

# The Pollinator Information Network Newsletter

Editorial

June 30, 2018. Vol. 2, Issue 2

## Welcome to the second issue of volume 2 of the Pollinator Information Network Newsletter!

The *Pollinator Information Network Newsletter* is one of the projected outputs of an ongoing project of the JRS Biodiversity Foundation, *i.e.* “The Pollinator Information Network for Two-Winged Insects” or simply PINDIP. The PINDIP project has its own website: <https://www.pindip.org/>.

In this issue, we will be looking ahead to the 9<sup>th</sup> International Congress of Dipterology (pages 3-4), which will take place in Namibia in 2018. Registration for the congress is still open! The first two volumes of the *Manual of Afrotropical Diptera* will be officially launched during ICD9 (see page 17). Moreover, there will be two symposia which relate directly to pollinating Diptera. One of these is the symposium “The importance of Diptera in plant-pollinator networks” for which we have Dr. Bruce Anderson (Stellenbosch University) as keynote speaker and with another 12 confirmed speakers (pages 4-5)!

We highlight the projects of three Afrotropical researchers, *viz.* Joseph Mulwa from Kenya (pages 7-8), Nadia Toukem from Cameroon (pages 9-10) and Longin Ndayikeza from Burundi (pages 11-14).

As usual, the issue ends with a list of new, although incomplete, published research related to pollination biology in its broadest sense. We invite everyone concerned to submit relevant information for the *Newsletter*, including summaries of their own research and projects on pollination biology – or publications that they want to see highlighted, relevant literature, upcoming conferences and symposia, possibilities for cooperation and grant applications related to plant-pollinator networks, *etc.*, before the 15<sup>th</sup> of September.

Enjoy reading!

Kurt Jordaens on behalf of the PINDIP team

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Registration: <http://icd9.co.za/registration/>

Registration / Abstract submission deadline: 1 September 2018

Registration and submission of abstract are electronic and all payments for registration fees must be made at the time of registration.



### Scientific programme:

The overall theme of the Congress will be “Afrotropical Dipterology” and specific symposia are planned that have special relevance to African delegates, but the scientific programme will include other general thematic and taxon-based symposia and poster sessions, and all major aspects of dipterology, including systematics, morphology, physiology, evolution, biodiversity and conservation, ecology, agriculture and forensics will be covered.

### Plenary speakers:

The five plenary speakers have now been finalized (see below) and the names, biographies and plenary titles of speakers are available on the official website <http://icd9.co.za/plenaries/>

Michelle Trautwein - Plenary title: Resolving the Fly Tree of Life.

Brian V. Brown - Plenary title: Phorid fly diversity – frontiers in species richness, structure and behavior.

Netta Dorchin - Plenary title: Unmitigated galls – specialisation leads to diversification in the Cecidomyiidae.

Rudolf Meiswinkel - Plenary title: Culicoides as vectors for viruses causing disease in livestock.

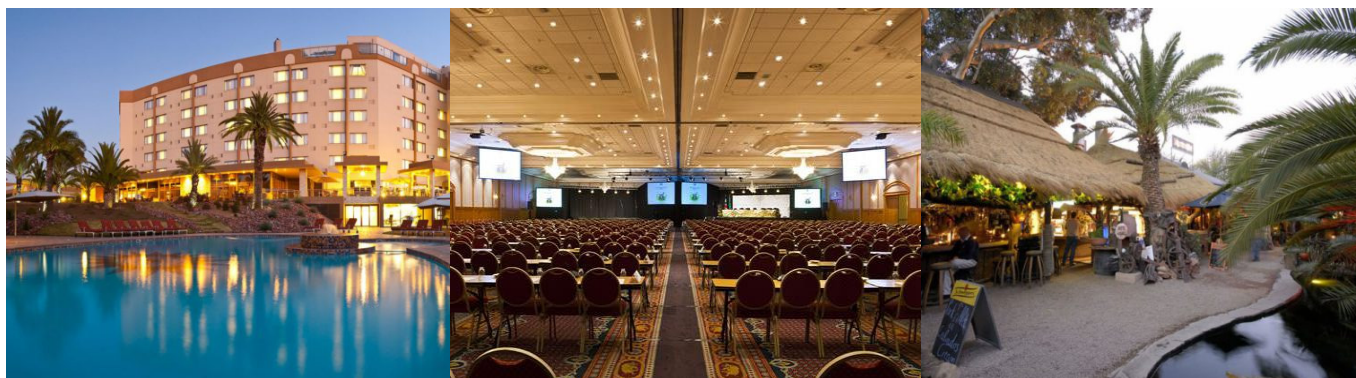
Martin Hall - Plenary title: The research-casework continuum in forensic dipterology.

