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17495. Akçakaya, R.; Hochkirch, A.; Bried, J.T.; van Grunsven, R.H.A.; Simaika, J.P.; De Knijf, G.; Henriques, S. (2021): Calculating population reductions of invertebrate species for IUCN Red List assessments. *Journal of Insect Conservation* 25: 377-382. (in English) ["Population reductions are often used to assess extinction risk of species in the IUCN Red List. Guidelines for Red List assessments describe specific methods for calculating the amount of reduction for species with strongly fluctuating populations. Recently, an alternative approach that involves expert opinion has been suggested for calculating population reduction in insect species. We argue that, while populations with high temporal variability do present challenges, the alternative suggestion is unnecessary, and inconsistent with the IUCN Red List Categories and Criteria. Implications for insect conservation Consistent application of standardized methods for calculating population reductions allows robust and objective assessment of extinction risk faced by invertebrate species." (Authors)] Address: Akçakaya, H.R., Dept of Ecology and Evolution, Stony Brook University, New York, USA. E-mail: Resit.Akçakaya@stonybrook.edu

17496. Akhtar, Z.R.; Tariq, K.; Mavian, C.; Ali, A.; Ullah, F.; Zang, L.-S.; Ali, F.; Nazir, T.; Ali, S. (2021): Trophic transfer and toxicity of heavy metals from dengue mosquito *Aedes aegypti* to predator dragonfly *Tamea cophysa*. *Ecotoxicology* 30(4): 1108-1115. (in English) ["Heavy metal pollution in aquatic habitats can be detrimental to both prey and predators in a food web. To investigate the potential for bio-transfer and bioaccumulation of heavy metals between specific trophic levels, 3rd instar larvae of *Aedes aegypti* were exposed to mercury (Hg), lead (Pb), cadmium (Cd), copper (Cu), and zinc (Zn) for three consecutive generations and fed to dragonfly (*Tamea cophysa*) nymphs. Exposure to Hg caused the highest mortality in *A. aegypti* larvae and *T. cophysa* nymphs. Bioaccumulation and life-history parameters of *A. aegypti*, including egg hatching time, larval and pupal duration, male and female life span, and fecundity, were also evaluated after metals exposure. All life-history parameters

except larval duration were significantly affected by heavy metal treatments. Bioaccumulation of metals in *A. aegypti* larvae and adults gradually and significantly increased from 1st to 3rd generation. To the best of our knowledge, this is the first study describing the acute toxicity of heavy metals to mosquitoes. Our study shows that heavy metals cause dietary toxicity to an aquatic predator, dragonfly, via trophic transfer, which could have considerable consequences on aquatic ecosystems." (Authors)] Address: Tariq, K., Dept of Agriculture Entomology, Abdul Wali Khan University Mardan, Mardan, Khyber Pakhtunkhwa, Pakistan

17497. Amaya-Vallejo, V.; Bota-Sierra, C.; Novelo-Gutiérrez, R.; Sánchez-Herrera, M. (2021): Two new species of *Archaeopodagrion* (Odonata, Philogeniidae) from the western foothills of the Tropical Andes, with biological observations and distributional records. *ZooKeys* 1036: 21-38. (in English) ["Two new species of the genus *Archaeopodagrion*, *A. recurvatum* sp. nov. and *A. mayi* sp. nov., are described from the confluence of the Tropical Andes and the Tumbes-Chocó-Magdalena biodiversity hotspots. Adults differ from the other known species in the shape of female posterior lobe of pronotum and male structures of cerci and paraprocts; the larva differs from other *Archaeopodagrion* species in the caudal lamellae structure and in the mandibular formula. The two new species are diagnosed, a morphological key to all known males and females in the genus is provided, and geographical distributions are updated. Finally, observations on habitat preferences for each newly described species are provided." (Authors)] Address: Amaya-Vallejo, Vanessa, Lab. de Zoología y Ecología Acuática, Univ. de los Andes, Bogotá DC, Colombia. E-mail: v.amaya10@uniandes.edu.co

17498. Anupama, V.S.; Raj, S.; Devi, S.S., Kumar, A.B. (2021): Diet of exotic *Pirapitinga Piaractus brachypomus* (Cuvier, 1818) from Vembanad-Kole Wetland, India, as inferred from gut content analysis and DNA barcoding. *Asian Fisheries Science* 34: 47-55. (in English) ["Gut contents of the exotic characid fish *Piaractus brachypomus* (Cuvier, 1818) that escaped into the Vembanad-Kole Wetland, India, during the floods were examined for their gut food spectrum. The qualitative analysis of gut contents showed that

the fish is an omnivore with detritus (27 %) as the most dominant food item followed by, plant matter (25 %), crabs (16 %), molluscs (12 %), fish (11 %) and insects (7 %), respectively. DNA barcoding of the gut contents revealed taxa such as *Puntius mahecola* (Valenciennes, 1844) (Cyprinid fish), *Bellamaya* sp. (Mollusca, Gastropoda, Viviparidae), *Spiralothelphusa* sp. (Crustacea, Brachyura, Gecarcinucidae) and *Ictinogomphus* sp. (Insecta, Odonata, Gomphidae) among diet contents. Ontogenic diet shift was not recorded, and none of the fishes showed empty guts, indicating the higher feeding rate and abundance of food in the habitat. The most predominant food item of *P. brachypomus* in the Vembnad-Kol wetland system is crabs in terms of percentage occurrence, percentage number, percentage volume, index of preponderance, and index of relative importance. *Piaractus brachypomus* showed greater variations in diet spectrum from their frugivorous nature in the home range (Amazon basin) to a more generalist heterogeneous feeding nature in the introduced ecosystem. The study found that in a highly biodiverse ecosystem, the introduced alien fish may compete with native fish and feed on native organisms. The paper suggests a precautionary approach in flood plain aquaculture, especially with the increase in extreme climatic events and holistic studies on invasion biology to manage invasive species." (Authors)] Address: Kumar, A.B., Department of Aquatic Biology and Fisheries, Faculty of Science, University of Kerala, Thiruvananthapuram 695581, India. E-mail: bijukumar@keralauniversity.ac.in

17499. Araujo, B.R.; Pinto, A.P. (2021): Dragonflies (Insecta: Odonata) from Mananciais da Serra, a Tropical-Araucaria Forest ecotonal remnant in the southern Atlantic Forest, state of Paraná, Brazil. *Zoologia* 38: e55283: 18 pp. (in English) ["This study provides a comprehensive checklist of Odonata species from the protected area of Mananciais da Serra. The survey was conducted in the endangered Atlantic Forest domain at the southern Serra do Mar mountain chain within a well-preserved area in the municipality of Piraquara, state of Paraná, Brazil. Adults and larvae were sampled between June 2017 and March 2020 using different techniques in numerous mesohabitats, including phytotelmata, pools, small streams, and large reservoirs. A total of 1,708 specimens from 9 families, 43 genera and 84 species were sampled resulting in 53 new records for the state of Paraná, almost doubling the known occurrence records for dragonflies and damselflies in that state. Furthermore, two hitherto undescribed females from the genera *Planiplax* and *Heteragrion*, four ultimate stadium larvae from *Planiplax*, *Neocordulia*, *Heteragrion*, and *Acanthagrion*, and five undescribed species were detected, one each from the genera *Heteragrion*, *Progomphus*, *Brechmorhoga*, *Erythrodiplax*, and *Dasythemis*. The estimated richness of odonates in this area is greater than 100 species, while the observed richness corresponding to almost 10% of all Odonata species in Brazil, the species-richest country in the world. These results reiterate the need to investigate under-sampled areas to improve knowledge on diversity, taxonomy, and distribution of neotropical species. Finally, taxonomic notes for some species, including the rare cordulid

Neocordulia mambucabensis Costa & T.C. Santos, 2000, are provided." (Authors)] Address: Araujo, B.R., Laboratório de Sistemática de Insetos Aquáticos, Depto de Zoologia, Univ. Federal do Paraná, Caixa Postal 19020, 81531-980 Curitiba, PR, Brazil. E-mail: breno.rda94@gmail.com

17500. Archibald, S.B.; Cannings, R.A. (2021): A new genus and species of Euphaeidae (Odonata, Zygoptera) from the early Eocene Okanagan Highlands locality at Republic, Washington, U.S.A.. *Zootaxa* 4966(3): 392-400. (in English) ["We describe *Republica weatbrooki*, a new genus and species of damselfly (Odonata, Zygoptera, Euphaeidae, Eodichromatinae) from the early Eocene (Ypresian) fossil locality at Republic, Washington, U.S.A. Its single specimen is the sole damselfly known from the Okanagan Highlands series of localities in far-western North America." (Authors)] Address: Archibald, S.B., Dept of Biological Sciences, Simon Fraser University, 8888 University Drive, Burnaby, British Columbia, V5A 1S6, Canada. E-mail: sba48@sfu.ca

17501. Archibald, S.B.; Cannings, R.A., Erickson, R.J.; Bybee, S.M.; Mathewes, R.W. (2021): The Cephalozygoptera, a new, extinct suborder of Odonata with new taxa from the early Eocene Okanagan Highlands, western North America. *Zootaxa* 4934(1): 1-133. (in English) ["We describe the Cephalozygoptera, a new, extinct suborder of Odonata, composed of the families *Dysagrionidae* and *Sieblosiidae*, previously assigned to the Zygoptera, and possibly the *Whetwhetaksidae* n. fam. The Cephalozygoptera is close to the Zygoptera, but differs most notably by distinctive head morphology. It includes 59 to 64 species in at least 19 genera and one genus-level parataxon. One species is known from the Early Cretaceous (*Congqingia rhora* Zhang), possibly three from the Paleocene, and the rest from the early Eocene through late Miocene. We describe new taxa from the Ypresian Okanagan Highlands of British Columbia, Canada and Washington, United States of America: 16 new species of *Dysagrionidae* of the existing genus *Dysagrion* (*D. pruettae*); the new genera *Okanagrion* (*O. threadgillae*, *O. hobani*, *O. beardi*, *O. lochmum*, *O. angustum*, *O. dorrellae*, *O. liquetoalatum*, *O. worleyae*, all new species); *Okanopteryx* (*O. jeppesenorum*, *O. fraseri*, *O. macabeensis*, all new species); *Stenodiafanus* (*S. westersidei*, new species); the new genus-level parataxon *Dysagrionites* (*D. delinei* new species, *D. sp. A*, *D. sp. B*, both new); and one new genus and species of the new family *Whetwhetaksidae* (*Whetwhetaksa millerae*)." (Authors)] Address: Archibald, S.B., Dept of Biological Sciences, Simon Fraser University, 8888 University Drive, Burnaby, British Columbia, V5A 1S6, Canada. 2. E-mail: sba48@sfu.ca

17502. Arumugam, S.; Athikesava, S. (2021): Diversity and distribution of aquatic insects in pond ecosystem in Cheyyar, Thiruvannamalai district of Tamil Nadu, India. *Uttar Pradesh Journal of Zoology* 42(9): 10-15. (in English) ["Aquatic insects are the most diverse group of organisms in freshwater bodies such as lakes, ponds, rivers, streams, reservoirs, etc. A pond ecosystem is a body of standing water and very important habitats for so many various types of animals

such as fishes, crustaceans, insects and amphibians. Aquatic insects are good bioindicators of water quality for assessment of pollution in short and long-term pollution events. The less or more aquatic insects are providing data to estimate the degree of environmental impact and its potential effects on other living organisms. In this study reveals diversity and distribution of aquatic insects from the pond ecosystem in the Kilpudupakkam, Cheyyar, Thiruvannamalai District for a period from August 2017 to January 2018. The aquatic insects were collected with the help of scoop net and hand nets. Later they were identified using original literature. The insects identified for following 7 orders viz., Hemiptera, Coleoptera, Odonata, Ephemeroptera, Trichoptera, Diptera and Lepidoptera. Order Hemiptera (33.63%) is the largest population of pond ecosystem and compare with other orders and diversity indices were calculated. The order followed by Hemiptera were Coleoptera (27.21%), Odonata (14.98), Ephemeroptera (8.56%), Trichoptera (7.64%), Diptera (5.50%) and Lepidoptera (2.44%)." (Authors)] Address: Arumugam, S., P. G. and Research Dept Zool., Arignar Anna Govt. Arts College, Cheyyar, Tamil Nadu, India

17503. Arunima, J.; Nameer, P.O. (2021): A preliminary checklist of dragonflies and damselflies (Insecta: Odonata) of Vakkom Grama Panchayath, Thiruvanthapuram District, Kerala, India. *Journal of Threatened Taxa* 13(8): 19125-19136. (in English) ["A one-year study was conducted at Vakkom Grama Panchayath, Thiruvananthapuram district, Kerala, to assess the diversity of odonates. We report 49 species, which include 31 species of Anisoptera and 18 species of Zygoptera. Among dragonflies, Libellulidae dominated with 26 species, while Coenagrionidae with 10 species was the dominant family among the damselflies. The odonate diversity of Vakkom Grama Panchayath accounted for 28% of the odonates in Kerala and 25% of the odonates of the Western Ghats. Vakkom Grama Panchayath also recorded the presence of *Mortonagrion varralli* which is an uncommon species in Kerala. This study provides some important baseline information on the odonates of one of the grama panchayaths in Kerala, India. An updated checklist of 57 species of odonates of Thiruvananthapuram district, Kerala is also provided." (Authors)] Address: Arunima, J.; Centre Wildlife Stud., Coll. of Forestry, Kerala Agricult. Univ., Vellankkara, Thrissur, Kerala 680656, India. E-mail: arunima.bindhu@gmail.com

17504. Baile, E.L. (2021): The effects of urbanization on insect morphology: a meta-analysis. Honors thesis, University of Tennessee at Chattanooga: 22 pp. (in English) ["Urbanization has been shown to create a rapid change in the environment as you move from rural areas to urban areas. It can create a multitude of effects on the environment. Some examples include, land disturbance, pollution, increasing temperatures and a disturbance in vegetation and biodiversity. Insects are useful organisms that provide maintenance and upkeep for ecosystem functioning. The rapid development of urbanization and how it is changing the environment may impact insect morphology. Measuring morphological change in organisms have been used success-

fully as indicators of environmental and ecological disturbance. Changes that take place in an insect's morphology may indicate stress and environmental instability, which will help deepen the understanding of urbanizations impact on urban ecosystems. To evaluate the effect of urbanization on insect morphology, I conducted a meta-analysis of 23 published peer-reviewed studies focused on insect morphology within the context of urbanization. The resulting sample sizes and effect sizes given for changes in morphological traits were extracted and converted to effect size Pearson's (r) for a more uniform measurement to analyze in the meta-analysis. I wanted to assess how urbanization impacted insect morphology and understand what may be the driving the effect of urbanization on insects. To identify possible sources of variation across studies, I analyzed five variables that focused on morphological traits, insect order, ecological level, environmental conditions and sex. The results indicated that although the overall effect size ($r=0.19$) of all studies included showed a change or significant effect in the morphological traits of insects between urban and non-urban areas, only ~25% of those studies had an actual impact. The majority, ~75% of studies did not show urbanization to have a significant impact on insect morphology. The insect orders, Hymenoptera, Hemiptera, Odonata and Orthoptera showed a significant effect in morphological changes. Studies that focused on body size and a combination of multiple morphological traits showed a significant effect in morphological changes. In terms of ecological organizations, both population and community groups studied had a significant effect on insect morphology. Disturbance and temperature were the only environmental conditions that showed a significant effect. Studies that measured changes in insect morphology with combined male and female populations showed a significant effect in morphological changes versus studies that focused on a singular sex. These findings may suggest urbanization is causing morphological changes in insects by some capacity but it is not as impactful as one would presume." (Author)] Address: not stated

17505. Barling, N.T.; Heads, S.W.; Martill, D.M. (2021): ADDENDUM: Behavioural impacts on the taphonomy of dragonflies (Odonata) from the Lower Cretaceous Crato Formation, Brazil. *Palaeoentomology* 4(3): 203. (in English) ["In our recent paper discussing the impacts of dragonfly behaviour on their taphonomy from the Lower Cretaceous Crato Formation of Brazil (Barling et al., 2021), we figured eight specimens illustrating dragonflies in various states of preservation. In the caption to this figure we listed the temporary laboratory numbers assigned to these specimens during the study (identified with the prefix "UOP-PAL-") and not their permanent accession numbers. On completion of the study, all specimens were transferred to the Museu de Paleontologia Plácido Cidade Nuvens (MPPCD) at the Universidade Regional do Cariri in Crato, Brazil." (Authors)] Address: Barling, N.T., Camborne School of Mines, College of Engineering, Mathematics and Physical Sciences, University of Exeter, Penryn Campus, Treliever Road, Penryn, Cornwall, TR10 9EZ, UK

17506. Baumann, K. (2021): Können intakte Gebirgsmoore in Zeiten des Klimawandels Refugien für seltene Libellenarten (Odonata) sein? Untersuchungen im Nationalpark Harz von 2017 bis 2020. *Libellula Supplement* 16: 35-66. (in German, with English summary) ["Can intact mountain bogs be refuges for rare dragonfly species (Odonata) in times of climate change? Investigations in the Harz National Park from 2017 to 2020 – The emergence abundance of *Aeshna juncea*, *A. subarctica*, *Somatochlora alpestris*, *S. arctica* and *Leucorrhinia dubia* was studied on permanent plots in two intact raised bogs of the Harz Mountains from 2017 to 2020. After the extremely dry summer of 2018, a supplementary exuviae search with a special focus on *S. alpestris* has been carried out in a further total of 19 raised bogs and slope located soligenous bogs. As a result of the drought in 2018, the small pools of the raised bogs were lost as reproductive waters for all species except *S. arctica*. This species endured the drought best, but still suffered significant population losses. *S. alpestris* was most affected by the drought, with probably only a maximum of 150 imagines emerging in the entire Harz Mountains in 2020, distributed among a few waters that had not dried up or had dried up only briefly in 2018. It became apparent that the intact mountain bogs of the Harz Mountains are massively exposed to the consequences of climate change. They can only serve as refuges for dragonflies to a very limited extent." (Author)] Address: Baumann, Kathrin, ALNUS GbR, Lärchenweg 15a, 38667 Bad Harzburg, Germany. E-mail: k.baumann@alnus.de

17507. Baumann, K.; Kastner, F.; Borkenstein, A.; Burkart, W.; Jödicke, R.; Quante, U. (2021): Rote Liste der in Niedersachsen und Bremen gefährdeten Libellen mit Gesamtartenverzeichnis. 3. Fassung – Stand 31.12.2020. Informationsdienst Naturschutz Niedersachsen 1/2021: 3-37. (in German, with English summary) ["The volunteer dragonfly working group of Lower Saxony and Bremen („Arbeitsgemeinschaft Libellen in Niedersachsen und Bremen“) has recently compiled a dragonfly atlas for the two federal states (Baumann et al. 2021a). For each species, the atlas includes a comprehensive analysis of the population situation and trend. It was therefore logical to compile a new Red List in this context. The atlas and the Red List are based on a comprehensive data set gathered by well over 1,000 volunteers. The dragonfly fauna of the study region is currently facing rapid changes, primarily caused by climate change. Direct negative effects of climate change have been identified for ten species with an affinity for bogs. In contrast, at least nine other species are profiting from this change, including those extending their range from the south. As a result, the number of species recorded from Lower Saxony and Bremen has increased to 73. Of these, 70 have been assessed in this Red List, 69 are established in the region, and one species is extinct since a long time. A total of 23 species (33 %) are ranked as Extinct or Endangered in the Red List. Almost half of these (11) are threatened with extinction, which is a significant deterioration from the previous Red List in 2007 (6). Overall, however, the number of Red List species has decreased, partly due to measures protecting streams, partly due to climate warming, and partly due to increased

knowledge as a result of improved data." (Authors)] Address: Jödicke, R., Am Liebfrauenbusch 3, 26655 Westerstede, Germany. E-mail: reinhard.joedicke@magenta.de

17508. Beck, S. (2021): Effects of *Microcystis aeruginosa* on New Jersey aquatic benthic macroinvertebrates. M.Sc. thesis, Montclair State University: 36 pp. (in English) ["As increases in anthropogenic eutrophication and climate change contribute to more severe and frequent cyanobacterial harmful algal blooms in freshwater ecosystems worldwide, understanding the effects and consequences cyanobacterial blooms have on aquatic organisms is crucial. *Microcystis aeruginosa* is one of the most common cyanobacteria taxa found in cyanobacterial blooms, producing a number of toxins including Microcystins. This study examined the effects of *Microcystis aeruginosa* on aquatic benthic macroinvertebrates, specifically the pollution intolerant taxa Ephemeroptera, the pollution moderately intolerant taxa Zygoptera, and the pollution tolerant taxa Chironomidae. In a controlled lab environment, macroinvertebrates were exposed to approximately 100,000 cells/ml of *Microcystis aeruginosa*. The survival percentage was lower for macroinvertebrates exposed to *Microcystis aeruginosa* in all three tolerance groups while corresponding with the pollution tolerance levels of the species. These findings support the notion that cyanobacterial blooms have deleterious effects on freshwater ecosystems and can affect aquatic food webs." (Author)] Address: not stated

17509. Belevich, O.; Yurchenko, Y.; Alekseev, A.; Kotina, O.; Odeyanko, V.; Tsentalovich, Y.; Yanshole, L.; Kryukov, V.; Danilov, V.; Glupov, V. (2021): Toxic effects of fine plant powder impregnated with avermectins on mosquito larvae and nontarget aquatic invertebrates. *Journal of Medical Entomology* 58(2): 773-780. (in English) ["The toxic effects of an avermectin-impregnated fine plant powder (AIFP) against larval *Aedes aegypti*, *Culex modestus*, and *Anopheles messeae*, as well as selected nontarget aquatic invertebrates, were studied under laboratory conditions. The possibility of trophic transfer of avermectins (AVMs) through the food chain and their toxic effects on predaceous species fed AIFP-treated mosquito larvae was also evaluated. Among mosquitoes, *Anopheles messeae* were the most sensitive to AIFP, while *Cx. modestus* exhibited the least sensitivity to this formulation. Among nontarget aquatic invertebrates, the greatest toxicity of AIFP was observed for benthic species (larval *Chironomus* sp.), whereas predators (dragonflies, water beetles, and water bugs) exhibited the lowest AIFP sensitivity. AIFP sensitivity of the clam shrimp *Lynceus brachyurus*, the phantom midge *Chaoborus crystallinus*, and the mayfly *Caenis robusta* Eaton was intermediate and similar to the sensitivity of the mosquito *Cx. modestus*. However, these nontarget species were more resistant than *An. messeae* and *Ae. aegypti*. Solid-phase extraction of mosquito larvae treated with AIFP and subsequent high-performance liquid chromatography (HPLC) analysis of the extracts revealed an AVM concentration of up to $2.1 \pm 0.3 \mu\text{g/g}$. Feeding the creeping water bug *Ilyocoris cimicoides* on the AIFP-treated mosquito larvae resulted in 51% mortality of the predaceous

species. But no toxicity was observed for *Aeshna mixta* larvae fed those mosquito larvae. The results of this work showed that this AVM formulation can be effective against mosquito larvae." (Authors)] Address: Belevich, Olga, Laboratory of Insect Pathology, Institute of Systematics and Ecology of Animals SB RAS, Novosibirsk, Russia

17510. Béthoux, O.; Norrad, R.E.; Stimson, M.R.; King, O.A.; Allen, L.F.; Deregnaucourt, I.; Hinds, S.J.; Lewis, J.H.; Schneider, J.W. (2021): A unique, large-sized stem Odonata (Insecta) found in the early Pennsylvanian of New Brunswick (Canada). *Fossil Record* 24: 207-221. (in English) ["A stem relative of dragon- and damselflies, *Brunellopteron norradi* Béthoux, Deregnaucourt and Norrad gen. et sp. nov., is documented based on a specimen found at Robertson Point (Grand Lake, New Brunswick, Canada; Sunbury Creek Formation; early Moscovian, Pennsylvanian) and preserving the basal half of a hindwing. A comparative analysis of the evolution of wing venation in early Odonates demonstrates that it belongs to a still poorly documented subset of species. Specifically, it displays a MPC+CuA fusion, a CuAC+CuP fusion, and a CuP+AA fusion, but it lacks the "extended" MP+Cu = CuA fusion and the "extended" (CuP / CuA+CuP) + AA fusion, the occurrence of which is typical of most Odonata, including *Meganeura*-like species. The occurrence of intercalary veins suggests that its closest relative might be *Gallotypus oudardi* Nel, Garrouste and Roques, 2008, from the Moscovian of northern France." (Authors)] Address: Béthoux, O., CR2P (Centre de Recherche en Paléontologie – Paris), MNHN – CNRS – Sorbonne Univ., 57 rue Cuvier, CP38, 75005, Paris, France. E-mail: obethoux@mnhn.fr

17511. Bhakare, S.D.; Nair, V.P.; Pawar, P.A.; Bhoite, S.H.; Sadasivan, K. (2021): Two new species of *Euphaea* Selys, 1840 (Odonata: Zygoptera: Euphaeidae) from northern Western Ghats, India. *Journal of Threatened Taxa* 13(5): 18200-18214. (in English) ["Two new species of the genus *Euphaea* are described from the Western Ghats of Satara District, Maharashtra, distinguished by their distinct morphology and coloration. *E. thosegharensis* Sadasivan & Bhakare sp. nov. is similar to *E. cardinalis* (Fraser, 1924), but is distinguished by the extensor and flexor surface of all femora black while all femora bright red in *E. cardinalis*; apical fourth of Hw black while apical half of Hw black in *E. cardinalis*; genae reddish-orange, black in *E. cardinalis*; a tuft of sparse stub black hair on either side of tergite of S9 while both S8 and S9 with tufts of long ventral hairs in *E. cardinalis*. Male genital vesicle mat black, with distal border rounded angles, while vesicle black and hexagonal in shape with rounded angles in *E. cardinalis* and S9 twice the length of S10, while S9 and S10 of equal length in *E. cardinalis*. *E. pseudodispar* Sadasivan & Bhakare sp. nov., is very close to *E. dispar* (Rambur, 1842), but is differentiated easily by the absence of yellow patch on legs as in *E. dispar*; only apical fifth of Hw black; genae being yellowish-white, while black in *E. dispar*; male genital vesicle brownish-black & rhomboid-shaped and with no transverse rugosities while black with distal border rounded and with fine transverse rugosities in *E. dispar*;

penis with single seta on each side while *E. dispar* has three pairs; sternite of S9 very prominently extending ventrally like a beak in comparison with *E. dispar*. We have identified additional morphological characters useful in taxonomy of *Euphaea* of the Western Ghats for example, tufts of ventral hairs on terminal abdominal segments genital vesicle, penile structure of males and sternite of S9 in the males, and vulvar scales of females. A taxonomic key to all known species of genus *Euphaea* of the Western Ghats is also provided." (Authors)] Address: Bhakare, S.D., 354, Somwar Peth, Near New English School, Satara, Maharashtra 415002, India. E-mail: milind1plus@gmail.com

17512. Bhartiy, S.K.; Elangovan, V. (2021): Seasonal prey availability and diet composition of Lesser Asiatic Yellow House Bat *Scotophilus kuhlii* Leach, 1821. *Journal of Threatened Taxa* 13(8): 19002-19010. (in English) ["Diet is an important factor in understanding bat ecology and conservation. This study assessed seasonal prey availability and diet composition of *S. kuhlii* in various districts of Uttar Pradesh between January 2016 to December 2018. Fecal and insect samples were collected seasonally using sweep nets between 1800 and 1900 h. From each location 20 fecal pellets were selected for analysis and searched for taxonomically recognizable remnants. The analysis revealed that *S. kuhlii* fed on Coleoptera, Diptera, Hymenoptera, Isoptera, Orthoptera, Odonata, Blattellidae, Lepidoptera, and Hemiptera, identified from legs, antennae and wings/elytra in fecal pellets. Seasonal variation in the presence of isolated insect remnants and insect abundance at foraging grounds was observed. Thus *S. kuhlii* is a voracious feeder and plays an important role as a pest control agent." (Authors)] Address: Bhartiy, S.K., Department of Zoology, Babasaheb Bhimaro Ambedkar University, Lucknow, Uttar Pradesh 226025, India. E-mail: shanikumarbhartiy@gmail.com

17513. Bhowmik, S.; Bora, A. (2021): *Amphithemis vacillans* Selys, 1891 (Odonata: Libellulidae): new addition to the Odonata fauna of Meghalaya, Northeastern India. *Revista Chilena de Entomología* 47(3): 489-492. (in English, with Spanish summary) ["*A. vacillans* is reported for the first time from Meghalaya, Northeastern India. The authors recorded a male individual from the forest of Bymihat, located in Ri-bhoi district of the state on November 23, 2017. The current sighting revised the distribution of this species in India being previously known from Assam and West Bengal." (Authors)] Address: Bora, A., Dept of Zoology, Moran College, Assam, India. E-mail: atanubora2019@gmail.com

17514. Bobrek, R. (2020): *Cordulegaster bidentata* Selys, 1843 in fragmented landscape of the Wielickie Foothills: reassessment of the northern limit of species range in the Western Carpathians. *Fragmenta Faunistica* 63(2): 67-80. (in English) ["In 2018–2019, the occurrence of *C. bidentata* in the Wielickie Foothills, located between the Beskidy mountain ranges (in the south) and the Vistula river valley (in the north) was investigated. It was examined whether *C. bidentata* inhabits fragmented landscape, with forest pat-

ches of various sizes. Larvae of this dragonfly were searched in the forest streams, the bottom of which was visually scanned using binoculars. The presence of 49 larvae was confirmed on 17 stream sections out of 53 (32%). They were recorded in almost the entire geographical extent of the study area, from the southernmost to the northernmost forest patches. The neighboring occupied streams were separated by a maximum of 3.7 km, and breeding sites were found in forest patches of an area of 75–1280 ha. It was confirmed that *C. bidentata* occurs up to the orographic edge of the Western Carpathians. Its range is continuous between the northern edge of the Beskidy Mountains and the Vistula valley. New data shift the northern range limit of *C. bidentata* in the Western Carpathians by nearly 20 km. The field method used proved to be efficient in assessing the distribution of larvae in large areas, with relatively little field effort. Its wider use would allow a more complete recognition of distribution of *C. bidentata* in the Carpathian Foothills." (Authors)] Address: Bobrek, R., Polish Society for the Protection of Birds, Odrowaza 24, 05–270 Marki, Poland. E-mail: rafal.bobrek@gmail.com

17515. Bobrek, R. (2021): Post-mining ponds in the Sandomierz Forest (SE Poland) as an important site for the conservation of a species-rich odonate assemblage. *Acta zoologica cracoviensia* 64(1): 159-168. (in English) ["In this study, the species composition and diversity of dragonfly and damselfly assemblages of six post-mining ponds differing in habitat conditions, located within a single sand pit in the central part of the Sandomierz Forest (SE Poland) were assessed. In total, 42 species were recorded in 2019, including 35 species considered resident to the site. In the six studied ponds, a range of 8 to 30 species were recorded, including 5 to 26 resident species. In each pond, at least one unique species was found, and one-third of all species were confined to single ponds only. As a result, the qualitative (Jaccard) and quantitative (Bray-Curtis) similarity indices between the pairs of ponds were low, reaching 12-61% and 19-53%, respectively. Thus, despite a lack of distinct barriers and negligible distances between the ponds (max. 350 m), the structure of assemblages in adjacent water bodies differed considerably. This is probably largely due to the habitat selectivity of species. A redundancy analysis (RDA) showed, that factors such as area and plant diversity of the pond were shaping odonate assemblages, explaining 49.1% of the total variance in the dataset. Due to the high species richness and the identification of several species of special concern, the studied sand pit should be considered a valuable secondary habitat for odonates, which – after termination of exploitation – should be regarded as a good candidate for a site designated for the conservation of biodiversity." (Author)] Address: Bobrek, R., Polish Society for the Protection of Birds, Odrowaza 24, 05–270 Marki, Poland. E-mail: rafal.bobrek@gmail.com

17516. Borisov, S.N. (2021): Updates to the fauna of dragonflies (Odonata) of the Altaiskii Krai with new records of species for Siberia. *Eurasian Entomological Journal* 20(3): 136-141. (in English, with Russian summary) ["35 dragonfly

species were recorded during an expedition to the Altaiskii Krai, three of which, *Sympetma fusca*, *Anax imperator* and *Orthetrum brunneum*, are recorded for Siberia for the first time. New data on the occurrence of the rare and little-known species *Ischnura pumilio*, *A. parthenope* and *O. albistylum*, are provided. A new record of the migrant species *Sympetrum fonscolombii* in Siberia is also presented." (Author)] Address: Borisov, S.N., Institute of Systematics and Ecology of Animals, Russian Academy of Sciences, Siberian Branch, Frunze Str. 11, Novosibirsk 630091 Russia. E-mail: borisov-s-n@yandex.ru.

17517. Bose, C.N.; Binoy, C.F.; Kakkassery, F.K. (2021): On the diversity and abundance of riparian odonate fauna (Insecta) of the midstream Chalakkudy River, Kerala, India. *Journal of Threatened Taxa*: 19053-19059. (in English) ["The riparian Odonate insect diversity of the midstream Chalakkudy River at six locations assessed from February 2018 to January 2019 has revealed the occurrence of 25 species of odonates. Among them, 10 species are dragonflies belonging to seven genera of the family Libellulidae and the remaining 15 species are damselflies belonging to six families and 11 genera. Five endemic damselfly species have been recorded. *Pseudagrion indicum* is endemic to the Western Ghats, while the remaining four species, *Vestalis apicalis*, *Libellago indica*, *Dysphaea ethela*, and *Heliocypha bisignata*, are endemic to India. Diversity indices of the odonates in all the six locations were analyzed and it showed less abundance at sites where tourist activities are more and with thin native riparian vegetation. Further, the study has unequivocally revealed that thick native riparian vegetation is essential for their perching and existence. By and large, the uncontrolled tourism activities and habitat alteration interfere with the density and diversity of these endemic species." (Authors)] Address: Bose, C.N., Research & Postgraduate Dept of Zoology,, St. Thomas' College (Autonomous), Thrissur, Kerala 680001, India. E-mail: nithabose-123@gmail.com

17518. Boudot, J.-P.; Doucet, G.; Grand, D. (2021): Dragonflies and Damselflies of Britain and Western Europe: A Photographic Guide. Bloomsbury Publishing: 152 pp. (in English) ["Dragonflies and damselflies are some of the most beautiful, fragile and resilient insects found in the natural world. With their complex behaviours, astonishing aerobatic skills and preference for freshwater habitats, they are a very rewarding group of animals to observe in the field. Dragonflies and Damselflies of Britain and Western Europe features all 98 species found in the region. Packed with outstanding photography, this comprehensive book includes close-up illustrations to highlight key identification features, diagrams of wing venation, and detailed guides to dragonfly larvae and exuviae. Each species account includes an accurate distribution map and information on field characteristics, confusion species, habitat and ecology. An introduction to the life cycle of Odonata, guidance on when and where to look for them, and the best ways to observe and photograph dragonflies and damselflies in the field are also included. These sections, combined with the identification

guides, make this book the ultimate resource for any field naturalist or entomologist interested in these incredible insects." (Publisher)]

17519. Boudot, J.-P. (2021): Synchronism, sex ratio at emergence, and voltinism of *Epithea bimaculata* in Lorraine (North-East France) (Odonata: Corduliidae). *Libellula Supplement* 16: 67-78. (in English, with German summary) ["Population size in *E. bimaculata* varied considerably with time in northeastern France. However, emergences were always synchronised with an EM50 percentile ranging from four to eight days, irrespective of the population size. The sex ratio of all exuviae collected at one locality varied from ca 0.7 to ca 1.0, depending on the year. Larval development of a large part or of the totality of the population was demonstrated to be completed in one year only. These results compared to published data from other countries are discussed." (Author).] Address: Boudot, J.-P., Immeuble Orphée, Apt 703, 78 rue de la Justice, 54710 Ludres, France. E-mail: jean-pierre.boudot@numericable.fr

17520. Brito, J.; Calvão, L.; Cunha, E.; Maioli, L.; Barbirato, M.; Rolim, S.; Juen, L. (2021): Environmental variables affect the diversity of adult damselflies (Odonata: Zygoptera) in western Amazonia. *International Journal of Odonatology* 24: 108-121. (in English) ["Our study evaluated the effects of environmental variables on the assemblages of the sub-order Zygoptera, and tested the hypothesis that environmental variables are more important determinants of the structure of these assemblages than limnological variables in streams. We sampled 17 streams in the Carajás National Forest and tested our hypothesis using a linear regression analysis, with the zygopteran species composition, richness, and abundance as the response variables. Our findings indicate that both limnological and physical variables influence, independently, the characteristics of the zygopteran assemblages. The riparian forest maintains the stability of the environment and provides dispersal corridors, along which the zygopterans can reach alternative, suitable environments. The small scale of this study also implies that the continuity of the vegetation is essential for the dispersal of the zygopterans among different landscapes. The high levels of abundance recorded in the better-preserved environments may reflect the maintenance of specific habitats and resource availability. Riparian forest is crucial to the ecological equilibrium of the stream systems, although further research at a broader spatial scale that focuses on a greater diversity of variables should provide more robust insights into the phenomenon." (Authors)] Address: Brito, J., Graduate Program in Ecology, Federal University of Pará, Belém, Brazil. E-mail: jotabio13@gmail.com

17521. Brockhaus, T. (2021): Eine auffällige Farbvariante bei Männchen von *Somatochlora metallica* (Odonata: Corduliidae). *Libellula Supplement* 16: 79-85. (in German, with English summary) ["A striking colour variant in males of *S. metallica* – A male colour morph in *S. metallica* is described. Instead of a yellow labium, such individuals have a central greyish-black oval spot on the labial palps (beard labium).

