# THE CERATOPOGONIDAE INFORMATION EXCHANGE

The CIE, issued twice a year (no subscription fee), was begun in 1968 as a newsletter to facilitate communication among workers interested in the Ceratopogonidae. The format is extremely flexible. Contributions may be of any length and deal with any subject having some bearing on the study of ceratopogonids. For example, contributors may report their current interests or plans, observations or techniques of probable value to the readership, requests for addresses, study material or reprints, or any other matter of concern. The newsletter serves also as a bulletin for planning and communicating information on meetings, symposia, workshops and so forth. Finally, there is in every issue a compilation of recent literature in the field. Any person(s) wishing to contribute to the newsletter or to receive future issues by email should contact:

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**CIE No. 106 –December 2020 -The Ceratopogonidae Information Exchange Newsletter**

Research Colleagues,

I hope that this issue of the CIE Newsletter finds you in good health during this continued, challenging period of our history. We are saddened by the loss of our colleagues, Shigeo Kitaoka and Craig Turner, who each made significant contributions to our science and whose obituaries and photographs appear in this issue. Also included are Bill Grogan's memories of Michel Kremer. The Recent Literature section contains citations of 158 original research papers, reviews, catalogs, monographs and letters representing diverse areas of research. I have again included figures with images from five of these papers on the last pages of this issue.

Two significant catalog updates in this issue are Art Borkent and Patrycja Dominiak's World Catalog, which includes a list of all valid 6,206 extant and 296 fossil species of Ceratopogonidae, and Maria Clara Alves Santarém and Maria Luiza Felippe-Bauer's Brazilian Species of Biting Midges. My thanks to all who sent material to be included in this issue of our newsletter.

**Summary of Contents:**



If anyone is not listed in the Directory of Workers, please send your contact information (or an update) to me. Lastly, please also send copies of your published papers, research summaries, requests for information, etc. to me for the May, 2021 issue by Friday, April 30th.

With Best Wishes for a Merry Christmas and a Happy New Year,
Steve Murphree, Nashville, Tennessee, U.S.A.

## New CIE Newsletter Subscribers/Address Updates

| New Subscriber: | Address Updates: |
|---|---|
| Dr. Marion England<br>email: marion.england@pirbright.ac.uk<br>tel.: +44(0) 7909 928278<br>Postdoctoral Scientist<br>The Pirbright Institute<br>Ash Road, Pirbright<br>Woking, Surrey GU24 0NF<br>United Kingdom | Gert Venter - email: ventergjgert@gmail.com<br><br>Joel Hutcheson – email: hjoel.hutcheson@gmail.com<br><br>Daniel V. Hagan, Ph.D.<br>email: dhagan@georgiasouthern.edu<br>mobile: 912-536-3109<br>Professor Emeritus of Biology<br>Department of Biology<br>Georgia Southern University<br>Statesboro, GA 30460-8046 U.S.A |

Back to Summary of Contents

# Obituaries

## In Memory of Dr. E. Craig Turner, Jr. (1927- July 31, 2020)

**Submitted by: Jeff Vaughan, Mike Fletcher, Ralph Williams and Walter Knausenberger**

DR. ERNEST CRAIG TURNER, JR., the founding father of Virginia Tech Medical and Veterinary entomology, quietly passed away at his home of natural causes on 31 July 2020, just one day shy of his 67th wedding anniversary to his beloved wife and soulmate, Janet. After graduating from high school, Craig attended Clemson University but was drafted into the U.S. Army near the end of World War II. He was on a troop ship scheduled to invade Japan when the war ended abruptly after the atomic bombings of Hiroshima and Nagasaki. After a few months in Japan, Craig was released from the military, returned to Clemson, and finished his B.S. degree. Craig then went on to Cornell University to earn his Ph.D. in entomology.

In 1953, Craig married his childhood sweetheart, Janet, and joined Virginia Tech as Associate Professor of Entomology in what was then the Department of Biology (Note: Entomology at Virginia Tech did not achieve full departmental status until 1959). Craig was initially in charge of research investigating biology and control of forage crop pests, but all that changed in 1956 when Craig jumped at the chance

to be in charge of the newly created research initiative on Insects Affecting Man and Animals. For the next 36 years until his retirement in 1992, Craig never looked back. During that time, Craig produced an astonishing number of Master's (n=19) and Ph.D. students (n=18); many of whom used their training in veterinary and public health entomology to become influential teachers, researchers, and policy-makers in their own right within industry, government, and academia. "Turner's Angels", as some of Craig's protégés often joke, turn up in the darndest places.

With respect to research projects, Craig and his students cast a wide net. For example, Craig and his early students were among the first to investigate the effectiveness of self-application devices such as insecticidal dust bags and back rubbers for the control of horn fly on cattle, the use of systemic insecticides to control cattle grub in cattle, and feed-through insect growth regulators to control flies breeding in poultry manure. Craig's body of work included, not only applied research on a variety of livestock pests (*e.g*., muscoid flies, mosquitoes, northern fowl mite, bed bugs), but also studies on basic biology (*e.g*., lesser mealworm), integrated pest management of house flies in commercial chicken houses, stream biomonitoring, vector biology (*e.g.*, Potomac horse fever), and taxonomic publications (e.g., the mosquitoes of Virginia; revision of the genus *Bezzia* (Ceratopogonidae) in North America). When the need arose, Craig and his students worked to establish and maintain breeding colonies of mosquitoes, house flies, face flies, lesser mealworms, and ticks. Of the many arthropod species that Craig studied over the course of his career, perhaps none brought him more joy than a group which is arguably the smallest of the bunch: *Culicoides* midges ("no-see-ums"). Craig became an internationally recognized authority on the group, and introduced some of his students to international careers, e.g., in the Caribbean, tackling no-see-ums. In addition to publishing several regional taxonomic keys, Craig also published many of the early works on host preference, mating, and overwintering biology of *Culicoides,* including breeding the intractable immature stages. For outstanding contributions to the field of livestock entomology, Craig received the prestigious Cooper Award from the Livestock Insect Workers Conference (1992), and was elected an honorary member of the Entomology Society of America (1993).

