Technical Report

Hidden Inside the Mountain: How Threatened is Leafhopper Biodiversity Within Native Forests of the Sierra Madre Del Sur, Mexico?

Adilson Pinedo

Introduction

The insect Cicadellidae family better known as "leafhoppers" is one of the largest specialized herbivorous insect families worldwide with more than 22,000 species over the earth. Its vast number of species is remarkable and outstanding nowadays, but its knowledge of tremendous biodiversity losses is underestimated for many reasons. One of these is the due to the meticulous sampling and hard manage soft oft bodies in field because most specimens have a tiny size which oscillate between 2 to 5mm. In addition, usually their presence is hidden in plain sight within any frondose forests. Other reasons are varied similarly as reported to other arthropods groups driven by climate change or biotic phenomena, but, despite all of this, leafhoppers are also a key taxon group very sensitive and not adapted to confront industrialization, changes of use of land, and deforestation happening during past and currently decade as observed in other insects which can adapt progressively or tolerate it habitat perturbation.

Mexico harbors ancient forests like Cloud, Dry, Pine, Oak, and Rain Forests running along the complex mountains of the Sierra Madre del Sur with many insolated areas determined as hotspots holding unique plants and insect's species, those areas historically known as preserved areas have some of the most critical and endemic representatives of the leafhopper family. Unfortunately, changes during past decades and still occurring modern days; such natural reservoirs have suffered significant decreases in the biodiversity of tropical leafhopper species. Evaluating threatened key leafhopper species biodiversity within the native forests of Mexico we can understand properly a better framework to model indicators of conservation and decision making.

Materials and methods

Sampling was carried out as designed for this project following the non-invasive methodology proposed in RSG-1 which is based on two-ways operation, (i) quantitative section based on number of entomological sweep nets, entomological aspirator, and motorized vacuum. In contrast to the (ii) not-quantitative methodology by malaise trap, flight interception trap, and light trap.

Species names were obtained by eye directly in fieldwork observing live specimens taken by the entomological aspirator, sweep net, or light trap. Thus, pre-identified, counted, and accordingly labeled. In case of uncertain identification, only 1 male is taken for full examination in the entomological laboratory of the University of Guadalajara.

Results

We gathered 2,508 observations of 27 species to occurs in all sites targeted (75 as total of 45 municipalities). Of all species, we focused specially on four species, *Neodonus piperatus*, *Pseudaligia nigropunctata*, *Retusanus apicatus*, and *Mesamia divisa* due to the highest value of threat found in 1st RSG and present work. Additionally, the species *Duocrassana longula*, was also identified as another threatened species with high rates of habitats compromised by deforestation.

Workshops in local communities

Three workshops in open recreational areas were carried out among communities: March 24, Jun 12, and July 27 in 2021. Topics were varied but mainly included: updates of project, didactical materials for adults and kids, care and use of natural resources, and help in administration to get subsides by government to protect native flora and fauna.

Workshops remotely

Twenty-nine virtual workshops were offered along this project which successfully in all were attended by researchers, volunteers, and other people having internet facilities along the Mexican territory. Remotely services were provided by the University of Guadalajara to anyone interested in our project to guaranty and free-easy-accessibility and assistance.

Date
January 18 and 30
February 16 and 24
March 12, 15, 21, 23, and 30
April 14, 21, 25, 28, and 30
May 6, 9, 11, 24, 26, 28 and 30
June 4, 6, 8 and 10
July 12, 17, 19 and 21

Workshop invitations received by academic institutions or nearby communities

Workshop to youth generations of the University of Agronomy, Biology and Environmental Sciences of Guadalajara, March 1, 20, and April 3.

Talk and child workshop to the community of Santa Maria Zoquitlan in Oaxaca state, August 1st. Talk available in: https://www.youtube.com/watch?v=4lmthAji_nU

Teaching
This extra activity is undertaken alongside the project by invitation of people interested and several students with the main interest in know-how to collect and process for study these tiny organisms within several types of vegetations in Mexico. This is having been a recurrent meeting every 10 days since February 2020 – current date.

