# Entomopathogenic Fungi Collection (CHE)

## National Reference Center for Biological Control

This area of the National Reference Center for Biological Control (CNRCB, in Spanish) houses a “live fungi collection” and plays an essential role as a Mexican biodiversity reservoir, in the face of the ongoing and advancing environmental damage to the many ecosystems of our country.  The CNRCB collection started operations in 1991, and to date it has 1053 isolated specimens (https://www.gob.mx/senasica/documentos/coleccion-de-hongos-entomopatogenos) of 27 federated states of Mexico, from the Clavicipitaceae, Cordycipitaceae and Ophiocordycipitaceae families, including the *Beauveria, Metarhizium, Isaria, Hirsutella, Lecanicillium, Simplicillium, Aschersonia, Cordyceps, Purpureocillium, Entomophthora, Acanthomyces* and *Gibellulla* genera. It also houses some reference variants from the Agricultural Research Service Collection of Entomopathogenic Fungi (ARSEF).

The National Agro-Alimentary Health, Safety and Quality Service (SENASICA) promotes the use of endemic organisms as agricultural pest control agents. An aspect of the primary collection activities is directing the search for entomopathogenic fungi that are present in different agricultural areas to isolate and purify new variants that would enrich and increase the

diversity of the collection. This makes possible to select virulent variants to address the main agricultural phytosanitary issues in Mexico. Under this work scheme, isolated samples of many pests such as *Diaphorina citri* (Hemiptera: Psyllidae), *Euwallacea kuroshio* (Coleoptera: Curculionidae) ambrosia beetles, *Melanaphis sacchari* (Hemiptera: Aphididae), *Raoiella indica* (Acari: Tenuipalpidae), and *Drosophila suzukii* (Diptera: Drosophilidae) have been collected. There are also over 100 isolated samples of *Metarhizium rileyi* (Farl.) Kepler, Rehner & Humber obtained from lepidoptera pests (Lepidoptera: Noctuidae) in corn crops, such as *Spodoptera frugiperda, Helicoverpa zea* y *Trichoplusia ni*, that could be useful as a preventive alternative against other lepidoptera pests such as *H. armígera* and *Tuta absoluta* (Lepidoptera: Gelechiidae). The collection also includes mycopathogens associated with the *Hemileia vastatrix* (Berk & Broome - Pucciniales) coffee leaf rust that come from many states in Mexico.

One of the fundamental functions of the collection is to enrich its archive by searching and collecting fungi-infected insects on-site.  The preservation of that material is of the utmost importance and requires the use of the most suitable methods for every acquisition which guarantee a long life for the isolated samples: cryopreservation @ -196°C, lyophilization, and silica gel. These activities are supplemented through the phenotypic and genotypic characterization of the isolated samples, which includes the isolation, purification, identification, and

preservation of separate physiology and biochemistry profile aspects for every isolated sample of interest.

**Objectives**

- Preserve the purity, viability, and genetic stability of the organisms housed by the CHE.
- Increase the number of acquisitions of the Entomopathogenic Fungi Collection through exploration and sample collection on-site.
- Become an actual alternative to synthetic insecticides for managing pests of quarantine relevance in Mexico.

**Services**

- Variant supplier to selected laboratories that provide inputs to address specific biological control programs implemented by the SENASICA.
- Organization of training events at their facilities (courses and workshops).
- Sale of variants to private laboratories, through the SENASICA's web page: https://sistemasssl.senasica.gob.mx/hojaAyuda/eCinco.jsp#pagoProductosEcinco.
- Free-access reservoir of entomopathogenic fungi variants.
- Research residences for bachelor's degree studies (professional practices and social service), and guide tours of its facilities.