### Symposia sessions:

Twenty-five symposia titles have been posted on the official website <http://icd9.co.za/symposia-titles/>. Note that two symposia relate specifically to Diptera pollinators! More specifically, there is the “Importance of Diptera in Plant-Pollinator Networks” symposium organized by Kurt Jordaens ([kurt.jordaens@africamuseum.be](mailto:kurt.jordaens@africamuseum.be)) (see pages 4-5) and the “Systematics and taxonomy of lower Cyclorrhapha” symposium organized by Andrew D. Young ([adyoung@gmail.com](mailto:adyoung@gmail.com)).

**The venue:**

The Congress venue will be the Safari Hotels and Conference Centre in central Windhoek. The Hotels offers modern, world class conference facilities, including a large reception area, suitable for functions, space for the erection of poster boards and three adjoining Congress rooms, the largest of which seats over 400 delegates and is suitable for plenary sessions. The Conference Centre has two restaurants, a bar and several smaller sites for beverages. Top-range accommodation and low-end affordable accommodation for students is available at a short distance from the Congress venue.

**Contact:**

All general e-mail enquiries should be directed to: [icd9\[at\]nasmus.co.za](mailto:icd9[at]nasmus.co.za).

**Registration:**

Registration must be done using the online registration system, which is available at: <http://icd9.co.za/registration/>. You will be given two options on the registration landing page: paying via credit card, or submitting a registration form and paying via EFT. Payment must be made at the time of Registration.

**Abstract submission:**

Only delegates who have registered and paid in advance are allowed to submit abstracts. Any submitted abstracts by unregistered delegates will be deleted from the system without prior notice. Important: Please refer to the formatting guidelines for abstracts at the congress website and ensure your abstract is properly formatted before submission. Abstract submissions must be done using the online registration system, which is available at: <http://icd9.co.za/abstractsubmissions/>.

More information on two of the symposiums can be found on the next pages of this issue.

## The importance of Diptera in plant-pollinator networks

Symposium at the 9<sup>th</sup> International Congress of Dipterology 2018



At ICD9 (see page 3 of this *Newsletter*) Kurt Jordaens (Royal Museum for Central Africa) will organize a symposium on the importance of Diptera in plant-pollinator networks. Prof. Dr. Bruce Anderson (Stellenbosch University) is invited speaker at the symposium and he will present a talk entitled: "Nectar foraging flies as agents of plant speciation".

(picture: female of the hover fly *Eristalinus* (*Eristalodes*) *quinquelineatus* on *Tridax diversifolia* ; photo taken by Subramanian Sevgan in Kenya)

In addition, we have the following confirmed speakers at the symposium, but the symposium is still open to other contributions!

Michelson Azo'o Ela (University of Maroua, Cameroon): Foraging behavior of *Calliphora* sp. (Robineau-Desvoidy) (Diptera: Calliphoridae: Calliphorinae) on *Ricinus communis* (Linnaeus) (Euphorbiaceae) flowers.

James Egonyu (University of Makerere, Uganda): Insects visiting flowers of oil palm *Elaeis guineensis* Jacquin (Arecales: Arecaceae) in Uganda.

Sidonie Fameni (University of Maroua, Cameroon): Diversity of Diptera families of wild and crop plants in Cameroon (Central Africa).