They were found in different regions of Europe. By means of a compilation of climate data in correspondence with the presumable temperature during their emergence and of an emergence experiment with F-0 larvae a temperature-dependent aberration is suggested. However, it is not a discrete colour morph, since continuous transitions can be seen in the individuals." (Author)] Address: Brockhaus, T., An der Morgensonne 5, 09387 Jahnsdorf, Germany. E-mail: t.brockhaus@t-online.de

17522. Buczynski, P.; Bielak-Bielecki, P. (2021): Disjunct locality of *Sombre Goldenring Cordulegaster bidentata* Selys, 1843 (Odonata: Cordulegasteridae) in the Sandomierz Basin (SE Poland). *Odonatrix* 17_5 (2021): 9 pp. (in Polish, with English summary) ["*C. bidentata* was found in the middle course of the Studzienica Stream on the north-eastern edge of the Sandomierz Basin in SE Poland (50.3889°N, 23.09-84°E, UTM: FA48, 219.5 m a.s.l.). One larva was caught on April 27, 2020 during studies conducted as part of the State Environmental Monitoring programme. The locality is described and data on the water parameters are provided. The locality is situated at least 5 km from human habitations in the vast Solska Forest, which consists mainly of moist mixed coniferous woodland. The strongly meandering stream bed is 1-3 m wide. The bottom sediments consist mainly of coarse-grained sand covered with CPOM and FPOM in lentic habitats. The water contains humic acids but its pH is neutral. Almost all the physical and chemical properties of the water meet the first-class quality criteria. The new locality, about 70 km from the Central Beskid Foothills, is the first one in Poland out-side the ranges of mountains and foothills. This discovery suggests that there may be more localities of *C. bidentata* here, forming a disjunct distribution area of this species. This may be a consequence of the relief of the borderland between the Roztocze Upland and the Sandomierz Basin. *C. bidentata* is the 69th odonate species recorded in Lublin Province; 93.4% of the Polish dragonfly fauna is present there." (Authors)] Address: Bielak-Bielecki, P., Główny Inspektorat Ochrony Środowiska, Centralne Laboratorium Badawcze, Oddział w Lublinie, ul. Obywatelska 13, 20-092 Lublin, Poland. E-mail: p.bielak-b@wp.pl

17523. Buczynski, P.; Tonczyk, G. (2021): Polish and dedicated to Poland odonatological papers. 19. The year 2020 and additions to the years 2017-2019. *Odonatrix* 17_1: 7 pp. (in English) ["The authors present a list of Polish and dedicated to Poland odonatological papers that were published in the year 2020. In the reported time period, 51 publications of various kind appeared, and one BSc thesis was created. Five papers from 2017-2019 are also given to supplement the previous lists." (Authors)] Address: Buczynski, P., Dept of Zool., Maria Curie-Skłodowska University, Akademicka 19, PL-20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

17524. Bui, A.P.; Phan, Q.P. (2021): Description of *Coeliccia diehlae* sp. n. from the Central Highlands of Vietnam with keys to the males and females of the pyriformis-group Odonata: Zygoptera: Platycnemididae. *International Journal*

of Odonatology 24: 51-63. (in English) ["*Coeliccia diehlae* sp. n. (holotype ♂ from Ko Roong Commune, Ka Bang District, Gia Lai Province, Central Highlands of Vietnam, deposited in the Zoological Collection of Duy Tan University) is described based on both sexes. This species belongs to the pyriformis-group and comes closest to *Coeliccia phamiha* Phan & Tran, 2018. Keys to the males and females of the pyriformis-group are provided." (Authors)] Address: Bui, A.P., Center for Entomology & Parasitology Research, Institute of Research & Training of Medicine, Biology & Pharmacy, Duy Tan University, Da Nang, 550000, Vietnam

17525. Cervený, D.; Fick, J.; Klaminder, J.; McCallum, E.S.; Bertram, M.G.; Castillo, N.A.; Brodin, T. (2021): Water temperature affects the biotransformation and accumulation of a psychoactive pharmaceutical and its metabolite in aquatic organisms. *Environment International* 155 (2021) 106705: 8 pp. (in English) ["Pharmaceutically active compounds (PhACs) have been shown to accumulate in aquatic and riparian food-webs. Yet, our understanding of how temperature, a key environmental factor in nature, affects uptake, biotransformation, and the subsequent accumulation of PhACs in aquatic organisms is limited. In this study, we tested to what extent bioconcentration of an anxiolytic drugs (temazepam and oxazepam) is affected by two temperature regimes (10 and 20°C) and how the temperature affects the temazepam biotransformation and subsequent accumulation of its metabolite (oxazepam) in aquatic organisms. We used European perch (*Perca fluviatilis*) and dragonfly larvae (*Sympetrum* sp.), which represent predator and prey species of high ecological relevance in food chains of boreal and temperate aquatic ecosystems. Experimental organisms were exposed to target pharmaceuticals at a range of concentrations (0.2.6 µg L⁻¹) to study concentration dependent differences in bioconcentration and biotransformation. We found that the bioconcentration of temazepam in perch was significantly reduced at higher temperatures. Also, temperature had a strong effect on temazepam biotransformation in the fish, with the production and subsequent accumulation of its metabolite (oxazepam) being two-fold higher at 20°C compared to 10°C. In contrast, we found no temperature dependency for temazepam bioconcentration in dragonfly larvae and no detectable biotransformation of the parent compound that would result in measurable concentrations of oxazepam in this organism. Our results highlight that while organisms may share the same aquatic ecosystem, their exposure to PhACs may change differently across temperature gradients in the environment." (Authors)] Address: Cervený, D., Dept of Wildlife, Fish & Environmental Studies, Swedish Univ. of Agricultural Sciences (SLU), Umeå, Sweden. E-mail: daniel.cervený@slu.se

17526. Cetinic, K.A.; Previšić, A.; Rožman, M. (2021): Holo- and hemimetabolism of aquatic insects: Implications for a differential cross-ecosystem flux of metals?. *Environmental Pollution* 277, 15 May 2021, 116798: 9 pp. (in English) ["Highlights: • Emerging aquatic insects facilitate cross-ecosystem transfer of metals. • Metamorphosis alters metal concentrations in aquatic insects. • Holometabolous aquatic

insects exhibit a two-step process in metal flux. • Greater rate of metal decline between larvae/pupae than pupae/adults in Trichoptera. • Bioamplification of toxic metals represents risk for terrestrial insectivores Abstract: Increased metal concentrations in aquatic habitats come as a result of both anthropogenic and natural sources. Emerging aquatic insects that play an indispensable role in these environments, transferring resources and energy to higher trophic levels in both aquatic and terrestrial habitats, may inadvertently also act as biovectors for metals and other contaminants. This study measured levels of 22 different metals detected in biofilm, aquatic and terrestrial life stages of Trichoptera and Odonata, as well as riparian spiders, to examine the uptake and transfer from freshwater to terrestrial ecosystems. We show that emerging insects transfer metals from aquatic to terrestrial ecosystems, however with large losses observed on the boundary of these two environments. Significantly lower concentrations of most metals in adult insects were observed in both hemimetabolous (Odonata) and holometabolous insect orders (Trichoptera). In holometabolous Trichoptera, however, this difference was greater between aquatic life stages (larvae to pupae) compared to that between pupae and adults. Trophic transfer may have also played a role in decreasing metal concentrations, as metal concentrations generally adhered to the following pattern: biofilm > aquatic insects > terrestrial invertebrates. Exceptions to this observation were detected with a handful of essential (Cu, Zn, Se) and non-essential metals (Cd, Ag), which measured higher concentrations in adult aquatic insects compared to their larval counterparts, as well as in aquatic and terrestrial predators compared to their prey. Overall, all metals were found to be bioavailable and biotransferred from contaminated waters to terrestrial invertebrates to some degree, suggesting that risks associated with metal-contaminated freshwaters could extend to terrestrial systems through the emergence of these potential invertebrate biovectors." (Authors)] Address: Rozman, M., Ruder Boskovic Institute, Bijenicka cesta 54, 10000, Zagreb, Croatia. E-mail address: marko.rozman@irb.hr

17527. Cezário, R.R.; Firme, P.P.; Pestana, G.C.; Vilela, D.S.; Juen, L.; Cordero-Rivera, A.; Guillermo, R. (2021): Sampling methods for dragonflies and damselflies. In: Jean Carlos Santos & Geraldo Wilson Fernandes (eds.): *Measuring Arthropod Biodiversity. A Handbook of Sampling Methods*: 223-240. (in English) ["Dragonflies and damselflies have become model organisms in ecological and evolutionary studies, mainly because they are considered flagship taxa for the conservation of water resources. Hence, how to standardize collection of odonates for the assessment of their diversity is an issue most researchers working with the group or the ecology of freshwaters may face. We aim at presenting sampling protocols that may aid researchers that are interested in sampling adults, exuviae, and larvae of Odonata. These three life phases have different detectabilities, and we propose that should be combined wherever possible." (Authors)] Address: Cezário, R.R.L, ESTES Lab, Federal University of São Carlos, São Carlos, Brazil

17528. Chandran, A.V.; Karakuth, A.K.; Jose, S.K.; Wildermuth, H. (2021): First record of gynandromorphism in *Trithemis aurora* (Odonata: Libellulidae). *Odonatologica* 50(1/2): 55-63. (in English) ["A gynandromorphic individual of *T. aurora* is reported from a garden in Palakkad district, Kerala state, India. Its eyes, thorax, legs, wings, and abdomen show mosaic gynandromorphy. The abdomen is mostly gynochromic with the tip bearing female appendages. Detailed study of the specimen shows that female characters predominate but significant areas exhibit male characters." (Authors)] Address: Chandran, A.V., Dept of Geology & Environmental Science, Christ College, Thrissur, Kerala, India. E-mail: avivekchandran2@gmail.com

17529. Chandran, V.A.; Jose, S.K. (2021): Comparison of Odonata diversity in Kole wetlands and selected man-made ponds of central Kerala. *Modern Trends in Biological Research*: 75-79. (in English) ["Diversity of Odonata in Kole wetlands, a Ramsar site and twenty manmade ponds in central Kerala were studied and compared. A total of 44 species (30 dragonflies and 14 damselflies) belonging to 33 genera and eight families were recorded in the study, out of which 14 species were exclusively found in the wetlands. All the species recorded in the man-made ponds were also recorded from the wetlands." (Authors)] Address: A. Vivek Chandran, Subin K. Jose, Dept of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda, Kerala

17530. Chen, M.; Qu, D.-H.; Tian, H. (2021): Dragonfly-wing-inspired polymer design for property enhancement. *Matter* 4(8): 2674-2676. (in English) ["Implementing bio-inspired strategies into the design of advanced functional materials is desirable but challenging. By mimicking the architecture of dragonfly wings, Fu et al. demonstrated an innovative strategy to fabricate a stiff yet tough healable nanocomposite. Its characteristic hierarchical architecture endows the original brittle material with significant mechanical improvement." (Authors)] Address: Chen, M., Key Lab. Advanced Materials & Joint International Research Lab. Precision Chemistry & Molecular Engineering, Feringa Nobel Prize Scientist Joint Research Center, Frontiers Science Center for Materiobiology & Dynamic Chemistry, Institute of Fine Chemicals, School of Chemistry & Molecular Engineering, East China University of Science and Technology, 130 Meilong Road, Shanghai 200237, China

17531. Chitsaz, N.; Siddiqui, K.; Marian, R.; Chahl, J. (2021): Numerical and experimental analysis of three-dimensional microcorrugated wing in gliding flight. *J. Fluids Eng.* Jan 2022, 144(1): 011205 : 11pp. (in English) ["In this study, computational fluid dynamics analysis was performed on a three-dimensional (3D) model of a Libellulidae wing to determine aerodynamic performance in gliding flight. The wing is comprised of various corrugated features alongside the spanwise and chordwise directions, as well as twist. The detailed features of real 3D dragonfly wing models, including all the corrugations through both span and chord, have not been considered in the past for a detailed aerodynamic analysis. The simulations were conducted by

solving the Navier–Stokes equations to demonstrate gliding performance over a range of angles of attack at low Reynolds numbers. The numerical model was validated against experimental data obtained from a fabricated corrugated wing model using particle image velocimetry. The numerical results demonstrate that bio-inspired wings with corrugations compared to flat profile wings generate more lift with lower drag, trapping the vortices in the valleys of wing corrugation leading to delayed flow separation and delayed stall. The experimental and numerical results demonstrate that the methodology presented in this study can be used to measure bio-inspired 3D wing flow characteristics, including the influence of complex corrugations on aerodynamic performance. These findings contribute to the advancement of knowledge required for designing an optimized bio-inspired micro-air vehicle." (Authors)] Address: Chitsaz, N., UNISA STEM, Australian Research Centre for Interactive & Virtual Environments, University of South Australia, University Boulevard, Mawson Lakes, South Australia 5095, Australia. E-mail: nasim.chitsaz@mymail.unisa.edu.au

17532. Chovanec, A. (2021): Beispiele starker Thoraxbeifung bei Männchen von *Orthetrum coerulescens* in Niederösterreich (Odonata: Libellulidae). *Libellula Supplement* 16: 87-100. (in German, with English summary) ["Examples of strong thoracic pruinescence in males of *O. coerulescens* in Lower Austria – The paper deals with different variations of thoracic pruinescence in *O. coerulescens* found at a small wetland in the Austrian province of Lower Austria in the years 2019 and 2020. Some specimens were intensively pale blue on the thorax, similar to adult males of *Orthetrum brunneum*. This – for this latitude – extraordinary pruinosity is interpreted as species-specific variation and thermoregulatory adaptation to increasing air temperatures in Central Europe due to climate change. Meteorological data for the study region support this hypothesis by showing significantly higher air temperatures in both years compared with long-term monitoring data." (Authors)] Address: Chovanec, A., Krotenbachgasse 68, 2345 Brunn am Gebirge, Austria. E-mail: andreas.chovanec@bmlrt.gv.at

17533. Córdoba, S. P.; Pérez, E. C. (2021): La Colección Entomológica del Instituto-Fundación Miguel Lillo, Tucumán, Argentina. *Acta Zoológica Mexicana* (n. s.) 37(1): 1-19. (in Spanish, with English summary) ["The Entomological Collection of the Miguel Lillo Foundation-Institute (IFML) preserves and guards the material deposited there, to facilitate study by the entire current and future scientific community. It holds 6,500,000 specimens of the orders Blattodea, Coleoptera, Collembola, Dermaptera, Diptera, Embioptera, Ephemeroptera, Hemiptera, Hymenoptera, Isoptera, Mecoptera, Megaloptera, Lepidoptera, Neuroptera, Odonata, Orthoptera, Phthiraptera, Plecoptera, Psocoptera, Thysanoptera, Trichoptera and Zygentoma. The entomological collection of the IFML preserves 11,216 specimens of the types series assigned to 2,185 species, mainly from the Neotropic, in addition to specimens from various parts of the world. It is made up of the entomological collection preserved dry and in alcohol, in two rooms equipped for the protection and

conservation of the material. It is a benchmark for the biodiversity of neotropical insects and was founded in 1944 based on the material collected by Dr. Miguel Lillo. The objective of this paper is to present in general way, the entomological collection of the I-FML, its organization, characteristics, current situation and future perspectives. Given its importance, both for the scientific community and for society in general, it is necessary to guarantee the conservation of the specimens deposited in it." (Authors)] Address: Córdoba, Silvia, Inst. Entomología, Fundación Miguel Lillo, Miguel Lillo 251 (4000), San Miguel de Tucumán, Argentina.

17534. Corral-Lopez, A.; Varg, J.E.; Cano-Cobos, Y.P.; Losada, R.; Realpe, E.; Outomuro, D. (2021): Field evidence for colour mimicry overshadowing morphological mimicry. *Journal of Animal Ecology* 90(3): 698-709. (in English) ["(1) Imperfect mimicry may be maintained when the various components of an aposematic signal have different salience for predators. Experimental laboratory studies provide robust evidence for this phenomenon. Yet, evidence from natural settings remains scarce. (2) We studied how natural bird predators assess multiple features in a multi-component aposematic signal in the Neotropical "clear wing complex" mimicry ring, dominated by glasswing butterflies. (3) We evaluated two components of the aposematic signal, wing colouration and wing morphology, in a predation experiment based on artificial replicas of glasswing butterflies (model) and Polythoridae damselflies (mimics) (*Euthore fasciata*) in their natural habitat. We also studied the extent of the colour aposematic signal in the local insect community. Finally, we inspected the nanostructures responsible for this convergent colour signal, expected to highly differ between these phylogenetically distinct species. (4) Our results provide direct evidence for a stronger salience of wing colouration than wing morphology, as well as stronger selection on imperfect than in perfect colour mimics. Additionally, investigations of how birds perceive wing colouration of the local insect community provides further evidence that a UV-reflective white colouration is being selected as the colour aposematic signal of the mimicry ring. Using electron microscopy, we also suggest that damselflies have convergently evolved the warning colouration through a pre-adaptation. (5) These findings provide a solid complement to previous experimental evidence suggesting a key influence of the cognitive assessment of predators driving the evolution of aposematic signals and mimicry rings." (Authors)] Address: Outomuro, D., Dept of Biological Sciences, University of Cincinnati, Rieveschl Hall, Cincinnati, OH 45221, USA. Email: outomuro.david@gmail.com

17535. Daso, J.M.; Arquival, I.B.; Yuto, C.M.M.; Mondejar, E.P. (2021): Species diversity of Odonata in Bolyok Falls, Naawan, Misamis Oriental, Philippines. *AACL Bioflux*, 14(2): 664-671. (in English) ["This study was conducted to assess the species composition of Odonata in the vicinity of Bolyok Falls in Brgy. Lubilan, Naawan, Misamis Oriental, Philippines. Field sampling was conducted in three sampling sites on March 9, 2019, using sweep netting and hand-picking methods. A total of nine species were identified belonging

to seven families and seven genera of Odonata. *Risicnemis appendiculata* was the most abundant Odonata species. The endemism is high at 77.78% with six species endemic to the Philippines and one endemic to Mindanao. The overall species diversity index of Bolyok Falls is very low at $H' = 1.59$. Identified threats of odonates include land clearing for agriculture and expansion of resort facilities near the sampling sites. The high levels of endemism indicate that the area is vital for odonates. Thus, the formulation of mitigation measures for conservation and preservation of species is needed in the area." (Authors)] Address: Daso, J.M., Iligan City East National High School, Sta. Filomena, Iligan City, Philippines. E-mail: jonnymdaso@gmail.com

17536. De Knijf, G. (2021): *Forcipomyia paludis* as a parasite of Odonata in Belgium (Diptera: Ceratopogonidae; Odonata), with notes on its ecology and habitat. *Libellula Supplement* 16: 101-114. (in English, with German summary) ["The biting midge *F. paludis* is the only ceratopogonid species known to parasitise Odonata in Europe. This parasite is widely distributed in the Western Palaearctic, but has only once been formally cited for one damselfly species in Belgium. However, many photographs of parasitised Odonata are stored in the citizen science website www.waarnemingen.be in Belgium. A thorough analysis of 2,300 photographs from four sites from 2019 and 2020 resulted in the finding of 100 photographs of 32 species of odonate being parasitised in Belgium. We also found two species, *Coenagrion scitulum* and *Sympetrum vulgatum* for the first time mentioned as hosts. Virtually all *F. paludis* (99%) were found at the sites Buitengoor and Hageven. Biting midges were found in at least 13% of the photographs from Buitengoor and 3% in Hageven. Most records date from the end of May to the end of July. The parasite prevalence was low: 87% of the individuals carried only one or two midges. They seemed to have a slight preference for the forewings over the hind wings (59% versus 41%), but no difference was found between the right and the left wings. The presence of biting midges on Odonata was correlated with the presence of *Cladium mariscus* vegetation. This vegetation type might be the larval habitat of *F. paludis*." (Author)] Address: De Knijf, G., Research Institute for Nature & Forest (INBO), Havenlaan 88 bus 73, 1000 Brussels, Belgium. E-mail: geert.deknijf@inbo.be

17537. Deviche, P. (2021): Partial submergence: An undescribed behavioral adjustment for thermoregulation at high ambient temperature in Aeshnidae. *International Journal of Odonatology* 24: 71-81. (in English) ["Many insects including odonates thermoregulate using a combination of behavioral and physiological mechanisms. At high ambient temperature (T_a), these mechanisms include decreased heat production and increased heat loss. Heat production can be reduced by decreasing activity. Heat loss can be enhanced by perching in a shaded microhabitat where temperature is cooler than in the surrounding environment. Aeshnids, which are intermittent endotherms, increase heat loss at high T_a also by increasing hemolymph circulation from the thorax, where most metabolic heat is produced, to the

abdomen, where it dissipates to the environment by convection. While studying two aeshnid species (*Anax junius* and *Rhionaeschna multicolor*) at a Sonoran Desert (Arizona, USA) stream, I observed partially submerged mature individuals of both sexes of these species. This heretofore undescribed behavior was seen only at $T_a > 43$ °C and almost exclusively during the hottest part of the day (15:00–17:00 hr), when the daily difference between T_a and water temperature (T_w) was, on average, largest. A cooling effect of partial submergence behavior on body temperature would, therefore, presumably be most effective also during this period. Several percher species of libellulids were present at the study site. These dragonflies are not known to use endothermy for thermoregulation or to increase hemolymph circulation to the abdomen to dissipate heat at high T_a , and none was ever observed to partially submerge. It is suggested in aeshnids that partial submergence at high T_a serves a thermoregulatory function by facilitating body heat dissipation from the abdomen." (Author)] Address: School of Life Sciences, Arizona State University, Tempe, AZ 85287-4501, USA. E-mail: deviche@asu.edu

17538. Díaz-Martínez, C.; Cardo-Maeso, N.; Simarro-Tórtola, J.; Valero, A.G.; Conesa García, M.A. (2021): Ampliación de la distribución conocida y caracterización del hábitat de *Onychogomphus cazuma* Barona, Cardo & Díaz, 2020 (Odonata: Gomphidae) en España. *Boletín de la Sociedad Entomológica Aragonesa* 68: 368-382. (in Spanish, with English summary) ["Extension of the known distribution and habitat characterisation of *O. cazuma* in Spain Abstract: The previously recorded distribution of *O. cazuma* consisted of eight localities in the provinces of Valencia, Albacete and Murcia. This paper presents the results of the sampling carried out between 2019 and 2021, including six new localities in Cuenca, Albacete and Valencia, thus improving the knowledge of the distribution of this Iberian endemic and providing additional records in two of the known localities. The description of the localities where *O. cazuma* is present reinforces the hypothesis of a very specific larval habitat, associated to the existence of hot springs. However, the water temperature may not be a determining factor. The issue of its detectability and some conservation threats and opportunities are pointed out." (Authors)] Address: Díaz-Martínez, Cecilia, Sociedad Entomológica y Ambiental de Castilla-La Mancha, c/Londres, 7, 45003 Toledo, Spain. E-mail: cdiaz.cuenca@gmail.com

17539. Dolný, A.; Ožana, S.; Burda, M.; Harabiš, F. (2021): Effects of landscape patterns and their changes to species richness, species composition, and the conservation value of odonates (Insecta). *Insects* 12(6), 478: 14 pp. (in English) [oas 57: "Simple Summary: In this study, we aimed to evaluate the relationship between human transformations of land use/land cover and adult dragonfly diversity. Based on previous studies, we assumed that with increasing rates of environmental degradation and declining levels of naturalness, the representation of species with high conservation value would significantly decrease, which, however, would not affect the regional alpha diversity. Our results have

shown that species richness did not correspond to habitat naturalness, but the occurrence of endangered species was significantly positively correlated with increasing naturalness; thus, habitat degradation and/or the level of naturalness significantly affected species composition, while species richness remained unchanged. Based on our analyses, it is evident that most natural areas, and therefore the least affected areas, provide suitable conditions for the largest number of endangered species. This research extends our knowledge about the impact of human activities, especially the conversion and degradation of habitats, on the composition of odonates and freshwater animals at the regional scale. Abstract: Understanding the impact of the changing proportion of land-use patterns on species diversity is a critical issue in conservation biology, and odonates are good bioindicators of these environmental changes. Some freshwater ecosystems that have been modified due to human activities can serve as important secondary habitats for odonate assemblages; however, the majority of studies addressing the value of secondary habitats in industrial and urban areas for adult dragonfly diversity have been limited to the local scale, and the value of such habitats for gamma diversity is still unclear. The aim of this study was to determine the relationship between human transformations of land use/land cover and dragonfly diversity. We interpolated the information based on dragonfly occurrence per grid cell and land cover data, indicating naturalness and degradation in 677 grid cells in the Czech Republic. Species richness did not correspond to habitat naturalness, but the occurrence of endangered species was significantly positively correlated with increasing naturalness; thus, habitat degradation and/or the level of naturalness significantly affected species composition, while species richness remained unchanged. Threatened species that occur predominantly in natural areas and threatened species with a dominant occurrence in degraded squares were also separated, which indicated that the conservation of the latter should be prioritised." (Authors)] Address: Dolný, A., Dept Biology & Ecology, Fac. Science, Univ. Ostrava, Chittussiho 10, 710 00 Ostrava, Czech Republic. E-mail: ales.dolny@osu.cz

17540. Dow, R.A. (2021): An annotated checklist of the Odonata (Insecta) known from Sarawak with records to district level. *Sarawak Museum Journal* LXXX1, No. 101 (New Series); Special Issue 10: 313-422. (in English) ["The first checklist of the Odonata of the state of Sarawak in Malaysian Borneo is presented. 303 species are included in the list. Records are given to district level. For each species, a reference to the first record from each district in which it occurs is given, except where this paper represents the first published district record, in which case this is indicated. Additionally all references for the species containing original records from Sarawak, or significant discussion of material from or relevant to Sarawak, are given. Known taxonomic issues are discussed in notes. The number of records from each district and division is summarised." (Author)] Address: Dow, R.A., Naturalis Biodiversity Centre, P.O. Box 9517, 2300 RA Leiden, The Netherlands. Email: rory.dow-230@yahoo.co.uk

17541. Dow, R.A. (2021): Corrections, amendments and updates to "An annotated checklist of the Odonata (Insecta) known from Sarawak with records to district level". *Faunistic Studies in SE Asian and Pacific Island Odonata* 34: 1-6. (in English) ["Corrections, amendments and some updates to an annotated checklist of the Odonata of Sarawak (Dow 2021) published in a special edition of the Sarawak Museum Journal are listed. With one exception taxonomical updates given here are confined to those based on publications that appeared between the last revision of the manuscript (early April 2019) and its publication (February 2021). The exception is that a *Merogomphus* (?) species lumped under *M. femoralis* Laidlaw, 1931 in Dow (2021) is considered to be a separate species here. Unfortunately there are a number of problems with records at district level and the reader of Dow (2021) is advised to simply ignore the district level records and counts until a revised version of the checklist using an accurate characterisation of Sarawak's districts is produced. Additionally the number of species known from Sarawak is updated to reflect information published in Dow et al. (2021) and in this paper and now stands at 308." (Author)] Address: Dow, R.A., Naturalis Biodiversity Centre, P.O. Box 9517, 2300 RA Leiden, The Netherlands; Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia. Email: rory.dow230@yahoo.co.uk

17542. Dow, R.A.; Zhang, H.-m. (2021): First description of the female of *Coeliccia furcata* Hämäläinen, 1986, with descriptive notes on males from Yunnan, China (Odonata: Zygoptera: Platycnemididae). *Zootaxa* 4974(1): 151-164. (in English) ["*Coeliccia furcata* Hämäläinen, 1986, an atypical species of *Coeliccia* Kirby, 1890 with bifurcated male cerci, had been known solely from the holotype male collected in Myanmar in 1938. In recent years the species has been rediscovered in Yunnan, China. The first description of the female is given, along with descriptive notes on the male and illustrations of both sexes, including fresh images of the holotype. Another of the unusual features of *C. furcata* is the extremely simple form of its penile organ, this is discussed and compared with other species from mainland Asia and Japan currently placed in *Coeliccia* and with a simple penile organ." (Authors)] Address: Dow, R.A., Naturalis Biodiversity Centre, P.O. Box 9517, 2300 RA Leiden, The Netherlands. Email: rory.dow230@yahoo.co.uk

17543. Dow, R.A.; Butler, S.G.; Ngiam, R.W.J.; Reels, G.T. (2021): Previously unpublished Odonata records from Sarawak, Borneo, part V: Odonata from the southwest of Sarawak, including the first records from the Bungo Range National Park. *International Dragonfly Fund - Report* 159: 1-77. (in English) ["Records of Odonata from three administrative divisions in the southwest of Sarawak (Kuching, Samarahan and Serian), mostly made during field work funded by the International Dragonfly Fund and the Sarawak Museum Campus Project, are presented. In the first part of the paper 176 species are listed, of which *Burmagomphus plagiatus* Lieftinck, 1964 was recorded from Sarawak for the first time during this study and one or possibly two unnamed

Onychogomphus sensu lato species were recorded from Borneo for the first time (one from a single female, the other from an exuvia). *Gynacantha maclachlani* is also recorded from Sarawak for the first time. The first records of Odonata from the Bungo Range National Park are included here. Other notable records include *Drepanosticta drusilla*, *D. kosterini*, *Podolestes chrysopus*, *Libellago stigmatizans*, *Rhinocypha aurofulgens* (recorded from southwest Sarawak for the first time), *Bornargiolestes reelsi*, *Amphicnemis madelenae*, *A. rigiketiti*, *Burmagomphus insularis*, *Gomphidia abbotti*, *Macrogomphus albardae*, *Macromia arachnomima*, *M. callisto* and *Nannophyopsis chalcosoma*. The importance of kampung (village) lands, still mostly farmed by traditional methods and presenting a mosaic of different habitat types in close proximity to each other, for conservation is discussed briefly, taking the Gomphidae as an example. In the second part of the paper some taxonomic issues are discussed and some molecular data is included. Bornean *Libellago stigmatizans* are shown to be indistinguishable from *L. stictica* (Selys, 1859) using COI based DNA barcoding, but the two are clearly separated in ITS. *Gomphidia caesarea* Lieftinck, 1929 is considered to be a junior synonym of *Gomphidia abbotti*, variation in *G. abbotti* is discussed and DNA barcoding data for *G. abbotti* and *G. maclachlani* is presented. The status of *Macrogomphus abnormis* Selys, 1884 is discussed and some COI data is presented to support the view that two species have been treated as *M. parallelogramma* in Borneo until now (an issue that will be dealt with in much more detail in a future paper). One of the *Onychogomphus sensu lato* species is discussed and illustrated from a female and illustrations of the female of "*Phaenandrogomphus*" *safei* are presented for the first time. A detailed list of previously unpublished specimens from the locations covered is given in an appendix and details of specimens used in the molecular analyses are given in a second appendix." (Authors)] Address: Dow, R.A., Naturalis Biodiversity Centre, P.O. Box 9517, 2300 RA Leiden, The Netherlands. E-mail: rory.dow230@yahoo.co.uk

17544. Dow, R.A.; Morris, J.R. (2021): The old Odonata (Insecta) Collection of the Sarawak Museum. *Sarawak Museum Journal* LXXX1, No. 101 (New Series); Special Issue 10: 261-311. (in English) ["The old Odonata collection of the Sarawak Museum has been examined and re-identified. An annotated list of the species and specimens present in the collection is given, along with remarks about the locations where they were collected. A total of 378 specimens are present in the collection, 356 of which are from or assumed to be from Sarawak, the remaining 22 specimens are from Sabah (all from Mount Kinabalu). In total, at least 89 species are represented in the collection, however the condition (or sex in some cases) of approximately 15% of the specimens precludes definite identification to species. The collection includes the holotype of *Orchithemis xanthosoma*, one of the syntypes of *Pseudagrionoptera diotima* and paratypes of *Podolestes harrissoni* and *Ictinogomphus acutus*. Other significant material includes the only specimen of *Euphaea ameeke* known from Limbang Division, the only specimen of *Gynacantha bayadera* from Sarawak and a series of

Chlorogomphus specimens." (Authors)] Address: Dow, R.A., Naturalis Biodiversity Centre, P.O. Box 9517, 2300 RA Leiden, The Netherlands; Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia. Email: rory.dow230@yahoo.co.uk

17545. El-Latief, M.E.A.; Elsayed, K.; Abdelrahman, M.M. (2021): Parametric study of a corrugated airfoil in a forward flight at ultra-low Reynolds number. SN Applied Sciences volume 3, Article number: 112 (2021): (in English) ["In the current study, the mid cross section of the dragonfly forewing was simulated at ultra-low Reynolds number. The study aims to understand better the contribution of corrugations found along the wing on the aerodynamic performance during a forward flight. Different flapping parameters were employed. FLUENT solver was used to solve unsteady, two-dimensional, laminar, incompressible Navier–Stokes equations. The results revealed that any stroke amplitude less than 1cm generated no thrust force. The stroke amplitude had to be increased to form the reversed Kármán vortices responsible for generating thrust force. The highest propulsive efficiency was found in the Strouhal number range $0.2 < St < 0.4$ with a peak efficiency of 57% at $St = 0.39$. Changing the phase difference between pitching and plunging motions from advanced to synchronized caused lift force to drop 91% and thrust force to increase by 15%. On the other hand, changing the phase difference from synchronized to delayed caused lift and thrust forces to increase by 89% and 36%, respectively, and propulsive efficiency to deteriorate significantly. In all performed simulations, the airfoil was assumed to start motion from rest with no initial angle of attack. The increase in initial angle of attack generates a very high lift force with a fair loss for both thrust force and propulsive efficiency. The decomposition of flapping motion into its elementary motions revealed that the aerodynamic forces generated are a non-linear superposition from both pure pitching and pure plunging aerodynamic forces. This can be attributed to the non-linear interaction between unsteady vortices generated from these decomposed motions." (Authors)] Address: Abdelrahman, M.M., Mechanical Engineering Dept, College of Engineering & Technology, Smart Village Campus, Arab Academy for Science, Technology and Maritime Transport, Giza 12577, Egypt

17546. Eriksen, E.; Friberg, N.; Brittain, J.E.; Søli, G.; Ballot, A.; Årstein-Eriksen, E.; Blakseth, T.A.; Veiteberg Braaten, H.F. (2021): Ecological condition, biodiversity and major environmental challenges in a tropical river network in the Bago District in South-central Myanmar: First insights to the unknown. Limnologia 86 (2021) 125835: 12 pp. (in English) ["Freshwater ecosystems in the Indo-Burma biodiversity hotspot face immediate threats through habitat loss and species extinction. Systems to monitor ecological status and trends in biodiversity are therefore crucially needed. Myanmar is part of Indo-Burma but with no past experience of biomonitoring in freshwaters. In this study, we aimed to assess the ecological and biodiversity status of a lowland

river network in south-central Myanmar by identifying and quantifying pressures using macroinvertebrates as bioindicators. Novel data on water quality (nutrients, sediments and metals), hydromorphology (Morphological Quality Index; MQI), habitat quality (Litter-Siltation Index; LSI), land use, and macroinvertebrates were collected from 25 river sites. The dominant pressures on rivers were urban land use, inputs of untreated sewage, in-stream and riparian garbage littering, run-off from agricultural fields and plantations, as well as physical habitat degradation. Water chemistry data indicated inputs of sediments and nutrients to degraded streams, but no obvious metal pollution. The LSI and MQI indices indicated high perturbation in agricultural and urban areas, respectively. Ecological status was assessed using a first version of a modified Average Score per Taxon index (ASPT), while biodiversity was assessed by family richness within the orders Ephemeroptera, Plecoptera, Trichoptera, Coleoptera and Odonata (EPTCO), which was tested against the pressure gradient by principal component regressions. ASPT had high diagnostic capabilities ($R^2 = 0.68$, $p < 0.001$) and showed that the index can be used to evaluate ecological water quality in this region. Biodiversity, expressed as family richness, also declined along the gradient ($R^2 = 0.59$, $p = 0.041$), giving support to the fact that current land-use practices in this area are unsustainable." (Authors)] Address: Eriksen, E., Norwegian Institute for Water Research (NIVA), Gaustadalléen 21, 0349, Oslo, Norway

17547. Everling, S. (2021): The effect of temperature on the interaction between larvae of a native and a range expanding dragonfly species. MSc. thesis, Biology Education Centre and Department of Ecology and Genetics, Uppsala University: 26 pp. (in English) ["Climate change might affect the distribution of species; therefore, it is important to anticipate the imminent impact of climate change. Even though climate responses have the potential to affect species interactions, most models on the effect of climate change on species distribution assume that species respond to climate individually. Hence studies on competition effects are needed. In this study, I estimated growth, mortality, and behaviour (prey capture success, activity, exploration and boldness) at 20° C and 23° C at intra- and interspecific competition conditions in larvae of a native and a northward dispersing dragonfly. The results showed that the northward expanding *Sympetrum fonscolombii* had a higher growth and survival rate compared to the native *Sympetrum vulgatum* at interspecific conditions. At intraspecific conditions the results showed that temperature had no significant effect on the performance of *S. fonscolombii*, but *S. vulgatum* showed both a higher growth rate and a higher mortality at 23° C. A significant difference between temperatures within prey capture success rate was found in *S. vulgatum* only, during the second observation period. There was a correlation between activity and exploration in both species, between prey capture success rate and activity during the third observation round in *S. vulgatum*, and between prey capture success rate and boldness during the first observation round in *S. fonscolombii*. No other behaviours were correlated. Prey capture success rate was shown to be repeatable in both

species, while boldness was repeatable in *S. vulgatum* only. The behavioural results suggests that behavioural traits are relatively plastic over ontogeny in both species, possibly caused by behavioural variation within each instar. Additionally, boldness, but not activity and exploration, might aid *S. fonscolombii* in their northward expansion. The majority of these results were similar at both temperatures and indicate that *S. fonscolombii* has a higher capacity to tolerate climate change, and their presence might negatively impact the performance of *S. vulgatum*." (Authors)] Address: Everling, S., Uppsala Univ., Disciplinary Domain of Science & Technology, Biology, Biology Education Centre

17548. Faasen, T. (2021): *Inpabasis intermedia*, a new species of damselfly from Peru (Odonata: Coenagrionidae); with an illustrated key to all known *Inpabasis*-species. *International Journal of Odonatology* 24: 95-107. (in English) ["*Inpabasis intermedia* sp. n. (holotype ♂: Peru, Loreto Region) is described and illustrated. An illustrated key to both sexes is given for all members of the genus. Males of *I. intermedia* can be distinguished from its congeners by the angled division laterally between dark and light areas of the pterothorax, by the short unbranched paraprocts and rounded cerci which bear only a small apical tooth and by the genital ligula with two long apical processes ending in a flattened hook. Females can be distinguished by the dorso-posteriorly directed posterior prothoracic lobe with straight hind margin." (Author)] Address: Faasen, T., Ecologica, Rondven 22, 6026 PX Maarheeze, The Netherlands. E-mail: tim.faasen@ecologica.eu

17549. Fabian, J.M.; Wiederman, S.D. (2021): Spike bursting in a dragonfly target-detecting neuron. *Scientific Reports* 11(4005) (2021): 6 pp. (in English) ["Dragonflies visually detect prey and conspecifics, rapidly pursuing these targets via acrobatic flights. Over many decades, studies have investigated the elaborate neuronal circuits proposed to underlie this rapid behaviour. A subset of dragonfly visual neurons exhibit exquisite tuning to small, moving targets even when presented in cluttered backgrounds. In prior work, these neuronal responses were quantified by computing the rate of spikes fired during an analysis window of interest. However, neuronal systems can utilize a variety of neuronal coding principles to signal information, so a spike train's information content is not necessarily encapsulated by spike rate alone. One example of this is burst coding, where neurons fire rapid bursts of spikes, followed by a period of inactivity. Here we show that the most studied target-detecting neuron in dragonflies, CSTMD1, responds to moving targets with a series of spike bursts. This spiking activity differs from those in other identified visual neurons in the dragonfly, indicative of different physiological mechanisms underlying CSTMD1's spike generation. Burst codes present several advantages and disadvantages compared to other coding approaches. We propose functional implications of CSTMD1's burst coding activity and show that spike bursts enhance the robustness of target-evoked responses." (Authors) Author-correction: Spike bursting in a dragonfly target-detecting neuron. Joseph M. Fabian & Steven

D. Wiederman. *Scientific Reports* volume 11, Article number: 9596 (2021) Cite this article. The Original Article was published on 17 February 2021. Correction to: *Scientific Reports* <https://doi.org/10.1038/s41598-021-83559-5>, published online 17 February 2021. This Article contains errors in Reference 13 which is incorrectly given as: Evans, B. J. E., Fabian, J. M., O'Carroll, D. C. & Wiederman, S. D. Dragonfly visual neurons selectively attend to features in naturalistic scenes. *J. Neurosci.* 39, 8051 (2020). The correct Reference 13 appears below as Reference 1. 1. Evans, B. J. E., Fabian, J. M., O'Carroll, D. C. & Wiederman, S. D. Dragonfly visual neurons selectively attend to features in naturalistic scenes. *J. Neurosci.* 39, 8051 (2020). bioRxiv 2020.09.14.-297374.] Address: Fabian, J.M., Centre for Neuroscience, Flinders University, Adelaide, SA, Australia. E-mail: Joseph.fabian@finders.edu.au

17550. Febriantim, N.A.; Murwitaningsih, S.; Sukandar, P.; Lestari, S. (2021): Dragonfly community in flowing and stagnating water in the Cibodas Botanical Garden Area. *IOP Conference Series: Earth and Environmental Science* 755: 7 pp. (in English) ["The diversity of dragonflies in Indonesia is quite high, namely about 750 species or 12.5% of the total in the world. This study aims to determine the dragonfly community ... in the Cibodas Botanical Garden Area. The research method used was a descriptive exploratory method, while the data collection technique used the Catch and Release technique (TLK). Data analysis in this study used descriptive analysis. Data collection was carried out in May-July 2018. The locations included in the flowing water group were Sakura Park and Ciismun Waterfall, while Air Mancur and Guest House were included in the stagnant water group. The results showed that there were 8 types of dragonflies identified, namely *Orthetrum pruinosum*, *O. sabinia*, *O. glaucum*, *Pantala flavescens*, *Neurothemis fluctuans*, *N. terminata*, *Ischnura senegalensis*, *Coeliccia membranipes*. The most common species found was *P. flavescens* with 533 individuals, while the least species found was *Neurothemis terminata* with 4 individuals. Zygoptera was found only in 2 types in this study, namely the *C. membranipes* with the number of 101 individuals and *I. senegalensis* with the number of 19 individuals. The dominant types of dragonflies in flowing and stagnant water are *P. flavescens* and *O. pruinosum*. The *C. membranipes* dragonfly was only found in running water, namely at the location of the Ciismun waterfall and *Ischnura senegalensis* only found in stagnant water, namely at the location of the fountain." (Authors)] Address: Febriantim, N.A., Biology Education, University of Muhammadiyah, Prof. DR. HAMKA, Jakarta, Indonesia 13830

17551. Felker, A.S. (2021): New damselflies of the family Kennedyidae (Odonata: Protozygoptera) from the upper Permian deposits of the Volgogda region. *Palaeontological Journal* 4/2021: 41-49. (in Russian, with English summary) ["*Kennedyya suchonensis* sp. nov. is described from Upper Permian (Severodvinian) deposits of the Isady locality (Vologda Region, Velikoustyugsky District). Despite the continuity of the main features of wing venation, new species has

an unusual structure of the stem's discoidal area. This structure is not typical of known Paleozoic damselflies, which allows us to re-consider the morphogenesis of this structure. The evolutionary relationships between damselflies of Isady and other kenedyids are discussed." (Author)] Address: Felker, A.S., Borissiak Paleontological Institute, Russian Academy of Sciences, Moscow, Russia

17552. Ferreras-Romero, M.; Suhling, F. (2021): On the dimorphism shown by the females of *Boyeria irene* (Odonata: Aeshnidae) in a southern Spain population. *Libellula Supplement* 16: 115-125. (in German, with English and Spanish summaries) ["A special feature of *B. irene* is a dimorphism of the females, which can have long (f. *typica*) or short (f. *brachycerca*) cerci, which occur at different frequencies. The aim of this work was to investigate whether there is a seasonal change in the occurrence of the two female forms. The exuviae investigated here belong to a population that lives in a permanent highland stream in the central part of the Sierra Morena in the province of Córdoba (Spain) in the southern part of the Spanish distribution area. Female exuviae of the *brachycerca* form accounted for 76.4 to 85.2% in the four years examined, while the annual frequency of the *typica* form varied between 14.8 and 23.6%. In two of the study years, the proportion of the *typica* form decreased during the emergence period. Obviously, this is not a pattern that always occurs, but it must nevertheless be considered in the further analysis of the numerical relationships between the female forms." (Authors)] Address: Ferreras-Romero, M., Depto Sistemas Físicos, Químicos y Naturales. Univ. Pablo de Olavide, 41013 Sevilla, Spain. E-mail: mferrom@upo.es

17553. Fliedner, H. (2021): The scientific names of Ris' odonate taxa. *International Dragonfly Fund - Report* 155: 1-145. (in English, with German summary) ["An explanation is presented for each of the more than 300 scientific names given to odonate taxa by the Swiss odonatologist Friedrich Ris (1867-1931), likewise for the names by other authors, into which taxa named (or mistaken) by Ris are now classified. But prior to that part, information is given about the life and work of this scientist. Finally his preferences in odonological nomenclature are analysed and his importance for the taxonomy of Odonata is appraised." (Author)] Address: Fliedner, H., Louis Seegelken Str. 106, 28717 Bremen, Germany. E-mail: H.Fliedner@t-online

17554. Flöss, I. (2021): Individuelle Raumnutzung und Wiedersichtungsrate von *Somatochlora flavomaculata* in einer voralpinen Moorlandschaft (Odonata: Corduliidae). *Libellula Supplement* 16: 127-140. ["Individual spatial movements and resighting rates of *S. flavomaculata* in a prealpine mire landscape – In a part of a prealpine mire landscape near Wetzikon, Switzerland, a total of 292 mature males and seven females were individually marked either on their wings or legs in the summer of 1997. 85 males (30.5%) but no females were at least once resighted up to 49 days after marking. Of the wingmarked individuals 33.8% were resighted and 21.3% of the leg-marked ones. There was a

considerable difference between the resighting rates from the first half of the season and the second half due to a longer spell of bad weather in June and July. Multiple resightings within the same day showed that some males relocated their territories only slightly within several hours, whereas some males changed the sites up to 100 m distance. The great time intervals sometimes observed between resightings and, additionally, the resighting of five males up to 1.7 km outside the study area indicate that *S. flavomaculata* moves of a large scale within the mire landscape and thereby even overcomes dense forests." (Author)] Address: Flöss, Isabelle, Langrütistr. 2, 8800 Thalwil, Switzerland. E-mail: isabelle.floess@bluewin.ch

17555. Fraker, M.E.; Ludsin, S.A.; Luttbeg, B.; Denver, R.J. (2021): Stress hormone-mediated antipredator morphology improves escape performance in amphibian tadpoles. *Scientific Reports* 11(4427): 9 pp. (in English) ["Complete functional descriptions of the induction sequences of phenotypically plastic traits (perception to physiological regulation to response to outcome) should help us to clarify how plastic responses develop and operate. Rapid tadpoles express several plastic antipredator traits mediated by the stress hormone corticosterone, but how they influence outcomes remains uncertain. We investigated how predator-induced changes in the tail morphology of wood frog (*Rana sylvatica*) tadpoles influenced their escape performance over a sequence of time points when attacked by larval dragonflies (*Anax junius*). Tadpoles were raised with no predator exposure, chemical cues of dragonflies added once per day, or constant exposure to caged dragonflies crossed with no exogenous hormone added (vehicle control only), exogenous corticosterone, or metyrapone (a corticosteroid synthesis inhibitor). During predation trials, we detected no differences after four days, but after eight days, tadpoles exposed to larval dragonflies and exogenous corticosterone had developed deeper tail muscles and exhibited improved escape performance compared to controls. Treatment with metyrapone blocked the development of a deeper tail muscle and resulted in no difference in escape success. Our findings further link the predator-induced physiological stress response of rapid tadpoles to the development of an antipredator tail morphology that confers performance benefits." (Authors)] Address: Fraker, M.E., Dept of Evolution, Ecology & Organismal Biology, The Ohio State University, Columbus, OH 43212, USA. E-mail: mfraker@umich.edu

17556. Freienstein, F.M.; Fartmann, T.; Löffler, F. (2020): Libellengemeinschaften extensiv genutzter Karpfenteiche (Insecta: Odonata) - Schlüsselfaktoren für die Biodiversität und Empfehlungen für eine naturschutzgerechte Bewirtschaftung. *Berichte der Naturforschenden Gesellschaft der Oberlausitz* 28: 3-20. (in German, with English summary) ["Dragonfly communities of extensively managed carp ponds (Insecta: Odonata) - key factors for biodiversity and recommendations for management in accordance with nature conservation Owing to the drastic loss of natural freshwater habitats over recent decades, anthropogenic waterbodies are taking on an increased significance for the

conservation of biodiversity. The value of traditionally managed carp-pond complexes for biodiversity is well known. Nevertheless, the periodic draining of ponds for harvesting and high fish-stocking intensities are assumed to have negative effects on biodiversity. However, empirical studies of the impact of carp farming on pond biodiversity are still scarce. In this study, we analyzed the effects of habitat quality and pond management on odonate communities in an extensively managed carp-pond complex in Oberlausitz (Saxony, Germany). The study sites included farmed carp ponds characterized by various habitat structures and stocking intensities as well as abandoned carp ponds and new ponds created for species conservation. The carp-pond complex hosted a very high diversity of dragonflies, which can mainly be attributed to the small-scale coexistence of different management regimes and habitat structures. The most important factors for a high species diversity of odonates were a high structural diversity and a short duration of the drained period. The different pond types harbored distinct odonate assemblages. Owing to the sensitivity of several odonate species to drought, the existence of perennial conservation ponds had a substantial significance for preserving species richness in the study area. Nevertheless, even the ponds with the longest drainage phases hosted odonate species of high conservation concern. The results of this study underline that traditional carp farming can promote odonate diversity in Central European anthropogenic landscapes. Based on our results, we outline recommendations for pond management to maintain the biodiversity of carp ponds." (Authors)] Address: Freienstein, M.T., Universität Osnabrück, Abteilung für Biodiversität & Landschaftsökologie, Barbarastr. 11, 49076 Osnabrück, Germany. E-mail: max.freienstein@uos.de

17557. Frömel, T.; Frank, M. (2020): Paarungsversuch von *Sympecma fusca* und *Lestes virens* (Odonata: Lestidae). *Libellen in Hessen* 13: 89-92. (in German) [25.06.2019, „Weilbacher Kiesgruben“, Main-Taunus-Kreis, Hessen, Germany, *Sympecma fusca* male and *Lestes virens* female] Address: Frank, M., Zur Traubenmühle 5A, 55268 Nieder-Olm, Germany. E-mail: mikel.frank@gmx.de