**Workshops**

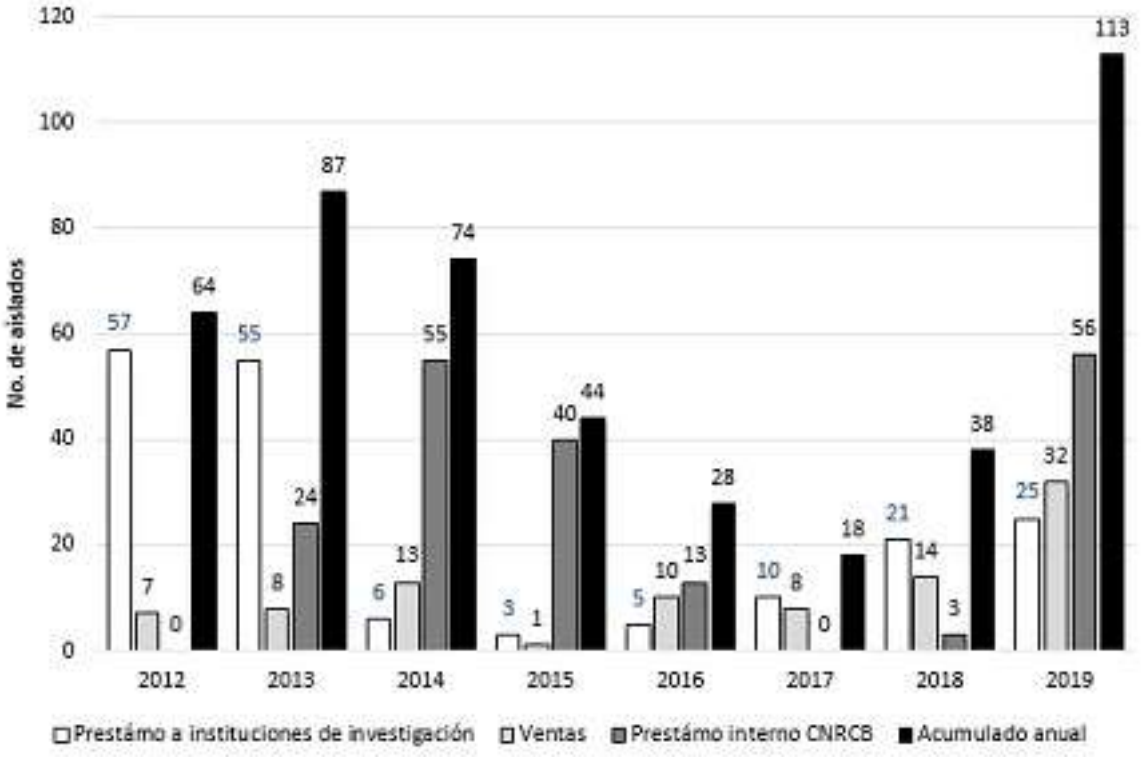
Annual organization and impartation of the "**Entomopathogenic fungi management and massive production workshop**".

Location: Centro Nacional de Referencia de Control Biológico, Tecomán, Colima, México. **8 workshops imparted from 2013 to 2019.**

**Impact-benefit of using the materials of this collection.**

The CHE of the CNRCB is an active collection. From 2012 to 2019, 182 entomopathogenic fungi isolated samples have been lent,

and 93 variants have been sold, mainly to private laboratories. In total, both modalities add up to 275 acquisitions. The biological material has benefited many educational institutions, including the UNAM, IPN, UAM, UANL, and other public and private institutions, as inputs for the development of research projects. In 2019, the University of Alberta, Canada, borrowed 24 variants of *Beauveria bassiana,* for assessing its potential against the *Dendroctonus ponderosae* (Coleoptera: Curculionidae) mountain pine beetle pest. It is worth mentioning that the CHE collaborates with all the areas of the CNRCB and has contributed with a total of 191 isolated samples from 2013 to 2019. All these activities drive the use and application of fungal and microbial agents in the Mexican countryside, to promote a sustainable agriculture.



## Current research lines

The CHE research lines aim to produce preventive technology as an alternative of pest biological control for ambrosial beetles in avocado crops, lepidoptera pests in corn crops, and to combat the coffee leaf rust, among other priority crops included in the 2018-2024 national development plan.

## Work team

**Roberto Montesinos Matias, PhD in Biotechnology, CHE coordinator/researcher.**

Functions: Curator of the collection. Development of research in aspects associated with the exploitation of entomopathogenic fungi. Establishment of cooperation liaisons (advisor for bachelor's

**Miguel Ángel Ayala Zermeño, PhD in Biology Sciences and Health, CHE researcher.**

Functions: Assistant curator of the collection. Develops entomopathogenic fungi phenotypic characterization activities, assessment of virulence

degree and postgraduate level students). Promotion of the development and transfer of microbial control technology through training events.

variables for pests of phytosanitary relevance, and activities in connection with the management and preservation of entomopathogenic fungi.

**Angélica María Berlanga Padilla, PhD in Sciences, CHE researcher.**

Functions: Curator of the collection; exploration, isolation, morphologic characterization and identification, and activities associated with the management and preservation thereof. Experienced in massively produced topical items, and quality control of entomopathogenic fungi.

**José Jesús Ávalos Andrade, agronomist engineer, on-site and laboratory auxiliary technician.**

Functions: Preparation of cultivation media, preservation of isolated samples, extraction of fungal mycelia for molecular identification thereof, among other activities.


Figure 1. Lyophilized variants


Figure 2. Variants preserved in silica gel

Figure 3 Variants stored in liquid nitrogen


Figure 4. Preservation process of entomopathogenic fungi in liquid nitrogen