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METALEPTEA

THE NEWSLETTER OF THE ORTHOPTERISTS' SOCIETY

President's Message

By DAVID HUNTER
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Dear Society Members,

I bring to your attention the official announcement of the upcoming 14th International Congress of Orthopterology to be held in Mérida, Yucatán, México from October 15-19, 2023, in the Hotel "El Conquistador." Mario Poot, President of the Organizing Committee has been organizing the Congress in collaboration with National and International Plant Protection Agencies who are planning to send substantial numbers of delegates to the Congress to give us a good basis for a successful Congress.

And once again we had many applicants for the Theodore J. Cohn Research Grants, there were 21 applications from 9 countries and we were able to fund 10 grants for a total of $15,054. These grants are an important part of our society's support for young scientists and we strongly encourage applications from students and postdocs from around the world that have an interest in Orthoptera and related insects.

As you can see from our Treasurer's Report, our society's investments are still doing well and with the substantial gains over the past few years, we still have about $500,000 more than we had at the end of 2014, the year of the late Ted Cohn's generous gifts to our society. The gains were actually much more than $500,000 because over the past 7 years we have spent

about $300,000 on various projects including moving our *Journal of Orthoptera Research* to open access with Pensoft, with no page charges for Orthopterists' Society members. In addition, there is regular support for Research grants and Young Professionals Awards, for Orthoptera symposia at various meetings, and of course substantial subsidies for travel and expenses for our International Congresses. Over the past few years, we have been setting aside some of the gains into a reserve bond fund that has retained its value well, so that we now have $130,000 in bond and cash reserves that can cover expenses even if there are declines in the stock market investments.

Of course, all of us are continuing our work in ways that work for our circumstances and once again I present another excellent *Metaleptea*, thanks to the tireless efforts of Hojun Song and Derek A. Woller!

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A brief report of the Orthoptera expedition in the Amazon basin and the Andes of southern Ecuador

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Fauna and flora of Ecuador are among the most diverse and magnificent in the New World. Because the Andean Cordillera's rise was relatively recent and complex, a great number of speciation events occurred in this area, most likely as a result of dispersion and vicariance. The Ecuadorian fauna is extremely rich and diversified, which is one of the key repercussions of these events. In this South American region, biological research consistently produces excellent and new data, not just in taxonomy but also in evolutionary biology, speciation studies, biogeography, and other relevant fields.

During March of 2021, and after a long time of being cooped up at home due to the COVID-19 pandemic, I decided to contact Felipe Campos to organize an expedition to Ecuador. Felipe is a passionate biologist from the INABIO (Instituto Nacional de Biodiversidad del Ecuador) who has a lot of field experience. After several virtual meetings, we planned grasshopper collections in 3 localities, which later became more than 20 geographic points around the country. Although this was the first objective of the project, the main goal is to contribute to the knowledge of the Ecuadorean fauna of Orthoptera using a multidisciplinary approach, i.e., taxonomy, cytogenetic, molecular phylogeny, and genomics.

On January 7th of 2022, Felipe and I met in Quito and soon after I arrived we started planning our expedition. Ecuador is smaller than most South American countries, yet it is geographically diverse, with four distinct biogeographical regions: Amazonia, the Andes, the Coastal

Figure 1. Male and female individuals of *Jivarus antisanae* collected in Pintag.

Figure 2. Some ecosystems sampled: A) Montane forest in the eastern foothills of the Andes (Jondachi); B) Amazonian tropical rain forest (Limoncocha).

Figure 3. Male and female Acridoidea specimens collected in montane forest of the eastern foothills of the ecuadorian Andes mountain range.

Plains, and the Galapagos Islands. Moreover, it includes a multitude of microclimates and altitudes that make the fauna and flora extremely diverse and rich (e.g., Páramos). These geographic features are also obstacles to overcome in insect collecting and for other organisms too. Based on that, we were aware that Orthoptera diversity from Ecuador would be far from being "completely" recorded in a month. For this reason, we focused our collection points based on several records from the Orthoptera Species File (OSF) (Cigliano et al., 2022), taxonomic descriptions (Rondero, 1979; Cigliano & Amedegnato, 2010), and the iNaturalist platform of citizen science (https://www.inaturalist.org/observations?place_id=7512&taxon_id=47650).

We planned two itineraries; **the first** would take us from Quito, located in the high Andes, all the way to the Ecuadorian Amazonia, including the eastern foothills of the Andes mountain range, to Limoncocha in low Amazon at 220 meters of altitude. **The second** would take us from Quito to Loja route along the Andes biogeographical region between 2,500 and 4,500 meters altitude; both within the span of 30 days.