Craig often said "My greatest joy in teaching was with my graduate students, and I learned as much from them as they learned from me". Over the course of his career he taught Medical and Veterinary Entomology, Arthropod Disease Carriers, Immature Insects, Aquatic Entomology, Systematic Entomology, and Literature and History of Entomology; all of which he expected his students to be intimately familiar with, from being able to construct a dichotomous key for a particular arthropod pest species, to building an epidemiologically-sound control program from scratch for a vector-borne disease outbreak. His students were exposed to the science of entomology in the broadest sense.
A full account of Craig's illustrious career, as told in his own words, can be found in the Golden Jubilee issue of the *Virginia Tech Entomologist* (pages 58-70):
(https://vtechworks.lib.vt.edu/bitstream/handle/10919/96174/GoldenJubilee_Entomologist.pdf?sequence=1&isAllowed=y)

Craig Turner was more than a researcher, teacher, and mentor of young entomologists. In his unassuming way, Craig really was something of a Renaissance man. Most of his graduate students understood that their major professor enjoyed research and also seemed fond of music. Few of us actually knew the full extent of his musical passion and abilities. Craig sang in amateur opera productions, at local weddings, and served as the choir director for his church for 30 years. It was not

uncommon for Craig to walk into the off-campus Price's Fork Research building to find his students sorting insects or picking through chicken manure while the stereo blasted out rock-and-roll or bluegrass music. At such times, Craig's eyes would twinkle as he asked if we were listening to Mozart. At least one of his students was invited to join his graduate student team when Craig learned of the student's involvement in undergraduate University choral groups.
Craig is survived by his wife, Janet, and three children, along with six grandchildren and three great grandchildren. Craig was a kind and sweet-tempered man with a sometimes goofy, but always gentle, sense of humor. He will be missed by all who knew him.

The authors would like to thank Craig's three children Marilyn, Ed, and Doug for providing much of the information provided here.

Jeff Vaughan
Mike Fletcher
Ralph Williams
Walter Knausenberger

[Editor's Note: over 100 of Craig Turner's publications are listed at the link above]

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## **In Memory of Dr. Shigeo Kitaoka** (1925- October 13, 2020)

### **Submitted by: Hayato Kitaoka and Shahin Nawai**

Shigeo Kitaoka with Shahin Nawai
at Beijiing, China in 1992

Hayato Kitaoka indicated that no English version of an obituary is available. Shigeo Kitaoka graduated with a degree in Zoology from Tokyo University (now Tsukuba University) in 1949. He became a National Park naturalist in 1951, began working at the National Institute of Animal Health in 1952 and received his Ph.D. from Hokkaido University in 1961. He again worked for the National Institute for Animal Health from 1966 until he joined the Department of Parasitology, School of Veterinary Medicine, Zambia University in 1985. Hayato Kitaoka sent two papers by his father that were published after he returned from Zambia and became a professor in the Faculty of Humanities at Niigata Sangyo University:

**Kitaoka, Shigeo. 1994.** Three new species of the biting midge *Forcipomyia*, subgenus *Lasiohelea* from Honshu, Japan (Diptera: Ceratopogonidae). *Japanese Journal of Sanitary Zoology* 45(1):1-6.

**Kitaoka, Shigeo. 1994.** Two new species of biting midges of the genus *Culicoides* from northernmost Honshu, Japan. *Japanese Journal of Sanitary Zoology* 42(4):289-292.

A list of Shigeo Kitaoka's publications and presentations from 1952 to 1985, some in English, others in Japanese, can be viewed at: https://server51.joeswebhosting.net/~js4308/files/2020kitaoka.pdf

From: **Shahin Nawai**, Berlin, 14 December 2020

Shigeo Kitaoka was a friendly, helpful and good colleague. I first met Shigeo in 1966 when I was a student and worked on *Culicoides* at Tehran University. He was there on a short duty from the FAO and worked at the Razi Institute, Hesarak, Iran. Later on, we continued to exchange papers and comments about the genus until the end of my active time in Iran and later at the University of Maryland, USA. After a few years of no news, we met at the Entomology Congress in Beijing, China in 1992. At that time, he was engaged in different research projects. A few years ago, he was a great help to me in locating the collection of Masaaki Tokunaga in Japan and arranging for the loan of some types. In November of 2010, he and his wife visited me at the Natural History Museum of Berlin during their holiday in Europe.

Shahin Nawai
Zoologisches Museum, Berlin, Germany

[Editors' Note: Alan Dyce, who met Shigeo Kitaoka in Bill Wirth's lab at Washington, D.C., described Shigeo in a letter to me in July of 2007. Alan wrote that he "considered Shigeo to be a valued contact in regards to *Culicoides* taxonomy. He is not very "open" in discussion and doesn't "give anything away" readily, but I respect his capacity (even though I don't always agree with his every contention)."]

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## Memories of Michel Kremer by Bill Grogan, Gainesville, Florida, U.S.A.

I was not able to contribute my remembrances of Michel Kremer in the May 2020 issue, #105, of the CIE Newsletter. But Steve Murphree kindly suggested that I could do so for the December 2020 issue, #106.