Genevieve Theron (Stellenbosch University, South Africa): Diversity underestimated? Identifying lineages in the hypervariable keystone pollinator species *Prosoeca peringuyei* from the Succulent Karoo biodiversity hotspot.

Joseph Mulwa (National Museums of Kenya, Kenya): Flies (Diptera) are essential pollinators of Avocado (*Persea americana*) in Murang'a County, Kenya.

Longin Ndayikeza (Burundian Office of Environmental Protection, Burundi): Improving knowledge on the importance of pollinating insects in natural and farming areas of Burundi: the family Bombyliidae.

Eugène Sinzinkayo (Burundian Office of Environmental Protection, Burundi): Study of the impact of natural ecosystems degradation on the abundance and diversity of pollinating Syrphidae in Burundi.

Nadia Toukem (International Institute of Tropical Agriculture, Cameroon): Insect diversity of cocoa *Theobroma cacao* (L.): role of Diptera in the pollination.

Harald Krenn (University of Vienna, Austria): Flowers fuel flies – supply of nectar for long-proboscid flies (*Prosoeca* sp.: Nemestrinidae).

Axel Ssymank (Zoologisches Forschungsmuseum Alexander Koenig, Germany): Insect decline in Germany & Europe – a major loss in pollination with case-studies on Syrphidae (hoverflies).

Kurt Jordaens (Royal Museum for Central Africa, Belgium): A conspectus of research on the role of Diptera in plant-pollination in the Afrotropical Region.

Funding was secured from the JRS Biodiversity Foundation and the Directorate General for development Cooperation (DGD) Belgium to the Royal Museum for Central Africa (RMCA).

As the deadline for abstract submission approaches, I look forward to more submissions.

I hope to see you at the symposium!

Kurt

Kurt Jordaens (kurt.jordaens[at]africamuseum.be)

Financially supported by:



# Biodiversity informatics of Diptera

Symposium at the 9<sup>th</sup> International Congress of Dipterology 2018

update from the symposium organizers:

Dr JM Midgley & Mr BS Muller

Biodiversity informatics is an ever changing and growing field that highlights the importance of data associated with specimens generated from research, museums, field work and other collections; and their application in answering various questions and problems.

So far, registration for the symposium has been slow, with many delegates opting to present in symposia related to their research fields. Despite this, we have confirmed the required minimum number of speakers and the symposium will be going ahead. We have two pollination related talks from PINDIP partner institutions, being presented by Tricia Pillay (KwaZulu-Natal Museum) and Kudzai Mafuwe (Natural History Museum of Zimbabwe), as well as talks from Burgert Muller (National Museum, Bloemfontein) in Biodiversity Informatics in Ecology and Conservation, John Midgley (KwaZulu-Natal Museum) on Biodiversity Informatics and Collections Databases and Torsten Dikow (Smithsonian National Museum of Natural History) on Biodiversity Informatics in Taxonomy.

Funding was also secured from the JRS Biodiversity Foundation for delegate support, and recipients of grants will be announced soon.

As the deadline for abstract submission approaches, we look forward to more submissions, especially from Pollination Biologists.

We hope to welcome you at the symposium!

John & Burgert

John M. Midgley (jmidgley[at]nmsa.org.za)  
Burgert S. Muller (burgert.muller[at]nasmus.co.za)

Financially supported by:

**JRS** Biodiversity  
Foundation

## SPOTLIGHT



## project: **Pollinators and pollination syndrome of avocados in Kenya**



Joseph Mulwa is a researcher at Kenya Agricultural and Livestock Research Organization based at Kabete. He has worked on Pest management, pollination, and industrial insects.

Insects are essential pollinators of agricultural crops. Fruit and seed set in most flowering plants is a product of fertilization which occurs after a successful completion of pollination process. Thus pollination directly impacts on food for human, livestock as well as wild animals. In Kenya, pollination studies are gaining interest from agricultural perspective, with indication that pollination deficit exists and probably contributes to the declining crop yields recorded even when the common inputs of production are optimally provided. Commercial avocado farming in Australia and other developed countries is supported by honey bee rentals to supply pollination. However, in Kenya, the complexity of the farming system has not allowed for including pollination management in the past, probably due to lack of understanding their role.