The **expedition started** in Pintag where we collected an abundant grasshopper species in that region: *Jivarus antisanae* (Fig. 1). With this finding, Felipe told me about the meaning of the word "Jivaro," a derogatory and rude term that was used decades ago to name the indigenous people from a specific region of the Ecuadorian Amazon, precisely where these insects are not distributed. From Pintag we traveled in a north-east direction to Baeza (precisely along the same path that the Spanish conquerors used to discover the Amazon River). We stopped at Cuyuja, Baeza, Reventador Volcano, and Jondachi (Napo province), on the eastern foothills of the Andes, at altitudes between 4,000 and 1,400 meter, where we stayed searching for specimens during the day and night (Fig. 2A; Fig. 3). From the Andes we traveled to Limoncocha where we spent three days near the Reserva Biológica Limoncocha. This amazing place, a lagoon next to the Napo River, is a humid tropical forest with many flooded areas (Fig. 2B and C). We collected at night and spent more than four hours in places

Figure 4. Male and female specimens of *Jivarus* sp. collected in Huagrahuasi.

around the Reserva. Our preliminary identification noted two species of *Typophyllum* (Tettigoniidae), other katydids, and several species of Acridoidea. The trip continued over the foothills of the mountain range, but this time in the basin of the Pastaza River, up to the town of Río Negro and then Baños, where we expected to find our second species of *Jivarus* (*J. jagoi*). However, we did not succeed since we could not reach the altitude reported in the bibliography. Far from being frustrated, we continued our expedition and moved north via Pillaro and stopped in Huagrahuasi, where we found our second species of *Jivarus*. At first, we only saw potato crops and grass for cows, but after one hour of inspection, a yellowish green insect jumped and we started to scream as we won the lottery "it is *Jivarus*, amigo, it is *Jivarus*" (Fig. 4). On the way back to Quito, we took the road in the direction to Boliche (Cotopaxi) and Machachi (Pichincha), collecting many *J. antisanae*.

After three days in Pintag (our base), we bought some food and provisions (organic coffee, water, "horchata" tea, and "tamales"… definitely not very varied due to the strange eating habits of one of the members of the expedition) and started **the second part of the itinerary** (Fig. 5). We went south, set our brain in *Jivarus* mode and stopped in several places based on the taxonomic revision of the genus (Cigliano & Amedegnato, 2010) and also helped by iNaturalist records. The first stop was Riobamba at 3,660 meters where we found a huge population of *Jivarus* sp. (Fig. 6) The next day we arrived at a place near Laguna de Atillo and stayed in an indigenous house that reminded me of Scotland in the 14th century, a magnificent place. During the next morning, we observed several grasshoppers, but the most amazing finding that day happened in the afternoon when, after several hours, we found a reddish *Jivarus* sp. (Fig. 7).

From that moment on, we collected mostly specimens of *Jivarus*. They were present in nine out of 10 places visited and practically always a different species for each collection site (Fig. 8). Over the next days, we visited several Páramo places located in a range of 3,000 and 3,600 meters: Osogoche and Alausi (3,160 meters), 30 km from Chunchi (2,830 meters), both in Chimborazo province, Jima (3,430 meters), La Ramada (3,185 meters), 17 km Norte Urdaneta, Cruz de Tiura (2,530 meters), until reaching Loja, the southernmost province of Ecuador.

Along the trip, we realized that *Jivarus* was the predominant group on the highlands, but when arriving at the province of Azuay, individuals from the genus Quitus began to be more and more abundant (Fig. 9). The first collecting point was on the road to the town of Jima, where after a long search we found a red individual in a Bromeliaceae (*Puya* sp.) of the same colour. An intensive search within these plants allowed the collection of several specimens and the suspicion of a conspecific relationship between the insect and the plant. In Loja, we

