Edible Lepidoptera in Mexico: Geographic distribution, ethnicity, economic and nutritional importance for rural people

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Abstract
In this paper, we reported the butterflies and moths that are consumed in Mexico. We identified 67 species of Lepidoptera that are eaten principally in their larval stage in 17 states of Mexico. These species belong to 16 families: Arctiidae, Bombycidae, Castniidae, Cossidae, Geometridae, Hepialidae, Hesperiidae, Lasiocampidae, Noctuidae, Nymphalidae, Papilionidae, Pieridae, Pyralidae, Saturniidae, Sesiidae, and Sphingidae. Saturniidae, Pieridae, Noctuidae and Nymphalidae were the more species consumed with 16, 11, 9, and 8 species, respectively. The genera with the largest numbers of species were: Phassus, Phoebis, Hylesia and Spodoptera, with three species. Their local distribution, corresponding to each state of Mexico, is also presented.

Background
Lepidoptera is one of the richest Insecta orders. Their larvae serve as food for many ethnic groups around the world [1,2]; they are often prepared charcoaled in salty water or, in some cases, fried or mixed with other food [3]. Also contribute a great amount of energy and protein to indigenous diet [4]. In general, this reflects their availability. In the forests of the Central African Republic, some species are so abundant, that when they are in the last larval stage, their excrement fall sounding like heavy raindrops, and two months later, the soil becomes white due to the mycelium that develops [Ramos-Elorduy J, Personal observations, 1990]. The inhabitants make good use of them, storing and selling. This help the people to obtain income that is necessary in a subsistence economy. Ancient Mexicans were traded larvae of Pantherodes pardalaria and Aegiale hesperiaris [5]. Peasants know very well when and where is the biggest and tasty larval stage. People even make long journeys to obtain them; however, because of an over-exploitation, as in Zambia happened, establish a law to enforce a closed season, to prevent extinction of Gynanisa maja and Gonimbrasia belina named “mumpa” [6], exploiting it in a rational way to balance preservation and exploitation [7]. The use of insects as food by the different ethnia of Mexico is a very complete study at Mexico that achieve 549 species [8]. We have documented 14 orders of the Insecta Class, including Lepidoptera.
A study of the edible species of Lepidoptera in Mexico has not yet been accomplished.

Methods
Field
Field work was conducted in 17 states of Mexico, including in 235 localities in: Chiapas (16), Chihuahua (2), Distrito Federal (22), Durango (1), Guanajuato (2) Guerrero (8), Hidalgo (64), State of México (51), Michoacán (5), Oaxaca (16), Puebla (17), Querétaro (1), Quintana Roo (2), Tlaxcala (15), Veracruz (10), Yucatán (1) and Zacatecas (2).

Emic-type interviews with an ethicist focus took place [9]; meetings were in rural areas, small towns, villages and cities. Their goal was to investigate the tracking, gathering, fixing and commercialization.
For collected, we use aerial nets, paint-brushes, knives or “machetes” and some by hand.

The larvae and pupal stages were placed in 70% alcohol solution or on dry ice if they were intended for chemical analysis. Adults were placed in potassium cyanide with plaster and then put in glassed paper envelopes labeled with the data.

Laboratory
For identification, adults were placed in a humid camera and mounted; after labeled, identified and catalogued. Forward were placed in the National Collection of Edible Insects of Mexico kept in the Institute of Biology, UNAM. The immature stages were placed in Khale Liquid for preservation. For identification, keys were used [10-17]. Our determinations were ratified by several specialists. With this information, the corresponding tables were elaborated.

The identification of hosts and the ecosystems was accomplished using different sources: De Vries [18], Martínez [19] and Rzedowski [20].

Results and Discussion
Diversity and ethnicity
We identified 67 species of Lepidoptera as being eaten in Mexico, in Table 1 shows family, subfamily, scientific name, places of consumption, developmental stage or stages consumed, common name, principal ethnia that use them as food, hosts, and principal ecosystems where they were localized.

The 13 families are in decreasing order of species number: Saturnidae (16), Pieridae (11), Noctuidae (9), Nymphalidae (8), Sphingidae (4), Arctiidae (4), Hepialidae (3), Hesperiidae, Papilionidae and Geometridae (2) each one, Cossidae, Pyralidae, Sesiidae, Castniidae, Bombycidae, and Lasiocampidae (1) each one (Table 2, Figure 1).

The species number in each genus is indicated in figure 2. It can be seen that most of the genera have only one species included (68.75%), followed by the bispecific (18.75%) and at the end trispecific genera (12.5%).

The most represented genera were Phassus, Phoebis, Hylesia, and Spodoptera (Table 3).

Lepidoptera are eaten in 85.41% as larvae, 8.33% as larvae and pupae and in 6.25% as adults.