### **Key objectives:**

- 1) To determine diversity and abundance of avocado flower visitors in Kandara, Murang'a, Kenya
- 2) To determine the diurnal visitation rates of the individual flower visitors in Kandara
- 3) To determine the avocado floral calendar in Kandara
- 4) To determine the pollination deficit of avocado in Kandara



The study was carried out for three years (2015-2017) covering three fruiting seasons. Insects in four orders were observed visiting avocado flowers. Hymenoptera (honeybees, wasps and ants) were the most abundant. Second in abundance were Diptera (blow flies and hoverflies). Others included lepidoptera and coleoptera, but at very low abundances. Among the four major individuals observed on avocado flowers, honeybees were the most abundant followed by blow flies. Hoverflies and wasps were third and fourth, respectively.

With and without pollination provision studies reviewed huge flower abortion of about 96%, showing that the current productivity of avocado is only based on 4% of the flowers. At the end of the season, a pollination deficit of 64.5% was documented showing that we lose all this when pollination is not provided. There is possibility that current pollination provision is not sufficient and possible supplementation with managed honey bees could enhance productivity of avocado. Further, farming practices that can enhance conservation and increasing farm presence of pollinators are required. For example, farmers could set aside

non-crop habitats within their farms for pollinators nesting. It is important to retain as many naturally occurring nesting sites as possible and to create new ones where appropriate. Pesticides application should be minimized through target applications while avoiding the crops' blooming to preserve pollinators.



**Acknowledgements:**

This project was financially supported by the Horticulture Research Fund (PI: Dr. Muo Kasina).

**Contact:**

Joseph Mulwa; [josemulwa0009@gmail.com](mailto:josemulwa0009@gmail.com). (Kenya Agricultural and Livestock Research Organization (KALRO) - Kabete). P.O. Box 14733-00800, Nairobi. Kenya

**Supervisors:**

- Dr. Ruth Kahuthia, Gathu, Kenyatta University, Kenya
- Dr. Muo Kasina, Kenya Agricultural and Livestock Research Organization (KALRO), Kenya.



## SPOTLIGHT



## Project: Population dynamics of pollinators in cocoa agroforestry systems and assessment of pesticide risks



Nadia Toukem has graduated with an MSc degree in Zoology at the University of Yaoundé 1 (Cameroon) and she has started a PhD program in the same University. She is now a consultant at the International Institute of Tropical Agriculture (IITA), Cameroon. Her research is focused on the assessment of population dynamics of pollinators in cocoa agroforestry systems and pesticides risks. This study is a contribution to the development of action plan for a sustainable increase of cocoa production by promoting pollinator-friendly practices. Cocoa is a pollinator-dependent crop which depends on midges (Diptera: Ceratopogonidae) to ensure fruit set. Previous studies have reported a low pollination rate (5-10%) and the hand pollination as a successful method to increase the yield to 40%. Moreover, supplying cocoa farms with adequate breeding sites such as decaying organic matter or the maintaining of natural patches nearby the farm have

positive impacts on cocoa pollinators. However, these evidence stems from relatively few studies done in Latin America, Indonesia and recently in Ghana and their application in other cocoa growing countries such as in Cameroon is unclear. Therefore, we have implemented this study with objectives to assess the population dynamics of midge pollinators and elucidate potential driving factors (plant phenology, weather conditions, landscapes, cropping systems), to assess pesticides and fungal- based biopesticides risks.



### Relevance:

This study will solve a gap in the knowledge of cocoa pollination in Cameroon and bring sustainable solutions to promote midges in the field and boost cocoa yield.

**Contact:**

Nadia Karelle TOUKEM, Danielle.toukem1@gmail.com; IITA, 2008 1st main road IRAD, Nkolbisson, Yaoundé, Cameroon; University of Yaoundé 1, department of Animal Biology and Physiology

**Supervisors:**

- Rachid HANNA, IITA, Cameroon
- Sévilor KEKEUNOU, University of Yaoundé , Cameroon

**Support:**

This study was initially conducted within the ProCISA project funded by GIZ. The laboratory of entomology of IITA provides other facilities.

