of the genus including the characterization of P. zoe, P. hyalina, P. fifth and P. duodecima; the synonymy of P. abrogata with P. quinta; as well as the description of 10 new species distributed in Mexico, Guatemala, Honduras and Nicaragua. New diagnostic characters and a dichotomous key are proposed for the identification of all males of the species known for this genus. We present maps with the known distributions of all species and finally, the first phylogenetic hypothesis for the genus derived from the 12S, 16S, 28S and CO1 genes, where we differentiate two clades, which are found to be congruent with cerci morphology." (Author)] Address: not stated

17830. Petrulevicius, J.F. (2019): A new Frenguelliidae (Insecta: Odonata) from the Eocene of Arroyo Chacay, Patagonia, Argentina. Palaeoentomology 2(6): 591-595. (in English) ["The family Frenguelliidae Petrulevicius & Nel, 2003 was hitherto known from two genera and three species: Frenguellia patagonica Petrulevicius & Nel, 2003, F. iglesiasi Petrulevicius & Nel, 2013 and Treintamilun vuelvenlucha Petrulevicius, 2017. Frenguelliidae is a very interesting group, controversially considered either an Epiproctophora, basal to Euepiproctophora by Petrulevicius & Nel (2003, 2007, 2013) and Petrulevicius et al. (2011), or a Zygoptera by Nel & Arillo (2006), Nel et al. (2008), Lak et al. (2009) and Bechly & Poinar (2013). Only the epiproctophoran hypothesis was discussed and based principally in a putative character of the group, the curved CuP (Petrulevicius & Nel, 2003, 2007, 2013). The zygopteran hypothesis could be reasonably adopted due to the presence in Frenguelliidae of a character which is absent in the basal Epiproctophora: the IR2 aligned with the subnodus (Petrulevicius, 2017). Other characters shared by Frenguelliidae and other Zygoptera are homoplastic and are also present in some Epiproctophora, i.e., arculus nearer to Ax2 than to Ax1 in Cyclothemistidae: Triassoneura (Fujiyama, 1991) and Epiophlebiidae: Mesoepiophlebia (Nel & Jarzembowski, 1996); the lack of pterostigmal brace in Campterophlebiidae: Ctenogampsophlebia (Petrulevicius et al., 2011); absence of secondary antenodals could also occur in Triassoneura. The morphology of the new species does not contradict the hypothesis postulated by Petrulevicius & Nel (2003, 2007, 2013) about the phyletic position of the group which remains uncertain and its resolution exceeds the possibility of the present work but is a nice topic for future research." (Authors)] Address: Petrulevicius, J.F., Museo La Plata; Dept Cient Paleozool Invertebrados; Paseo Bosque S-N; RA-1900 La Plata; Argentina. E-mail: levicius@netverk.com.ar

17831. Petzold, F. (2019): Die Libellenfauna (Insecta, Odonata) des FFH-Gebietes „Pöllwitzer Wald“. Mauritiana (Altenburg) 36: 103-118. (in German, with English summary) ["The Special Area of Conservation (SAC) „Pöllwitzer Wald“ hosts with 31 recorded species a particu larly diverse dragonfly fauna, ranking above the Thuringian average. Apart from its diversity in pond species, this area holds special significance for dystrophic water species (Coenagrion hastulatum, Leucorrhinia dubia, L. rubicunda, Sympetrum

danae). This above-average biodiversity is particularly highlighted by the occurence of Leucorrhinia pectoralis, a highly protected species according to the Habitats Directive. Of this species, the largest number of individuals in Thuringia has currently been recorded in SAC „Pöllwitzer Wald“. In addition to dragonfly fauna assessment, from the viewpoint of dragonfly protection recommendations regarding optimal care and development provided." (Author)] Address: Petzold, F., Pappelallee 73, 10437 Berlin, Germany. E-Mail: petzold.falk@googlemail.com

17832. Pinkert, S. (2019): Physiological and historical determinants of the distribution and abundance of insects. Dissertation, Philipps-Universität Marburg: 285 pp. (in English) ["Understanding the consequences of past and future climatic changes on biodiversity has become one of the most important challenges of current ecological research. Due to the fundamental importance of climate for determining the distribution and abundance of species, climatic changes have led to strong shifts of species' ranges to higher altitudes and latitudes as well as to local changes in the phenology and abundance of species during the last decades. Nevertheless, most organisms are incapable of rapid responses to such changes as they are constrained by, for instance, phylogenetic conservatism in thermal adaptations and dispersal limitations. Therefore, a mechanistic understanding of the variation in functional traits of species is crucial for predicting biological responses to climate change. However, so far, most trait-based inferences focused on endotherm taxa, whereas the physiological processes shaping the diversity patterns of ectothermic organisms, particularly of insects, remain poorly understood. The overall objective of this PhD thesis is to investigate the importance of interactions between environmental factors and species' functional traits across regions, scales and taxa, to improve forecasts of the ecological consequences of climate change as well as our understanding of the ecological and evolutionary processes that determine biogeographical patterns, the range size and the abundance of insects. Insects, like 99.9 % of the species on our planet, are ectothermic organisms that in contrast to endothermic organisms, mainly depend on thermal energy from their environment for their activity and for maintaining vital physiological processes. Ectotherms therefore evolved adaptations to the temperature regime in which they live. From a physiological perspective, strong arguments exist that biophysical principles link variation in species' colour lightness and body size to heat gain and loss in endothermic animals. Larger species retain body heat more efficiently than smaller species owing to their lower surface-area-to-volume ratio, and darker coloured species heat up faster than lighter coloured species because they absorb more solar radiation. Other functions include enhanced immunocompetence of larger species and enhanced pathogen resistance (Gloger's rule) as well as UV protection of darker species. Mechanistic links between these two morphological traits, species' physiology and climate are hence probably important determinants of variation in the distribution and abundance of ectotherm organisms, but the limited availability of distributional and morphological data has so far hampered a large-scale perspective on the physiological processes that shape biogeographical patterns in insects. Constraints to the evolution of species' morphological traits and dispersal abilities can limit the colonization of regions characterized by new climates or habitats and thereby influence geographical patterns in the phylogenetic diversity or geographical rarity of taxa. On the one hand, spatial concentrations of rare species are important conservation targets, because they indicate the distribution of species that are both particularly vulnerable to extinction in the future and unique elements of biodiversity. On the other hand, overall patterns of these facets of diversity provide information about past dispersal events and the ecological processes that shaped contemporary patterns of biodiversity. In six chapters of my thesis I investigate whether biogeographical patterns of insect assemblages are driven by variation in the colour lightness and the body size. I show that melanin-based thermoregulation, pathogen resistance and UV protection are important mechanisms that influence the distribution of dragonflies, butterflies and moths at both local and continental scales. In all studies, species assemblages in cooler climates are on average darker coloured than assemblages in warmer climates. Furthermore, in line with the prediction that darker colouration is advantageous in regions with high humidity and in regions with high solar radiation due to the protective functions of melanin, colour lightness generally decreases with increasing precipitation and insolation. Body size clines are less strong and differ considerably among the considered taxa. In addition, I demonstrate that contrasting effects of the benefits and the energetic costs of an investment into body size and melanization on the range size and abundance of butterfly species can offset each other when their interactions with components of the energy budget are not taken into account. Thus, larger and darker butterfly species only have wider distributions and are more abundant if they compensate the costs of an investment into body size and melanization by reducing mobility costs or increasing energy uptake. In three additional chapters, I investigate whether evolutionary constraints on species' thermal adaptations and dispersal ability influence the composition of insect assemblages and I assess the extent to which diversity patterns of insects are shaped by the contemporary climate and historical climatic changes. Using European dragonflies, I show that both phylogenetic conservatism of thermal adaptations and dispersal limitations constrain the recolonization of previously glaciated areas of Europe, resulting in a decrease of the endemism and phylogenetic diversity of assemblages with decreasing temperature and the increasing proportion of species with a high dispersal ability. In addition, I demonstrate that the climatic changes since the Last Glacial Maximum are consistently major drivers of the endemism and species richness of mammals, birds, amphibians and dragonflies across Africa. However, the results of this study also indicate that the signatures of species' responses to historical climatic changes differ considerably between the considered taxa and are currently less effectively protected. Finally, using a group of flightless orthopterans endemic to Africa, I exemplify that the diversity of this group, and probability most of the insect

diversity today found in the Eastern Arc Mountain biodiversity hotspot, has been generated by the interplay of humid periods that allowed the spread of forest-bound lineages across Africa with aridity-driven fragmentations of forests and their associated faunas. In conclusion, I demonstrate that both body size and colour lightness are major determinants of distribution and abundance of insects, across taxa, regions and scales. Despite the significant contributions of other functions of colour lightness, such as pathogen resistance and UV protection, as well as of the thermoregulatory function of body size, melanin-based thermoregulation is the most important and a strikingly general mechanism that shapes biogeographical patterns of insect. To understand and predict the effects of body size and colour lightness on ecological dynamics of insect species it is, however, crucial to account for their interactions with components of the energy budget, because the contrasting effects of an investment into body size, wing size and melanization on the range size and abundance of species can partly offset each other. Purely correlative approaches that predict spatiotemporal variation in the distribution and abundance of insect species based on easily measured morphological traits are therefore prone to false mechanistic conclusions and likely underestimate the functional importance of morphological traits. Furthermore, phylogenetic conservatism of thermal adaptations and dispersal limitations affect trait-environment relationships and species' responses to historical climatic changes. Together these results highlight the potential of models that integrate morphological, climatic and phylogenetic data for improving predictions of species' responses to climate change as well as our understanding of the processes that generated and maintain the remarkable diversity of insects on Earth." (Author)] Address: Pinkert, S., Department of Ecology – Animal Ecology, Philipps-Universität Marburg, Karl-Von-Frisch-Str. 8, 35043 Marburg, Germany. E-mail: stefanpinkert@posteo.de

17833. Pinto, A.P. (2019): First report on the dragonflies from Parque Estadual da Ilha do Cardoso, state of São Paulo, Brazil, with notes on the morphology and behavior of Lauromacromia picinguaba (Odonata: Corduliidae s.l.). Studies on Neotropical Fauna and Environment 54(1): 48-60 (in English) ["The dragonflies from the Parque Estadual da Ilha do Cardoso, municipality of Cananéia, located at the southern limit of the state of São Paulo in the Brazilian Atlantic Forest, were surveyed for the first time through a short sampling effort lasting four days in October 2011. A total of 36 species, including four new state records for species of the genera Lestes, Phyllocycla, Navicordulia and 'Schizocordulia', and three undescribed species of damselflies belonging to Cyanallagma, Forcepsioneura and Idioneura were identified. Some notes are also given for other species, as well as on the morphology and behavior of the intriguing corduliid Lauromacromia picinguaba (incertae sedis). The results, based on a small sample, indicate that the local dragonfly biota at Parque Estadual da Ilha do Cardoso is rich and impressive, and needs to be investigated and protected." (Author) Address: Pinto, A.P., Departamento de Zoologia, Laboratório de Sistemática de Insetos Aquáticos (LABSIA), Universidade Federal do Paraná, Curitiba, PR, Brazil. E-mail: appinto@ufpr.br

17834. Pokorný, J.; Waldhauser, M. (2019): Mapping the distribution of reophilic dragonflies, damselflies and water beetles in the Czech Republic in the years 2012–2015. Príroda, Praha 39: 95-112. (in Czech, with English summary) ["Mapping the distribution of reophilic dragonflies and water beetles was carried out in the Czech Republic in the years 2012–2015. The investigations were focussed on sites with current or potential occurrence of the species of European Community importance, Ophiogomphus cecilia, Stylurus flavipes and the genus Cordulegaster. The mapping ran under the scheme "Monitoring and Widescale Mapping of the EC Species of Importance as a Ground for the Completing the Natura 2000 Network in the Czech Republic". Mapping took place in 444 quadrates of grid mapping, i.e. covering two thirds of the area of the country. Five species are on the Red List (Hejda et al. 2017). Twelve obligatory or facultative reophilic species were found: Calopteryx splendens, C. virgo, Ischnura elegans, Platycnemis pennipes, Stylurus flavipes, Gomphus vulgatissimus, Ophiogomphus cecilia, Onychogomphus forcipatus, Cordulegaster boltonii, C. bidentata, C. heros and Somatochlora metallica. The results improved our knowledge on the distribution of most of the Goldenring and Clubtail species. Significant new data on their distribution, not only in new quadrates, but also in new extensive areas were gathered. These new findings can be mostly considered as filling in the gaps in our knowledge rather than the species spreading to new areas. A total of 2,167 specimens of water beetles belonging to 115 species were found. …" (Authors)] Address: Pokorný, J., Hrusice 33, CZ-251 66 Hrusice. E-mail: aegolius.j@seznam.cz

17835. Porst, G.; Brauns, M.; Irvine, K.; Solimini, A.; Sandin, L.; Pusch, M.; Miler, O. (2019): Effects of shoreline alteration and habitat heterogeneity on macroinvertebrate community composition across European lakes. Ecological Indicators 98: 285-296. (in English) ["Human lake shore alterations often result in a substantial decrease of littoral and riparian habitat diversity and physical complexity, but the intensity at which shore alterations affect biodiversity may differ among European geographical regions. We tested if the response of littoral macroinvertebrate communities to human shoreline alterations is consistent among geographical regions. We compared community composition and diversity of human altered with those of unmodified littoral zones from 51 lakes across seven European countries in four geographical regions based on pooled composite as well as habitat-specific macroinvertebrate samples. Taxon richness and community composition differed among shore types and different habitats in all geographic regions, with morphological alteration having an overall negative effect on macroinvertebrate taxon richness. In addition, habitat heterogeneity also had a strong effect on littoral communities, with highest taxon richness found in the structurally complex macrophyte habitats in all regions. Average proportional densities of Diptera and Oligochaeta taxa generally increa-

sed in morphologically altered shores in all geographical regions, while Bivalvia, Crustacea, Ephemeroptera, Gastropoda and Trichoptera showed comparatively lower numbers in many anthropogenically altered sites. Furthermore, taxon richness was positively correlated with habitat diversity. We were able to relate changes in littoral communities to anthropogenic shoreline alterations, and linked the effect to the loss of habitats and habitat complexity. The results of our study demonstrate that littoral macroinvertebrates respond consistently negative to the influence of morphological alterations across European geographical regions in terms of biodiversity. While macroinvertebrates have previously been identified to be useful descriptors of morphological change in single countries/regions, we can now validate that they can be used to assess the ecological status of lakes in terms of morphological alterations across European regions. Our results can be used to further improve ealready existing WFD-compliant multimetric indices, for example by including taxa groups, which show a strong reaction to shoreline alterations. This could be supported by the inclusion of a suit of indicator taxa reflecting the loss of complex habitats such as macrophytes in the lake littoral. ... Odonata taxa showed a general decrease from macrophyte to sand and stone habitats in all, but the Northern European lakes". (Authors)] Address: Porst, Gwendolin, Leibniz Institute of Freshwater Ecology & Inland Fisheries (IGB), Department of Ecosystem Research, Müggelseedamm 301, 12587 Berlin, Germany. E-mail: gwendolin.porst@uwi.tu-berlin.de

17836. Purwanto, P.B.; Nur Zaman, M.; Ike P, A.; Akbar, M.; Arief, M. (2019): Study of Odonata diversity in Kerangas Forest Sukadamai Village and Punai Beach Simpang Pesak, Belitung Timur. Proceedings of the International Conference on Science and Engineering, Indonesia 2019 2: 133-136. (in English) ["Belitung is known as the biggest tin mining in Indonesia. … The research was conducted in June 2018 by exploration in Belitung, particularly in Punai beach and Kerangas forest (ex-tin mining) area. 17 dragonfly species were found including Ichtinogomphus decoratus, Macrogomphus sp., Orthetrum sabina, Nannophya pygmaea, Neurothemis fluctuans., Rhodothemis rufa, Rhyothemis phyllis, Urothemis signata, Pseudagrion coomansi, Ceriagrion cerinorubellum., Acisoma panorpoides., Brachydiplax chalybea, Diplacodes nebulosa, Orthetrum pruinosum, Agriocnemis femina, Agriocnemis pygmaea, and Ischnura senegalensis. All species were conducted to find out the diversity using Shannon-Wiener index and resulting 2,77 index." (Authors)] Address: Purwanto, P.B., Biology Dept, Fac. Science & Tech., UIN Sunan Kalijaga Jl. Marsda Adisucipto No. 1 Yogyakarta 55281, Indonesia. E-mail: bimopurwanto91@gmail.com

17837. Qiu, G.; Abeysinghe, K.S.; Yang, X.-D.; Xu, Z.; Xu, X.; Luo, K.; Goodale, E. (2019): Effects of selenium on mercury bioaccumulation in a terrestrial food chain from an abandoned mercury mining region. Bulletin of Environmental Contamination and Toxicology 102(3): 329-334. (in English) ["Few reports of the relationship exist between mercury (Hg) and selenium (Se) from locations of severe Hg contamination in terrestrial environments. Here, we report the concentrations of Hg and Se as well as Se:Hg molar ratios in biotic samples collected from a region with a long history of Hg mining. Nitrogen isotopes (d15N) were analyzed to confirm the trophic levels. Results showed that bird feathers at the top trophic level exhibited the highest Hg concentrations, while the lowest concentrations were found in herbivorous insects, demonstrating a significant biomagnification across the food chain. In contrast, herbivorous insects of different types (generalists vs. specialized rice pests, and including Symeptrum flaveolum) exhibited both the highest and the lowest concentrations of Se, indicating a lack of biomagnification. Indeed, Se was correlated positively with Hg when Se:Hg ratios were greater than one, suggesting Se:Hg molar ratios can be a controlling influence on Hg in terrestrial organisms." (Authors)] Address: Qiu, G., State Key Laboratory of Environmental Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang, China

17838. Rangnekar, P.; Dharwadkar, O.; Sadasivan, K.; Subramanian, K.A. (2019): A new species of Cyclogomphus Selys, 1854 (Insecta: Odonata: Gomphidae) from the Western Ghats, India with comments on the status of Cyclogomphus vesiculosus Selys, 1873. Zootaxa 4656(3): 515-524. (in English) ["A new species of Cyclogomphus Selys, 1854 is described from the Western Ghats of India based on male and female specimens collected from Goa and Kerala states. The new species differs from all the known species of Cyclogomphus in the shape of the anal appendages as well as the thoracic and abdominal markings. We also provide here an updated key to the Cyclogomphus species and comment on the status of C. vesiculosus Selys, 1873." (Authors)] Address: Rangnekar, P., Foundation for Environment Research & Conservation. #407, III-A, Susheela Seawinds, Alto-Vaddem, Vasco-da-Gama-403 802, Goa, India. E-mail: rangnekarparag@gmail.com

17839. Razkallah, Z.; Houhamdi, M. (2019): Community structure of the odonatofauna of an important Maghrebian watershed: the Seybouse (Northeast Algeria). Zoology and Ecology 28(4): 395-402. (in English) ["Odonata of the Maghreb have been shown to be particularly diverse and rich in endemic species. Although studies have peaked during the last decade, especially in the Seybouse watershed (Northeast Algeria), a few have used larvae to assess the community structure and ecology of odonates. Here, we present a larva-based investigation of the odonate of the Seybouse watershed conducted during 2015–2016 in a dozen of sites using community ecology quantitative approaches and multivariate analysis to determine the checklist, species richness, abundance, and environmental characteristics of communities. We found 17 species (7 zygopterans and 10 anisopterans), of which Calopteryx exul, Coenagrion mercuriale, Gomphus lucasii were locally and/or globally of conservation concern. There was a strong correlation between the frequency occurrence (distribution) and abundance, meaning that the cosmopolitan species were also the most abundant in the community. The multivariate analysis showed that the communities were structured by substrate type and abiotic factors such as conductivity, dissolved oxygen, and

water flow. Our study also confirms the extinction of some populations of the endangered endemic C. exul, and thus rings the alarm for an urgent conservation plan that should manage the extensive water pumping and pollution in the region." (Authors)] Address: Razkallah, Z., Laboratoire d'écologie fonctionelle et évolutive, Université Chadli Benjdid, El Tarf, Algeria. E-mail: zahra.razkallah@yahoo.fr

17840. Rocha-Ortega, M.; Rodriguez, E.P.; Cordoba-Aguilar, A. (2019): Spatial and temporal effects of land use change as potential drivers of odonate community composition but not species richness. Biodiversity and Conservation 28: 451-466. (in English) ["Land-use changes and land cover change are drivers of diversity. The effects of such drivers over the temporal trend in species richness and composition, particularly on invertebrate diversity in megadiverse countries, is controversial. One key animal group to clarify this controversy is that of odonate insects (dragonflies and damselflies), given their combined close water-land requirements. We have investigated whether changes in land use impact species richness and composition of odonates from 1980 to 1993 (period I) to 1994–2010 (period II) in Mexico. The effect of land use changes and land cover changes on species richness was analyzed using multiple diversity measures and at different spatial scales. In period II, an area reduction in original vegetation and increase in land use occurred. Responses to land use varied among spatial scales and measures of diversity but, overall, species richness in the transformed area was higher than in the original vegetation. However, species composition indicated a high species turnover inside hydrologic regions (watersheds) and across land uses classes, particularly between original and secondary vegetation. Our interpretation is that despite high land use conversion in Mexico, adult odonates seem resilient to land use change in terms of species richness, but not in species composition, which is in partial agreement with the intermediate disturbance hypothesis. Finally, we suggest that hydrologic region scale and use of entropy maximization (HCDT entropy), could provide a reliable biodiversity estimation of species loss associated with land use change." (Authors)] Address: Rodriguez, Pilar, Departamento de Ecologia Evolutiva, Instituto de Ecologia, Universidad Nacional Autonoma de Mexico, Apdo. P. 70.275, Circuito Exterior, Ciudad Universitaria, 04510 Coyoacan, DF, Mexico. E-mail: prodrig@conabio.gob.mx

17841. Rodriguez, J.S; Molineri, C. (2019): The larva of Neoneura confundens Wasscher and van't Bosch, 2013 (Odonata, Coenagrionidae) and key to the larvae of genus. Anais da Academia Brasileira de Ciências 91(4): 10 pp. (in English) ["The beautifully colored damselflies included in Neoneura Selys are divided in 28 species known from North, Central and South America. Larval stage is little known, only seven species were described at this stage. We describe and illustrate the final instar larva of Neoneura confundens for the first time. Adults associated to this larva correspond to the blue form of the species and are also discussed and illustrated. The larva of N. confundens is similar to other Neoneura larvae, showing 1 premental seta and a well-marked nodus in caudal lamellae, but it can be differentiated by having fringed posterior margin in all tibiae and in middle and hind tarsi, among other characters. A key to known larvae of Neoneura and new records extending the species range in the southern cone are provided." (Authors)] Address: Instituto de Biodiversidad Neotropical, National Council of Scientific Research/CONICET, Universidad Nacional de Tucumán, Facultad de Ciencias Naturales e IML, Ciudad Universitaria Horco Molle (T4105XAY), Argentina

17842. Rodriguez-Escobar, F.E.; Carrillo-Muñoz, A.I.; Serrano-Meneses, M.A. (2019): Seasonal variation in the allometry of wing pigmentation in adult males of the territorial damselfly Hetaerina vulnerata (Insecta Odonata). Ethology Ecology & Evolution 32(2): 148-161. (in English) ["Several sexually selected traits exhibit positive allometry. One of the explanations for this pattern suggests that positive allometry should be expected only for "pure" threat male signals, whilst isometry and negative allometry should occur in "pure" courtship signals. Wing pigmentation (WP) is a sexually selected trait exhibited by the males of several Zygoptera taxa, which has been the focus of a number of studies of allometry. Whilst WP tends to exhibit positive allometry in many taxa, the pattern is not general. Previous studies have shown that in Hetaerina vulnerata, a territorial species in which WP is used as a "pure" threat signal, positive allometry is common. However, little attention has been paid to the seasonal variation in the allometry of WP in this species. To address this research gap, we collected data from a full reproductive season, from a natural population of H. vulnerata located in Central Mexico. Our results suggest that, first, male WP and body size generally increase throughout the season. Second, WP increases as the end of the season approaches, independently of body size. Finally, WP tends to be either not related to body size, or to exhibit isometry during the first half of the season (April–June), and positive allometry during the second half of the season (July–October). We suggest that our results may be explained by (i) the availability of resources critical to the development of larvae, as well as the duration of development, and (ii) an increase in the number or larger males towards the end of the season, which may favour the exaggeration of WP. Furthermore, the opportunity for sexual selection may vary, so that WP may be more relevant to male mating success towards the end of the reproductive season." (Authors)] Address: Rodríguez-Escobar, Frida, Depto de Ciencias Químico-Biológicas, Universidad de las Américas Puebla, Puebla, C.P. 72810, México

17843. Ryan, S.C.; Belby, C.S.; King-Heiden, T.C.; Haro, R.J.; Ogorek, J.; Gerrish, G.A. (2019): The role of macroinvertebrates in the distribution of lead (Pb) within an urban marsh ecosystem. Hydrobiologia 827: 337-352. (in English) ["Environmental risk from contaminated aquatic sediments requires an understanding of its spatial distribution, bioavailability and rate of transfer to resident aquatic and terrestrial biota. We hypothesized that macroinvertebrates play a role in the sequestration, distribution, and dispersal

of lead from lead shot contaminated sediments. To assess this, we sampled the predominant aquatic macroinvertebrate, Leptocerus americanus, from sites within the La Crosse River Marsh (La Crosse, Wi) identified to contain high levels of lead contamination. We measured lead content in larval cases, larval tissues and emergent adult tissues. Lead concentrations within whole larvae correlated with levels of lead within sediments, and lead was differentially partitioned between larval tissue and their silk cases. Over 90% of the lead was retained in larval cases, while the rest was distributed to the body tissue, which was largely conserved during the process of metamorphosis. Our models support that L. americanus emerging from the marsh in the contaminated area transfer as much as 160 mgPb out of the aquatic habitat each year. Our work demonstrates that macroinvertebrates affect the mobilization and dispersal of contaminants within aquatic sediments, and this role should be evaluated when making management decisions regarding contaminated ecosystems." The paper includes only a passing note to Odonata (Authors)] Address: Gerrish, Gretchen, The River Studies Center, Univ. of Wisconsin – La Crosse, La Crosse, WI 54601, USA. E-mail: ggerrish@uwlax.edu