International meetings
I attended and presented our results as key insects using endangered forest of Sierra Madre del Sur, Mexico in the following professional events.

Inscribed:
May 24, 2021 – Second congress of the Mexican Association of Arthropod Systematics, Mexico

Invited:
July 14, 2021 – IV Symposium of Biosystematics and Management of Natural and Agricultural Resources, Mexico

Awarded:
May 24, 2021 – AMXSA, second national congress, Mexico

Upcoming:
October 20, 2021 – XXIII Symposium of Zoology of the University of Guadalajara, Mexico

November 22-25, 2021 – LXII National Convention of Entomology, Peru

Scientific disseminations
We successfully provided six manuscripts with new and relevant information regarding all goals proposed in out project: (a) gather data of selected endemic species occurring in the Sierra Madre del Sur with their conservation status *in situ* (https://doi.org/10.11646/zootaxa.4822.4.6; https://doi.org/10.11646/zootaxa.4830.3.1; https://doi.org/10.1080/00222933.2019.16832449), (b) show changes in leafhoppers biodiversity over 75 years inhabiting native Mexican forests (https://doi.org/10.1098/rsos.201370), (c) identify areas of high species endemism and determine the affinities of species to provide data useful for conservation prioritization using IUCN criteria (https://doi.org/10.1111/ddi.13254), and (d) enlist all native species documented along the project occurring in all localities sampled (http://dx.doi.org/10.14411/eje.2021.027).

Future work
Looking ahead in the rise of a non-governmental civil association to help communities monitoring threatened species as assistance highly demanded and mitigate our framework to assess species to appropriate protection within those endangered forests.

Acknowledgements
We are deeply grateful to communities in the Sierra Madre del Sur for their kind hospitality and support over these years, despite all obstacles we had their help was more than necessary to reach all goals. To all volunteers which participated in every sampling from each community. To the Rufford Foundation for the opportunity to support the basis of this research.

Teamwork members

- Adilson Pinedo (University of Guadalajara).
- Gustavo Moya Raygoza (University of Guadalajara).
- James N. Zahniser (USDA, APHIS, PPQ, Washington, USA).
- Liberato Portillo (University of Guadalajara).
- Mildred Torres (University of Enrique Diaz de Leon).
- J. Guillermo Rodríguez (University of Guadalajara).
- Diego Yassir Pinedo Escatel (University of Guadalajara)
- Institute of Botanic of the University of Guadalajara

Fieldwork

Mildred Torres taking biotic data *in situ* to evaluate human activities affecting the habitat of the threatened leafhopper species *Pseudaligia nigropunctata*. Photo by Adilson Pinedo.

Adilson sampling in Guerrero over the Dry Tropical Forest. Photo by Bruno Rodriguez Arriaga

Adilson counting and identify species by eye in Guerrero. Photo by Bruno Rodriguez Arriaga.

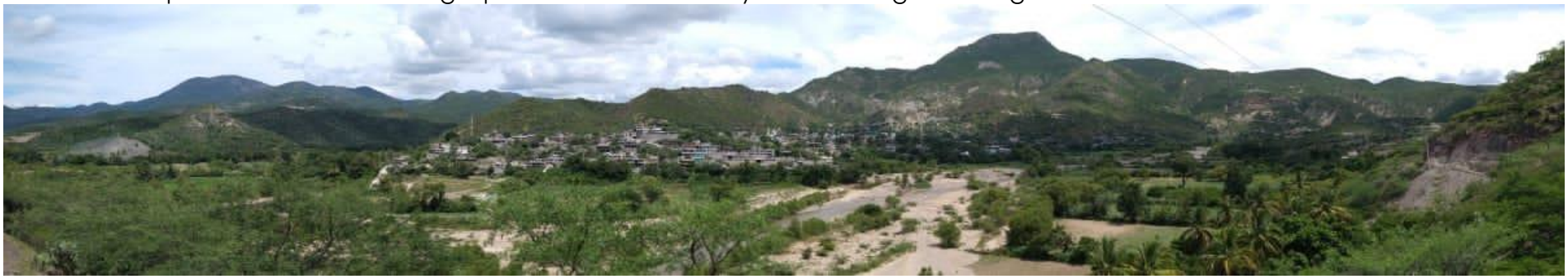
Adilson identify leafhoppers species in situ, Oaxaca. Photo by Diego Pinedo