## SPOTLIGHT



## Project: The influence of urbanization on the diversity of wild bees and their interactions with the flora in Burundi



Longin Ndayikeza is a researcher at the Burundi Office for the Protection of the Environment (OBPE: Office Burundais pour la Protection de l'Environnement) and member of the Biodiversity Research Laboratory. Longin holds a master's degree in Environmental Sciences.

Longin has been carrying out research on invertebrates, especially on the pollinating insects of the natural and agricultural ecosystems of Burundi in the framework of several projects

initiated by the OBPE and the Royal Belgian Institute of Natural Sciences (RBINS) since 2010. I have had several training opportunities in Taxonomy and Systematics, particularly at the Royal Belgian Institute of Natural Sciences (RBINS, Brussels, Belgium) and the International Center for Insect Physiology and Ecology (ICIPE, Nairobi, Kenya). At the end of each training, I brought samples of pollinating insects collected in the National Parks of Kibira, Ruvubu and Rusizi. This resulted in a large collection of more than 20,000 specimens of insect pollinators, mainly Hymenoptera and Diptera. This collection consists of 15 Diptera families, some of which are pinned (700 specimens dominated by Syrphidae) and ethanol preserved specimens (around 1200 specimens). The Diptera families comprise Syrphidae, Muscidae, Calliphoridae, Sarcophagidae, Tachnidae, Micropezidae, Rhizophoridae, Lonchaeidae, Asilidae, Dolichopodidae, Stratiomyiidae, Bombyliidae, Diopsidae, Tabanidae, Conopidae and Tephritidae. Hymenoptera families comprise Apidae, halictidae, Megachilidae, Colletidae and Andrenidae (for bees families), Scoliidae, Sphecidae, Vespidae, Formicidae, Tenthredinidae, Ichneumonidae, Braconidae, Pompilidae, Tiphiidae, Mutilidae, Evanidae and Chrysididae.

Now I am preparing for the thesis project for the Title: "The study of the influence of urbanization on the diversity of wild bees and their interactions with the flora in Burundi".

The deterioration of ecosystems affects the relation plant-pollinators, which is itself an important element of biodiversity and the resilience of ecosystems. Thus, research on the effect of human action on the network of plant-pollinator interactions is essential, especially in prospected areas such as Central Africa and the Great Lake Regions. and are victims of a growing urbanization associated with the destruction of natural and semi-natural habitats. In Burundi, the population has doubled since 2000: it is estimated that the population is now approaching 12 million inhabitants. This real



demographic boom is obviously not without having a significant impact on the environment: natural forest ecosystems have thus been reduced to about 199 063 ha, or 7.15% of the total area of the country in a few years (Nzigidahera and Fofu, 2010). The reduction of these ecosystems occurred for the benefit of immense agro-ecosystems and urbanized areas which have gone increasing (Nzigidahera & Fofu, 2010 and Ndirariha, 2009). Moreover, the use of pesticides is widely practiced in the Imbo plain for tomatoes and eggplants and in high altitudes for coffee trees. This causes pollution of Burundi's ecosystems.

This destruction and pollution of ecosystems raise several questions. According to contemporary data (SNEB, 1997), Burundi biodiversity would comprise 3000 species of plants, including 56 amphibians, 716 birds and 163 mammals among which there are many endemic species. As far as pollinators, bees in particular are concerned, an inventory of those pollinators has not been drawn despite their ecological and economic importance. It is therefore questionable whether the modification and pollution of natural ecosystems is not accompanied by the regression of species of wild pollinating bees, especially in favor of the expansion of generalist species. What could be the role of artificial vegetation introduced in agro-ecosystems and in urban areas keeping pollinators? Which species of wild bees participate in agricultural production?