17844. Ryazanova, G.I. (2019): Odonata and anthropogenic salinization of inland waters. Moscow University Biological Sciences Bulletin 74: 33-39. (in English) [Original publication in Vestnik Moskovskogo universiteta. Seriya 16. Biologiya 74(1):42-49. (In Russ.) "Anthropogenic salinization of internal waters and its impact on freshwater biota are topical environmental problems. Such salinization leads to changes in the natural environment, which is undesirable from the point of view of environmental protection and is not indifferent to humans. One of the three most important factors of anthropogenic salinization of fresh water in temperate and cold climates, along with agricultural and mining activities, has been the widespread use of chemical reagents in the fight against road icing. Today, the main components of these reagents are Na and Ca chlorides - cheap and easily accessible natural materials. Their blend of sand and sand, used in de-icing practices, is usually stored in bulk at special outdoor sites all year round. Exposure to precipitation makes it a source of salinization of surrounding soils and waters. In 2015, 2016 and 2018, the salinity of inland water bodies was recorded near the long-term open storage of anti-ice reagents in the Kaluga region. The anthropogenic nature of salinization of the surveyed reservoirs was determined. The main components of water body salinization in the study area are Na and Ca chlorides. Maximum salinization level in the studied conditions is 4‰, the degree of salinization depends on the distance of the reservoir from the road salt storage. The influence of anthropogenic salinity on dragonflies, mainly of the Coenagrion puella L. species, was considered. It was found that the influence of increased water salinity is manifested only in slowing down the development of individuals with a high level of fluctuating asymmetry, it does not affect their number in the population. The high salinity of the water only leads to changes in the timing of migration of individuals with high levels of FA. It is assumed that dragonflies, as one of the mass objects of freshwater biota, obviously, are not subject to significant influence of anthropogenic salinization. Translated with www.DeepL.com/Translator Russian Text © The Author(s), 2019, published in Vestnik Moskovskogo Universiteta, Seriya 16: Biologiya, 2019, Vol. 74, No. 1, pp. 42–49.] Address: Ryazanova, G.I., Dept of Biology, Moscow State University, Moscow, Russia. E-mail: ryazanovagi@mail.ru

17845. Rychla, A. (2019): Besiedlung künstlicher Kleingewässer durch Großlibellen (Odonata: Anisoptera) – eine 4-jährige Studie aus der Niederschlesischen Heide (SW Polen). International Dragonfly Fund Report 140: 1-18. (in German, with English summary) ["Dragonflies frequently colonise newly created pools. However, little is known about the long-term establishment of populations, especially of rare and endangered species. The aim of this study was to investigate the colonization process at small artificial waters by dragonflies with special focus on typical peat bog species. From 2015 to 2018, exuviae of Anisoptera were collected quantitatively at six man-made pools, three new and three old ones, in the Lower Silesian Forest. The colonization success by Zygoptera was investigated qualitatively and served as an additional information on the biodiversity of these waters. In total, 26 Odonata species (9 Zygopterans and 17 Anisopterans) with successful reproduction were found. However, species diversity varied significantly both between the pools and the years of study. There were no significant differences between new and old pools. There were four peat bog species (Aeshna juncea, Leucorrhinia dubia, L. albifrons, L. pectoralis) among the autochthonous species, Long-term development could only be confirmed for A. juncea and L. dubia in particular pools. Leucorrhinia albifrons occurred only sporadically and was not found in the last study year (2018). By contrast, L. pectoralis did complete its development in the years 2017 and 2018. Generally, these species preferred waters with moderately or well developed vegetation. The results confirm that a wide range of species can reproduce in artificial pools. However, permanent reproduction could be recorded for just a few dragonfly species. Consequently, man-made pools in the Lower Silesian Forest should not be considered as long-term surrogate habitats but rather as temporary sub-population patches of the regional dragonfly fauna." (Author)] Address: Rychla, A., ul. Osiedlowa 12, Ploty, PL 66016 Czerwieñsk, Poland. E-mail: rychlan@op.pl

17846. Sackville, M.; Brauner, C.J.; Matthews, P.G.D. (2019): Complete larval development of the dragonfly, Rhionaeschna multicolor, at 20°C under natural photoperiod (Odonata: Aeshnidae). Notulae odonatologicae 9(3): 103-108. (in English) ["Rhionaeschna multicolor was reared from hatch to emergence in a controlled laboratory setting for the first time. Complete development at 20°C under natural photoperiod consisted of 13 stadia over 428 ± 3 days. Moult timing and total exuvia length tightly followed semi-log (R2 = 0.993, Sy.x = 0.349) and exponential growth curves (R2 = 0.984, Sy.x= 1.301), respectively, yielding a mean growth ratio of 1.26 ±0.026. Winter diapause may persist through spring and summer photoperiods for late stadia nymphs in

these conditions, potentially delaying adult emergence relative to nymphs reared in the wild." (Authors)] Address: Sackville, M., Department of Zoology, University of British Columbia, Vancouver, British Columbia, Canada V6T 1Z4. E-mail: mikesack@zoology.ubc.ca

17847. Sánchez-Rosario, A. (2019): Distribución de la riqueza de especies de los odonatos (Insecta: Odonata) de la República Dominicana: una actualización a partir de especímenes de colección. Distribution of species richness of the odonates (Insecta: Odonata) of the Dominican Republic: An update from collection specimens. Actualidades Biológicas 41 (111): 72-80. (in Spanish, with English summary) ["Scientific collections are important biodiversity records, as is the one from the Instituto de Investigaciones Botánicas y Zoológicas (IIBZ) from the Universidad Autónoma de Santo Domingo in Dominican Republic. They provide a partial but useful view of the common occurrence localities and information gaps of specific groups of organisms. Presented in this paper are a list of species and an occurrence map of adult odonate specimens represented in the collection from the IIBZ; a comparison of them with reports from previous works was performed. Of the 67 species currently reported in the Dominican Republic, 63 were found in the collection. Regarding previous works, species richness increased in some provinces, such was the case in Distrito Nacional, where it increased from 44 to 51. A correlation analysis examined the association between numeric richness and the drainage density, annual precipitation and surface area of the province; none of the correlations yielded significant results. Additionally, linear mixed effect models were generated, using the mentioned variables as fixed effect and a qualitative variable related to accessibility and population density as random effect. All the models found that a substantial percentage of the variance of the numeric richness is explained by the random effect variable, which means the accessibility conditions the species' occurrence, suggesting a sampling bias exists. From this arises the need of collecting specimens in regions with few records to better comprehend the distribution of odonates in the country." (Author)] Address: Sánchez-Rosario, América, Inst. de Investigaciones Botánicas y Zoológicas Prof. Rafael M. Moscoso, Univ. Autónoma de Santo Domingo, Santo Domingo, República Dominicana. E-mail: america.sanchez@hotmail.com

17848. Sansault, É.; Dhuicque, V.; Baeta, R.; Motteau, V. (2019): Découverte de Leucorrhinia albifrons en région Centre-Val de Loire et structure des populations du centre-ouest de la France (Odonata: Libellulidae). Martinia 34(1/2): 17-25. (in French, with English summary) ["Discovery of L albifrons in the Centre-Val de Loire region and structure of central-western populations in France: In France, Leucorrhinia albifrons is a rare species with a fragmented distribution and three areas of occupancy: in the Nouvelle-Aquitaine, in the Bourgogne-Franche-Comté and in the Pays de la Loire regions. Close to this last region, the discovery of a population in Indre-et-Loire department in June 2017 represents the first record of the species for the Centre-Val de Loire region. The conservation status of this population seems favorable regarding population size and habitat quality. Although it is still unknown whether this population remains from an ancient bigger population or follows a recent colonization, it seems to be isolated from the other sites found in the central western part of France. Oncoming monitoring should provide new information about the population's origins." (Authors)] Address: Sansault, É., Association Naturaliste d'Étude et de Protection des Écosystèmes (ANEPE) Caudalis, 1 rue de la Mairie, 37520 La Riche, France. E-mail: anepe.caudalis@gmail.com

17849. Sanubar Guliyeva A. (2019): Species composition and quantitative distribution of the larvae of dragonflies (Odonata) in the new ecological conditions of the lake Mehman. Economic and Social Development. 37th International Scientific Conference on Economic and Social Development – "Socio Economic Problems of Sustainable Development" Book of Proceedings. Editors: Muslim Ibrahimov, Ana Aleksic, Darko Dukic, Baku: 985-988. (in English) ["The paper presents new data on species composition, number and distribution of the larvae of Odonata in new environmental conditions of the different habitats of in the lake Mehman. Field works conducted in 2015 - 2017 in the lake Mehman resulted in the rearings of 25 species and forms of dragonfly larvae. Seven of these L. nympha, S. fusca, E. viridulum, I. pumilio, O. cancellatum, L. depressa, L. quadrimaculata, Cordulia sp. are new to the lake. Species Lestes virens, and I. elegans, were found in winter, spring and autumn of 2015 and winter and autumn of 2017; C. scitulum in winter and autumn of 2015; C. hastulatum - winter, spring and autumn of 2017; E. fatime in winter and autumn of 2015 - 2017; in winter and spring of 2015 - 2017. Species C. mercuriale [sic!], C. scitulum, L. virens, I. elegans, C. puella, E. najas, O. albistylum are observed in the lake in all seasons and are dominated by widespread. It should be noted that the decrease in the number of larvae of dragonflies in the summer, especially at depths of up to 0.5 m is due to their intensive consumption by fish and water birds and emergence of adult dragonflies which leave the lake. On the other hand, in summer period, the volume of oxygen in shallow water of the lake Mehman greatly reduced, and asa result of evaporation of water, the amount of salts in water is increased. In such circumstances, the probability of occurrence of freshwater organisms in the benthos is naturally decreased. The study of the distribution of larvae of dragonflies on specific habitats of the lake revealed their maximum development on plant and silty habitats, and the minimum - on black silty sand. Changes in biomass of benthic organisms as well as larvae of dragonflies, which developed very poor is analyzed. Poor development of dragonfly larvae in the lake Mehman characterized, on the one hand with their intensive consumption by fish and water birds and on the other hand - the steady worsening of the environmental conditions of the lake." (Author)] Address: Sanubar Guliyeva A., Azerbaijan State University of Economics (UNEC), Azerbaijan. E-mail: Sama2013@bk.ru

17850. Schilder, R.J.; Stewart, H. (2019): Parasitic gut infection causes functional and molecular resemblance of Libellula pulchella dragonfly flight muscle to skeletal muscle

of obese vertebrates. Journal of Experimental Biology 222(5): jeb188508. doi: 10.1242/jeb.188508: 10 pp. (in English) ["We previously demonstrated the existence of a naturally occurring, metabolic disease phenotype in Libellula pulchella dragonflies, that shows high similarity to vertebrate obesity and type II diabetes, and is caused by a protozoan gut parasite. To further mechanistic understanding of how this metabolic disease phenotype affects male L. pulchella fitness in vivo, we examined infection effects on in situ muscle performance- and molecular traits relevant to L. pulchella flight performance in nature. Importantly, these traits were previously shown to be affected in obese vertebrates. Similar to obesity effects in rat skeletal muscle, dragonfly gut infection caused a disruption of relationships between body mass, flight muscle power output and alternative pre-mRNA splicing of troponin T, a trait known to affect muscle calcium sensitivity and performance in insects and vertebrates. In addition, when simulated in situ to contract at cycle frequencies ranging from 20-45Hz, infected individuals' flight muscles displayed a left-shift in the power-cycle frequency curves, i.e., their optimal cycle frequency was significantly reduced. Interestingly, this left-shift resulted in power-cycle frequency curves that were similar to those produced by flight muscles of non-infected, teneral (i.e., physiologically immature) adult L. pulchella males. Overall, our results indicate that effects of metabolic disease on skeletal muscle physiology in natural insect systems are similar to those observed in vertebrates maintained in laboratory settings. More generally, they indicate that study of natural, host-parasite interactions can contribute important insight into how environmental factors other than diet and exercise may contribute to the development of metabolic disease phenotypes." (Authors)] Address: Schilder, R.J., Pennsylvania State Univ., Dept Entom., 501 Ag Sciences & Industries Building, State College, PA 16802, USA. E-mail: rjs360@psu.edu

17851. Schilling, E.G.; Lawrenz, R.; Kundel, H. (2019): An assessment of the geographic distribution and status of a rare dragonfly, Rhionaeschna mutata, at the northwestern edge of its range. Northeastern Naturalist 26(3): 523-536. (in English) ["R. mutata is a rare North American dragonfly, most widely distributed in the eastern US. In 2009, a reproductive population was found in 2 ponds in eastern Minnesota, establishing a substantial northwestern range expansion. We assessed the geographic distribution of the Spatterdock Darner in the region to inform conservation planning for this species. Using previously defined habitat criteria, we identified potential reproductive ponds in the ecoregion with GIS. In 2015 and 2016, we used multiple methods to survey 25 ponds for Spatterdock Darner nymphs, adults, and exuviae. We found no Spatterdock Darners in the region, despite intensive survey efforts targeted at ponds that met the habitat criteria. The Spatterdock Darner may be present in this water-rich region, but was undetected by our efforts, or a local extirpation may have occurred, possibly linked to recent fish colonization in one of the original reproductive ponds." (Authors)] Address: Schilling, Emily, Biology Dept, Augsburg University, Minneapolis, MN 55454, USA

17852. Schneider, T.; Ikemeyer, D. (2019): The Damselflies and Dragonflies of Iran – Odonata Persica. Natur in Buch und Kunst (NIBUK) (ISBN 978-3-931921-23-7): 255 pp- ["This book is the first comprehensive publication about damselflies and dragonflies in Iran. Within a period of six years, from 2013 to 2018, the authors travelled 16 times to almost every Iranian province to investigate the indigenous dragonfly fauna. As a result one dragonfly could be described as a new species, Aeshna vercanica, and other dragonflies were recorded in Iran for the first time. These are Lestes dryas, L. macrostigma, Platycnemis kervillei, Coenagrion puella, C. pulchellum, C. ponticum, C. lunulatum, Crocothemis sanguinolenta, Brachythemis contaminata, Trithemis pallidinervis and Calopteryx s. tschaldirica. In total 103 species have been illustrated by photography. For detailed distribution maps data from formerly published literature and available unpublished data about Iranian dragonflies were screened up to the end of 2018 and entered in a database. Further information on biometric data, identification, habitat and taxonomy is given. One of the key objectives of this book is to help preserving the heritage of the Iranian dragonfly fauna which is gravely endangered by the water crisis and all its repercussions. There are distribution maps and 2 to 5 colour photos of each of the 103 species treated in the book." (Publisher] Address: Publisher: Natur in Buch und Kunst, Verlag und Versand, Dieter Prestel, Beiert 11a, 53809 Ruppichteroth, Germany. E-mail: nibuk@nibuk.de

17853. Seehausen, M. (2019): Über den Aquaristikhandel nach Deutschland importierte Libellen (Odonata) - eine Übersicht der letzten Jahre. Libellen in Hessen 12: 71-80. (in German, with English summary) ["Dragonflies introduced to Germany via the aquarium trade (Odonata) – an overview of recent years. More than 330 Odonata larvae and imago have been given to the author since 2011. Of that 189 Zygoptera and 39 Anisoptera were bred to emergence and the species identified. Nine species were recorded, including two native (Ischnura elegans, Aeshna cyanea) and seven exotic species (Agriocnemis pygmaea, Ischnura senegalensis, Pseudagrion microcephalum, Anax guttatus, Crocothemis servilla, Orthetrum chrysostigma, O. sabina). Except for the African and Mediterranean O. chrysostigma all these latter species have a predominantly or exclusively Asian distribution, whereas Ischnura senegalensis is wide spread in Asia as well as in Africa. A published record of the American Ischnura ramburii has been withdrawn. Seasonal increases in records from November to April is noticeable." (Author)] Address: Seehausen, M., Museum Wiesbaden, Naturhistorische Sammlungen, Friedrich-Ebert-Allee 2, 65185 Wiesbaden, Germany. E-mail: malte.seehausen@museum-wiesbaden.de

17854. Snegovaya, N.Yu. (2019): Dragonfly (Insecta, Odonata) fauna of Nakhichevan Autonomic Republic (Azerbaijan). International Dragonfly Fund Report 127: 1-28. (in English) ["The article presents new faunistic data on 33 Odonata species, based on the material collected by the author in 2012, 2016 and 2017 and a systematic research in 2018 throughout the Nakhichevan Autonomous Republic (AR). Onychogomphus assimilis (Schneider, 1845) is a new

record for the fauna of Azerbaijan. Eight species were registered for the first time for the territory of Nakhichevan AR: Lestes virens, Coenagrion scitulum, Aeshna mixta, Anaciaeschna isoceles, Anax parthenope, Sympetrum sanguineum, Crocothemis erythraea, and Selysiothemis nigra." (Author)] Address: Snegovaya, Nataly, Zoological Institute NAS of Azerbaijan, proezd 1128, kvartal 504, Baku, AZ 1073, Azerbaijan. E-mail: snegovaya@yahoo.com

17855. Song, N.; Li, X.; Yin, X.; Li, X.; Yin, J.; Pan, P. (2019): The mitochondrial genomes of palaeopteran insects and insights into the early insect relationships. Scientific Reports | (2019) 9:17765 | https://doi.org/10.1038/s41598-019-54391-9: 11 pp. (in English) ["Phylogenetic relationships of basal insects remain a matter of discussion. In particular, the relationships among Ephemeroptera, Odonata and Neoptera are the focus of debate. In this study, we used a next-generation sequencing approach to reconstruct new mitochondrial genomes (mitogenomes) from 18 species of basal insects, including six representatives of Ephemeroptera and 11 of Odonata, plus one species belonging to Zygentoma. We then compared the structures of the newly sequenced mitogenomes. A tRNA gene cluster of IMQM was found in three ephemeropteran species, which may serve as a potential synapomorphy for the family Heptageniidae. Combined with published insect mitogenome sequences, we constructed a data matrix with all 37 mitochondrial genes of 85 taxa, which had a sampling concentrating on the palaeopteran lineages. Phylogenetic analyses were performed based on various data coding schemes, using maximum likelihood and Bayesian inferences under different models of sequence evolution. Our results generally recovered Zygentoma as a monophyletic group, which formed a sister group to Pterygota. This confirmed the relatively primitive position of Zygentoma to Ephemeroptera, Odonata and Neoptera. Analyses using site-heterogeneous CAT-GTR model strongly supported the Palaeoptera clade, with the monophyletic Ephemeroptera being sister to the monophyletic Odonata. In addition, a sister group relationship between Palaeoptera and Neoptera was supported by the current mitogenomic data." (Authors)] Address: Song, N., College of Plant Protection, Henan Agri. Univ, Zhengzhou, 450002, China. E-mail: songnan@henau.edu.cn

17856. Staufer, M. (2019): Ein ungewöhnliches Vorkommen der Großen Quelljungfer (Cordulegaster heros Theischinger, 1979) in der Feuchten Ebene im südlichen Wiener Becken, Österreich (Odonata: Cordulegastridae). Beiträge zur Entomofaunistik 20: 127-142. (in German, with English summary) ["In Central Europe C. heros inhabits predominantly small forest streams in hilly locations. Therefore, an occurrence in the agricultural landscape within the plains of the Pannonian East of Austria was rather unexpected. Investigations, carried out from 2018 to 2019, revealed a spatially limited population from the Leitha to the western slopes of the Leitha Mountains. Reproduction evidence was found mainly in small streams and ditches of the so-called “Feuchte Ebene”, where, due to the particular geological-hydrological conditions, water bodies can be structurally very similar to those of typical breeding sites. In the Leitha Mountains, hardly suitable habitats for the larvae are present. Due to its central location, the region is considered to be an important connecting corridor between the populations of the Vienna woods and Rosalia Mountains in Austria and the Little Carpathians (Malé Karpaty) in Slovakia." (Author)] Address: Staufer, Martina, Lindenbauergasse 13, 1110 Wien, Österreich (Austria). E-Mail: m_staufer@web.de

17857. Strobl, K.; Moning, C.; Kollmann, J. (2019): Positive trends in plant, dragonfly and butterfly diversity of rewetted montane peatlands. Restoration Ecology doi: 10.1111/rec.-12957. 11 pp, 7 pp suppl. mat. (in English) ["Drainage and afforestation of peatlands cause extensive habitat degradation and species losses. Restoration supports peatland biodiversity by creating suitable habitat conditions, including stable high water tables. However, colonization by characteristic species can take decades or even fail. Peatland recovery is monitored shortly after restoration, but initial trends may not continue, and results might differ among taxonomic groups. This study analyzes trends in plant, dragonfly, and butterfly diversity within 18 years after rewetting of montane peatlands in central Germany. We compared diversity and species composition of 19 restored sites with three drained peatlands and one near-natural reference site. Restoration resulted in improved habitat conditions and benefited species diversity, but there were marked differences among taxonomic groups. Dragonflies rapidly colonized small water bodies but their diversity did not further increase in older restoration sites. Characteristic peatland vegetation recovered slowly, since it depended on a high water holding capacity that was only reached after peat started accumulating. Generally, plant diversity developed towards reference conditions albeit incompletely, even 18 years after restoration. Butterflies responded less to peatland restoration; generalists increased only temporarily and specialists could not establish. In conclusion, peatland restoration improves habitat conditions and biodiversity, while trajectories of recovery are nonlinear and incomplete after two decades. This highlights the need of long-term monitoring and a strategic selection of indicator species for evaluation of restoration success." (Authors)] Address: Strobl, Katharina, Chair of Restoration Ecology, Technical University of Munich, Emil-Ramann-Str. 6, 85354 Freising, Germany. E-mail: katharina.strobl@tum.de

17858. Sugiman, U.; Romdhoni, H.; Putera, A.K.A.; Robo, R.J.; Oktavia, F.; Raffiudin, R. (2019): Oviposition behaviour and oviposition site selection in Pseudagrion pruinosum (Burmeister) (Odonata: Coenagrionidae). Jurnal Entomologi Indonesia 16(1): 29-40. (in Indonesian, with English summary) ["Pseudagrion pruinosum (Burmeister) is a common damselfly that is widely distributed in Southeast Asia. However, information related to the oviposition behavior and habitat is still limited. This study was aimed to determine the behavior of P. pruinosum when laying eggs and characterized the oviposition habitat. This research used focal sampling method to observe oviposition behavior and measure habitat parameters on egg-laying location. Results

showed, there was mate guarding when P. pruinosum females lay eggs. The male forms a tandem formation (contact mate guarding), then released the female and keep a guarding behavior around the female (non-contact mate guarding). Eggs were placed by the female on plant tissue with the technique of positioning the body to remain on the surface and then submerged. There is no tendency of P. pruinosum behavior towards one type or technique. Based on the results of principal component analysis, 75.8% of habitat components can be described for egg-laying habitat. Air temperature, pH, light intensity, and heterogeneity of vegetation positively correlated with the occurrence of egg-laying while TDS, humidity, water depth, and water temperature were negatively correlated. The results of this study concluded that the characteristics of egg-laying techniques included, i.e contact and non-contact mate guarding by the males and females putting eggs on the surface then submerged into water." (Authors)] Address: Sugiman, U. Departemen Biologi, Fakultas Matematika dan Ilmu Pengetahuan Alam, Institut Pertanian Bogor Jalan Agatis, Kampus IPB Dramaga, Bogor 16680, Indonesia. E-mail: usugiman22@gmail.com

17859. Supple, J.A. (2019): Descending premotor target tracking systems in flying insects. Doctoral thesis, Department of Physiology, Development, and Neuroscience, University of Cambridge: 198 pp. (in English) ["The control of behaviour in all animals requires efficient transformation of sensory signals into the task-specific activation of muscles. Predation offers an advantageous model behaviour to study the computational organisation underlying sensorimotor control. Predators are optimised through diverse evolutionary arms races to outperform their prey in terms of sensorimotor coordination, leading to highly specialised anatomical adaptations and hunting behaviours, which are often innate and highly stereotyped. Predatory flying insects present an extreme example, performing complex visually-guided pursuits of small, often fast flying prey over extremely small timescales. Furthermore, this behaviour is controlled by a tiny nervous system, leading to pressure on neuronal organisation to be optimised for coding efficiency. In dragonflies, a population of eight pairs of bilaterally symmetric Target Selective Descending Neurons (TSDNs) relay visual information about small moving objects from the brain to the thoracic motor centres. These neurons encode the movement of small moving objects across the dorsal fovea region of the eye which is fixated on prey during predatory pursuit, and are thought to constitute the commands necessary for actuating an interception flight path. TSDNs are characterised by their receptive fields, with responses of each TSDN type spatially confined to a specific portion of the dorsal fovea visual field and tuned to a specific direction of object motion. To date, little is known about the descending representations mediating target tracking in other insects. This dissertation presents a comparative report of descending neurons in a variety of flying insects. The results are organised into three chapters: Chapter 3 identifies TSDNs in demoiselle damselflies and compares their response properties to those previously described in dragonflies. Demoiselle TSDNs are also found to integrate binocular information, which is further elaborated with prism and eyepatch experiments. Chapter 4 describes TSDNs in two dipteran species, the robberfly Holcocephala fusca and the killerfly Coenosia attenuata. Chapter 5 describes an interaction between small- and wide-field visual features in TSDNs of both predatory and nonpredatory dipterans, finding functional similarity of these neurons for prey capture and conspecific pursuit. Dipteran TSDN responses are repressed by background motion in a direction dependent manner, suggesting a control architecture in which target tracking and optomotor stabilization pathways operate in parallel during pursuit." (Authors)] Address: Supple, J.A., Dept of Physiology, Development & Neuroscience, University of Cambridge, Downing Street, Cambridge CB3 2EG, UK

17860. Svensson, E.I. (2019): Eco-evolutionary dynamics of sexual selection and sexual conflict.Functional Ecology 33): 60-72. (in English) ["1. The research framework of eco-evolutionary dynamics is increasing in popularity, as revealed by a steady stream of review articles and a recent and influential book, but primary empirical research is lagging behind. Moreover, the few empirical case studies demonstrating eco-evolutionary dynamics might not be entirely representative. 2. Much current research on eco-evolutionary dynamics is focused on how ecological interactions lead to natural selection on phenotypic traits (“eco-evo”), and in turn how the evolutionary change in such traits feed back on ecological dynamics (“evo-eco”). A key feature of eco-evolutionary dynamics is thus a feedback loop between ecology (e.g., population dynamics) and evolution (i.e., genetic change). 3. In contrast to previous research on eco-evolutionary dynamics driven by natural selection, the role of eco–evolutionary feedbacks in sexual selection and sexual conflict is largely unknown. Here, I review theory and the limited empirical evidence in this area and identify some promising future lines of research.4. I update a past review on contemporary evolution of secondary sexual traits in natural populations and formulate six explicit and rigorous criteria for contemporary evolution of secondary sexual traits by natural or sexual selection or sexual conflict. I then discuss the other key prediction of eco-evolutionary dynamics (i.e., evolution by sexual selection or sexual conflict shapes ecological dynamics). My overview reveals that our current knowledge in this area is limited and mainly come from theoretical models and laboratory experiments.5. A major challenge in eco-evolutionary dynamics is therefore to link ecological and population dynamics with sexual selection and sexual conflict. This is not an easy task but might be possible with carefully chosen study systems and methods." References to Ischnura elegans are made. (Author)] Address: Svensson, E.I., Evolutionary Ecology Unit, Dept Biol., Lund Univ, Lund, Sweden. Email: erik.svensson@biol.lu.se

17861. Takahashi, Y.; Noriyuki, S. (2019): Colour polymorphism influences species' range and extinction risk. Biology letters 15(7): 5 pp. (in English) ["Polymorphisms in a population are expected to increase the growth rate and the sta-

bility of the population, leading to the expansion of geographical distribution and mitigation of extinction risk of a species. However, the generality of such ecological consequences of colour polymorphism remains uncertain. Here, via a comparative approach, we assessed whether colour polymorphisms influence climatic niche breadth and extinction risk in some groups of damselflies, butterflies and vertebrates. The climatic niche breadth was greater, and extinction risk was lower in polymorphic species than in monomorphic species in all taxa analysed. The results suggest that colour polymorphism facilitates range expansion and species persistence." (Authors)] Address: Takahashi, Y., Graduate School of Science, Chiba University, Chiba, Japan. E-mail: takahashi.yum@gmail.com