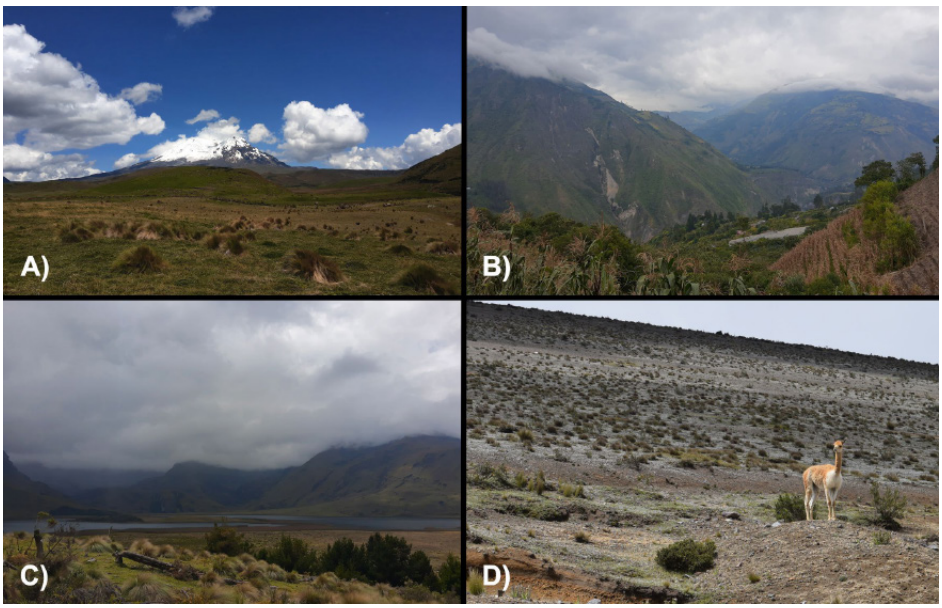

Figure 5. Some ecosystems sampled: A) Napo province; B) and C) Chimboraso province; D) Cotopaxi province.

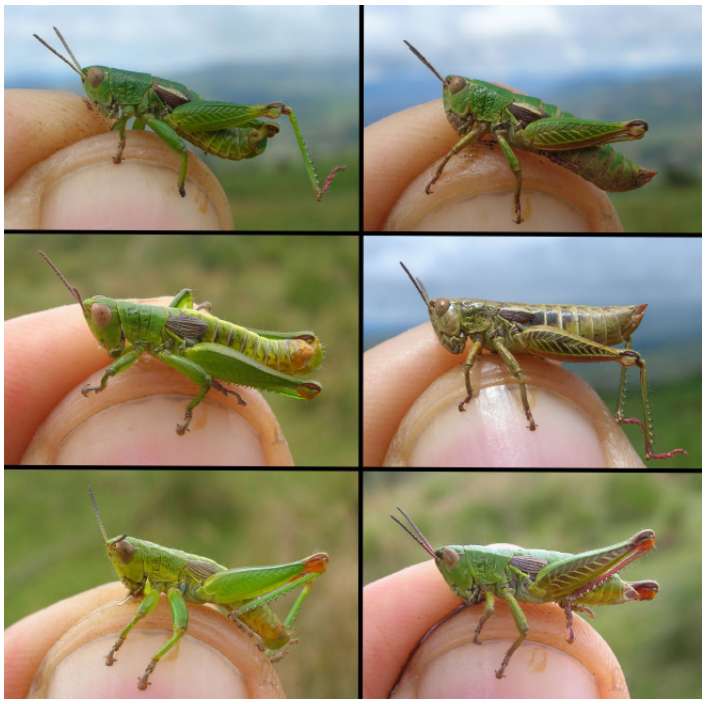

Figure 6. Male and female specimens of *Jivarus* spp. collected in the central and southern Andes of Ecuador.

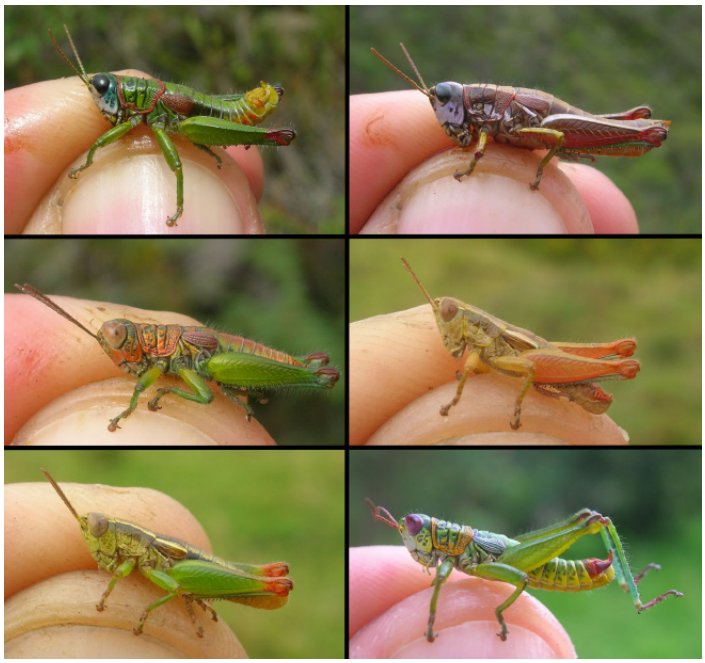

Figure 8. Male and female specimens of *Jivarus* spp. collected in Chimborazo province.