There is also a question to know whether the distribution of ecosystems along the altitudinal gradient affect the characteristic of species of pollinators at each altitude level. Moreover, starting from the already established scenarios that there will be climate change depending on altitudes, a decline in species at each altitudinal stage should be considered. The present study thus attempts to find solutions to all these questions.



### **Key objectives:**

*Establishment of the specific composition of pollinating bees in the ecosystems at different levels of disruption.*

This will involve identifying pollinating bee species and their host plants in natural ecosystems and anthropized areas including the agricultural, urban and semi-urban areas of Burundi. Moreover, on the basis of the data obtained, we will establish a link between the urbanization gradient and the diversity and abundance of pollinating bees. We will also establish the specific composition and phylogenetic diversity (estimated from the taxonomic hierarchical classification) of the pollinating bees during and after the spraying period of phytosanitary products in the fields. It will also be necessary to identify indicator species or subspecies at different altitudes and habitat types. All these analyzes will be carried out using bioinformatics tools and R software in close collaboration with Prof. Nicolas Vereecken at the Free University of Brussels (ULB, Belgium).

*Improvement of the knowledge of bees by describing new species.*

In this rarely studied fauna of Central Africa, several species remain unknown for science. It will therefore be necessary to describe the new species in order to enhance the understanding of the diversity of wild bees in Burundi. This will also improve the interpretation of our results on the basis of well-known species. This study will enhance a reference collection of pollinating bee species in order that future studies on pollinators and monitoring their health can be carried out. The work of identifying and describing known and new taxa will be conducted in close collaboration with Alain Pauly (Royal Belgian Institute of Natural Sciences, RBINS, Brussels, Belgium), an internationally known specialist and expert of wild bees in sub-Saharan Africa.

*Improvement of the interrelations which exist between pollinating bees and their surroundings.*

This will involve analyzing existing interrelationships between pollinating bees and their host plants in ecosystems in order to study the influence of urbanization and altitude on the structure of plant-bee interactions networks. We will also establish altitudinal influences on the distribution of bees and the results will be compared at different scenarios / projections of the effect of climate change on the specific composition of pollinating bees. All these aspects will help to establish a strategic plan for the protection of pollinators that will make the study area of Burundi a pilot area for studying wild bees in Central Africa.

*Assessing the economic importance of pollinators in Burundi.*

By means of agricultural production statistics in the study area, market prices and the relation of dependence of insect-induced crops on insects (i.e. the proportion of the crop lost because of the absence of insects), we will draw an initial assessment of the economic importance of pollinators in Burundi. This analysis will be carried out using an FAO tool specifically developed for this purpose (<http://www.fao.org/pollination/resources/pollination-assessment/economic-value/en/>) and will therefore help us to complete, using the economic arguments, the conclusions about "environmental" or "conservatory" of our study.

### **Planned outputs/outcomes:**

- Wild bee species will be classified according to habitats and forested plants or host plants.
- Wild bee species will be classified according to abundance, specific composition, and phylogenetic structure depending on the altitudinal gradient.
- New species of wild bees will be inventoried and identified especially in endemic areas including areas bordering Lake Tanganyika.
- Conservation of wild bees will be integrated into agricultural development and ecological restoration projects due to the



influence of wild bees on economically beneficial plants, such as legumes.

**Contact:**

Longin Ndayikeza, ndayilkeza2009@gmail.com, Burundi Office for the Protection of Environment (OBPE), Jabe quarter, Imprimerie Avenue 12, Bujumbura-Burundi.