17558. Fukaya, W. (2021): Record of a gynandromorph *Anaciaeschna martini* (Seiys, 1897). *Tombo* 63: 66-67. (in Japanese, with English summary) ["A gynandromorph *A. martini* was recorded from Shakuji-mpark, Tokyo. Although it is morphologically almost female, it has blue regions characteristic of a male in the ventral part of the right compound eye." (Authors)] Address: Fukaya, W. E-mail: tochigi@au.com

17559. Gajbe, P.U. (2021): Impact of a small artificial water source on the diversity of odonates (Insecta: Odonata) in an urban landscape. *Arthropods* 10(2): 60-65. (in English) ["Rapid urbanisation is mainly responsible for the degradation and fragmentation of natural ecosystems in urban areas. Odonata constitute an important part of urban biodiversity. The odonate larval stage is aquatic and being dependent on freshwater ecosystems, odonates are often

used as ecological indicators for such ecosystems. Both larval and adult odonates are carnivorous and prey on other insects including mosquitoes. Hence, they perform an important role as predators in the ecosystems where they are found. In this study, the impact of a small artificial water source on the diversity of odonates in an urban landscape has been evaluated. The impact of the water source was found to be positive as its availability resulted in an increase in odonate diversity." (Authors)] Address: Gajbe, P.U., Dept Zool., Shri Mathuradas Mohota Coll. Scien., Nagpur 440024, Maharashtra, India. E-mail: pgajbe884@gmail.com

17560. Galasso, P.; Amore, E.; Ientile, R.; Signorello, G. (2021): Odonata checklist of Nature Reserve "Complesso Speleo logico Villasmundo - S. Alfio" (Sicily, Italy). *Biodiversity Journal* 12(1): 205-211. (in English) ["From March to September 2018 and 2019, a first monitoring of Odonata promoted by CUT GANA was conducted inside the Nature Reserve named "Complesso Speleologico Villasmundo - S. Alfio", in Melilli (Syracuse), in south-eastern Sicily. A total of 18 different species were recorded, 6 belonging to the Zygoptera suborder and 12 to the Anisoptera suborder, including *Onychogomphus uncatatus* and *Libellula fulva*. Some information on uncommon species recorded in the neighbouring areas are also reported." (Authors)] Address: Galasso, P., Stiftung Pro Artenvielfalt®, Meisenstraße 65, 33607 Bielefeld, Germany. E-mail: paolo_galasso@hotmail.com

17561. Garcia Junior, M.D.N.; Damasceno, M.T.; Martins, M.J.L.; Silva da Costa, T.; Ferreira, R.M.; Souto, R.N.P. (2021): New records of dragonflies and damselflies (Insecta: Odonata) from Amapá state, Brazil. *Biota Neotropica* 21(1): e20201074, 2021: 7 pp. (in English, with Portuguese summary) ["This study aims to present the results of the survey of Odonata species sampled in three counties in the state of Amapá. The state is located in the north of the country, inserted in the Amazon Biome. Odonata were caught between January and December 2018, with 472 specimens being sampled, belonging to seven families, 36 genera and 53 species. In total, 27 of the species found during the study correspond to new records for the state of Amapá. Due to the lack of information on the diversity of the Odonata order in Amapá, the list of species presented should serve as input for new studies contributing to the knowledge of the order in the state." (Authors)] Address: Garcia Junior, M.D.N., Universidade Federal do Amapá, Programa de Pós-Graduação em Biodiversidade Tropical, Macapá, AP, Brasil. E-mail: m.d.juniorbio@gmail.com

17562. Garcia-Junior, M. D. N., Damasceno, M. T. dos S., Costa, T. S. da, & Souto, R. N. P. (2021): Data from diversity of Zygoptera (Odonata) in the state of Amapá, Brazil. *Anales de Biología* 43: 101-109. (in English, with Portuguese summary) ["The Amapá is located in northern Brazil, numerous groups are little studied in the state, among them the order Odonata. The objective of the present work is to present data on the diversity of Amapá Damselflies. Sampling was carried out between the years 2018 and 2019. Were captured 602 individuals, of which, 26 species are

new records for the state. The Amapá has so far registered 58 species of Zygoptera, inserted in 27 genera and seven families. Coenagrionidae, with 45 species registered comprised the highest abundance during the study with approximately 81% of the captured organisms. The present work increases the number of species of zygopterans by 44% for the state, thus, the results found acquire high relevance in the recognition of the diversity of the order Odonata in Amapá and the Amazon biome." (Authors)] Address: Garcia-Junior, M.D.N., Laboratory Arthropoda. Dept of Biological and Health Sciences, University Federal of Amapá, Amapá, Brasil. E-mail: m.d.juniorbio@gmail.com

17563. Garcia-Júnior, M.D.N.; Souto, R.N.P. (2021): Primeiro registro de Perilestidae (Odonata: Zygoptera) para o estado do Amapá, Brasil. *Biota Amazônia* 11(1): 85-86. (in Portuguese, with English summary) ["Perilestidae are insects of the order Odonata, in the Neotropical region the family comprises 19 species. For Brazil, it is confirmed by the time of occurrence of 12 species, being, in many Brazilian states there are no family records yet. The present paper reports the first occurrence record of Perilestidae (*Perilestes gracillimus* Kennedy, 1941) to the state of Amapá, Brazil. One specimen was collected in a forest environment on the banks of the Cajari River (0°34'09.7"S 52°10'33.5"W) in the month of december 2019. The area is located in the municipality of Laranjal do Jari, which is located south of the state of Amapá. The finding expands the distribution of the Perilestidae family in Brazil." (Authors)] Address: Garcia-Júnior, M.D.N., Programa de Pós-Graduação em Biodiversidade Tropical - PPGBio, Universidade Federal do Amapá (UNIFAP, Amapá, Brasil. E-mail: m.d.juniorbio@gmail.com

17564. Gazzola, A.; Balestrieri, A.; Scribano, G.; Fontana, A.; Pellitteri-Rosa, D. (2021): Contextual behavioural plasticity in Italian agile frog (*Rana latastei*) tadpoles exposed to native and alien predator cues. *J. Exp. Biol.* 224(9) /jeb.240-465: 11 pp. (in English) ["Predation is a strong driver for the evolution of prey behaviour. To properly assess the actual risk of predation, anuran tadpoles mostly rely on water-borne chemical cues, and their ability to evaluate environmental information is even more crucial when potential predators consist of unknown alien species. Behavioural plasticity – that is, the capacity to express changes in behaviour in response to different environmental stimuli – is crucial to cope with predation risk. We explored the defensive behaviour of *R. latastei* tadpoles when exposed to the chemical cues of two predator species, one native (dragonfly larvae) and one alien (red swamp crayfish). Firstly, we observed whether a plastic life history trait (i.e. hatching time) might be affected by native predatory cues. Secondly, we recorded a suite of behavioural responses (activity level, lateralization and sinuosity) to each cue. For assessing lateralization and sinuosity, we developed a C++ code for the automatic analysis of digitally recorded tadpole tracks. Hatching time seemed not to be affected by the potential risk of predation, while both predator species and diet affected tadpoles' defensive behaviour. Tadpoles responded to a predator threat by two main defensive strategies: freezing and 'zig-

zagging'. While the first behaviour had previously been reported, the analysis of individual trajectories indicated that tadpoles can also increase path complexity, probably to prevent predators from anticipating their location. We also recorded a decrease in lateralization intensity, which suggests that under predation risk, tadpoles tend to scrutinize the surrounding environment equally on both sides." (Authors)] An invader prowls the ponds and rivers of Northern Italy, taking out locals and threatening entire species; can they fight back? This is not a Hollywood movie; it's happening right now in the gentle streams of Lombardy and the chief intruders are alien red swamp crayfish. 'This highly invasive and voracious predator ... can have dramatic impacts on freshwater fauna and alter aquatic ecosystems', says Daniele Pellitteri-Rosa from the University of Pavia, Italy. The crayfish have already devastated one local species: the Italian agile frog (*Rana latastei*). But hope for this threatened species could lie in the form of the next generation. If embryos in frogspawn can sense a lurking threat, they may be able to alter when they hatch to stand a better chance of survival. Alternatively, tadpoles might be able to improve their odds by taking evasive action when danger looms. Pellitteri-Rosa and colleagues decided to find out how Italian agile frog embryos and tadpoles respond to local predators – such as dragonfly larvae, which they always reside alongside – and the crayfish invaders that threaten their future. Collecting both predators from nearby waterways, Andrea Gazzola fed them on Italian agile frog tadpoles, to make sure that they reeked of danger; predators release the alarming aroma of their dismembered victims in their vicinity. Then, Pellitteri-Rosa retrieved freshly laid Italian agile frog frogspawn from ponds in three nearby areas, taking them to the lab to find out whether the stench of feasting dragonfly larvae would affect when the tiny frog embryos emerged from their eggs. But it did not. The tiny embryos were unable to alter when they hatched to evade danger. So, how would the youngsters fare in later life when faced with peril? Filming 15 day old tadpoles swimming in a cup, Gazzola then infused 2 ml of water carrying the odour either of unfed predators or of predators that had recently dined on tadpoles, while continuing to record the tadpoles' reactions. Sure enough, when Giovanni Scribano and Alessandro Balestrieri (University of Pavia) and Andrea Fontana (Istituto Nazionale di Fisica Nucleare, Italy) scrutinised the movies, they found the tadpoles were afraid of the fed dragonfly larvae, freezing ~80% of the time, while the fasted dragonfly larvae were almost as terrifying for the tadpoles. And when the youngsters did move after catching a whiff of their predator, they wove around more, in a bid to throw off the hunters, and switched course in all directions, to keep an eye out all around. However, the tadpoles were less savvy when Gazzola added eau de crayfish to their water. Only the tadpoles retrieved from a pond where crayfish reside showed any sign of toning down their activity to evade detection. The tadpoles from ponds with few or no crayfish didn't alter their behaviour much, as if they didn't have a care in the world. However, when Gazzola added a dash of water from the container of fed crayfish to the youngsters' home, the developing amphibians became more wary. Even the tadpoles that did not

share their home ponds with crayfish were slightly more cautious, but less so than the youngsters from ponds where crayfish had already taken up residence. It seems that Italian agile frog tadpoles can learn to evade alien predators, probably by learning to associate the scent of devoured tadpoles with the invader's aroma. But Pellitteri-Rosa and colleagues are anxious that time might be stacked against survival for species that are already teetering on the brink.] Address: Pellitteri-Rosa, D., Dipartimento di Scienze della Terra e dell'Ambiente, Università di Pavia, I-27100 Pavia, Italy. E-mail: daniele.pellitterirosa@unipv.it

17565. Ge, Y.; Xia, C.; Wang, J.; Zhang, X.; Ma, X.; Zhou, Q. (2021): The efficacy of DNA barcoding in the classification, genetic differentiation, and biodiversity assessment of benthic macroinvertebrates. *Ecology and Evolution* 11(10): 5669-5681. (in English) ["Macroinvertebrates have been recognized as key ecological indicators of aquatic environment and are the most commonly used approaches for water quality assessment. However, species identification of macroinvertebrates (especially of aquatic insects) proves to be very difficult due to the lack of taxonomic expertise in some regions and can become time-consuming. In this study, we evaluated the feasibility of DNA barcoding for the classification of benthic macroinvertebrates and investigated the genetic differentiation in seven orders (Insecta: Ephemeroptera, Plecoptera, Trichoptera, Diptera, Hemiptera, Coleoptera, and Odonata) from four large transboundary rivers of northwest China and further explored its potential application to biodiversity assessment. A total of 1,144 COI sequences, belonging to 176 species, 112 genera, and 53 families were obtained and analyzed. The barcoding gap analysis showed that COI gene fragment yielded significant intra- and interspecific divergences and obvious barcoding gaps. NJ phylogenetic trees showed that all species group into monophyletic species clusters whether from the same population or not, except two species (*Polypedilum laetum* and *Polypedilum bullum*). The distance-based (ABGD) and tree-based (PTP and MPTP) methods were utilized for grouping specimens into Operational Taxonomic Units (OTUs) and delimiting species. The ABGD, PTP, and MPTP analysis were divided into 177 ($p = .0599$), 197, and 195 OTUs, respectively. The BIN analysis generated 186 different BINs. Overall, our study showed that DNA barcoding offers an effective framework for macroinvertebrate species identification and sheds new light on the biodiversity assessment of local macroinvertebrates. Also, the construction of DNA barcode reference library of benthic macroinvertebrates in Eurasian transboundary rivers provides a solid backup for bioassessment studies of freshwater habitats using modern high-throughput technologies in the near future." (Authors)] Address: Zhou, Q., Coll. Fisheries, Huazhong Agri. Univ., Wuhan 430070, China. E-mail: hainan@mail.hzau.edu.cn

17566. Geiger, M.; Koblmüller, S.; Assandri, G.; Chovanec, A.; Ekrem, T.; Fischer, I.; Galimberti, A.; Grabowski, M.; Haring, E.; Hausmann, A.; Hendrich, L.; Koch, S.; Mamos, T.; Rothe, U.; Rulik, B.; Rewicz, T.; Sittenthaler, M.; Stur, E.; Tonczyk, G.; Zangl, L.; Moriniere, J. (2021): Coverage and

quality of DNA barcode references for Central and Northern European Odonata. *PeerJ* 9:e11192 DOI 10.7717/peerj-11192: 31 pp. (in English) ["Background: Odonata are important components in biomonitoring due to their amphibiotic lifecycle and specific habitat requirements. They are charismatic and popular insects, but can be challenging to identify despite large size and often distinct coloration, especially the immature stages. DNA-based assessment tools rely on validated DNA barcode reference libraries evaluated in a supraregional context to minimize taxonomic incongruence and identification mismatches. Methods: This study reports on findings from the analysis of the most comprehensive DNA barcode dataset for Central European Odonata to date, with 103 out of 145 recorded European species included and publicly deposited in the Barcode of Life Data System (BOLD). The complete dataset includes 697 specimens (548 adults, 108 larvae) from 274 localities in 16 countries with a geographic emphasis on Central Europe. We used BOLD to generate sequence divergence metrics and to examine the taxonomic composition of the DNA barcode clusters within the dataset and in comparison with all data on BOLD. Results: Over 88% of the species included can be readily identified using their DNA barcodes and the reference dataset provided. Considering the complete European dataset, unambiguous identification is hampered in 12 species due to weak mitochondrial differentiation and partial haplotype sharing. However, considering the known species distributions only two groups of five species possibly co-occur, leading to an unambiguous identification of more than 95% of the analysed Odonata via DNA barcoding in real applications. The cases of small interspecific genetic distances and the observed deep intraspecific variation in *Cordulia aenea* are discussed in detail and the corresponding taxa in the public reference database are highlighted. They should be considered in future applications of DNA barcoding and metabarcoding and represent interesting evolutionary biological questions, which call for in depth analyses of the involved taxa throughout their distribution ranges." (Authors)] Address: Geiger, M., Zoologisches Forschungsmuseum Alexander Koenig (ZFMK) - Leibniz Institute for Animal Biodiversity, Bonn, Germany. E-mail: m.geiger@leibniz-zfmk.de

17567. González, R.C.; Jerkovic, M.; Arteaga, A.B. (2021): Insectos y arañas asociados a plantas ornamentales en David, Chiriquí, Panamá - Insects and spiders associated with ornamental plants in David, Chiriquí, Panama. *Aporte Santiaguino* 14(1): 9-20. (in Spanish, with English summary) ["The purpose of this work was to know the insects and spiders associated with ornamental plants in David, Chiriquí, Panama. For this, five random samplings were carried out in four locations, randomly selecting 35 plants which belong to 15 families and 20 species. The soil, branches and foliage levels were reviewed, manually collecting the arthropods found. The identification of the specimens was made by consulting specialized documentation and a photographic record was kept. The results obtained indicated that three species of spiders and 15 species of insects were associated with nine plant species. The predominant

spiders were *Argiope argentata* (Araneidae) and *Leucauge venusta* (Tetragnathidae). About defoliating insects, the Family Diapheromeridae (Phasmatodea) and *Oiketeticus kirbyi* (Lepidoptera: Psychidae), were found in Arecaceae; three species of Orthoptera associated with Toro grass, of which *Taeniopoda varipennis* (Romaleidae) stood out; Scarabaeidae and Chrysomelidae (Coleoptera) in *schefflera*. The biting-sucking species were represented by nymphs of *Blissus* sp. (Hemiptera: Blissidae) on Toro grass; *Aphis* sp. (Hemiptera: Aphididae) and *Coccus* sp. (Hemiptera: Coccidae), associated with ants (Hymenoptera: Formicidae); nymphs and adults of *Membracis mexicana* (Hemiptera: Membracidae), in *schefflera* shoots and damage by *Gynai-kothrips uzeli* (Thysanoptera: Phlaeothripidae) in *Ficus*. The predatory insects were represented by eggs and larvae of Chrysopidae (Neuroptera), found in *schefflera* and adults of *Orthemis ferruginea* (Odonata: Libellulidae), in water surfaces. The absence of parasitoids, pollinators and the low number of taxa found could be due to the use of synthetic pesticides, which breaks the trophic balance; although the surrounding wild vegetation can serve as a biological corridor for the species survival." (Authors)] Address: González, R.C., Univ. de Panamá. Facultad de Ciencias Agropecuarias, Chiriquí, Panamá. E-mail: rdcg31@hotmail.com

17568. González-Soriano, E.; Noguera, F.A.; Pérez-Hernández, C.X.; Zaragoza-Caballero, S.; González-Valencia, L. (2021): Patterns of richness, diversity and abundance of an odonate assemblage from a tropical dry forest in the Santiago Dominguillo Region, Oaxaca, México (Insecta: Odonata). *Biodiversity Data Journal* 9: e60980: 21 pp. (in English) ["A study on the patterns of richness, diversity and abundance of the Odonata from Santiago Dominguillo, Oaxaca is presented here. A total of 1601 specimens from six families, 26 genera and 50 species were obtained through monthly samplings of five days each. Libellulidae was the most diverse family (21 species), followed by Coenagrionidae (19), Gomphidae (4) and Calopterygidae (3). The Lestidae, Platystictidae and Aeshnidae families were the less diverse, with only one species each. *Argia* was the most speciose genus with 11 species, followed by *Enallagma*, *Hetaerina*, *Erythrodiplax* and *Macrothemis* with three species each and *Phyllogomphoides*, *Brechmorhoga*, *Dythemis*, *Erythemis* and *Orthemis* with two species each. The remaining 17 genera had one species each. *Argia pipila* Calvert, 1907 and *Leptobasis vacillans* Hagen in Selys, 1877 were recorded for the first time for the state of Oaxaca. We also analysed the temporal patterns of taxonomic and phylogenetic divergence for the Santiago Dominguillo Odonata assemblage: the Shannon diversity value throughout the year was 21.07 effective species, while the Simpson diversity was 13.17. In general, the monthly phylogenetic divergence was higher than expected for taxonomic distinctness, and lesser for average taxonomic distinctness. Monthly diversity, evenness and taxonomic divergence showed significant positive correlations (from moderate to strong) with monthly precipitation values. The analysis of our results, however, indicates that an increase in rainfall not only influences the temporal diversity of species, but

also the identity of supraspecific taxa that constitute those temporal assemblages, i.e. there is an increase in temporal phylogenetic divergence." (Authors)] Address: González-Soriano, E., Depto de Zoología, Instituto de Biología, UNAM, Ciudad de México, Mexico. E-mail: Enrique González-Soriano (esoriano@ib.unam.mx)

17569. Günther, A.; Nicolai, B.; Petzold, F.; Waldhauser, M.; Lange, M. (2021): Aktueller Kenntnisstand zur Verbreitung von *Erythromma lindenii* in Ostdeutschland und der Tschechischen Republik (Odonata: Coenagrionidae). *Libellula* 40(1/2): 107-135. (in German, with English and Czech summaries) ["State of knowledge of the occurrence of *E. lindenii* in Eastern Germany and the Czech Republic – In the 20th century, *E. lindenii* was restricted in eastern Germany to a sharply defined, discontinuous enclave, which included parts of Berlin and Brandenburg and extended to western Poland. These isolated populations have been described as the subspecies *E. lindenii lacustre* (Beutler, 1985). The type form is spreading from southwestern Germany to the northeast at least since the 1970s. This expansion of the distribution area led to the first record in Thuringia in 1997, followed by the first record in Saxony-Anhalt from 2000. The first record in Saxony was made in the year 2002. In this case, however, a colonization from Brandenburg is more likely. The Czech Republic was probably colonized from Saxony (first recorded in 2009). The dispersal of the species accelerated considerably, especially in the years 2018 to 2020. In this study we present the current distribution of *E. lindenii* in East Germany and the Czech Republic. Large populations, becoming established in rivers like Saale (Thuringia), Mulde (Saxony) and Berounka (Bohemia), most probably have a key role in the very dynamic expansion of the species in the last few years. This colonization was obviously promoted by mild winters. Furthermore, we suspect positive effects to larval habitats in winter-green submerged vegetation through shorter and less deep freezing of the water bodies in the last years. We do not yet have any indications of direct contacts between the sub-populations of the isolated and the main range. However, this will undoubtedly take place in the next few years." (Authors)] Address: Günther, A., Naturschutzzentrum Freiberg, B.-Kellermann-Straße 20, 09599 Freiberg, Germany. E-mail: andre.guenther@extern.tu-freiberg.de

17570. Günther, A.; Lange, M.; Palfi, I. (2021): Erste Nachweise von *Coenagrion scitulum* in Ostdeutschland (Sachsen) deuten auf einen neuen Einwanderungsweg der Art hin (Odonata: Coenagrionidae). *Libellula* 40(1/2): 47-56. (in German, with English summary) ["First records of *C. scitulum* in Eastern Germany (Saxony) suggests a new migration route of the species – In the years 2019 and 2020 *C. scitulum* was recorded in Saxony and Eastern Germany for the first few times. On 06-vii-2019 a single male was photographically documented in the post-mining landscape of the former Berzdorf open-cast lignite mine south of Görlitz in SE Saxony (UTM: VS95). In 2020, at least four single individuals were discovered on a former military training area near Glauchau in SW Saxony (UTM: US23). It is unclear

whether these individuals immigrated in 2020 or were also due to an immigration in 2019 and subsequently successful reproduction. So far, no reproductive behaviour of the species has been observed in Saxony. The geographical location of the closest localities of the species suggests a new, southern migration route from the Czech Republic. This route could become important for the expansion in eastern Germany and western Poland in future years.] Address: Günther, A., Naturschutzzentrum Freiberg, B.-Kellermann-Str. 20, 09599 Freiberg, Germany. E-mail: andre.guenther@extern.tu-freiberg.de

17571. Guillermo-Ferreira, R.; Gorb, S.N. (2021): Heat-distribution in the body and wings of the morpho dragonfly *Zenithoptera lanei* (Anisoptera: Libellulidae) and a possible mechanism of thermoregulation. *Biological Journal of the Linnean Society* 133(1): 179-186. (in English) ["Animals that live in hot environments must deal with extreme temperatures and overcome the constraints imposed by overheating. Some species exhibit remarkable adaptations to control body temperature, usually in the form of structures that act as thermal windows to cool down the body by dissipating heat. Here, we describe the case of *Z. lanei*, which inhabits open areas in the Neotropical Savannah and the Amazon. Males have striking and unique adaptations on the wings, not known in any other insect. The wings are covered with wax nanocrystals that reflect ultraviolet light and infrared radiation. Furthermore, the wing membrane is permeated by an intricate system of tracheae, another unique trait in Insecta. We hypothesized that these adaptations might be important not only for intraspecific communication, but also for thermoregulation. We analysed male body and wing temperatures and compared them with another dragonfly with common translucent wings. The results suggest that the dorsal wing surface acts as a cooling system, whereas the ventral surface might serve to elevate body temperature. Therefore, we conclude that *Z. lanei* possesses adaptations that are unique in nature; a complex system of thermoregulation with the dual function of cooling down or elevating body temperature, depending on wing position." (Authors)] Address: Guillermo-Ferreira, R., Department of Hydrobiology, Federal University of São Carlos (UFSCar), São Carlos, São Paulo, Brazil

17572. Haberski, A.; Hagelin, J.C.; Barger, C.P.; Sikes, D.S.; DuBour, K.A. (2021): An efficient method for sampling aerial arthropods at nest sites of an insectivorous songbird in steep decline. *Avian Conservation and Ecology* 16(2):1: 10 pp. (in English, with French summary) ["The decline of aerial insectivorous birds has been hypothesized to stem, in part, from a decline in aerial arthropod prey, underscoring the need for long-term monitoring of both bird and arthropod populations. However, trapping arthropods can be time consuming and efficient methods are required. Our primary goal was to identify the optimal combination of insect traps to collect taxonomic orders of prey in the diet of a songbird in steep decline, the Olive-sided Flycatcher (*Contopus cooperi*). Our secondary goal was to sample the arthropod community as broadly as possible, and thereby monitor for

general changes in arthropod assemblages, which may affect multiple species of migratory insectivores. In the boreal forest of central Alaska, we compared captures of canopy Malaise traps and three types of near-ground pollinator traps (blue vane traps, yellow vane traps, and chemically baited wasp traps) at 22 breeding territories where adult flycatchers actively foraged and bred. Combined, traps collected 11,193 specimens from 12 arthropod orders, of which moths (Lepidoptera, 36%), flies (Diptera, 34%), and wasps (Hymenoptera, 18%) were the most abundant, and also known components of flycatcher diets. General linear mixed models determined that canopy Malaise traps collected the greatest overall ordinal richness (11 orders) with a significantly greater abundance of specimens from six orders, two of which are aquatic specialists linked to breeding success of Tree Swallows (*Tachycineta bicolor*), another declining aerial insectivore. The three types of near-ground pollinator traps overlapped in taxa collected, but blue vane traps captured the most flies, bees, and yellowjackets, all of which were not well represented in Malaise samples. All trap types failed to collect dragonflies, a known prey item of breeding *C. cooperi*. We therefore conclude that a combination of canopy Malaise traps and blue vane traps, plus hand-netting of dragonflies, is an efficient combination for quantifying prey abundance on *C. cooperi* territories, while simultaneously monitoring the broadest possible number of arthropod orders near flycatcher nests within the boreal forest." (Authors)] Address: Haberski, A.; Dept of Plant & Environ. Scien., 277 Poole Agric. Center, Clemson Univ., Clemson, SC 29634-0310, USA. E-mail: habersk@clemson.edu

17573. Hämäläinen, M. (2021): An annotated list of individuals commemorated eponymously in scientific names of extant Odonata published in 2016 – 2020. *International Dragonfly Fund - Report 157*: 1-35. (in English) ["From 2016-2020, a total of 276 new scientific species-group and 11 genus-group names of extant Odonata were introduced. From these 124 species-group and 3 genus-group names are eponyms representing a total of 124 individuals. A list of these persons and associated taxa is provided. Additionally, the original etymologies of the taxon names are given verbatim together with references. The publication is a supplement to the catalogue published by the author: *International Dragonfly Fund – Report 92 (2016)*.] Address: Hämäläinen, M., Naturalis Biodiversity Center, P.O. Box 9517, 2300 RA Leiden, the Netherlands. E-mail: libellago@gmail.com

17574. Hafeez, B.; Malik, M.F.; Asghar, W.; Shabbir, R.; Latif, I.; Jabeen, A.; Basit, H.; Ghafoor, F. (2020): Diversity and distribution of dragonfly in District Sialkot, Punjab, Pakistan. *Pure Appl. Biol.* 10(4): 988-994. (in English) [In 2019, at 16 localities in four tehsils (Sialkot, Sambrial, Daska, Pasroor) a total of 185 odonate specimens was captured resulting in 10 species: *Pantala flavescens*, *Crocothemis erythraea*, *C. servilia*, *Neurothemis fluctuans*, *Acisoma panorpoides*, *Acisoma variegatum*, *Orthetrum prunosum*, *O. sabina*, *Anax indicus* and *A. ephippiger*.] Address: Hafeez, B., Dept of Zoology, University of Gujrat, Gujrat, Punjab-Pakistan. E-mail: burhanhafeez575@gmail.com

17575. Haneef, M.; Crasta, B.R.S.; Chandran, A.V. (2021): Report of *Bradinopyga konkanensis* Joshi & Sawant, 2020 (Insecta: Odonata) from Kerala, India. *Journal of Threatened Taxa* 13(8): 19173-19176. (in English) [1 ♂, Kidoor (12.633°N, 74.981°E, 32m), 20-v-2020] Address: Haneef, M., Department of Botany, Government Brennen College, Thalassery, Kannur, Kerala 670106, India. E-mail: haneefmangad@gmail.com,

17576. Hart, I.S.; Utz, R.M.; Taylor, A.N.; Chess, M.; Porter, B.A.; Locy, D.D. (2021): High conservation value of the Odonata assemblage in the upper Ohio River mainstem: A large, regulated river in North America. *The American Midland Naturalist* 185(2): 175-186. (in English) ["Like many large rivers in modern industrialized regions, the Ohio River mainstem is a heavily modified riverine habitat comprised of various reservoir-dam series and shaped channels, rather than a free-flowing system. However, many odonate species in such habitats, even species of conservation concern, have been shown to prosper in degraded lotic habitats due to key life history attributes, such as rapid recolonization following large disturbances. In this study we characterize the assemblage of odonates in a Pennsylvania section of the Ohio River mainstem and determined if any species of conservation concern were present. We also tested hypotheses on distributions in the channel by testing if proximity to banks and channel depths helped predict odonate abundance. Samples were acquired as bycatch to benthic fish sampling conducted using electrified benthic trawling, a novel approach for collecting benthic macroinvertebrates in large freshwater rivers. We found seven odonate species, all of which were known to be species of conservation concern in one or more U.S. states. We also concluded that gradients of bank distance and river depth only weakly predicted odonate abundance, suggesting that the Ohio River species regularly use mid-channel habitat that is several meters deep. Life histories of most of the species collected are typical of those living in large lotic, and occasionally lentic, environments. Studies of other large, temperate rivers show that the ability to persist is not uncommon for odonates in these modified environments, and may be due to their ability to use mid-channel resources successfully. Despite the substantial differences between contemporary and historic conditions of habitats in the Ohio River basin, an odonate assemblage worth conserving continues to be present in the mainstem channel." (Authors) *Stylurus notatus*, *S. scudderi*, *S. spiniceps*, *Gomphurus vastus*, *Macromia illinoensis*, *Didymops transversa*, *Argia translata*] Address: Hart, I.S., Falk School Sustainabil., Chatham Univ., 6035 Ridge Rd, Gibsonia, Pennsylvania 15044, USA. E-mail: ian.hart167@gmail.com

17577. Hasanah, M.; Rohman, F.; Susanto, F. (2021): Development of dragonfly bioecology E-book in empowering students' problem solving skills and environmental attitudes. *AIP Conference Proceedings* 2330, 030021 (2021); <https://doi.org/10.1063/5.0043241> Published Online: 02 March 2021: 9 pp. (in English) ["The research on the deve-

lopment of dragonfly bioecology e-book in empowering student problem-solving skills and environmental attitudes has been carried out. This study aims to produce a teaching material product of dragonfly bioecology e-book that valid and practical. This type of research is descriptive quantitative research. The research sample of 28 students who were randomly assigned to undergraduate students in the Biology Study Program at State University of Malang. The research used the ADDIE development model includes stages of analyze, design, develop, implement, and evaluate. Research data collection using questionnaires and problem-solving questions. The results showed this study obtained a very valid e-book (87.25%) and very practical (88%). A dragonfly bioecology e-book implemented with Problem Based Learning is also effective for empowering problem-solving skills and environmental attitudes. The gain score result of problem-solving skills is 0.39 (medium category), and the gain score result of environmental attitudes is 0.32 (medium category). The conclusion, the dragonfly bioecology e-book is effective in empowering student's problem-solving skills and environmental attitudes." (Authors)] Address: Hasanah, M., Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang, Indonesia. E-mail: miftahul.hasanah.1803418@students.um.ac.id

17578. Hasanah, M.; Rohman, F.; Susanto, H. (2021): Environmental indicators based on Odonata diversity around the springs in Malang Raya, East Java. *AIP Conference Proceedings* 2353(1): 030035-1-030035-5. (in English) ["This research was designed to determine the environmental condition based on Odonata diversity found around the springs in Malang, East Java. The research was carried out around the springs, which focused on the species, the number of individuals of Odonata, habitat, and physical condition of the environment. Visual observation was used by the VES method, then counting the number of species and number of individuals within a radius of 200 m from the springs as a focal point of observation. Data collection was done at 4 springs, including Kendedes, Jenon, Taman, and Cangar. The results showed that there were 17 species of Odonata from 7 different families, with a total number of individuals found from 4 Springs as many as 245 individuals. The most common type was *Agriocnemis femina* and *Orthetrum sabina*. The analysis also portrayed a moderate Odonata diversity index and that there was a correlation between the physical condition of the environment and the species of Odonata found in a habitat. This condition can be used to describe the structure of the Odonata community in the area." (Authors)] Address: Rohman, F., Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang, Jl. Semarang 5, Malang 65145, Indonesia. E-mail: fatchur.rohman.fmipa@um.ac.id

17579. Hu, F.-S.; Chan, T.-W.; Huang, L.-C.; Lee, I.-L. (2021): Description of the final instar larva of *Cephalaeschna risi* Asahina, 1981 with notes on its semi-terrestrial lifestyle (Odonata: Aeshnidae). *International Journal of Odonatology* 24: 139-148. ["The final instar larva of *Cephalaeschna risi* Asahina, 1981 is described for the first time based on

material from Taiwan. In Taiwan, the larva of *C. risi* can be separated from other aeshnid / larvae by its relatively short antennae and presence of small protuberances on the legs. Diagnostic characters to distinguish it from other known larvae of *Cephalaeschna* are also discussed. A comprehensive description, detailed illustrations, bionomics and observations of the semi-terrestrial lifestyle of *C. risi* are presented. Finally, a key to the genera of Aeshnidae in Taiwan is proposed." (Authors)] Address: Hu, F.-S., Dept of Entom., Nat. Chung Hsing Univ., No. 145, Xingda Rd., South Dist., Taichung City 402, Taiwan. E-mail: fangshuo_hu@smail.nchu.edu.tw

17580. Husband, D.M.; McIntyre, N.E. (2021): Urban areas create refugia for odonates in a semi-arid region. *Insects* 2021, 12(5), 431: 15 pp. (in English) ["In western Texas, most wetlands are fed from precipitation runoff, making them sensitive to drought regimes, anthropogenic land-use activities in their surrounding watersheds, and the interactive effect between these two factors. We surveyed adult odonates in 133 wetlands (49 in grassland settings, 56 in cropland, and 28 in urban areas) in western Texas from 2003–2020; 33 species were recorded. Most species were widespread generalists, but urban wetlands had the highest species richness, as well as the most unique species of any of the three wetland types. Non-metric, multidimensional scaling ordination revealed that the odonate community in urban wetlands was distinctly different in composition than the odonates in non-urban wetlands. Urban wetlands were smaller in surface area than the other wetland types, but because they were fed from more consistently available urban runoff rather than seasonal precipitation, they had longer hydroperiods, particularly during a multi-year drought when wetlands in other land-cover contexts were dry. This anthropogenically enhanced water supply was associated with higher odonate richness despite presumably impaired water quality, indicating that consistent and prolonged presence of water in this semi-arid region was more important than the presence of native land cover within which the wetland existed. Compared to wetlands in the regional grassland landscape matrix, wetlands in agricultural and urban areas differed in hydroperiod, and presumably also in water quality; these effects translated to differences in the regional odonate assemblage by surrounding land-use type, with the highest richness at urban playas. Odonates in human environments may thus benefit through the creation of a more reliably available wetland habitat in an otherwise dry region." (Authors)] Address: McIntyre, Nancy, Dept of Biological Sciences, Texas Tech University, Lubbock, TX 79409-3131, USA. E-mail: nancy.mcintyre@ttu.edu

17581. Huynh, T.Q.; Oyabu, A.; Nomura, S.; Takashima, T.; Usio, N. (2021): Do agrochemical-free paddy fields serve as refuge habitats for Odonata? *Ecologies* 2(1): 15 pp. (in English) ["Agrochemical-free rice farming has attracted interest for restoring paddy field biodiversity and producing safe food. Odonata are commonly used as a biodiversity indicator in these low-input farms. However, the effect of agrochemical-free rice farming on odonate diversity has rarely been

assessed over the entire emergence period of these insects. We investigated whether different farming practices, such as conventional or natural (agrochemical-and fertilizer-free) cultivation, and associated water management strategies affect the emergence rates of Odonata in paddy field landscapes in central Japan. Weekly exuviae sampling in 2017 and 2019 suggested that odonate assemblages differed between conventional and natural paddy fields, with a higher number of taxa emerging from natural paddy fields. Contrary to expectations, conventional paddy fields had equivalent or higher emergence rates of all Odonata and two numerically dominant *Sympetrum* species. Peak emergence periods for numerically dominant taxa differed between the farming types, with the emergence of three *Sympetrum* species peaking in late June in conventional paddy fields and that of *S. frequens* peaking in early to mid-July in natural paddy fields. Our findings suggest that both conventional and natural paddy fields are important habitats for Odonata in Japan." (Authors)] Address: Takashima, T., JA Haku Head Office, Haku 925-8588, Japan

17582. Iamba, K.; Waldi, D.; Kumawayo, I.; Elias, M. (2021): A rapid assessment of insect communities in Balsa plantations of East New Britain Province, Papua New Guinea. *International Journal of Entomology Research* 6(2): 109-115. (in English) ["Insect communities were documented across six (6) commercial Balsa plantations in East New Britain Province of Papua New Guinea. Gilalum recorded mostly Coleopterans (50%) while very few Hymenopterans (16.7%), Lepidopterans (16.7%), Orthopterans (16.7%) and Odonata (16.7%). Lepidopterans were common in Kaingaski (55.6%) when compared to other taxa. There were more lepidopterans (58.8%) in Klinwata plantation than other taxa while 23.5% consisted of Orthopterans. Laup plantation had 35.7% lepidopterans, 21.4% hymenopterans, 21.4% odonatans, 14.3% coleopterans and 7.1% orthopterans. Putput had a good representation of lepidopterans (56.2%) followed by coleopterans (28.1%) and orthopterans (9.4%). Putput plantation was the most diverse site having a total of 32 species which were uniformly distributed ($H=2.66$, $E=0.77$). Tanao had the second highest diversity with species richness of 19 which were evenly distributed within the site ($H=2.37$, $E=0.81$). Laup plantation had the third highest diversity of 14 species with uniform distribution ($H=1.93$, $E=0.73$). Klinwata followed with total of 17 species that were less uniform in their distribution within the plantation ($H=1.72$, $E=0.61$). Gilalum recorded 6 species that were not uniformly distributed within the plantation ($H=0.93$, $E=0.52$). Kaingaski plantation had the lowest diversity with 9 species that were poorly distributed within the study site ($H=0.79$, $E=0.36$). From the aforementioned results, we concluded that a plantation with vegetation heterogeneity, complex undergrowth, low anthropogenic disturbances, long-standing trees, strict conservation guidelines and effective monitoring is paramount to enhance species richness of insects." (Authors)] Address: Iamba, K., Dept of Agri., PNG Univ. Natural Res. & Environ., Private Mail Bag, Vudal, Papua New Guinea

17583. Jana, P.K.; Mallick, P.H.; Bhattacharya, T. (2021):

A study on the community structure of damselflies (Insecta: Odonata: Zygoptera) in Paschim Medinipur, West Bengal, India. *Journal of Threatened Taxa* 13(7): 18809-18816. (in English) ["For gauging suitability of zygopteran odonates as bioindicators of ecosystems, an attempt was made to record the seasonal diversity of damselflies from seven different types of habitats in Paschim Medinipur District, West Bengal covering 14 land use sites. The study revealed existence of 19 species of damselflies belonging to 10 genera under two families. While the riparian zone had maximum number of species (15), paddy field had the lowest number (six). *Ceriagrion coromandelianum* and *Agriocnemis pygmaea* were the most common species. *C. coromandelianum* was eudominant in grassland and wetland-forest interface, whereas *A. pygmaea* was eudominant in fish pond and paddy field. Six species, viz., *Paracerion calamorum*, *P. malayanum*, *Pseudagrion australasiae*, *P. decorum*, *P. spencei*, and *P. microcephalum* were confined only to the riparian zone. Maximum abundance of damselflies was found in the riparian zone and minimum in the paddy field. Damselflies exhibited a distinct peak in March–April and a lesser peak in September–October. Most of the land use patterns exhibited similar zygopteran faunal composition. Species diversity index was moderate (1.4–2.5) and evenness index was on the higher side (0.76–0.94). Dominance Index ranged from 26.2 to 64.6. Riparian zone appeared to be the least stressed and most equitable habitat with highest diversity and evenness index and lowest dominance index. Paddy field seemed to be the harshest habitat for damselflies with least diversity and highest dominance index. The present study suggests that community analysis of damselflies can be quite useful in the assessment of the quality of any ecosystem." (Authors)] Address: Jana, P.K., Dept Zool., Vidyasagar Univ., Midnapore, Paschim Medinipur, West Bengal 721102, India. E-mail: pathikjana@gmail.com,

17584. Janra, M.N.; Herwina, H. (2021): Parasitism on riparian dragonflies (Odonata) at biology education and research forest, Universitas Andalas. IOP Conf. Ser.: Earth Environ. Sci. 757 012083: 7 pp. (in English) ["Parasitism on dragonflies may become the least attention in most entomological studies in Indonesia, since it possesses much indirect effect to human being. The odonata parasitism is caused by the infestation of water mite larvae onto the body of adult dragonflies. In this paper we discuss the result of odonatological survey we did at two tributaries in Biology Education and Research Forest (BERF), Universitas Andalas. The survey had been conducted between August to November 2019. We recorded 17 dragonfly species bound to these tributaries, 12 Zygopterans and 5 Anispterans. Water mite infestation was observed to happen on four Zygopteran species and one Anisoptera. The highest prevalence was shown by *Orthetrum testaceum* (100%), followed by *Euphaea variegata* (16.67%), *Prodasineura verticalis* (14.29%), *Euphaea modigliani* (3.57%) and *Heliocypha angusta angusta* (0.85%). In overall, the prevalence on community level reached 3.29%. The parasitism case observed in the tributaries of BERF can be classified as low incident, each infested odonate only contained a single water mite except

for *O. testaceum* with two water mites. We presume that habitat condition may contribute to the rate of dragonfly parasitism, where a good habitat help lowering the parasitism incident." (Authors)] Address: Janra, M.N., Biology Dept, Fac. of Mathematics & Natural Sciences, Univ. Andalas, Padang, Indonesia. E-mail: mnjanra@sci.unand.ac.id

17585. Jiang, B.; Li, J.; Zhang, Y.; Sun, Y.; He, S.; Yu, G.; Lv, G.; Mikolajewski, D.J. (2021): Complete mitochondrial genomes of two damselfly species in coenagrionidae and phylogenetic implications. *Mitochondrial DNA Part B* 6(8): 2445-2448. (in English) ["*Agriocnemis femina* (Brauer, 1868) and *Ischnura senegalensis* (Rambur, 1842) are two damselflies inhabiting paddy lands. As an intermediate predator, they play an important role in controlling certain crop pest and mosquitoes. In this study, we sequenced complete mitogenomes of these two species. The total length of mitogenomes is 15,936 bp in *A. femina* and 15,762 bp in *I. senegalensis*. Both of mitogenomes consist of 13 protein-coding genes, 22 tRNA genes, two rRNA genes, and one control region. The close relationship between *I. senegalensis* and *I. elegans* was further proved by phylogenetic analysis. Our phylogenetic analysis indicated a clear two lineages in Coenagrionidae (Core and ridge-faced Coenagrionidae). Ridge-faced Coenagrionidae consisted of *Megaloprepus caerulatus* and *Ceriagrion fallax*. In core Coenagrionidae, *Ischnura* and *Enallagma* are most closely related; they formed one clade with *Agriocnemis* and then grouped together with *Paracerion*. Our study provides new genetic information for further study in phylogenetic analysis of Coenagrionidae." (Authors)] Address: Jiang, B., College of Life Science, Anhui Normal University, Wuhu, China. E-mail: bin.jiang@ahnu.edu.cn