17862. Thompson, A. (2019): The life history of Anax junius (Drury) in Minnesota: Determining instars, growth development pathways, emergence phenology, and the effect of temperature on development (Odonata: Aeshnidae). Ph.D. thesis, University of Minnesota: 135 pp. (in English) ["… the study of dragonflies and damselflies, is presently at a delightful stage of maturity. The basics of odonate life history are well understood but the details of how different species express variations in their development and reproduction, in response to different evolutionary drivers, is ripe for exploration. These variations can only be discovered through field observations executed with thoughtful experimental design and then the observational data collected must be interpreted with appropriate statistical and analytical tools. For a naturalist with a patient and inquisitive mind this kind of research is exceptionally rewarding. Chapters 1, 2, and 3 focus on these goals. Observational data on A. junius growth and emergence were collected over a period of two years at Crow-Hassan Park Reserve, near Minneapolis, Minnesota. Severe winter conditions are the largest constraint influencing dragonfly life histories in Minnesota. Odonata must both survive the winter, and time their emergence and reproduction so that they occur during the short growing season. This research was designed to explore how northern A. junius have adapted to survive winter. Chapter 1 demonstrates the application of a statistical tool that identifies the number of instars in a field-collected sample of nymphs: a need for interpreting observed growth and development data. This mixed distribution analysis has been used in other fields of entomology, but this is the first time (to the author's knowledge) that it has been applied to dragonflies. Chapter 2 maps nymph growth over time and identifies different A. junius growth pathways that are associated with two different overwintering strategies. Chapter 3 summarizes observations of A. junius emergence phenology via exhaustive exuviae collection, and reveals that cold temperatures and stochastic events are the greatest constraints on emergence duration. Northern ectoderms, like dragonflies, with life histories that are constrained by severe winters are impacted by climate change. The implications of the changing climate on dragonfly natural history are of increasing conservation interest. Rare and threatened niche species of Odonata could be at risk of extinction if their habitat conditions are altered beyond to what they can adapt to. However, A. junius is a common and abundant dragonfly and is of conservation interest for different reasons. Extremely common species are the skeletons of ecosystems; they make up most of the biomass and provide structure and support for all the other components. A change in the geography or abundance of A. junius could have wide-ranging and cascading effects. Models based on known temperature thresholds are required to predict ectoderm response to the changing climate. Chapter 4 describes an experiment that defined these threshold temperatures for the northern winter growth pathway of A. junius. Development duration and rate were measured for nymphs reared in different temperature-controlled chambers, and the base and optimum growth temperatures were calculated for the last two nymph development stages. These values can now be used in models to predict the impact of climate change on the phenology of A. junius development and emergence. Note: Some materials and methods descriptions, figures, and tables are repeated in this dissertation because each chapter was written with the intent to be published individually." (Author)] Address: not stated

17863. Toussaint, E.F.A.; Bybee, S.M.; Erickson, R.J.; Condamine, F.L. (2019): Forest giants on different evolutionary branches: Ecomorphological convergence in helicopter damselflies. Evolution 73(5): 1045-1054. (in English) ["The convergent evolution of analogous features is an evolutionary process occurring independently across the tree of life. From the evolution of echolocation, prehensile tail, viviparity, or winged flight, environmental factors often drive this astonishing phenomenon. However, convergent evolution is not always conspicuous or easily identified. Giant damselflies count among the largest flying insects on Earth, and have astonishing ecologies including orb-web spider plucking and oviposition in phytotelmata. One species occurs in the Afrotropics and 18 species are found in the Neotropics. Convergent evolution was historically hypothesized based on the ecological and morphological affinities of these two geographically distant lineages but was not supported by earlier phylogenetic inferences supporting their monophyly. Using a molecular supermatrix approach and a large selection of outgroups, we revisit and reject the monophyly of Afrotropical and Neotropical giant damselflies that is otherwise supported by a morphological phylogeny. Molecular divergence time estimation suggests an origin of Afrotropical giant damselflies in the late Paleogene, and of Neotropical ones at the Cretaceous/Paleogene boundary, thereby rejecting a long-standing West Gondwana vicariance hypothesis. The strong ecological and morphological resemblances between these two independent lineages represents an astonishing case of Amphi-Atlantic tropical convergent evolution." (Authors)] Address: Toussaint, E.F.A., Natural History Museum of Geneva, 1211 Geneva 6, Switzerland. E-mail: emmanuel.toussaint@ville-ge.ch

17864. Veras, D.S.; Castro, E.R.; Lustosa, G.S.; de Azevêdo, C.A.S.; Juen, L. (2019): Evaluating the habitat integrity index as a potential surrogate for monitoring the water quality of streams in the cerrado-caatinga ecotone in

northern Brazil. Environ. Monit. Assess. 191:562: 9 pp. (in English) ["Human activities have long been altering the natural conditions of streams, including the quality of their water, throughout most of Brazil. This problem is even worse in regions with low rainfall levels, such as the Brazilian Northeast, where water quality needs to be monitored more carefully. In this context, the present study investigated the effects of environmental integrity on the physicochemical characteristics of the streams of the basin of the Itapecuru River in northeastern Brazil. We tested the hypothesis that streams with lower habitat integrity would have higher conductivity, pH, and temperature, due to the reduced input of allochthonous organic matter and the greater washout of sediments to the stream bed. A total of 15 streams, of a sedimentary basin, were evaluated in the municipality of Caxias, in the Brazilian state of Maranhão, between June 2015, and July 2016; each stream was sampled once a month during the drought period in the region, where physicochemical measurements were taken to determine the environmental integrity of the stream through the application of a habitat integrity index. Streams with greater habitat integrity had lower conductivity, pH, and temperature and had higher discharge rates. The index proved to be not an effective tool for the evaluation of water quality, but was found to be important for the management of hydrographic basins by indicating important changes in environmental variables. In this case, the index can be used primarily for the management of hydrographic basins, given that it can be applied straightforwardly, it can be interpreted easily by decision-makers, and it can quantify alterations to the structure of the system with precision." (Authors)] Address: Veras, D.S., Programa de Pós-graduação em Biodiversidade, Ambiente e Saúde, Univ. Estadual do Maranhão, Caxias, Maranhão, Brazil

17865. Verheyen, J.; Delnat, V.; Stoks, R. (2019): Increased daily temperature fluctuations overrule the ability of gradual thermal evolution to offset the increased pesticide toxicity under global warming. Environ. Sci. Technol. 53(8): 4600-4608. (in English) ["The widespread evidence that global warming can increase species sensitivities to chemical toxicants, and vice versa, and the recent insight that thermal evolution may mitigate these effects is crucial to predict the future impact of toxicants in a warming world. Nevertheless, a major component of global warming, the predicted increase in daily temperature fluctuations (DTFs), has been ignored at the interface of evolutionary ecotoxicology and global change biology. We studied whether 4 °C warming and a 5 °C DTF increase (to 10 °C DTF) magnified the negative impact of the insecticide chlorpyrifos (CPF) in larvae of low- and high-latitude populations of the damselfly Ischnura elegans. While 4 °C warming only increased CPF-induced mortality in high-latitude larvae, the high (10 °C) DTF increased CPF-induced larval mortality at both latitudes. CPF reduced the heat tolerance; however, this was buffered by latitude-specific thermal adaptation to both mean temperature and DTF. Integrating our results in a space-for-time substitution indicated that gradual thermal evolution in high-latitude larvae may offset the negative effects of CPF on heat tolerance under warming, unless the expected DTF increase is taken into account. Our results highlight the crucial importance of jointly integrating DTFs and thermal evolution to improve risk assessment of toxicants under global warming." (Authors)] Address: Verheyen, Julie, Evolutionary Stress Ecology and Ecotoxicology, University of Leuven, Charles Deberiotstraat 6 32, B-3000 Leuven, Belgium. E-mail: julie.verheyen@kuleuven.be

17866. Verheyen, J.; Stoks, R. (2019): Current and future daily temperature fluctuations make a pesticide more toxic: Contrasting effects on life history and physiology? Environmental Pollution 248: 209-218. (in English) ["Highlights: • Daily temperature fluctuations (DTFs) increased chlorpyrifos toxicity. • Chlorpyrifos only induced mortality and reduced growth rate in the presence of DTFs. • Chlorpyrifos did not affect life history when the temperature was kept constant. • Current and future DTF increased toxicity to the same extent. Abstract: There is increasing concern that climate change may make organisms more sensitive to chemical pollution. Many pesticides are indeed more toxic at higher mean temperatures. Yet, we know next to nothing about the effect of another key component of climate change, the increase of daily temperature fluctuations (DTFs), on pesticide toxicity. Therefore, we tested the effect of the pesticide chlorpyrifos under different levels of DTF (constant=0°C, low=5°C (current maximum level) and high=10°C (predicted maximum level under global warming)) around the same mean temperature on key life history and physiological traits of Ischnura elegans damselfly larvae in a common-garden experiment. At all levels of DTF, chlorpyrifos exposure was stressful: it reduced energy storage (fat content) and the activity of its target enzyme acetylcholinesterase, while it increased the activity of the detoxification enzyme cytochrome P450 monooxygenase. Notably, chlorpyrifos did not cause mortality or reduced growth rate at the constant temperature (0°C DTF), yet increased mortality 6x and reduced growth rate with ca. 115% in the presence of DTF. This indicates that daily short-term exposures to higher temperatures can increase pesticide toxicity. Our data suggest that when 5°C DTF will become more common in the studied high-latitude populations, this will increase the toxicity of CPF, and that a further increase from 5° DTF to 10°C DTF may not result in a further increase of pesticide toxicity. Our results highlight the biological importance of including daily temperature fluctuations in ecological risk assessment of pesticides and as an extra dimension in the climate-induced toxicant sensitivity concept." (Authors)] Address: Verheyen, Julie, Evolutionary Stress Ecology and Ecotoxicology, University of Leuven, Charles Deberiotstraat 6 32, B-3000 Leuven, Belgium. E-mail: julie.verheyen@kuleuven.be

17867. Verheyen, J.; Stoks, R. (2019): Shrinking body size and physiology contribute to geographic variation and the higher toxicity of pesticides in a warming world. Environ. Sci. Technol. 53, 19: 11515-11523. (in English) ["To improve current and future risk assessment of pesticides under global warming, mechanistic insights and consideration of daily temperature fluctuations (DTFs) are needed. One overlooked mechanism how both higher mean temperatures and DTFs

may increase toxicity is by reducing body size (temperature-size-rule). We studied whether a higher mean temperature and DTF magnified chlorpyrifos toxicity in Ischnura elegans damselfly larvae, and whether this was mediated by temperature-induced reductions in body size and/or physiological changes. The lethal effects of chlorpyrifos were magnified at the high mean temperature (up to ~15 %) and under DTF (up to ~33 %), and especially at their combination (up to ~46 %) indicating synergisms. This highlights that not only considering DTFs, but also their interaction with higher mean temperatures is pivotal for realistic predictions of pesticide toxicity. Both higher temperatures and DTFs resulted in smaller larvae, which were more sensitive to chlorpyrifos. Notably, the DTF-induced smaller body sizes, as well as the higher oxidative damage to lipids, contributed to the higher chlorpyrifos toxicity under DTF. By integrating the temperature-size rule and size-pesticide sensitivity pattern we provide proof-of-principle for a novel, likely general mechanism contributing to geographic variation and the higher toxicity of pesticides in a warming world." (Authors)] Address: Verheyen, Julie, Evolutionary Stress Ecology & Ecotoxicology, University of Leuven, Charles Deberiotstr. 6 32, 3000 Leuven, Belgium. E-mail: julie.verheyen@kuleuven.be

17868. Wagner, H.C. (2019): Wiener Ameisenbeobachtungen (Hymenoptera: Formicidae). Beiträge zur Entomofaunistik 20: 143-159. (in German, with English summary) ["Ants in the state Vienna were collected on 38 days from 2016 to 2018. Interesting observations are described in detail: … ant predation behavior of dragonflies (Odonata: Aeshnidae), …." (Author)] Address: Wagner, H.C., ÖKOTEAM – Institut für Tierökologie und Naturraumplanung, Bergmanngasse 22, 8010 Graz, Österreich (Austria). E-Mail: heriwagner@yahoo.de

17869. Walia, G.K.; Dhillon, G.K. (2019): Mitochondrial COI gene barcoding four species of genus Ischnura (Odonata: Coenagrionidae) from India. J. Adv. Zool. 40(1): 69-77. (in English) ["Taxonomically, identification of complex taxa based on external morphological characters may leads to wrong identification of unknown organism at species level because these characters may also be altered due to geographical and seasonal variations. To overcome this molecular taxonomy has been emerged. In India, out of 9 morphologically described species of genus Ischnura (Odonata: Coenagrionidae), Ischnura senegalensis is the only species, which has been barcoded on the basis of COI gene. During the present study, mitochondrial COI gene has been barcoded for four species of genus Ischnura (I. aurora, I. forcipata, I. rufostigma and I. senegalensis), collected from fresh water bodies from the states of Punjab and Himachal Pradesh (India). Across the final alignment of COI sequences of 352bp, there are 282 conserved sites (80.1%), which represents that COI gene is highly conserved. Conspecific species show <1% divergence range (0% to 0.6%) and interspecific divergence ranges from 7.5% to 15.6%. COI gene sequences of all the species shows 95 – 100% similarity with the sequences of conspecific species deposited in GeneBank. Mitochondrial COI gene based DNA barcoding has been done for I. aurora, I. forcipata and I. rufostigma for the first time from India and for I. forcipata throughout the world." (Authors)] Address: Walia, G.K., Dept of Zoology and Environmental sciences, Punjabi University, Patiala-147 002, Punjab, India. Email: gurinderkaur_walia@yahoo.co.in

17870. Walia, G.K.; Chahal, S.S. (2019): Cytogenetic report on Cordulegaster brevistigma and Watanabeopetalia atkinsoni (Odonata: Cordulegastridae, Chlorogomphidae). Odonatologica 48(1/2): 101-113. (in English) ["Live adult male specimens of C. brevistigma and W. atkinsoni have been collected from Shimla, Himachal Pradesh (India). Male germ cell chromosomes of the species are described on the basis of conventional staining, C-banding, silver nitrate staining and sequence specific staining. Both the species possesses 2n = 25m, as a diploid chromosome number and XO (♂)/XX (♀) type sex determination. In both the species, dark terminal C-bands are present on all the autosomal bivalents and X chromosome is C-positive throughout the length. Terminal light/dark NORs (Nucleolar Organizer Regions) are present on all autosomal bivalents, while X chromosome also possesses terminal NORs. During sequence specific staining, all the autosomal bivalents show prominent terminal DAPI (4',6-diamidino-2-phenylindole) and CMA_3 (Chromomycin A_3) bright regions and X chromosome also possesses both DAPI and CMA_3 signals. In addition, a brief review of the size of X element in the allied families Cordulegastridae, Corduliidae and Macromiidae is given." (Authors)] Address: Walia, Gurinder Kaur, Dept of Zoology and Environmental Sciences, Punjabi Univ., Patiala 147002, Punjab, India. E-mail: gurinderkaur_walia@yahoo.co.in

17871. Wei, G.; Shih, C.; Ren, D.; Wang, Y. (2019): A new burmaeshnid dragonfly from the mid-Cretaceous Burmese amber elucidating wing base structure of true Odonata. Cretaceous Research 101: 23-29. (in English) ["A new fossil burmaeshnid, Proaeschna zhangi gen. et sp. nov., is described from the mid-Cretaceous Burmese amber. Its well-preserved wing base structure allows us to illustrate the morphological details of wing base in the fossil Odonata for the first time. The proximal costal plate in the new species consists of the anterior and posterior parts which are fused together with a suture. The anterior proximal costal plate in P. zhangi and extant Odonata is homologized to the basalare of Protodonata. In addition, P. zhangi has developed the semi-detached scutal plate that is similar as the extant Aeshnidae. The traces of venal basivenalia in weakly sclerotized axillary plate contribute useful information to interpret the venation of wing base within Odonata." (Authors)] Address: Ren, D. College of Life Sciences, Capital Normal Univ., Beijing 100037, China. E-mail: rendong@mail.cnu.edu.cn

17872. Willink, B.; Duryea, M.C.; Svensson, E.I. (2019): Macroevolutionary origin and adaptive function of a polymorphic female signal involved in sexual conflict. The American Naturalist 194(5): 707-724. (in English) ["Intersexual signals that reveal developmental or mating status in females have evolved repeatedly in many animal lineages. Such signals have functions in sexual conflict over mating and can therefore influence sexually antagonistic coevolution.

However, we know little about how female signal development modifies male mating harassment and thereby sexual conflict. Here, we combine phylogenetic comparative analyses of a color polymorphic damselfly genus (Ischnura) with behavioral experiments in one target species to investigate the evolutionary origin and current adaptive function of a developmental female color signal. Many Ischnura species have multiple female color morphs, which include a male-colored morph (male mimics) and one or two female morphs that differ markedly from males (heterochrome females). In Ischnura elegans, males and male-mimicking females express a blue abdominal patch throughout postemergence life. Using phenotypic manipulations, we show that the developmental expression of this signaling trait in heterochrome females reduces premating harassment prior to sexual maturity. Across species this signal evolved repeatedly, but in heterochrome females its origin is contingent on the signal expressed by co-occurring male-mimicking females. Our results suggest that the co-option of a male-like trait to a novel female antiharassment function plays a key role in sexual conflict driven by premating interactions." (Authors)] Address: Willink, Beatriz, Dept of Biology, Evolutionary Ecology Unit, Ecology Building, Lund University, Lund 223-62, Sweden. E-mail: beatriz.willink@ucr.ac.cr

17873. Wolf, J.; Günther, A. (2019): Libellenfauna des FFH-Lebensraumtyps Dystrophe Stillgewässer in Sachsen. Libellula Supplement 15: 183–202. (in German, with English summary) ["Odonata fauna of the Annex I habitat type Natural dystrophic lakes and ponds in Saxony, Germany – Between 2012 and 2017 the Odonata fauna of 25 sites characterised as Annex I habitat type 3160 Natural dystrophic lakes and ponds in Saxony were investigated. Altogether, 41 odonate species were recorded, 36 of which were found to be autochthonic in at least one of the waterbodies investigated. The number of recorded species was found to be correlated to altitude. Among the autochthonic species, Libellula quadrimaculata, Sympetrum danae, Coenagrion puella, C. hastulatum, Pyrrhosoma nymphula, Lestes sponsa, L. virens, Aeshna cyanea, Cordulia aenea, and Leucorrhinia dubia achieved the highest constancy values." (Authors)] Address: Wolf, J., Staatliche Betriebsgesellschaft für Umwelt & Landwirtschaft, Waldheimer Str. 219, 01683 Nossen, Germany. E-mail: juergen.wolf@smul.sachsen.de

17874. Xue, J.; Zhang, H.; Ning, X.; Bu, W.; Yu, X. (2019): Evolutionary history of a beautiful damselfly, Matrona basilaris, revealed by phylogeographic analyses: the first study of an odonate species in mainland China. Heredity 122: 570-581. (in English) [„M. basilaris is distributed mainly in mainland China. A total of 423 individuals from 48 populations covering almost the entire range were sampled to explore the genetic diversity, phylogeographic structure, and demographic dynamics of the species using sequences of three mitochondrial genes (COI, COII, and ND1) and a nuclear (ITS1 + 5.8 S + ITS2) gene. Phylogenetic tree, median-joining network, and BAPS analyses indicated a four-group division of the entire population, and the divergence event was estimated to have occurred in the middle Pleistocene. The diverse terrain of mainland China as well as past climatic oscillations were assumed to have shaped the current phylogeographic pattern of M. basilaris. Multiple lines of evidence supported population expansion in Group 1 and Group 2 but not in Group 3 or Group 4. The expansion times corresponded to the transition phase from the LIG (~0.14–0.12 Mya) to the LGM (~0.021–0.018 Mya). The pre-LGM expansion model reflected a different pattern affecting the historical dynamics of the population of East Asian species caused by Pleistocene climatic changes. Interestingly, Group 2 exhibited a disjunctive distribution pattern. The possible reasons were introgression caused by female-biased dispersal or human phoresy during construction of the Forbidden City during the Ming Dynasty of China." (Authors)] Address: Yu, X., Inst. Entom., College of Life Scien., Nankai Univ., Tianjin 300071, China. E-mail: lannysummer@163.com

17875. Yen, C.C.; Chung, A.Y.C. (2019): Odonata fauna of Imbak Canyon Conservation Area, Sabah. Journal of Tropical Biology and Conservation 16: 1-8. (in English) [„The Odonata fauna of the Imbak Canyon Conservation Area (ICCA) was surveyed during the Batu Timbang Research Station Scientific Expedition on 16-26 August 2017. A total of 62 Odonata species from 13 families were recorded. The family Libellulidae had the highest number of species (27), and this was followed by Coenagrionidae (9 species), Calopterygidae (5 species), Platycnemididae (5 species) and Platystictidae (4 species). The other families (Devadattidae, Chlorocyphidae, Euphaeidae, Lestidae, Philosinidae, Aeshnidae, Corduliidae and Macromiidae) were only represented by 1-3 species. Of the species recorded, 30 are new records for ICCA. The number of species recorded was high, indicating the high diversity of Odonata fauna of ICCA. These records were combined with the existing records in literature to produce a checklist. At present, 68 species from 15 families are known from ICCA." (Authors)] Address: Chung, A.Y.C., Forest Research Centre, Sabah Forestry Dept, P.O. Box 1407, 90715 Sandakan, Sabah, Malaysia. E-mail: cychoong@ukm.edu.my

17876. Yu, X.; Zhang, M.; Ning, X. (2019): A study of Coeliccia cyanomelas Ris, 1912 (Odonata: Platycnemididiae). International Journal of Odonatology 22(3-4): 155-165. (in English) ["C. cyanomelas is studied based on a large series of specimens from its whole distribution range. Intraspecies variations of color patterns on the thorax are discussed. C. sexmaculata Wang, 1994, C. mingxiensis Xu, 2006, and C. wilsoni Zhang & Huo, 2011 are all assigned as junior synonyms of Coeliccia cyanomelas. One 'variety' from Guizhou is reported and discussed briefly." (Authors)] Address: Yu, X., College of Life Sciences, Chongqing Normal University, Chongqing, PR China

17877. Zheng, D.; Nel, A.; Jarzembowski, E.A.; Wang, J.; Zhang, H.; Wang, B. (2019): New gomphaeschnid dragonflies (Odonata: Anisoptera: Aeshnoptera) from mid-Cretaceous Burmese amber. Cretaceous Research 100: 138-144. (in English) ["A new true dragonfly, named Kachinaeshna zhuoi Zheng, Nel and Wang, gen. et sp. nov., is described

from Cretaceous Burmese amber representing the second gomphaeschnaoidine from this deposit. Kachinaeshna Zheng, Nel and Wang, gen. nov. differs from other Gomphaeschnaoidinae in: the absence of an elongate distal paranal cell, directly basal of the anal loop, in the hindwing; a distinct curvature of RP2; and a curve of RP1 at the pterostigmal brace. The gomphaeschnaoidine dragonflies were previously only recorded from the Lower Cretaceous and mainly from the upper Aptian Crato Formation of Brazil. Based on the true dragonfly fossils found in Burmese amber, a possible late Early Cretaceous age is supported for Burmese amber." (Authors)] Address: Zheng, D., Dept of Earth Sciences, University of Hong Kong, Hong Kong Special Administrative Region, China. E-mail: dranzheng@gmail.com

2020

17878. Lu, S.; Qiu, R.; Hu, J.; Li, X.; Chen, Y.; Zhang, X.; Cao, C.; Shi, H.; Xie, B.; Wu, W.-M.; He, D. (2020): Prevalence of microplastics in animal-based traditional medicinal materials: Widespread pollution in terrestrial environments. Science of The Total Environment 709, 20 March 2020, 136214: 9 pp. (in English) ["Highlights: • 20 types of animal medicinal materials and 10 types of fresh animals were collected in China. • Microplastics (MPs) were found in all medicinal materials with average incidence rate of 94.67%. • The abundance of MPs was in the range of 1.80 ± 0.38 to 7.80 ± 0.83 items/individual. • Major MPs were microfibers (84.68%), or PET (40.45%), Rayon (30.64%) and PE (10.11%). • MPs show similar characteristics between medicinal materials and fresh animals. Abstract: Microplastics (MPs) pollution is an emerging environmental and health concern. MPs have been extensively observed in the aquatic environment, yet rarely investigated in the terrestrial ecosystem, especially in relation to health risks. To evaluate potential MPs pollution in land-dwelling animal medicine materials, we collected 20 types of small animal-based medicinal materials and 10 types of available fresh terrestrial animals from eight different regions in China. MPs were found in all medicinal materials with an average incidence rate of 94.67%. The abundance of MPs was in the range of 1.80 ± 0.38 to 7.80 ± 0.83 items/individual or 1.59 ± 0.33 to 43.56 ± 9.22 items/g (dry weight), with polymer distribution by polyethylene terephthalate (40.45%), rayon (30.64%), polyethylene (10.11%), nylon (7.35%), polypropylene (5.93%), and polyvinyl chloride (5.52%). The majority of MPs were microfibers (84.68%), with 15.32% of fragments. Moreover, MPs were directly observed in the intestine, detected in all ten types of fresh medicinal animals with the abundance of 0.83 ± 0.35 to 3.42 ± 0.46 items/individual. Furthermore, significant positive correlations (R: 0.32–0.99, $p < 0.05$) of MPs characteristics were found between medicinal materials and fresh animals, including shape, size, color, and polymer distribution of MPs. The results support that MPs in the medicinal materials were likely derived from living animals. This study demonstrates the prevalence of MPs in animal-based, traditional medicinal materials, and also suggests widespread MPs pollution in terrestrial environments and latent health risks." (Authors)] Address: Lu, S., School of Ecological and Environmental Sciences, Shanghai Key Laboratory for Urban Ecological Processes and Eco-Restoration, East China Normal University, Shanghai 200241, China

17879. Lupiyaningdyah, P. (2020): The past, present and future of dragonfly research in Indonesia. BIO Web Conf. 19(00024): 4 pp. (in English) ["Up to present, Indonesia has 900 described species of dragonflies with around 70% are endemic; among them, the most diverse is in Papua. This data is collected based on 356 publications from scientific journals, bulletins, magazines, books, theses, and proceedings from 1773 to 2019. There is still a lack of information about what is the most and least popular topics and where is the most explored regions in Indonesia for Odonata research. I categorized the topics into biodiversity, taxonomy and systematics, biogeography, conservation, ecology, education, ethnozoology, history, and molecular. The result shows that the most popular topic is biodiversity by 139 publications and the least are history and molecular by only one publication. Most popular group to be observed is dragonflies in general (both suborders) by 200 publications and the least observed is Anisoptera by only 71 publications. Java is the most explored island for about 160 publications in 250 years." (Authors)] Address: Lupiyaningdyah, P., Zoology Division - Museum Zoologicum Bogoriense, Research Center for Biology, Indonesian Institute of Sciences (LIPI), Gedung Widyasatwaloka, Jl. Jakarta Bogor Km. 46, Cibinong, 16911, Jawa Barat, Indonesia. E-mail: pungkilupi@gmail.com

