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The volume under review has reached our hands at a time when the whole world is severely affected by COVID-19 pandemic. As biologists all over the world are trying to understand its severity and look for solutions, concerns have been raised about the possibility of such pandemics occurring in future due to change in climate, land use patterns and habitat destruction. In fact, many scientists have pointed out that environmental degradation, including deforestation, land use change and agricultural intensification, may make pandemics more likely and less manageable. These factors have their impact on insects as well. There is a decline in insect population; at the same time some medically important vectors of human and animal pathogens are extending their geographic ranges. Some others have relocated to favourable environmental conditions. This volume addresses some issues connected with these.

A total of 23 reviews are included, covering various aspects of insects such as biocontrol, pesticide resistance, vector biology, role of symbionts, fate of pollinators, insect range extension, invasion biology and new genomic strategies for insect control and identification.

The autobiographical sketch by Lynn M. Riddiford throws light on her journey in deciphering the roles of juvenile hormones (JH) in moulting and metamorphosis. Her experiments with *Manduca sexta* and *Drosophila melanogaster* have given insight into the molecular aspects of JH. Young researchers will certainly get inspired by her dedicated work. She points out how excellent mentors can shape young researchers early on.

The article 'Invasion biology, ecology and management of western flower thrips' elaborates on their invasiveness and pest status. Insecticidal applications have been unsuccessful in controlling them due to development of resistance. Integrated management approaches along with new control technologies such as gene-editing and RNAi are recommended for their control. The authors high-

light some aspects of genetics, biology and ecology that facilitate its use as a model study organism. 'Influence of nesting characteristics on health of wild bee communities' emphasizes the importance of nest site availability and quality for maintaining robust populations of wild bees which are affected by habitat disturbance and climate change. The effects of common threats to bees through nesting may strongly influence their survival and persistence. The author recommends more research into nesting biology to promote conservation efforts.

'Sexual size dimorphism in spiders' assesses its occurrence in extreme form in some female spiders. The authors suggest that extreme sexual size dimorphism is female biased and in some may represent an evolutionary dead end. The article 'Balancing disturbance and conservation in agroecosystems to improve biological control' deals with a range of disturbances that influence pest control by natural enemies and how conservation practices can mitigate disturbance and increase the potential for biological control. Disturbances associated with agricultural intensification reduce our ability to achieve sustainable crop production. The disturbances stem from crop management techniques. Cover crops, soil health, and organic farming practices will offer benefits.

'Ecology of terrestrial arthropods in fresh water wetlands' discusses about how these organisms, with their rich diversity influence ecology. Wetlands present a range of habitat, with unique fauna being associated with soils and ground litter, living plant substrates, and peat lands. Most terrestrial arthropods possess fairly rudimentary adaptations for life in wetlands. Many of them act as bioindicators of wetland ecological conditions. The article 'Insect circulatory system: structure, function, and mutualism' presents the details of circulatory organs and how they support mechanisms for defense against predators and microbial invaders by means of reflex bleeding and functional integration with the immune system. This system also plays critical roles in thermoregulation and tracheal ventilation in higher-performance fliers. The authors suggest how novel discoveries could be harnessed for the control of vector-borne diseases and for translational medicine.

'Versatile and dynamic symbioses between insects and *Burkholderia* bacteria'

highlights how this provides nutritional benefits and resistance against insecticides. The interaction is characterized by environmental symbiont acquisition or mixed-mode transmission. It is a valuable model system to derive insights into general principles governing symbiotic interactions. The article 'Microbial symbionts of parasitoids' elaborates on how they are involved in parasitoid reproduction, suppression of host immune responses and manipulation of the behaviour of herbivorous hosts. Parasitoid symbionts may also influence plant-mediated interactions at different trophic levels.

'The global expansion of dengue: how *Aedes aegypti* mosquitoes enabled the first pandemic Arbovirus' highlights the successful invasive nature of the mosquito due to key changes in its ecology. The authors argue that characterizing geographic heterogeneity in mosquito bionomics has to be a key priority to design control strategies in order to reverse global spread. The article 'Global trends in bumble bee health' summarizes the potential causes such as habitat loss, pathogen transmission, invasion of nonnative species and pesticides for population decline. As decline in bee population is a great concern today, this article underscores the importance of expanding experimental research.

The article 'Botanical insecticides in the Twenty-First century – Fulfilling their promise?' argues that even though academic interest has been growing, commercialization is lagging behind. Botanicals are likely to remain niche products in many developing countries in tropical regions where source plants are readily available. 'Insect sterol nutrition: Physiological mechanisms, ecology, and applications' suggests that there is potential to exploit insect sterol requirements to control insect pests and understand sterol biology. The authors suggest to study the genetic mechanism of sterol metabolism.

'Insect-resistant genetically engineered crops in China: Development, application and prospects for use' suggests that economic, social and human health effects are largely positive. It calls for further financial investment in innovative and greater scientific engagement with the public due to misperception. 'Mechanisms, applications and challenges of insect RNA interference' suggests that RNAi is highly efficient in Coleopterans but highly variable in other insects. Lack

of dsRNA delivery methods, off-target and non-target effects and potential development of resistance in most populations are major challenges.

'Chikungunya virus; Role of vectors in emergence from enzootic cycles' highlights the involvement of non-human primates and humans in amplification and transmission and extensive spread. Mutations in chikungunya virus make them more efficient for infection. The article 'Resistance to the fumigant phosphine and its management in insect pests of stored products: a global perspective' elaborates on how many insects have developed resistance to phosphine. Suitable alternatives are not available as yet. The authors suggest development and field evaluation of alternative fumigants to manage phosphine-resistant pest species.

'Ecology of *Francisella tularensis*' assesses the human risk associated with the bites of flies, mosquitoes, or ticks. The risk may be fomite related, and large outbreaks can occur due to inhalation or ingestion of contaminated materials. The authors suggest that the very concept that *F. tularensis* is an obligate vector-borne infection has to be proved. 'Dormancy, diapause and the role of the circadian

system in insect photoperiodism' highlights the involvement of circadian clock genes in photoperiodism. 'Non-bee impacts as visitors and pollinators of crops: biology, ecology and management' deals with the available literature between 1950 and 2018 regarding the pollinators or visitors of 105 global food crops. Nearly 77% of crops are visited by both bee and non-bee taxa. Non-bee taxa visit a wide range of crops.

'Pesticide-induced planthopper population resurgence in rice cropping systems' speaks about chronic resurgence which poses new threats to global rice production. The authors identify two forms of resurgence, acute and chronic. The findings on the physiological and molecular mechanisms of chronic planthopper resurgence are highlighted. 'Ecology and evolution of insect-fungus mutualisms' talks about transition from facultative to obligate mutualism. Obligate dependency leads to morphological adaptations in insects and fungi, evolution of social behaviour in some insects and loss of sexuality in some fungal mutualists. The article 'Insect declines in the Anthropocene' highlights species loss and population decline globally because

of which ecosystem services get affected. Habitat destruction, agricultural intensification including pesticide use, climate change, and invasive species are some evident causes. Apart from this, atmospheric nitrification and effects of droughts also make some impact on insect decline.

True to expectations, this volume satisfies the longings of entomologists and others interested in insects by carrying articles which are pertinent to today's problems. All the articles include figures, colour plates and tables which add to the depth of presentation. Many articles present some ideas for future research. The authors and editors deserve our appreciation for their meticulous work. No doubt this volume will serve the needs of researchers and insect enthusiasts in eliciting interest and promoting further research in some of the areas covered by the articles.

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