We found 29 ethnic groups that consume Lepidoptera in Mexico: Amuzgo, Chatinos, Chinantecos, Cholos, Huasteco, Huaves, Lacandones, Matlazinca, Maya, Mazahua, Mazatecas, Mixes, Mixtec, Nahuatl, Otomi, Otopame, Popolucas, Tarahumara, Tarascan, Tepetlahuano, Tlapancoco, Totonaco, Tojolabal, Triques, Tzeltal, Tzotzil, Yutoazteca, Zapotec and Zoques.

Geographic Distribution
These Lepidoptera species were found in those states of the central, south and southeast regions of the country. The highest number of species (22) was recorded in the eastern part of Veracruz, followed by Hidalgo (17), Distrito Federal (the capital) (16), and Chiapas and Puebla (12 species each). The remaining states, each one had six or fewer edible species.

With regard to the ecosystems [20], these species are attached from the pine oak forest, to the savannah and palmar. The Lepidoptera are also present in several agronomic plants, such as maize, alfalfa, cabbage and cauliflower, depending on the species.

Anthropolarvifagia of Lepidoptera in the World
Bergier [21] reports 15 species for the world, for America only one species Hesperiaris sp., in two countries. Taylor [22] registered 25 species in 12 families. Silow [23] describes 42 species of the genera Gonimbrasia, Imbrasia, Bunaea, Bunaeopsis, Cirina, Pseudantheraea, Micragone, Olocerina, and Melanocera, 33 of them are eaten in Zambia. It is important to mention that all these authors only did bibliographic research. In contrast, Malaisse and Parent [24] performed long-term field work studying Meridian Shaba area in Republic of Congo and in Zambia reporting 37 species (70% classified) and Latham [25] in Low-Congo, documented 31 species (77% classified). In both studies, the principal families were Attacidae and Notodontidae. Banjo et al. [26] reported six species in Nigeria, four of Anaphe genus. Oliveira et al. [27] also reported four species eaten in Angola. We note that six references are books and almost all refer to Africa.

Wen [28] in China presented 66 species, 20 genera and 17 families; 36 species of Hepialus genus. Mitsuhashi [29] reported five species in Japan.

Paoletti et al. [30] noted that larvae of Castniidae, Noctuidae and Sphingidae families are consumed in the Amazon area. Our report has 67 species occurring in just a part of the country.

Rural Nutritional Importance
For rural peasants, the big diversity that Edible Lepidoptera has, besides the good nutritive value achieve (18-57% proteins, 7-77% fats, 0.7-8% minerals, 0.8-25% carbohydrates and 3-29% crude fiber, 231-777 kcal/100 g, [4], and their good flavor that gives their fats, united to the abundance of their populations, conspicuousity of their specimens (latest larva stage) that save various important nutrients as proteins and the numerous muscles they posses, combined with their quick preparation (only roasted or boiled), and their innocuity, the easiness to store, make of them an item very searched plus their versability of fix make the Lepidopterans a suitable food,
### Table 1 TAXONOMY

**FAMILY HEPIALIDAE**

1. **Phassus trajesa**  
   **Schaus.**  
   **Places:** Argovia, Independencia, Ixtapa, Chiapas.  
   **Edible stage:** larvae.  
   **Common names:** gusanillo (Esp), gusano tindáco (Zap), gusano yutu lolo (Mix).  
   **Ethnos:** Maya, tzotzil, tzeltal, chol, lacandon, tojolabal.  
   **Host:** *Buddleia americana* L., *Senecio salignus* D.C.  
   **Ecosystems:** Pine-oak forest, Tropical deciduous forest, Arid tropical scrub, Cloud forest, Rain forest.

2. **Phassus triangularis**  
   **Edwards. 1885**  
   **Places:** Santa Ana Tlacotenco, San Pablo Oztotepec, San Salvador Cuahtenco, San Pedro Atocpan, San Bartolo Xicomulco, San Antonio Teconmitl, Milpa Alta, DF. San Rafael, Pueblo Nuevo, Amanalcó de Becerra, Tenancingo, Tequixquiac, Valle de Bravo, *(Mex)*. Yosotato, Coatzospan, Jamiltepec, Oaxaca. Necoxta, Zongolica, Veracruz.  
   **Edible stage:** larvae.  
   **Common names:** Gusanillo (Esp), gusano rayado (Esp), gusano grande (Esp), nduyacacitl (Mix), gusano gordo de la jarilla (Esp), chiáhuitl (Ntl).  
   **Ethnos:** Yutoazteca, Nàhuatl, Otomí, Otopame, Mazahua, Matlazinca, Zapotec, Mixteco, Chatinos, Chinantecos, Mazatecos, Zoques, Triques, Huave.  
   **Host:** *Buddleia parviflora* H.B.K., *Senecio salignus* D.C.  
   **Ecosystems:** Arid tropical scrub, Rain forest.