17880. Ma, F.; Hu, Y.; Wu, J. (2020): The complete mitochondrial genome of Anax parthenope (Odonata: Anisoptera) assembled from next-generation sequencing data. Mitochondrial DNA Part B Resources 5(3): 2823-2824. (in English) ["The complete mitochondrial genome of A. parthenope was assembled from next-generation sequencing data. The circularized mitochondrial genome spans 15,306 bp with a high A + T content of 74.7% and consists of 13 protein-coding genes, 22 tRNA genes, and 2 rRNA genes. Its gene composition and order were similar to Anax imperator. The overall base composition is 36.6% for A, 34.8% for T, 16.8% for C, and 11.8% for G. A phylogeny of 31 dragonfly species clustered this species within Odonata." (Authors)] Address: Ma, F., Nanjing Inst. of Environmental Sciences, Ministry of Ecology & Environment, Nanjing, China

17881. Makepeace, H.S.; Lewis, J.H. (2020): New and notable records of Odonata from New Brunswick, Canada, with a significant eastern range extension of Enallagma anna. Northeastern Naturalist 27(4): N58-N62. (in English) ["We report the occurrences of Tramea lacerata, Enallagma anna, and Epiaeschna heros from localities in central and southwestern New Brunswick, Canada. The former 2 species are reported here for the first time from the province, and the E. heros is reported for the second time, 118 years after the first known specimen was captured in 1899. Our record of a E. anna represents a significant geographic range extension (~500 km east)." (Authors)] Address: Lewis, J.H., New Brunswick Mus., 277 Douglas Avenue, Saint John, NB E2K 1E5, Canada. E-mail: jlewis3@unb.ca

17882. Medina-Espinoza E.F. (2020): First record of Heteragrion cooki from Peru (Odonata: Heteragrionidae). Notulae Odonatologicae 9(6): 236-240. (in English) ["H. cooki is reported from Peru for the first time based on a specimen collected in Cerros de Amotape National Park, Tumbes, Peru. This record expands the distribution of this species which previously was only known from Ecuador." (Authors)] Address: Medina-Espinoza, Emmy, Depto de Entomología, Museo de Historia Natural de la Universidad Nacional, Mayor de San Marcos, Av. Arenales 1256, Jesús María, Lima, Peru. E-mail: efme.04@gmail.com

17883. Metge, T.; Goertzen, D.; Suhling, F. (2020): Libellen der Flora-Fauna-Habitat Richtlinie in Braunschweig (Niedersachsen). Braunschweiger Naturkundliche Schriften 16: 1-19. (in German, with English summary) ["Dragonfly records in the city of Braunschweig between 1980 and 2018 were evaluated to provide an overview of the distribution and changes in the population of dragonfly species that are particularly protected by the Habitats Directive (FFH-species). Five FFH-species occurred: Coenagrion mercuriale, Leucorrhinia albifrons, L. caudalis, L. pectoralis, and Ophiogomphus cecilia. Two of these, L. pectoralis and O. cecilia, were recorded since the late 1980s and early 1990s, respectively, and have native populations. In the case of O. cecilia, there was a significant increase in grid cells occupied during the investigation period. In recent years, C. mercuriale and L. caudalis were observed. Leucorrhinia albifrons was observed only once in 2007. The four established or possibly established species are characteristic for four different types of freshwater habitats and thus possible target species for nature conservation. In this work, we report on the development of the occurrences over a period of four decades and we provide information on possible actions to protect and promote these populations." (Authors)] Address: Suhling, F., Technische Universität Braunschweig, Institut für Geoökologie, Abteilung Landschaftsökologie und Umweltsystemanalyse, Langer Kamp 19c, 38106 Braunschweig, Germany. E-mail: f.suhling@tu-bs.de

17884. Mofu, L.; Woodford, D.J.; Wasserman, R.J.; Dalu, T.M.; Weyl, O.L.F. (2020): Diet of Glossogobius callidus (Teleostei: Gobiidae) in freshwater impoundments in the Sundays River Valley of the Eastern Cape, South Africa. African Journal of Aquatic Science 44(4): 415-420. (in English) ["Despite the high abundance of the gobiid fish Glossogobius callidus in many freshwater ecosystems in South Africa, very few studies have assessed the biology and ecology of the species. Here, we investigated the diet of G. callidus populations sourced from Sundays River irrigation ponds. A total of 571 fish grouped into two size classes (TL, range ± SD: juveniles of 20–60 ± 45 mm; adults of 61–140 ± 85 mm) were sampled by seine netting; prey items were removed from the guts and identified and sorted to obtain dietary information for each prey group. Of the examined guts, 97% contained prey comprising 17 taxa within 10 taxonomic groups. Teleosts were identified to species level, whereas most dietary components were identified to a broad taxonomic group. Aquatic invertebrates were the most important component of the diet of G. callidus, but the index of relative importance (%IRI) of dominant invertebrate taxa varied according to ontogenetic stage of G. callidus and season. Prey taxa included: Diptera, Hemiptera, Trichoptera, Odonata, Cladocera, Copepoda, Hydracarina, Amphipoda, Mollusca and Teleostei. Dipteran prey taxa were consistently encountered in both size classes and across all seasons. G. callidus can therefore be regarded as a generalist invertivore." (Authors)] Address: Mofu, L., Dept of Ichthyology and Fisheries Science, Rhodes University, Grahamstown, South Africa. E-mail: l.mofu@saiab.ac.za

17885. Muzon, J.; Lozano, F. (2020): Negragrion sagma gen.n. and sp.n. from South America with a morphological phylogeny of the New World Ischnurinae (Odonata: Zygoptera: Coenagrionidae). Anais da Academia Brasileira de Ciências 92, Suppl. 2, e20190025 DOI 10.1590/0001-3765202020190025: 11pp. (in English) ["A new coenagrionid genus, Negragrion, is described for N. sagma sp.n. found in Argentina and Brazil (Holotype and allotype, pair in tandem. Argentina: Corrientes: Santo Tomé, arroyo Ita Cuá sobre RP 94, 28°26'48.30"S 56°00'33.11"W, 24.ii.2003, Muzón & Pessacq coll., MLP). The new genus is characterized by the shape of male cerci (decumbent from base; saddle-shaped; in lateral view with an acute apophysis directed dorsally located at 0.3 from base). The presence of a vulvar spine on S8 of females places this genus within Ischnurinae. A cladistics analysis using morphological data was carried out to determine its phylogenetic position. Negragrion gen.n. is recovered within the clade 4 as the sister group of the clade (Acanthallagma Acanthagrion (Oxyagrion, Fluminagrion))." (Authors)] Address: Muzon, J., Universidad Nacional de Avellaneda, Laboratorio de Biodiversidad y Genética Ambiental/BioGeA, Mario Bravo 1460 esq. Isleta, 1870 Piñeyro, Buenos Aires, Argentina

17886. Ngo, Q.P.; Phan, Q.T.; Karube, H.; Kompier, T.; Bui, A.P.; Le, H.S. (2020): Description of the female and notes on ecology of Sieboldius nigricolor (Fraser, 1924) from central Vietnam (Odonata: Gomphidae). International Dragonfly Fund Report 152: 1-7. (in English) ["The female of S. nigricolor is formally described from Central Vietnam, and both male and female specimens are illustrated. Information is given on the occurrence and ecology of the species in Vietnam." (Authors)] Address: Phan, Q.T., Center for Entomology & Parasitology Research, Institute of Research &Training of Medicine, Biology & Pharmacy, Duy Tan University, Da Nang, 550000, Vietnam. E-mail: pqtoan84@gmail.com

17887. Nicolai, B. (2020): Libellen am Leth (Nordharzvorland, Sachsen-Anhalt) im Klimawandel Hotspot der Odonatenfauna und sein schnelles Ende. Abh. Ber. Mus. Heineanum 12: 91-115. (in German, with English summary) ["The Leth is a small isolated subsurface lake in the arable landscape of the north-eastern Harz foreland. From 2016 to 2020, the Odonatenfauna was recorded there over 33 days and a total of 31 dragonfly species (12 Zygoptera, 19 Anisoptera) were detected. For 20 species there were indications of reproduction at the lake. Seven species were identified

as once only guests. A number of heat-loving, southern species are to be highlighted. These species include Lestes barbarus, Aeshna affinis, Crocothemis erythraea and Sympetrum meridionale, which were down-to-earth during the observation period at the Leth. Two species (Lestes sponsa, Coenagrion lunulatum), which Handtke (1966, 1968) identified at this location, could not be detected. The hot summers and lack of rainfall in recent years led to the very shallow lake completely drying out in 2020. Due to the general climate development, no temporary water surface is expected in the near future. The Leth thus seems to be lost as a dragonfly hotspot in the northern Harz foreland for an unforeseeable time." (Author)] Address: Nicolai, B., Herbingstr. 20, 38820 Halberstadt, Germany. E-mail: nicolaibea@gmx.de

17888. Nidup, T.; Tamang, D.T.; Tobgay, S.; Bajgai, R.C.; Wangmo, S.; Dorji, T.; Wangchuk, K. (2020): Abundance and distribution of threatened Epiophlebia laidlawi Tillyard, 1921 (Odonata: Epiophlebidae) in eastern Bhutan. Sherub Doenme: The Research Journal of Sherubtse College 13(1): 79-89. (in English) ["With series of macro-invertebrate studies, Epiophlebia laidlawi Tillyard, 1921 is recorded from Trashigang (Gomchu stream) and Trashi Yangtse (Gellingchu, Mangchi and Chuthakang), districts in eastern Bhutan. Its abundance is higher in post-monsoon season. The pH of the water from Gom-chu stream ranged from 6.63-7.50, electrical conductivity from 18.02-241 uS/cm, total dissolved solids from 11.21-121.66 mg/l, turbidity from 0-2 NTU and water temperature from 8.5-16.3oC. The abundance of the E. laidlawi is negatively correlated to water temperature (r=-0.650, p=0.058) and positively correlated to altitude (r=0.496, p=0.174) and turbidity (r=0.381, p=0.312). Six stages of nymphs are measured and reported. The nymph of Gomphidae is the only Odonata nymph found associated with the habitat of E. laidlawi. The fish species, Creteuchiloglanis bumdelingensis Thoni & Gurung, 2018 is reported from the habitat of laidlawi and is the additional new locality for the fish in Bhutan. As E. laidlawi is Near Threatened, it deserves to be protected through policies and laws of Bhutan. Due to anthropogenic pressure its habitats are disturbed and thus, intervention is required from the policy makers on the conservation of the habitats." (Authors)] Address: Tshering Nidup Royal University of Bhutan, Sherubtse College

17889. Novello-Gutierrez, R.; Bota-Sierra, C.A.; Amaya Vallejo, V. (2020): Description of the larva of the genus Archaeopodagrion Kennedy, 1939 (Zygoptera: Philogeniidae). Zootaxa 4816(3): 325-332. (in English, with Spanish summary) ["The larva of A. fernandoi Bota-Sierra, 2017, is described and illustrated in detail, being the first larva described for the genus Archaeopodagrion. The description is based on F-0 larvae collected from the type locality. The larva of A. fernandoi shows great resemblance to larvae of Philogenia spp., which adds support to the hypothesis of the monophyletic family Philogeniidae which groups together Archaeopodagrion and Philogenia. However, both genera differ each other by the presence of basal, spiny, fleshy tubercles on caudal lamellae of Archaeopodagrion." (Authors)] Address: Novelo-Gutiérrez, R., Depto de Entom., Inst. de Ecologia A.C., Km 2.5. antiqua carretera a Coatepec, Aparatdo Postal 63, 91000 Xalapa, Veracruz, Mexico. E-mail: rodolfo.novelo@inecol.edu.mx

17890. Ogura, K.; Itoh, S.; Futahashi, R. (2020): First record of Aeschnophlebia anisoptera Selys, 1883 from Iwate Prefecture, N. Honshu, Japan. Tombo 62: 126-127. (in Japanese, with English summary) ["A female A. anisoptera was collected at Ueda, Morioka, and a male A. anisoptera was photographed at Hanaizumicho-Oimatsu, Ichinoseki. These are the first records of this species from Iwate Prefecture." (Authors)] Address: not stated

17891. Okude, G.; Watanabe, K.; Futahashi, R. (2020): DNA analysis of Neurothemis terminata Ris, 1911 collected in Ishigaki Island, Okinawa Prefecture, Japan. Tombo 62: 106-108. (in English, with Japanese summary) ["We report the results of DNA analyses of a male Neurothemis terminata Ris, 1911 collected in Ishigaki Island in 1980. Both nuclear and mitochondrial DNA results indicated that this male is a genuine N. terminata. To our knowledge, this individual is the only record of this species from Japan." (Authors)] Address: Futahashi, R., National Institute of Advanced Industrial Science and Technology (AIST), Central 6, Tsukuba, Ibaraki 305-8566 Japan. E-mail: ryo-futahashi@aist.go.jp

17892. Okude, G.; Futahashi, R. (2020): Interspecific hybrid between Paracercion sieboldii and P. melanotum from Japan (Odonata: Coenagrionidae). Notulae odonatologicae 9(5): 204-208. (in English) ["Interspecific hybrids have been occasionally found in the field. Here were describe a male of the interspecific hybrid between Paracercion sieboldii and P. melanotum with intermediate phenotypes between the two parent species from Japan. Nuclear and mitochondrial DNA analyses indicated that this individual was derived from interspecific mating between a female P. sieboldii and a male P. melanotum. To our knowledge, this is the only report of the hybrid between these two species." (Authors)] Address: Okude, G., Dept of Biological Sciences, Graduate School of Science, University of Tokyo, Tokyo, Japan. E-mail: gentaokude@gmail.com

17893. Oliveira de Resende, B.; Ferreira, V.R.S.; Juen, L.; Cabette, H.S.R. (2020): Emergence trap for the collection of exuviae and adult of Odonata. Oecologia Australis 24(3): 742-747. (in English) ["Odonates have aquatic larval stages and terrestrial adults. The extreme change in habitat occupation during their life cycle means that combined collection methods, capable of providing data for both larvae and adults, are scarce and are often inefficient. Given this, we applied a method for the collection of specimens of both life phases using emergence traps. During fieldwork, 78 emergence events were recorded for 15 species. We also briefly discuss the emergence pattern of the recorded species. We believe the information obtained here provide an important contribution to the understanding of the ecology and basic biology of Neotropical odonate species, as well as helping to solve the taxonomic problems associated with the identification of larvae." (Authors)] Address: Oliveira de Resende,

B., Universidade do Estado de Mato Grosso, Programa de Pós-Graduação em Ecologia e Conservação, Laboratory of Entomology, Av. Prof. Dr. Renato Figuera Varella, BR 158, Olaria, CEP: 78690-000. Nova Xavantina, MT, Brazil. E-mail: bethania-nx@hotmail.com

17894. Oo, S.; Hmwe, K.; Aung, N.; Su, A.; Soe, K.; Mon, T.; Lwin, K.; Thu, M. (2020): Diversity of insect pest and predator species in monsoon and summer rice fields of Taungoo environs, Myanmar. Advances in Entomology 8: 117-129. (in English) ["Paddy fields are natural and artificial wetland ecosystems that supply rice for the people and provide the wildlife especially insect diversity of different functional aspects. A total of 71 insect species belonging to 40 families under eight orders were observed during the study period. Among the 71 insect species,.., eight species of dragonfly, ...] (Authors)] Address: Oo, S.S., Zool. Dept, Univ. Yangon, Yangon, Myanmar

17895. Oota, K.; Futahashi, R. (2020): First record of Anax evhippiger (Burmeister, 1839) from Yakushima Is. off Kyusnu, Japan. Tombo 62: 135-136. ["A male A.x ephippiger was collected in Koseda, Yakushima Is. (Kagoshima Prefecture), off Kyushu, Japan. This is the first record of this species from the Kyushu region." (Authors)] Address: E-mail: keisuke-8200@gm ail.com

17896. Ostrovsky, A.M. (2020): Distribution of Winter Damsels (Odonata: Lestidae) in south-eastern Belarus. Field Biologist Journal 2(2): 143-146. (in Russian, with English summary) ["The brief data from our research on distribution of Sympetrum fusca and S. paedisca in South-Eastern Belarus are analysed in this article. As a results of observations, it was found that S. paedisca is much more widespread than previously assumed, and a new habitat of S. fusca was discovered in this region." (Author).] Address: Ostrovsky, A.M., Gomel State Medical Univ., 5 Lange St, Gomel, 246000, Republic of Belarus. E-mail: Arti301989@mail.ru

17897. Ostrowski, K. (2020): New locality of Ornate Bluet Coenagrion ornatum (SELYS, 1850) (Odonata, Coenagrionidae) in the vicinity of Wroclaw. Odonatrix 16_20 (2020): 5 pp. (in Polish, with English summary) ["New site of C. ornatum in Poland. In the vicinity of Wroclaw in the valley of Sleza River (UTM XS44) small population of C. ornatum have been observed in 2019 and 2020. It is one of the rarest species in Poland . CR status on the Red List of Dragonflies of Poland. Though today it is known only from Lublin Voivodeship, this species still can be found in Lower Silesia." (Author)] Address: Ostrowski, K., Marcinkowice 5, 55-020 Zorawina, Poland. E-mail: ostrowski85@go2.pl

17898. Osuala, F.I.; Abiodun, O.A.; Oyeleke, B.G.; Humphrey, O.F. (2020): Biodiversity of fauna and heavy metal assessment in selected areas of University of Lagos Akoka Campus, Lagos, Nigeria. Ife Journal of Science 22(2): 159-173. (in English) ["The biodiversity of terrestrial fauna and assessment of some heavy metals - cadmium (Cd), chromium (Cr), cobalt (Co), lead (Pb), nickel (Ni) and manganese (Mn) concentrations in soil samples were investigated in selected areas of the University of Lagos Akoka campus. Atomic Absorption Spectrophotometer (AAS) was used for heavy metals analysis and biodiversity index was calculated with Margalef, Shanon- Weiner and Simpson index. On the basis of the Shanon- Weiner index, Zoological garden had the highest species richness (2.75) while High-Rise (1.71) had the lowest species diversity. On the basis of the Simpson index (1-D), Faculty of Science had the highest species diversity (0.95) while High-Rise had the lowest diversity (0.75). Formicidae (21.60%), Gecarcinidae (13.77%) and Libellulidae (13.51%) were the families with the highest relative abundance in the University of Lagos while Cercopithecidae (0.26%), Elapidae (0.34%) and Gryllidae (0.34%) were the families with least relative abundance. The result of the soil texture (particle size) of the various sampled zones indicated that sand is the dominant component with a mix of loam. Heavy metal mean concentrations of the soil samples from the University of Lagos indicated the presence of Pb (0.17 - 29.67 mg/kg), Ni (0.59 - 6.63 mg/kg), Mn (72.72 - 398.63 mg/kg), Cr (0.01 - 16.23 mg/kg), Cd (0.20 - 0.87 mg/kg) and Co (0.17 – 6.52 mg/kg). All heavy metals detected were below Federal Ministry of Environment (FMEnv) and European Union (EU) permissible limit for heavy metals in soils except Mn. Though, Mn is biologically important with low toxicity, there is need for consistent monitoring of the heavy metals so as not to pose a threat to the biodiversity of the study area." (Authors)] Address: Osuala, F.I., Dept of Zoology, Fac. of Science, University of Lagos, P.M.B. 101017, Lagos, Nigeria. E-mail: fhilosu@yahoo.com

17899. Ota, S. (2020): Records of Somatochlora arctica (Zetterstedt, 1840) confirmed in 2018-2019 from Fukushima, Gunma, and Tochigi Prefectures — Observations in Fukushima Prefecture, a rediscovery after 60 years. Tombo 62: 116-122. (in Japanese, with English summary) ["S. arctica was observed in Ozenuma, Fukushima Prefecture and Ozegahara, Gunma Prefecture in 2018, and in Senjogahara, Tochigi Prefecture in 2019. This species has been recorded from these areas in the past, but recent records could not found. Certainly in Fukushima Prefecture, it was the first rediscovery in 60 years since 1958. In Ozenuma and Senjogahara. breeding habitats were confirmed for the first time in each prefecture." (Author)] Address: not stated

17900. Papazian, M.; Bonneau, P.; Filippi, G.; Nève, G. (2020): Contribution à la connaissance des Odonates de l'archipel de Sao Tomé-et-Principe 2. Présence d'Agriocnemis zerafica Leroi, 1915 (Odonata Coenagrionidae). L'Entomologiste 76(2): 69-73. (in French, with English and Portuguese summaries) ["During the second expedition carried out in October and November 2019 as part of the São Tomé-et-Principe « Archipel de Biodiversité » project, A. zerafica, was collected on the island of Principe, bringing to 17 the number of Odonates known to the archipelago." (Authors)] Address: Papazian, M., Opie Provence-Alpes-du-Sud, Muséum d'histoire naturelle de Marseille, palais Longchamp, 13233 Marseille cedex 20, France. E-mail: papazianmcm@wanadoo.fr

17901. Pattanayak, A., Kumari, M., Pahari, P.R., & Deen, S.N.P.Y. (2020): Aquatic insects (Odonata) diversity in floating and emergent macrophytes in Saheed Matangini Block (Tamluk), West Bengal (India). Uttar Pradesh Journal of Zoology 41(13): 27-33. (in English) ["Geographical zone-wise biodiversity study of different species is of paramount importance to monitor and conserve the species diversity in an ecosystem. The objective of present study was to make a diversity database of macrophyte associated aquatic insects in Purba Medinipur, West Bengal, India. The aquatic insects were collected from aquatic macrophytes, Ipomoea aquatica, Eichhornia crassipes and Nelumbo nucifera grown in 6 water bodies of Sahid Matangigi Block (Tamluk, 22.3°N 87.92°E), Purba Medinipur, West Bengal, India. The results revealed that occurrences of 6 aquatic insect orders (Coleoptera, Hemiptera, Odonata, Diptera, Ephemenoptera and Trichoptera) in Ipomoea aquatica with maximum abundance of 3 odonate families (Libellulidae, Coenagrionidae and Platycnemididae). The present biodiversity study of aquatic insects indicate that Odonata especially prefer floating macrophyte as a favourable habitat and therefore higher species diversity therein. Further study is needed considering other aquatic macrophytes in this concern to develop a valid species specific database essential for biodiversity conservation in the rapidly changing present environment." (Authors)] Address: Department of Zoology, Magadh University, Bodh-Gaya, Gaya-824234, Bihar, India

17902. Pavithran, S.; Chitra, N.; Arulprakash, R.; Sugumaran, M.P. (2020): Diversity of Odonata in the rice fields of Tamil Nadu. Journal of Entomology and Zoology Studies 8(5): 2115-2118. (in English) ["Odonata is one of the most predominant natural enemy of the rice ecosystems and their diversity in rice fields from different parts of Tamil Nadu viz., Coimbatore, Aduthurai, Pudukkottai, Ramanathapuram, Bhavanisagar and Gudalur was studied. The Odonata assemblage comprised 21 species under 19 genera under 4 families. Anisoptera were dominant with 15 species and 14 genera over Zygoptera (6 species, 5 genera). Libellulidae was the most speciose family with 14 species followed by Coenagrionidae with 5 species. Diversity analysis of Odonata from rice fields of Tamil Nadu revealed that the order of Simpson Diversity index (SID) of diversity was Coimbatore (0.89) > Bhavanisagar (0.88) > Aduthurai (0.87) > Ramanathapuram (0.87) > Gudalur (0.84) > Pudukottai (0.82). Margalef index (á) of species richness were high in Coimbatore (2.33) and least in Gudalur (1.55). Eveness of species within the region (Pielou`s evenness index, E1) was the highest for Bhavanisagar (0.94) and the lowest for Aduthurai (0.84). Among the different regions, Odonata in rice fields of the Coimbatore and Aduthurai were found to have a maximum similarity." (Authors)] Address: Pavithran, S., Dept Agricultural Entomology, Tamil Nadu Agricultural Univ., Coimbatore, Tamil Nadu, India

17903. Payra, A.; Dash, S.K.; Mishra, A.K. (2020): Pseudagrion microcephalum Rambur preying on small web-building spider (Odonata: Coenagrionidae; Araneae: Araneidae). Historial Natural 10(3): 229-232. (in Emglish) ["During our field study on the Odonata fauna in Athgarh Forest division, Cuttack, Odisha, India, on 05/03/2015 at 08:25 a.m., we observed an adult male P. microcephalum in a small open and sunlit wetland near Suhagi Dam (20.558° N; 84.976° E, 96 m a.s.l.). This individual hovered in front of us for some seconds, and then suddenly darted to the nearby leaf, 45 cm distant from the hovering site and 90 cm above water. The damselfly grasped a small unidentified spider from the little cobweb that stuck in leaf groove. At the site of observation, the water, covered by emergent grasses and macrophytes, was 30 cm deep." (Author)] Address: Payra, A., Ramnagar, Purba Medinipur, West Bengal, Pin-72144, India. E-mail: arajushpayra@gmail.com

17904. Payra, A. (2020): A record of cannibalism in Ceriagrion coromandelianum Fabricius (Zygoptera: Coengrionidae). Revista de la Sociedad Entomológica Argentina 79(4): 44-46. (in English, with Spanish summary) ["During winter season on January 12th, 2014, a case of cannibalism in C. coromandelianum was observed near Bara Solemanpur, village of Purba Medinipur district, West Bengal, India. This is the first instance of cannibalism recorded in C. coromandelianum, where a female devours its conspecific male." (Author)] Address: Payra, A., Ramnagar, Purba Medinipur, West Bengal, Pin-72144, India. E-mail: arajushpayra@gmail.com

17905. Payra, A.; Dash, S.K.; Palei, H.S.; Tiple, A.D.; Mishra, A.K.; Mishra, R.K.; Rout, S.D. (2020): An updated list of Odonata species from Athgarh Forest Division, Odisha, Eastern India (Insecta: Odonata). Mongolian Journal of Biological Sciences 18(1): 55-64. (in English) ["Altogether 72 species of Odonata belonging to 46 genera and 9 families were recorded from Athgarh Forest Division, of which 32 species are representatives of the suborder Zygoptera and 40 species are members of the suborder Anisoptera. Athgarh Forest Division represents 65.4 % of the Odisha state and 14.7 % of the Indian Odonata fauna. Among recorded species, 17 species are newly recorded for Athgarh Forest Division. Elattoneura nigerrima is reported for the first time from the state, and occurrence of Indothemis carnatica in Odisha is confirmed here for the first time. Pseudagrion spencei is also added to the Odonata fauna of Odisha and reported for the second time in the state from Athgarh Forest Division." (Authors)] Address: Payra, A., Ramnagar, Pin-721441, Purba Medinipur, West Bengal, India

17906. Peniston, J.H.; Gomez-Ruiz, P.A.; Panwar, P.; Uno, H.; Ramirez, A. (2020): Target species affects the duration of competitive interactions in the Neotropical dragonfly, Micrathyria atra (Odonata: Libellulidae). Notulae odonatologicae 9(5): 173-177. (in English) ["Dragonflies often engage in aggressive interactions over access to mates, food, or other resources. We should expect species to have behavioral adaptations for minimizing such interactions with other species because they are not competing with them for mates and often require different resources. We conducted observational trials in natural water pools that provide new evidence for one such adaptation in the Neotropical Micrathyria atra-males in this species have shorter interactions with

individuals of other species than with conspecifics." (Authors)] Address: Peniston, J.H., Dept of Biology, University of Florida, Gainesville, FL, USA. E-mail: jimmpen@ufl.edu