I met Michel Kremer during the late August 1976 International Congress of Entomology held in Washington D.C. Other foreign workers at that Congress included Jean Clastrier, Christian Raccurt, John Boorman, Richard Lane, Botha de Meillon, Saulo de Jesus Soria, Shahin Nawai, Durno Murray and several others I cannot recall. This great meeting occurred during the hottest days that summer just prior to my 3rd & final year of my Ph.D. at the University of Maryland (my graduate advisors were Don Messersmith and Willis Wirth). During this Congress, I decided to invite several foreign colleagues and John Linley to our apartment (just south of the University of Maryland) for "dinner". Due to the oppressive heat "dinner" was simply a salad and "make your own cold-cut sandwiches". It was apparent to me that the "Grand Parisian" Jean Clastrier, had never eaten sandwiches as he stacked everything on his plate and proceeded to slice everything into bite-size morsels that he ate with a fork.

Most people at that Congress also attended the Post-Congress Ceratopogonidae meeting held at Mountain Lake, Virginia and hosted by Craig Turner and his Ph.D. students Mark Dow and Walter Knausenberger. At the close of that Post-Congress meeting, Willis Wirth asked if I could drive Michel Kremer and Jean Clastrier to their hotel in Washington, and I was glad to do so. During that 6 hour drive back to Washington D.C., I stopped at a McDonald's restaurant for lunch and I was somewhat surprised that Jean Clastrier ordered their filet-o-fish sandwich. He obviously enjoyed it as he described it as "bon,

bon." Later that evening I returned Drs. Clastrier and Kremer to their hotel, and bid them goodbye and bon voyage back to France. I wondered then… if I would ever see these two great colleagues again.

During late spring 1982, I received an invitation from Michel Kremer to give a talk at the 5th international ceratopogonid meeting during early July at the Pasteur Institute in Strasbourg, France. I was fortunate to obtain a travel grant from (then) Salisbury State College and soon after my Congressman helped me with a passport for my only trip to Europe late June/early July 1982. I flew from Baltimore, Maryland to Frankfurt, Germany, bought a train ticket to Strasbourg and arrived just before dark. I phoned Michel who drove to the railroad station and took me to the hotel where I and several others stayed. During that great meeting, I met Yehuda Braverman, Jean Callot, Michel Cornet, Jean-Claude Delécolle, Peter Havelka, Jean-Pierre Rieb and Ryszard Szadziewski. A summary of this well attended meeting was published in the December (No.4) 1982 issue of Mosquito News Volume 42: pp. 515-531: "Proceedings of the Fifth International Symposium of Ceratopogonidae, Strasbourg, 1-3 July 1982." The authors of this article were: Michel Kremer, Strasbourg 67000, France; Willis W. Wirth, Washington, D.C. ; and, John Boorman, Pirbright, Woking, Surrey, GU24 ONF, U.K. The summary of this 5th Symposium included abstracts of 26 talks by some of the "…25 specialists from 7 countries." This 1st paragraph also listed the previous 4 meetings: 1. 1973 Strasbourg, France; 2. 1976 Blacksburg, Virginia; 3. 1978 Warsaw, Poland; and 4. 1980 U.K., London.

Who were the USA couple at the 5th International Symposium in Strasbourg, France June 1982 reported in CIE Newsletters #104 (Dec. 2019) & #105 (May 2020) CIE Newsletter?? The 1982 5th international ceratopogonid meeting hosted by Michel Kremer at the Pasteur Institute, Strasbourg, France was incorrectly reported in the Dec. 1982 CIE on pp. 6-7 as the "1st International Ceratopogonid meeting, Strasbourg, France, 1974". The bottom photo on p. 7 states: "American ceratopogonid worker with his wife and Michel Kremer (right). This "American ceratopogonid worker" is Wayne Rowley and his wife, now retired from Department of Entomology, Iowa State University, Ames, Iowa. I visited Wayne and his wife during summer 1983 on our way back to Maryland after visiting relatives in Utah. It turned out that Wayne and his wife are from Price, Utah, the birthplace of my father and his two younger brothers, Roy and Terry. My uncle Terry was a classmate of Wayne and his wife, and they graduated High School ca. 1954-55. Wayne's presentation summary on pp. 526-527 is entitled "Spatial Distribution of Selected Ceratopogonidae in a Restricted Habitat in Central Iowa, U.S.A. by R. D. Keith (Marin/Sonoma Mosquito Abatement District, Petaluma, California) and Wayne A. Rowley (Department of Entomology, Iowa State University, Ames, Iowa).

Michel Kremer has two species of predaceous midges named for him:
*Brachypogon kremeri in*: Szadziewski, R. & Havelka, P. (1984) A review of the Palaearctic biting midges of the subgenus *Brachypogon* (s. str.) (Diptera, Ceratopogonidae). *Polskie Pismo Entomologiczne* 54, 341–358.
*Clastrieromyia kremeri in*: Spinelli, G.R. & Grogan, W.L (1985) *Clastrieromyia*, a new Neotropical genus of predaceous midges related to *Palpomyia* and *Bezzia* (Diptera: Ceratopogonidae). *Proceedings of the Entomological Society of Washington* 87, 329–334.

I can best summarize my memories of Michel Kremer by simply saying that he was a very generous colleague that greatly influenced the careers of several of his graduate students at the Pasteur Institute

in Strasbourg, France, especially Jean-Claude Delécolle, Jean-Pierre Rieb, E. Chaker and several others, many that I never met. Rest in peace Michel, mon ami.

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# Announcement

## The 65th Annual Livestock Insect Workers Conference

**June 13-16, 2020 in Fredericksburg, Texas**

- This meeting will be hosted by the research staff of the USDA Knipling-Bushland U.S. Livestock Insects Research Laboratory in Kerrville, Texas. Details will be posted later at: https://www.liwconline.org/welcome
- The 2022 meeting will be held in Dallas, Texas.