**Supervisors:**

- Prof. Nicolas Vereecken, Université Libre de Bruxelles, Belgium
- Prof. Bernadette Habonimana, Université du Burundi, Burundi

**Collaborators:**

- Benoit Nzigidahera, Burundi Office for the Protection of Environment (OBPE)
- Alain Pauly, Royal Belgian Institute of Natural Sciences (RBINS)
- Dr. Marie-Lucie Sussini, Point Focal- GTI, Royal Belgian Institute of Natural Sciences (RBINS)
- Ir. Han De Koeijer, Point Focal, CHM-Belgium, Royal Belgian Institute of Natural Sciences (RBINS)

## GTI-grant: Study of the impact of habitat degradation on the abundance and diversity of Syrphidae (Insecta: Diptera) in Burundi



'Capacities for Biodiversity and Sustainable development' or 'CEBioS' is a programme funded by the Directorate General for development Cooperation (DGD) and housed at the Royal Belgian Institute of Natural Sciences (RBINS). CEBioS carries out capacity building for partner countries of the Belgian Development Cooperation in the field of biodiversity conservation and sustainable development linked to poverty eradication. In the light of this programme, Eugène Sinzinkayo (Burundian Office for the Protection of the Environment, BOPE/OBPE, Burundi (picture: left) has received a short term grants via the Global Taxonomy Initiative (GTI) of the RBINS, with support of the Royal Museum for Central Africa (RMCA, Belgium) to study the Afrotropical Syrphidae in the entomological collections of the RBINS and RMCA (photo: below).

In the framework of the conservation of the biodiversity and the reinforcement of the taxonomic capacity in Burundi, the OBPE has launched a research project entitled "Study of the impact of natural ecosystems degradation on the abundance and diversity of pollinating Syrphidae in Burundi". The overall objective of this project is to compile a checklist of the Syrphidae of Burundi and to increase our taxonomic knowledge of this group in central Africa. Specifically, the aim is to inventory and identify flower visiting Syrphidae species, and the plants visited, in both natural and agricultural ecosystems and to establish a reference collection of the Syrphidae of Burundi. This will result in a detailed description of their distribution, relative abundance and occurrence frequency on flowering plants. In addition, the effects of degradation of natural ecosystems on the diversity and abundance of pollinating Syrphidae will be studied. This project is a continuation of the recent research where 26 species of Syrphidae from 16 genera were identified in Burundi.



So far, more than 5,500 Syrphidae specimens has been collected of which approximately 1,000 will be identified during Eugène's GTI visit to RBINS/RMCA from 15 June – 15 July 2018 (photo of part of the collection: right). The preliminary results of this study will be presented by Eugène at the 9<sup>th</sup> International Congress of Dipterology (Windhoek, Namibia, 25-30 November 2018; see pages 2-4 of this issue).

Promotor of the GTI-grant to Eugène Sinzinkayo is Wouter Dekoninck (RBINS) and co-promotor is Kurt Jordaens (RMCA). This research is financially supported by DGD and the JRS Biodiversity Foundation.





**OUT NOW!**

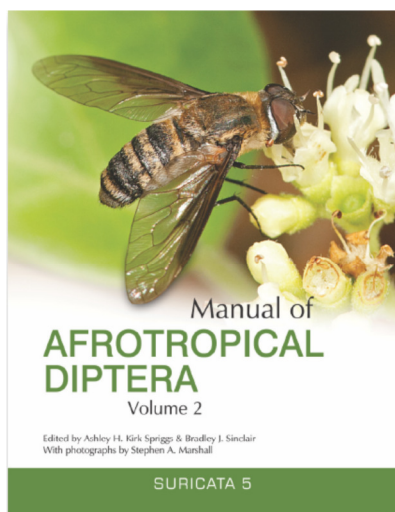
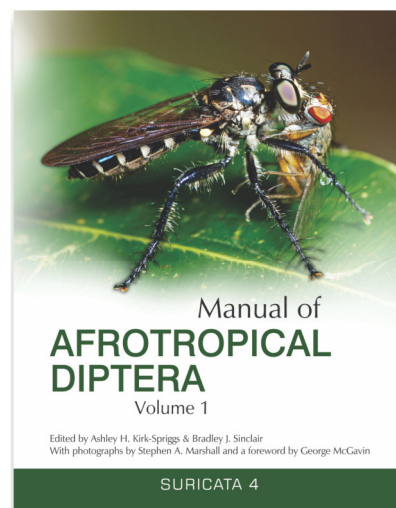
## **Books:** **The *Manual of Afrotropical Diptera:*** **Volumes 1 and 2**