17907. Perez, E.S.N.; Bautista, M.G. (2020): Dragonflies in the City: Diversity of Odonates in Urban Davao, Philippines. Journal of Agricultural Science and Technology A 10: 12-19. (in English) ["Dragonflies are well-known group of insects because of their biological and ecological importance in a community, that is, they indicate the environmental health of an ecosystem. However, in an urban ecosystem, there are many threats that can affect the assemblages of dragonfly species such as the intensification of urbanization which contributes biodiversity loss of most dragonfly species. This study aimed to identify dragonfly species and determine the species richness, relative abundance, species diversity, evenness and effective number of dragonflies in selected areas in Davao City. Opportunistic sampling using sweep net and photo documentation were used during the study. The sampling lasted for three months from June 2017 to August 2017. A total of 962 individuals of dragonflies were observed and recorded comprising of six species of dragonflies from six different genera of one family. Orthetrum sabina was the most abundant among the six species recorded in all sampling sites. The species richness was six. Low species diversity was obtained in all sampling which shows that the sites were not evenly distributed and indicating that the study sites were not diverse in terms of the number of species and highly disturbed." (Authors)] Address: Perez, E.S.N., Natural Science Dept, College of Arts and Sciences, University of Southeastern Philippines (USEP), Barrio Obrero, Davao City 8000, Philippines

17908. Perron, M.A.C.; Pick, F.R. (2020): Stormwater ponds as habitat for Odonata in urban areas: the importance of obligate wetland plant species. Biodiversity and Conservation 29: 913-931. (in English) [Urbanization significantly alters hydrological regimes in cities by reducing infiltration rates and increasing runoff. Stormwater ponds have been constructed in North American cities to mitigate the effects of increased urban runoff by dampening floods and filtering out contaminants. However, these ponds may also provide habitat for wetland species in cities. This study aimed at determining the significance of stormwater ponds as attractive habitats for the adult stages of Odonata, widely considered bioindicators of aquatic and wetland ecosystem health. A total of 41 urban stormwater ponds and ten rural natural ponds were sampled across the National Capital Region of Canada. On average, stormwater ponds had fewer species and lower abundance of dragonflies but, in contrast, more species of damselflies. Stormwater ponds had a higher total plant species richness because of a higher number of non-native species. However, some stormwater ponds had similar odonate and plant species assemblages to natural ponds. The variation in odonate abundance and species composition was largely explained by plant community composition and significantly linked to the presence of specific obligate wetland plant species. Overall, this study highlights the importance of wetland features in cities and points to design elements of stormwater ponds that could be implemented to enhance biodiversity and ecosystem services." (Authors)] Address: Perron, Mary Ann C., Department of Biology, University of Ottawa, 20 Marie Curie Private, Ottawa, ON K1N 6N5, Canada. E-mail: mperr058@uottawa.ca

17909. Petrulevicius, J.F, (2020): First argiolestid damselfly (Odonata: Zygoptera) from the late Palaeocene of Northwest Argentina. Palaeoentomology 3(6): 541-545. (in English) ["Megapodagrionids in the wide sense are a polyphyletic group of damselflies. In recent studies there is a tendency to restrict the Megapodagrionidae only to few genera, and to over rank some subfamilies such as Philosininae and Argiolestinae to family. These efforts are based on nymphal and wing characters." (Author)] Address: Petrulevicius, J.F, CONICET - División Paleozoología Invertebrados, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Paseo del Bosque s/n, La Plata (1900), Argentina. E-mail: levicius@fcnym.unlp.edu.ar

17910. Phan, Q.T.; Ngo, Q.P.; Bui, A.P. (2020): Description of Coeliccia lephuocdieui sp. nov. from the Central Highlands of Vietnam (Odonata: Zygoptera: Platycnemididae) with notes on its congeners. Zootaxa 4786(1): 69-80. (in English) ["C. lephuocdieui sp. nov. (holotype ♂, 14.2586N, 108.3786E, Kon Ka Kinh National Park in Ayun Commune, Mang Yang District, Gia Lai Province, the Central Highlands of Vietnam) is described and illustrated for both sexes. A comparison of the new species with C. scutellum Laidlaw, 1932 and C. yamasakii Asahina, 1984 is provided with notes on the morphological variation of the Vietnamese C. scutellum. The female of C. yamasakii is described for the first time." (Authors)] Address: Phan, Q.T., Center for Entom. & Parasitology Res., Institute of Research & Training of Medicine, Biology & Pharmacy, Duy Tan Univ., 3 Quang Trung, Da Nang city, Vietnam. E-mail: pqtoan84@gmail.com;

17911. Phan, Q.T.; Ngo, Q.P.; Toan, T.C.; Tuan, V.A. (2020): Description of Coeliccia natgeo sp. nov. from Central Vietnam with keys to the males and females of the hayashii-group (Odonata: Zygoptera: Platycnemididae). Zootaxa 4896(1): 96-104. (in English) ["Coeliccia natgeo sp. nov. is described from central Vietnam (holotype ♂, 18.2708 N, 105.3431 E, Khe Nhop, Vu Quang National Park, Ha Tinh Province, deposited in the Zoological Collection of Duy Tan University, Da Nang City, Vietnam). The new species differs from other members of the hayashii-group by males lacking antehumeral stripes, spots and pruinosity on the synthorax and female having the central part of the posterior pronotal lobe reduced to a small projection. Keys to the males and females of the hayashii-group are provided." (Authors)] Address: Phan, Q.T., Center for Entom. & Parasit. Res., Insti. Res. & Training of Medicine, Biol. & Pharmacy, Duy Tan Univ., Da Nang, 550000, Vietnam. E-mail: pqtoan84@gmail.com

17912. Phan, Q.T.; Ngo, Q.P. (2020): A revision of the systematics and distribution of the damselfly genus Prodasineura Cowley, 1934 (Odonata: Zygoptera: Platycnemididae) in Vietnam with description of two new species. European

Journal of Taxonomy 650: 1-27. ["Eight species of the genus Prodasineura Cowley, 1934 are recorded from Vietnam, including two newly described species: Prodasineura lancastrei sp. nov. and P. kong sp. nov. from north and central Vietnam. All species recorded are illustrated, including figures of morphological structures, and distribution maps and keys to the males and females are provided. We consider the record of P. laidlawi (Forster in Laidlaw, 1907) a misidentification and exclude it here." (Authors)] Address: Phan, Q.T., Center for Entom. & Parasit. Res., Insti. Res. & Training of Medicine, Biol. & Pharmacy, Duy Tan Univ., Da Nang, 550000, Vietnam. E-mail: pqtoan84@gmail.com

17913. Phan, Q.T. (2020): Description of Drepanosticta karubei sp. nov. from Mindoro Island, the Philippines (Zygoptera: Platystictidae). Tombo 62: 53-56. (in English) ["Drepanosticta karubei sp. nov. is described based on a single male from Mt. Falcon, Mindoro Island, the Philippines (deposited in Kanagawa Prefectural Museum, Japan)." (Author)] Address: Phan, Q.T., Center Entom. & Parasit. Res., Insti. Res. & Training of Medicine, Biol. & Pharmacy, Duy Tan Univ., Da Nang, 550000, Vietnam. E-mail: pqtoan84@gmail.com

17914. Phan, Q.T.; Ngo, Q.P.; Anh, P.B.; Hai, S.L.; Giang, S.N. (2020): Notes on the changes in body color with age in male and female Coeliccia mattii Phan & Kompier, 2016 (Odonata: Zygoptera: Platycnemididae). International Dragonfly Fund Report 153: 1-6. (in English) ["The changes in coloration with age in males and females of Coeliccia mattii Phan & Kompier, 2016 from the Central Highlands of Vietnam are documented. Immature forms have extensive yellow markings on the thorax and S9 is yellowish, while in the fully mature male form, the thorax is largely black and covered in pruinosity and S9 is completely black. S9 is yellowish in the immature female while S9 is black in the fully mature female." (Authors)] Address: Phan, Q.T., Center for Entom. & Parasit. Res., Insti. Res. & Training of Medicine, Biol. & Pharmacy, Duy Tan Univ., Da Nang, 550000, Vietnam. E-mail: pqtoan84@gmail.com

17915. Phuge, S.; Shetye, K.; Pandit, R. (2020): Effect of water level on insect-tadpole predator-prey interactions. Acta Oecologica Volume 108, October 2020, 103649. (in English) ["Highlights: • High water level increases survival of neustonic prey. • Low water level reduces predation pressure on benthic prey. • The presence of mesopredator in the water column increases the survival of prey tadpoles. Abstract: Predator-prey interactions are affected by environmental conditions. We examined the effect of changes in water level on the predator-prey interactions in a food web comprising of a top predator (dragonfly naiad), one mesopredator (backswimmer), and prey tadpoles of species that differ in microhabitat occupancy (neustonic and benthic). The results revealed that under high water level conditions (HWL), predators took longer to attack the neustonic tadpoles (Microhyla nilphamariensis) relative to the low-water-level condition (LWL). Dragonfly larvae mostly attacked the benthic tadpoles (Euphlyctis cyanophlyctis) when the water level was high. Nevertheless, under LWL, dragonfly larvae equally attacked both benthic and neustonic tadpoles. Interestingly, dragonfly larvae frequently attacked mesopredators (i.e., backswimmers) when they were presented together with neustonic tadpoles. These results demonstrated that changes in water level influence predator-prey interactions in the pond ecosystem where neustonic tadpoles faced lower risk under HWL. The reduction of water level favored the survival of benthic prey tadpoles. The presence of mesopredator (backswimmers) reduced the predation risk of neustonic tadpoles. These results help to understand how the differences in predation risks shape anti-predator responses in these prey tadpoles." (Authors)] Address: Phuge, S., Dept of Zoology, Savitribai Phule Pune University, Ganeshkhind, Pune, 411007, India

17916. Piazzini, S.; Tamburini, M.; Favilli, L. (2020): New records of Cordulegaster trinacriae from Pollino National Park, Italy (Odonata: Cordulegastridae). Notulae Odonatologicae 9(6): 256-262. (in English) ["New data on distribution and ecology of C. trinacriae from the Calabrian side of the Pollino National Park (Basilicata, Calabria) are presented. The species was recorded at ten localities in the province of Cosenza, nine of which were previously unknown. Larvae were recorded from medium-sized to large rivers at a minimum altitude of 120 m a.s.l. and a maximum of 600 m a.s.l. The riverbeds were mostly intact and protected by a zone of well structured riparian forest. To date, C. trinacriae doesn't appear to be at risk in the region, but global climate change and increasing use of fresh water for human purposes are likely to pose a threat in the near future." (Authors)] Address: Piazzini, S., Dept Physical Sci., Earth & Environment, Univ. Siena, via P.A. Mattioli 4, 53100 Siena, Italy. E-mail: piazzini5@unisi.it

17917. Pineiro Alvarez, X. (2020): Alta densidad de Lestes macrostigma (Eversmann, 1836) (Odonata: Lestidae) en un humedal de La Mancha Húmeda (Ciudad Real, España). Arquivos Entomolóxicos 22: 17-22. (in Spanish, with English summary) ["High density of L. macrostigma in a wetland of La Mancha Húmeda (Ciudad Real, Spain). A high count of L. macrostigma in the restored wetland of Junta de los Ríos, province of Ciudad Real, in June 2019, is reported. An assessment of the water conditions and vegetation associated with this species during the study period is provided. Information on the accompanying odonatofauna in the wetland is also included." (Author)] Address: Piñeiro Álvarez, X., Revolta 2, Noalla. E-36990 Sanxenxo (Pontevedra), Spain. E-mail: xurxolusitanica@gmail.com

17918. Qin, J.; Xie, S.; Cheng, F. (2020): Broad diet composition and seasonal feeding variation facilitate successful invasion of the Shimofuri Goby (Tridentiger bifasciatus) in a water transfer system. Water 12(12), 3411; https://doi.org/-10.3390/w12123411: 9 pp. (in English) ["The diet composition of an invasive population of Shimofuri goby (Tridentiger bifasciatus) was investigated bimonthly during the period from September 2015 through August 2016 in Nansi Lake, a storage lake of the East Route of the South-to-North Water Transfer Project, China. The diet consists of a broad spectrum of prey items, including mollusca (Bellamya sp.

and Physa sp.), aquatic insects (Odonata sp., Chironomidae sp., and Cirolanidae sp.), other macroinvertebrates (Nematoda sp. and Rhynchobdellida sp.), shrimp (Palaemon modestus and Gammarus sp.), fish (Rhinogobius giurinus and Tridentiger bifasciatus), fish eggs, and detritus. Dominant diets shifted from Rhynchobdellida sp. and unidentified digested food in July to P. modestus during September and November, and then shifted to both P. modestus and R. giurinus. Additionally, cannibalism was observed in March before spawning season of the goby, during which large males (SL > 70.0 mm) predated on small-sized ones. We suggest that broad spectrum of prey items and apparent seasonal shifting of dominant diets in the invasive goby fish, which might be an important mechanism favoring its successful invasion in water transfer system." (Authors)] Address: Qin, J., The Key Lab. Aquatic Biodiversity & Conservation of Chinese Acad. of Sci., Inst. Hydrobiol., Chinese Academy of Sci., Wuhan 430072, China. E-mail: qinjiao@ihb.ac.cn

17919. Ramírez, A.; Maldonado-Benítez, N.; Mariani-Ríos, A.; Figueroa-Santiago, J. (2020): Dragonflies and damselflies (Odonata) from Puerto Rico: a checklist with notes on distribution and habitat. PeerJ 8:e9711 https://doi.org/10.7717/peerj.9711: 18 pp. (in English) ["Background: Conservation of tropical freshwater fauna requires a solid understanding of species biodiversity patterns. We provide an up to date annotated list of Odonata of Puerto Rico, which is based on current reports. The list is complemented with notes on the geographic and altitudinal distribution of this order on the island. We also compare current composition relative to early reports conducted when Puerto Rico was mostly an agricultural region. Methods: We surveyed adult Odonata all over Puerto Rico with the aid of undergraduate students. Students were trained on capturing, preserving, and data basing specimens. All material was centralized, identified by the lead author, and deposited in the Zoology Museum at the University of Puerto Rico (MZUPR), Río Piedras campus. Surveys were complemented with focal collections by the authors and a literature review of published records for Puerto Rico and the Caribbean. We requested records from specialists to obtain the most complete list of species for the island. Results: An annotated list of Odonata from Puerto Rico is presented, reporting 49 species distributed in two suborders and four families. We provide information on species distribution among municipalities and elevations around Puerto Rico. A historic list of species was developed for the 1930s-1940s, when agriculture covered most of Puerto Rico, based on literature and museum specimens. Both current and historic records are similar and suggest that the Odonata fauna is dominated by generalist species and has changed little since the agricultural period. Our list provides a point of reference to understand biodiversity patterns in Puerto Rico and the Caribbean and for assessing the effects of land use change on aquatic insect diversity." (Authors)] Address: Ramírez, A., Dept of Applied Ecology, North Carolina State Univ., Raleigh, NC, USA. E-mail: alonso.ramirez@ncsu.edu

17920. Ramos-Sanchez, J.; García-Valero, Á.; Menor-Albero, R.; Tarruella-Rodenas, M.J.; Fernández-Terrer, J.L.; Martínez-García, T.; Evangelio, J.M. (2020): Primeras citas de Onychogomphus cazuma Barona, Cardo & Díaz, 2020 (Odonata: Anisoptera: Gomphidae) para la región de Castilla-La Mancha (centro-este de España). Anales de Biología 42: 167-171. (in Spain, with English summary) ["The first data on the biology of O. cazuma in Castilla-La Mancha region are provided. Its reproduction in this territory is confirmed by the detection of exuvians and a teneral female. The species had been only detected in the province of Valencia, in locations more than 100 km away." (Authors)] Address: Ramos-Sánchez, J., AHSA, Amigos de los Humedales del sur de Alicante. Apartado de correos 292, 03280 Elche, Spain

17921. Ranjan, K.S.; Pawar, A.A.; Roy, A.; Saha, S. (2020): Trans-continental migration of dragonfly Pantala flavescens between India and Africa: Energetics and Role of wind. Bulletin of the American Physical Society; 73rd Annual Meeting of the APS Division of Fluid Dynamics; Sunday–Tuesday, November 22–24, 2020; Virtual, CT (Chicago time). Session X02: Biological Fluid Dynamics: Flying (10:45am - 11:30am). 10:45 AM, Tuesday, November 24, 2020: (in English) [Verbatim: P. flavescens migrates between India and Africa, covering a distance of around 14000-18000 km, crossing the Indian ocean twice, which is very extraordinary for a dragonfly or any flier. The route followed in this migration is India-Maldives-Seychelles-Africa-India, comprising of four legs. For such a migration, flight energetics and role of wind are most important factors. Computation models were developed for energetics, optimal time and route estimation. Energetics estimation shows, a P. flavescens can fly for 90hrs, covering a distance of 1400km; without wind, time required for the completion of migration is more than 90hrs for all the legs. Our results show that with wind assistance, the time taken is well within 90hrs for all the legs. Also, P. flavescens detour from the virtual direct line connecting the two points of a leg in the sense of geodesic, and it follows the wind, which is expected based on the wind compensation capability of dragonflies. The results clearly show that wind assistance is vital if P. flavescens has to complete the migration. Pantala flavescens is able to achieve this great feat with the help of winds and stand in league of birds as far as migration flight is concerned.] Address: Indian Inst. Technology Kharagpur

17922. Reels, G.T. (2020): A ranking of key dragonfly sites in Hong Kong using a species conservation value assessment metric. Faunistic Studies in Southeast Asian and Pacific Island Odonata 31: 1-50. (in English) ["Dragonflies were surveyed at 33 sites across the territory of Hong Kong Special Administrative Region over the period 2016-2017. Surveys included identification of larvae, exuviae and adults, and involved 92 separate site visits. The chosen sites covered the whole spectrum of dragonfly habitats in Hong Kong, with the exception of actively managed fish ponds and reservoirs. Twenty-two of the study locations had been identified as "key dragonfly sites" by Wilson (1997a); eight of these are found to no longer merit such status. Two of the "key dragonfly sites" are here retained and expanded to include adjacent dragonfly-rich areas, and four new key dragonfly

sites are proposed. Sites are evaluated by species richness, number of species of conservation importance (Reels 2019), and by means of a species conservation value metric (Reels 2019) applied to the entire dragonfly species assemblage present at each site. By all such measures, Sha Lo Tung / Hok Tau is determined to be Hong Kong's premier dragonfly site." (Author)] Address: Reels, G.T., 31 St Anne's Close, Winchester, SO22 4LQ, UK. E-mail: gtreels@gmail.com

17923. Rippel, C.G.; Neiss, U.G.; Del Palacio, A.; Schröder, N.M.; 4, Fleck, G.; Hamada, N.; Martí, D.A.; Schweigmann, N.J. (2020): Description of the last-instar larva of Zenithoptera lanei Santos, 1941 (Odonata: Libellulidae). Zootaxa 4732(3): 488-494. (in English) ["The larva of Z. lanei is described and illustrated based on three exuviae of reared larvae collected in Misiones, Argentina, Roraima and Amazonas, Brazil. A comparison with the larva of Z. anceps Pujol-Luz, 1993 is included." (Authors)] Address: Rippel, Camila, Laboratorio de Genética Evolutiva. Instituto de Biología Subtropical (IBS) CONICET-UNaM. FCEQyN, Félix de Azara 1552, Piso 6°. Posadas, Misiones, Argentina. E-mail: camilag.rippel@gmail.com

17924. Rodríguez-Esteban, M.; Hernández Alonso, D. (2020): Nuevas citas de Brachythemis impartita (Karsch, 1890) y Trithemis kirbyi Selys, 1891 en la provincia de Salamanca (centro-oeste Península Ibérica) (Odonata: Libellulidae). Arquivos entomolóxicos 22: 109-112. ["New records of B. impartita and Trithemis kirbyi in the province of Salamanca (center-western Iberian Peninsula). The 3rd and the 2nd provincial records, respectively, of Brachythemis impartita and Trithemis kirbyi for the province of Salamanca (central-western Spain) are reported." (Authors)] Address: Rodríguez-Esteban, M., Avda. S. Agustín, 44, portal 1, 1ºA. 37005 Salamanca, Spain. E-mail: elornitoblog@hotmail.com

17925. Rodríguez-Esteban, M.; Hernández-Mata, E. (2020): Nuevos registros y confirmación de la reproducción de Sympetrum vulgatum ibericum Ocharan, 1985 (Odonata: Libellulidae) en la provincia de Salamanca (España). Boletín de la Sociedad Entomológica Aragonesa 66: 231-232. (in Spanish, with English summary) ["New data and evidence of breeding of S. vulgatum ibericum Ocharan, 1985 in the province of Salamanca (Spain). Breeding evidences (tenerals and reproductive behaviour) of S. vulgatum ibericum on Salamanca province are provided." (Authors)] Address: Rodríguez-Esteban, M., Avda San Agustín, 44. Portal 1. 1º A. 37005, Salamanca, Spain. E-mail: elornitoblog@hotmail.com

17926. Rodríguez-Esteban, M.; Benito-Ruiz, A.; Hernández-Martín, H.; Martín-Diego, M.; Salvador-Vilariño, V. (2020): Ampliación del rango de distribución conocido de la libélula Aeshna juncea (Linnaeus, 1758) (Odonata: Aeshnidae) en Castilla y León (España). Boletín de la Sociedad Entomológica Aragonesa 66: 225-230. (in Spanish, with English summary) ["Extension of the known range of the dragonfly A. juncea in Castilla y León (Spain). “The first records of A. juncea from the provinces of Ávila, Palencia and Salamanca are presented, and new localities are added from the provinces of Burgos, León, and Zamora (central Iberian Peninsula). Furthermore, detailed information about two published records from Soria province is given." (Authors)] Address: Rodríguez-Esteban, M., Avda San Agustín, 44. Portal 1. 1º A. 37005, Salamanca, Spain. E-mail: elornitoblog@hotmail.com

17927. Rodríguez-Esteban, M.; Hernández-Alonso, M.; Palomo-Sepúlveda, M.; Martín-Diego, M.; Hernández-Martín, H.; Andrés-Criado, A.; Benito-Ruiz, A. (2020): Primera observación de Diplacodes lefebvrii (Rambur, 1842) y nuevas citas de Trithemis annulata (Palisot de Beauvois, 1807) en la provincia de Salamanca (centro-oeste península ibérica) (Odonata: Libellulidae). Boletín de la Sociedad Entomológica Aragonesa 67: 407-410. (in Spanish, with English summary) ["This brief note reports the first record of D. lefebvrii for the province of Salamanca and region of Castilla y León and new contributions to the distribution of T. annulata in the province of Salamanca." (Authors)] Address: Palomo-Sepúlveda, Miryam, Instituto de Biodiversidad CIBIO, Univ. de Alicante, Crta. San Vicente del Raspeig s/n, E-03080 (Alicante), Spain. E-mail: miryampalomo@hotmail.com

17928. Rohman, A.; Faradisa, N. (2020): Dragonfly diversity (Insect: Odonata) in Asem Binatur River, Pekalongan, Indonesia. Borneo Journal of Resource Science and Technology 10(1): 79-84. (in English) ["This research was conducted in the Asem Binatur River, Pekalongan, Indonesia, from November 2018 to April 2019. The purpose of this study was to determine species diversity, the index value of the Pekalongan River dragonfly diversity by using the point count method. Long hand high net, wrapping paper/papilot and camera were used to catch and observe the dragonflies. The Shannon-Wiener species diversity index was calculated. Seven species of dragonflies were recorded from Asem River. There were Diplacodes trivalis, Neurothemis ramburii, N. stigmatizans, Crocothemis servilia, Pantala flavescens, Orthetrum sabina and O. chrysis. The Shannon-Wiener diversity index analysis was ranged from 0 to 0.31, indicating low diversity. Abiotic parameter measurements showed the humidity was 67.17%, the soil pH was 7.11, the light intensity was 46310 lux and the temperature was 30 °C. The analysis of the dragonfly diversity index was correlated with the poor water quality status in Asem Binatur River, Pekalongan." (Authors)] Address: Rohman, A., Biology Education, Faculty of Teacher Training & Education, University of Jember, 68121, Indonesia. E-mail: abdu.fkip@unej.ac.id

17929. Roman-Heracleo, J.; Springer, M.; Novelo-Gutierrez, R. (2020): Redescription of the larva of Neoerythromma cultellatum (Hagen in Selys, 1876) (Odonata: Coenagrionidae: Coenagrioninae). Zootaxa 4830(3): 565-572. (in English, with Spanish summary) ["The final instar of N. cultellatum is redescribed and illustrated based upon reared specimens from Turrialba, Cartago, Costa Rica. This is a detailed complement of the original description provided by García-Díaz (1938) and illustrated with high quality photos of the larval morphology. The larva of N. cultellatum is characterized by a slender, spinulose, and yellow to yellowish-

brown body, premental setae 3+1, five palpal setae, male cerci long, and caudal lamella lanceolate, with obvious node, spotted, and markedly tracheate." (Authors)] Address: Roman-Heracleo, J., Sistema de Estudios de Posgrado en Biol., Univ. de Costa Rica, San Pedro Montes de Oca, 2060 San José, Costa Rica. E-mail: romanjareth@gmail.com

17930. Román-Heracleo, J.; Springer, M. (2020): First record of Elga leptostyla Ris, 1911 (Odonata, Libellulidae) from Costa Rica. Check List 16(4): 911-914. (in English) ["During research in the Tirimbina Biological Reserve, on the Caribbean slope of Costa Rica, we captured adult specimens and reared larvae of Elga leptostyla Ris, 1911 (Libellulidae). This species was previously reported only from southern Panama to northern South America. Therefore, this is the first record of the species and genus from Costa Rica, increasing the number of Libellulidae species recorded in the country to 95. This species' known distribution is northwards." (Authors)] Address: Román-Heracleo, J., Sistema de Estudios de Posgrado en Biología, Univ. de Costa Rica, San Pedro Montes de Oca, 11501-2060 San José, Costa Rica. E-mail: romanjareth@gmail.com

17931. Rusconi, J.M.; Di Battista, C.; Balcazar, D.; Rosales, M.; Achinelly, M.F. (2020): Amphimermis enzoni n. sp. (Nematoda: Mermithidae) parasitizing damselflies and dragonflies in Argentina. Journal of Nematology 52: 1-9. (in English) ["A mermithid nematode was found parasitizing nymphs of Odonata. The host specimens were collected from the stream Cajaravilla, Magdalena, Buenos Aires state, Argentina. In this work, we described Amphimermis enzoni n. sp., a nematode new to science. Nematodes were identified through morphological and molecular methods. The combination of the following characters separates A. enzoni n. sp. from other members of the genus Amphimermis Steiner: long and S-shaped vagina, twisted spicules for proximal 34% of their length, untwisted for 12%, again twisted for 30%, and untwisted for the last 24%; genital papillae arranged in three rows, medial row marginally longer than sub-medial rows; medial row bifurcated immediately anterior and posterior to cloaca, with 111 genital papillae (73 preanals and 38 post-anals). The sequences of 18S rDNA regions from A. enzoni formed a well-supported monophyletic clade with two GenBank sequences of Amphimermis spp. (EF617354 and EF617355) with 0.63 to 1.26% divergence and two Mermithidae spp. (LC512371 and LC512370) with 0.63 to 1.1% divergence, respectively. To our knowledge, this is the first example of mermithid infection in nymphs of dragonflies and damselflies for South America." (Authors)] Address: Rusconi, J.M., Centro de Estudios Parasitológicos y de Vectores, (CEPAVE)-CCT-La Plata-CONICET-UNLP, Boulevard 120 S/N e/61 y 64, (1900) La Plata, Buenos Aires, Argentina. E-mail: rusconi@cepave.edu.ar