17586. Jödicke, R.; Borkenstein, A. (2021): Der lange Tag der *Leucorrhinia rubicunda* (Odonata: Libellulidae). *Libellula* 40(1/2): 77-92. (in German, with English summary) ["The long day of *L. rubicunda* – Amongst the Central European Libellulidae species *L. rubicunda* displays a particularly long diel activity. We studied the morning and evening activities of this species on hot and sunny days during its main flying season in 2018, both at the water and in its terrestrial habitat. Already three quarters of an hour after sunrise the first males flew from their roosting sites in the canopy of birch trees to sunlit trunks for warming up. About 20 minutes later they started to occupy their perches at the water, where females had already been ovipositing without having been harassed by males. During the whole course of the day typical perching of the males and occasional visits of females at the water with subsequent copulation took place. Oviposition was hardly possible when male abundance was high, because females were constantly disturbed by males. In the evening, as soon as the water was shaded, the behaviour of males switched from perching to permanent flying. Other individuals used this time for collective and sustained hunting in the air or basking on the last sunlit trunks of birch trees. Shortly before sunset the number of wheel formations increased, then the males rapidly

disappeared. Oviposition still regularly took place after sunset, defining *L. rubicunda* as a vespertine species." (Authors)] Address: Jödicke, R., Am Liebfrauenbusch 3, 26655 Westerstede, Germany. E-mail: reinhard.joedicke@magenta.de

17587. Johansson, F.; Watts, P.C.; Sniegula, S.; Berger, D. (2021): Natural selection mediated by seasonal time constraints increases the alignment between evolvability and developmental plasticity. *Evolution* 75(2): 464-475. (in English) ["Phenotypic plasticity can either hinder or promote adaptation to novel environments. Recent studies that have quantified alignments between plasticity, genetic variation and divergence propose that such alignments may reflect constraints that bias future evolutionary trajectories. Here, we emphasize that such alignments may themselves be a result of natural selection and do not necessarily indicate constraints on adaptation. We estimated developmental plasticity and broad sense genetic covariance matrices (G) among damselfly populations situated along a latitudinal gradient in Europe. Damselflies were reared at photoperiod treatments that simulated the seasonal time constraints experienced at northern (strong constraints) and southern (relaxed constraints) latitudes. This allowed us to partition the effects of (1) latitude, (2) photoperiod and (3) environmental novelty on G and its putative alignment with adaptive plasticity and divergence. Environmental novelty and latitude did not affect G, but photoperiod did. Photoperiod increased evolvability in the direction of observed adaptive divergence and developmental plasticity when G was assessed under strong seasonal time constraints at northern (relative to southern) photoperiod. Since selection and adaptation under time constraints is well understood in *Lestes* damselflies, our results suggest that natural selection can shape the alignment between divergence, plasticity and evolvability." (Authors)] Address: Johansson, F., Department of Ecology and Genetics, Animal Ecology, Uppsala University, Uppsala 752 36, Sweden. E-mail: frank.johansson@ebc.uu.se

17588. Johari, P.R.; Jain, N. (2021): Comparative study of Odonates in two selected sites (Umed Ganj and Chatra Vilas garden) of Kota, Rajasthan (India). *Journal of Entomology and Zoology Studies* 9(1): 930-933. (in English) ["Odonates are the insects that are commonly seen in and around water bodies. Kota district possesses many ponds and canals. Amongst them Chatra Vilas garden (near a pond) and Umed Ganj (near a canal) were selected for the present study. The study was carried out in three seasons during 2018 to 2019. The collection of adult Odonates was done by belt transect method. According to the survey, total 12 species of Odonates, belonging to two families (Libellulidae and Coenagrionidae) were identified. Species richness was same in both sites but abundance at CV Garden was greater than Umed Ganj. Umed Ganj was highly disturbed due to anthropogenic activities." (Authors)] Address: Johari, P.R., Government Post Graduate College, Kota, Rajasthan India

17589. Jones, C.D.; Kingsley, A.; Burke, P.; Holder, M. (2021): Field Guide to The Dragonflies and Damselflies of

Algonquin Provincial Park and the Surrounding Area. 2nd revised edition. Algonquin Field Guide Series: 263pp. (in English) ["A comprehensive field guide to all 135 species of dragonflies and damselflies found in Algonquin Provincial Park and surrounding area, extending across southcentral Ontario and into southwestern Quebec. Detailed, full-colour illustrations of all species, including males, females and variants. Additional close-up illustrations of features important in species identification. Key field marks are highlighted through the use of arrows and accompanying text. Information on identification, similar species, habitat, behaviour, flight period, status and range for each species. Includes an introduction, complete with illustrations and photographs, to anatomy and life cycle, as well as the fundamentals of observation, identification and capture. A site guide to some of the key areas within Algonquin Park to find and observe these fascinating insects. This book is one of many publications produced by The Friends of Algonquin Park, and the first in the new "Field Guide" series." (Publisher)] Address: Publisher: https://secure.baytides.on.ca/algonquinpark/cgi/algonquinpark/00517.html?id=onK3Zkt3&mv_pc=66

17590. Jose, J.; Sherif, M.; Chandran, A.V. (2021): A note on the ecology and distribution of Little Bloodtail *Lyriothemis acigastra* Brauer, 1868 (Insecta: Odonata: Libellulidae) in Kerala, India. *Journal of Threatened Taxa*. 13(6): 18642-18646. (in English) ["The behaviour and ecology of *L. acigastra* based on observations from Kadavoor Village, Ernakulam District, Kerala are detailed. Range extension of the species within Kerala after its first report in 2013 is also discussed." (Authors)] Address: Jose, J., Society for Odonate Studies, Velloparampil, Kuzhimattom PO, Kottayam, Kerala 686533, India

17591. Ketenchiev, Kh.A.; Kozminov, S.G.; Paritov, A.Yu.; Sabanova, R.K.; Krapivina, E.A. (2021): Comparative study on the fauna composition of dragonflies (Insecta: Odonata) in the Armenian, Iranian and Asia Minor Highlands as part of the Asiatic Mediterranean (Mediterranean faunal subregion, Paleosubtropical region, Boreal kingdom. IOP Conference Series: Earth and Environmental Science, Volume 817, Ninth International Symposium "Steppes of Northern Eurasia" 7 - 11 June 2021, Orenburg, Russian: 9 pp. (in English) ["The paper presents the results of a comparative analysis of the taxonomic composition of the dragonfly faunas in the Armenian, Iranian and Asia Minor Highlands. Among all the regional faunas of the Mediterranean, the odonofauna of the Iranian and Asia Minor highlands is the richest, with 97 species each. The odonofauna of the Armenian Highlands includes 77 species. A specific feature of the Asia Minor odonofauna is the richness of rheophilic species. Among the representatives of the rheophilic fauna, the Gomphidae family in the Iranian Highlands includes 12 species, the genus *Anormogomphus* includes 1 species – *A. kiritschenkoi* Bartenef. There are 7 species in the Gomphidae family in the Armenian Highlands, and 10 species in the Asia Minor Highlands. In the suborder Zygoptera in the Iranian Highlands, the largest family is Coenagrionidae, in which the genus *Ischnura* is the richest in species. Specific

species characteristic of the compared highlands are given. The odonatofaunas of the uplands contain European and Eurasian boreal as well as endemic taxa, which gives the dragonfly fauna a distinctive appearance. Analysis of the odonatofauna of the Asia Minor Highlands shows its eclecticity and species richness. Unlike the dragonfly fauna of the Armenian Highlands, the presence of European species is noticeable in the fauna of the Asia Minor." (Authors)] Address: Kozminov, S.G., Federal State Budgetary Educational Institution of Higher Education "Kabardino-Balkarian State Univ. named after H.M. Berbekov", Nalchik, Russia. E-mail: s_g_k@mail.ru

17592. Khan, M. A.; Padhy, C. (2021): Aerodynamic characterization of bio-mimicked pleated dragonfly aerofoil. *International Journal of Aviation, Aeronautics, and Aerospace* 8(2): 24 pp. (in English) ["The work inspired by the dragonfly wing corrugation positioned at the front wing's radius section lying at 40% of the total wingspan of forewing from the root section. During gliding flight, dragonfly wings presumed to be an ultra-light aerofoil due to its well-defined cross-sectional corrugation. The aerodynamic simulation carried out to understand the aerodynamic performance of a bio-mimetic dragonfly corrugated airfoil at low Reynolds number range of 75000-150000 to explore the potential advantages of pleated airfoils at a varying angle of attack from 0° to 12°. CFD analysis accomplished by using ANSYS Fluent to understand the aerodynamic performance of the pleated aerofoil and its counterpart profiled aerofoil. The simulation result exhibits aerodynamic commission, i.e. the corrugated aerofoil's gliding ratio (CL/CD), is higher than that of a profiled aerofoil. The analysis demonstrates that the pleated corrugated aerofoil produces a comparable higher lift coefficient than that of profiled aerofoil NACA 0015 and reduces the separation bubble. The vortices trapped inside the valleys, which re-energize the flow and delay flow separation leads to an increment in lift coefficient (CL). These investigations amplify the demand of insect-inspired corrugated wing structure and make a possible application for improved design of pretended wings for micro air vehicles." (Authors)] Address: Padhy, C., Mechanical Engineering Dept, GITAM School of Tech., Hyderabad, India. E-mail: dr.padhy.iitkgp@gmail.com

17593. Khan, M.A.; Padhy, C. (2021): Influence of aerodynamic parameters on dragonfly inspired corrugated aerofoil. In: Rushi Kumar B., Sivaraj R., Prakash J. (eds) *Advances in Fluid Dynamics. Lecture Notes in Mechanical Engineering*. Springer, Singapore: 289-304. (in English) ["This work is focused on the variation of corrugation angle and peak height of 2-D corrugated aerofoil inspired from the forewing of 'Pantala Flavescens' or yellow dragonfly basal wing section. A computational analysis is done on a newly designed dragonfly corrugated aerofoil wing-A and wing-B at $Re = 15.603 \times 10^3$ and the flow is considered as steady and density of the flow is constant. In this study, the aerodynamic performance of 2-D dragonfly corrugated aerofoil is performed at different angle of attack (AoA) with variation in corrugation angle and peak height. With the varying peak height and corrugation angle, there is low wake formation, reduced

drag, and increase in flight performance compared to streamlined aerofoil and flat plate. The computational fluid dynamic (CFD) analysis is performed using a high fidelity fluent solver. The CFD result shows that the aerodynamic performance, i.e., the gliding ratio (CL/CD) (CLCD) of wing-A is higher than wing-B and streamlined aerofoil. The vortex formed is trapped inside the valleys which re-energizes the flow and delays separation leads to an increment in lift coefficient (CL). This finding enhances the knowledge of insect-inspired corrugated wing structure and facilitate the application for improved design of artificial wings for MAVs and UAVs." (Authors)] Address: Padhy, C., Mechanical Engineering Dept, GITAM School of Technology, Hyderabad, India. E-mail: dr.padhy.iitkgp@gmail.com

17594. Khelifa, R.; Mahdjoub, H.; Baaloudj, A.; Cannings, R.A.; Samways, M.J. (2021): Effects of both climate change and human water demand on a highly threatened damselfly. *Scientific Reports* 11(7725): 11 pp. (in English) ["While climate change severely affects some aquatic ecosystems, it may also interact with anthropogenic factors and exacerbate their impact. In dry climates, dams can cause hydrological drought during dry periods following a great reduction in dam water discharge. However, impact of these severe hydrological droughts on lotic fauna is poorly documented, despite climate change expected to increase drought duration and intensity. We document here how dam water discharge was affected by climate variability during 2011–2018 in a highly modified watershed in northeastern Algeria, and how an endemic endangered lotic damselfly, *Calopteryx exul* Selys, 1853, responded to hydrological drought episodes. Analysis was based on a compilation of data on climate (temperature, precipitation, and drought index), water dam management (water depth and discharge volume and frequency), survey data on *C. exul* occurrence, and capture–mark–recapture (CMR) of adults. The study period was characterized by a severe drought between 2014 and 2017, which led to a lowering of dam water depth and reduction of discharge into the river, with associated changes in water chemistry, particularly during 2017 and 2018. These events could have led to the extirpation of several populations of *C. exul* in the Seybouse River (Algeria). CMR surveys showed that the species was sensitive to water depth fluctuations, avoiding low and high water levels (drought and flooding). The study shows that climate change interacts with human water requirements and affects river flow regimes, water chemistry and aquatic fauna. As drought events are likely to increase in the future, the current study highlights the need for urgent new management plans for lotic habitats to maintain this species and possible others." (Authors)] Address: Khelifa, R., Dept Zool., Univ. British Columbia, Vancouver, BC V6T 1Z4, Canada. E-mail: rassimkhelifa@gmail.com

17595. Khelifa, R.; Mahdjoub, H.; M'Gonigle, L.; Kremen, C. (2021): Integrating high-speed videos in capture-mark-recapture studies of insects. *Ecology and Evolution* 11(11): 6033-6040. (in English) ["Capture–mark–recapture (CMR) studies have been used extensively in ecology and evolution. While it is feasible to apply CMR in some animals, it is

considerably more challenging in small fast-moving species such as insects. In these groups, low recapture rates can bias estimates of demographic parameters, thereby handicapping effective analysis and management of wild populations. Here, we use high-speed videos (HSV) to detect the mark of two large dragonfly species, *Anax junius* and *Rhionaeschna multicolor*, that rarely land and, thus, are particularly challenging for CMR studies. We test whether HSV, compared to conventional "eye" observations, increases the "resighting" rates and, consequently, improves estimates of both survival rates and the effects of demographic covariates on survival. We show that the use of HSV increases the number of resights by 64% in *A. junius* and 48% in *R. multicolor*. HSV improved our estimates of resighting and survival probability which were either under- or overestimated with the conventional observations. Including HSV improved credible intervals for resighting rate and survival probability by 190% and 130% in *A. junius* and *R. multicolor*, respectively. Hence, it has the potential to open the door to a wide range of research possibilities on species that are traditionally difficult to monitor with distance sampling, including within insects and birds." (Authors)] Address: Khelifa, R., Dept of Zoology and Biodiversity, Research Centre, University of British Columbia, Vancouver, BC, Canada

17596. Khelifa, R.; Mahdjoub, H.; Baaloudj, A.; Cannings, R.A.; Samways, M.J. (2021): Remarkable population resilience in a North African endemic damselfly in the face of rapid agricultural transformation. *Insects* 12(4), 353; <https://doi.org/10.3390/insects12040353>: (in English) ["There has been a rapid expansion of agricultural area worldwide, resulting in a substantial change in the physical structure, biodiversity, and ecosystem functioning of various natural habitats. In North Africa, many natural habitats have been transformed into agricultural lands, especially in the North, where biodiversity is the highest, to meet the food security and economic development of a rapidly growing population. We estimated the agricultural expansion in North African region between the 1990s and 2000s and found that the percentage of agriculture-free area within the species range declined from 79.5% to 26.2%. Knowing that agroecosystems near lotic environments simplify the structural complexity of habitats (from heterogeneous to homogenous ecological communities) of amphibiotic species such as odonates, we estimated the geographic range of an endemic damselfly and quantified the temporal change in the overlap between agriculture and species occurrence. Our results showed the overlap more than tripled between 1992 and 2005, suggesting that the species experienced a radical change in its terrestrial habitats. We conducted capture-mark-recapture to confirm that the species survives by frequently using croplands and grasslands. Abstract: Agriculture can be pervasive in its effect on wild nature, affecting various types of natural habitats, including lotic ecosystems. Here, we assess the extent of agricultural expansion on lotic systems in Northern Africa (Algeria, Tunisia, and Morocco) and document its overlap with the distribution of an endemic damselfly, *Platycnemis subdilatata* Selys, using species dis-

tribution modeling. We found that agricultural land cover increased by 321% in the region between 1992 and 2005, and, in particular, the main watercourses experienced an increase in agricultural land cover from 21.4% in 1992 to 78.1% in 2005, together with an increase in the intensity of 226% in agricultural practices. We used capture-mark-recapture (CMR) surveys in terrestrial habitats surrounding a stream bordered by grassland and cropland in northeastern Algeria to determine demographic parameters and population size, as well as cropland occupancy. CMR modeling showed that the recapture and survival probabilities had an average of 0.14 (95%CI: 0.14–0.17) and 0.86 (0.85–0.87), respectively. We estimated a relatively large population of *P. subdilatata* (~1750 individuals) in terrestrial habitats. The occupancy of terrestrial habitats by adults was spatially structured by age. Our data suggest that *P. subdilatata* has survived agricultural expansion and intensification better than other local odonate species, mainly because it can occupy transformed landscapes, such as croplands and grasslands." (Authors)] Address: Khelifa, R., Dept Zoology, Univ. British Columbia, Vancouver, BC V6T 1Z4, Canada

17597. Kietzka, G.J.; Pryke, J.S.; Gaigher, R.; Samways, M.J. (2021): Congruency between adult male dragonflies and their larvae in river systems is relative to spatial grain. *Ecological Indicators* 124: 14 pp. (in English) ["Highlights: • Dragonfly larvae and adults congruent for abundance and richness at larger scales. At all scales number of matches were never significantly greater than mismatches. The stages responded similarly to water temperature and agriculture. The stages responded differently to ten other variables. Larger scale assessments can use either adults or larvae, smaller scale use both. Abstract: Dragonflies are globally renowned bioindicators, with larvae, exuviae and/or adult life stages used in freshwater quality assessments. However, little is known about the extent to which conspecific adults and larvae occur within close proximity of each other, or how they comparably respond to biotic and abiotic factors. Firstly, we test the extent to which adult male dragonflies are congruent with their larvae at three independent sample unit scales (small 10 m × 3 m, medium 90 m × 3 m, and large 450 m × 3 m) along four rivers, along with a subset of 40 randomly selected small scale sites (small 40) to test for a possible effect of sampling design on the outcomes of the spatial scale analyses. Secondly, we test the extent to which adult males and larvae share similar responses to environmental variables. At medium and large spatial scales, larvae and adults were strongly congruent for abundance, species richness, and Dragonfly Biotic Index (DBI) scores. Despite this, at the small spatial scale, only 15% of observations matched (contained adults and conspecific larvae). This increased to 46% at the medium scale, and 60% at the large scale, neither of which were significantly different from the number of mismatches. Dragonfly species composition differed between larval and adult assemblages at the small, small 40, and medium scales but did not differ at the large scale. Water temperature was the only variable that generally elicited similar responses in both life stages, at all spatial scales. Exuviae here were so under-represented that

they provided no extra information. Assessments, where medium or large spatial scales are suitable for sampling, such as measuring the state of a river, can utilize either life stage. However, for comprehensive biodiversity surveys, both larvae and adults should be sampled." (Authors)] Address: Kietzka, Gabriella, Dept of Conservation Ecology & Entomology, Stellenbosch University, Stellenbosch 7602, South Africa. E-mail: gkietzka@sun.ac.za

17598. Kladaric, L.; Cuk, R.; Dukic, I.; Popijac, A.; Marinovic Ruždjak, A. (2021): Can Ephemeroptera, Plecoptera, Trichoptera (EPT) assemblage reflect nitrogen and phosphorus load in the riverine ecosystem? *Natura Croatica* 30(1): 217-230. (in English, with Croatian summary) ["The aim of this paper is to make a comparative analysis of benthic macroinvertebrate compositions in streams and rivers in Croatia with relation to different physical-chemical factors, especially nutrients. Samples were collected according to the AQEM method. At all the sites, 20 taxa were recorded of which Turbellaria, Gastropoda, Bivalvia, Oligochaeta, Hirudinea, Crustacea, Ephemeroptera, Odonata, Plecoptera, Heteroptera, Trichoptera, Coleoptera and Diptera were included in the present study. Water temperature mostly affected the composition of benthic macroinvertebrates to which it was inversely proportional. Nutrient enrichment, i.e., higher concentrations of ammonium, nitrates, nitrites, total nitrogen, orthophosphates and total phosphorus mostly affected Ephemeroptera, Plecoptera, Trichoptera and Diptera, by decreasing their diversity." (Authors)] Address: Kladaric, Lidijia, Central Water Management Lab., Ulica Grada Vukovara 220, HR-10000 Zagreb, Croatia

17599. Knoblauch, A.; Thoma, M.; Menz, M.H.M. (2021): Autumn southward migration of dragonflies along the Baltic coast and the influence of weather on flight behaviour. *Animal Behaviour* 176: 99-109. (in English) ["Highlights: • Evidence for dragonfly migration along the Baltic coast in Europe. *Aeshna mixta* and *Sympetrum vulgatum* show directed southward flight. Temperature, cloud cover and wind direction predict migration intensity. Migratory *Aeshna* and *Sympetrum* species respond differently to local weather. The migrant hawkler *A. mixta* selects for favourable tail winds. Despite mass movements of insects being documented for decades, whether dragonflies migrate in Europe has not yet been experimentally tested. Similarly, little is known about the influence of weather on the movement decisions and intensity of dragonflies. Taking advantage of large movements of dragonflies along the Baltic Sea coast of Latvia, we investigated whether European dragonflies showed directed movements indicative of migratory behaviour and how weather influences their movements. First, we performed orientation tests with individual dragonflies of two commonly captured species, *A. mixta* and *S. vulgatum*, to determine whether dragonflies showed directed flight and whether flight direction differed from wind direction. Both *A. mixta* and *S. vulgatum* displayed a uniform mean southward orientation, which differed from the prevailing overhead wind direction, indicating migratory behaviour. Second, we investigated the influence of weather conditions on the abundance

of dragonflies captured. Differences in flight behaviour in relation to weather conditions were observed between *A. mixta* and the two smaller *Sympetrum* species (*S. vulgatum* and *S. sanguineum*). Generally, temperature, cloud cover and wind direction were the most important predictors for dragonfly abundance, with temperature positively, and cloud cover negatively, influencing abundance. *A. mixta* appeared to select favourable tail winds (northerlies), whereas abundance of *Sympetrum* increased with more easterly winds. Our results provide important information on the influence of local weather conditions on the flight behaviour of dragonflies, as well as evidence of dragonfly migration along the Baltic coast." (Authors)] Address: Knoblauch, Aline, Inst. of Ecology and Evolution, Univ. of Bern, Bern, Switzerland

17600. Königsdorfer, M.; Jedicke, J.; Meyer, C.; Kling, S. (2021): Libellengräben in Schwaben – Grabenpflege für Helm- und Vogel-Azurjungfer. *ANLIEGEN NATUR* 43(1): 45-54. (in German) ["Damselfly ditches in Swabia – management of ditches to conserve the ornate bluet and the southern damselfly: In Bavaria *Coenagrion mercuriale* and *C. ornatum* are endangered and threatened with extinction. Swabia is home to the main distribution of these species and therefore has an outstanding responsibility to preserve the populations of the two species. The project „Damselfly ditches in Swabia“ includes the recording investigation where the two species occur and the maintaining and development of their habitats. The project is successful because it cooperates with local actors and uses established sponsoring structures. The whole project is accompanied by intensive public relation. So the project goals can be ensured even beyond the project duration." (Publisher)] Address: Kling, Susanne, Landschaftspflegeverband Donaual-Aktiv e. V. E-mail: kling@donauaktiv.de

17601. Kohli, M.; Djernæs, M.; Sanchez Herrera, M.; Sahlén, G.; Pilgrim, E.; Simonsen, T.J.; Olsen, K.; Ware, J. (2021): Comparative phylogeography uncovers evolutionary past of Holarctic dragonflies. *PeerJ* 9:e11338 <https://doi.org/10.7717/peerj.11338>: 25 pp. (in English) ["Here, we investigate the evolutionary history of five northern dragonfly species to evaluate what role the last glaciation period may have played in their current distributions. We look at the population structure and estimate divergence times for populations of the following species: *Aeshna juncea*, *A. subarctica*, *Sympetrum danae*, *Libellula quadrimaculata* and *Somatochlora sahlbergi* across their Holarctic range. Our results suggest a common phylogeographic pattern across all species except for *S. sahlbergi*. First, we find that North American and European populations are genetically distinct and have perhaps been separated for more than 400,000 years. Second, our data suggests that, based on genetics, populations from the Greater Beringian region (Beringia, Japan and China) have haplotypes that cluster with North America or Europe depending on the species rather than having a shared geographic affinity. This is perhaps a result of fluctuating sea levels and ice sheet coverage during the Quaternary period that influenced dispersal routes and refugia. Indeed, glacial Beringia may have been as much a

transit zone as a refugia for dragonflies. *S. sahlbergi* shows no genetic variation across its range and therefore does not share the geographic patterns found in the other circumbo-real dragonflies studied here. Lastly, we discuss the taxonomic status of *Sympetrum danae*, which our results indicate is a species complex comprising two species, one found in Eurasia through Beringia, and the other in North America east and south of Beringia. Through this study we present a shared history among different species from different families of dragonflies, which are influenced by the climatic fluctuations of the past." (Authors)] Address: Kohli, M., Dept of Invertebrate Zoology, American Museum of Natural History, New York, New York, United States

17602. Koli, Y.; Dalvi, D. (2021): A new distribution record of the Western Ghats endemic damselfly *Melanoneura bilineata* Fraser, 1922 (Insecta: Odonata) from Maharashtra, India. *Journal of Threatened Taxa* 13(9): 19380-19382. (in English) [8.x.2020., Myristica swamp (15.8090N 74.1210E, 73m), Hevale village, Dodamarg taluka of Sindhudurg district)] Address: Koli, Y., Department of Zoology, Sant Rawool Maharaj College Kudal, Sindhudurg, Maharashtra 416520, India. E-mail: dryjkoli@gmail.com

17603. Koli, Y.; Dalvi, A.; Sawant, D. (2021): New records of *Agriocnemis keralensis* Peters, 1981 and *Gynacantha khasiaca* MacLachlan, 1896 (Insecta: Odonata) from Maharashtra, India. *J. of Threatened Taxa* 13(7): 18908-18919. (in English) ["*A. keralensis* is reported for the first time from Maharashtra, India. Previously it was known from Kerala and Goa states. In this paper we report *A. keralensis* from Thakurwadi and Bambuli wetlands and Chipi Plateau, Sindhudurg District. Also, the new record of *Gynacantha khasiaca* MacLachlan, 1896 is confirmed on the basis of specimens collected from Sindhudurg District. Hence, we report the range extension of both *A. keralensis* and *G. khasiaca* in northern Western Ghats. Apart from this, a combined checklist of Odonata fauna of Thakurwadi (51 species), Bambuli wetlands (44 species), and Chipi Plateau (51 species) is provided." (Authors)] Address: Koli, Y., Department of Zoology, Sant Rawool Maharaj College Kudal, Sindhudurg, Maharashtra 416520, India. E-mail: dryjkoli@gmail.com

17604. Kompier, T.; Holden, J.; Makbun, N. (2021): A new species of *Lyriothemis* Brauer, 1868 from Vietnam and Thailand (Odonata: Libellulidae). *Zootaxa* 4933(4): 586-594. (in English) ["*Lyriothemis pallidistigma* sp. nov. (holotype ♂: Cat Tien National Park, Dong Nai Prov., southern Vietnam) is described. This species is reminiscent of *L. defonsekai* van der Poorten, 2009 and *L. elegantissima* Selys, 1883, but can be separated by the shape of its secondary genitalia and its patterning. Information on its biology and ecology is provided." (Authors)] Address: Kompier, T., Schoutenstraat 69, 2596 SK Den Haag, the Netherlands. E-mail: kompiertokyo@yahoo.com

17605. Kompier, T.; Karube, H.; Futahashi, R.; Phan, Q.T. (2021): The genus *Planaeschna* McLachlan, 1895 and its subgroupings in Vietnam, with descriptions of three new

species (Odonata: Aeshnidae). *Zootaxa* 5027(1): 1-35. (in English) ["Twelve *Planaeschna* McLachlan, 1895 species recorded in Vietnam are presented and their subgroupings based on nuclear DNA analysis are discussed. Three new species are described (*Planaeschna crux* sp. nov. [holotype: Pia Oac NP, Cao Bang Prov.], *Planaeschna samurai* sp. nov. [holotype: Khau Pha, Tu Le, Yen Bai Prov.] and *Planaeschna tsuchi* sp. nov. [holotype: Xuan Son NP, Phu Tho Prov.]. *P. celia* Wilson & Reels, 2001 is recorded from Vietnam for the first time. *P. guentherpetersi* Sasamoto, Do & Vu, 2013 is shown to be a subspecies of *P. ishigakiana* Asahina, 1951. The female of *P. cucphuongensis* Karube, 1999 is described for the first time. Additional records are provided for *P. asahinai* Karube, 2011, *P. tamdaoensis* Asahina, 1996, *P. tomokunii* Asahina, 1996, and *P. viridis* Karube, 2004. Lastly, the females of two unidentified *Planaeschna* spp. are illustrated. Information on the ecology of all species is provided." (Authors)] Address: Kompier, T., Schoutenstraat 69, 2596 SK Den Haag, the Netherlands. E-mail: kompiertokyo@yahoo.com

17606. Koparde, P.; Sridhar Halali, S.; Tiple, A.; Ranganeekar, P.; Sonawane, A.; Payra, A.; Dawn, P.; Raju, A.; Subramanian, K.A. (2021): Lost in time: Re-description and ecological re-assessment of two Indian endemic *Elattonera* Cowley, 1935 (Zygoptera: Libellulidae) damselflies. *International Journal of Odonatology* 24: 82-94. (in English) ["The Indian *Elattonera* are a difficult group to identify due to their extreme morphological similarity and sparse information in identification keys and on geographical distribution. The ambiguity is prominent among two Peninsular Indian *Elattonera* species, *E. nigerrima* (Laidlaw, 1917) and *E. tetrica* (Laidlaw, 1917), described a hundred years ago. Both species were described based on male specimens with scant information on their females. The species are IUCN Red-listed, *E. nigerrima* (Data Deficient) and *E. tetrica* (Least Concern). Hitherto it was thought that *E. nigerrima* was smaller than *E. tetrica* and both have non-overlapping geographical distribution. Here, we re-describe both sexes of *E. nigerrima*; *E. tetrica* along with morphometric data and geospatial analysis. We found that *E. nigerrima* is significantly larger than *E. tetrica*. The species are largely allopatric in distribution, with the former having a much wider spatial distribution than previously thought. Based on our geospatial analysis, we provide occurrence data useful for the future IUCN assessments of *E. nigerrima* and *E. tetrica*. We highlight the importance of updating taxonomic status information and data on spatiotemporal distribution to proceed with the conservation of endemic insects such as *Elattonera* damselflies. Our study indicates ecological and threat assessments of Indian Odonata species are urgently needed." (Authors)] Address: Koparde, P., School of Ecology & Environmental Management, Faculty of Sustainability Studies, MIT World Peace University, Kothrud, Pune, Maharashtra, India. E-mail: pankajkoparde@gmail.com

17607. Koroiva, R.; Pereira-Colavite, A.; Batista, F.R.C.; Vilela, D.S. (2021): Checklist and contribution to the knowledge of the odonatofauna of Paraíba state, Brazil. *Biota*

Neotropica 21(3): e20211196: 10 pp. (in English, with Portuguese summary) ["We present the first listing of odonatan species (Insecta: Odonata) that occur in the state of Paraíba, Brazil. There are 49 species and 29 genera registered, making Paraíba the third in number of species among the Brazilian states of northeastern region. The families with the largest number of species were Libellulidae, with 31 species and 15 genera, followed by Coenagrionidae with 11 species and 7 genera. Interior regions of the state are under-sampled, which should still lead to an underestimated number of species. In addition, we present taxonomic notes of two species collected during our expeditions: males of *Progomphus dorsopallidus* Byers, 1934 and females of *Macromthemis griseofrons* Calvert, 1909. Here, we detail important characteristics and present figures to aid their morphological identifications." (Authors)] Address: Koroiva, R., Univ. Fed. da Paraíba, Depto de Sistemática e Ecologia, João Pessoa, PB, Brasil. E-mail: ricardo.koroiva@gmail.com

17608. Koroiva, R.; Brasil, P.G.; Neiss, U.G.; Vilela, D.S.; Hamada, N. (2020): Dragonflies and damselflies (Insecta: Odonata) housed in the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia, Brazil. *Hetaerina* 2(2): 14-23. ["This paper documents the odonatan specimens deposited in the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil. A total of 3901 Odonata specimens are deposited in the collection (3294 genus/species-identified specimens and 607 unidentified specimens) belonging to 206 species and 84 genera. The type collection consists of 14 type specimens (three holotypes, one allotype and ten paratypes). We provide three new species record for Brazil and 11 new species record for Amazonas State. Thus, the Amazonas State has now record 335 species and 103 genera. Only 51% of the Odonata species recorded in Amazonas State are represented in the INPA collection, highlighting the need for more sampling of species." (Authors)] Address: Koroiva, R., Laboratório Multi-usuário do Programa de Pós-Graduação em Ciências Biológicas-Zoologia, Univ. Fed. Paraíba, João Pessoa, Brazil. E-mail: ricardo.koroiva@gmail.com

17609. Kovács, T.; Theischinger, G.; Horvath, R.; Juhász, P. (2021): Odonata from Batanta (Indonesia, West Papua) with description of one new species. *Opuscula Zoologica* 52(2): 119-139. (in English) ["58 taxa of Odonata are here-with reported from Batanta Island (including Arefi and Birie Islands). One new species is described: *Argiolestes varga* sp. nov. The following ten species are new to the Raja Ampat Islands: *Papuagrion magnanimum* (Selys, 1876), *Gynacantha rosenbergi* Kaup, 1867, *Palaeosynthemis cf. cervula* (Lieftinck, 1938), *Diplacina smaragdina* Selys, 1878, *Nannophlebia amphicyllis* Lieftinck, 1933, *Pantala flavescens* (Fabricius, 1798), *Rhodothemis nigripes* Lohmann, 1984, *Rhythemis regia* (Brauer, 1867), *Tramea transmarina propinqua* Lieftinck, 1942, *Zyxomma multinervorum* Carpenter, 1897, and fifteen are new to Batanta: *Selysioneura cornelia* Lieftinck, 1953, *P. magnanimum*, *Agyrtacantha dirupta* (Karsch, 1889), *Anax maclachlani* Förster, 1898, *G. rosenbergi*, *P. cf. cervula*, *D. smaragdina*, *N. amphicyllis*, *Nesoxenia mysis*

(Selys, 1878), *P. flavescens*, *R. nigripes*, *R. regia*, *Tetrathemis irregularis* Brauer, 1868, *T. transmarina propinqua*, *Z. multinervorum*. *Metagrion postnodale* (Selys, 1878) and *Selysioneura cf. cervicornu* Förster, 1900 are deleted from the faunal lists of Odonata of Raja Ampat and Batanta Islands. The total number of species recorded for Batanta Island is 62. (Authors)] Address: Kovács, T., Mátra Museum of Hungarian Nat. History Museum, Kossuth Lajos utca 40, 3200 Gyöngyös, Hungary. E-mail: koati1965@gmail.com

17610. Krieg-Jacquier, R.; Boudot, J.-P. (2021): Observation d'*Erythromma najas* Hansemann, 1823 dans le département du Var et mise à jour des données sur la région Provence-Alpes-Côte d'Azur (Odonata, Coenagrionidae). *Martinia* 35(3): 10-12 (in French, with English summary) ["Observation of *Erythromma najas* Hansemann, 1823 in the department of Var and update of data from Provence-Alpes-Côte d'Azur region (Odonata, Coenagrionidae); 16-VIII-1996, l'étang Colbert, Cannet-des-Maures (Var), 43.38810°N 6.35930°E 97 m a.s.l.," (Authors)] Address: Krieg-Jacquier, R., 628 route de Marboz 01440 Viriat, France. E-mail: regis.krieg.jacquier@gmail.com

17611. Küry, D. (2021): Besiedlung eines neu geschaffenen Fließgewässers im Kanton Basel-Stadt durch *Coenagrion mercuriale* und weitere Libellenarten (Odonata: Coenagrionidae). *Libellula Supplement* 16: 161-176. (in German, with English summary) ["Colonisation of a newly created ditch in the canton Basel-City by *C. mercuriale* and other odonate species – A newly created section of a ditch in the canton Basel-City (Switzerland) was colonised by *C. mercuriale* after ten years. A sporadic monitoring of the Odonata fauna showed that prior to this date *Calopteryx splendens* and *C. virgo* had dominated and only few other species were present. *C. mercuriale* colonised only sectors with low density of vegetation. To colonise the new habitats, it had to disperse over more than 8 km. At the end of the flight period the density was four individuals per 100 m. Since *C. mercuriale* had never before been observed in this region, it is assumed that the species is currently in an initial stage of colonisation. Optimized measures will facilitate the development of a stable population." (Author)] Address: Küry, D., Life Science AG, Greifengasse 7, CH-4058 Basel, Switzerland. E-mail: daniel.kuery@lifescience.ch

17612. Lietz, C.; Schaber, C.F.; Gorb, S.N.; Rajabi, H. (2021): The damping and structural properties of dragonfly and damselfly wings during dynamic movement. *Communications Biology* 4(737) (2021): 14 pp. (in English) ["For flying insects, stability is essential to maintain the orientation and direction of motion in flight. Flight instability is caused by a variety of factors, such as intended abrupt flight manoeuvres and unwanted environmental disturbances. Although wings play a key role in insect flight stability, little is known about their oscillatory behaviour. Here we present the first systematic study of insect wing damping. We show that different wing regions have almost identical damping properties. The mean damping ratio of fresh wings is noticeably higher than that previously thought. Flight muscles and

hemolymph have almost no 'direct' influence on the wing damping. In contrast, the involvement of the wing hinge can significantly increase damping. We also show that although desiccation reduces the wing damping ratio, rehydration leads to full recovery of damping properties after desiccation. Hence, we expect hemolymph to influence the wing damping indirectly, by continuously hydrating the wing system." (Authors) *Aeshna cyanea*, *Sympetrum striolatum*, *Calopteryx splendens*, *Ischnura elegans*] Address: Rajabi, H., Division of Mechanical Engineering and Design, School of Engineering, London South Bank University, London, UK. E-mail: harajabi@hotmail.com

17613. Lipinskaya, T. P.; Moroz, M. D. (2021): Native and alien species of macrozoobenthos in rivers of the Belarusian part of the Dnieper River basin. Proceedings of the National Academy of Sciences of Belarus. Biological series 66(1): 64-73. (in Russian, with English summary) ["The Dnieper River basin in Belarus was studied in 2016–2019. In total, 201 species and forms of macrozoobenthos were found and 146 of them were identified to the species level. New habitats of several protected species (... *Anax imperator*, *Ophiogomphus cecilia* and *Gomphus flavipes* ... (Authors)] Address: Lipinskaya, Tatsiana, Scientific and Practical Center for Bioresources of the National Academy of Sciences of Belarus (27, Akademicheskaya Str., 220072, Minsk, Republic of Belarus. E-mail: tatsiana.lipinskaya@gmail.com

17614. Liu, Z.; Zhou, T.; Cui, Y.; Li, Z.; Wang, W.; Chen, Y.; Xie, Z. (2021): Environmental filtering and spatial processes equally contributed to macroinvertebrate metacommunity dynamics in the highly urbanized river networks in Shenzhen, South China. *Ecological Processes* 10(23): 12 pp. (in English) [oas 57: "Background: Disentangling the relative roles of environmental filtering and spatial processes in structuring ecological communities is a central topic in metacommunity ecology. Metacommunity ecology in the temperate river ecosystems has been well developed, while less attention has been paid to subtropical urban river networks. Here, we examined the ecological factors and seasonal difference in structuring macroinvertebrates metacommunity assembly in the subtropical urban river networks in Shenzhen, South China. Results: Our results revealed that there was no significant distinction of macroinvertebrate community composition among seasons, with only the relative abundance of Mollusca and Odonata significantly differed in both wet and dry seasons. One possible explanation was that most macroinvertebrates are generally pollution-tolerant taxa characterized with nonseasonal life cycle. In addition, distance-based redundancy analysis and variation partitioning approach revealed that metacommunity was determined equally by the environmental and dispersal-related factors. Further, our results showed that, although a slight temporal variation of relative contribution, the identity and explanation power of ecological factors were different among seasons. Specifically, stronger environmental filtering structuring community dynamics was observed in the dry than wet seasons, which might be owing to higher environmental heterogeneity under a low water-flow condition. Moreover,

we detected that the influence of spatial processes was stronger in the wet than dry seasons, indicating an obvious dispersal processes due to high connectivity among sites. Conclusion: Overall, our results revealed that environmental and spatial factors equally explained variations of macroinvertebrate metacommunity, implying the necessity of considering dispersal-related processes structuring ecological communities in river bioassessment programs. Moreover, degraded habitat conditions and water quality were the predominant factors that affected macroinvertebrate communities, indicating the significance and feasibility of improving local abiotic conditions to sustain local biodiversity. Further, our findings revealed the importance of seasonal dynamics of these urban river networks in structuring macroinvertebrate metacommunity. Thereby, our study improves the understanding of ecological processes governing macroinvertebrate metacommunity and underlines the idea that community ecology studies should go beyond the single snapshot survey in river networks." (Authors)] Address: Xie, Z., Inst. Hydrobiology, Chinese Academy of Sciences, Wuhan 430072, Hubei, China. E-mail: yushunchen@ihb.ac.cn

17615. Lohr, M. (2021): *Selysiotthemis nigra* new for continental France (Odonata: Libellulidae). *Libellula Supplement* 16: 177-188. (in English, with French and German summaries) ["On 24-vii-2020 one adult male and two exuviae of *S. nigra* were found in the middle Durance Valley, southern France, in the North of the Var department, not far from the village of Vinon-sur-Verdon. These observations are the first records of the species in continental France. The exuviae were found on the shore of a former gravel pit, while the imago was photographed perching on a stem at a river bank near the Durance. The findings are discussed regarding the hitherto known range of the species, and possible immigration routes are described. The nearest sites where the species occurs are situated in northwestern Italy, northeastern Corsica and northeastern Spain, between 250 and 330 km from the Durance Valley. Most probably there is a migration of *S. nigra* along the shore of the Mediterranean Sea, either from the Southwest (Spain) or the Southeast (Corsica and Italy), before entering continental France and following the Durance Valley. The causes of an increase of records of *S. nigra* in an almost constant range, as well as the obvious spreading of other species like *Trithemis annulata* and *T. kirbyi*, are discussed. Climate change has clearly favoured the expansion of at least *T. annulata* and *T. kirbyi* during the last decades and years, respectively, and these species entered continental France coming from Spain. However, the increase of anthropogenic water bodies like man-made dams, irrigation basins, impoundments or gravel pits have also favoured this trend as recently stated for the highly ubiquitous *T. kirbyi*, for which both climate and habitat changes act in synergy. In the case of *S. nigra*, the increasing availability of such artificial, suitable habitats might be the main reason for the expansion as the species has been demonstrated to have recently established in areas where temperatures have decreased and rainfall increased since the turn of the millenium. Whether climatic factors also have a significant influence on the increase of observations and the small

range expansions of this species might be made clearer by future research." (Authors)] Address: Lohr, M., Technische Hochschule Ostwestfalen-Lippe, An der Wilhelmshöhe 44, 37671 Höxter, Germany. E-mail: mathias.lohr@th-owl.de

17616. Lopez-Diaz, J.A.; Gómez, B.; González-Soriano, E.; Gómez-Tolosa, M. (2021): Odonata (Insecta) como indicador de la calidad ambiental en humedales de montaña neotropicales. *Acta Zoologica Mexicana* (N.S.) 37(1): 1-17. (in Spanish, with English summary) ["In order to evaluate the diversity of the Odonata order and relate it to environmental quality, in San Cristobal de Las Casas (Chiapas) four wetlands were chosen according to their accessibility and permissibility. For the environmental typology, among other characteristics, the visual quality was considered, estimated through the Index of the State of Conservation of Wetlands (IECH). Systematic monthly collections of adult odonates were carried out between July 2014 and June 2015. A total of 14 species, distributed in five families and 10 genera were found. The genus *Argia* was the richest, while *Ischnura denticollis* and *Enallagma rua* represented the dominant species. Las Cañadas, a wetland with suboptimal visual quality, presented the greatest diversity of dragonflies by integrating a lotic environment. As one of the parameters evaluated in the visual quality, the degree of alteration of the aquatic vegetation was very important in the differences found in the diversity and abundance of Odonata in the four wetlands. Maria Eugenia and La Kisst classified as environments with optimal and regular visual quality, respectively, obtained the greatest similarity in their odonatofauna related to the different life forms of their aquatic vegetation and for the equivalent size of these two wetlands." (Authors)] Address: López-Díaz, J.A., Univ. de Ciencias y Artes de Chiapas, Instituto de Ciencias Biológicas. Libramiento Norte-Poniente s/n, Col. Lajas Maciel. Tuxtla Gutiérrez, Chiapas, México. C.P. 29000. E-mail: juanlodi44@gmail.com