Copies of the books are available for purchase from the SANBI Bookshop  
[bookshop@sanbi.org.za](mailto:bookshop@sanbi.org.za)

This four volume book, a collaboration of over 90 international experts on Diptera, is the first-ever synopsis of the 108 families of flies known from the Afrotropical Region. This work provides the basics for understanding the diversity of a major order of insects in a large tropical and sub-tropical region and is the first such synopsis of its kind for any major insect order occurring in the Afrotropics. The books will be officially launched at a special event during ICD9 in Windhoek, Namibia in November 2018 (see pages 2-3 of this *Newsletter*).

### **VOLUME 1**

Volume 1 is published in full colour and comprises ±420 printed pages. The volume includes 11 general introductory chapters dealing with the history of Afrotropical dipterology, collection and preservation, morphology and terminology, natural history, agricultural and veterinary, medical, forensic and phytosanitary significance, biogeography, conservation and the phylogeny of flies. The volume also includes identification keys to all Afrotropical fly families for both adult and larval stages. The text is richly illustrated with over 1,600 illustrations, including 40 colour maps, 800 colour and 60 black and white images and 690 line drawings of flies.



### **VOLUME 2**

Volume 2 is published in full colour and comprises ±920 printed pages. The volume includes family chapters dealing with 43 of the 108 families of flies that occur in the region and covers the nematocerous Diptera and lower Brachycera (sometimes termed the lower Diptera). Each chapter includes a diagnosis of the family, sections dealing with biology and immature stages, classification and identification, an identification key to genera (if more than one) and a synopsis of the fauna section, arranged genus by genus alphabetically. The text is richly illustrated with over 2,900 illustrations, including 1,360 colour and 130 black and white images and 1,430 line drawings of flies.

Copies of the books are available for purchase from the **SANBI Bookshop**  
[bookshop\[at\]sanbi.org.za](mailto:bookshop[at]sanbi.org.za).

**Literature:**

An EndNote database of >13,600 references related to pollination biology is available from Dr. David Inouye, [inouye@umd.edu](mailto:inouye@umd.edu). It can also be exported in formats for other bibliographic database programs.

**Dr. David W. Inouye**

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In the section below, we will list some, but not all, of the newest publications on pollination, mainly, but not exclusively, related to Diptera. If you want to receive a pdf of any of these papers, send an email to [kurt.jordaens\[at\]africamuseum.be](mailto:kurt.jordaens[at]africamuseum.be).

## JULY

Ouvrard, P.; Transon, J. ; Jacquemart, A.-L. (2018). Flower-strip agri-environment schemes provide diverse and valuable summer flower resources for pollinating insects. *Biodiversity and Conservation*, 27: 2193-2216.

## JUNE

Gardner, E.M.; Gagne, R.J.; Kendra, P.E.; et al. (2018). A flower in fruit's clothing: Pollination of Jackfruit (*Artocarpus heterophyllus*, Moraceae) by a new species of gall midge, *Clinodiplosis ultracrepidata* sp. nov. (Diptera: Cecidomyiidae). *International Journal of Plant Sciences*, 179: 350-367

Kozuharova, E.; Lapeva-Gjonova, A.; Shishiniova, M. (2018). Plant-insect interactions: gentians, seed predators and parasitoid wasps. *Arthropod-Plant Interactions*, 123: 453-463.

## MAY

Knop, E.; Gerpe, C.; Ryser, R.; et al. (2018). Rush hours in flower visitors over a day-night cycle. *Insect Conservation and Diversity*, 113: 267-275.

Hussain, R.I.; Walcher, R.; Brandl, D.; et al. (2018). Influence of abandonment on syrphid assemblages in mountainous meadows. *Journal of Applied Entomology*, 1424: 450-456.

Hoe, Y.C.; Gibernau, M.; Wong, S.Y. (2018). Diversity of pollination ecology in the *Schismatoglottis calyptrata* Complex Clade (Araceae). *Plant Biology*, 3: 563-578

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## APRIL

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