17932. Sasamoto, A.; Saitoh, K.; Futahashi, R. (2020): The second record in Japan of Somatochlora exuberata exuberata Bartenev, 1910 (Odonata: Corduliidae) from Nagano Prefecture, Honshu, Japan Akihiko. Tombo 62: 123-125. (in Japanese, with English summary) ["A female Somatochlora exuberata exuberata Bartenev, 1910 was collected at Nagano Prefecture, Honshu, Japan. This is the second record of the nominotypical subspecies from Japan." (Authors)] Address: Futahashi, R., National Institute of Advanced Industrial Science and Technology (AIST), Central 6, Tsukuba, Ibaraki 305-8566 Japan. E-mail: ryo-futahashi@aist.go.jp

17933. Sasamoto, S.; Yanagisawa, T.; Yokoi, N.; Zhang, H.; Souphanthong, V.; Futahashi, R. (2020): The record of dark color form of Merogomphus pavici from Laos (Odonata: Gomphidae). Tombo 62: 73-76. (in English, with Japanese summary) ["M. pavici (sometimes incorrectly spelled as "paviei" is the type species of the genus, distributed in Taiwan, southern and eastern continental China, Vietnam, Thailand and Laos (Kosterin, 2016). Male of M. pavici usually has yellow and black pattern of synthorax, as typical in Gomphidae, with characteristics abdominal maculation, as shown Fig. 1C (Asahina, 1968 [as Merogomphus chui, which is a junior synonym of M. pavici]; Chao, 1990). However, we obtained conspicuously dark color form of M. pavici from Laos. Although photograph of such specimen has already appeared on Yokoi & Souphanthong (2014), there are no detail remarks. Therefore we here discuss this interesting form on morphology and genetic analysis." (Authors)] Address: Sasamoto, A., Mawaramoto-cho, Shiki-gun, Nara prefecture, 636-0341, Japan. E-mail: akssmt@sea.plala.or.jp

17934. Schädel, M.; Müller, P.; Haug, J.T. (2020): Two remarkable fossil insect larvae from Burmese amber suggest the presence of a terminal filum in the direct stem lineage of dragonflies and damselflies (Odonata). Rivista Italiana di Paleontologia e Stratigrafia 126(1): 13-35. (in English) ["The fossil record of dragonfly relatives (Odonatoptera) dates back to the Carboniferous, yet knowledge about these extinct animals is meagre. For most of the species little is known except for the characteristics of the wing venation. As a result, it is difficult to include fossil larvae in a (wing character based) phylogenetic tree as the wing venation is not visible in most of the larval instars. Two larval specimens from Cretaceous Burmese amber are in the focus of this study. The two specimens likely represent two subsequent early stage larval instars of the same individual. Not only is this an exceptional case to study ontogenetic processes in fossils – the larval instars are morphologically completely different from all known larvae of Odonata with respect to the posterior abdominal region. Therefore, besides the difficulties regarding the phylogenetic interpretation and though all Burmese amber odonatans are known from adults only, a new species – Arcanodraco filicauda n. sp. – is formally described. Aside from likely representing a new species, the morphology of the posterior abdominal region is highly informative for reconstructing the character evolution within the lineage towards modern dragonflies and damselflies. A long median process in both of the fossils meets all criteria to be interpreted as a terminal filum (structure or derivative of tergite of abdominal segment 11, annulated in one of the specimens). Although the exact phylogenetic affinity of Arcanodraco filicauda n. sp. remains enigmatic, the presence of a larval terminal filum can be reconstructed for the ground

pattern of Odonatoptera (including its direct stem lineage)." (Authors)] Address: Schädel, M., Dept of Biology, Ludwig-Maximilians-Univ. München, Großhaderner Str. 2, 82152 Planegg-Martinsried, Germany. E-mail: mario.schaedel@-palaeo-evo-devo.info

17935. Schneider, T.; Sar, K.D.; Schneider, J. (2020): Odonata from N-Myanmar during dry season – the Putao-Region. Entomologische Zeitschrift, Schwanfeld 130(4): 213-216. (in German, with English summary) ["There is a lack of knowledge about the Odonata fauna of Myanmar, because little field work was done there in the last decades. We undertook a first approach to study the Odonata fauna of the Putao-Region (N-Myanmar) during dry season 2019. Thirty-six species were observed during a five day fieldtrip. Most of the species were widely distributed in the deforested surrounding of Putao and belong to common dragonflies of South-East Asia. Other more rare species were restricted to brooks in the natural forests adjacent to the deforested area, like: Matrona nigripectus, Aristocypha fenestrella, Euphaea sanguinea, Indocnemis orang, and Coeliccia svihleri." (Authors)] Address: Sar, K.D., Lung Sha Yang No.192, Puta-O, Kachin State, Myanmar

17936. Schorr, M. (2020): Wolfgang Schneider (10. August 1953 - 17. September 2019). International Dragonfly Fund Report 150: 1-2. (in German) [obituary] Address: Schorr, M., Schulstr. 7B, 54314 Zerf, Germany. E-mail: oestlap@online.de

17937. Schröder, N.; Anjos-Santos, D.; Rippel, C.G.; Pessacq P. (2020): Description of the last instar larva of Peristicta aeneoviridis Calvert, 1909 (Odonata: Coenagrionidae). Zootaxa 4728(4): 461-468. (in English) ["The larva of P. aeneoviridis is described for the first time, based on material from Misiones Province, Argentina. It differs from the rest of the larvae described for the genus in the shape and coloration of caudal lamellae, femur setae, lacinia teeth and coloration patterns. Additions to the description of the larva of P. forceps Hagen in Selys, 1860 are included." (Authors)] Address: Schröder, Noelima, Lab. de Biotecnología Molecular, Instituto de Biotecnología Misiones, FCEQyN, UNaM. Ruta 12 km 7.5—Posadas, Misiones, CP 3300, Argentina

17938. Senn, P. (2020): Records of dragonflies (Odonata: Zygoptera, Anisoptera) from an endangered peat pool in Gdynia, northern Poland. Odonatrix 16_2 (2020): 6 pp. (in Polish, with English summary) ["The paper reports 11 odonate species, including Leucorrhinia pectoralis (legally protected in Poland), recorded in 2018 at a peat pool in Gdynia, northern Poland, which is endangered by the construction of a new multi-level expressway interchange." (Author)] Address: Senn, P., ul. Kañskiego 7D/9,81-603 Gdynia, Poland. E-mail: petersenn47@gmail.com

17939. Sheikh, A.H.; Lone, M.A.; Wani, M.A. (2020): New distributional records of dragonflies (Libellulidae: Anisoptera: Odonata) from Rajori district of Jammu and Kashmir. Journal of Entomological Research 44(1): 121-124. (in English) ["The present paper reports five libellulid speciesf from the Rajori district of Jammu and Kashmir. All five species are reported for the first time from this area: Orthetrum pruinosum, O. sabina, Crocothemis servilia, Neurothemis tullia and Tramea basilaris." (Authors)] Address: Sheikh Altaf Hussain, Dept Zool., Govemement Degree College, Pulwama-192 301, Jammu and Kashmir, India. E-mail: khushialtafl 986@-gmail.com

17940. Shimbori, O.; Futahashi, H.; Futahashi, R. (2020): Records of Sympetrum frequens (Selys, 1883) in January in Toyama Prefecture Osamu. Tombo 62: 141-143. (in Japanese, with English summary) ["We recorded S. frequens in January in Kami-ichi Town, Toyama Prefecture. To our knowledge, January 19 is the latest appearance date for this species in Japan." (Authors)] Address: Futahashi, R., National Institute of Advanced Industrial Science & Technology (AIST), Central 6, Tsukuba, Ibaraki 305-8566 Japan. E-mail: ryo-futahashi@aist.go.jp

17941. Sih, C.; Ngiam, R. (2020): A dragonfly of the genus Heliaeschna in Jalan Lembah Thomson estate. Singapore Biodiversity Records 2020: 24-25. (in English) ["Singapore Island, Jalan Lembah Thomson; 2-XI-2019; 2200 hrs. Habitat: Suburban housing estate. In the outdoor kitchen of a terrace house." (Authors)] Address: sihchristian@gmail.com

17942. Silva Pinto, R.M.; Lopes, J.P.; Trainor, C.R.; Seehausen, M. (2020): New records of Odonata from the eastern Lesser Sunda Islands of Timor, Semau, Rote, and Alor, with discovery of Hemicordulia eduardi (Odonata: Corduliidae). Faunistic Studies in Southeast Asian and Pacific Island Odonata 33: 1-60. (in English) ["Eleven species of Odonata are reported for the first time from Timor and Semau Islands, 13 new records are reported for Rote Island and four new records for Alor Island. These records increase the checklists to 51 species for Timor (thereof 45 from Timor-Leste), 11 for Semau, 23 for Rote and 13 for Alor. An annotated listing is provided for these four islands. Furthermore three species were rediscovered at Timor: Indolestes lafaeci Seehausen, 2017 for the first time since the type series collected in 1929, also the first photographs of living individuals and notes about the habitat are provided; Diplacodes haematodes (Burmeister, 1839) for the first time since 1935 and Tramea loewii Brauer, 1866 for the first time since an unspecific record published by Lieftinck (1953). The identification of Hemicordulia eduardi Lieftinck, 1953, formerly supposed to be an endemic from Sumba Island, is discussed with reference to the holotype male. Also notes about the habitat and behaviour are given. Five taxa of the Rhyothemis phyllis (Sulzer, 1776) group were shortly discussed with respect to the individuals from Timor which are provisionally assigned to ssp. ixias Lieftinck, 1953. Illustrations of the face, labium and wings of the nominate subspecies as well as of ssp. ixias, ssp. obscura (Brauer, 1868), ssp. snelleni (Selys, 1878), and ssp. chloe (Kirby, 1894) are provided." (Authors)] Address: Seehausen, M., Museum Wiesbaden Hessisches Landesmuseum fur Kunst und Natur, Friedrich-Ebert-Allee 2, 65185 Wiesbaden, Germany. E-mail: malte.seehausen@museum-wiesbaden.de

17943. Simaika, J.P.; Ware, J.L.; Garrison, R.W.; Samways, M.J. (2020): Phylogeny of the Synlestidae (Odonata: Zygoptera), with an emphasis on Chlorolestes Selys and Ecchlorolestes Barnar. Scientific Reports 10(15088) (2020) 12 pp. (in English) ["The Synlestidae of southern Africa comprise some highly localized species. All but one species are endemic to South Africa, and many to the Cape Floristic Region. Here we present the first phylogenetic reconstruction of the southern African Synlestidae using nuclear and mitochondrial molecular data. The genera Ecchlorolestes and Chlorolestes are monophyletic, and we propose that the Neotropical family Perilestidae consisting of two genera, Perilestes and Perissolestes, be sunk within Synlestidae. We discuss the intrafamilial relationships for the southern African Synlestidae." (Authors)] Address: Simaika, J.P., IHE Delft Institute for Water Education, Westvest 7, 2611 AX Delft, The Netherlands. E-mail: j.simaika@un.ihe.org

17944. Snegovaya, N.Yu. (2020): A progress study of the Odonata from Azerbaijan in summer 2019. International Dragonfly Fund Report 142: 1-20. (in English) [Azerbaijan, "15 localities in seven districts (Quba, Khachmaz, Goygol, Samukh, Gusar, Siyazan, Shabran). A total of 36 species was recorded, including Lestes macrostigma, Ischnura fountaineae, Coenagrion pulchellum, Lindenia tetraphylla, Sympetrum vulgatum." (Author)] Address: Snegovaya, Nataly, Zoological Institute NAS of Azerbaijan, proezd 1128, kvartal 504, Baku, AZ 1073, Azerbaijan. E-mail: snegovaya@yahoo.com

17945. Sparrow, D.J.; Makris, C.; Sparrow, R.; Michaelides, M.; Konis, D.; De Knijf, G. (2020): First records of Aeshna isoceles and the rediscovery of Lestes barbarus on Cyprus (Odonata: Lestidae, Aeshnidae). Notulae odonatologicae 9(5): 185-195. (in English) ["In this paper we report the presence of A. isoceles for the first time from Cyprus. Five males were observed and photographically documented in May 2012 in a small valley below Rizokarpaso on the Karpasia peninsula. This was, however, not followed up at that time. The species was rediscovered by members of the CDSG in the same valley in April 2019. Reproductive behaviour (copula and oviposition) was observed and a population is assumed to be present. It seems possible that the species has been present on the island for some time but overlooked, due to the remoteness of the site. Furthermore, members of the CDSG also photographically documented a male L. barbarus at an agricultural tank near Agridia in August 2019. The last published sighting of this species on Cyprus was of four specimens dating back to 1948 that are stored in the collection of the British Museum of Natural History. We further report on two unpublished sightings of this species at Fasouri marsh in 1997 and on the Gialias river near Kotsiatis in 2002. The records of Aeshna isoceles increase the Odonata checklist for Cyprus to 38 species." (Authors)] Address: Sparrow, D.J., Cyprus Dragonfly Study Group (CDSG), P.O. Box 62624, 8066, Paphos, Cyprus. E-mail: davidrospfo@hotmail.com

17946. Spitsyn, V.M.; Zhukova, T.A. (2020): New data on the distribution of Banded Demoiselle Calopteryx splendens in the Arkhangelsk region. Fauna of the Urals and Siberia 1: 41-42. (in Russian, with English summary) ["We report the northernmost records of C. splendens in the Arkhangelsk region. We found specimens of the species in the valleys of the rivers Pinega (64.2792°N, 44.2632°E) and Bolshaya Yura (64.4124°N, 41.6996°E) (the River Severnaya Dvina basin)." (Authors)] Address: Spitsyn, V.M., Federal Center for Integrated Arctic Research, Russian Academy of Sciences, 23, Severnoy Dviny emb., Arkhangelsk, Russia, 163000. E-mail: spitsyn.v.m.91993@yandex.ru

17947. Stand-Perez, M.A.; Perez-Gutierrez, L.A. (2020): Pseudotepuibasis gen. nov., a new monotypic genus of Coenagrionidae from Colombian Amazon (Odonata: Zygoptera). Zootaxa 4845(4): 576-584. (in English) ["Pseudotepuibasis gen. nov. is erected for P. garrisoni sp. nov. from the Colombian Amazon (December 2015, Caquetá Department, Solano Municipality, Araracuara, Guacamayo Guard, -72.2497, -0.6308, L. Pérez leg.). Male and female of this new genus are described and illustrated, cerci of male with a ventrobasal spur for which it is considered in the tribe Teinobasini, close to Tepuibasis De Marmels, 2007 and Austrotepuibasis Machado & Lencioni, 2011, by its color pattern and cerci morphology; and close to Leptobasis Selys, 1877 and Mesoleptobasis Sjöstedt, 1918, by its genital ligula. Some notable characters of Pseudotepuibasis are a chitinized spine-like process directed posteriorly on the genital ligula, male cerci with chitinized median tooth, and thoracic color pattern." (Authors)] Address: Perez-Gutierrez, L.A., Lab. Sistemática de Insetos Aquáticos (LABSIA), Univ. Federal do Paraná, Jardim das Américas, Curitiba, Brasil. E-mail: talysker@gmail.com

17948. Subramanian, K.A.; Babu, R.; Kalkman, V.J. (2020): Orthetrum erythronigrum sp. nov. (Odonata: Libellulidae) from the Great Nicobar Island, India. Zootaxa 4869(2): 242-250. (in English) ["The male and female of Orthetrum erythronigrum sp. nov. are described from Great Nicobar Island and are believed to be endemic to the Nicobar Islands archipelago (holotype male, India, Andaman and Nicobar Islands, Great Nicobar Island, Great Nicobar Biosphere Reserve, N 6.99067, E 93.871363; 01-xii-2018; deposited in ZSI, SRC, Chennai, India). The male of this new species is easily distinguished from other known Orthetrum species by its black abdomen with contrasting crimson belly. Female is distinguished by its large size, the black non-metallic head, black thorax and the red abdomen with a distinct black pattern. Based on field observations and photographs, notes on the life colouration of the mature male and information on the distribution and habitat of this Great Nicobar endemic are provided." (Authors)] Address: Sunramanian, K.A., Zoological Survey of India, Southern Regional Centre, Santhome High Road, Chennai-600 028, Tamil Nadu, India. E-mail: subbuka.zsi@gmail.com

17949. Sugiman, U.; Atmowidi, T.; Priawandiputra, W. (2020): Diversity of dragonflies (Insecta: Odonata) in Ujung Kulon National Park. IOP Conf. Series: Earth and Environmental Science 457 (2020) 012031: 7 pp. (in English) ["Ujung Kulon National Park is a lowland tropical forest that was still preserved. There was limited information about the diversity

of dragonflies in Ujung Kulon National Park. The purpose of this study was to study species diversity of dragonfly in Ujung Kulon. The research was conducted in Ujung Kulon Peninsula, Banten, Indonesia in five locations and three types of aquatic habitats i.e., natural ponds, streams in forests, and rivers. The transect line method is used to collect adult dragonflies. 31 species … were reported in this study. 22 species were as new records based on previous publications. There were different species compositions in all habitat types (R = 1, p = 0.0016, one-way ANOSIM with Bray-Curtis similarity index). Natural ponds have the highest anisopteran species richness compared to other habitats. Eight species Anisoptera only were found in natural ponds. Meanwhile, zygopteran species prefer in flowing water habitat." (Authors)] Address: Sugiman, U., Dept Biol., Faculty Math. & Natural Sciences, IPB Univ., Kampus IPB Darmaga, Bogor 16680 Indonesia. E-mail: atmowidi@apps.ipb.ac.id

17950. Sugimura, M.; Futahashi, R. (2020): A record of an interspecific hybrid between Sympetrum eroticum (Selys, 1883) and S. kunckeli (Selys, 1884) from Kochi Prefecture, Shikoku, Japan. Tombo 62: 104-105. (in English, with Japanese summary) ["A male interspecific hybrid between S. eroticum and S. kunckeli was captured in Gudo, Shimanto, Kochi Prefecture, Honshu, Japan. This is the first record of this hybrid from the prefecture. This specimen has intermediate morphological characteristics and the results of nuclear and mitochondrial DNA analyses indicate that this individual was derived from interspecific mating between a male S. eroticum and a female S. kunckeli."] Address: Sugimura, M., 9-7, Uyamasatsuki-cho, Nakamura City, Kochi Prefecture, 787, Japan. E-mail:tombo@gakuyukan.com

17951. Supple, J.A.; Pinto-Benito, D.; Khoo, C.; Wardill, T.J.; Fabian, S.T.; Liu, M.; Pusdekar, S.; Galeano, D.; Pan, J.; Jiang, S.; Wang, Y.; Liu, L.; Peng, H.; Olberg, R.M.; Gonzalez-Bellido, P.T. (2020): Binocular encoding in the damselfly pre-motor target tracking system. Current Biology 30(4): 645-656. (in English) ["Highlights: • Demoiselles align their prey frontally during predatory flights • Target-selective descending neurons are homologous in dragonflies and damselflies • TSDN reference frame is binocular-fused in damselflies but sagittal in dragonflies • Summation to threshold explains binocular responses of demoiselle TSDNs. Summary: Akin to all damselflies, Calopteryx… possess dichoptic (separated) eyes with overlapping visual fields of view. In contrast, many dragonfly species possess holoptic (dorsally fused) eyes with limited binocular overlap. We have here compared the neuronal correlates of target tracking between damselfly and dragonfly sister lineages and linked these changes in visual overlap to pre-motor neural adaptations. Although dragonflies attack prey dorsally, we show that demoiselles attack prey frontally. We identify demoiselle target-selective descending neurons (TSDNs) with matching frontal visual receptive fields, anatomically and functionally homologous to the dorsally positioned dragonfly TSDNs. By manipulating visual input using eyepatches and prisms, we show that moving target information at the pre-motor level depends on binocular summation in demoiselles. Consequently, demoiselles encode directional information in a binocularly fused frame of reference such that information of a target moving toward the midline in the left eye is fused with information of the target moving away from the midline in the right eye. This contrasts with dragonfly TSDNs, where receptive fields possess a sharp midline boundary, confining responses to a single visual hemifield in a sagittal frame of reference (i.e., relative to the midline). Our results indicate that, although TSDNs are conserved across Odonata, their neural inputs, and thus the upstream organization of the target tracking system, differ significantly and match divergence in eye design and predatory strategies." (Authors)] Address: Supple, J. A., Dept of Physiology, Development, & Neuroscience, Univ. of Cambridge, Downing Str., Cambridge CB3 2EG, UK

17952. Susanth, C.; Anooj, S.S. (2020): Checklist of Odonata of Wayanad District, Kerala. Indian Journal of Entomology 82(2): 315-323. (in English) ["This study presents the Odonata diversity of Wayanad district of Kerala. 59 species in 40 genera and seven families are included, of which Libellulidae included the most number of species followed by the Coenagrionidae. A check list of the species observed is provided." (Authors)] Address: Anooj, S.S., Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi 110012, India. E-mail: anooj227@gmail.com

17953. Susanto, M.A.S.; Abdillah, M.M.; Permana, R.C.; Mubarak, Z.; Anwar, M.S. (2020): Inventarisasi Jenis Capung (Anisoptera) Dan Capung Jarum (Zygoptera) di Sumber Clangap dan Sumber Mangli Kabupaten Kediri. Seminar Nasional Biologi 5 tahun 2020 - Jurusan Biologi Fakultas Sains dan Teknologi, UIN Sunan Gunung Djati Bandung: 113-119. (in Indonesian, with English summary) ["Sumber Clangap and Mangli are springs that are located at Puncu Village, Puncu District, Kediri Regency. These two springs are commonly used by local residents as their water resources. Both locations have a good water quality that makes them suitable habitats for dragonflies. This research was aimed to make an inventory of odonate species in Sumber Clangap and Mangli. The method used in this research was belt transect and visual day flying to obtain data on the type and number of dragonflies. The data obtained were then analyzed using the Shannon-Wiener Heterogeneity Index and the percentage of relative abundance. The results showed that the Odonata taken from Sumber Clangap comprised 13 species from 6 families, while in Sumber Mangli there were 10 species from 7 families. Sumber Clangap had a higher value of diversity (H '= 1.99) compared to Sumber Mangli (H' = 1.79). The percentage of relative abundance analysis showed that Euphaea variegata was the most dominant species in both locations with a value of 27.30%." (Authors)] Address: Susanto, M.A.S., Program Studi Biologi, Fakultas Sains dan Teknologi UIN Sunan Ampel Surabaya, Jalan A. Yani 117, Surabaya, Indonesia. E-mail: muhammadazmidwi@gmail.com

17954. Suzuki, K.; Watanabe, Y.; Tojo, K. (2020): Embryogenesis of the damselfly Euphaea yayeyamana Oguma (Insecta: Odonata: Euphaeidae), with special reference to the

formation of their larval abdominal “gill-like” appendages. Entomological Science 23: 280-293. (in English) ["The acquisition of wings in insects is the most significant subject in considering the diversification and adaptive radiation of insects, that is, the “macro-evolution” of insects. In the discussion of the origin of insect wings, Palaeoptera has attracted particular attention in phylogenetic and evolutionary studies. In particular, Ephemeroptera have segmental gill-structures on their abdominal segments during their nymphal stage, and these have been noted in discussions regarding their homology and/or serial homology between wings, gills and appendages. Although Odonata has received little attention in the course of these discussions, there are cases of segmental gill-like structures on their abdomen in the two families, Euphaeidae and Polythoridae. Under such cirumstances, in this study, the embryological developmental process in Euphaea yayeyamana of Euphaeidae was observed, focusing on the formation process of the gill-like structures. As a result, it was revealed that four of the seven pairs of gill-like projection structures started their visible formation within the middle stages of embryonic development, and the remaining three pairs developed during the early stages of post-embryogenesis. Some joint-like structures existed in all of the gill-like projections. It was revealed that muscle tissue was interposed within these protrusions and that all of the projections themselves fully articulated, and that the nervous system was extended into the protrusions. All of the gill-like projections strongly suggested their homology with the cephalic and thoracic appendages, when we considered them with regard to their serial homology based on the topology of their formation position." (Authors)] Address: Suzuki, K., Department of Biology, Faculty of Science, Shinshu University, Matsumoto, Japan,

17955. Taguchi, M. (2020): Variation and blackening of the white pruinose potion on the dorsal abdomen in a mature male of the white-tailed skimmer Orthetrum albistylum Selys, 1848 (Anisoptera: Libellulidae) in coastal, Yokohama. Tombo 62: 91-103. (in English, with Japanese summary) ["The pruinescence, consisting of wax, of O. albistylum is considered to play an advantageous role in territorial behavior and communication between individuals, by strongly reflecting ultra violet light (UV). In 2018, in Keihin district, Yokohama City, a blacked male specimen with pruinescence on only half of the abdomen was discovered. As a result of this, we researched variation in this species in five localities; three in the city, one in the northern part of the prefecture (Kenhoku), and one south of Tama district. We found there was a broad spectrum on the dorsum of the 6th abdominal segment of mature male specimens, as divided into five stages, from lacking pruinescence to completely pruinosed. In addition, it was revealed that the pruinose area does not change once maturity is reached. In the coastal region, although UV and radiant heat are strong, the blackish variant was more frequent compared to other regions. This variant is considered to be weaker in its sexual appeal, but the sex ratio in the coastal region was biased to female, and male competition was not so strong. On the other hand, the sex ratio at Kenhoku was most biased to male, and there male competition appeared to be strongest. The results from Kenhoku showed that the individuals with most developed pruinescence were dominant, and the ratio of this variant was negatively correlated with the ratio of female/male. When immature, the adults of Odonata need to develop the muscle of the thorax, moreover, males of this species have to secrete the wax for pruinescence. Because small worms are not abundant for food in the coastal region, it is speculated that to reduce the burden of producing wax the colour change is an adaption, creating situation with less male competition. However, a bottleneck effect cannot be excluded in such phenomenon, and actually, multi factors may induce the frequency of blackened variants of the male in the coastal region." (Author)] Address: Taguchi, M., Yaei-Higashi High School, Sagamihara, Kanagawa 229-0029, Japan.E-mail: taguchim@cameo.plala.or.jp

17956. Theischinger, G. (2020): Nannophya fenshami sp. nov., a tiny dragonfly from an artesian spring wetland in Queensland, Australia (Anisoptera: Libellulidae). International Dragonfly Fund - Report 149: 1-10. (in English) ["Nannophya fenshami sp. nov. is described from an artesian spring wetland in Queensland. Diagnostic characters of male, female and larva are presented and illustrated and the probable affinities of the species are discussed." (Author)] Address: Theischinger, G., Australian Museum, Entomology, 6 College Street, Sydney, NSW, 2010, Australia. Email: theischingergunther@gmail.com