Sampling in valleys of Oaxaca. Photo by Diego Pinedo

Collecting trip to Oaxaca. Photo by Diego Pinedo.

Adilson and Mr. Alfonso (local guide) searching leafhoppers in Oaxaca. Photo by Bruno Rodriguez Arriaga

Landscape view of first collecting trip to Oaxaca. Photo by Bruno Rodriguez Arriaga



Landscape view of community of El Chilar, Guerrero. Photo by Adilson Pinedo.

Landscape view of study area in Guerrero. Photo by Bruno Rodriguez Arriaga

Workshops

Talk of Adilson during workshop in Zoquitlan, Oaxaca. Photo by Diego Pinedo.

Material given in workshops. Photo by Adilson Pinedo

Explanation of sites sampled along the project by volunteer Bruno Rodriguez Arriaga, Guerrero. Photo by Adilson Pinedo.

Stand of didactic materials for communities. Photo Adilson Pinedo.

Poster of some threatened leafhopper species in the Sierra Madre del Sur during 2nd workshop in Oaxaca. Photo by Adilson

Assembly after workshop with community. Photo by Bruno Arriaga.


Part of didactic materials given to children. Photo by Bruno Rodriguez Arriaga.

Kids playing during child workshop in Oaxaca. Photo by Bruno Rodriguez Arriaga

Child workshop in Oaxaca. Photo by Diego Pinedo

Students and Adilson during the workshop to youth generations by the University of Agronomy, Biology and Environmental Sciences of Guadalajara. Photo by Adilson Pinedo.

Adilson in field during the workshop to youth generations by the University of Agronomy, Biology and Environmental Sciences of Guadalajara. Photo by Adilson Pinedo.

Meetings

IV SIMPOSIO

UNIVERSIDAD DE GUADALAJARA
CENTRO UNIVERSITARIO DE CIENCIAS BIOLÓGICAS Y AGROPECUARIAS
MAESTRÍA EN CIENCIAS EN BIOSISTEMÁTICA Y MANEJO DE
RECURSOS NATURALES Y AGRÍCOLAS

Otorga la presente

CONSTANCIA

al: **M.C. JORGE ADILSON PINEDO ESCATEL**

Por su participación como MODERADOR en la LGAC:

ECOLOGÍA

Dentro del marco del IV SIMPOSIO "**La investigación en la Maestría en Ciencias en Biosistemática y Manejo de Recursos Naturales y Agrícolas**", celebrado en Modalidad virtual los días 13 y 14 de julio de 2021

Las Agujas, Zapopan, Jalisco, 15 de julio de 2021

Maestría en Ciencias en Biosistemática y Manejo de Recursos Naturales y Agrícolas
Centro Universitario de Ciencias Biológicas y Agropecuarias

Dra. Patricia Zarazúa Villaseñor
Coordinadora de la Maestría
BIMARENA

Dr. Ramón Rodríguez Macías
Secretario Académico
C.U.C.B.A

Certificate of participation during the IV Symposium of Biosystematics and Management of Natural and Agricultural Resources, Mexico

La Asociación Mexicana de Sistemática de Artrópodos AMXSA A. C. otorgan la presente constancia

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Pinedo-Escatel J. Adilson, C. H. Dietrich, J N Zahniser, G. Moya-Raygoza, J. Aragón-Parada y L. Portillo

Por la presentación de su trabajo intitulado

"Sistemática y endemismo de la subfamilia Deltocephalinae (Hemiptera: Cicadellidae) en México y su impacto en la clasificación del nuevo mundo"

Impartido durante el
Segundo Congreso de la AMXSA,
realizado en línea del 24 al 26 de mayo del 2021.