Figure 7. Male specimens of *Jivarus* sp. collected in the Laguna de Atillo.

Figure 9. Male specimens of *Quitus* spp. from the paramos of southern Ecuador. Jima, Azuay province.

stayed three days because records in the OSF and Cigliano & Amedegnato's taxonomic revision suggest this site as the center of diversity for *Jivarus*. Therefore, we tried searching in several collecting points, like the Abra de Zamora at different altitudes, Santiago, Saraguro and Podocarpus. Although the acridofauna diversity in that area was low, we had success with *Jivarus* (Fig. 10) and *Quitus* species.

On the way back to Quito we carefully explored other localities in the provinces of Cañar (road Guamote-Macas and Cachapamba), Bolívar (Guaranda), and Azuay (Cajas), in all of which we found several species of *Jivarus* (Fig. 11) and species of *Quitus* as far north as the province of Cañar. We closed out our survey expedition in Santo Domingo in the Pichincha province where we found, once again, *J. antisanae* (Fig. 1).

Across the entire expedition, a total of 840 individuals of Orthoptera were collected. At least half of the

Figure 10. Male and female specimens of *Jivarus* spp. collected in Abra de Zamora, Santiago, Saraguro, and Podocarpus.

Figure 11. Male specimens of *Jivarus* spp. collected in provinces of Cañar, Bolívar, and Azuay.

specimen records correspond to new distributions and some species found will be added to the current list of Ecuadorian Orthoptera. We also believe that some of them correspond to species not yet described. It was a gorgeous expedition and all the observations and material collected exceeded our expectations. This trip was ambitious and also a challenging task because, in that moment, COVID-19 cases in Ecuador were multiplying daily and restriction of physical contact to prevent the spread of the disease was strict. Additionally, the last collections in Ecuador for several grasshopper groups were made more than 15 years ago (e.g., *Jivarus* and *Quitus* species), so we did not know the impact of human activities (or others) in their distribution.

Work on the project with Ecuadorian species is planned to be continued. In this sense, the new taxonomic, cytogenetic, and phylogenetic data will be interpreted with those information available for other related groups. To that end, Sofía Chica Ruiz, a student of the BSc. in Genetics [Universidad Nacional de Misiones (UNaM)] achieved the first results concerning the chromosome morphology and diploid number of several *Jivarus* species; we present here for the first time, the male meiotic metaphase I of *Jivarus antisanae* (Fig. 12). Moreover, we have proposed a scheme of work to be covered in a medium term period. First, continue the taxonomic identification of specimens with emphasis in *Jivarus*, *Quitus*, and katydid species, and publish a complete list of the orthopterans collected in this expedition. Felipe Campos will continue with more collections in other unexplored areas of the country. Second, provide the cytogenetic description of *Jivarus* and *Quitus* species (the same for the other species collected).

We believe that all the activities along the stages of the project will contribute greatly to the knowledge of the Andean orthopterans from Ecuador and will boost the collaborative work between Latin American orthopterists. The new material for taxonomic, cytogenetic, and molecular analyses will enable the ability to conduct a multidisciplinary study and

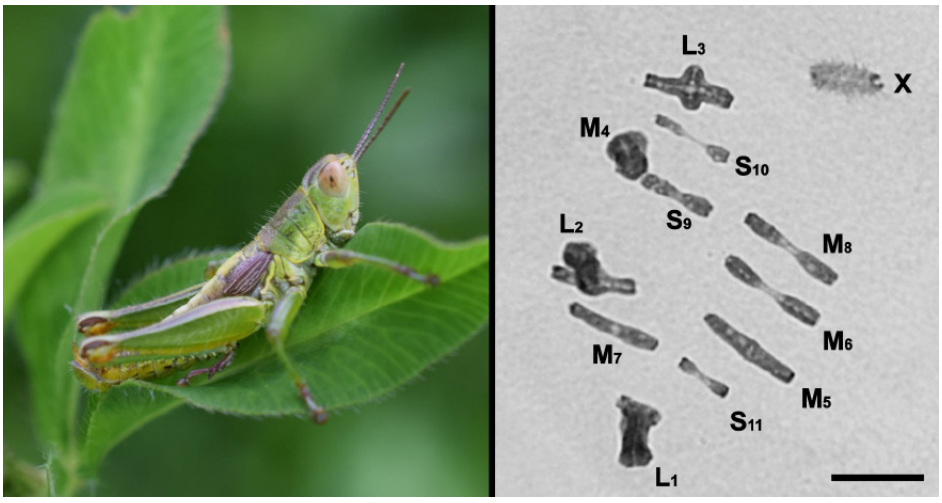

Figure 12. *Jivarus antisanae* male metaphase I, showing eleven autosomal bivalents and the X chromosome (2n=23 and a X0 sex chromosome determination system). Conventional staining. Bar = 10 µm.

in-depth discussion of the evolutionary scenarios previously proposed for several indigenous grasshoppers groups of Ecuador.