17957. Theischinger, G.; Richards, S. (2020): Palaeosynthemis papilio sp. n., a new dragonfly from Papua New Guinea (Odonata: Anisoptera: Synthemistidae). Australian Entomologist 47(3): 169-176. (in English) ["Palaeosynthemis papilio' sp. n. is described from a single male collected in the Purari River basin in the Gulf Province of south-central Papua New Guinea. The male is most similar to P. elegans Theischinger and Richards, 2013, a species currently known only from the Sepik River basin on the northern side of New Guinea's central cordillera, but can be distinguished from that species and all other congeners by the lack of yellow markings on the face, the presence of a pale antehumeral patch and a butterfly-like yellow medio-dorsal patch on abdominal segment 3, and absence of a spine on the dorsum of abdominal segment 10. The new species flies predominantly at dusk, in clearings in lowland tropical rainforest." (Authors)] Address: Theischinger, G., Office of Environment and Heritage New South Wales, Sydney, NSW, Australia, and Australian Museum, Entomology, 6 College Street, Sydney, NSW, 2010, Australia. E-mail: theischingergunther@gmail.com

17958. Tierney, A.; Deregnaucourt, I.; Anderson, J.M.; Tierney, P.; Wappler, T.; Béthoux, O. (2020): The Triassic Mesophlebiidae, a little closer to the crown of the Odonata (Insecta) than other ‘triassolestids’. Alcheringa: An Australasian Journal of Palaeontology 44(2): 279-285. (in English) ["Two new, subcomplete forewings belonging to the ‘triassolestid assemblage’, a group of Triassic stem-relatives of dragon- and damselflies (Odonata), are described. One, re-

covered from Australia (Aranbanga Volcanic Group), belongs to Mesophlebia antinodalis Tillyard, 1916, previously documented on the basis of two very incomplete wings. The other, recovered from South Africa (Molteno Formation), is assigned to a new species, Mesophlebia elegans sp. nov. The new data allow a reconsideration of the diagnosis of the genus Mesophlebia Tillyard, 1916 and a re-instatement of the family Mesophlebiidae Tillyard, 1916. Notably, the new specimens possess, near the wing base, a posterior lobe absent in most 'triassolestid' genera, but present in crown-Odonata and a number of their stem-relatives. Lobodonata tax. nov. is erected to accommodate odonates possessing this lobe. The nature of the 'vein-like' element anteriorly delimiting this lobe is discussed. We submit that it might have been initially composed of an invagination of the posterior wing-margin ('fibula'), which was later captured by AA, imposing its course on CuP." (Authors)] Address: Béthoux, O., Sorbonne Université, MNHN, CNRS, Centre de recherche sur la paléontologie – Paris (CR2P), 57 rue Cuvier, CP38, F-75005 Paris, France. E-mail: obethoux@mnhn.fr

17959. Tiple, A. (2020): Dragonflies and Damselflies (Odonata: Insecta) of the Bor Wildlife Sanctuary, Wardha, Maharashtra, Central India. Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa" 63(2): 131-140. (in English) ["Odonata species diversity was studied in the Bor wildlife sanctuary from 2011 to 2018. A total of 72 species of odonates belonging to 8 families were recorded. The study adds three new species for the Vidarbha region. The highest number of odonates belonged to the family Libellulidae (31 species) followed by Coenagrionidae (15 species), and Aeshnidae (six species). Of the total, 30 species were very common, 18 were common, seven were frequent common, 11 rare and six very rare. Among all, six species were Data Deficient, Indothemis carnatica is listed as Near Threatened and 64 were Least Concern, in IUCN red-list of threatened species. The observations support the value of the wildlife sanctuary area in providing valuable resources for Odonata." (Author)] Address: Tiple, A., Dept Zool., Vidyabharti College, Seloo, Wardha 442 104, India. E-mail: ashishdtiple@gmail.com

17960. Tiple, A.; Payra, A. (2020): First Record of Epophthalmia frontalis from Central India (Insecta: Odonata: Macromiidae). Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa" 63(2): 127-130. (in English) ["E. frontalis, a new Macromiidae dragonfly for Central India, is recorded from Seoni of Madhya Pradesh based on a collection of a single male. In India, earlier, this species was only known from a few places of Western Ghats and Eastern India. Diagnostic characters with closely resemble species and field photographs are given." (Authors)] Address: Tiple, A., Dept of Zoology, Vidyabharti College, Seloo, Wardha 442 104, India. E-mail: ashishdtiple@gmail.com

17961. Tomasi, E. (2020): Fito-Zoocecidi dell'Alta Valcellina (Prealpi Carniche) (Parco Naturale Dolomiti Friulane). Atti Mus. Civ. St. Nat. Trieste 6: 5-122. (in Italian, with English summary) ["Investigation Gall-making of the high Valcellina, (Friuli Venezia Giulia, North-Eastern Italy). The Autor reports the results schieved between 1990 and 2011, of the researches concerning the galls of the high Valcellina (Prealpi Carniche) Dolomiti Friulane Natural Park (Friuli Venezia Giulia, Italy NE). 1145 species have been identifi ed, subdivided as follows: … Insecta Odonata Lestidae (1)…." (Author)] Address: Tomasi, E., Museo Civico di Storia Naturale di Trieste, Via dei Tominz, 4 – I – 34139 Trieste, Italia

17962. Tsaryk, Y.; Reshetylo, O.; Nazaruk, K.; Lesnik, V. (2020): Species diversity of invertebrates (Invertebrata) on the routes of student zoology practice in the Western Chornohora (the Ukrainian Carpathians). Studia Biologica 14(2): 137-150. (in Ukrainian, with English summary) ["Since the second half of the 19th century invertebrate fauna of the Carpathians has been studied in detail by numerous scientists. The western branches of the Chornohora massif of the Ukrainian Carpathians has been attractive for the researchers of different groups of invertebrates. However, there is no possibility to evaluate their diversity dynamics in this area due to the lack of generalized comparative long-term data. With regard to that and considering the advantageous localization of the high-mountain biological station of Ivan Franko National University of Lviv as a convenient place for such investigation, the aim of our study was to describe the species diversity of invertebrates in the Western Chornohora for the initiation of stationary research of its dynamics. The material was collected by students according to the standard zoological methods during their field practice trips in July 2015–2019 on seven radial routes in various coenotic conditions and on different sites of the Western Chornohora. 149 species of invertebrate animals from 9 classes were identified in total. Insects considerably predominate among them by the species composition (about 80 %). The most common species of the 14 registered orders of Insecta represent Coleoptera (about 40 %), Hymenoptera and Lepidoptera (15 % each). … The study revealed seven species listed in the Red Data Book of Ukraine (… Cordulegaster bidentata, ..." (Authors)] Address: Tsaryk, Y., Ivan Franko National University of Lviv, 4, Hrushevskyi St., Lviv 79005, Ukraine. E-mail: yosyf.tsaryk@lnu.edu.ua

17963. Tunon, M. (2020): Time constraint and genetic (phenotypic) variation in wing shape in a damselfly along a latitudinal gradient. MSc. thesis, Biology Education Centre and Animal Ecology, Uppsala University: 25 pp. (in English) ["This degree project examined the effect of time constraint on wing shape and phenotypic variation in wing shape along a latitudinal gradient in the damselfly species Lestes sponsa. Fore and hind wings from individuals originating from three different latitudes: North (66°N), Central (59°N) and South (54°N) Europe were treated with their native temperature and photoperiod. In addition, the north and south populations were treated with south and north conditions respectively, resulting in five groups in total. Morphometric analyses of the wings revealed a positive correlation between body mass and wing centroid size, along with a difference in wing shape between the groups. Forewings and hindwings from the northern group were broader and rounder than wings from the central and southern groups. Additionally, the wings from

the transplant groups resembled those of the native group of their treatment, indicating a phenotypic plasticity in wing shape. Lastly, statistical tests of phenotypic variation revealed that variation was highest in relative warp 2 in the forewings and hindwings, and this warp represents the curvature of the wing both upwards/downwards or towards the inside/outside of the wing. These results on phenotypic variation indicate that even in a new or changing environment, L. sponsa could be capable of adapting to varying temperatures and environmental conditions. This study builds our understanding of how this damselfly species, and potentially insects, will be affected by current and future potential climate change." (Author)] Address: not stated

17964. Vega-Sanchez, Y.M.; Mendoza-Cuenca, L.F.; Gonzalez Rodriguez, A. (2020): Hetaerina calverti (Odonata: Zygoptera: Calopterygidae) sp. nov., a new cryptic species of the American Rubyspot complex. Zootaxa 4766(3): 485-497. (in English) ["Hetaerina americana Fabricius, 1798 has a long and irresolute taxonomic history. Several synonyms have been suggested (H. californica Hagen in Selys-Longchamps, 1859, H. basalis Hagen in Selys-Longchamps, 1859, H. texana Walsh, 1863, H. scelerata Walsh, 1863, etc.), related to the variation in the size of the wing spots as well as to the morphology of the male cerci. However, Calvert (1901) suggested that H. americana represents one variable species. Nevertheless, Vega-Sánchez et al. (2019) through a genetic and morphological analysis presented evidence to propose that H. americana represents a species complex. In the present work, we describe a new species that belongs to this complex: H. calverti sp. nov. The morphological characteristics by which males and females of H. calverti differ from H. americana are highlighted. The most important character for the differentiation of males is the shape of the cerci and the size of the individuals (when the two species are in sympatry). In females, the main differences are in the shape of the intersternites and the medio-dorsal carina of the last segment of the abdomen. Some generalities about the biology of the species are presented, including geographical distribution patterns and genetic divergence data.“ (Authors)] Address: González-Rodríguez, A., Inst. de Investigaciones en Ecosistemas y Sustentabilidad, Univ. Nacional Autónoma de Mexico. Antigua carretera a Pátzcuaro #8701, Morelia, Michoacán 58190, Mexico. Email: agrodrig@iies.unam.mx

17965. Viela, D.S.; Venacio, H.; Santos, J.C. (2020): Final instar larva of Acanthagrion truncatum Selys, 1876 (Zygoptera: Coenagrionidae). Zootaxa 4881(2): 393-400. (in English) ["Here we describe the final instar larvae of A. truncatum, the 16th described for the genus. We compare the diagnostic characters of A. truncatum with other species of the Group II. Although very similar to other Acanthagrion, the larvae of A. truncatum can be separated from other congeners from having the following character combination: cephalic lobes bulging and rounded, seven antennomeres, 2+1 or 2 premental setae, and nodus at 0.60–0.62 of total length of the lamella." (Authors)] Address: Viela, D.S., Rua Jaime Bilharinho, 575, CEP 38065-280, Uberaba, Minas Gerais, Brazil. E-mail: deeogoo@gmail.com

17966. Viella, D.S.; Neiss, U.G.; Koroiva, R.; Guillermo-Ferreira, R.; Hamada, N. (2020): The female of Epipleoneura spatulata Rácenis, 1960 (Odonata: Protoneurinae). Zootaxa 4803(2): 381-387. (in English, with Portuguese summary) ["Here we describe the hitherto unknown female of Epipleoneura spatulata Rácenis, 1960 and present a table of characters (all illustrated) to distinguish it from other known congeneric females. We suggest that the main diagnostic character of the female of E. spatulata is the shape of posterior margin of prothorax, which is flat medially with smoothly curved erect lateral projections." (Authors)] Address: Viela, D.S., Rua Jaime Bilharinho, 575, CEP 38065-280, Uberaba, Minas Gerais, Brazil. E-mail: deeogoo@gmail.com

17967. Vilela, D.S.; Koroiva, R.; Azevedo Tosta, T.H.; Novaes, M.C.; Guillermo-Ferreira, R. (2020): Dragonflies and damselflies from the West of Minas Gerais, Brazil: checklist and new records. Biota Neotropica 20(1): e20190851, 2020: 15 pp. (in English, with Portuguese summary) ["The knowledge about the richness and distribution of Brazilian dragonflies is still being unveiled. Over the years, inventories, reviews, and descriptions have been made. These contributions, apart from the taxonomic value, also provide valuable data on the occurrence of species and their distributions, which are rarely accompanied by notes about natural history and behavior. Keeping this legacy in mind, we collected dragonflies between 2011 and 2019 in Minas Gerais state, which resulted in the registration of 90 species, 41 data, an important tool for conservation actions, and provide additional information about habitat and biology of species." (Authors)] Address: Vilela, D.S., Univ. de São Paulo, Depto de Biologia, Programa de Pós-Graduação em Entomologia, Ribeirão Preto, SP, Brasil. E-mail: deeogoo@gmail.com

17968. Villanueva, R.J.T.; Estacio, R.D. (2020): The Odonata collected in October 2019 on Patnanungan Island, Jomalig Island and Panukulan (northeastern Polillo), Philippines, with a checklist of the Polillo Odonata fauna. International Dragonfly Fund - Report 151: 1-21. (in English) ["The paper presents new odonatological data from the formerly unstudied islands Patnanungan and Jomalig as well from the northeastern part of Polillo, The Philippines. Four species are new for the Polillo Island group, including one new taxon Anax parthenope julius – for The Philippines. Currently, 78 odonate taxa are known from the Polillogroup." (Author)] Address: Villanueva, R.J.T., College of Arts & Sciences Education, University of Mindanao, Matina, Davao City, 8000 Philippines. E-mail: rjtvillanueva@gmail.com

17969. Vlasov, D.V. (2020): The dragonflies (Insecta: Odonata) of the National Park «Pleshcheevo Lake» (Yaroslavl region). Scientific proceedings of the Prisursky State Nature Reserve 35: 109-114. (in Russian, with English summary) [26 species including Libellula fulva recorded in the Yaroslavl region for the first time at the imago stage. The paragraph on Aeshna grandis includes an observations of imaginal preying for ants (Hymenoptera). Address: Vlasov D.V., Russia, Yaroslavl, Yaroslavl State Historical and Architectural and art museum-reserve, Russia. E-mail: mitrich-koroed@mail.ru

17970. Wakhid; Rauf, A.; Krisanti, M.; Sumertajaya, I.M.; Maryana, N. (2020): Aquatic insect assemblages in four urban lakes of Bogor, West Java, Indonesia. Biodiversitas 21(7): 3047-3056. (in English) ["Urban lakes represent important habitats for some freshwater organisms and support a high diversity of insect fauna. Study was conducted with the objectives to determine and compare aquatic insect assemblages in four urban lakes of Bogor, West Java, Indonesia. Insects were collected in the littoral zone using D-net at a certain interval along the perimeter of each lake. Sampling was carried out monthly during March, April, and May 2017. A total of 6,686 individuals representing 82 species / morphospecies, 28 families, and seven orders were recorded. Estimation of species richness by Chao1 suggested that sampling completeness for Situ Babakan, Situ Burung, Situ Gede, and Situ Tonjong were 88.71%, 75.86%, 82.17%, and 95.23%, respectively. Rarefaction curves indicated that more sampling would record a higher species richness. The least species richness and diversity of aquatic insect assemblages occurred in Situ Babakan characterized by high organic pollution due to fish farming. Canonical correspondence analysis showed that certain environmental factors were related to some species. … Odonates such as Pseudagrion sp.1, Rhinocypha sp., Acisoma panorpoides, Orthetrum sabina and Crocothemis servilia were associated with conditions of a high density of macrophytes. Our study provides baseline data for future monitoring and conservation management of these lakes." (Authors)] Address: Wakhid, Program of Entomology, Graduate School, Institut Pertanian Bogor. Jl. Meranti, Kampus IPB Darmaga, Bogor 16680, Indonesia

17971. Wakhid; Rauf, A.; Krisanti, M.; Sumertajaya, I.M.; Maryana, N. (2020): Species richness and diversity of aquatic insects inhabiting rice fields in Bogor, West Java, Indonesia. Biodiversitas 21: 34-42. (in English) ["Rice fields occupy the largest cultivated area in agricultural landscape in Indonesia and support a variety of living organisms, including aquatic insects. This study was conducted with the objective to determine the species richness and diversity of aquatic insects inhabiting rice fields. Sampling was made in March, May, and July 2017 in rice fields at Situgede, Pandansari, and Kawungluwuk (Bogor region, West Java, Indonesia), and carried out by dragging dip net on the bottom along the edge of the rice plots. A total of 3,306 individuals representing 45 species of aquatic insects belonging to 30 genera, 20 families, and seven orders were recorded. Order Hemiptera was the most abundance comprising 28.89% of the total insects collected, followed by Diptera (24.80%), Coleoptera (24.41%), and Odonata (21.42%). Functional feeding group analysis showed that collectors-gatherers had the highest proportion (40 - 46%), followed by predators (23-44%) and scrapers (10-35%). Rank-abundance curve showed low species evenness with the four most abundant species were Micronecta siva (Kirkaldy) (Hemiptera: Micronectidae), Chironomus sp. (Diptera: Chironomidae), Orthetrum sabina , and Helochares sp. (Coleoptera: Hydrophilidae). The Shannon-Wiener index showed the lowest value (H'=1.84) at Situgede and the highest (H'=2.05) at Pandansari. Richness estimate and individual-based rarefaction curve revealed that rice fields at Pandansari have more species richness than the other two sites. This study provides some insights into the aquatic insect community of the human-made ecosystem and suggests that the ecological approach to pest management is necessary for maintaining ecosystem health and promoting biodiversity." (Authors)] Address: Wakhid, Program of Entomology, Graduate School, Institut Pertanian Bogor. Jl. Lingkar Akademik, Kampus Dramaga, Bogor 16680, West Java, Indonesia

17972. Wakimura, K.; Takemon, Y.; Ishiwata, S.; Tanida, K.; Abbas, E.M.; Inai, K.; Taira, A.; Tanaka, A.; Kato, M. (2020): A reference collection of Japanese aquatic macroinvertebrates. Ecological Genetics and Genomics 17 (2020) 100065: 6 pp. (in English) ["Properly identified specimen databases that include DNA sequences are mandatory for studies on species identification by DNA barcodes, metabarcoding of biota, and environmental DNA (eDNA) analyses. In addition, high-resolution digital images of well-characterized specimens are useful for morphology-based taxonomy studies. We have isolated the genomic DNA of physical collections (specimens) of Japanese aquatic macroinvertebrates that were stored at the authors' laboratory and determined partial coding regions for 18S rRNA, histone H3, and mitochondrial cytochrome c oxidase subunit I (COI) genes. Through this work, digital data (photographs and DNA sequences) on aquatic macroinvertebrates inhabiting Japan, along with their collection data, have been made available on the J-amir website (http://www.b.s.osakafu-u.ac.jp/~mkato/J-amir_home.htm). As of March 2020, our collections included 75 taxa of Ephemeroptera (out of 152 species known to inhabit Japan), 30 taxa of Odonata (out of 211 species), 11 taxa of Plecoptera (out of 203 species), and 33 taxa of Trichoptera (out of 484 species), in addition to data of other orders. The website will be continuously updated with new data. Our collection offers a reference for species identification by DNA barcodes, quick image matching of aquatic macroinvertebrates, and evaluating the molecular phylogeny of aquatic insects." (Authors)] Address: Kato, Mikio, Dept of Biological Science, Graduate School of Science, Osaka Prefecture University, 1-1 Gakuen-cho, Naka-ku, Sakai, Osaka, 599-8531, Japan. E-mail: mkato@b.s.osakafu-u.ac.jp

17973. Walker, J.; Mahoney, M.; Templeton, A.R.; McKenzie, P.; Vogt, T.E.; Cashatt, E.D.; Smentowski, J.; Day, R.; Gillespie, R.; Henry, B.; Wiker, J.; Braude, S.; Landwer, B. (2020): Contrasting Ozark and Great Lakes populations in the endangered Hines emerald dragonfly (Somatochlora hineana) using ecological, genetic, and phylogeographic analyses. Conservation Science and Practice. 2020;e162: 15 pp. (in English) ["The federally endangered S. hineana is found in fens surrounding the Great Lakes region and in a small portion of the Missouri Ozarks. Most previous work has focused on the populations in the Great Lakes region. We present mark/recapture studies and genetic surveys to address the status of the Ozark populations. The densities and genetic diversity tend to be higher in the Ozarks than in the Great Lakes region. A phylogeographic analysis indicates

that the Ozarks, with its unglaciated fens, is the likely source for the populations currently inhabiting the formerly glaciated Great Lakes region, and genetic diversity decreases with increasing distance from the Ozarks. This work illustrates the inadequacy of using geography alone to identify a population as marginal and of less conservation concern. We also reanalyzed genetic data on the Great Lakes populations, where several populations have been extirpated over the last several decades. We show that the populations in the Great Lakes region have already lost more than 30% of their genetic diversity over just several decades, and the phylogeographic analysis indicates that increased fragmentation is a possibility in this region due to local extirpations. Ecologically and genetically, the Ozark populations should have a high priority in management plans, and the high rate of loss of genetic diversity and potential fragmentation indicates that continued monitoring and management is needed in the Great Lakes region for this highly endangered dragonfly." (Authors)] Address: Templeton, A.R., Dept of Biology, Washington Univ., St. Louis, MO 63130-4899, USA. Email: temple_a@wustl.edu

17974. Wang, C.; Zhang, R.; Zhou, C.; Sun, Z. (2020): Numerical investigation on flapping aerodynamic performance of dragonfly wings in crosswind. International Journal of Aerospace Engineering, Volume 2020 |Article ID 7325154: 14 pp. (in English) ["Numerical simulations are performed to investigate the influence of crosswind on the aerodynamic characteristics of rigid dragonfly-like flapping wings through the solution of the three-dimensional unsteady Navier-Stokes equations. The aerodynamic forces, the moments, and the flow structures of four dragonfly wings are examined when the sideslip angle between the crosswind and the flight direction varied from 0o to 90o. The stability of the dragonfly model in crosswind is analyzed. The results show that the sideslip angle has a little effect on the total time-average lift force but significant influence on the total time-average thrust force, lateral force, and three-direction torques. An increase in the sideslip angle gives rise to a larger total time-average lateral force and yaw moment. These may accelerate the lateral skewing of the dragonfly, and the increased rolling and pitching moments will further aggravate the instability of the dragonfly model. The vorticities and reattached flow on the wings move laterally to one side due to the crosswind, and the pressure on wing surfaces is no longer symmetrical and hence, the balance between the aerodynamic forces of the wings on two sides is broken. The effects of the sideslip angle on each dragonfly wing are different, e.g., has a greater effect on the aerodynamic forces of the hind wings than those of the fore wings. When sensing a crosswind, it is optimal to control the two hind wings of the bionic dragonfly-like micro aerial vehicles." (Authors)] Address: Wang, C., School of Mech. Engineer., Dongguan Univ. Tech., Dongguan 523000, China

17975. Wildermith, H.; Schneider, B. (2020): Froschattacken auf schlüpfende Kleinlibellen. Libellula 39(1/2): 91-104. (in German, with English summary) ["Frog attacks on emerging damselflies – Besides birds and spiders, frogs are among the most important predators of dragonflies. While ovipositing females and tandems may successfully avoid being preyed on by frogs, pharate larvae as well as emerging and freshly emerged imagines seem to be helplessly exposed to their predators. However, this is not principally the case. By means of video films from a gravel pit by the river Rhine at the Swiss/German border we demonstrate by several examples that damselflies during emergence may react on approaching green frogs and avoid predation by different tactics. Pharate larvae and emerging imagines either remained motionless and were no longer noticed by the predator or the larvae suddenly disengaged from the substrate and dropped with flipping movements back into the water. Frog attacks occurred at the water line, from floating platforms or by stalking their prey under the water surface. Prey-catching leap and tongue projection were released by movements of the prey, occasionally occurring with some delay. Frog attacks on emerging damselflies were only sometimes successful. Thus, damselflies are able to actively avoid predation even during emergence." (Authors)] Address: Schneider, B., Wolfbühlstrasse 34A, 8408 Winterthur, beatsch@bluemail.ch

17976. Wildermuth, H. (2020): Arthropoden im Nahrungsspektrum des Eisvogels Alcedo atthis. Ornithologischer Beobachter 117: 296-311. (in German, with English summary) ["The food of the Kingfisher mainly comprises small fish, rarely other aquatic vertebrates and occasionally also invertebrates, largely arthropods. While the diversity and the preferred size of fish prey has extensively been studied, comparatively little is known about the arthropod prey spectrum. The aim of this study was to learn more about the crustacean and insect prey, its origin and behaviour in respect to the Kingfisher as predator. Study site was the river Töss near Winterthur (canton of Zürich), a tributary of the river Rhine in the Swiss Plateau. Some of the captured prey was identified on photos and video films. More detailed Information was obtained by the analysis of 160 regurgitated pellets that were collected outside the breeding burrow in springtime between 2010 and 2019. Altogether 1415 fragments of 442 prey items could be identified to species or genus level, in some cases only to family level yet. Almost half of the prey were water bugs, predominantly Backswimmers Notonecta sp., and one third consisted of dragonfly larvae comprising ten species, most of them Anax Imperator and Orthetrum cancellatum. The remaining 18 % were composed of two crustacean Orders, mainly amphipods, and six insect Orders, mayflies and stoneflies among them. The prey originated partly front the river and partly from ponds, depending on the breeding localities and the accessible hunting grounds. Based on direct observation and indirect inferences from pellet analyses the Kingfisher catches its prey usually by plunging into the water but he can also capture it from the water surface or the bottom. Terrestrial prey may be taken from Vegetation, wet mud or dry sand and even from midair. This diurnal bird can also detect primarily nocturnal prey such as the larvae of Cordulegaster boltonii when they are not completely burrowed in soft ground or occasionally move by day." (Author)] Address: Wildermuth, H., Haltbergstr. 43, 8630 Rüti, Switzerland. E-mail: hansruedi@wildermuth.ch

17977. Wilk, T. (2020): Great abundance of adult Green Snaketails Ophiogomphus cecilia (Fourcroy, 1785) along the lower course of the River Biala Nida. Odonatrix 16_15: 6 pp. (in Polish, with English summary) ["There are not many publications in the Polish scientific literature providing data on the overall magnitude of dragonfly populations. This paper presents the results of a count of adult O. cecilia along a 16.3 km section of the lower course of the River Biała Nida and a short section of the River Nida. During a canoe trip on 21.08.2020, I recorded 162 adult O. cecilia, distributed at regular intervals along the two rivers. The results indi-cate that this species occurs abundantly on the lower Biała Nida. The paper also discusses the usefulness of counting adults of rheophilic dragonflies during canoe trips, as a complementary research technique that could provide large sets of data for habitat and ecological analyses, and also for the planning of nature conservation measures." (Authors)] Address: Wilk, T., Ogólnopolskie Towarzystwo Ochrony Ptaków, ul. Odrowąza 24, 05-270 Marki, Poland. E-mail: tomaszwilk3-@gmail.com