17617. Lorenzo-Carballa, M.O.; Garrison, R.W.; Encalada, A.C.; Cordero-Rivera, A. (2021): Darwin returns to the Galapagos: Genetic and morphological analyses confirm the presence of *Tamea darwini* at the Archipelago (Odonata, Libellulidae). *Insects* 2021, 12, 21. <https://doi.org/10.3390/insects12010021>: 17 pp. (in English) ["The status of the *Tamea* species present in the Galapagos Islands (Odonata, Libellulidae) has been the subject of a long-standing debate among odonatologists. Here, we use molecular and morphological data to analyze a series of specimens from this genus collected in 2018 from the Islands of San Cristobal, Isabela, and Santa Cruz, with the aim of determining their relationship with *Tamea calverti* Muttkowski and with their currently considered senior synonym *T. cophysa* Hagen. We combined sequencing of mitochondrial and nuclear DNA with morphological examination of several specimens of *Tamea*, including representatives of continental *T. cophysa* and *T. calverti*. Our molecular analyses place the *Tamea* from Galapagos in the same clade as *T. calverti*, with *T. cophysa* as a closely related species. The morphological analyses found only one consistent difference bet-

ween *T. cophysa* and *T. calverti*: the presence of an accessory lobe in the male vesica spermalis of *T. cophysa* that is absent in *T. calverti* and in the *Tamea* from Galapagos. In agreement with our genetic results, the overall morphological differences documented by us indicate that the Galapagos material examined is conspecific with *T. calverti*. In light of this, and following the principle of priority in taxonomic nomenclature, *Tamea calverti* Muttkowski, 1910 should hereafter be considered a junior synonym of *Tamea darwini* Kirby, 1889." (Authors)] Address: Lorenzo-Carballa, María Olalla, ECOEVO Lab, E.E. Forestal, Campus Univ. A Xunqueira s/n, University of Vigo, 36005 Pontevedra, Spain

17618. Mafuwe, K.; Tambara, E.; Matutu, F.F.; Maforimbo, C.; Tsamba, J.; Mapendere, C.; Moyo, S. (2021): Community assembly of adult odonates in lacustrine systems of an understudied world heritage site of south-eastern Zimbabwe. *International Journal of Odonatology* 24: 122-138. (in English) ["Odonata are efficacious for management and conservation efforts in freshwaters. In recent times, increased effort has gone into enhancing awareness, data and information on dragonflies among scientists and policymakers. Here, we examined the Odonata community of dams within the Matobo National Park, a world heritage site in southern Zimbabwe. Specifically, we determined diversity of larval and adult odonate in five dams over one year. Several physico-chemical parameters were measured, including pH, total dissolved salts (TDS), electrical conductivity (EC). Further, we assessed how habitat types (i.e., detritus, sand, gravel, plant type) affect Odonata communities. In addition, surveys were conducted to identify critical threats to Odonata in the Matobo National Park and surrounding areas. Broadly, results showed that Odonata nymphs and volant adults did not change predictably across all sampling occasions. Further, pH was positively correlated with Libellulidae and Platycnemididae, whereas TDS and EC were positively correlated with Libellulidae, Platycnemididae and Macromiidae. Contrariwise, Gomphidae were found to be negatively correlated to TDS, EC and pH. The threat analyses identified natural system modifications, agricultural expansion and intensification, as well as human intrusions and disturbance as the major threats to Odonata and freshwater resources in Matobo National Park. Taken together, these data provide baseline data that will be useful for future monitoring of threats and subsequently conservation strategies in the Matobo National Park and other protected areas in Southern Africa." (Authors)] Address: Mafuwe, K., Univ. of Zimbabwe, Dept Biol. Sciences, Mt Pleasant, Harare, Zimbabwe; Nat. Hist. Museum of Zimbabwe, Park Rd, Bulawayo, Zimbabwe. E-mail: kudzimaffy@gmail.com

17619. Maksoud, S.; Azar, D. (2021): Hjoula: A remarkable mid-Cenomanian Lebanese fossil fish Lagerstätte now also promising for fossil insects. *Palaeoentomology* 4(3): 223-227. ["Lebanon is worldwide famous in Palaeontology for its rich Late Cretaceous marine fish deposits in Haqel, Nammoura and Hjoula. Recently, the two latter outcrops yielded surprisingly some complete and none-dislocated fossil insects (Azar et al., 2019; Vršanský & Makhoul, 2013; Nel et

al., 2004), indicating a particular depositional marine palaeoenvironment, close to a palaeoshoreline during the mid-Cenomanian." (Authors)] Address: Maksoud, Sibelle, Lebanese Univ., Faculty of Sciences II, Dept of Natural Sciences, Fanar, P.O. Box 26110217, Fanar–Matn, Lebanon

17620. Mallah, S.R.; Khan, M.H.; Agrawal, A. (2021): Dragonfly-inspired corrugated foil flight dynamics in heaving motion across various heaving frequencies. 5-6th Thermal and Fluids Engineering Conference (TFEC) 2021, 26–28 May : 71-79. ["The corrugated wing cross-section significantly affects flight dynamics of a dragonfly. Therefore, a heaving corrugated foil inspired from a dragonfly wing, is being numerically studied in this work. The objective is to understand the effect of heaving frequency on the lift and thrust coefficients of the bio-inspired corrugated foil, thereby unravelling the secret of dragonfly flight at various heaving frequencies of its wing. Two-dimensional numerical simulations are performed over a wide range of reduced frequencies, $K = 0.09 - 2.63$, covering the entire range of actual dragonfly wing's flapping frequency. The chord-based Reynolds number is 10,000 and a nondimensional heaving amplitude (normalized by the chord length) is 0.15. The results are compared against a smooth heaving NACA (National Advisory Committee for Aeronautics) 0012 foil. Over the studied heaving frequency range for the corrugated foil, at $K = 0.09$ net drag on the corrugated foil is observed which transitions into a net thrust at $K = 1.76$ and thereafter a monotonic increase in thrust is observed up to the largest studied reduced frequency. The drag to thrust transition is earlier for NACA0012 foil compared to corrugated foil because of lower leading-edge vortex strength and further at any studied K , NACA0012 foil is better in terms of thrust generation. The present study helps understand the influence of varying heaving frequency in the flight dynamics of dragonflies." (Authors)] Address: Mallah, S.R., Department of Mechanical Engineering, Indian Institute of Technology Bombay, Powai, Mumbai 400076, India

17621. Mallah, S.R.; Padinjattayil, S.; Agrawal, A.; Sharma, A. (2021): Investigating dragonfly flight dynamics at various heaving amplitudes of its wing. 5-6th Thermal and Fluids Engineering Conference (TFEC): 85-91. (in English) ["The dragonfly wing has a corrugated cross-section that significantly affects its flight dynamics. Therefore, inspired from a dragonfly wing, the corrugated foil performing heaving motion at various heaving amplitude, is being studied through numerical simulations. The objective is to understand the effect of heaving amplitude on the bioinspired corrugated foil, thereby unravelling the secret of dragonfly flight at various heaving amplitude of its wing. Two-dimensional numerical simulations are performed over a wide range of heaving amplitude (normalized by the chord length), $H = 0.15 - 0.75$. The chord-based Reynolds number is 10,000 and reduced frequency is 0.87. Further, to explore the effect of corrugations found in dragonfly wing, the results are compared with a smooth heaving NACA (National Advisory Committee for Aeronautics)0012 foil. Over the studied heaving amplitude range for the corrugated foil, at $H = 0.15$

net drag on the corrugated foil is observed which transits into a net thrust at $H = 0.3$, however the time-averaged thrust is less than that for NACA0012 foil at all H . At any studied H , corrugated foil out-performs the NACA0012 foil in terms of time averaged lift generation. Therefore, corrugations found in dragonfly wings are for enhancement of lift rather than thrust. The present study helps understand the influence of corrugations of dragonfly wing in the enhanced lift generation mechanisms of dragonflies." (Authors)] Address: Mallah, S.R., Dept Mechanical Engineering, Indian Inst. Technology Bombay, Powai, Mumbai 400076, India

17622. Mancini, F.; De Giorgi, R.; Ludovisi, A.; Vizzini, S.; Mancinelli, G. (2021): Ontogenetic shift in the trophic role of the invasive killer shrimp *Dikerogammarus villosus*: a stable isotope study. *Biological Invasions* 23(6): 1803-1817. (in English) ["The introduction of the amphipod *Dikerogammarus villosus* in European fresh waters is to date recognized as a threat to the integrity of invaded communities. Predation by *D. villosus* on native benthic invertebrates is assumed as the key determinant of its ecological impact, yet available information describe the species as a primary consumer as well as a carnivore depending on local conditions. Here, we assessed the trophic position (TP) of *D. villosus* in Lake Trasimeno, a recently invaded lentic system in central Italy, using the CN isotopic signatures of individuals captured in winter spanning two orders of magnitude in body size. TP estimations were compared with those characterizing the native amphipod *Echinogammarus veneris* and other representative invertebrate predators. On average, *D. villosus* showed a trophic position higher than *E. veneris*, and comparable with that of odonate nymphs. An in-depth analysis revealed that large-sized individuals had a trophic position of 3.07, higher than odonates and close to that of the hirudinean predator *Erpobdella octoculata*, while small-sized specimens had a trophic position of 2.57, similar to that of *E. veneris* (2.41). These findings indicate that size-related ontogenetic shifts in dietary habits may per se vary the nature of the interaction between *Dikerogammarus villosus* and native invertebrates from competition to predation. Information collated from published isotopic studies corroborated the generality of our results. We conclude that intra-specific trophic flexibility may potentially amplify and make more multifaceted the impact of the species on other invertebrate species in invaded food webs." (Authors)] Address: Mancini, F., Department of Biological and Environmental Sciences and Technologies, University of Salento, 73100 Lecce, Italy. E-mail: giorgio.mancinelli@unisalento.it

17623. Manger, R. (2021): Odonate wing vein preferences in haemolymph sucking *Forcipomyia paludis* (Diptera: Ceratopogonidae; Odonata). *Libellula Supplement* 16: 189-200. (in English, with German summary) ["In summer 2020, the Odonata fauna in the Weerribben-Wieden National Park was examined at various localities for the Odonata parasite *Forcipomyia paludis*. This park is currently one of the localities in the Netherlands where the species is found every year. Five localities in the area have been surveyed and many of the Odonata species were found to be infected by

biting midges. The parasites have been studied in more detail on photos of the Odonata species and an accurate overview was obtained on which wing veins they sucked. The highest numbers of biting midges were observed on the Cubitus vein. Furthermore, 91% of all observed midges sucked on the lower wing veins of the dragonflies and 9% on the upper ones. Biting midges were not observed in all of the sites surveyed in the park." (Author)] Address: Manger, R., Schukkingpad 17, 7971 BV Havelte, The Netherlands. E-mail: rene@mangereco.nl

17624. Martens, A.; Wildermuth, H. (2021): Gynandromorphism and intersexuality in Odonata: a review. *Odonatologica* 50(1/2): 65-80. ["Gynandromorphism is a rare phenomenon among insects, and as measured by the number of publications, particularly so in Odonata. The first case of gynandromorphism in the order was reported in 1866, the second in 1917. To date, 56 chimeric individuals have been described in 45 papers. Bilateral gynandromorphs account for about a third of all cases, the remainder consisting of phenotypical mosaics of male and female characters exhibited in wing patterns, genitalia, or other body parts. There are no patterns of gynandromorphism exclusive to Odonata. Here, as a basis for future work, we provide an overview as complete as possible of the known cases in the order of gynandromorphism in a broad sense, including intersexuality. This is the third review on this topic: the first dates from 1929 and the second from 1971, supplemented in 1975. In the last ten years, all new records have been based on photographic evidence rather than collected specimens, a practice which has its limitations and may skew the data by recording only the most obvious of cases. For future research it is recommended that specimens should not only be photographed in the field but also collected and preserved for detailed description and analysis in the laboratory. In addition, researchers should be alive to the possibility of finding gynandromorphs in final instar larvae and exuviae." (Authors)] Address: Martens, A., Institute of Biology, Univ. of Education Karlsruhe, Bismarckstraße 10, 76133 Karlsruhe, Germany. E-mail: martens@ph-karlsruhe.de

17625. Martin, R.; Maynou, X. (2021): A case of phoresis between *Rheotanytarsus* Thienemann & Bause, 1913 (Diptera: Chironomidae) and *Calopteryx* Leach, 1815 (Odonata: Calopterygidae). *Boletín de la Sociedad Entomológica Aragonesa* 68: 388-390. (in English, with Spanish summary) ["We describe a case of phoresis of *Rheotanytarsus* sp. (Diptera: Chironomidae) on larvae of *C. virgo meridionalis* and *C. haemorrhoidalis* in a mountain river in the Montseny massif, Catalan Pre-Coastal Range, NE Iberian Peninsula." (Authors)] Address: Martín, R., Martí Julià, 19-23, 08911 Badalona, Spain. E-mail: ricardo.martin@cllicenciats.cat 2 Dr. Salvà, 23, 08224 Terrassa, Spain

17626. Matomela, N.H.; Chakona, A.; Kadye, W.T. (2021): Comparative assessment of macroinvertebrate communities within three Afrotropical headwater streams influenced by different land use patterns. *Ecological Indicators* 129 (2021) 107972: 11pp. (in English) ["Headwater streams in

Afrotropical ecoregions harbour locally adapted aquatic communities. However, across many regions in Africa, these ecosystems and their unique aquatic biodiversity have been severely impacted by unsustainable land use practices. We tested the hypothesis that land use disturbances were the primary drivers of community dynamics by comparing spatial and temporal dynamics together with trait-environment relationships of macroinvertebrate communities in three headwater streams influenced by different land use practices. The three headwater streams were distinguished based on high conductivity, total dissolved solids and alkaline pH in the agriculture-disturbed stream, and low temperature in a stream whose riparian zone was invaded by nonnative vegetation compared to a near-natural stream. Macroinvertebrate taxonomic diversity was, nevertheless, comparable among these three streams. Constrained canonical ordination revealed that seasonality was a major driver of macroinvertebrate dynamics that was reflected mostly by the abundances of six macroinvertebrate taxa (*Baetis*, *Dicentropetelum*, *Afronurus*, *Tricorythus*, *Simulium* and *Cheumatopsyche*), whereas land use contributed a small but significant difference. Trait-environment relationships reflected seasonal changes that included the importance of benthic substratum in winter, the occurrence of collector-gatherer invertebrates in spring and aerial breathing traits in summer. Land use-related traits were, nevertheless, reflected by gill respiration and grazer feeding traits represented by *Afronurus* in the near-natural stream, predator traits represented by *Aeshna* and *Lestes* in the invaded stream, and aerial respiration represented by *Enithares*, *Orectogyrus* and *Rhagovelia* in the agriculture-disturbed stream. Our results suggest that environmental variability associated with seasonality probably played a deterministic role within which land use disturbances operated. Overall, our study suggests that importance of using multiple metrics to unpack the patterns associated with land use disturbances in headwater streams." (Authors)] Address: Matomela, N.H., Dept of Ichthyology and Fisheries Science, Rhodes University, PO Box 94, Makhanda (Grahamstown) 6140, South Africa

17627. Matrozis, R.; Shergalin, E.E. (2021): Janis Racenis (1915-1980) - Latvian ornithologist and Venezuelan odonatologist. *Russian Ornithological Journal* 30: 317-324. (in Russian) [Janis Racenis was born on April 10, 1915 in Riga - the capital of the then Livonia and modern Latvia, which at that time was part of the Russian Empire, and died on the day of his 65th birth on April 10, 1980 in the capital of Venezuela, the city of Caracas. For his native Latvia in the historical memory, he remained as an ornithologist, and for South America - as an odonatologist (specialist in dragonflies Odonata).] Address: Matrozis, R., Latvian Ornithological Society. E-mail: matruslv@inbox.lv

17628. Michalczyk, W.; Buczynski, P.; Piwko-Witkowska, E. (2021): Record of *Sombre Goldenring Cordulegaster bidentata* SELYS, 1843 (Odonata: Cordulegasteridae) in the Roztocze Upland confirms the existence of its disjunct distribution area in south-eastern Poland. *Odonatrix* 17_6

(2021): 4 pp. (in Polish, with English summary) ["Single males of *C. bidentata* hunting and resting around potential breeding habitat were recorded twice in July 2018 in the lower valley of the Jeleń stream in the Roztocze Upland (50°24'01.7"N 23°11'38.6"E, UTM: FA58, 249 m a.s.l.). This is the first record of this species in this region. *C. bidentata* was also found recently in the Sandomierz Basin. These two localities are separated by a distance of only ca 7 km. The data from the Roztocze Upland confirm the hypothesis that an isolated distribution area of *C. bidentata* exists in the middle part of the River Tanew basin. This is the only area of occurrence of this species in Poland that is not situated in the mountains or foothills. This is due to the favourable terrain on the border of the Roztocze Upland and the Sandomierz Basin, and the unfavourable topography in the central part of the Sandomierz Basin." (Authors)] Address: Michalczuk, W., Zamojskie Towarzystwo Przyrodnicze, ul. Oboźna 19, 22-400 Zamosc, Poland. E-mail: wiack@wp.pl

17629. Michalczuk, W.; Buczynski, P. (2021): Reproductive success of Wandering Glider *Pantala flavescens* (Fabricius, 1798) (Odonata: Libellulidae): the second record from Poland. *Odonatrix* 177 (2021): 5 pp. (in Polish, with English summary) ["Two exuviae of *P. flavescens* were found on August 21, 2020 in a small water body (1.21 ha) in the initial stage of succession in a sand mine near Tyszowce, eastern Poland (50°38'09.7" N 23°43'07.8" E, 192 m a.s.l.). This is the fourth locality of this species in Poland and the second one where reproductive success has been confirmed (both cases in 2020). This record is discussed in the context of data from central and eastern Europe. *P. flavescens* is known to have migrated as far north as 55°20' N, possibly even to 55°35' N (uncertain data from Russia). Reproductive success was found farthest north at 50°38' N-52°31' N. First-generation imagines have been observed in Europe from late May to early July, and the development of eggs and larvae is rapid, taking slightly more than 40 days. Therefore, the hatching of second generation individuals can be expected from the first half of July to the first half of August." (Authors)] Address: Michalczuk, W., Zamojskie Towarzystwo Przyrodnicze, ul. Oboźna 19, 22-400 Zamosc, Poland

17630. Mikołajczuk, P. (2021): Habitat selection and population dynamics of *Nehalennia speciosa* (Charpentier, 1840) in Southern Podlasie and adjacent areas, Mideastern Poland. *Odonatrix* 17_Suplement 1.IV, 81 pp, 51 pp suppl. (Polish, with English summary) ["The paper presents rich new data about 61 localities of *Nehalennia speciosa* discovered after 2009 in Mideastern Poland (tab. 1). Acidic Sphagnum mires formed greatest part of the species habitat spectrum there while acidic non-Sphagnum fens were slightly less frequent (fig. 5-l). Alkaline non-Sphagnum fens and water bodies in gravel pits were rarely inhabited by the species (fig. 5-l). The used by *N. speciosa* emergent plant formations were composed by many herbaceous species, but most frequently by – in descending order of frequency – *Carex rostrata*, *Juncus effusus*, *Carex lasiocarpa*, *Eriophorum vaginatum* and *Carex vesicaria* (fig. 6). The localities in the study area usually were only shallowly inundated and

lacked open, stable water bodies. This general feature was more pronounced in the eastern part of the study area, where almost no stable water bodies occurred, and it was less marked in the western part, where the stable water bodies occurred fairly often. Probably all the water bodies had anthropogenic (peat excavation) origin. Most of the recorded localities showed great habitat dynamics related to annual precipitation variability. The water level, being extremely risen in 2010-2011 and still high in further three years (tab. 3, fig. 7b), caused significant changes in the habitats, such as massive decline of forests and expansion of Sphagnum mosses and formations of Cyperaceae. During this time, at least 40–50% of the 37 monitored localities in the eastern part of study area became colonised by *Nehalennia speciosa* or at least attempts of colonisation occurred (tab. 4). The colonisations were really rapid, usually in the first two years of suitable conditions. In the next years, progressive drop in the water level caused drying up of the habitats and decline of the populations. Finally, probably only two of the 37 monitored populations were still existing in 2018, while the rest became extinct (tab. 4, fig. 7b). The main cause of the populations' extinction was, thus, absence of stable permanent water bodies, where *N. speciosa* might have survived the unfavourable dry years. Deep and relatively stable anthropogenic post-peat water bodies turned out, thus, to be very important for the species survival in the study area. The long-term precipitation data, historical maps and paleoecological data from upper peat deposits indicated that the localities in the eastern part of study area were hydrologically unstable also in the past, with a series of wet and dry phases during the 20th and 21st centuries (fig. 9). In many peat profiles, highly decomposed peat layers and botanical indicators of dry conditions, such as *Betula*, *Pinus*, *Carex canescens*, *Calamagrostis canescens* and *Lycopus europaeus*, were found in their 20th century's parts (fig. 8a-b). Some localities remained overgrown by forest for many decades, leaving relatively thick woody peat layers. The age of dying trees during extremely wet years 2010–2011 suggested that a previous similarly extremely wet period occurred here probably in the first half of the 20th century. However, the complex of wet episodes between the 1960s and 1980s was also significant. This situation suggest that occurrence of *N. speciosa* in the eastern part of study area was generally fluctuating not only in the 21st century, but at least since the first half of the 20th century. The paper also includes a synthesis of all published Polish data collected up to 2017 (fig.1, tab. 6) as well as comparison between the current (i.e. known in 2017) and older (2007) state of knowledge (tab. 7). Up to 2007, *N. speciosa* was described from 69 localities in Poland. These localities concentrated mainly in the northern part of the country, in areas covered by the last glaciation (lakelands), locally also in the east and south in old-glacial areas. The older data indicated that the species inhabited in Poland mainly small, natural dystrophic lakes surrounded by transition (Sphagnum) mires. Habitats of other types, such as peat excavation pools and transition mires without open water bodies were more rarely reported and located mainly in the old-glacial areas in the East. Almost all Polish localities known up to 2007 were situated in

forests. According to those data, the species was found most frequently in formations of *Carex lasiocarpa* and *C. limosa*, clearly more rarely in *Carex rostrata* and only exceptionally in other herbaceous plants' formations. Up to 2017, the number of known Polish localities rose to 168. Most of the newly reported localities were situated in old-glacial areas, mainly in the eastern part of country. The current data shows that the habitat spectrum in Poland is generally wider in comparison to older (2007) data and is different in last-glacial and old-glacial areas. In the former, the habitat spectrum was still based mostly on small, midforest dystrophic lakes surrounded by transition (*Sphagnum*) mires with a rim of *Carex limosa*/*Carex lasiocarpa* formations near the open water table, while in the latter the habitat spectrum was more diverse, comprising various types of nutrient-poor peatland (acidic *Sphagnum* mires, acidic and alkaline non-*Sphagnum* fens), in many cases without any open water bodies. Also broader spectrum of inhabited plant formations was recorded in the recently studied old-glacial areas, including e.g. *Carex rostrata*, *C. lasiocarpa*, *Juncus effusus*, *Eriophorum vaginatum*, *Carex vesicaria*, *C. elata*, and *Equisetum fluviatile*. The stable open water bodies inhabited in the old-glacial areas were often of anthropogenic origin. Some of the newly reported localities were also situated completely outside forests. Data from the study area and the recent water level oscillations recognisable on the photomaps indicated that the occurrence of *N. speciosa* in Poland is obviously fluctuating due to precipitation variability. This dynamics is regionally diversified: greater in the old-glacial areas and lesser in the last-glacial areas in the North. The terrestrialisation of natural water bodies is much more advanced in the old-glacial areas, because the lake depressions here are usually shallow and filled with sediments almost completely. For that reason, the habitats here are generally more sensitive to drying out in comparison with the last-glacial areas in the North, where stable, deep post-glacial lakes are still common. Except for mountains in the South of the country, also annual precipitation averages are higher in the last-glacial areas in the North, what is also followed by higher stability of the habitats in that zone. *N. speciosa* was considered as a low-mobile species due to its small size, delicate body build, poor flight activity, strong attachment to narrow-leaved vegetation in development places, very rare observations in unsuitable habitats (even very close, e.g. 100 meters from large populations) and occurrence mostly in stable, natural habitats. However, a) regularly reported colonisations of new habitats, including rapid colonisations of many localities recorded in the study area, b) the species genetics (low diversity, lack of phylogeographic structure) as well as c) its wide, trans-Palaearctic range do not support that conclusion. It seems, therefore, that long-distance relocation of imagines occurs more frequently. This relocation is hypothetically based on specific long-distance dispersal flights that comprise three main phases: 1) active rising into the air, possibly to considerable heights, 2) partly active flight driven and supported by air streams and observation of terrain from a height, 3) falling down into a suitable habitat. This suggested pattern of relocation was supported by data from the study area, where

active flights of imagines high into the air were observed. It might also explain rare observations of imagines in unsuitable habitats." (Author)] Address: Mikolajczuk, P., Sekcja Odonatologiczna Polskiego Towarzystwa Entomologicznego, Poland. E-mail: gugapm@wp.pl

17631. Mohidilkhan, Z.M.; Alimovich, M.B. (2021): Seasonal activity of dragonflies (Insecta: Odonata) in the Fergana valley. Scientific Bulletin of Namangan State University 2(2): 125-129. (in Tajik, with Russian and English summaries) ["The article discusses the features of seasonal activity of dragonflies in the Fergana valley. It was found that the activity of dragonflies lasts from the second decade of March to the end of October during the year. At the same time, 2 activation time Peaks were observed." (Authors)] Address: Suvanhanovna, Zakirova Mohidilkhan, Andijon state University named after Z.M.Babur

17632. Mohira, A.; Makhsetbai, M.; Ikrom, A. (2021): Dragonfly fauna (Insecta: Odonata) of the Khorezm oasis. III international scientific and practical conference | ICNS "SCIENCE AND EDUCATION" : 22-24. (in Russian, with English summary) ["An article about our research on the faunistic analysis of dragonflies in the Khorezm oasis, information on some species of dragonflies that arise in Uzbekistan. Of great scientific and practical importance is the assessment of the current state of dragonflies, one of the most important groups of animals in the ecosystem, analysis of their faunistic composition, substantiation and implementation of scientific conclusions in the development of measures to study their distribution, economic significance and harm." (Authors)] Address: details not stated

17633. Monnerat, C.; Weiss, E.; Churko, G.; Fabian, Y. (2021): Die Libellengemeinschaft der Nassreisfelder in der Schweiz (Odonata). Libellula Supplement 16: 201-228. (in German, with English and French summaries) ["The dragonfly community in paddy fields in Switzerland (Odonata) – Odonata monitoring carried out in ten Swiss paddy fields in 2019 and 2020 revealed 42 species. Of these, 14 species developed in the fields, of which ten are bivoltine (*Ischnura elegans*, *I. pumilio*, *Anax ephippiger*, *A. imperator*, *A. parthenope*, *Crocothemis erythraea*, *Orthetrum albistylum*, *O. brunneum*, *O. cancellatum*, *Sympetrum fonscolombii*) and four univoltine (*Sympecma fusca*, *Sympetrum depressiusculum*, *S. striolatum*, *S. vulgatum*). The discovery of exuviae of *S. depressiusculum*, *S. striolatum*, and *S. vulgatum* in July 2020 documented their development and the survival of the eggs during the harvest in October and the preparation of the plots for sowing and planting in May. A mass emergence of a second generation of *A. ephippiger* and *S. fonscolombii* was observed in 2019. Population estimates for the Brugg site amounted to thousands or even tens of thousands of individuals, confirming the attractiveness of this habitat for the development of both migratory species in Central Europe. For *A. ephippiger*, the year 2019 corresponds to one of the largest known influxes in Switzerland and Europe over the last thirty years. The proven development of *S. depressiusculum* in the rice field of Ins suggests that rice fields have a

conservatory significance for this threatened species." (Authors)] Address: Monnerat, C., Info fauna, Bellevaux 51, 2000 Neuchâtel, Switzerland. E-mail: christian.monnerat@unine.ch

17634. Monnerat, C. (2020): La première donnée suisse d'*Aeshna subarctica* Walker, 1908 est jurassienne! (Odonata: Aeshnidae). *Entomo Helvetica* 13: 117-122. (in French, with German and English summaries) ["An adult male of *Aeshna subarctica* collected in 1967 by Willy Matthey in the Vallée de Joux in the Swiss Jura Mountains was discovered in the entomological collection at the Institute of Biology at the University of Neuchâtel. This specimen represents the first record for this species in Switzerland, as well as in the Jura Mountains." (Author)] Address: Monnerat, C., info fauna, Bellevaux 51, CH-2000 Neuchâtel, Switzerland. E-mail: christian.monnerat@unine.ch

17635. Moore, M.P.; Hersch, K.; Sricharoen, C.; Leeb, S.; Reice, C.; Rice, P.; Kronick, S.; Medley, K.A.; Fowler-Finna, K.D. (2021): Sex-specific ornament evolution is a consistent feature of climatic adaptation across space and time in dragonflies. *PNAS* 2021 Vol. 118 No. 28 e2101458118. 7 pp. (in English) ["Adaptation to different climates fuels the origins and maintenance of biodiversity. Detailing how organisms optimize fitness for their local climates is therefore an essential goal in biology. Although we increasingly understand how survival-related traits evolve as organisms adapt to climatic conditions, it is unclear whether organisms also optimize traits that coordinate mating between the sexes. Here, we show that dragonflies consistently adapt to warmer climates across space and time by evolving less male melanin ornamentation—a mating-related trait that also absorbs solar radiation and heats individuals above ambient temperatures. Continent-wide macroevolutionary analyses reveal that species inhabiting warmer climates evolve less male ornamentation. Community science observations across 10 species indicate that populations adapt to warmer parts of species' ranges through microevolution of smaller male ornaments. Observations from 2005 to 2019 detail that contemporary selective pressures oppose male ornaments in warmer years; and our climate-warming projections predict further decreases by 2070. Conversely, our analyses show that female ornamentation responds idiosyncratically to temperature across space and time, indicating the sexes evolve in different ways to meet the demands of the local climate. Overall, these macro- and microevolutionary findings demonstrate that organisms predictably optimize their mating-related traits for the climate just as they do their survival-related traits." (Authors)] Address: Moore, M.P., Living Earth Collaborative, Washington University, St. Louis, MO 63130, USA

17636. Murwitaningsih, S.; Setyaningsih, M.; Sandajaja, D.P. (2021): Developing an Android-based guidebook to dragonflies and butterflies. *Advances in Social Science, Education and Humanities Research* 547: 227-231. (in English) ["Dragonflies (Odonata) and butterflies (Lepidoptera) play very important roles in the ecosystem and there are a great many of them. It is estimated that there are more than 5,000

types of dragonflies and 17,500 types of butterflies in the world, among them around 800-1,000 types of dragonflies and 2,200-3,000 types of butterflies can be found in Indonesia. A series of observations conducted in July 2018 at the Cibodas Botanical Garden in West Java found 8 species of dragonflies and 33 species of butterflies. The aim of this research is to develop an Android-based mobile guidebook application for dragonfly and butterfly observation that can be used at any time to easily identify dragonflies and butterflies. This research is a development research that refers to the 4D development model. In the Define stage, activities were carried out to collect initial information related to the diversity of dragonflies and butterflies. In the Design stage, activities were carried out to design books and Android applications. In the Develop stage, validation activities were carried out by dragonfly and butterfly experts, as well as media experts using questionnaires, interviews and discussions (FGD). In the Disseminate stage, activities were carried out to test an android application on students of the Biology Education Department at FKIP UHAMKA. The data obtained were analyzed using quantitative and qualitative descriptive techniques. The test results show that the guidebook was assessed as very good on the presentation aspect, very good for the material and good for the language, with a score of 88%, 85% and 82%, respectively. Thus, this mobile guidebook application, called ODOLEPI, is feasible for use in the observation of dragonflies and butterflies." (Authors)] Address: Murwitaningsih, S., Biology Education Dept, Univ. of Muhammadiyah Prof. Dr. HAMKA, Jakarta, 12130, Indonesia. E-mail: murwitaningsih@uhamka.ac.id

17637. Nayak, A.K.; Roy, S. (2021): Further additions to the Odonata (Insecta) fauna of Asansol-Durgapur Industrial Area, Paschim Bardhaman, India. *Journal of Threatened Taxa* 13(6): 18631-18641. (in English) ["In this present communication we report the occurrence of additional 13 Odonate species from the Asansol-Durgapur Industrial Area, West Bengal, India, making the total 76. This paper reports the first record of *Libellago indica* and first photographic records of *Macromia flavicincta* from West Bengal. It also reports the range extension of *Macromia cingulata* from the Purulia District to Paschim Bardhaman District." (Authors)] Address: Roy, S., B-9/138, Kalyani, Nadia, West Bengal 741235, India. E-mail: roy.riju.nitdgp@gmail.com

17638. Nel, A.; Huang, D. (2021): A new damselfly family from the Middle–Late Jurassic of China (Odonata: E-piproctophora). *Alcheringa* 45(1): 91-94. (in English) ["*Enigmalestes lini* gen. et sp. nov. is described and illustrated on the basis of a complete forewing from the Middle–Late Jurassic of China. It corresponds to a new family *Enigmalestidae* due to a unique combination of characters. We propose to include it in the isophlebiopteran clade *Euparazygoptera*. This new species shows a highly specialized cubitoanal area, features that are convergently present in *Asiapteridae*, *Triasolestidae*, and the enigmatic genus *Germanophlebia*, the latter of which we exclude from the *Euparazygoptera* and transfer into the *Isophlebiida* sit. nov. *Enigma-*

lestes is among the youngest representatives of the Eupazygoptera, otherwise known from the Late Triassic to the Early Jurassic. This discovery confirms the high diversity of the Odonata during the Mesozoic." (Authors)] Address: Nel, A., Lab. Ent.. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: anel@cimrs1.mnhn.fr

17639. Nel, A. (2021): Maastrichtian representatives of the dragonfly family Aeschnidiidae question the entomofaunal turnover of the early Late Cretaceous. *Palaeoentomology* 4(3): 209-212. ["Gaps in the fossil record are the major challenge for estimations of impacts of crises of biodiversity of the various clades. They can lead to important misinterpretations in the effects of the different events on the fauna and flora. It is especially the case for the end-Cretaceous, which is 'near the midpoint of a 16-million-year gap in the insect fossil record' (Schachat & Labandeira, 2021: 111). All the important Cretaceous insect Konzentrat Lagerstätten are before the Turonian. The analysis of Schachat et al. (2019) has reconstructed a massive loss of family-level diversity for the insects at the boundary Cretaceous-Cenozoic, a possible artefact due to this gap. An alternative scenario was that a turnover in the entomofauna occurred during the early Late Cretaceous in relation to the floristic changes of the Albian–Cenomanian (Nel et al., 2018). This turnover would have also affected the aquatic insects through important changes in the freshwater environments (Sinitshenkova & Zherikhin, 1996; Ivanov & Sukatsheva, 2002). The current knowledge on the odonatan fossil record suggests a pronounced turnover with the last records of several major clades during the Cenomanian-Turonian and first records of several modern ones during the same period (Nel et al., 2015). The widespread and very diverse Jurassic–Cretaceous family Aeschnidiidae is among the best examples of such extinctions supposed to have occurred after the Cenomanian, because of the absence of any fossil in younger strata." (Author)] Address: Nel, A., Lab. Ent.. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: anel@cimrs1.mnhn.fr

17640. Nel, A.; Zhang, D. (2021): The recently proposed odonatan 'suborder' Cephalozygoptera: fact or fiction. *Palaeoentomology* 4(2): 165-170. (in English) ["The new 'suborder' Cephalozygoptera was recently proposed for three fossil families of damselfly-like Odonata, on the basis of three characters of the head. Here we show, thanks to counterexamples of the presence of these characters in compression fossils of genuine Zygoptera, that these 'characters' do not exist in reality but are due to deformations and compression of the heads, a very frequent phenomenon in the fossil record of the whole superorder Odonatoptera. Furthermore, these alleged characters would have to have been regarded as symplesiomorphies, insufficient to support a new clade. Consequently, we consider the Cephalozygoptera as unfounded, to be rejected in the current state of knowledge. A new phylogenetic analysis of the whole clade Panodonata would be welcome. We also discuss the position of some previously described fossils: the Paleocene genus *Valerea*

is restored in the Epallagidae (Euphaeidae), and the two Burmese amber genera *Electrodysagrion* and *Palaeodysagrion* are restored in the family *Dysagrionidae*." (Authors)] Address: Nel, A., Lab. Ent.. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: anel@cimrs1.mnhn.fr

17641. Nemirini, T. (2021): Improving the performance of horizontal axial wind turbines using bioinspired airfoil shapes for its blades at low Reynolds numbers. PhD. thesis, Department of Electrical and Mining Engineering, University of South Africa. XII + 80pp.(in English) ["Small-scale wind turbines were not considered viable in the past due to their poor efficiencies, mainly because of their aerodynamic effects around the irfoil shape. Recently researchers have renewed interest in enhancing the aerodynamic performances of the blades' designs inspired by the aerodynamic pattern of biological characteristics of insects and marine mammals such as locusts, dragonflies, damselflies, Humpback Whales etc. Bioinspired wing designs have advantages compared to conventional smooth irfoil blades as they can counter the bending forces that the wings experience during flapping. Bio-inspired corrugated airfoil based on dragonfly wing geometries have been reported to perform well compared to conventional airfoil at low Reynolds numbers. Corrugated airfoils reduce flow separation and enhance aerodynamic performance by trapping vortices in the corrugations thus drawing flow towards the airfoil's surface. This results in the higher lift whilst incurring only marginally higher drag. Such airfoils also have an advantage when it comes to span-wise structural stiffness due to the corrugated cross-sections. Replacing conventional turbine blades by tubercles or corrugated blades could enhance turbine performance by reducing the pressure gradient along the leading edge; however, the aerodynamic effects at the leading edge will depend on the variations of wavelength and amplitude. In this study, two types of computational studies were investigated: Optimising a corrugated airfoil and investigating the aerodynamic effects of a sinusoidal shape at the leading edge of a blade. Previous studies used an idealized geometry based on the dragonfly wing cross-section profile but did not attempt to optimize the geometry. In the present study: a two-dimensional CFD model is constructed using ANSYS Fluent Workbench-Design Explorer to determine the optimal corrugated blade profile for four angles of attack (AOA) from 5° to 20° corresponding to typical AOA of small-scale wind turbine blades. Two modified blades with variations of wavelength and amplitude at the leading edge were studied to investigate the aerodynamic effects. Three-dimensional models were constructed using Qblade software and 3D points were exported to AutoCAD Inventor to generate the CAD model. The governing equations used are continuity and Navier-Stokes equations written in a frame reference rotating with the blade. The CFD package used is ANSYS FLUENT 19.0. The simulation was run under steady-state, using SST-k omega turbulence model. The modifications have improved the aerodynamic performance. The optimised corrugated blade produced a maximum increase of CL and L/D. Both modified blades (1 and 2) had their performances measured separately and compared to that of

baseline blade SG6042 (Conventional blade). Modified blade 1 had a lower wavelength and amplitude at the leading edge of 14.3 % and 4 % respectively of the chord. It was noted that the aerodynamic performance decreased by 6%. Modified model 2, on the other hand had a higher wavelength and amplitude at the leading edge. of 40.4 % and 11.9 % respectively of the chord. It was also noted the aerodynamic performance increased by 6%. From the empirical evidence highlighted above, it can be observed that there is a direct correlation between wavelength, amplitude, and aerodynamic performance of the blade." (Author)] Address: Nemirini, T., Dept of Electrical and Mining Engineering, University of South Africa, Private Bag X6, FLORIDA, 1710, SA

17642. Ngiam, R.W.J.; Chan, J.P.S.; Khoo, M.D.Y.; Kong, E.Y.L.; Low, B.W. (2021): Description of the larva of *Brachygonia oculata* (Brauer, 1878) (Odonata: Libellulidae) with notes on rearing technique. *Zootaxa* 4966(5): 563-570. (in English) ["The larva of the genus *Brachygonia* Kirby, 1889 is described and illustrated for the first time based on the larvae of *Brachygonia oculata* (Brauer, 1878) discovered and successfully reared in Singapore. Compared to known larvae from genera in the rather heterogeneous subfamily Brachydiplacinae, *B. oculata* is most similar to species from the genus *Brachydiplax* Brauer, 1868 after comparison is made with the larva of *Brachydiplax farinosa* Krüger, 1902." (Authors)] Address: Ngiam, R.W.J., Block 539, Ang Mo Kio, Avenue 10, Unit 13-2577, Singapore 560539. E-mail: yan-robin@hotmail.com

17643. Ngo, Q.P.; Phan, Q.T.; Bui, A.P.; Karube, H. (2021): Description of the female *Atratothemis relsi* Wilson, 2005, from central Vietnam, with notes on the male (Odonata: Libellulidae). *Odonatologica* 50(1/2): 107-114. (in English) ["Illustrations of both sexes of *Atratothemis relsi* Wilson, 2005, including a description of the female based on specimens from central Vietnam are presented." (Authors)] Address: Ngo, Q.P., Center for Entomology & Parasitology Research, College of Medicine & Pharmacy, Duy Tan Univ., Da Nang 550000, Vietnam. E-mail: ngo-quocphu@gmail.com

17644. Nilamsari, E.I.; Umah, N.; Daradwinta, R.; Nicolla, A.C.; Irsyad, A.N.; Firdasia, W.; Sarifah, Z.; Sukirno, S. (2021): The diversity of Odonata in Parangkusumo Sand Dune Yogyakarta, Indonesia. *IOP Conf. Ser.: Earth Environ. Sci.* 736 012047: 5 pp. (in English) ["Parangkusumo sand dune is a one of unique eolian ecosystem in Yogyakarta. The study on the species diversity of dragonflies in this habitat is still limited. The main purpose of this research was to observe the dragonflies species diversity in Parangkusumo sand dune, Yogyakarta, Indonesia. The collection of dragonflies was done by aerial collection using sweep net. The specimens identification was done in Entomology Laboratory, Faculty of Biology, Universitas Gadjah Mada based on the morphological characters of the adult stage. The results showed that there were 22 species of Odonata, including 17 Anisoptera and 5 Zygoptera. The diversity index (H') was 2.51 which inferred medium diversity. Several species such as

Anax guttatus, *Lestes praemorsus* and *Tramea transmarna* were found to be endemic species. The highest relative abundance of the species was *Orthetrum sabina* (21.79%) and lowest abundance of species is *Orthetrum chrysis* (0.14%). Parangkusumo sand dune has medium dragonfly diversity, thus it is recommended this habitat need to be conserved." (Authors)] Address: Nilamsari, E.I., Faculty of Biology, Universitas Gadjah Mada, Yogyakarta, Indonesia. E-mail: elvianindah@mail.ugm.ac.id

17645. Noorhidayah, M.; Arpah, A.; Norma-Rashid, Y. (2021): Classification and morphology of *Rhinocypha* spp. (Odonata): A comprehensive taxonomic study within the females. *Zoological Studies* 60: 39 pp. (in English) ["Studies on Odonata have gained worldwide attention as well as locally in Malaysia. Although there is a wealth of data available to be utilized for solving taxonomic problems but ecological and behavioural research areas are more favoured in contrast to taxonomy and systematics. Thus, there are existing confusions for correct identifications in closely related and sympatric species, especially in female odonates. One such example is in the genus of *Rhinocypha*. Consequently, the research is focused on taxonomic work, employing multi-approaches in the form of morphological (morphological diagnostics, Field Emission Scanning Electron Microscope and geometric morphometric analysis), with applying the molecular technique. 17 morphological characteristics were created to differentiate between the females of *Rhinocypha* spp. The FESEM on the female's ovipositor was done to focus on the anal appendages and sheathing valve (V3). Also, the phylogenetic patterns expressed by COI and 16S rRNA genes, and canonical variate analysis for the wing geometric morphometric revealed three clusters that supported the distinction of the *Rhinocypha* group. In summary, this study had effectively developed an integrated approach of classic morphological and trendy molecular, combined with microscopy techniques, FESEM, which provided corroborative evidence in resolving taxonomic uncertainties." (Authors) *Rhinocypha biforata*, *R. fenestrella*, *R. perforata*] Address: Noorhidayah, M., Institute of Biological Science, Faculty of Science, University of Malaya, Kuala Lumpur, Malaysia. E-mail: nhidayahm@um.edu.my