AMXSA

Dr. Alejandro Zaldívar Riverón
Presidente de la AMXSA

Certificate of participation during the second congress of the Mexican Association of Arthropod Systematics, Mexico

ASOCIACIÓN MEXICANA DE SISTEMÁTICA DE ARTRÓPODOS

AMXSA

LA PRESENTE CONSTANCIA SE OTORGA A

J. Adilson Pinedo Escatel

por su destacada presentación en el segundo congreso de la AMXSA

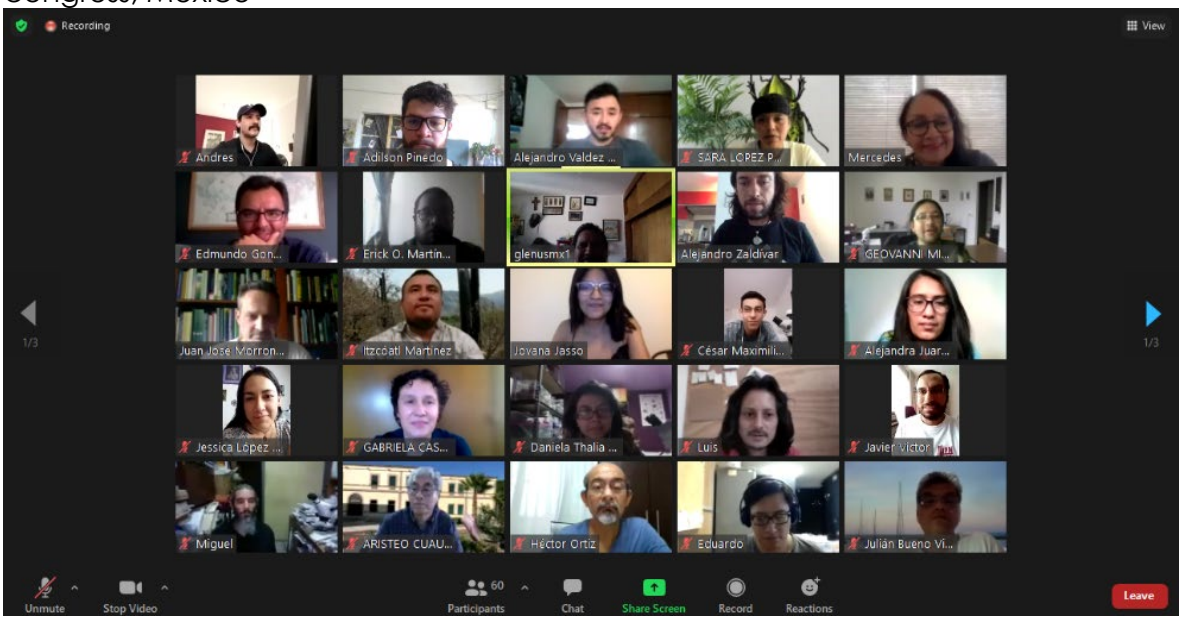
"Caras vemos, artejos no sabemos: aportaciones en la descripción de taxones mexicanos nuevos de la familia Cicadellidae (Hemiptera: Cicadellidae)"