17978. Willink, B.; Duryea, M.C.; Wheat, C.; Svensson, E.I. (2020): Changes in gene expression during female reproductive development in a color polymorphic insect. Evolution 74(6): 1063-1081. (in English) ["Pleiotropy (multiple phenotypic effects of single genes) and epistasis (gene interaction) have key roles in the development of complex phenotypes, especially in polymorphic taxa. The development of discrete and heritable phenotypic polymorphisms often emerges from major-effect genes that interact with other loci and have pleiotropic effects on multiple traits. We quantified gene expression changes during ontogenetic color development in a polymorphic insect (Ischnura elegans), with three heritable female morphs, one being a male mimic. This female color polymorphism is maintained by male mating harassment and sexual conflict. Using transcriptome sequencing and de novo assembly, we demonstrate that all three morphs downregulate gene expression during early color development. The morphs become increasingly differentiated during sexual maturation and when developing adult coloration. These different ontogenetic trajectories arise because the male-mimic shows accelerated (heterochronic) development, compared to the other female morphs. Many loci with regulatory functions in reproductive development are differentially regulated in the male-mimic, including upstream and downstream regulators of ecdysone signaling and transcription factors potentially influencing sexual differentiation. Our results suggest that long-term sexual conflict does not only maintain this polymorphism, but has also modulated the evolution of gene expression profiles during color development of these sympatric female morphs." (Authors)] Address: Svensson, E.I., Dept Zool., Stockholm Univ., Stockholm S-106 91, Sweden. E-mail: erik.svensson@biol.lu.se

17979. Wilson, K.D.P. (2020): Taxonomic revisions for a subset of Chinese odonates explained. International Dragonfly Fund Report 145: 1-13. (in English) ["Arising from a number of 2019 IUCN Red List assessments for a subset of Chinese Odonata, a series of corrections and taxonomic revisions were made to the World Odonata List. The rationale for these amendments is provided here. Paragomphus wuzhishanensis Liu, 1988 is shown to be a junior synonym of Paragomphus pardalinus Needham (1942). Epophthalmia kuani Jiang 1998 is synonymised as a junior synonym of Epophthalmia. elegans (Brauer, 1865) and Epophthalmia bannaensis Zha & Jiang, 2010 is treated as a junior synonym of Epophthalmia vittata Burmeister, 1839. Idionyx pseudovictor Xu, 2013 is shown to be junior synonym of Idionyx claudia Ris, 1912 and Sympetrum anomalum Needham, 1930 is treated as a junior synonym of Sympetrum maculatum Oguma, 1922." (Author)] Address: Wilson, K.D.P., 18 Chatsworth Road, Brighton, BN1 5DB, UK. Email: kdpwilson@gmail.com

17980. Wolterink, K.K. (2020): Verklaring versnelde afname van venlibellen in Nederland. Afstudeerwerkstuk, Aeres Hogeschool Almere. 40 pp. (Dutch, with English summary) ["Insect populations are suffering a very severe global decline. A lot of publications focus on pollinators, because of their financial merits. A different group of species that are suffering from a severe decline, are acid water dragonflies. There are several well-known reasons for the decline of dragonflies. The reason why acid water dragonflies show a faster decline than other dragonflies however, is not as well researched or described. Coenagrion lunulatum, C. hastulatum and Aeshna juncea are 3 rare species that are showing a rapid decline in the Netherlands. The rapid decline of these 3 species is researched in this report, using a collection of available literature. Reasons known to cause a decline in dragonfly populations were researched. These reasons were then looked at, to see whether they impact acid water dragonflies more severely than other species, causing the faster decline. The influence of species characteristics, invasive species, drought, accumulation of sludge, acidification, a lack of balance in water chemistry, conductivity, habitat fragmentation and lack of proper nature conservation were researched. Afterwards the impact of each effect was weighted according to relevant literature, to check which effects had the largest impact on acid water dragonflies compared to other species of dragonfly. The results showed multiple effects have a more negative effect on acid water dragonflies than on other species. Drought has the biggest impact on dragonflies in general, and an even larger impact on acid water dragonflies. The pressure of invasive species has a large effect on acid water dragonflies in the form of sunfish. Moorland pools are sensitive to acidification, and severe acidification can lead to local extinction of dragonflies. The species characteristics of acid water dragonflies also influence them negatively. Some of the researched effects have been inadequately researched, making it difficult to make an accurate measurement of their effect. To make these measurements more reliable, specific research into these effects has to be done in pools where the 3 researched species occur. In conclusion, it is not possible to name a single reason for the rapid decline of acid water dragonflies. The faster decline is mostly caused by the increased sensitivity to well-known reasons for the decline of dragonflies. Droughts cause the most issues, but invasive species, negative species characteristics and acidification

also contribute to the rapid decline." (Author)] Address: not stated

17981. Wonglersak, R.; Fenberg, P.B.; Langdon, P.G. (2020): Temperature-body size responses in insects: a case study of British Odonata. Ecological Entomology 45(4): 795-805. (in English) "1. Body size is highly correlated with physiological traits, fitness, and trophic interactions. These traits are subject to change if there are widespread reductions of body size with warming temperatures, which is suggested as one of the 'universal' ecological responses to climate change. However, general patterns of body size response to temperature in insects have not yet emerged. 2. To address this knowledge gap, we paired the wing length (as a proxy for body size) of 5331 museum specimens of 14 species of British Odonata with historical temperature data. Three sets of analyses were performed: (i) a regression analysis to test for a relationship between wing length and mean seasonal temperature within species and subsequent comparisons across species and suborders; (ii) an investigation of whether the body size of species has an effect on sensitivity to warming temperature; and (iii) a linear-mixed effects model to investigate factors that potentially affect temperature–size response. 3. The regression analysis indicated that wing length is negatively correlated with mean seasonal temperatures for Zygoptera, whereas Anisoptera showed no significant correlation with temperature. 4. There is a significant decline in wing length of all Zygoptera (but not Anisoptera) with collection date, suggesting that individuals emerging later in the season are smaller. 5. Life-cycle type was not important for predicting wing length–temperature responses, whereas sex, species, and suborder were indicated as important factors affecting the magnitude of temperature–size responses in Odonata. 6. Overall, wing lengths of Zygoptera are more sensitive to temperature and collection date than Anisoptera." (Authors)] Address: Wonglersak, R., Department of Life Sciences, The Natural History Museum, 7th Floor DC2, Cromwell Road, London SW7 5BD, U.K. E-mail: r.wonglersak@soton.ac.uk

17982. Xu, Y.-H. (2020): Redescription of the final stadium larva of Megalestes heros Needham from Fujian, China, with discussion of the characters of genus Megalestes Selys (Odonata: Zygoptera: Synlestidae). Zootaxa 4728(3): 381-384. (in English) ["The final stadium larva of M. heros is redescribed and illustrated in detail. It is characterized by having a long and cylindrical body, a very long prementum with two end hooks of unequal size on lateral lobe, parallel wing sheaths, long and slender legs, female ovipositor short reaching the basal third of S10, and based on a distinct abdominal color pattern. The major diagnostic characters of the larvae of the genus Megalestes are as follows: (1) body smooth and slender, with long abdomen and leaf-shaped caudal gills; (2) antenna filiform, seven-segmented, third segment longest; (3) median cleft present in median lobe of prementum; lateral lobe with two end hooks of unequal size, the inner one being longer and larger than the outer, movable hook without setae; (4) wing sheaths parallel to each other." (Author)] Address: Xu, Y.-H., Dept of Garden & Horticulture, Zhangzhou City Univ., Zhangzhou, Fujian 363000, PR China. E-mail: qihanxu@aliyun.com

17983. Yang, G.-H.; Liu, Q. (2020): Descriptions of the last instar larvae of two species of Megalestes Selys from Yunnan, China (Odonata: Zygoptera: Synlestidae). International Journal of Odonatology 23(4): 357-363. (in English) ["The final stadium larvae of Megalestes micans Needham, 1930 and M. kurahashii Asahina, 1985 are described and illustrated from Yunnan Province, China, and a key to the known larvae of seven species of the genus Megalestes is provided. All exuviae will be stored at the Invertebrate Collection of the College of Agriculture and Life Sciences, Dali University, Dali, Yunnan, China." (Authors)] Address: Yang, G.-h., College of Agriculture and Life Sciences, Dali University, Yunnan, PR China. E-mail: yanggh727@sina.com

17984. Yokoi, N.; Souphanthong, V.; Teramoto, T. (2020): Nannophya miyahatai sp. nov., a new dragonfly from Bolaven Plateau, southern Laos (Odonata: Libellulidae). Tombo 62: 63-69. (in English, with Japanese summary) ["A new species of the genus Nannophya Rambur, 1842 is described from the Bolaven Plateau, southern Laos. The new species, N. miyahatai, can be easily distinguished from similar species, N. pygmaea by its slim body, thorax maculation and number of cells in the anal field of hind wing. Holotype specimen is deposited in the National Museum of Nature & Science, Tsukuba, Japan." (Authors)] Address: Yokoi, N., Koriyama, Fukushima, Japan. E-mail: yokoi@orange.plala.or.jp

17985. Yokoyama, Y.; Ikushima, T.; Minamide, Y.; Hirose, Y. (2020): A record of bluish compound eyes and body maculation in males of Sarasaeschna pryeri (Martin, 1909) from Hokkiado Prefecture. Tombo 62: 109-110. (in English, with Japanese summary) ["The color of body maculation of S. pryeri usually changes from yellow to green with maturity. However, the authors discovered three individuals, in which the maure color was vivid blue, instead of green, from Teshikugu-cho, Hokkaido." (Authors)] Address: Yokoyama, Y. E-mail: wild.ym@ray.ocn.co.jp

17986. Yoshioka, A.; Shimizu, A.; Oguma, H.; Kumada, N.; Fukasawa, K.; Jingu, S.; Kadoya, T. (2020): Development of a camera trap for perching dragonflies: a new tool for freshwater environmental assessment. PeerJ 8:e9681 https://doi.org/10.7717/peerj.9681. 21 pp. (in English) ["Although dragonflies are excellent environmental indicators for monitoring terrestrial water ecosystems, automatic monitoring techniques using digital tools are limited. We designed a novel camera trapping system with an original dragonfly detector based on the hypothesis that perching dragonflies can be automatically detected using inexpensive and energy-saving photosensors built in a perch-like structure. A trial version of the camera trap was developed and evaluated in a case study targeting red dragonflies (Sympetrum spp.) in Japan. During an approximately 2-month period, the detector successfully detected Sympetrum dragonflies while using extremely low power consumption (less than 5 mW). Furthermore, a short-term field experiment using time-lapse

cameras for validation at three locations indicated that the detection accuracy was sufficient for practical applications. The frequency of false positive detection ranged from 17 to 51 over an approximately 2-day period. The detection sensitivities were 0.67 and 1.0 at two locations, where a time-lapse camera confirmed that Sympetrum dragonflies perched on the trap more than once. However, the correspondence between the detection frequency by the camera trap and the abundance of Sympetrum dragonflies determined by field observations conducted in parallel was low when the dragonfly density was relatively high. Despite the potential for improvements in our camera trap and its application to the quantitative monitoring of dragonflies, the low cost and low power consumption of the detector make it a promising tool." (Author)] Address: Yoshioka, A., Fukushima branch, National Institute for Environmental Studies, Miharu, Fukushima Prefecture, Japan. E-mail: yoshioka.akira@nies.go.jp

17987. Zakirova, M.; Muminov, B. (2020): Morphobiological characteristics of the facility of dragonfly (Insecta: Odonata) of the Fergana Valley. Universum 3(69): 9-14. ["The present study describes the morphobioecological features of the fauna of Odonata in the natural landscapes of the Fergana Valley of the Republic of Uzbekistan: Sympecma fusca, Lestes dryas Calopteryx virgo, C. splendens, Ischnura elegans, Aeshna isosceles, A. juncea, Anax parthenope, A. imperator, Sympetrum vulgatum, Orthetrum cancelatum, O. brunneum." (Authors)] Address: Muminov, B., Andijàn state University named after Z.M.Babur, Uzbekistan, Andijan. E-mail: muminovba@gmail.com

17988. Zaman, M.N.; Purwanto, P.B.; Iman, D.I.; Farida; Sari, A.M.; Maulany, S.L.; Luthfika, M.; Rofiah, N.; Halimah, G. S.; Cahya (2020): Dragonfly and damselflies at Gajahwong River in D.I. Yogyakarta urban district. Proceeding International Conference on Science and Engineering 3: 73-76. (in English) ["This study aims to reveal the population of dragonflies in the Gajah Wong river in urban areas in Yogyakarta. The method used is an exploratory method that is by exploring the Gajahwong river which is located between the southern ring road at Giwangan to the northern ring at Catur Tunggal. The results showed that 16 types of dragonflies and 9 types of damselflies were found there. The species which has the most number is Orthetrum sabina with 253 individuals, and the less type is Gynacantha subinterrupta, and Zyxomma obtusum which only found one individual for each. Whereas for damselflies most species is Pseudagrion rubriceps with 255 and Ischnura senegalensis is the less which only has one individual." (Authors)] Address: Zaman, M.N., Faculty of Science and Technology, UIN Sunan Kalijaga, Jl. Marsda Adisucipto No 1 Yogyakarta 55281, Indonesia. E-mail: azamavicenna@gmail.com

17989. Zhang, H.; Hämäläinen, M. (2020): Description of a new Caliphaea species from Yunnan, China (Odonata: Calopterygidae). Zootaxa 4895(1): 103-110. (in English) ["Caliphaea hermannkunzi sp. nov. (holotype ♂ China, Yunnan Province, Lufeng County, Chuxiong City, Gaofeng village, 10 June 2019) is described and illustrated for both sexes and compared with its named congeners, from which it differs in the colour pattern of synthorax and the structure of the male anal appendages." (Authors)] Address: Zhang, H., South China DNA Barcoding Center, Kunming Institute of Zoology, Chinese Academy of Sciences, 32 Jiaochang Donglu, Kunming 650223, China. E-mail: zhanghaomiao@mail.kiz.ac.cn

17990. Zheng, D.-r.; (2020): A review of Odonata in Mid-Cretaceous Kachin amber of north Myanmar. Acta Palaeontologica Sinica 59(1): 49-57. (in Chinese, with English summary) ["In the past five years, abundant and diverse odonatans were described from mid-Cretaceous Kachin amber, including three extant suborders. The odonatans in Kachin amber are quite diversified with 35 species described and dominated by the damselfly Burmahemiphlebia zhangi. These odonatans contain some first fossil records of extant damselflies, i.e., Perilestidae, Platycnemididae and Platystictidae. Some dragonflies previously only recorded in the Cretaceous sedimentary rocks, such as Araripegomphidae, Gomphaeschnidae and Stenophlebiidae, provide a late Early Cretaceous age for Kachin amber. The dragonflies in Kachin amber contribute to discussing the origin, evolution and palaeogeography of Odonata." (Author)] Address: Zheng, D.-r., Dept of Earth Sciences, University of Hong Kong, Hong Kong Special Administrative Region, China. E-mail: drzheng@hku.hk

17991. Zheng, D.; Jarzembowski, E.A. (2020): A brief review of Odonata in mid-Cretaceous Burmese amber. International Journal of Odonatology 23(1): 13-21. (in English) ["Odonatans are rare as amber inclusions, but quite diverse in Cretaceous Burmese amber. In the past two years, over 20 new species have been found by the present authors after studying over 250 odonatans from 300,000 amber inclusions. Most of them have now been published, and here we provide a brief review. Three suborders of crown Odonata have been recorded, including the damselfly families or superfamilies Platycnemididae, Platystictidae, Perilestidae, Hemiphlebiidae, Coenagrionoidea, Pseudostigmatoidea, Mesomegaloprepidae and Dysagrionidae, plus the dragonfly families Lindeniidae, Gomphaeschnidae and Burmaeshnidae, and the damsel-dragonfly family Burmaphlebiidae." (Authors)] Address: Jarzembowski, E.A., The Natural History Museum, London, UK. E-mail: jarzembowski2@live.co.uk

17992. Zoch, L., Reich, M. (2020): Torfmooskultivierungsflächen als neuer Lebensraum für Moorlibellen. Libellula 39(1/2): 27-48. (in German, with English summary) ["The cultivation of peat moss Sphagnum spp. (‘Sphagnum farming’) is considered as a new, climate-friendly and sustainable alternative to drained peatland-agriculture. By rewetting the sites and establishing peat moss, potential habitats for typical peatland species are created. In 2015 and 2016 two cultivation sites were established in Lower Saxony, Germany, in cooperation with the substrate company Klasmann-Deilmann GmbH. The dragonfly fauna was investigated on the two cultivation sites, and additionally on a 10-year-old rewetted site and two nearnatural raised bogs in 2017 and 2018. In total 31 species were recorded on all sites. Some characteristic

peatland species (Aeshna juncea, Leucorrhinia rubicunda) have already been observed with reproductive behavior on the cultivation sites as well as first species (Ceriagrion tenellum, Libellula quadrimaculata, Sympetrum danae) with exuviae. Therefore, the cultivation sites are suitable as reproduction habitat for some dragonfly species after only two years, but are not equivalent to natural raised bogs, at least in the short term." (Authors)] Address: Reich, M., Institut für Umweltplanung, Herrenhäuser Str. 2, D-30419 Hannover, Germany. E-mail: reich@umwelt.uni-hannover.de

17993. Zuyderduyn, C. (2020): First successful reproduction of Vagrant Emperor (Anax ephippiger) in the dutch dunes. Brachytron 21: 31-37. (in Dutch, with English summary) ["Short note „on successful reproduction of A. ephippiger in 2019 in a dune reserve in the Netherlands, after a period of influx of this species earlier that year. In September 2019, 166 exuviae were collected in a small water body and several freshly emerged living and dead imagines were observed. The habitat consists of a small (10 x 5 m) dune pond holding permanent water and with pioneering vegetation such as Chara species and a Phragmites australis belt. Although the 2019 influx of Vagrant Emperor resulted in numerous observations of copulations and oviposition, this represents one of very few reports of successful reproduction of the species in the Netherlands." (Authors)] Address: Zuyderduyn, C. E-mail: purperstreep@hotmail.com

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17994. Khelifa, R.; Mahdjoub, H. (2021): EcoDragons: A game for environmental education and public outreach. Insects 2021, 12, 776. 14 pp. (in English) ["Simple Summary: We face serious ecological and societal issues that require a rethinking of our approaches to involving the public in problem-solving and decision-making. Researchers need help from community scientists to gather data and generate fruitful discussions to tackle planetary problems. However, the establishment and maintenance of strong links between scientists and society require innovative ways of communication outside conventional educational institutions. Here, we propose a game that teaches the players the basics of ecological thinking when approaching environmental issues and biodiversity conservation. The game is called EcoDragons and it uses dragonflies as the main biological entity to colonize, establish and maintain biodiversity in an empty landscape that regularly faces climatic and anthropogenic disturbances. While the current EcoDragons was based on European dragonflies, the concept is highly adaptable to dragonflies of other regions (changing the species names), or even to other taxonomic groups. Besides the various pedagogical benefits, the game has the potential to foster public engagement in biodiversity conservation and community science. Abstract: Environmental education is crucial to tackling the pressing ecological and societal issues on our planet. Although there are various ways to approach environmental education and raise public awareness, games are potentially an effective vehicle of knowledge and engagement because they vulgarize the scientific information in a universal 'language' and bring people together. Here, we designed a game, EcoDragons, that integrates principles of ecology, biological conservation, life history, and taxonomy. The protagonists of the game are dragonflies and damselflies. The aim of the game is to colonize habitats with different species and use ecological processes (e.g., predation, competition, and mutualism) and conservation measures (e.g., restoration and reintroduction) to face random environmental disturbances (e.g., climate warming, drought, pollution, and biological invasion). The version of the game presented in this paper was based on European species. The game includes 50 species (25 dragonflies and 25 damselflies). The winner of the game is the one who occupies more habitats, establishes and maintains the largest number of species, and solves more anthropogenic disturbances. EcoDragons has a global outreach potential to educate the public about ecology, conservation, and organismic life history, and will probably engage people in environmental advocacy." (Authors)] Address: Khelifa, R., Zoology Dept, Univ. of British Columbia, Vancouver, BC V6T 1Z4, Canada. E-mail: rassimkhelifa@gmail.com

17995. Yang, G.-H.; Zhang, H.-m.; Orr, A.G. (2021): Descriptions of larvae of Caliphaea angka Hämäläinen, 2003 and Mnais gregoryi Fraser, 1924 (Odonata: Calopterygidae). Zootaxa 4926(2): 276-284. (in English) ["The larvae of C. angka and M. gregoryi are described and illustrated for the first time from Erhai lake Basin, Yunnan Province, China. Notes on their habitat are provided. This paper represents the first verified description of the larva of Caliphaea Hagen in Selys, 1859." (Authors)] Address: Zhang, H., State Key Laboratory of Freshwater Ecology and Biotechnology, Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan 430072, China. E-mail: zhanghaomiao6988@gmail.com

17996. Yang, L.-J.; Kapri, N. ; Waikhom, R.; Unnam, N.K. (2021): Fabrication, aerodynamic measurement and performance evaluation of corrugated flapping wings. Journal of Aeronautics, Astronautics and Aviation 53(1): 83-93. (in English) ["This paper deals with the fabrication, aerodynamic measurement, and performance evaluation of the corrugated wing patterns on a flapping wing micro air vehicle (FWMAV). The corrugated wing pattern is generally seen in insects. Insect wings with their corrugated topological features give themselves high load-bearing capacity during flapping and hovering. It is believed that appropriate corrugated structures on insect wings enhance aerodynamic performance. A new fabrication process using polydimethylsiloxane (PDMS)-molding and parylene coating was proposed and implemented for a 24 cm-span FWMAV, which is composed of corrugated wing inspired by the dragonfly wing. The fabrication includes the master wing template made by three-dimensional (3D) printing, the PDMS molding process for wing template duplication, and the final parylene coating to obtain corrugated wings. The parylene-C thickness was selected as 40 μm. For comparing the aerodynamic performance, two types of flapping wings were implemented on the FWMAVs: first with a pair of parylene corrugated wings and the other with polyethylene terephthalate (PET) flat membrane (without corrugation) wings. The lift signal was

then measured by the load cell in a wind tunnel. Regarding the aerodynamic performance of flapping wings, a systematic performance estimation of finding the cruising conditions and the cruising lift for FWMAVs was investigated through the massive wind tunnel data. The parylene flapping wings with corrugation attained lift coefficients of 7.8-8.0, which the PET flat membrane wing cannot achieve so far." (Authors)] Address: Waikhom, R., Dept of Mechanical & Electromechanical Engineering, Tamkang University, 151, Ying-Zhuan Rd., Tamsui District, New Taipei City, 251301, Taiwan. E-mail: reshmiwaikhom@gmail.com

17997. Ye, Y.; Hu, C.; Jiang, Y.; Davison, G.W.H.; Ding, C. (2021): Three-dimensional niche partitioning between two colonially nesting ardeid species in central China. Avian Research volume 12, Article number: 33 (2021): 8 pp. (in English) ["Background: Interspecific competition is known to be strongest between those species that are both closely related and sympatric. Egrets are colonially nesting wetland birds that often overlap and can therefore be expected to compete in roosting and nesting habitat as well as in diet. According to the niche partitioning hypothesis, it is to be expected that these similar species would show differentiation in at least one of the main niche dimensions to reduce competition. We tested niche partitioning between the colonially nesting Little Egret (Egretta garzetta) and Cattle Egret (Bubulcus ibis) in temporal, spatial and trophic dimensions. Methods: Field study was conducted in three mixed egret colonies in Yangxian County, southwest Shaanxi Province, central China. For each nest colony we recorded its spatial location, the height of nesting trees and of nests, the height of roosting trees and of roosting individuals within the trees. We determined the first egg-laying and first hatching dates of the two species. Craw dissection of storm-killed egret nestlings was used to measure the diet. Six transects were surveyed to study foraging habitat selection. Results: We found that hatching time of Little Egrets peaked earlier (by about 1 month) than that of Cattle Egrets. Cattle Egrets nested and roosted higher than Little Egrets. The foraging habitats used by Little Egrets were dominated by river banks (73.49%), followed by paddy fields (13.25%) and reservoirs (10.84%), whereas Cattle Egret foraging sites were characterized by grasslands (44.44%), paddy fields (33.33%) and river banks (22.22%). Little Egrets consumed more fishes (65.66%) and Odonata larvae (13.69%) than Cattle Egrets, while Cattle Egrets were found feeding mainly on Coleoptera (29.69%) and Orthoptera (23.29%). Little Egrets preyed on larger mean biomasses of food items than Cattle Egrets. Conclusions: Our results confirm the niche partitioning hypothesis as a mechanism for coexistence among ecologically similar species. In two coexisting egret species, niche partitioning is multidimensional, such that the two coexistent species occupy differing ecological space based on all three temporal, spatial and trophic niche dimensions." (Authors)] Address: Ding, C., School of Ecol. & Nature Conserv., Beijing Forestry Univ., Beijing 100083, China. E-mail: cqding@bjfu.edu.cn

17998. Yu, D.-N.; Yu, P.; Zhang, L.; Storey, K.B.; Gao, X.; Zhang, J. (2021): Increasing 28 mitogenomes of Ephemeroptera, Odonata and Plecoptera support the Chiastomyaria hypothesis with three different outgroup combinations. PeerJ 9:e11402 https://doi.org/10.7717/peerj.11402: 25 pp. (in English) ["Background: The phylogenetic relationships of Odonata (dragonflies and damselflies) and Ephemeroptera (mayflies) remain unresolved. Different researchers have supported one of three hypotheses (Palaeoptera, Chiastomyaria or Metapterygota) based on data from different morphological characters and molecular markers, sometimes even re-assessing the same transcriptomes or mitochondrial genomes. The appropriate choice of outgroups and more taxon sampling is thought to eliminate artificial phylogenetic relationships and obtain an accurate phylogeny. Hence, in the current study, we sequenced 28 mt genomes from Ephemeroptera, Odonata and Plecoptera to further investigate phylogenetic relationships, the probability of each of the three hypotheses, and to examine mt gene arrangements in these species. We selected three different combinations of outgroups to analyze how outgroup choice affected the phylogenetic relationships of Odonata and Ephemeroptera. Methods: Mitochondrial genomes from 28 species of mayflies, dragonflies, damselflies and stoneflies were sequenced. We used Bayesian inference (BI) and Maximum likelihood (ML) analyses for each dataset to reconstruct an accurate phylogeny of these winged insect orders. The effect of outgroup choice was assessed by separate analyses using three outgroups combinations: (a) four bristletails and three silverfish as outgroups, (b) five bristletails and three silverfish as outgroups, or (c) five diplurans as outgroups. Results: Among these sequenced mitogenomes we found the gene arrangement IMQM in Heptageniidae (Ephemeroptera), and an inverted and translocated tRNA-Ile between the 12S RNA gene and the control region in Ephemerellidae (Ephemeroptera). The IMQM gene arrangement in Heptageniidae (Ephemeroptera) can be explained via the tandem-duplication and random loss model, and the transposition and inversion of tRNA-Ile genes in Ephemerellidae can be explained through the recombination and tandem duplication-random loss (TDRL) model. Our phylogenetic analysis strongly supported the Chiastomyaria hypothesis in three different outgroup combinations in BI analyses. The results also show that suitable outgroups are very important to determining phylogenetic relationships in the rapid evolution of insects especially among Ephemeroptera and Odonata. The mt genome is a suitable marker to investigate the phylogeny of inter-order and inter-family relationships of insects but outgroup choice is very important for deriving these relationships among winged insects. Hence, we must carefully choose the correct outgroup in order to discuss the relationships of Ephemeroptera and Odonata." (Authors)] Address: Zhang, L., The Department of Biology, College of Chemistry and Life Science, Zhejiang Normal University, Jinhua, Zhejiang, China. E-mail: zhangjiayong@zjnu.cn