17646. Novelo-Gutiérrez, R.; Arce-Pérez R. (2021): Description of the larva of *Micrathyria paulsoni* González-Soriano, 2020 (Odonata: Libellulidae). *Zootaxa* 4981(2): 357-364. (in English) ["The last instar larva of *M. paulsoni* is described and illustrated in detail based on specimens collected in Veracruz State, Mexico. It is compared with the larvae of *M. didyma* (Selys in Sagra, 1857) and *M. hypodidyma* Calvert, 1906, all of them belonging into the "*Micrathyria didyma*" group. The main structural features of *M. paulsoni* larva are 9–10 long premental setae plus 4–5 small setae, palpal setae 10, legs banded, a large, submedian, dark spot on each side of a pale middorsal line on S6–9, S8–9 with a posterolateral spine, larger in S9." (Author)] Address: Arce-Pérez R., Inst. Ecología A.C. Red Biodiversidad y Sistemática. Carretera Antigua a Coatepec 351, El Haya, 91070 Xalapa, Veracruz, Mexico. E-mail: roberto.arce@inecol.mx

17647. Novelo-Gutierrez, R. (2021): Description of the larva of *Planiplax sanguiventris* (Calvert, 1907) (Odonata: Libellulidae). *Zootaxa* 4966(5): 578-584. (in English, with Spanish summary) ["The last instar larva of *P. sanguiventris* is described and illustrated in detail based on one specimen collected in the municipality of Tenosique, Tabasco, Mexico. It is compared with the larvae of *P. phoenicura* Ris, 1912 and a congeneric unidentified species from Colombia. The main structural features are the number of setae on palp and prementum, the size of dorsal protuberance on S3, and the length of posterolateral spines on S8–9 and caudal appendages." (Author)] Address: Novelo-Gutierrez, R., Instituto de Ecología A.C. Red de Biodiversidad y Sistemática. Carretera Antigua a Coatepec 351, El Haya, 91070 Xalapa, Veracruz, Mexico. E-mail: rodolfo.novelo@inecol.mx

17648. Novin, T.; Riyanto (2021): The abundance of Odonata insect in Lebak swamp, Bukit Baru, Palembang, Indonesia. *Jurnal Biologi Tropis* 21(1): 255-261. (in English) ["Lebak swamp in Bukit Baru has been largely degraded due to reclamation activity. Lebak swamp plays important role as land resource in Bukit Baru, Palembang. The aim of this study was to examine the composition of Odonata in lebak swamps in Bukit Baru, Palembang, Indonesia. The transect line (1 km) was used to collect odonata in the study area. This study recorded 8 species during the study period. The highest diversity of odonata was found in site A1. The highest abundance of odonata was recorded at site A2 and A4 and dominated by *Ceriagrion coromandelianum* and *Orthetrum sabina*. *Neurothemis ramburii* had the lowest abundance at site A1 and A2, but absent at site A3 and A4. The occurrence of odonate species are lower at site around anthropogenic activity suggests the need to protect the lebak swamp so that such uncommon species will not go into local extinction. *Neurothemis ramburii* can become potential species to evaluate the rate of disturbed environment." (Authors)] Address: Novin, T., Raden Fatah Islamic State Univ., Palembang, Indonesia; E-mail: Novinteristiandi_uin@radenfatah.ac.id

17649. Noviyana, W.; Triyanti, M.; Widiya, M. (2021): Inventory of dragonflies in the Curug Panjang Waterfall area, Muara Beliti District, Musi Rawas Regency. *Journal on Biology and Instruction* 1(1): 1-6. (in English, with Indonesian summary) ["There are many kinds of fauna in the waterfall Curug Panjang Muara Beliti, Musi Rawas Regency. One of the types of fauna found in this area is insects. Dragonflies is insects whose habitats live in water and in the air. This study aims to determine the types of dragonflies and abiotic factors carried out in the Curug Panjang waterfall area by using purposive sampling method. Data collection techniques are observation, documentation and identification. Sampling using insects net. The results of the study have been obtained by 2 sub-orders, 4 families and 12 different species namely *Diplacodes trivialis*, *Orthetrum pruinosum*, *O. sabina*, *O. pruinosum*, *Crocothemis servillia*, *Neurothemis ramburii*, *Trithemis aurora*, *Pantala flavescens*, *Tholymis tillarga*, *Ictinogomphus*, *Agriocnemis pygmaea*, and *Copera marginipes*. Abiotic factor measurement results are

with an average air temperature of 27,75°C, 76% air humidity and 396,5 lux light intensity." (Authors)] Address: Noviyana, Windy, Biology Education STKIP PGRI Lubuklinggau, Jl. Mayor Toha Kel. Air Kuti, Lubuklinggau, Indonesia. E-mail: windy.ny09@yahoo.com

17650. Nunes, L.; Casanueva, P.; Santamaría, T.; Hernández, M.A.; Campos, F. (2021): Useful biometric variables in Iberian exuviae of *Boyeria irene* (Fonscolombe, 1838) (Odonata: Aeshnidae). *International Journal of Odonatology* 24: 158-168. (in English) ["In species of similar shape and size, biometric analyses make it possible to establish differences. Within one species, biometrics can help researchers to detect differences between populations and analyze their adaptations to environmental conditions. Until now little was known about the biometrics of the Iberian populations of *B. irene*, a large species living mainly in southern Europe. Eight biometric variables were studied in male and female exuviae of *B. irene* collected in three rivers of the Iberian Peninsula, with the objective of ascertaining which are the most suitable populations of this species to study. An analysis of principal components (PCA) shows that lengths of the epiproct, paraproct and prementum are the most influential in each of the three populations. The other variables (head width, body length, length of the gonapophyses, maximum and minimum width of the prementum) proved not to be relevant in this context." (Authors)] Address: Nunes, Luisa, Escola Superior Agrária de Castelo Branco (ESA-IPCB/CEABN-INBIO), Qta. Sra. Mércules, 6000 Castelo Branco, Portugal. Email: pcasanueva@uemc.es

17651. Nur-ul-Islam, H.; Zia, A.; Khan, K.; Ali, H.; Aziz, A. (2021): *Sympetrum hypomelas* (Selys, 1884), an addition to Anisoptera fauna of Pakistan. *Pakistan Journal of Agricultural Research*, 34(3): 538-544. (in English) ["*S. hypomelas* is added to the Anisoptera fauna of Pakistan by reporting it from district Swabi of Khyber Pakhtunkhwa province. Out of 33 sampling sites, specimens of *S. hypomelas* were found from a single locality of the district. Identification of the specimens was done at National Insect Museum, Islamabad. Detailed description including synonyms, differential characters for the species, previous global records, habitat description, measurements of body parts and ecological data for the positive localities are provided. With the addition of this taxon, Anisoptera fauna of Pakistan now counts 74 species. The area carries important ecology and is less explored for odonate fauna. Although in recent past, few faunistic studies were conducted in this area; yet these couldn't add anything new to the country's fauna. The area under district Swabi represents many lush green valleys and possesses lots of water bodies which support a broad complex of Odonata. More surveys in the district are suggested to unveil probable new records from the area. ... Locality: Tehsil Razzar: Village, Qassam Killi/ also known as Shadad Killi (34.10759°N, 72.27002°E; 1112ft), 19. ix. 2018, 1 male; 24. ix. 2018, 1 ♀." (Authors)] Address: Nur-ul-Islam, H., Dept Zool., Abdul Wali Khan Univ. Mardan, Khyber Pakhtunkhwa, Pakistan

17652. Odabasi, S. (2021): Assessment of habitat quality using macroinvertebrates and water quality parameters of a clay quarry wetland. *Journal of Advanced Research in Natural and Applied Sciences* 7(2): 274-281. (in English) ["In this study, it is aimed to determine the habitat quality of the Bozalan quarry wetland by using diversity and a compositional index of benthic macroinvertebrates and some of the water quality parameters. The field studies were conducted in the three sampling sites chosen in the wetland three times (March, April, and May) in 2018. The standard multi-habitat method was used for the benthos sampling. Besides, water sampling was performed for the parameters measured in-situ and analyzed in the laboratory to reveal the water quality status of the wetland. Some of the diversity index values of the benthic macroinvertebrates including Shannon Wiener (H'), Evenness Index (EI), and BMWP-e were calculated. The results showed that the sampling sites were categorized into higher classes (I and II) in general according to water quality criteria of the surface waters of Turkey. Fourteen taxa of benthic macroinvertebrates were identified. The most dominant taxa were *Coenagrion* sp. (42.31%), *Baetis rhodani* (15.38%), and *Physella acuta* (10%) in the study area. The highest number of individuals of macroinvertebrates was obtained in March (62 ind./m²), meanwhile the highest taxa number was determined in May (10 taxa). The H' index was reached its highest value in May (1.723), whereas the lowest value of the index was in March (1.054). The highest score of the BMWP-e was found in May (26), while the lowest score was found in April (16)."] (Authors)] Address: Odabasi, S., Vocational School of Marine Technologies, Çanakkale Onsekiz Mart University, Çanakkale, Turkey

17653. Okude, G.; Futahashi, R. (2021): Pigmentation and color pattern diversity in Odonata. *Current Opinion in Genetics and Development* 69: 14-20. (in English) ["The order Odonata (dragonflies and damselflies) comprises diurnal insects with well-developed vision, showing diverse colors in adult wings and bodies. It is one of the most ancestral winged insect groups. Because Odonata species use visual cues to recognize each other, color patterns have been investigated from ecological and evolutionary viewpoints. Here we review the recent progress on molecular mechanisms of pigmentation, especially focused on light-blue coloration. Results from histology and pigment analysis showed that ommochrome pigments on the proximal layer and pteridine pigments on the distal layer of the epidermis are essential for light-blue coloration. We also summarize genes involved in the biosynthesis of three major insect pigments conserved across insects and discuss that gene-functional analysis deserves future studies."] (Authors) Males of the following species are studied: *Calopteryx japonica*, *C. cornelia*, *Crocothemis servilia* (mature and immature), *Ceriaton melanurum*, *Paracercion hieroglyphicum*, *Lyriothemis pachygastra*, and *Orthetrum japonicum*.] Address: Okude, G., Department of Biological Sciences, Graduate School of Science, The University of Tokyo, Bunkyo-ku, Tokyo, 113-0033, Japan. E-mail: gentaokude@gmail.com

17654. Ott, J. (2021): Libellen im Donnersbergkreis. In: Himmler, H. (Koord.) (2021): *Die Natur in der Region am Donnersberg*. Hrsg: POLLICHA-Kreisgruppe Donnersberg e.V. Eigenverlag der POLLICHA-Kreisgruppe Donnersberg. Kirchheimbolanden, 228 S.: 128-133, -219-220. (in German) [Rheinland-Pfalz, Germany; 49 odonate species are checklisted.] Address: Ott, J., Friedhofstr. 28, D-67705 Trippstadt, Germany. E-mail: ott@lupogmbh.de

17655. Orioli, V.; Gentili, R.; Bani, L.; Aguzzi, S. (2021): Microhabitat selection and population density of *Nehalennia speciosa* Charpentier, 1840 (Odonata: Coenagrionidae) in a peripheral microrefugium. *Wetlands* 41 (86). 14 pp. (in English) ["Peripheral populations of boreal tyrophilic animals and plants often occupy relict Alpine peatlands, which act as microrefugia. Ecological conditions within local peatlands can lead to uncommon adaptations, highly valuable for the long-term conservation of species and habitats. *N. speciosa* is an endangered Odonata distributed in Central and Eastern Europe with peripheral populations in the Alps. We investigated the microscale species-habitat association and the conservation status of one of these populations in a relict raised bog. We applied dynamic N-mixture models to assess population ecology and density, while disentangling predictors' effect on ecological and observation process. We counted *N. speciosa* individuals in spring 2018 along with vegetation, water, soil and weather conditions during surveys. Final model resulted reliable according to performance measures. Spatial variation in *N. speciosa* abundance was driven by vegetation type, with a strong selection for flooded hollows where *C. rostrata*, *R. alba* and *S. palustris* vegetation occupy acidic and oligotrophic shallow pools. Population density showed a peak in the first decade of June and increased with accumulation of superficial water. Detection probability was generally low and decreased further when wind blew. The reduced ecological plasticity of the species imperil the species to habitat and climate changes, which will be particularly threatening for its peripheral Alpine populations in the near future, causing water imbalance and rapid vegetation turnover within the peatlands' fragile microhabitat. The studied peat bog could thus be retained a key future microrefugium for the long-term conservation of tyrophilous wildlife and habitats."] (Authors)] Address: Orioli, V., Dept of Earth and Environmental Sciences, Univ. of Milano-Bicocca, Milan, Italy. E-mail: valerio.orioli@unimib.it

17656. Pachomski, A.; McNulty, S.; Foss, C.; Cohen, J.; Farrell, S. (2021): Rusty Blackbird (*Euphagus carolinus*) foraging habitat and prey availability in New England: Implications for conservation of a declining boreal bird species. *Diversity* 2021, 13, 99.: 15 pp. (in English) ["*E. carolinus* is an imperiled migratory songbird that breeds in and near the boreal wetlands of North America. Our objective was to investigate factors associated with Rusty Blackbird wetland use, including aquatic invertebrate prey and landscape features, to better understand the birds' habitat use. Using single-season occupancy modeling, we assessed breeding Rusty Blackbird use of both active and inactive beaver-influenced wetlands in New Hampshire and Maine, USA. We

conducted timed, unlimited-radius point counts of Rusty Blackbirds at 60 sites from May to July 2014. Following each point count, we sampled aquatic invertebrates and surveyed habitat characteristics including percent mud cover, puddle presence/absence, and current beaver activity. We calculated wetland size using aerial imagery and calculated percent conifer cover within a 500 m buffer of each site using the National Land Cover Database 2011. Percent mud cover and invertebrate abundance best predicted Rusty Blackbird use of wetlands. Rusty Blackbirds were more likely to be found in sites with lower percent mud cover and higher aquatic invertebrate abundance. Sites with Rusty Blackbird detections had significantly higher abundances of known or likely prey items in the orders Amphipoda, Coleoptera, Diptera, Odonata, and Trichoptera. The probability of Rusty Blackbird detection was 0.589 ± 0.06 SE. This study provides new information that will inform habitat conservation for this imperiled species in a beaver-influenced landscape." (Authors)] Address: Pachomski, Amanda, Department of Environmental and Forest Biology, State University of New York College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse, NY 13210, USA. E-mail: amandapachomski@gmail.com

17657. Pachu, A.V.; Kumar, S.; Mohan, V.; Jeeva, V. (2021): Biomonitoring of water quality by the use of aquatic macroinvertebrates of the Mahan River in Singrauli, Madhya Pradesh, India. *Indian Forester* 147(4): 328-338. (in English) ["Aquatic macroinvertebrates in the perennial/seasonal streams of the River Mahan in the Mahan Reserved forest in Singrauli district, Madhya Pradesh were sampled semi-quantitatively with a view to ascertain biological water quality by employing the Macroinvertebrate Water Quality Index (MWQI). The study identified 747 individuals of macroinvertebrates comprising of 32 taxa belonging to 10 orders and 28 families with Ephemeroptera (57%) and Odonata (54%) as the dominant taxa respectively during monsoon and summer. Abundance and richness of macroinvertebrates were relatively high during summer than during the monsoons. Among the Biotic Indices of macroinvertebrates used for biomonitoring, the Taxa Tolerance Score (TTS) indicated 'good' with 'clean, but slightly impacted' water quality, that of the Average Score Per Taxon (ASPT) was 'moderate' and the Macroinvertebrate Water Quality Index (MWQI) indicated 'fair' water quality with 'significant pollution' respectively during both the sampling seasons. This study has improved the authors' knowledge about aquatic biodiversity of the water course and to improve the evaluation of water quality by employing biotic indices based on macroinvertebrates." Odonate taxa are treated at the family level. (Authors)] Address: Pachu, A.V., Institute of Forest Genetics and Tree Breeding, Coimbatore - 641002 India. E-mail: anishpachu@gmail.com

17658. Park, S.-C.; Lee, K.Y.; Choi, K.-S.; Han, M.-S.; Ko, M.-H. (2021): Inhabitat status and gastric contents of invasive fish species and the effect on fish fauna at three reservoirs in National Parks of Korea. *Korean Journal of Ichthyology* 33(2): 84-94. (in Korean, with English summary) [„This

study was conducted to elucidate the impact of invasive species, *Micropterus salmoides* and *Lepomis macrochirus* in Geumgyeji, Samgaji and Naejangji reservoirs of National Parks, Korea in 2020. In the Geumgyeji, 1,221 individuals of 11 species in 7 families were collected including *M. salmoides* (relative abundance, 96.3%) and *L. macrochirus* (0.3%), *M. salmoides* fed mainly on *Rhinogobius brunneus* (IRI, 37.2%), Odonata (25.6%), Megaloptera (11.6%), and *M. salmoides* (7.0%). In the results of Samgaji showed that 854 individuals of 10 species in 5 families were collected including *M. salmoides* (60.8%), and *M. salmoides* fed mainly on Decapoda (shrimp, 33.6%), Odonata (34.4%), *R. brunneus* (21.2%), and *Zacco platypus* (6.1%). In the Naejangji showed that 1,075 individuals of 13 species belonging to 7 families were collected including *L. macrochirus* (38.1%) and *M. salmoides* (9.5%), and *L. macrochirus* fed mainly on Branchiopoda (77.5%), Diptera (9.8%), Decapoda (4.0%) and *M. salmoides* fed mainly on *R. brunneus* (73.3%), Decapoda (21.2%). *M. salmoides* of Geumgyeji and Samgaji were apparently introduced more than a 10 years ago. The fish population declined rapidly since the introduction of *M. salmoides*. *L. macrochirus* of Naejangji was introduced more than 20 years ago, which increased its relative abundance to 40%. *M. salmoides* was introduced five to six years ago, and the fish species and population declined rapidly since the introduction of *M. salmoides*. Finally, we discussed the inhabitat status and management of *M. salmoides* and *L. macrochirus* in the National Park." (Authors)] Address: Ko, M.-H., Kosoo Ecology Institute, Seoul 07952, Republic of Korea. E-mail: hun7146@gmail.com

17659. Paulson, D.; Marinov, M. (2021): Zootaxa 20th Anniversary Celebration: Odonata section. *Zootaxa* 4979(1): 218-221. (in English) ["During the two decades (2001–2020) of the journal's existence, 346 papers on Odonata were published in *Zootaxa*. These papers contributed 317 new extant taxa, 26 new fossil taxa, and 106 new larval descriptions. By the end of the period, papers in *Zootaxa* were contributing slightly more than half of all descriptions of new extant taxa. Research was published from all over the world but predominantly from the American and Asian tropics, and authors from 42 countries contributed papers." (Authors)] Address: Marinov, M., Investigation and Diagnostic Centres and Response, Operations Branch, Ministry for Primary Industries, 231 Morrin Rd, Auckland 1072 New Zealand. E-mail: Milen.Marinov@mpi.govt.nz

17660. Paulson, D.R.; Haber, W.A. (2021): Dragonflies and Damselflies of Costa Rica. Comstock: 416 pp. (in English) ["Among the largest of all insects, dragonflies and damselflies are conspicuous. Active during the day, often brightly colored, and extremely photogenic—something about their appearance and dashing flight suggests a primeval world of tree ferns and dinosaurs. The first guide of its kind, this book includes an in-depth introduction with an overview of Costa Rican biodiversity and illustrated morphological terms. The species accounts show males and females of most species, detailed illustrations and close-ups of key distinguishing fea-

tures, and descriptions of habitat, behavior, and range. Dragonflies and Damselflies of Costa Rica gives readers the information they need to identify nearly every species in the country. Experienced dragonfly fans and new enthusiasts alike will find it an indispensable resource. "Written by two leading authorities, this handsome identification guide to the dragonflies and damselflies of Costa Rica is a first for any Central American country. Naturalists, researchers, and conservationists now have a richly illustrated resource with which to delve further into this important and beneficial group of insects. A splendid addition to the hiker's backpack, it is sure to lure new enthusiasts to the Odonata." Ken Tennesen, author of *Dragonfly Nymphs of North America* "This field guide covers the entire odonate fauna of Costa Rica, a biologically diverse country with nearly 300 species. It meets the high standards of Dennis Paulson's previous photographic guides to North American species. This will certainly become essential reading for anyone with an interest in the insects of Costa Rica and, in fact, much of Central America and northern South America." Michael May, coauthor of *Damselflies of North America*] Address: Paulson, D.R., Slater Museum, Univ. of Puget Sound, Tacoma, WA 98416, USA. E-mail: dpaulson@pugetsound.edu

17661. Payra, A.; Biswas, S.; Boruah, B.; Das, G.N.; Gogoi, M.J. (2021): First record of *Indothemis carnatica* (Fabricius, 1798) from Assam, Northeast India (Odonata: Libellulidae). *Boletín de la Sociedad Entomológica Aragonesa* 68: 385-386. (in English, with Spanish summary) ["*I. carnatica* is reported here for first time from Assam (Northeast India) based on photographic records, from the Jeypore Reserve Forest of Upper Assam." (Authors)] Address: Payra, A., Ramnagar, Purba Medinipur, West Bengal 721441, India. E-mail: arapayra@gmail.com

17662. Payra, A.; Dawn, P.; Subramanian, K.A.; Deepak, C.K.; Chandra, K.; Tripathy, B. (2021): New record of *Megalestes gyalsey* Gyeltshen, Kalkman & Orr, 2017 (Zygoptera: Synlestidae) from India, with first description of female and larva. *Zootaxa* 4938(2): 233-242. (in English) ["*M. gyalsey* is recorded for the first time from India, extending the known geographic range of the species. This report is based on the collection of 5 individuals (4 males, 1 female) from Jang waterfall, Tawang, Arunachal Pradesh and 2 males from Neora Valley National Park, Kalimpong district, West Bengal. The female of *M. gyalsey* is described for the first time with notes on the variation in the male. A probable larva of the species is also described and illustrated." (Authors)] Address: Subramanian, K.A., Zoological Survey of India, Southern Regional Centre 130, Santhome High Road, Chennai-600 028, India. E-mail: subbuka.zsi@gmail.com

17663. de Paz, V.; Baños-Picón, L.; Rosas-Ramos, N.; Tobajas, E.; Tormos, J.; Asís, J.D. (2021): The role of artificial ponds in maintaining dragonfly populations in an intensified farmland landscape. A case of study in Zamora, Spain. *Journal of Natural History* 54(37-38): 2439- 2454. (in English) ["Freshwater ecosystems are exceptionally threatened habitats and suffer biodiversity losses that exceed those in any

other ecosystem. Small waterbodies have been typically neglected and excluded from conservation strategies, even though they are essential for maintaining freshwater biodiversity. Dragonflies are considered effective surrogates of the diversity of other taxa and bioindicators of the state of aquatic environments. This study compares, in an intensified farmland landscape of western Spain, the capacity of farm ponds to maintain dragonfly diversity by comparing the Odonata communities of the four type of aquatic systems (river, stream, reservoir and farm pond) present in this region, in which the extant of permanent water bodies is scarce. The results showed higher diversity and abundance values in farm ponds than in any other aquatic system, agreeing with previous studies. Also, farm ponds harbour species from every other aquatic system, thereby occupying an intermediate position in the MDS, which demonstrated their potential value to act as stepping stones. Nevertheless, investigation of the dragonfly community composition revealed a generally low degree of ecological integrity of the studied systems, which are negatively impacted by agricultural and livestock farming intensification. These findings support the role of farm ponds in the maintenance of dragonfly diversity in the study area and emphasise the need of a specific legislation to regulate and protect them." (Authors)] Address: de Paz, V., Depto de Biología Animal, Ecología, Parasitología, Edafología y Química Agrícola, Univ. de Salamanca, Salamanca, Spain. E-mail: victordepaz177@usal.es

17664. Peng, L.; Zheng, M.; Pan, T.; Su, G.; Li, Q. (2021): Tandem-wing interactions on aerodynamic performance inspired by dragonfly hovering. *R. Soc. Open Sci.* 8: 202275. <https://doi.org/10.1098/rsos.202275>: 15 pp. (in English) ["Dragonflies possess two pairs of wings and the interactions between forewing (FW) and hindwing (HW) play an important role in dragonfly flight. The effects of tandem-wing (TW) interactions on the aerodynamic performance of dragonfly hovering have been investigated. Numerical simulations of single-wing hovering without interactions and TW hovering with interactions are conducted and compared. It is found that the TW interactions reduce the lift coefficient of FW and HW by 7.36% and 20.25% and also decrease the aerodynamic power and efficiency. The above effects are mainly caused by the interaction between the vortex structures of the FW and the HW, which makes the pressure of the wing surface and the flow field near the wings change. During the observations of dragonfly flight, it is found that the phase difference (γ) is not fixed. To explore the influence of phase difference on aerodynamic performance, TW hovering with different phase differences is studied. The results show that at $\gamma = 22.5^\circ$, dragonflies produce the maximum lift which is more than 20% of the body weight with high efficiency; at $\gamma = 180^\circ$, dragonflies generate the same lift as the body weight." (Authors)] Address: Pan, T., Res. Institute of Aero-Engine, Beihang Univ., Beijing 100083, People's Republic of China. E-mail: pantianyu@buaa.edu.cn

17665. Perron, M.A.C.; Richmond, I.C.; Pick, F.R. (2021): Plants, water quality and land cover as drivers of Odonata

assemblages in urban ponds. *Science of The Total Environment* 773, 15 June 2021, 145467: 12 pp. (in English) ["Highlights: • Dragonfly and damselfly assemblages were largely determined by local-scale factors. Plants and water quality were significant for both terrestrial and aquatic stages. Landscape factors explained less variation in Odonata community structure. Diverse native wetland plant communities benefit Odonata lifecycles. Abstract: As cities expand, urban ecosystems could either contribute to or impede conservation efforts. To maximize the potential for urban areas to support biodiversity, there is a need to understand how systems in an urban environment can sustain the natural history requirements of species. This study compared the relative importance of local-scale factors (plant communities and water quality) to landscape factors (surrounding land cover) in structuring assemblages of a group of well-known indicators of wetlands and aquatic ecotones. Odonata (dragonflies and damselflies), at both the adult and larval life stages, along with plant communities, pond water quality and surrounding land cover types were sampled at 51 ponds across a north temperate metropolitan area. Plant communities (particularly of wetland species) consistently explained the largest amount of variation in both dragonfly and damselfly community structure at all life stages. Pond water quality was of secondary importance for both aquatic and terrestrial life stages, with dragonflies more negatively affected by urban contaminants than damselflies. Overall, surrounding land cover types in pond catchments explained less variation in Odonata community structure, especially in the case of damselflies. However, the presence of adjacent ponds and wetlands had a measurable effect. Plant, water quality and land cover variables together explained as much as half of the variation in Odonata community structure at ponds. Urban ponds could potentially provide high quality habitat for species when designed and managed to promote native wetland plant communities and water quality is maintained." (Authors)] Address: Perron, Mary Ann, Dept of Biology, Univ. of Ottawa, 20 Marie Curie Private, Ottawa, Ontario, Canada, K1N 6N5. E-mail: mperr058@uottawa.ca

17666. Peryana, R.; Anggraito, Y.U.; Widiatningrum, T. (2021): Development of supplement book based on dragonfly diversity in Lusi watershed. *Journal of Biology Education* 10(1): 52-62. (in English) ["The Lusi River has local potential for abundant biodiversity, one of them is the diversity of dragonfly species. This local potential can be compiled into a teaching supplement to complement the student's teaching book. Data on the diversity of dragonflies in the Lusi watershed of Blora region was successfully obtained and compiled as a supplementary book of biodiversity chapters. However, the feasibility of the book needs to be assessed by material experts, media experts, teachers, and students. The purpose of this study was to analyze the feasibility and response of teachers and students to the supplement book developed. This study is designed as Research and Development (R&D) that is limited to the small-scale test stage. Eligibility data obtained by using media validation questionnaires and questionnaires made in accordance with BSNP 2014 standards, while teacher and student response data is obtained

by using teacher and student response questionnaires. The validation of material experts against teaching supplements got a score of 93.23% and media experts gave a score of 98.61%, both with very decent categories. However, there are suggestions from material and media validators for minor revisions. Teacher and student responses to teaching supplement received scores of 91.83% and 97.3% respectively with very decent categories. Based on the results of the study, it can be concluded that the teaching supplement of dragonfly diversity in Lusi River watershed is feasible for use in the study of biodiversity chapters." (Authors)] Address: D6 Building 1st Floor Jl Raya Sekaran Gunungpati Semarang, Indonesia. E-mail: risks.peryama@gmail.com

17667. Phan, Q.T.; Karube, H.; Hung, N.V.; Anh, T.D. (2021): Description of *Chlorogomphus danhkyi* sp. nov. from Vu Quang National Park, central Vietnam with notes on other congeners from the Park (Odonata: Chlorogomphidae). *Zootaxa* 4985(1): 102-110. (in English) ["*Chlorogomphus danhkyi* sp. nov. (Holotype ♂: Khe Ro, Vu Quang National Park, Ha Tinh Province, 15.0444 N, 107.9270 E, altitude 1480 m) based on both sexes is described. The new species differs from *Chlorogomphus piaoacensis* Karube, 2013 mainly by the shape of male cerci. Other species of *Chlorogomphus* Selys, 1854 from Vu Quang National Park are also recorded." (Authors)] Address: Phan, Q.T., The Center for Entom. & Parasitol. Res., College of Medicine & Pharmacy, Duy Tan Univ., 550000, Da Nang, Vietnam. E-mail: pqtoan84@gmail.com

17668. Piano, E.; Mammola, S.; Dalle, M.; Riservato, E.; Isaia, M. (2021): Niche partitioning at emergence of two syntopic dragonflies. *Ecologies* 2021, 2(1), <https://doi.org/10.3390/ecologies2010001>: 11pp. (in English) ["We investigated the ecological requirements in the emergence phase of two congeneric species of Aeshnidae, *Aeshna grandis* and *A. juncea*, occurring in syntopy at the southernmost limit of their range. We sampled the exuviae of the two species at the peak of their emergence in three lakes in NW Italy. In each lake we defined 30 to 50 sampling plots along the lake borders where we checked for the presence of exuviae and collected data on the microhabitat composition. By modeling the response of the exuviae presence and abundance against the environmental parameters, we could highlight a partial differentiation in the ecological requirements of the two species at emergence. In particular, *A. grandis* is more influenced by the structure of the aquatic vegetation than *A. juncea* and the niche space occupied by *A. grandis* is wider, almost totally encompassing the one of *A. juncea*. We argue that *A. grandis* exploits microhabitats rich in aquatic plants to avoid competition with *A. juncea*. We suggest the preservation of well-structured aquatic vegetation as a key management practice to preserve the three studied populations of *A. grandis*, a species which has been recognized as Vulnerable for Italy according to the IUCN criteria." (Authors)] Address: Riservato, Elisa, Laboratory of Terrestrial Ecosystems, Dept of Life Sciences & System Biology, University of Turin, Via Accademia Albertina, I-10123 Torino, Italy. E-mail: elisa.riservato@gmail.com

17669. Polhemus, D.A.; Kalkman, V.J. (2021): Four new species of Wahnesia Förster, 1900 from the D'Entrecasteaux, Louisiade and Woodlark island groups, Papua New Guinea (Odonata: Argiolestidae). *Zootaxa* 5004(3): 447-464. (in English) ["The species of the damselfly genus Wahnesia Förster, 1900 occurring in the D'Entrecasteaux Islands, Louisiade Archipelago, and on Woodlark Island are reviewed, and four new species are described: *W. muyuw* from Woodlark Island, *W. misima* from Misima Island, *W. tagula* from Tagula (Sudest) Island, and *W. rossel* from Rossel Island, these latter three islands all lying in the Louisiade Archipelago. In addition, new information is presented on the identification and distribution of the two previously described species from the D'Entrecasteaux islands: *W. anulipes* (Lieftinck, 1956) from Goodenough, Fergusson, and Normanby islands, and *W. armeniaca* (Lieftinck, 1956) from Goodenough and Fergusson islands. Illustrations are provided for the male abdominal terminalia and genital ligula of the four new species, as well as the wings and a color photograph of a live male of *W. muyuw*, and the ligula of *W. armeniaca*, accompanied by updated distribution maps for all species treated." (Authors)] Address: Polhemus, D., Dept. of Natural Sciences, Bishop Museum, 1525 Bernice St., Honolulu, HI, 96817, USA. Email: bugman@bpbm.org

17670. Pompilio, L.; Mosini, A. (2021): The Odonate fauna of Val Grande National Park (Insecta: Odonata). *Fragmenta entomologica* 53(1): 25-42. (in English) ["The results of a survey aimed at describing the Odonate fauna of Val Grande National Park are presented, which was carried out in the framework of the project "Animal Biodiversity Monitoring in Alpine Habitat". Relevant literature was examined and data collected intensively in summer 2016 and extensively in the period 2014-2019. Prior to this research specific knowledge on dragonfly and damselfly presence and distribution accounted for 6 species for the study area, which were recorded near the northern border but outside the park. The first Odonate checklist here provided is based on 188 records (1173 individuals), of which 137 are recent and unpublished. Comprehensively 25 species were recorded (14 breeding), which represent 26% of the Italian fauna, 36% of Piedmont and 58% of the province of Verbano Cusio Ossola, whereas three species were not confirmed; 10 species were found inside the park (4 breeding). Odonate diversity was remarkable, thanks to Val Grande geographical position between the Alps and the Insubric region and to high rainfall coupled with a complex orography. The study area hosts populations of the boreo-alpine species *Somatochlora alpestris* and *Sympetrum danae*, which are scattered and isolated in Italian Alps, and of the endemic European *Cordulegaster bidentata*; it hosts lotic taxa which are concentrated in SW Europe where they are under pressure because of droughts and exploitation of freshwater. Conservation and status issues of observed dragonflies and damselflies are discussed in the light of the growing interest gained by odonates as ecological indicators. The study proposes to use this knowledge to guide the future expansions of the protected area." (Authors)] Address: Pompilio, Lucia, Società di Scienze Naturali del Verbano Cusio Ossola, Natural

Science Museum of Collegio Mellerio Rosmini, Via Antonio Rosmini 24, 28845 Domodossola (VB), Italy. E-mail: lucia.pompilio@libero.it

17671. Pound, K.L.; Larson, C.A.; Passy, S.I. (2021): Current distributions and future climate-driven changes in diatoms, insects and fish in U.S. streams. *Global Ecology & Biogeography* 30(1): 63-78. (in English) ["Aim Biodiversity on Earth is threatened by climate change. Despite the vulnerability of freshwater habitats to human impacts, most climate change projections have focused on terrestrial systems. Here, we examined how the current distributions and biodiversity of stream taxa might change under mitigated, stabilizing and increasing greenhouse gas emissions. Location Conterminous USA. Time period Present day to 2070. Major taxa studied Stream diatoms, insects and fish. Methods We developed species distribution models for 336 freshwater taxa from 1,227 distinct stream localities using water chemistry, watershed and climatic variables. Models based only on climate were used to project changes in the distributions and biodiversity of cold- versus warm-water taxa under representative concentration pathways (RCPs) ranging from 2.6 to 8.5 W/m². Results In all three organismal groups, climate emerged as the strongest predictor of species distributions, providing comparable explanatory power to water chemistry and watershed variables combined. The RCP-based projections suggested a widespread expansion of warm-water taxa, outpacing the decline of cold-water taxa. Consequently, overall species richness would increase, but beta diversity would decrease drastically with the severity of climate change. A closer look at individual taxa and functional guilds revealed that vulnerable cold-water taxa included: (a) diatom guilds forming the base and bulk of the biofilm; (b) environmentally sensitive insects, characteristic of unpolluted streams; and (c) ecologically and recreationally important salmonids, which were forecast to diminish dramatically in source habitats. Warm-water fish projected to increase their distributions include bait bucket release minnows and dominant predators. Main conclusions Our results suggest potentially devastating impacts of climate change on stream ecosystems, with the restructuring of diatom, insect and fish communities, diminished distributions of functionally important taxa and widespread expansion of warm-water taxa, giving rise to biotic homogenization. Given that the magnitude of these biotic shifts depends on the severity of climate change, appropriate current policy decisions are necessary to preserve freshwater ecosystems." (Authors)] Address: Passy, Sophia, Department of Biology, University of Texas at Arlington, Box 19498, Arlington, TX 76019-0498, USA. E-mail: sophia.passy@uta.edu

17672. Prakash, L.; Karthik, P. (2021): Effect of vehicular traffic on wild animals in Anaikatty Hills, Southern Western Ghats, India. *Indian Journal of Ecology* 48(1): 108-111. (in English) ["An increase in road networks causing a significant impact on tropical biodiversity, especially the ones passing through forest protected zones have a negative impact on wild animals. The mortality rates of wild animals were investigated by using a fortnight sampling method in the selected stretch

of state highway 164, of Anaikatty Hills, Tamil Nadu. The sampling was performed in two different seasons namely dry and wet from June 2015 to December 2019. A total of 96 species and 419 individuals of road kill observed. Birds are the most affected taxa (30.21 %), followed by reptiles (28.13 %), butterflies (20.83 %), mammals (11.45%), amphibians (5.21 %) and odonates (4.17 %; *Anax guttatus*, *Brachythemis contaminata*, *Diplacodes trivialis*, *Pantela flavescens*) were least affected by vehicular traffic. Conservation and management implications are essential to prevent the local extinction of wildlife from Anaikatty reserve forest." (Authors)] Address: Karthik, P., Salim Ali Centre for Ornithology & Natural History, Anaikatty, Coimbatore-641 108, India. E-mail: karthikwildlifebiology@gmail.com

17673. Preston, D.L.; Layden, T.J.; Segui, L.M.; Falke, L.P.; Brant, S.V.; Novak, M. (2021): Trematode parasites exceed aquatic insect biomass in Oregon stream food webs. *Journal of Animal Ecology* 90(3): 766-775. (in English) ["1. Although parasites are increasingly recognized for their ecosystem roles, it is often assumed that free-living organisms dominate animal biomass in most ecosystems and therefore provide the primary pathways for energy transfer. 2. To examine the contributions of parasites to ecosystem energetics in freshwater streams, we quantified the standing biomass of trematodes and free-living organisms at nine sites in three streams in western Oregon, USA. We then compared the rates of biomass flow from snails *Juga plicifera* into trematode parasites relative to aquatic vertebrate predators (sculpin, cutthroat trout and Pacific giant salamanders). 3. The trematode parasite community had the fifth highest dry biomass density among stream organisms (0.40 g/m²) and exceeded the combined biomass of aquatic insects. Only host snails (3.88 g/m²), sculpin (1.11 g/m²), trout (0.73 g/m²) and crayfish (0.43 g/m²) had a greater biomass. The parasite 'extended phenotype', consisting of trematode plus castrated host biomass, exceeded the individual biomass of every taxonomic group other than snails. The substantial parasite biomass stemmed from the high snail density and infection prevalence, and the large proportional mass of infected hosts that consisted of trematode tissue (M = 31% per snail). 4. Estimates of yearly biomass transfer from snails into trematodes were slightly higher than the combined estimate of snail biomass transfer into the three vertebrate predators. Pacific giant salamanders accounted for 90% of the snail biomass consumed by predators. 5. These results demonstrate that trematode parasites play underappreciated roles in the ecosystem energetics of some freshwater streams." (Authors)] Address: Preston, D.L., Dept of Forest & Wildlife Ecology, Univ. Wisconsin-Madison, Madison, WI, USA. Email: daniel.preston@wisc.edu

17674. Pushpalal, M.G.S.; Malkumari, M.G.K.S.; Sumanapala, A.P. (2021): Some observations on the natural history of *Archibasis lieftincki* (Zygoptera: Coenagrionidae). *Agrión* 25(2): 79-81. (in English) [Madugeta Village (6.3848 N, 80.4058 E), Neluwa, Sri Lanka; phenology, Habitat choice, reproductive behaviour] Address: Pushpalal, M.G.S., Post Graduate Institute of Archaeology, University of Kelaniya,

Sri Lanka. E-mail: apsumanapala@gmail.com

17675. Quanz, M.E.; Walker, T.R.; Oakes, K.; Willis, R. (2021): Contaminant characterization in wetland media surrounding a pulp mill industrial effluent treatment facility. *Wetlands Ecol. Manage.* 29: 209-229. (in English) ["Three media (sediment, surface water, and dragonfly larvae tissue) were collected from wetlands surrounding an industrial effluent treatment facility prior to closure. Samples were analyzed for metals, total mercury, and polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans (PCDD/PCDF) concentrations. Sediment and surface water concentrations were compared to provincial and federal guidelines, as well as reference wetland concentrations. Exceedances of arsenic, cadmium, chromium, copper, zinc, and PCDD/PCDF guidelines were found in deeper areas of wetlands historically contaminated from effluent, as well as wetlands exposed to current effluent inputs. Composite Libellulidae samples were collected from wetlands, and comparisons were made to reference tissue concentrations ? 20%. Elevated As, Cu and Pb tissue concentrations were measured at two site wetlands, but total mercury (THg) and PCDD/PCDF reference tissue concentrations were higher than wetlands near the effluent treatment facility. Spearman rho tests identified a significant correlation between sediment and tissue Pb concentrations and between surface water and sediment THg concentrations. Results suggest relatively low ecological risk to macroinvertebrates within wetlands near the effluent treatment facility from current effluent inputs, and highlight strengths and weaknesses of federal and provincial guidelines." (Authors)] Address: Quanz, Meaghan, School for Resource & Environmental Studies, Dalhousie Univ., Halifax, Nova Scotia, B3H 4R2, Canada. E-mail: meaghan.quanz@dal.ca

17676. Rasaily, B.; Kalkman, V.J.; Katel, O.; Dorji, C. (2021): Composition of the dragonfly fauna at different altitudes in Bhutan based on larval samples. *International Dragonfly Fund - Report 160*: 1-20. (in English) ["In 2020 thirty sites with running water and ten sites with standing water were sampled for both adult and larval odonates in both the pre-monsoon and the post-monsoon period. This sampling was performed along an altitudinal gradient from 500-3000 m in Punakha and Wangduephodrang provinces of Bhutan. The results of the running water sites showed that there are clear differences between the overall abundance, species diversity and species associations at different altitudes. Furthermore, a clear difference was observed in the number of larvae collected in running water in the post-monsoon (404 specimens) and the pre-monsoon (654 specimens) periods, with five species being clearly more abundant in the pre-monsoon and one species being more abundant in the post-monsoon period." (Authors)] Address: Kalkman, V.J., p/a Nationaal Natuurhistorisch Museum - naturalis, Postbus 9517, 2300 RA Leiden, The Netherlands. E-mail: kalkman@naturalis.nl

17677. Rasaily, B.; Kalkman, V.J.; Katel, O.; Suberi, B. (2021): The distribution, phenology and altitudinal range of

dragonflies and damselflies in Bhutan. International Dragonfly Fund - Report 160: 21-74. (in English) ["Odonata are attractive and relatively well studied insects that can serve to monitor the conservation status of freshwater habitats. Their effective use as conservation tools necessitates some basic requirements. It should be possible to identify adults and preferably also larvae with relative ease, and basic data on distribution and habitat preferences needs to be available. Freshwater habitats in Bhutan are relatively well preserved but are nonetheless threatened by both climate change and the construction of hydroelectric installations. Biological monitoring of freshwater biodiversity in Bhutan is therefore urgently needed and should include data on dragonflies and damselflies. In order to establish a framework for effective monitoring we constructed a database of all published records and use these to present information on the distribution, the altitudinal range and phenology of all species thus far recorded from Bhutan." (Authors)] Address: Kalkman, V.J., p/a Nationaal Natuurhistorisch Museum - naturalis, Postbus 9517, 2300 RA Leiden, The Netherlands. E-mail: kalkman@naturalis.nl