Acknowledgements
ERDC is very grateful to the Orthopterist' Society for the financial support through the Theodore J. Cohn Research Fund. ERDC and FCY thank INABIO for field assistance and authorizations. Special thanks to Alex for the support and to Angel Hualpa and his son for their help and company in the city of Loja. ERDC also thanks María José Campos for making our expedition possible. ERDC is grateful to Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET).

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Locust management in Central America in the COVID-19 Period

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The COVID-19 pandemic continues affecting the world. The governments of almost all countries took strict measures to prevent the contagion of the disease, suspending all activities with massive gatherings, imposing quarantines, limiting citizen movement, and allowing work only on essential activities, closing borders, imposing curfews, amongst other measures.

Simultaneous to the pandemic, swarms of the Central American locust (CAL: *Schistocerca piceifrons piceifrons*) are continuing to threaten agriculture production and pasture in countries of Central America. To face this problem, OIRSA (Regional International Organization for Agricultural Health) developed a series of activities to reduce the risk of CAL and contagion in the official personnel that controlled the current outbreaks. This organization undertakes field assessment missions, strengthens national capacity, and coordinates survey and control operations, as well as emergency assistance during locust outbreaks and upsurges.

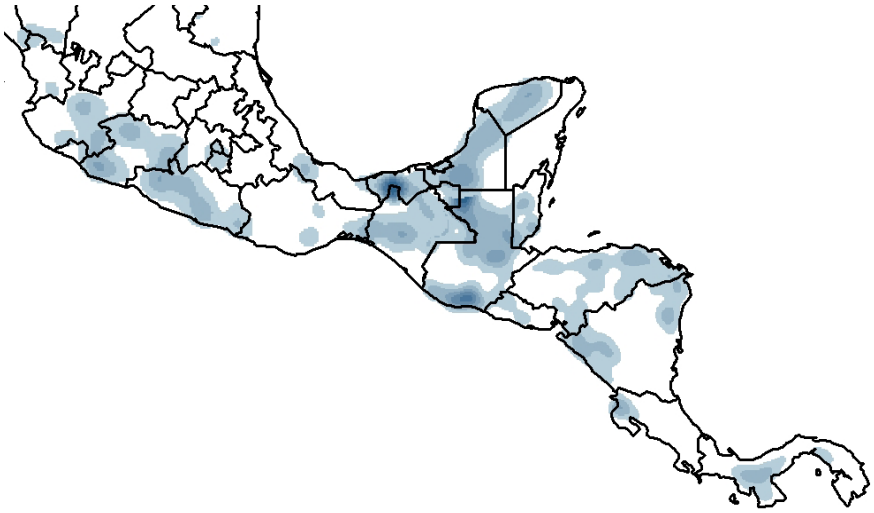

Figure 1. Kernel density of burned sites associated with CAL development areas. From January 1 to March 25, 2020. MODIS. https://firms.modaps.eosdis.nasa.gov/map

Capacity strengthening. From July 13 to August 23, 2020, the first virtual locust workshop was held, Management of CAL towards a preventive approach. 1,037 people from 21 countries signed up: 19 from Latin America, Israel, and Tunisia. It had the support of important institutions such as FAO, GLI, Texas A&M University, Michigan State, INIFAP (Mexico), and OIRSA itself. At the end, the students learned different strategies in the prevention and control of the locust, an event of full satisfaction for the attendees, organizers and institutions that supported it.

OIRSA also developed guidelines and guides to prevent COVID-19 infection among agricultural workers, marketers and exporters: https://www.oirsa.org/contenido/2020/Lineamientos Oirsa-29abril2.pdf.

Regional cooperation. OIRSA is made up of 9 countries from Central America, Mexico and the Caribbean. Locust prevention and management action plans have been reviewed and improved, focusing on ecological alternatives, such as the use of the entomopathogenic fungus Metarhizium acridum, which is already available in the region through a donation of the strain to Mexico. Additionally, OIRSA personnel have visited the countries to analyze the country's situation, recommendations are issued at the end of the mission for the improvement of pest management processes.

Information and forecasting. With the aim of being prevented in the