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# Contributions/Requests from Scientists:

### From: Matt Bertone, North Carolina State University, Raleigh, NC, USA

Colleagues,

I sent the photo (below) of a male *Forcipomyia* to Bill Grogan and Art Borkent because I thought it was very handsome, and Bill suggested I submit it to the CIE Newsletter. Bill identified it as a *F.* (*Lepidohelea*) and suggested that it could be identified to species since I still have the specimen. It was found at a light sheet at my house in Cary, North Carolina.

Cheers,
Matt

Matthew Bertone, Ph.D.
Director and Entomologist
Plant Disease and Insect Clinic
North Carolina State University
maberto2@ncsu.edu

[Editor's Note: more of Matt's excellent photographs of adult and larval ceratopogonid species can be viewed at: https://www.flickr.com/search/?user_id=76790273%40N07&view_all=1&text=ceratopogonidae ]


## From: Art Borkent, Salmon Arm, British Columbia, Canada

September 28, 2020

Dear friends and colleagues,

I know it may not be everyone's cup of tea but I wanted to let you know I was on a radio program called North by Northwest on CBC (Canadian Broadcasting Corporation - British Columbia) on Sunday, September 27. The interview with Sheryl MacKay was mostly about my early roots in entomology and some of things I found studying no-see-ums (our North American name for Ceratopogonidae).

If you are so inclined, click on the following link: https://www.cbc.ca/listen/live-radio/1-43-north-by-northwest. Select the arrow beside Sept. 27, 2020: Sunday Sept. 27, which starts the 3 hour program. I was on for the third hour, so you can use the slider at the bottom of the page to go about 2/3 across to get to the start of that segment of the program (1:38:00). They interject news at the top of the hour and at the half hour, so the whole interview is actually about 45 minutes.

I hope you might enjoy it.
Best wishes, Art Borkent

artborkent@telus.net
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Salmon Arm, British Columbia,
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[Editor's Note: I listened to Art's interview and agree with Brad Mullens, who wrote: "What a delightful interview to listen in on. With your unique blend of unbridled enthusiasm, dedication, competence and humor, you not only entertained, but made a great case for both entomology and science in general. There are few people I know who could have made a better use of the megaphone to try to reach the general public." Art also mentions a graduate student in Texas, with whom he is working (see below)].

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[Editor's Note: After you have read the next contribution (from Phillip Shults and the email correspondence I had with him below), I would like to receive your thoughts concerning the value of immatures in studying the taxonomy and evolution of the Ceratopogonidae. Please send your ideas about this topic to me to be included in the May, 2021 issue of this newsletter.]

## From: Phillip Shults, Texas A & M University, College Station, Texas, U.S.A.

October 15, 2020

Hello Dr. Murphree,

I am a Ph.D. student working on a revision of *C.* (*Monoculicoides*) with Art Borkent. I do not have a very complete sampling of the larvae within this subgenus, but from the specimens I have and the descriptions from the literature, each member has a large epipharyngeal complex. It looks to be a synapomorphy of the group, but we were curious what you think. It is also interesting that you found this character state to be most similar to *C.* (*selfia*) as there is evidence in the adults that these subgenera could potentially be sister groups. Look forward to hearing from you.

Best wishes,
Phillip Shults
ptshults@tamu.edu
Research Associate, Texas A&M University

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December 4, 2020

Hello Phillip,

I am glad to know that you have been working on *C.* (*Monoculicoides*) with Art Borkent. Your question about synapomorphy within *Monoculicoides* and between *Monoculicoides* and *C.* (*selfia*) is a really good question. When in talks about my doctoral dissertation research in which I suggested that the characters, particularly head capsule characters, of the late instar larvae of *Culicoides* species were

good taxonomic characters that mirrored those highly exalted adult taxonomic characters, I met with some good-natured opposition! Mostly these individuals dismissed larval characters as convergence towards designs for feeding, etc. that had evolved in similar larval habitats. I was able to find a reference to this way of thinking in a letter I received from Alan Dyce in July of 1996:

"Whether or not the morphology/taxonomy of immature stages reflect taxonomic relationships of adult *Culicoides* is, I feel, an important aspect. Frankly, I don't believe they do. I think it is more likely the parameters of larval habitats influence the morphological expression of various structures of larvae and pupae irrespective of systematic grouping. These *C.* (*Amossovia*) spp. With long setae, long head capsules, truncated pupal respiratory horns and the ability of pupae to sink or float are, I suggest, the best adapted *Culicoides* spp. For tree-hole aquatic habitats."

So, it is still my contention that most larval characters, particularly the morphology of the epipharynx, are good taxonomic characters that should align with the taxonomy of adults. Art Borkent made a good case for the use of pupal characters as well in his 2014 publication, The Pupae of the Biting Midges of the World (Diptera: Ceratopogonidae), With a Generic Key and Analysis of the Phylogenetic Relationships Between Genera. Zootaxa 3879:1-327.
What do you think of my including your query in the December issue of the CIE newsletter to encourage comments and discussion from other scientists who work on Ceratopogonidae?

With Kind Regards,
Steve Murphree
steve.murphree@belmont.edu
Professor of Biology, Belmont University

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December 7, 2020

Hi Steve,

Thank you so much for the reply. I think I have a pretty strong case that *C.* (*Monoculicoides*) is monophyletic and that there are immature synapomorphies. All of the described larvae have this enlarged complex regardless of habitat type or geographic distribution. Additionally, you can collect the larvae of other *Culicoides* species in the same larval habitat as some *Monoculicoides* and they lack this character state. I am sure there are instances of convergence; however, as we do not have good phylogeny, that sentiment itself is conjecture. The inability to interpret phylogenetic signal using morphology does not mean it is not present. Until we have more cladistical analyses and larval descriptions it will be hard to interpret these characters.