17678. Razy Japir, Momin, B.; John, L.Y.; Chung, A.Y.C. (2021): Insect diversity of Sungai Serudong Forest Reserve, Sabah Malaysia. *Serangga* 26(2): 1-15. (in English) ["Insect diversity of Sungai Serudong Forest Reserve in Sabah was investigated under the Heart of Borneo programme in Sabah. The nocturnal insect diversity was evaluated by using light-trap from 7:00 p.m. until 9:00 p.m. for three consecutive nights. Diurnal insects were sampled using sweep net. A total of nine insect orders were recorded namely Coleoptera, Hemiptera, Hymenoptera, Isoptera, Lepidoptera, Neuroptera, Odonata, and Phasmida. ... The mean Shannon Index was 4.00, Simpson Index was 47.76 and Fisher Alpha Index was 83.64. The diversity is considered high, however moderate when compared to other forest reserves in Sabah, Malaysia. This study was able to identify insect communities inside the reserve. It was also able to identify the potential threats affecting the insect diversity. The documented data can serve as baseline information to be used in forest management plan and other relevant research." (Authors)] Address: Razy Japir, Forest Research Centre, Sabah Forestry Dept., P.O. Box 1407, 90715 Sandakan, Sabah, Malaysia. E-mail: razy.japir@sabah.gov.my

17679. Ribeiro, C.; Santos, L.R.; Rodrigues, M.E. (2021): New records of the Critically Endangered *Leptagrion acutum* Santos, 1961 (Odonata, Coenagrionidae) from southern Bahia, Brazil. *Check List* 17(1): 59-62. (in English) ["*L. acutum* is endemic to Brazil and, since 2003, listed as Critically Endangered in the Red Book of Threatened Brazilian Fauna. In this study, *L. acutum* is recorded for the first time from the state of Bahia, expanding known occurrences of this species to northern areas of the Atlantic Forest. Three males were collected in the Veracel Station Private Reserve of Natural Heritage. Information concerning distributional records of rare or endangered species is essential because it can add to species' occurrence records and assist in future Red List assessments." (Authors)] Address: Rodrigues,

M.E., Programa de Pós-graduação em Sistemas Aquáticos Tropicais, Lab. de Organismos Aquáticos, Depto de Ciências Biológicas, Univ. Estadual de Santa Cruz (UESC), Rodovia Jorge Amado, KM 16, Ilhéus, Bahia, Zip code: 45662-900, Brazil. E-mail: rodrigues.mbio@gmail.com

17680. Rincón, V.; Santamaría, T.; Velázquez, J.; Sánchez Mata, D. (2021): Nuevos registros de reproducción de *Anax imperator* Leach, 1815 (Odonata: Aeshnidae) en montañas del Sistema Central en España. *Graellsia*, 77(1): e136: 4 pp. (in Spanish, with English summary) ["New breeding records of *Anax imperator* Leach, 1815 (Odonata: Aeshnidae) in mountains of the Sistema Central in Spain: Information is presented about the location of breeding sites of the species *Anax imperator* in high mountain lagoons of the Sistema Central in the province of Ávila. In this area, the breeding records of this species in the 1980s were limited to altitudes close to 1300 m a.s.l. However, coinciding with an increase in temperatures due to climate change, this species has been rising in altitude, until successfully breeding at altitudes above 1700 m a.s.l." (Authors)] Address: Rincón, V.; Depto de Farmacología, Farmacognosia y Botánica, Fac. de Farmacia, Universidad Complutense de Madrid, Spain

17681. Riyaz, M.; Sivasankaran, K. (2021): A preliminary survey of dragonflies and damselflies (Insecta: Odonata) in and around Hirpora Wildlife Sanctuary Shopian, Kashmir. *Egyptian Academic Journal of Biological Sciences* 14(1): 133-139. (in English) ["Odonata of Hirpora Wildlife Sanctuary are presented. The Sanctuary is located in the District Shopian of Kashmir Valley (33°39'28.6"N 74°41'15.2"E). The area is rich in both floral and faunal diversity with most of the area covered with lush green forests. Around the sanctuary, Agro and Horticultural plantations such as Apple, Pear, Peach and vegetable crops abides most of the land cover in the area. The present study was carried out from June to October 2020. A total number of 10 species from six families were recorded in and around the area. The most abundant species recorded are from the family Libellulidae which are active mostly in the months from June to October. A number of freshwater bodies flow through the district and receives annual precipitation of around 1800mm, which makes the area more suitable for the Odonates diversity. Here we present the first preliminary report of order Odonata collected from the sanctuary and adjoining areas of Kashmir Valley." (Authors)] Address: Sivasankaran, K., Division of Taxonomy & Biodiversity, Entomology Research Institute, Loyola College, Chennai, Tamil Nadu, India. E-mail: ganesh_swamy-2005@yahoo.com

17682. Roucourt Cezario, R.; Guillermo-Ferreira, R. (2021): *Heteragrion gorbi* sp. nov. (Odonata: Heteragrionidae) from southeastern Brazil. *Zootaxa* 4965(1): 78-86. (in English) ["*Heteragrion gorbi* sp. nov. is described and diagnosed based on six males and one female. The specimens were collected in a stream in a Neotropical savannah fragment in Sao Carlos, Sao Paulo, Brazil. We present pictures of the holotype and the female. This is a species with blue coloration pattern, rare among its congeners." (Authors)] Address:

Roucourt Cezario, R., Graduate Program in Entomology, Dept of Biology, Univ. of Sao Paulo (USP), Ribeirao Preto, Brazil. E-mail: rcezario@usp.br

17683. Rüppell, G.; Hilfert-Rüppell, D. (2021): Männchenabwehr und Männchenauswahl (female choice) bei Weibchen von *Libellula quadrimaculata* (Odonata: Libellulidae). *Libellula Supplement* 16: 229-238. (in German, with English summary) ["Male repelling and female choice of females of *L. quadrimaculata* – By means of slow motion videos new behaviour can be discovered. Examples therefore were analysed: refusal of males by females of *L. quadrimaculata* by flying loops and active female choice. In the latter case a female was pursued by three males. A small male was always close to the female, who suddenly slowed down and hit the small candidate with its wings. Immediately after that she accelerated. By this a gap developed enabling a larger male to proceed and to grasp the female. This is the first time details of female choice in Anisoptera were analysed." (Authors)] Address: Rüppell, G., An der Wasserfurche 32, 38162 Cremlingen, Germany. E-mail: g.rueppell@freenet.de

17684. Rychla, A. (2021): Persistence of exuviae in natural conditions: Results of monitoring of selected dragonfly species (Odonata: Anisoptera) at the lake Plaw in western Poland. *Odonatrix* 172 (2021): 9 pp. (in Polish, with English summary) ["Exuviae of Odonata are valuable sampling material in faunistic, phenological, and monitoring research. However, one of the downsides of this method is impermanence of exuviae in natural conditions, which still makes the designation of sampling frequencies difficult. In this study, the effort has been made to investigate persistence time of exuviae of five selected Anisoptera. The experiment revealed that the average durability of the exuvial material was 4 (median) to 7 (arithmetic mean) days, without any significant differences between species. However, there was considerable variation within the collected material, with minimal and maximal values lying between 1 and 35 days of persistence for individual exuviae. The results indicate, that investigations of rare species may require sampling frequencies at least at weekly scale whereas biweekly sampling should be sufficient to obtain the representative species richness." (Author)] Address: Rychla, Anna, Sekcja Odonatologiczna Polskiego Towarzystwa Entomologicznego. E-mail: rychlan@op.pl

17685. Sadasivan, K.; Palot, M.J. (2021): A note on the current distribution of reedtail damselfly *Protosticta rufostigma* Kimmins, 1958 (Odonata: Zygoptera: Platystictidae) from Western Ghats, and its addition to the odonate checklist of Kerala. *Journal of Threatened Taxa* 13(1): 17548-17553. (in English) ["The genus *Protosticta* is represented by nine species in the Western Ghats of peninsular India, of which seven are reported for the state of Kerala. Our recent records of *P. rufostigma* from the Western Ghats of Kerala State is discussed, and despite a thorough literature search no collection records or photographs of the species has been found after the original description from Tamil Nadu. The species is, thus, added to the checklist of odonates of Kerala State.

The description of the live insect, its ecology, status and distribution is discussed." (Authors)] Address: Sadasivan, K., TNHS Odonate Research Group (TORG), Travancore Nature History Society (TNHS), MBRR-65, Jyothis, Mathrubhumi Road, Vanchiyoor, Kerala 695035, India. E-mail: kaleshs2002in@gmail.com

17686. Sadasivan, K.; Sethumadavan, M.; Jeevith, S.; Kochunarayanan, B. (2021): Rediscovery of Martin's Duskhawker *Anaciaeschna martini* (Selys, 1897) (Odonata: Aeshnidae) from Western Ghats, peninsular India, with notes on its current distribution and oviposition behavior. *Journal of Threatened Taxa* 13(1): 17543-17547. (in English) ["Rediscovery and recent distribution records of *A. martini* from Western Ghats of peninsular India is discussed with notes on oviposition behavior. Although mentioned in odonate checklists of the region, there are no recent records or photographic evidence of the species from Western Ghats since its last report and collection by F.C. Fraser from Annamalai Hills in 1933." (Authors)] Address: Sadasivan, K., TNHS Odonate Research Group (TORG), Travancore Nature History Society (TNHS), MBRR, Mathrubhumi Road, Vanchiyoor, Trivandrum, Kerala 695024, India. E-mail: kaleshs2002in@gmail.com

17687. Santangelo, J.M.; Vanschoenwinkel, B.; Trekels, H. (2021): Habitat isolation and the cues of three remote predators differentially modulate prey colonization dynamics in pond landscapes. *Oecologia* 196: 1027- 1038. (in English) ["Recent evidence suggests predators may change colonization rates of prey in nearby predator-free patches as an example of context-dependent habitat selection. Such remote predator effects can be positive when colonizers are redirected to nearby patches (habitat compression), or negative when nearby patches are avoided (risk contagion). However, it is unknown to what extent such responses are predator- and prey-specific and change with increasing distance from predator patches. We evaluated how cues of fish, backswimmers and dragonfly larvae affect habitat selection in replicated pond landscapes with predator-free patches located at increasing distances from a predator patch. We found evidence for risk contagion and compression, but spatial colonization patterns were both predator- and prey-specific. The mosquito *Culex pipiens* and water beetle *Hydraena testacea* avoided patches next to patches with dragonfly larvae (i.e. risk contagion). Predator-free patches next to patches with backswimmers were avoided only by mosquitoes. Mosquitoes preferentially colonized patches at some distance from a fish or backswimmer patch (i.e. habitat compression). Colonization patterns of beetles also suggested habitat compression, although reward contagion could not be fully excluded as an alternative explanation. Water beetles preferred the most isolated patches regardless of whether predators were present in the landscape, showing that patch position in a landscape alone affects colonization. We conclude that habitat selection can be a complex product of patch isolation and the combined effects of different local and remote cues complicate current attempts to predict the distribution of mobile organisms in landscapes." (Authors)]

Address: Santangelo, J.M., Depto de Ciências Ambientais, Univ. Federal Rural do Rio de Janeiro (UFRRJ), Rodovia BR 465, Km 07, CEP, Seropédica, RJ, 23890-000, Brasil

17688. Sánchez-Rosario, A.; Bastardo, R.H. (2021): Confirmation of the presence of *Progomphus integer* (Odonata: Gomphidae) in the Dominican Republic. *Novitates Caribaeae* 17: 184-186. (in Spanish, with English summary) ["*P. integer* is one of four species of Gomphidae endemic to the Greater Antilles, reported for the Dominican Republic in references from the last Century. Recently, some authors suggested that the presence of this species in Hispaniola was doubtful, based on the lack of specific locality records. In this paper, we confirm the presence of the species in the Dominican Republic. Moreover, we provide the first specific localities with some notes of the habitats on which the species was collected." (Authors)] Address: Sánchez-Rosario, América, Universidad Autónoma de Santo Domingo (UASD), Instituto de Investigaciones Botánicas y Zoológicas Prof. Rafael M. Moscoso, Santo Domingo, República Dominicana. E-mail: america.sanchez@hotmail.com

17689. Sankar Thampuran, M.V.; Udaya Kumar, K.; Nagaraj, S.; Bharath, S. (2021): A preliminary study on diversity status of Odonates in and around college of forestry Campus, Uttara Kannada, Karnataka, India. *Journal of Entomology and Zoology Studies* 9(1): 1051-1057. (in English) ["Odonata is an insect order with two sub orders, Zygoptera and Anisoptera. They are an amazing insect group with an amphibious life cycle. This makes them an important component of freshwater ecosystems and indicators of ecosystem health. The present study was an attempt made to document and analyse the odonate diversity of College of Forestry Sirsi campus, a 14-ha site in Sirsi, Karnataka, India. The study was done in the field where individual observations were identified and recorded with the help of appropriate field guides. A total of 32 odonate species, i.e., 22 dragonflies and 10 damselflies belonging to 7 families were observed in the study area. Within this diversity, a higher proportion of families Libellulidae and Coenagrionidae respectively was found. This presence of generalists more than specialists might be due to higher proportion of anthropogenic disturbances in the study site." (Authors)] Address: Sankar Thampuran, M.V., Dept of Silviculture & Agroforestry, Coll. Forestry, Kerala Agri. Univ., Thrissur, Kerala, India

17690. Santana, M.S.; Bezerra dos Santos, C.; Mitsuka, P.M. (2021): Composição de macroinvertebrados associados a macrófitas aquáticas como parâmetro para avaliação da qualidade da água de um reservatório no semiárido baiano. *Biotemas* 34(3): 1-14. (Portuguese, with English summary) ["Composition of macroinvertebrates associated with aquatic macrophytes as a parameter for assessing water quality in a reservoir in the semiarid region of Bahia. Macroinvertebrates associated with aquatic macrophytes have become more abundant since the plant's morphological characteristics contribute to an increase in colonization, diversity and environmental quality assessment. This study

presents a survey of the composition and richness of macroinvertebrates (Insecta Class) associated with different species of aquatic macrophytes and evaluates the water quality of the Tanque de Aroeiras reservoir, Caetité, Bahia. Macroinvertebrates were collected from macrophyte banks of different biotypes (*Nymphaea* L.; *Ludwigia* L.; *Polygonum ferugineum* Wedd.) and identified at the family taxonomic level. The Biological Monitoring Working Party System (BMWP) and Average Score per Rate (BMWP-ASPT) indices were determined. A total of 7,120 specimens were recorded, with a richness of 27 families, distributed in the following orders: Coleoptera, Diptera, Ephemeroptera, Hemiptera, Odonata (Aeshnidae, Coenagrionidae, Libellulidae, Protoneuridae) and Trichoptera. Coleoptera showed greater richness, while dipterans showed greater dominance, with Chironomidae being more abundant. This fact may be associated with a variety of aquatic life habits that contribute to a greater availability of food resources. The results of the BMWP-ASPT classified the water in this reservoir as likely to be moderately polluted. All things considered, this study highlights the importance of new research for added knowledge regarding the macroinvertebrate community and its application in evaluating the water quality of this reservoir." (Authors)] Address: Santana, M.S., Univ. do Estado da Bahia, Depto de Ciências Humanas, Campus VI CEP 46.400-000, Caetité – BA, Brasil. E-mail: santanamailson4@gmail.com

17691. Santos, J.P.; Lopes, G.N.; Gonzaga, K.S.; Abreu, K.G.; Souza Muniz, L.E.; Cartaxo, P.H. (2021): Insetos como bioindicador de qualidade ambiental em ambientes aquáticos - Insects as a bioindicator of environmental quality in aquatic environments. *Revista Thema* 19(2): 356-366. (Portuguese, with English summary) ["Strategies for monitoring the environmental quality of the most diverse ecosystems have been developed, especially for the aquatic environments, spaces severely affected by anthropic actions. Among the techniques developed, the use of bioindicators, species that show sensitivity to changes in the environment and respond to these anthropogenic stimuli are highlighted. In this sense, the present study aimed to analyze in the scientific literature the advances in the use of these organisms, with emphasis to the class Insecta and its applicability of use for the monitoring of the ecological health of aquatic ecosystems. The main orders of insects reported for use in bioindication of the environmental quality of water bodies are Diptera and Odonata. Chironomidae (Diptera) is often applied in studies of heavy metal contamination, and the development of larvae is considered for bioindication, as they develop in contact with the sediment, an important compartment of accumulation of contaminants in the aquatic body. Odonata insects can be used in the larval or adult phase for bioindication whose families may respond to changes in the environment, some being more sensitive than others to environmental changes. The use of these organisms may represent an efficient strategy for monitoring these environments, facilitating the interpretation of the effects of anthropogenic impacts on these ecosystems and their ecological relationships." (Authors)] Address: Santos, J.P., Univ. Fe-

deral da Paraíba – UFPB, Areia/PB – Brasil. E-mail: jpos@agro.adm.br

17692. Sanz Sanz, T.; Montoya Jiménez, M. (2021): Primera cita de *Anax parthenope* (Sélys, 1839) (Odonata, Aeshnidae) en la provincia de León (NO de España). *Archivos Entomológicos* 24: 99-101. (in Spanish, with English summary) ["The first record of *A. parthenope* from the province of León (NW Spain) is documented, which remained as the only one in the Castilla y León Autonomous Community from where its occurrence had not been so far reported. Embalse de Villameca, Quintana del Castillo (29TQH32 / 29TQH42), male, 26-VII-2019, Carlos Álvarez Alvarado leg" (Authors)] Address: Sanz Sanz, T., c/ El Esquilo, 4. E-24878 Fresnedo de Valdellorma (León). Spain. E-mail: donguillos@hotmail.com

17693. Sasamoto, A.; Vu, V.L (2021): Description of *Cephalaeschna yashiroi* sp. nov. from northern Vietnam, with first record of *C. asahinai* Karube, 2011 female (Odonata: Aeshnidae). *Tombo* 63: 21-27. (in English) ["*C. yashiroi* sp. nov. from northern Vietnam (Hoang Lien National Park, Lai Chau Province, (103°46" E, 22°21" N, 1,900 m a.s.l.), is described and illustrated. This species is differentiated from the other species of the genus in that not acute dorso-frontal margin of frons, two markings of mesepimeron misaligned, abdominal postero-dorsal markings on S2 to S6, and absence of acute apical spine on cercus. In addition, the female of *C. asahinai* Karube, 2011 is for the first time described from the same locality." (Authors)] Address: Sasamoto, A., Tawaramoto-cho, Shiki-gun, Nara Pref. Japan. E-mail: aks-smt@sea.plala.or.jp

17694. Saxton, N.A.; Paxman, E.M.; Dean, A.M.; Jensen, C.R.; Powell, G.S.; Bybee, S.M. Factors (2021): Influencing the distribution of endemic damselflies in Vanuatu. *Insects* 2021, 12, 670. <https://doi.org/10.3390/insects12080670>: 11 pp. (in English) ["*Vanuatubasis* Ober & Staniczek is a genus of damselfly endemic to Vanuatu. Little is known about the distribution and general natural history of the genus. We present the results of 14 weeks of fieldwork in Vanuatu to provide a better understanding of the biology of this genus. Specifically, we tested ecological niche models to predict the presence of *Vanuatubasis* throughout the region and explored how water pH may play a role in their distribution and ecology. The results of this fieldwork refined our model and further predicted the presence of this genus on additional islands. We also found stream pH as a strong predictor for the presence of *Vanuatubasis*, with their presence in alkaline streams significantly higher ($p < 0.001$). The mean pH for those streams where the genus was collected was 8.44 ($n = 53$)."] (Authors)] Address: Saxton, Natalie, Monte L. Bean Museum, Brigham Young Univ., Provo, UT 84602, USA. E-mail: natalie.a.saxton@byu.edu

17695. Schröder, N.; Rippel, C.G.; Pessacq P. (2021): Lista de especies de Odonata (Insecta) en reservas en la ecorregión de Campos y Malezales de Misiones, Argentina, con nuevos registros de distribución. *Revista de la Sociedad*

Entomológica Argentina 80(1): 70-73. (in English, with Spanish summary) ["The Odonata fauna of four reserves located in Campos y Malezales ecoregion, Misiones Province, was studied between 2014 and 2018. 36 species and eight morphotypes, belonging to six families were identified, representing together 22% of the known species in the Province. Libellulidae with 22 species were followed by Coenagrionidae (15 species). Two species were new records, one for Argentina (*Minagrion waltheri* Selys), and one for Misiones province (*Tholymis citrina* Hagen)."] (Authors)] Address: Schröder, Noelia, Lab. Biotecnología Molecular, Inst. Biotecnología Misiones, FCEQyN, UNaM. Posadas, Misiones, Argentina. E-mail: noeliaschroder@gmail.com

17696. Schröter, A. (2021): Mit Hansruedi Wildermuth durch den Kaukasus: Erinnerungen an eine dreiwöchige Libellenreise durch Georgien im Juni 2019. *Libellula Supplement* 16: 23-33. (in German, with English summary) ["Personal recollections of a three weeks' dragonfly survey with Hansruedi Wildermuth across Georgia, southern Caucasus ecoregion, in June 2019 – Based on personal recollections, memorable events of a three weeks' trip across Georgia with Hansruedi Wildermuth, his wife Elisabeth, Stefan Kohl, and his wife Franziska are reviewed. Wildermuth's discoveries made during this trip were already published in books and international journals and will stimulate further odonatological research in the country." (Authors)] Address: Schröter, A., Tsulukidse Straße 18, 0190 Tbilissi, Georgia. E-mail: asmus.schroeter@gmx.de

17697. Schultz, B.; Koprivnikar, J. (2021): The contributions of a trematode parasite infectious stage to carbon cycling in a model freshwater system. *Parasitology Research* 120(5): 1743-1754. (in English) ["Parasites remain understudied members of most ecosystems, especially free-living infectious stages, such as the aquatic cercariae of trematodes (flatworms). Recent studies are shedding more light on their roles, particularly as prey for a diverse array of aquatic predators, but the possible fates of cercariae remain unclear. While this is critical to elucidate because cercariae represent a large potential source of energy and nutrients, determining the fate of cercariae-derived organic matter involves many logistical challenges. Previous studies utilized elemental and stable isotope analysis when examining host-parasite interactions, but none has used such approaches to track the movement of cercariae biomass within food webs. Here we report that *Plagiorchis* sp. cercariae were effectively labelled with ^{13}C by introducing this compound in the food of their snail host. We then added ^{13}C -labelled cercariae as a potential food source to experimental mesocosms containing a simplified model freshwater food web represented by diving beetles (*Dytiscidae* sp.), dragonfly larvae (*Leucorrhinia intacta*), oligochaete worms (*Lumbriculus variegatus*), and a zooplankton community dominated by *Daphnia pulex*. The oligochaetes had the highest ratio of ^{13}C to ^{12}C , suggesting benthic detritivores are substantial, but previously unrecognized, consumers of cercariae biomass. In an experiment where *L. variegatus* were fed mass

equivalents of dead *D. pulex* or cercariae, growth was greater with the latter diet, supporting the importance of cercariae as food source for benthic organisms. Given the substantial cercariae biomass possible in natural settings, understanding their contributions to energy flow and nutrient cycling is important, along with developing methods to do so." (Authors)] Address: Schultz, B., Dept Chem. & Biol., Ryerson Univ., Toronto, ON, Canada. bschultz@uoguelph.ca.

17698. Schwantes, D.; Gonçalves Junior, A.C.; Manfrin, J.; Campagnolo, M.A.; Zimmermann, J.; Conradi Junior, E.; Bertoldo, D.C. (2021): Distribution of heavy metals in sediments and their bioaccumulation on benthic macroinvertebrates in a tropical Brazilian watershed. *Ecological Engineering* 163, 1 May 2021, 106194: 10 pp. (in English) ["The objectives of this study were (i) to evaluate the quality of the Ouro River, a tropical Brazilian river, assessing the concentration of the metals in surface waters, sediments, and benthic macroinvertebrates; (ii) to investigate the possible sources of pollution in Ouro River basin through field research and spatial analysis (G.I.S.); (iii) to evaluate the possible occurrence of metals bioaccumulation in the trophic chain, by comparing the concentration of the metals in water, sediments (total and bioavailable) and in benthic macroinvertebrates; and (iv), to assess the biological metrics of benthic macroinvertebrates that inhabit the Ouro River, and the possible relation regarding its distribution (richness, abundance, dominance) with the human occupancy. Water, sediment, and macroinvertebrates samples were assessed in five sample sites for 9 months. The macroinvertebrates were arranged, identified, and analyzed taxonomically. The concentrations of Cu, Zn, Fe, Mn, Cd, Pb, and Cr in waters and sediments (total and Mehlich-1) were determined, the obtained results were compared to Brazilian and international standards indexes (Igeo and E.F.). According to our findings, the quality of Ouro River is directly affected by the human activities carried out in the watershed, and despite that the vast majority of the assessed metals in water was found below the legislation maximum levels, these accumulate in sediments, with extremely high enrichment of Cd, and moderately to heavily contamination of Cd, Mn, and Cu. Also, Zn and Pb high bioaccumulation in macroinvertebrates was observed, in which concentrations were 172% and 92% higher than the mean total concentration in sediment. The fit's goodness indicates that Mehlich-1 could be used as an extractant solution for the correlation of Pb in sediments and B.M.I. On average, Pb levels in the benthic are 14.94x higher than the bioavailable fraction in sediments (Mehlich-1). Mainly for Decapoda, Bivalve, and Gastropoda, results indicate high adsorption rates of Pb and Zn. The probable metal contamination in the Ouro River basin is from diffuse sources such as agriculture erosion (fertilizers and fertilizers with heavy and toxic heavy metals)." (Authors) Libellulidae, Calopterygidae] Address: Schwantes, D., Depto de Ciencias Vegetales, Fac. de Agronomía e Ing. Forestal, Pontificia Universidad Católica de Chile, Vicuña Mackenna Avenue 4860, Macul, Santiago, Región Metropolitana, Chile. E-mail: daniel_schwantes@hotmail.com

17699. Seehausen, M.; Turiault, M. (2021): Beobachtungen zum Schlupf von *Stylurus flavipes* am hessischen Oberrhein (Odonata: Gomphidae). *Libellen in Hessen* 14: 57-69. (in German, with English summary) ["Studies of *S. flavipes* emergence at the Upper Rhine in Hesse – From May to September 2020 emergence of *S. flavipes* at the "Nonnenau-Langenu" island on the Rhine near Ginsheim-Gustavsburg /Germany was studied. We searched for emerged individuals and exuviae and measured the length of the emergence sequence, distance from waterline, height of emergence and position and emergence substrate. We collected 1030 exuviae of which 302 were observed in their original emergence position. The remaining 728 exuviae were counted as drift line findings. We observed 46 individuals during emergence. The emergence period spanned 84 days. Emergence mostly took place 10-200 cm away from the waterline at a 10-60 cm above the water's surface. At lower water levels, distances of 500-1000 cm were also regularly covered. Predominantly emergence took place in a vertical position on willow grafts, about a third of the individuals emerged in a horizontal position respectively sloped up to about 45°." (Authors)] Address: Seehausen, M., Boddenweg 12, 18439 Stralsund, Germany. E-mail: 1m.seehausen@gmx.de

17700. Sganzerla, C.; Schmidt Dalzochio, M.; Prass, G.; Périco, E. (2021): Effects of urbanization on the fauna of Odonata on the coast of southern Brazil. *Biota Neotropica* 21(1): 10 pp. (in English, with Portuguese summary) ["Urbanization significantly increases the rates of environmental disturbance, being one of the main causes of habitat loss and biodiversity. The growing trend of converting the natural landscape into areas for real estate speculation in the coastal region of the southernmost part of Brazil is a current concern, as the region is home to unique ecosystems, such as dunes, wetlands and large brackish lagoons. As they are organisms sensitive to environmental changes, variations in the structure of Odonata communities are used as indicators of habitat quality reflecting the human impact on the environment. Here we assessed how the Odonata community is affected by the growing urbanization around natural ponds on the coast of the state of Rio Grande do Sul, testing the hypothesis that the increase in the percentage of urbanization negatively influences the Odonata community, following the same pattern found for other groups of invertebrates. The collections took place in 28 coastal ponds, which were classified as urbanized and non-urbanized based on the surrounding ground cover. Anisoptera's richness, abundance and composition were influenced by urbanization, but the same was not found for Zygoptera. The analysis of indicator species specifies three species associated with non-urbanized areas: *Erythrodiplax* sp.1, *Erythemis credula* and *Telebasis corallina*. Our study highlights the importance of Odonata as organisms that indicate environmental integrity and reinforces the need for urban planning strategies that favor the conservation and maintenance of the environments affected by urbanization." (Authors)] Address: Sganzerla, C., Universidade do Vale do Taquari, Laboratório de Ecologia e Evolução, Lajeado, RS, Brasil

17701. Shao, H.; Li, Q.; Liu, Y. (2021): The complete mitochondrial genome of *Ceriagrion fallax* (Odonata: Zygoptera: Coenagrionidae) and phylogenetic analysis. *Mitochondrial DNA Part B*, 6:2: 491-492. (in English) [*C. fallax* is ubiquitous in south China and is particularly easy to be found in some rice fields. In this study, we sequenced and analyzed the complete mitochondrial genome (mitogenome) of *C. fallax*. This mitogenome was 15,350 bp long and encoded 13 protein-coding genes (PCGs), 22 transfer RNA genes (tRNAs) and two ribosomal RNA unit genes (rRNAs). The nucleotide composition of the mitogenome was biased toward A and T, with 74.0% of A+T content (A 42.1%, T 31.9%, C 14.6%, G 11.4%). Gene order was conserved and identical to most other previously sequenced Zygoptera dragonflies. Most PCGs of *C. fallax* have the conventional start codons ATN (seven ATG, two ATT, and two ATC), with the exception of *nad3* and *nad1* (TTG). Except for four PCGs (*cox1*, *cox2*, *cox3*, and *nad5*) end with the incomplete stop codon T—, all other PCGs terminated with the stop codon TAA. Phylogenetic analysis showed that *C. fallax* got together with the same family species (*Agriocnemis femina*, *Enallagma cyathigerum*, *Ischnura elegans*, *I. pumilio*) with high support value. The relationships (Megapodagrionidae + ((Calopterygidae + (Euphaeidae + Pseudolestidae)) + (Coenagrionidae + Platynemididae))) were supported within Zygoptera." (Authors)] Address: Yunxiang Liu, Y. State Key Lab. of Plateau Ecology & Agriculture, State Scientific Observing & Experimental Station of Crop Pest in Xining, Ministry of Agriculture & Provincial Key Lab. Agricultural Integrated Pest Management in Qinghai, Qinghai Acad. Agriculture & Forestry Sciences, Qinghai Univ., Ningda Rd No. 251, Xining 810016, China. E-mail: 17791394452@163.com

17702. Sharma, M. (2021): A new record of the Emerald Striped Spreadwing *Lestes viridulus* Rambur, 1842 (Zygoptera: Lestidae) from Nepal. *Journal of Threatened Taxa* 13(9): 19383- 19385. (in English) [Swathi (27.650 N & 83.657 E, 132 m), Sunwal municipality of Nawalparasi, southern Terai of central Nepal, 20–23-IX-2019. Records of *Agriocnemis femina* (Brauer, 1868) and *Ischnura nursei* (Morton, 1907) are documented too.] Address: Sharma, M., Central Dept of Zoology, Tribhuvan Univ., Kirtipur, Kathmandu, Nepal. E-mail: munu.nepal50@gmail.com

17703. Silva, G.G.; Poulin, R.; Guillermo-Ferreira, R. (2021): Do latitudinal and bioclimatic gradients drive parasitism in Odonata?. *International Journal for Parasitology* 51(6): 463-470. (in English) ["Highlights: • Prevalence of parasites in odonates is driven by latitudinal and bioclimatic gradients. Latitudinal variation affects ecto-, but not endoparasites. Prevalence of water mites is positively associated with latitude. Gregarines are not affected by bioclimatic gradients. Abstract: Prevalence of parasites in wild animals may follow ecogeographic patterns, under the influence of climatic factors and macroecological features. One of the largest scale biological patterns on Earth is the latitudinal diversity gradient; however, latitudinal gradients may also exist regarding the frequency of interspecific interactions such as the prevalence of parasitism in host populations. Odonata are hosts

of a wide range of ecto- and endoparasites, interactions that can be affected by environmental factors that shape their occurrence and distribution, such as climatic variation, ultraviolet radiation and vegetation structure. Here, we retrieved data from the literature on parasites of Odonata, represented by 90 populations infected by ectoparasites (water mites) and 117 populations infected by endoparasites (intestinal gregarines). To test whether there is a latitudinal and bioclimatic gradient in the prevalence of water mites and gregarines parasitizing Odonata, we applied Bayesian phylogenetic comparative models. We found that prevalence of ectoparasites was partially associated with latitude, showing the opposite pattern from our expectations – prevalence was reduced at lower latitudes. Prevalence of endoparasites was not affected by latitude. While prevalence of water mites was also positively associated with vegetation biomass and climatic stability, we found no evidence of the effect of bioclimatic variables on the prevalence of gregarines. Our study suggests that infection by ectoparasites of dragonflies and damselflies is driven by latitudinal and bioclimatic variables. We add evidence of the role of global-scale biological patterns in shaping biodiversity, suggesting that parasitic organisms may prove reliable sources of information about climate change and its impact on ecological interactions." (Authors)] Address: Guillermo-Ferreira, R., LETES Lab, Dept Hydrobiol., Fed. Univ. Sao Carlos, Sao Carlos, SP, Brazil. E-mail address: rhainerguillermo@gmail.com

17704. Silva-Filho, E.S.; Guimarães de Araújo-Piovezan, T.; Dantasa, J.O.; Silvestre, M.; Alves, E.E.; Ribeiro, G.T. (2021): Controle de Larvas de *Aedes aegypti* por Ninfas de libélula (Odonata) sob Condições Laboratoriais - *Aedes aegypti* Larvae Control by Dragonflies (Odonata) under laboratory conditions. *Ensaio e Ciência* 25(2): 239-242. (in Portuguese, with English summary) ["Studies of *A. aegypti* control are especially important for reducing the incidence of Dengue, Zika and Chikungunya cases that are responsible for thousands of human deaths in the world. This study hypothesizes that Odonata nymphs influence the *A. aegypti* larvae control with different efficacy among their families, due to their chewing apparatus morphology and to their diverse behavior in nature. The objective was to evaluate the efficiency of seven families of Odonata nymphs as predators of the *A. aegypti* larvae under laboratory conditions. Odonata nymphs of seven families were collected with a net trap at Poxim Açu River. Each nymph was placed in a 20-cm diameter plastic recipient containing river water at room temperature. In order to verify the Odonata nymphs predation on the *A. aegypti* larvae, the predation rate of 30 mosquito larvae was verified on each recipient per day. The Odonata nymphs presented an average predation rate of 6.08 mosquito larvae per day. The families Aeshnidae (9,28) and Libellulidae (8,37) obtained the greatest average predation rate per day. All the Odonata families predated from 25 to 30 larvae in at least one day, except Cordulidae. Therefore, the Aeshnidae and Libellulidae predators were highly effective on the *A. aegypti* control. Thus, they represent a low-cost alternative for *Aedes* control in cisterns and water tanks at home sites, which have similar conditions to the ones

found in this experiment." (Authors)] Address: Guimarães de Araújo-Piovezan, Talita, Instituto Federal de Sergipe. SE, Brasil. E-mail: talit_a@hotmail.com

17705. Singh, A.P.; Chandra, A.; Uniyal, V.P.; Adhikari, B.S. (2021): Catalogue of selected insect groups of Lalwan Community Reserve and Ranjit Sagar Conservation Reserve, Punjab, India. *The Journal of Threatened Taxa* 13(3): 18020-18029. ["We present the first documentation of the insect fauna of Lalwan Community Reserve and Ranjit Sagar Conservation Reserve, Punjab. The survey was conducted in the months of May and June 2019. Selected insect groups were focused on for the rapid documentation of the entomofauna. Overall, we recorded 91 species of insects belonging to the orders Lepidoptera, Coleoptera, and Odonata. A total of 68 species including 46 species of order Lepidoptera, nine species of Odonata, and 13 species of Coleoptera were reported from Lalwan Community Reserve. Thirty-seven species consisting of 23 species of Odonata and 14 species of Lepidoptera were recorded from Ranjit Sagar Conservation Reserve, Punjab." (Authors)] Address: Singh, A.P., Wildlife Institute of India, Post Box #18, Chandrabani, Dehradun, Uttarakhand, 248001, India. E-mail: amarpaulsingh4@gmail.com

17706. Snegovaya, N.Yu. (2021): Odonata collected in summer 2020 in Azerbaijan, including a new record of *Stylurus ubadschii* (Gomphidae) and the confirmation of *Aeshna cyanea* (Aeshnidae) for Azerbaijan. *International Dragonfly Fund Report* 156: 1-28. (in English) ["In summer 2020, 35 localities in eleven districts and the vicinity of the two cities Mingechevir and Baku were studied odonatologically. A total of 39 species from 8 families was recorded. *Stylurus ubadschii* Schmidt, 1953 is reported as new for the fauna of Azerbaijan. The first certified find of *A. cyanea* is also reported." (Author)] Address: Snegovaya, Nataly, Zoological Institute NAS of Azerbaijan, proezd 1128, kvartal 504, Baku, AZ 1073, Azerbaijan. Email: snegovaya@yahoo.com

17707. Sniegula, S.; Raczynski, M.; Golab, M.J.; Johansson, F. (2020): Effects of predator cues carry over from egg and larval stage to adult life-history traits in a damselfly. *Freshwater Science* 39(4): 804-811. (in English) ["Non-consumptive predator effects experienced in early life stages of prey may result in life-history costs in later life stages. Such effects can, for example, alter the growth rate during the juvenile stage, which may carry over to size at maturity. However, we have limited knowledge of the carry-over effects starting from the egg stage through the larval stage to the adult stage. Here, we present results from a laboratory experiment in which we exposed *Ischnura elegans* to chemical cues originating from a fish predator, perch. We used a 2 × 2-full-factorial design in which the damselflies were exposed to predator cues during either the immobile egg or the mobile larval stage. The presence of predator cues, i.e., non-consumptive predator effects, during the egg stage caused decreased survival, but only until 2 wk after larval hatching. Predator cues during the larval stage caused de-

creased survival until emergence and an increase in development time until emergence. However, mass at emergence was not affected by predator cues. When fish cues were present in the egg or larval stage, there was a lower growth rate until final-instar larvae than in larvae that did not receive fish cues. Our results add to the growing number of studies showing that predation-risk cues in the egg stage can carry over to the adult stage, which ultimately could have consequences for adult life-history traits, such as survival and fecundity." (Authors)] Address: Sniegula, S., Dept Ecosystem Conservation, Inst. of Nature Conservation, Polish Academy of Sciences, aleja Adama Mickiewicza 33, 31-120 Kraków, Poland. E-mail: szymon.sniegula@gmail.com

17708. Soboleva, V.A.; Shorenko, K.I.; Golub, V.B. (2021): To the study of dragonflies species diversity (Odonata) of the Karadag Nature Reserve. *Field Biologist Journal* 3(2): 146-153. (in Russian, with English summary) [Ukraine, now Russian occupied territory; Karadag Nature Reserve. The following species are documented: *Sympecma fusca*, *Ischnura elegans*, *Platycnemis pennipes*, *Anaciaeschna isoceles*, *Anax ephippiger*, *Aeshna mixta*, *Sympetrum fonscolombii*, *S. meridionale* and *S. striolatum*.] Address: Soboleva, Viktoria, Voronezh State University, 1 Universitetskaya Sq, Voronezh, 394018, Russia. E-mail: strekoza_vm@bk.ru

17709. Son, S.-h.; Choi, J.-y. (2021): Influence of environmental characteristics on the community structure of benthic macroinvertebrates in stream-type waterways constructed at upper reaches of Geum River. *Korean Journal of Ecology and Environment* 54(1): 24-38. (in English) ["Microhabitat in the upper stream is created by various environment variables such as the bottom substrate and the physicochemical factors, and may influence the distribution of benthic macroinvertebrates. We investigated the bottom substrate and environmental variables influencing the distribution of benthic macroinvertebrate in 26 stream-type waterways established at upper reaches of Geum River. During study period, total 85 families, 160 species, 9305 individuals of benthic macroinvertebrates were recorded [Odonata: 10 families with 26 species (16,4%); no further details are given]. The stream-type waterways, where the bottom substrates consist mainly of pebble (16~64 mm) and cobble (64~256 mm) or with rapid water velocity (more than 0.2 m/s) and high dissolved oxygen (more than 120%), were supported by high species diversity of benthic macroinvertebrate. Hierarchical cluster analysis and the nonparametric multidimensional scale (NMDS) divided 26 stream-type waterways into a total of three clusters. In Cluster 1, the invertebrate species, such as *Branchiura sowerbyi*, *Cloeon dipterum*, *Ischnura asiatica*, *Paracercion calamorum*, and *Radix auricularia*, closely related to aquatic macrophytes, and *Chironomidae* spp., *Limnodrilus gotoi*, and *Tanytopodinae* sp. were abundant in waterways, with high coverage of silt and clay as well as high turbidity and total nitrogen. The benthic macroinvertebrate species (*Cheumatopsyche brevilineata*, *Drunella ishiyamana*, *Dugesia japonica*, *Ephemera orientalis*, *Gumaga KUa*, *Macrostemum radiatum*, *Potamanthus formosus*, *Semisulcospira libertine*, *Stenelmis*

vulgaris, and *Teloganopsis punctisetae*) included in Cluster 2 were dominated in sites with high cover rates of pebble and gravel. Cluster 3 was predominantly covered by the Cobbles, was supported by *Simulium* sp. Such a clear distinction in the study sites means that each stream-type waterways is governed by a clear habitat environment. In the case of some sites with low species diversity, improvement measures are required to restore nature, such as improving the function of inflows and outflows, creating meandering channel, and inducing the settlement of littoral vegetation." (Authors)] Address: Choi, J.-y., National Institute of Ecology, Seo-Cheon Gun, Chungcheongnam province 33657, Republic of Korea. E-mail: jyc311@nie.re.kr

17710. Souza, A.G.M. de; Lameira Neto, V. de J.; Pereira Junior, A. (2021): A. Integrative review on biology, water quality and the order Odonata. *Research, Society and Development* 10(9), p. e24910917605, 2021. DOI: 10.33448/rsd-v10i9.17605: 18 pp. (in Portuguese, with English and Spanish summaries) ["Sciences such as biology generate information about ecosystems, such as aquatic ecosystems, and promote integration with ethnic knowledge associated with botany. The objective of this work was to carry out an integrative review about the interrelationship of biology with various environmental areas, under two aspects, conservation, and balance, to investigate the relationship between biology and research on water quality and the use of the order Odonata as bioindicator of the environmental quality of water bodies. The research method was deductively associated with a quantitative and qualitative approach of a basic nature. The data obtained and analyzed indicated that the biological terms are present in most of the selected literature (n = 46.2%); regarding water quality, there was a small reduction (n = 30.8%); the use of the order Odonata as bioindicators of water quality is still scarce (n = 22.9%). As for the use of descriptors in the analyzed research, the following citations were identified: "Biological terms and water quality" (n = 65.8%); "Odonata and water quality" (n = 21.1%); "Biological terms and Odonata" (n = 13.2%). The order Odonata, as a bioindicator, is evolving (Amount = 33.3%) and with high frequency (fr > 50%) when compared to the application of Biological Terms and Water Quality. So, the application of biology is already effective in environmental areas such as water quality analysis. However, the use of Odonata as bioindicators of water quality is not used very often yet. Thus, it is recommended that there is a greater appreciation by researchers of this relationship, which can contribute to the qualification and monitoring of this natural resource more comprehensively and effectively." (Authors)] Address: de Souza, Annanda, Univ. do Estado do Pará, Brasil. E-mail: annanda.annandasouza@gmail.com

17711. Späth, J.; Brodin, T.; Cervený, D.; Lindberg, R.; Fick, J.; Nording, M.L. (2021): Oxylinins at intermediate larval stages of damselfly *Coenagrion hastulatum* as biochemical biomarkers for anthropogenic pollution. *Environmental Science and Pollution Research* 28: 27629-27638. (in