realizado en línea del 24 al 26 de mayo

ALEJANDRO ZALDÍVAR RIVERÓN

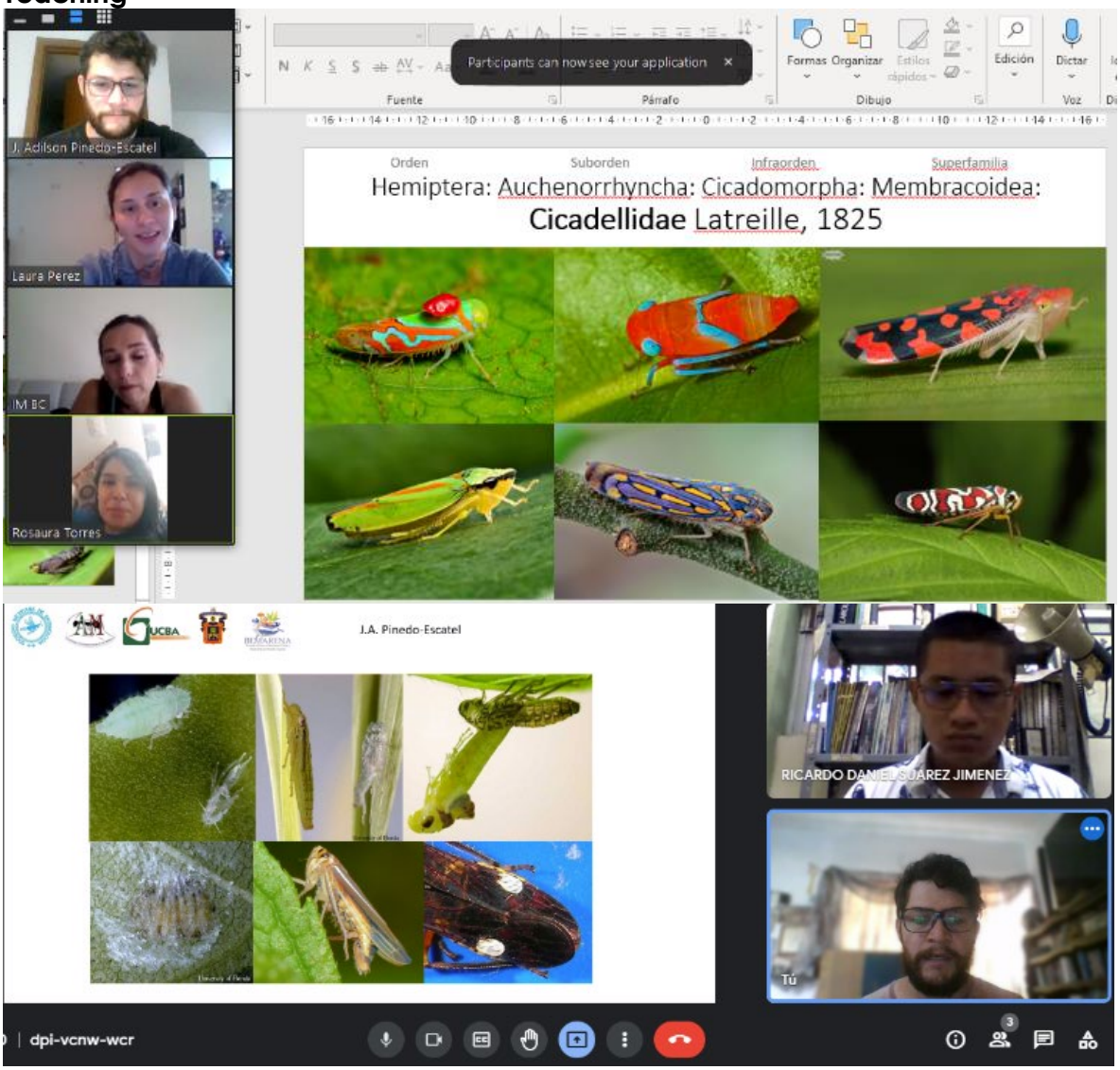
Presidente de la AMXSA

Awarded project during the formal meeting of AMXSA in the second national congress, Mexico



Closure of second congress of the Mexican Association of Arthropod Systematics, Mexico

Teaching



Teaching online