I would love for you to pose this question in the next issue of the CIE newsletter. My view of the larval characters is pretty restricted to *Culicoides* and so it would be nice here what other people think.

-Phillip Shultz

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**Back to Summary of Contents**

# Recent Literature:

## Taxonomy and Morphology

**Anjos-Santos, D., F. Diaz, G. R. Spinelli, and M. M. Ronderos. 2020.** The immatures of three Neotropical species of *Palpomyia* Meigen (Diptera, Culicomorpha, Ceratopogonidae). *Anais da Academia Brasileira de Ciencias* 92(Suppl 2): e20190718.

**Belgers, J.D.M. and P.L.T. Beuk. 2020.** *Atrichopogon* (*Psammopogon*) *flauolineatus*, a new biting midge for the Netherlands. *Entomologische Berichten* 80(3):105 [in Dutch].

**Belkharchouche, M., S. Berchi, B. Mathieu, I. Rakotoarivony, M. Duhayon, T. Baldet, and T. Balenghien. 2020.** Update of the *Culicoides* (Diptera: Ceratopogonidae) species checklist from Algeria with 10 new records. *Parasites & Vectors* 13: 463.

**Borkent, A. and P. Dominiak. 2020.** Catalog of the Biting Midges of the World (Diptera: Ceratopogonidae). *Zootaxa* 4787(1):1-377 [Read Abstract].

**Brahma, S., S. Chatterjee and N. Hazra. 2020.** Three new species of *Dasyhelea* Kieffer and new record of *D. flaviformis*. *Journal of Insect Biodiversity* 16(2):55-80 [Read Abstract].

**Carvalho, L. P. C., A. M. Pereira Júnior, F. A. C. Pessoa, and J. F. Medeiros. 2020.** Biting Midges in Jamari National Forest, in the Brazilian Amazon, With 12 New Records of *Culicoides* Species (Diptera: Ceratopogonidae) for the State of Rondônia. *Journal of Medical Entomology* tjaa138 [Read Abstract].

**Chatterjee, S., Brahma, S. and N. Hazra. 2020.** Two new species of *Culicoides* Latreille (Diptera: Ceratopogonidae) from the Gangetic Plains of West Bengal, India with a key to the Indian species. *Oriental Insects* [Published online 5 July 2020 – Read Abstract].

**Da Silva, I. M., R. L. Ferreira-Keppler, N. Hamada, and C. G. Cazorla. 2020.** Redescription of *Stilobezzia* (*Stilobezzia*) *albicoxa* Lane and Forattini, 1956 with new synonymy (Diptera: Ceratopogonidae). *Zootaxa* 4822(3):443-445 [Read Abstract].

**El-Hawagry, M.S., SE-DA El-Azab, M.S. Abdel-Dayem and H.M. Al Dhafer. 2020.** Biting midges of Egypt (Diptera: Ceratopogonidae). *Biodiversity Data Journal* 8:e52356:1-50.

**Grogan, W. L., Jr. 2020.** A Revision of the Nearctic Predaceous Midges in the *Bezzia* (*Bezzia*) *pulverea* complex (Diptera: Ceratopogonidae). *Zootaxa* 4877(3):429-467 [Read Abstract].

**Hakima, B., H.-S. Hwang, and K.-Y. Lee. 2020.** Molecular identification of *Culicoides* (Diptera: Ceratopogonidae) species in Algeria. *Acta Tropica* 202:105261 [Read Abstract].

**Hristescu, D., F. Bărbuceanu, L. Dascălu, C. Nițescu, M. Goffredo, A. Santilli, M. Quaglia, T. Balenghien, and G. Predoi. 2020.** Species composition and relative abundance of the genus *Culicoides* (Diptera: Ceratopogonidae) in Romania. *Parasites & Vectors* 13: 393.

**Lu, X., C. Duan, Y. Ning, X.H. Jiang and X.H.Hou. 2020.** Morphology of the immature stages of *Dasyhelea silvatica* Wang, Zhang & Yu with redescriptions of adults (Diptera, Ceratopogonidae). *ZooKeys* 961:119-127.

**Mathieu, B., C. Garros, T. Balenghien, E. Candolfi, J.-C. Delecolle, and C. Cetre-Sossah. 2020.** A phylogenetic analysis of the biting midges belonging to *Culicoides* Latreille (Diptera: Ceratopogonidae) subgenus *Avaritia* using molecular data. *Parasites & Vectors* 13: 243.

**Meurgey, F. and T. Ramage. 2020.** Challenging the Wallacean shortfall: A total assessment of insect diversity on Guadeloupe (French West Indies), a checklist and bibliography. *Insecta Mundi* (0786): 1-183. [Ceratopogonidae – pp. 161-162; From Bill Grogan, who also sent this citation: **Floch, H. and E. Abonnenc. 1950.** Les *Culicoides* de la Guadeloupe. Description de *Culicoides guadeloupensis* n. sp. Publication de l'Institut Pasteur de la Guyanne et du Territory de L'Inini 203: 1–5. – Ed]