English) ["Aquatic pollution resulting from anthropogenic activities requires adequate environmental monitoring strategies in sentinel organisms. Thus, biochemical biomarkers have been used as early-warning tools of biological effects in aquatic organisms. However, before using these markers for environmental monitoring, knowledge about their developmental variation is vital. In this study, we assessed baseline levels and developmental variations of a group of potential biomarkers, oxylinins, during the lifespan of *C. hastulatum* using liquid chromatography-tandem mass spectrometry. Effects of wastewater exposure on baseline levels were studied in a subset of damselflies to investigate the responsiveness due to anthropogenic pollution. Thirty-eight oxylinins deriving from four polyunsaturated fatty acids via two enzymatic pathways were detected in damselflies at three larval stages and in the adult form. Overall, oxylinin baseline levels showed developmental variation, which was lowest in the intermediate larval stages. Effects of exposure to wastewater effluent on oxylinin baseline levels were dependent on the life stage and were greatest in the early and intermediate larval stages. The study provides first insights into oxylinin profiles of damselflies at different stages of development and their developmental variation. Based on our results, we propose further strategies for incorporating oxylinins in damselfly larvae as biochemical markers for anthropogenic pollution." (Authors)] Address: Späth, Jana, Dept of Chemistry, Umeå University, 90187 Umeå, Sweden. E-mail: jana.spath@umu.se

17712. Stunkle, C.R.; Davidson, A.T.; Shuart, W.J.; McCoy, M.W.; Vonesh, J.R. (2021): Taxa-specific responses to flooding shape patterns of abundance in river rock pools. *Freshwater Science* 40(2): 397-406. (in English) ["Connectivity and patch size are important landscape characteristics that drive patterns of abundance and diversity across scales. However, responses to connectivity and patch size are dependent on species traits. Riverine landscapes are highly dynamic both spatially and temporally, with hydrologic connectivity being a major driver of abundance and diversity. Here we modeled the densities of 2 taxa that differ in life history and dispersal ability, the Virginia River Snail (*Elmilia virginica*) and skimmer dragonfly larvae (*Pantala* spp.), as a function of flooding, patch area, and season in >300 riverine rock pools. We found key differences in how each taxon responded to these predictors. Specifically, increasing pool flood height had a strong negative effect on snail densities, whereas dragonfly nymph densities increased as pools became isolated from the river channel for longer durations of time. Increasing pool surface area had a positive effect on snail densities, whereas dragonfly nymph densities showed no such relationship. Dragonfly nymph densities were greater in summer and autumn than in spring, but snails showed no difference in their temporal distribution across seasons. Our study highlights how differential responses to landscape characteristics are dependent on organism traits. These findings give insight into patterns of abundance and diversity across spatiotemporal scales." (Authors)] Address: Stunkle, C.R., Center Environmental Studies, Virginia Com-

monwealth Univ., 1000 West Cary Street, Suite 105, Richmond, Virginia 23284 USA. E-mail: crstunkle@vcu.edu

17713. Sumanapala, A.P. (2021): *Macromia weerakooni* sp. nov. (Odonata: Anisoptera: Macromiidae), a new dragonfly species from Sri Lanka. *International Journal of Odonatology* 24: 169-177. (in English) ["The genus *Macromia* is represented in Sri Lanka by two endemic species. In this paper a third presumed endemic species is described based on a single male specimen collected at Kirikitta, Weliveriya, Western Province in the low country wet zone of the country. *Macromia weerakooni* sp. nov. differs from its congeners in Sri Lanka by having turquoise blue eyes, an entirely black labrum, a short yellow ante-humeral stripe, an interrupted yellow stripe on the anterior margin of metepisternum and differences in the secondary genitalia and anal appendages. As this is the only record of the species knowledge of its natural history and distribution is limited. This discovery highlights the need for further systematic surveys of Odonata in Sri Lanka using sampling methods suitable for the detection of elusive species." (Author)] Address: Sumanapala, A.P., Dept of Zool. & Environ. Scien., Univ. Colombo, Colombo, Sri Lanka. E-mail: apsumanapala@gmail.com

17714. Supanekar, S.P.; Naik, M.S.; Meshram, L.N.; Rokade, A.G.; Pawar, P.R. (2021): Species diversity and abundance of dragonflies and damselflies (Odonata: Insecta) in and around Panvel, Navi Mumbai, Maharashtra (India). *International Journal of Scientific and Research Publications* 11(5): 368-374. (in English) ["Panvel is one of the fast-changing metro city in Navi Mumbai, Maharashtra, India, due to ongoing construction of Navi Mumbai International Airport (NMIA), rampant urbanization, industrialization and unplanned development have resulted into ecological disturbances and habitats fragmentation. Literature review suggest that no baseline data is available with respect to Odonata. Hence present study is undertaken."] 15 species of odonates recorded Address: Supanekar, S.P., Mahatma Phule Arts, Science & Commerce College, Panvel, Navi Mumbai, India. E-mail: sankam23@gmail.com

17715. Syahroni, A.M.; Nurrofik, A.; Rachman, H.T.; Syarifudin, A.; Kurnianto, A.S. (2021): Rediscovery of *Ceriagrion annulosum* (Lieftinck, 1934) from Java, Indonesia. *Agrion* 25(2): 74-75. (in English) [12-XI-2020, 8°23'42.84" S 112°32'19.32" E, Sumber Bening Village, Bantur District, Malang, East Java, Indonesia.] Address: Syahroni, A.M., Dept Biol., Brawijaya Univ., Jalan Raya Veteran, Malang City 65145, Indonesia. E-mail: amshahroni@student.ub.ac.id

17716. Tanczuk, A.; Bojar, P. (2021): The new site of *Somatochlora arctica* (Zetterstedt, 1840) (Odonata: Corduliidae) in Lublin Province. *Odonatrix* 17_3: 12 pp. (in Polish, with English summary) ["Lublin Province is one of the best researched area in Poland as far as Odonata are concerned, yet there are still places worth examining and needing protection where one may find interesting habitats and species. The obser-

ations were conducted on two strongly hydrated transitional bogs near the village Zanie in Sandomierz Basin in the south-east of Poland. *S. arctica* is a species protected in Poland, included in the Red Book and the Red List of endangered species. The male of *S. arctica* was seen on 10-VIII-2020, in patrolling flight and feeding and the exuvium of the dragonfly was found on 29-VIII-2020. Furthermore, on this area some other interesting observations of dragonflies were recorded, like protected species *Ophiogomphus cecilia* and "southern" species *Aeshna affinis* and the one from the Red List *Orthetrum coerulescens*. Taking into consideration climatic changes, especially drying out of the water bodies where dragonflies live and reproduce, it is very important to protect such places. The adequate management of habitats may help to preserve populations of protected and rare species." (Authors)] Address: Tanczuk, Agnieszka, ul. Przasnyczki 2/40, 20-838 Lublin, Poland. E-mail: 1atanczuk@gmail.com,

17717. Tang, D.H.Y.; Visconti, P. (2021): Biases of Odonata in Habitats Directive: Trends, trend drivers, and conservation status of European threatened Odonata. *Insect Conservation and Diversity* 14(1): 1-14. (in English) ["1. Odonata, are important ecological indicators with widely recognised conservation value. They are generally better researched and protected than other invertebrates, yet, they have received limited protection from the European Union (EU)'s Habitats Directive, which serves as the major legislative tool for species conservation in Europe. 2. We reviewed the conservation status and trends, legal protection status, and knowledge gaps of Odonates within the EU. Among the 22 threatened and 27 endemic species in EU, respectively 19 and 11 of them are not protected by the Directive. Out of the 35 species which are threatened and/or listed on the Annexes, 61.5% of them are declining. 3. Nevertheless, threatened non-Annex species are more likely to have a decreasing population trend than Annex species. There are also 26% of threatened non-Annex species with unknown trends. Inaccuracies in evaluating Odonata trends are also revealed due to the lack of standardised methodology and incomplete surveys. 4. Moreover, most conservation research focuses on climate change's effects on range shift, therefore knowledge gaps exist in understating how water and habitat qualities, the most important Odonate trend drivers, shape Odonata conservation status. 5. There is an urgent need to revise the legal protection status of Odonata in Europe, for instance by revising the EU Habitats Directive Annexes to include threatened damselflies and dragonflies. 6. There is also an urgent need for systematic, standardised, and regular survey to be able to investigate trends and drivers of change to identify priority conservation actions." (Authors)] Address: Visconti, P., Centre for Biodiversity & Environment Research, Univ. College London, London, UK

17718. Tann, J. (2021): Images of Australian Odonata wings. *Technical Reports of the Australian Museum Online* 33: 1-101. (in English) ["A recently finished project has created an openly accessible, high-resolution, photographic library of wings of Australian dragonflies and damselflies, order Odonata. The library is an open resource for identification and

research. Both male and female wings of 318 species of Odonata have been photographed with a specialist set-up using identified museum collection material. In general, both wings were removed from the insect body to produce an image with a minimum of visual artefacts. Each resulting image shows a pair of right wings, a scale, an identifying taxonomic name and sex." (Author)] Address: Tann, J., Australian Museum Research Institute, Australian Museum, 1 William Street, Sydney NSW 2010, Australia

17719. Tchibozo, S. (2021): The endangered dragonfly *Ceragrion citrinum* Campion, 1914 (Zygoptera: Coenagrionidae) from West Africa and efforts to protect it. *Entomologie heute* 32: 75-81. (in English, with French and Germany summaries) ["*C. citrinum* is a very rare threatened damselfly species that nowadays clearly occurs only in southern Benin in the Gnanhouzoumè Community Forest and especially in the Lokoli Swamp Forest. Both areas are not yet protected and are endangered by human activities. A largely privately initiated project is in the process of sensitising the local population, primarily through the youth, to conservation issues with the help of this rare dragonfly." (Author)] Address: Tchibozo, S., Centre de Recherche pour la Gestion de la Biodiversité (CRGB) 04 B.p. 0385 Cotonou, Bénin. E-Mail: s.tchibozo@crgbbj.org

17720. Thakuria, D.; Kalita, J. (2021): Diversity and distribution of odonates in Rani Reserve Forest, Assam, India. *Journal of Threatened Taxa* 13(1): 17487-17503. (in English) ["Odonata are the bioindicators of freshwater ecosystem health and is recognised as an excellent 'flagship' group among insects. Baseline knowledge on the diversity and distribution of odonates over spatiotemporal scale is the key to biodiversity conservation. Rani Reserve Forest of Assam is a mosaic of all the habitat types suitable for odonates. The present work aims at studying the diversity and distribution of Odonates in Rani Reserve Forest. The study was carried out from December 2014 to November 2017 by categorising the study area into three major habitat types: 1. lentic system, 2. lotic system and 3. terrestrial woodland. A total of 67 species belonging to 44 genera, representing 11 families were recorded. First published records of three species, *Onychothemis testacea*, *Philoganga montana* and *Indocnemis orang* from the state are also provided herewith. Species richness was the highest in lentic system whereas recorded the lowest in running waters of larger forested streams. Shannon diversity index also indicated that the lentic system is relatively diverse (2.95) and smaller streams of the lotic system showed the highest species evenness (0.87). Libellulidae (43%) was found to be the most dominant family belonging to suborder Anisoptera followed by Coenagrionidae (22%) of suborder Zygoptera. Philogangidae (1%) recorded the lowest number of species. Taxonomically related species showed distinct ecological segregation within these different habitat types occupying different microhabitats therein." (Authors) monsoon] Address: Thakuria, D., Biodiv. & Cons. Lab., Dept Zool., Gauhati Univ., Gopinath Bordoloi Nagar, Assam 781014, India. E-mail: dipti.thakuria@gmail.com

17721. Theischinger, G.; Miller, J.; Tang, C.; Huxley, M.; Jacobs, S. (2021): What will happen to them? Notes on some dragonfly (Odonata) species that are susceptible to the impacts of global warming-induced climate change. *The Victorian Naturalist* 138(3): 68-77. (in English) ["Many aquatic macroinvertebrates that require specific habitat niches are expected to relocate in response to global warming-induced climate change. For some species, relocation will not be possible because of geographic constraints or complete loss of the required habitat. Data compiled by Theischinger et al. (2018) was used to identify some species of Odonata at risk of extinction due to loss of habitat caused by climate change. While numerous species are at risk, this paper details only examples of habitats most likely to be impacted. Twelve species requiring these habitats are discussed. Species most at risk are those requiring alpine, sub-alpine and montane habitats. The combined effects of reduced rainfall and increased temperatures have been identified as the factors most likely to degrade these habitats catastrophically. Australia has limited alpine, sub-alpine and montane regions, and little or no alternative habitat for these species. Also, species requiring spring-fed streams are at risk due to reduced renewal of groundwater, while those that inhabit large slow-flowing rivers, particularly in the Murray Darling Basin, are likely to be impacted by algal blooms." (Authors)] Address: Jacobs, S., 55 Lindley Avenue, Narrabeen, NSW 2101, Australia. E-mail: janrob02@gmail.com

17722. Thongprem, P.; Davison, H.R.; Thompson, D.J.; Lorenzo-Carballe, M.O.; Hurst, G.D.D. (2021): Incidence and diversity of *Torix Rickettsia*-Odonata symbioses. *Microbial Ecology* 81: 203-212. (in English) ["Heritable microbes are an important component of invertebrate biology, acting both as beneficial symbionts and reproductive parasites. Whilst most previous research has focussed on the 'Wolbachia pandemic', recent work has emphasised the importance of other microbial symbionts. In this study, we present a survey of odonates (dragonflies and damselflies) for *torix* group *Rickettsia*, following previous research indicating that this clade can be common in other aquatic insect groups. PCR assays were used to screen a broad range of odonates from two continents and revealed 8 of 76 species tested were infected with *Rickettsia*. We then conducted further deeper screening of UK representatives of the Coenagrionidae damselfly family, revealing 6 of 8 UK coenagrionid species to be positive for *torix Rickettsia*. Analysis of *Rickettsia* gene sequences supported multiple establishments of symbiosis in the group. Some strains were shared between UK coenagrionid species that shared mtDNA barcodes, indicating a likely route for mitochondrial introgression between sister species. There was also evidence of coinfecting *Rickettsia* strains in two species. FISH analysis indicated *Rickettsia* were observed in the ovarioles, consistent with heritable symbiosis. We conclude that *torix Rickettsia* represent an important associate of odonates, being found in a broad range of species from both Europe and South America. There is evidence that coinfection can occur, vertical transmission is likely, and that symbiont move-

ment following hybridisation may underpin the lack of 'bar-coding gap' between well-established species pairs in the genus. Future work should establish the biological significance of the symbioses observed." (Authors)] Address: Hurst, G.D.D., Institute of Infection, Veterinary and Ecological Sciences, University of Liverpool, Liverpool L69 7ZB, UK. E-mail: g.hurst@liverpool.ac.uk

17723. Tüzün, N.; Savasçi, B.B.; Stoks, R. (2021): Seasonal time constraints shape life history, physiology and behaviour independently, and decouple a behavioural syndrome in a damselfly. *Oikos* 130(2): 274-286. (in English) ["The integration of traits into 'syndromes' has been suggested as a useful framework to advance insights in trait responses to environmental stressors. Yet, how stressors shape the consistency ('repeatability') of traits and their covariation at the individual level remains debated. We studied how seasonal time constraints shape trait repeatability and integration of life-history, behavioural, and physiological traits along a fast-slow continuum, using the 'pace-of-life syndrome' as a framework. We manipulated the photoperiod during the larval development of the damselfly *Ischnura elegans*, generating a time-relaxed early, a control, and a time-constrained late group. The photoperiod treatment did not seem to affect the voltinism of the larvae. As predicted, late-period larvae accelerated development and growth, yet this acceleration was no longer detectable for growth and metabolic rate during the final instar, possibly due to costs of the initial life-history acceleration. This warrants caution when inferring a species' pace-of-life based on a specific developmental stage. The late-period larvae were as predicted more active (only during the later stages of the final instar) and bolder than the control larvae, but not different from the early-period larvae. Most studies on time constraints only compared late and control animals, thereby potentially wrongly concluding adaptive responses to time constraints. Activity, boldness, and body mass were repeatable, while growth and metabolic rates were not. Notably, repeatabilities did not change under time constraints. There was no support for an overall trait integration in a pace-of-life syndrome, yet activity and boldness covaried positively as expected. Importantly, this 'behavioural syndrome' was decoupled in the late-period larvae, which might be adaptive to enhance energy acquisition to fuel the accelerated development rate. Our results suggest that besides the predicted plastic acceleration of life-history, plastic changes in behavioural trait integration may also be an important but overlooked adaptive aspect of responding to time constraints." (Author)] Address: Stoks, R., Laboratorium voor Aquatische Ecologie, K.U.Leuven, De Beriotstraat 32, B-3000 Leuven, Belgium. E-mail: robby.stoks@bio.kuleuven.ac.be

17724. Twardochleb, L.; Hiltner, E.; Pyne, M.; Zametske, P. (2021): Freshwater insects CONUS: A database of freshwater insect occurrences and traits for the contiguous United States. *Global Ecology & Biogeography* 2021: 16 pp. (in English) ["Freshwater insects comprise 60% of freshwater animal diversity; they are widely used to assess water qua-

lity, and they provide prey for numerous freshwater and terrestrial taxa. Our knowledge of the distribution of freshwater insect diversity in the USA is incomplete because we lack comprehensive, standardized data on their distributions and functional traits at the scale of the contiguous United States (CONUS). We fill this knowledge gap by presenting Freshwater insects CONUS: A database of freshwater insect occurrences and traits for the contiguous United States. This database includes 2.05 million occurrence records for 932 genera in the major freshwater insect orders, at 51,044 stream locations sampled between 2001 and 2018 by federal and state biological monitoring programmes. Compared with existing open-access databases, we tripled the number of occurrence records and locations and added records for 118 genera. We also present life-history, dispersal, morphological and ecological traits and trait affinities (analogous to fuzzy-coded traits) for 1,007 stream insect genera, assembled from existing databases, reference books and the primary literature. We nearly doubled the number of traits for 11 trait groups and added traits for 180 genera that were not available from open-access databases. Our database, Freshwater insects CONUS, facilitates the mapping of freshwater insect taxonomic and functional diversity and, when paired with environmental data, will provide a powerful resource for quantifying how the environment shapes stream insect diversity and taxon-specific distributions." (Authors)] Address: Twardochleb, Laura, California Dept Water Resources, 3500 Industrial Boulevard, West Sacramento, CA 95799, USA. E-mail: laura.twardochleb@water.ca.gov

17725. Uz, A.G.; Salur, A. (2021): Intraspecific wing variations in *Orthetrum brunneum* (Insecta: Odonata): effects of Anatolian diagonal. *Fresenius Environmental Bulletin* 30(3): 2879-2887. (in English) ["Geographical and ecological diversity positively leads to variations in different populations of a species. In Turkey, researches on the effect of Anatolian diagonal with dozens of ecological barriers in terms of biodiversity, have been increased in recent years. The aim of this study is to determine the variations of wing morphologies of *Orthetrum brunneum* populations by using biometric characters. For this purpose, intra-species wing variations of three different *Orthetrum brunneum* populations were investigated where collected from Tunceli province located in east, Yozgat province located in west and Western Mediterranean Region located in south of Anatolian diagonal. Statistical analysis (Tukey HSD) showed that various biometric characteristics differed statistically among these taxon ($P < 0.05$). According to Principal Component Analysis (PCA), four components with total variance Eigen value greater than 1 can be explained among these groups. Tunceli population were divergent from other populations by Discriminant Function Analysis (DFA). These findings support the idea that Anatolian diagonal is a barrier for populations of *O. brunneum*." (Authors)] Address: Salur, A., Hitit Univ., Dept Biol., Fac. of Arts and Sciences, Ikbalkent Campus, Corum, Turkey

17726. Van Damme, K.; Vahalik, P.; Ketelaar, R.; Jeziorski, P.; Bouwman, J.; Morris, M.; Suleiman, M.S.; Dumont, H.J.

(2020): Dragonflies of Dragon's Blood Island: Atlas of the Odonata of the Socotra Archipelago (Yemen). *Rendiconti Lincei. Scienze Fisiche e Naturali* 31: 571-605. (in English) ["Odonata are important bioindicators of aquatic ecosystem health. We discuss the distribution and richness of the 22 odonate species known from the Socotra Archipelago UNESCO World Heritage Site (Yemen) in the western Indian Ocean. We compiled 841 records from literature, field data and museum collections, covering a surveying period of 123 years (1896–2019). Distribution of the only endemic, *Azuragrion granti* (McLachlan, 1903), an indicator of pristine lotic waters, is updated. Relatively higher dragonfly species richness occurs in eastern Socotra where suitable aquatic habitats are present all year. We observed a significant drop of the number of taxa over several decades in areas in the Hadiboh Plain where human development impacts are strongest. We discuss the indigenous people's perception of dragonflies to assess the potential of these invertebrates as local flagships for aquatic biodiversity conservation. Our knowledge of the Socotran Odonata remains incomplete, yet they are now among the best studied animal groups in the archipelago. A new record of an Oriental *Anax* indicates that the island's dragonfly fauna may yet harbour surprises. Our compilation of odonate records is the first for Socotra and serves as a baseline for future monitoring of the archipelago's vital aquatic habitats. We converted all records into a geodatabase which we uploaded to an online, freely available web mapping server and mobile application to facilitate research and conservation of the Socotran dragonflies (www.dragonfliesofsocotra.com)."] (Authors)] Address: Van Damme, K., Senckenberg Res. Inst. & Nat. Hist. Mus. Frankfurt, Senckenberganlage 25, 60325 Frankfurt am Main, Germany. E-mail: kay.vandamme@gmail.com

17727. Veljkovic, M. (2021): Contribution to the knowledge of dragonfly fauna (Insecta: Odonata) of Bjelovar area, Croatia – results of a four-year photographic study. *Natura Croatica* 30(1): 161-172. (in English, with Croatian summary) ["This paper gives a list of 10 species from five Odonata families observed in Gornje Plavnice near Bjelovar, Croatia in a period between the 18th of June 2017 and the 11th of August 2020. This photographic research, conducted along the Jarak Pond and on the surrounding meadows, agricultural land and forest edge in Gornje Plavnice, represents a contribution to the knowledge of dragonfly fauna of the Bjelovar-Bilogora area as well as of Croatia as a whole." (Author)] Address: Veljkovic, Monika, Gornje Plavnice 56, 43000 Bjelovar, Croatia. E-mail: monika.veljkovic1@gmail.com

17728. Venancio, H.; Vilela, S.S.; Barbosa, M.S.; Santos, J.C. (2021): Dragonflies and damselflies in a region of the Triângulo Mineiro, Minas Gerais: checklist and taxonomic additions. *Biota Neotropica* 21(3): e20201182, 2021: 16 pp. (in English, with Portuguese summary) ["Remaining freshwater systems are historically under threat mainly due to human activities such as agriculture and urbanization. The consequences of such activities are innumerable, and among them there is a decrease of suitable habitats for threatened fauna. In the Brazilian Cerrado, the odonatofauna of palm

swamps and riparian forests are still poorly explored, a fact that difficult conservation efforts of the group. Thus, we performed an inventory in several urban and rural sites containing these phytophysiognomies in Uberlândia, Triângulo Mineiro region, western Minas Gerais state. In total, we found 101 Odonata species, seven families and 46 genera in the municipality, with 76 and 66 species, respectively, belonging to palm swamp and forest sites. From this diversity, eight species were first records in the state of Minas Gerais: *Neuraeschna claviforcipata*, *Phyllocycla* cf. *medusa*, *Diastatops intensa*, *Oligoclada pachystigma*, *O. xanthopleura*, *Angelagrion nathaliae*, *Telebasis sanguinalis* and *Telebasis simulacrum*. We also sampled *Erythrodiplax ana*, a species listed as endangered (EN) by the IUCN red list. Additionally, we include some taxonomic notes of *Forcepsioneura machadorum* females, a newly discovered species in the region. Our results contribute to the Odonata database in Brazil and highlights the importance inventories in poorly explored aquatic ecosystems." (Authors)] Address: Venâncio, H., Univ. de São Paulo, Fac. de Filosofia, Ciências e Letras de Ribeirão Preto, Programa de Pós-Graduação em Entomologia, Ribeirão Preto, SP, Brasil. E-mail: henrivens@gmail.com

17729. Viella, D.S.; Farias, A.B.S.; Santos, J.C. (2021): *Heteragrion lencionii* (Odonata: Heteragrionidae) sp. nov. from Serra de Itabaiana National Park, Northeastern Brazil. *Zootaxa* 4966(4): 476-482. (in English, with Spanish summary) ["The Neotropical genus *Heteragrion* Selys, 1862 is one of the most speciose among Zygoptera. Notwithstanding, most of its species are poorly known, especially those from undersampled areas such as Northeastern Brazil. Here, we describe *Heteragrion lencionii* sp. nov., from protected areas of Sergipe state (Holotype ♂, Brazil, Sergipe, Areia Branca, Serra de Itabaiana National Park, -10.7484, -37.3390, 179 m, 7.xii.2020, A.B. Farias & A.E. dos Santos leg., in UFS). This is only the second *Heteragrion* species discovered as new for the Northeastern region of Brazil, separated from other congeners by cercus morphology and thoracic coloration pattern." (Authors)] Address: Viella, D.S., Rua Jaime Bilharinho, 575, Fabrício, CEP 38065-280, Uberaba, MG, Brazil. E-mail: deeogoo@gmail.com

17730. Vilela, D.S.; Lencioni, F.A.A.; Santos, J.C. (2021): *Leptagrion itabaiana* sp. nov. (Odonata: Coenagrionidae) from Serra de Itabaiana National Park, Sergipe state, Northeastern Brazil. *Zootaxa* 4980(3): 558-564. (in English) ["*Leptagrion itabaiana* sp. nov. (Brazil, Sergipe, Areia Branca, Serra de Itabaiana National Park, (10.7517 S, 37.3415 W, 179 m asl), 3.ii.2021, J.C. Santos leg.) is described, diagnosed, illustrated and compared with morphologically close congeners based on male specimens. The new species can be separated from other *Leptagrion* species mainly by cercus morphology." (Authors)] Address: Vilela, D.S., Rua Jaime Bilharinho, 575, Fabrício, CEP 38065-280, Uberaba, MG, Brazil. E-mail: deeogoo@gmail.com

17731. Vilenica, M.; Kerovec, M.; Pozojevic, I.; Mihaljevic, Z. (2021): Odonata assemblages in anthropogenically impacted lotic habitats. *Journal of Limnology* 80(1): 10 pp. (in

English) ["Increasing human pressures have a negative impact on freshwater habitats and their biota worldwide. To protect habitats and the species contained within them, ecological assessments over a gradient of near natural to degraded freshwater habitats are essential. Odonata assemblages were investigated at 46 study sites in Croatia encompassing slightly to heavily modified lowland rivers and streams. Nymphs were sampled between April and September 2016 using a benthos hand net. A total of 19 species was recorded, and *Ischnura elegans* and *Platynemis pennipes* were most frequently recorded. RDA analysis indicated that water pollution (i.e. levels of chemical oxygen demand and total organic carbon), water temperature and oxygen concentration had the highest influence in the formation of Odonata assemblages at a specific habitat, reflecting their widely recognized bioindicator properties. This study showed that degraded lowland rivers can provide habitat for a relatively low number of species with broad ecological tolerance, while rare and specialist species are generally not able to reproduce there. These results contribute to our knowledge of Odonata occurrence in anthropogenically impacted habitats, and their relationships with such degraded environment." (Authors)] Address: Vilenica, Marina, University of Zagreb, Faculty of Teacher Education, Trg Matice hrvatske 12, Petrinja, Croatia

17732. Wade, A. (2021): Role of vegetated buffer zones for mitigating wetland pesticide contamination and protecting aquatic invertebrate communities in northern prairie wetlands. M.Sc. thesis, Toxicology Centre, University of Saskatchewan. XIII, 151 pp. (in English) ["Prairie Pothole Region (PPR) wetlands are unique resources that provide a number of ecosystem services. However, the majority of these wetlands have been drained or otherwise degraded due to agricultural activities. Wetlands in the PPR are frequently contaminated by agrochemicals from surrounding agriculture, which has been previously demonstrated to have negative impacts on wetland ecology. Vegetation buffers have been proven to be effective in mitigating pesticide and nutrient contamination of water bodies, but have yet to be fully researched in their efficacy in protecting PPR wetlands. Here I examined how multiple agricultural stressors impact PPR wetland health, and whether natural wetland vegetation or producer-implemented perennial plantings are effective buffers, able to mitigate some of the negative effects of agriculture to wetlands. Measurements of pesticides, nutrients, other water quality parameters, in addition to aquatic invertebrate community endpoints were used to comprehensively evaluate the health of PPR wetlands. Pesticide contamination was widespread, with 59 of the 60 wetlands sampled in 2018 and 2019 containing one or more pesticides in a single growing season. Natural wetland vegetation and the degree of its disturbance from agricultural activities did not have a significant effect on pesticide concentrations in wetlands, although this disturbance did influence the aquatic invertebrate community. Wider and less disturbed wetland vegetation zones were associated with greater macroinvertebrate richness ($p = 0.031$) and greater abundance of Odonata ($p = 0.001$). Aspects of water quality

were significant predictors of multiple aquatic invertebrate community indices. The occurrence of cyanobacteria blooms as well as increased total nitrogen (TN) were associated with declines in Shannon's diversity (Cyanobacteria: $p = 0.001$ and TN: $p = 0.016$) and Shannon's Evenness (Cyanobacteria: $p = 0.002$ and TN: $p = 0.001$) as well as increases in Berger-Parker Dominance (Cyanobacteria: $p = 0.004$ and TN: $p = 0.001$). The Pesticide Toxicity Index (PTIs) calculated for each wetland was associated with changes to the aquatic invertebrate community including a decline in total and relative insect abundance ($p = 0.016$ and $p < 0.001$) and an increase in relative snail abundance ($p = 0.005$). Higher PTIs were also associated with a shift in relative abundance of different functional feeding groups ($p = 0.017$). This PTI associated shift in taxa and functional feeding groups likely has greater implications for ecosystem function including the many wildlife species that depend on aquatic insects for food. Perennial buffers are considered an important management tool to reduce the negative impacts of agriculture on surface waters. Perennial vegetated buffers recently planted under conservation incentive programs were evaluated for their efficacy in mitigating pesticide and nutrient runoff and protecting wetland health. Wetlands that were fully surrounded by perennial buffers and/or other natural vegetation contained significantly lower concentrations of pesticides ($p = 0.001$), lower PTIs ($p < 0.001$), and total phosphorus ($p = 0.005$). However, the presence of perennial buffers alone did not have a significant effect on pesticide or nutrient detections, and even those wetlands that were fully surrounded by perennial buffers or additional natural vegetation all contained some detectable pesticide contamination. The presence of perennial buffers was significantly associated with greater abundances of macroinvertebrates ($p = 0.001$), zooplankton ($p = 0.005$), and insects ($p = 0.039$) which may benefit the many wildlife species that depend on wetland invertebrate productivity for food. This study establishes a framework for using wetland invertebrate communities as an integrative biomonitoring tool for assessing effects of complex agricultural stressors to PPR wetlands. The results from this study demonstrate negative effects of multiple agricultural stressors on wetland health, as measured by changes in the aquatic invertebrate community. Findings here suggest that leaving or planting wetland vegetation around PPR wetlands could increase community richness and abundance of beneficial insects, but is not sufficient for protecting wetlands from pesticide contamination. However, surrounding wetlands with perennial vegetation plantings in addition to other natural vegetation could be an effective method for reducing pesticide and nutrient contamination of wetlands and increasing the abundance and diversity of aquatic invertebrates, which are an important food source for many wildlife species. These findings may help guide producers and land managers motivated to improve wetland health and ecosystem services in prairie agricultural landscapes." (Author)] Address: not stated

17733. Walia, G.K.; Singh, H. (2021): First cytogenetic report on four species of family libellulidae (Odonata: Anisop-

tera) from India. *International Journal of Entomology Research* 6(2): 223-227. (in English) ["Chromosome complement of *Cratilla lineata*, *Hylaeothemis apicalis*, *Orthetrum chrysis* and *Zygonix irix* of family Libellulidae has been studied by conventional staining, C-banding, silver nitrate staining and sequence specific staining. Among these, *Cratilla lineata*, *Orthetrum chrysis* and *Zygonix irix* possess $2n$ (‰) = 25 as the chromosome number, while *Hylaeothemis apicalis* reveals $2n$ (‰) = 23, which is originated by the fusion of X chromosome with an autosome pair as X chromosome is the largest element in the complement. Terminal C-bands and terminal NORfs are present on the autosomal bivalents, while X chromosome is entirely C-positive and NOR-positive in all the species, whereas m bivalent shows variation in distribution of C-heterochromatin and NORfs. Similarly, autosomal bivalents and X chromosome show more DAPI bright signal than CMA3, while m bivalent possesses variation in AT-GC region specificity. Cytogenetically, all these species has been studied for the first time in the world." (Authors)] Address: Walia, Gurinder Kaur, Department of Zoology and Environmental Sciences, Punjabi University, Patiala, Punjab, India

17734. Walker, G.; Theischinger, G. (2021): Observation before, at and after oviposition of *Tetrathemis irregularis cladophila* (Anisoptera, Libellulidae). *Agrion* 25(2): 51-53. (in English) ["Observations made in tropical Queensland before, at and immediately after the oviposition of *Tetrathemis irregularis cladophila* Tillyard, 1908 are described, illustrated and discussed." (Authors)] Address: Walker, G., 14 Drishane Street, The Gap, Brisbane Queensland 4061 Australia. E-mail: gwalke13@bigpond.net.au

17735. Wang, L.-J.; Hsu, M.-H.; Wang, C.-H.; Chung, C.H.; Sung, C.-H. (2021): The complete mitochondrial genome of *Mnais tenuis* Oguma, 1913 (Odonata: Calopterygidae) and its phylogenetic implications. *Mitochondrial DNA Part B Resources* 6(5): 1648-1649. (in English) ["We sequenced and assembled the complete mitochondrial genome of *Mnais tenuis* from Darshi, Taoyuan County, Taiwan. The complete mitogenome of *M. tenuis* is 15,131 bp long, and contains 13 protein-coding, 22 tRNA, and two rDNA genes. Nucleotide compositions of the mitogenome of the *M. tenuis* are A: 40.08%, T: 25.47%, C: 20.38%, and G: 14.07%. The AT and GC skewness of the mitogenome sequence was 0.2228 and -0.183, showing the A-skew and C-skew. The clade including *M. tenuis* and all the other Odonata species received absolute support (100%). The phylogenetic position of Anisozygoptera is sister to Anisoptera. *Mnais* is phylogenetically close to *Psolodesmus*. Mitogenomic data from this study will provide useful information for further studies for the population genetics, speciation and conservation of *M. tenuis* in the future." (Authors)] Address: Chia-Hsuan Sung, Division of Forest Protection, Taiwan Forestry Research Institute, Taipei, Taiwan. E-mail: chsung@mail.tfrin.gov.tw

17736. Wang, Y.; Du, Y.; Song, X.; Huang, A. (2021): Characterization and phylogenetic analysis of the complete mitochondrial genome of *Pseudothemis zonata* (Odonata:

Anisoptera: Libellulidae). *Mitochondrial DNA Part B*, 6:1: 24-25. (in English) ["*P. zonata* is a commonly seen dragonfly with a big yellow or white ringlike spot on the third and fourth segments of its abdomen. In this study, we sequenced and analyzed the complete mitochondrial genome (mitogenome) of *P. zonata*. This mitogenome was 15,434 bp long and encoded 13 protein-coding genes (PCGs), 22 transfer RNA genes (tRNAs), and 2 ribosomal RNA unit genes (rRNAs). Gene order was conserved and identical to most other previously sequenced Libellulidae dragonflies. The whole mitogenome exhibited heavy AT nucleotide bias (74.6%). Most PCGs of *P. zonata* have the conventional start codons ATN (six ATG, three ATT, and two ATC), with the exception of *cox1* and *nad1* (TTG). Except for four genes (*cox1*, *cox2*, *cox3*, and *nad5*) end with the incomplete stop codon T, all other PCGs terminated with the stop codon TAA or TAG. Phylogenetic analysis showed that *P. zonata* got together with *Brachythemis contaminata* with high support value, and the relationships ((*Brachythemis* + *Psolodesmus*) + ((*Hydrobasileus* + *Trigomphus*) + (*Orthetrum* + *Acisoma*))) were supported in Libellulidae.] Address: Wang, Y., School of Life Sciences, Gannan Normal University, Ganzhou, PR China; bNational Navel Orange Engineering and Technology Research Center, Ganzhou, PR China

17737. Wang, Y.; Du, Y.; Song, X.; Huang, A. (2021): Complete mitochondrial genome sequence of *Anax parthenope* (Odonata: Anisoptera: Aeshnidae) and phylogenetic analysis. *Mitochondrial DNA Part B*, 6:1: 122-123. (in English) ["*A. parthenope* is a big dragonfly which can be seen patrolling around ponds, lakes and other still water. In this study, we sequenced and analyzed the complete mitochondrial genome (mitogenome) of *A. parthenope*. This mitogenome was 15,366 bp long and encoded 13 protein-coding genes (PCGs), 22 transfer RNA genes (tRNAs) and two ribosomal RNA unit genes (rRNAs). The nucleotide composition of the mitogenome was biased toward A and T, with 74.8% of A + T content (A 40.1%, T 34.7%, C 14.0%, G 11.2%). Gene order was conserved and identical to most other previously sequenced Aeshnidae dragonflies. Most PCGs of *A. parthenope* have the conventional start codons ATN (six ATG, three ATT, and two ATC), with the exception of *cox1* and *nad1* (TTG). Except for three genes (*cox1*, *cox2*, and *nad5*) end with the incomplete stop codon T, all other PCGs terminated with the stop codon TAA. Phylogenetic analysis showed that *A. parthenope* is sister to *Anax imperator* with high support value. All 15 Anisoptera species constituted a major clade with well support, and Aeshnidae had a close relationship with Gomphidae and Libellulidae." (Authors)] Address: Wang, Y., School of Life Sciences, Gannan Normal Univ., Ganzhou, China

17738. Wang, Z.; Li, B.; Luo, Q.-q.; Zhao, W. (2021): Effect of wall roughness by the bionic structure of dragonfly wing on microfluid flow and heat transfer characteristics. *International Journal of Heat and Mass Transfer* 173 July 2021, 121201: (in English) ["Highlights: • A novel of bionic rectangular microchannel (BRM) with a hydraulic diameter of 1000 μ m was designed based on the bionic wall roughness (BWR)

of dragonfly wings structure. Using k-w (SST) model on the calculation of turbulence in the microchannel are effectiveness and reliability. The existence of BWR can effectively increase the temperature and velocity fluctuation range of the fluid, and enhance the fluid disturbance and velocity, and generate a large number of regular vortex flow in a wide scope. The effects of the bionic rectangular microchannel (BRM) on flow and heat transfer is significantly better than that of the smooth rectangular microchannel (SRM), and an enhancement of 218% in heat transfer was achieved compared to a SRM, and the thermal enhancement factor is 1.34. Transition occurs when the re number range of flow in BRM is 933–1166. Abstract: In order to strengthen flow and heat transfer performance of the smooth rectangular microchannel (SRM), a novel of bionic rectangular microchannel (BRM) with a hydraulic diameter of 1000 μm was designed based on the bionic wall roughness(BWR) of dragonfly wings structure. The effect of BWR and different microchannel lengths, and BWR with different tiny structures on flow and heat transfer was investigated, and the optimal of BWR's parameter, arrangement, combination and Re number range were studied. The results indicated that the influence of BWR on the flow and heat transfer performance is significantly better than that of SRM. When the Re is 5830, the heat transfer performance of the BRM model is 2.08 times that of SRM, and the heat enhancement factor is 1.233. Moreover, the optimal BRM's maximum velocity of the fluid is 19.6 m/s, which is 3.1 times of that of SRM, and the maximum temperature is 14.3 K lower than that of SRM, and an enhancement of 218% in heat transfer was achieved compared to a SRM, and the thermal enhancement factor is 1.34. Compared with BWR effect, the influence of the entry effect on heat transfer can be ignored, and the existence of BWR increases the number and scope of fluid disturbance and brings a large number and a wide range of high speed vortex flow appears in BRM, and they are regularly distributed after each group of BWR and the central of the microchannel, which further increases the flow velocity and disturbance, and reduces the range of low-speed and high-temperature region near the wall, and finally enhances flow and heat transfer performance." (Authors)] Address: Wang, Z., School of Energy and Power Engineering, University of Shanghai for Science and Technology, Shanghai 200093, PR China

17739. Wendel, E. (2021): Effects of pH and conductivity on the condition and abundance of dragonfly larvae. BSc. thesis, Halmstad University, School of Business, Innovation and Sustainability: 17 pp. (in English) ["Acidification in lentic ecosystems can generate significant negative impacts for freshwater organisms. Prior research has shown that most dragonfly (Odonata) species are more tolerant against low pH than other aquatic invertebrates; however, detailed knowledge regarding autecology and physiological burdens of pH and conductivity is still scarce. In this thesis, the effects of two environmental factors on the condition (mass per unit head width) and abundance of dragonfly were researched in a series of 18 lakes in SW Sweden. Regressionary analy-

sis revealed that the larva condition of *Libellula quadrimaculata* is significantly dependent upon pH and presumably also conductivity, while no such relationship was indicated for *Cordulia aenea*. The inferior condition of *L. quadrimaculata* in acidic lakes is presumably an evolutionary adaption, whereas part of its tolerance mechanism utilises more fats and carbohydrates than protein. The data also supports the proposal that the abundance of *L. quadrimaculata* increases at lower pH, although further examination is required to conclude the suspected trend." (Author)] Address: not stated

17740. Westra, T.; De Knijf, G.; Ledegen, H.; Van De Poel, S.; Piesschaert, F.; Onkelinx, T. (2021): Resultaten van de Vlaamse libellenmeetnetten voor de periode 2016 - 2020. Rapporten van het Instituut voor Natuur- en Bosonderzoek 2021(12). Instituut voor Natuur- en Bosonderzoek, Brussel. DOI: doi.org/10.21436/inbor.34106517: 53 pp. (in Dutch, with English summary) ["The species monitoring programme meetnetten.be aims at collecting reliable information on priority species in Flanders. It consists of a series of monitoring schemes which were designed by the Research Institute for Nature and Forest (INBO). Species are counted by volunteers in a standardized way under the coordination of the NGO Natuurpunt. This report shows the first results of the dragonfly monitoring schemes for the period 2016 -] 2020. *Coenagrion lunulatum* and *Sympetrum depressiusculum* show a decrease in abundance and *Leucorrhinia pectoralis* shows a strong decrease in abundance. On the other hand, *Gomphus flavipes* shows a strong increase in abundance between 2016 and 2020. For other priority dragonfly species we are not able to detect a trend yet. The continuation of this monitoring project will enable us to detect future patterns. This is the case for following species: *Calopteryx virgo*, *Coenagrion hastulatum*, *C. pulchellum*, *Aeshna isocetes*, *Gomphus vulgatissimus* and *Leucorrhinia caudalis*." (Authors)] Address: Knijf, G. de, Instituut voor Natuurbehoud, Kliniekstraat 25, B-1070 Brussel, Belgium

17741. Xu, Q.-h. (2021): Description of the final stadium larva of *Calicnemia sinensis* Lieftinck, with discussion of the larval characters of genus *Calicnemia* Strand Odonata: Zygoptera: Platycnemididae. International Journal of Odonatology 24: 64-70. (in English) ["The final stadium larva of *Calicnemia sinensis* Lieftinck is described and illustrated in detail. It is characterized by (1) palpal lobe of prementum with two end hooks of unequal size, the inner longer and sharper, and the outer shorter and stouter; (2) inner side of palpal lobe with five long setae above and two or three short ones below; (3) wing sheaths parallel to each other, reaching beyond the distal margin of abdominal segment 6; and (4) caudal gills strongly ridged, median gill large and broad, more than 2 times of lateral gill in width." (Author)] Address: Xu, Q.-h., Dept of Garden & Horticulture, Zhangzhou City University, Zhangzhou, Fujian 363000, PR China. E-mail: qihanxu@aliyun.com