**Mignotte, A., C. Garros, L. Gardès, T. Balenghien, M. Duhayon, I. Rakotoarivony, L. Tabourin, L. Poujol, B. Mathieu, A. Ibañez-Justicia, A. Deniz, A. Cvetkovikj, B. V. Purse, D. W. Ramilo, D. Stougiou, D. Werner, D. Pudar, D. Petrić, E. Veronesi, F. Jacobs, H. Kampen, I. Pereira da Fonseca, J. Lucientes, J. Navarro, J. M. de la Puente, J. Stefanovska, K. R. Searle, K. Khallaayoune, C. L. Culverwell, M. Larska, M. Bourquia, M. Goffredo, M. Bisia, M. England, M. Robin, M. Quaglia, M. Miranda-Chueca, R. Bødker, R. Estrada-Peña, S. Carpenter, S. Tchakarova, S. Boutsini, S. Sviland, S. M. Schäfer, Z. Ozoliņa, Z. Segliņa, Z. Vatansever, and K. Huber. 2020.** The tree that hides the forest: cryptic diversity and phylogenetic relationships in the Palaearctic vector *Obsoletus*/*Scoticus* Complex (Diptera: Ceratopogonidae) at the European level. *Parasites & Vectors* 13: 265 [Correction on p. 483].

**Neupane, S., A. Ghosh, S. Gunther, K. Martin, and L. Zurek. 2020.** *Culicoidibacter larvae* gen. nov., sp. nov., from the gastrointestinal tract of the biting midge (*Culicoides sonorensis*) larva, belongs to a novel lineage Culicoidibacteraceae fam. nov., Culicoidibacterales ord. nov. and Culicoidibacteria classis nov. of the phylum Firmicutes. *International Journal of Systematic and Evolutionary Microbiology* [online 30 October 2020 – Read Abstract].

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**Back to Summary of Contents**

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**Back to Summary of Contents**

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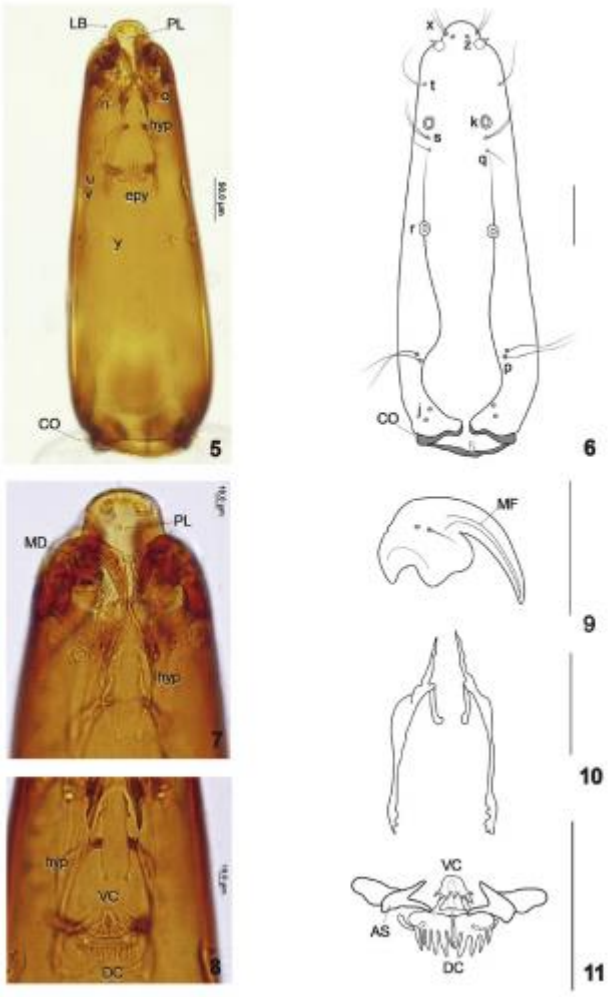
Back to Summary of Contents




**Figures 5-11.** *Palpomyia mapuche* Spinelli, Grogan & Ronderos, fourth instar larva. 5, 7-8. photomicrographs. 6, 9-11. draw illustrations. 5. head capsule, ventral view; 6. head capsule, dorsal view; 7. detail of anterior portion of head capsule and hypopharynx, ventral view; 8, 11. epipharynx, ventral view; 9. left mandible, ventral view; 10. hypopharynx, ventral view. Scale 0.05 mm.
Collar (CO); dorsal comb (DC); mandible (MD); fossa mandibularis (MF); labrum (LB); palatum (PL); ventral comb (VC). Head capsule chaetotaxy: j, colar pits; k, pronotal pits; o, parahypostomal setae; p, posterior perifrontal setae; q, postfrontal setae; r, postnotal pits; s, anteroperifrontal setae; t, prefrontal setae; x, parantennal setae; z, frontal pits.

**From:** Anjos-Santos et al. 2020

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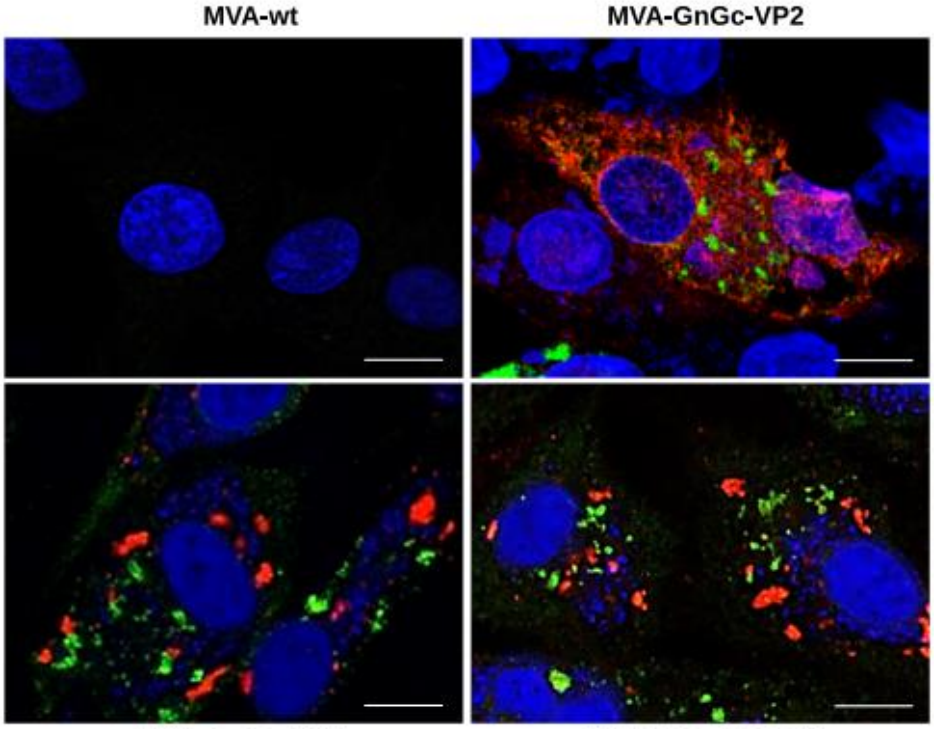
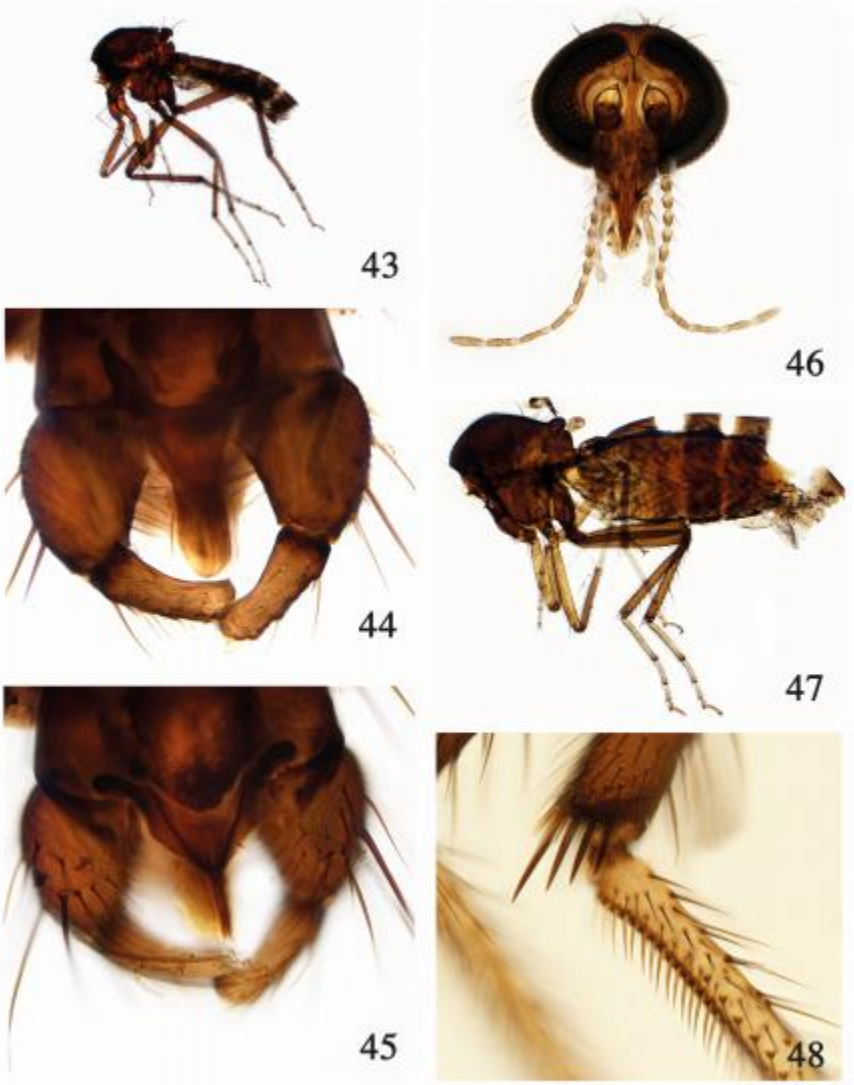



**Fig. 2 Expression analysis of heterologous proteins by MVA-GnGc-VP2, MVA-GnGc-NS1, and MVA-GnGc-NS1-Nt vectors.** DF-1 cells were infected with recombinant MVAs (MOI 0.1) and immunofluorescence analysis was performed at 48 h.p.i. Expression of Gn and Gc was detected by staining with serum from sheep infected with RVFV and a secondary green antibody. BTV proteins (VP2, NS1, and NS1-Nt) were detected with BTV-infected mouse serum and a secondary red antibody. Images visualized by confocal microscopy (63×). Scale bars 10 µm.

**From: Calvo-Pinilla et al. 2020**




**FIGURES 43–48**. *Bezzia folkertsi* **n. sp.** Male, 43–45, Female, 46–48. 43, 47 Thorax and legs. 44 Genitalia at focal level of parameres, gonocoxites and gonostyli. 45 Genitalia at focal level of aedeagus. 46 Head. 48 Apical hind tibial spines.

**From: Grogan 2020**

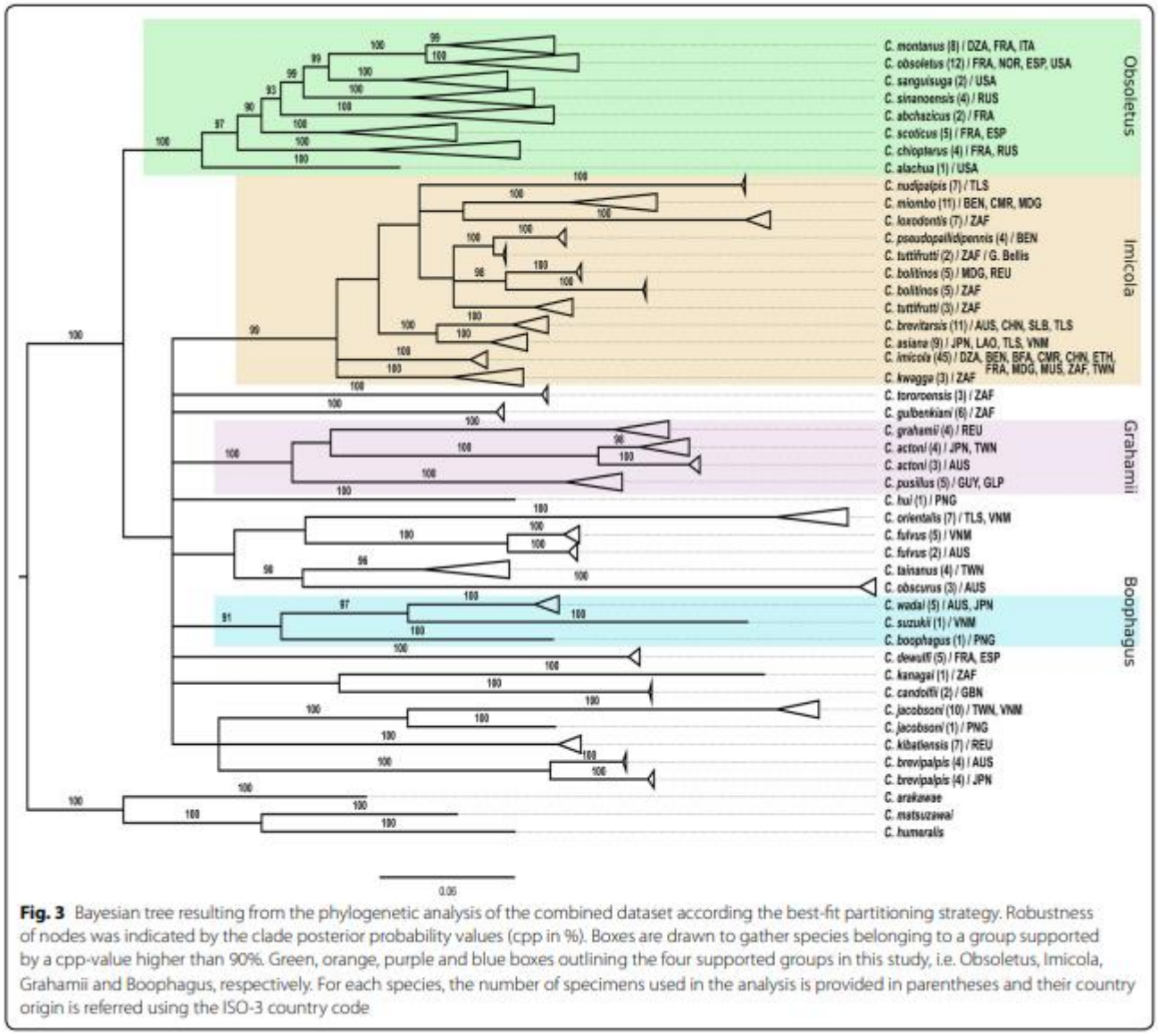



**Fig. 3** Bayesian tree resulting from the phylogenetic analysis of the combined dataset according the best-fit partitioning strategy. Robustness of nodes was indicated by the clade posterior probability values (cpp in %). Boxes are drawn to gather species belonging to a group supported by a cpp-value higher than 90%. Green, orange, purple and blue boxes outlining the four supported groups in this study, i.e. Obsoletus, Imicola, Grahamii and Boophagus, respectively. For each species, the number of specimens used in the analysis is provided in parentheses and their country origin is referred using the ISO-3 country code

**From: Mathieu et al. 2020**

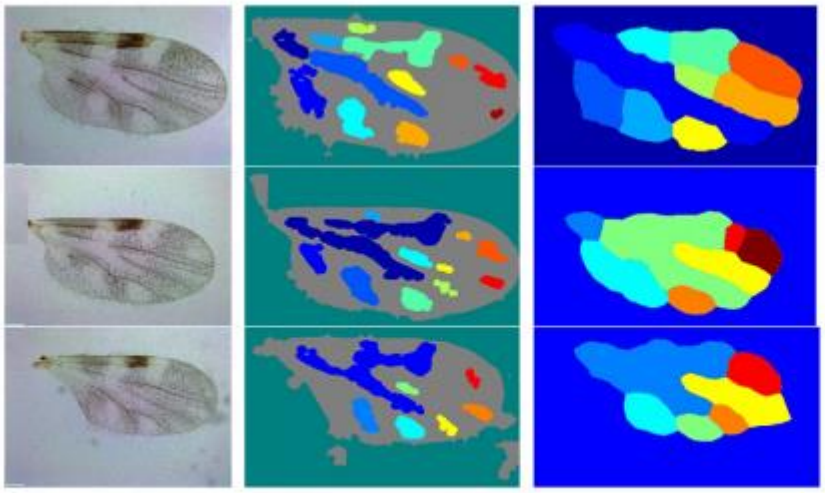



**Fig 5. Performance of the proposed method on *C. obsoletus* species samples.** From left to right column: original wing image, particle detection, segmentation of zones of interest through the watershed method, and the final feature vector output obtained.

**From:** Venegas et al. 2020

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Back to Summary of Contents