3. **Phassus sp.**  
   **Places:** San Bartolo Xicomulco, San Pedro Atocpan, Milpa Alta, DF. Oztotepec, Cuitzalan, Alchichica. Puebla. Felipe Carrillo Puerto, Quintana Roo. San Pablo del Monte, Xicoténcatl, Tetla, Tlaxcala. Chocamán, Veracruz.  
   **Edible stage:** larvae.  
   **Common name:** gusanillo (Esp), gusano del aile (Esp), gusano del Tepozán (Xoc), calpulocuillin (Ntl).  
   **Ethnos:** Yutoazteca, Nàhuatl, Otomí, Otopame, Mazahua, Matlazinca, Chatinos, Chinantecos, Mazatecos, Huave.  
   **Host:** *Senecio salignus* D.C.  
   **Ecosystems:** Arid tropical scrub, Rain forest.

**FAMILY COSSIDAE**

4. **Comadia redtenbacheri**  
   **Hammerschmidt 1848**  
   **Places:** San Pedro Atocpan, San Salvador Cuahtenco, San Jerónimo Miacatlán, Santa Ana Tlacotenco, San Bartolo Xicomulco, San Lorenzo Tlazaculco, San Agustín Obotitlán, San Antonio Tecotitlán, Francisco Tecotitlán, San Juan Tepetitán, Milpa Alta, DF. San Bartolo Morelos, Santiago Tianguistenco, Almoloya de Juárez, Villa Nicolás Regla. Comadia, Teocaltenco, Carpiñostec, Atlaxcalco, Durango, Huasca, Huayacán, Hidalgo. Cañada, Coatzhou, Jamiltepec, San Juan Coatzalan, Yosotato Oaxaca. Santiago Yanchitlalán, Cuetzalan, Alchichica. Puebla. Felipe Carrillo Puerto, Quintana Roo. San Pablo del Monte, Xicoténcatl, Tetla, Tlaxcala. Chocamán, Veracruz.  
   **Edible stage:** larvae.  
   **Common name:** gusanillo (Esp), gusano del aile (Esp), gusano del Tepozán (Xoc), calpulocuillin (Ntl).  
   **Ethnos:** Yutoazteca, Nàhuatl, Otomí, Otopame, Mazahua, Matlazinca, Mixteco, Chatinos, Chinantecos, Mazatecos, Huave.  
   **Host:** *Senecio salignus* D.C.  
   **Ecosystems:** Desert.
### Table 1 TAXONOMY (Continued)

#### FAMILY PYRALIDAE

5. **Subfamily Pyraustinae**

*Laniifera cyclades* Druce 1895

**Places:** San Antonio Teconil, San Francisco Teconil, San Agustín Teotitlán, Milpa Alta, Tlaltenco, DF; San Pablo Jalalpan, Oxtotipac, Cerro de las Promesas, Acuitlapilco, Cananejas, Los Reyes, San Juan Teotihuacan, Mex: Ajacuba, Cordonal, Chapantongo, Cuautapex, Texcalinco, Valle del Mezquital, Hueyapan, Tulancingo, Santo Tomás, Tezontepeque, Maravillas, Actopan, Alfaajuyucan, El Dexthi, San Juanico, Ixmiquilpan, *Hidalgo*, Tetla, Tlaxcala.

**Edible stage:** Larvae.

**Common names:** *gusano del nopal* (Esp), *citlacuilli* (Oto), *citlalin* (Ntl).

**Ethnos:** Yutoazteca, Náhuatl, Otomí, Otozomme, Mazahua, Matlazinca.

**Host:** *Opuntia* spp.

**Ecosystems:** Desert.

#### FAMILY SESIIDAE

6. **Subfamily Sesiinae**

*Synanthedon cardinalis* Dampf.

**Places:** Meseta Tarasca, Michoacán.

**Edible stage:** Larvae.

**Common names:** *gusanos cremosos*, *gusano blanco, mantecoso* (Esp), *cuillin* (Ntl).

**Ethnos:** Tarasco, Náhuatl, Otomí.

**Host:** *Pinus* spp.

**Ecosystems:** Pine-oak forest.

#### FAMILY CASTNIIDAE

7. **Subfamily Castniinae**

*Castnia synpalamides chelone* (Hopffer 1856) (Figure 4)

**Places:** San Sebastián Jonacapa, Texcalinco, Mixquiahuala, Valle del Mezquital, Venustiano Carranza, Xochitlán, Maravillas, Santa Ana Bertha, Tula de Allende, Zimapán, Pachuca, Singuilucán, Tezontepeque, Tula, Cuautapex, Chapantongo, Chilcuautla, Santo Tomás, Golondrinas, El Dexthi, San Juanico, Ixmiquilpan, Trancas, Ismolintla, Cantayame, *Hidalgo*.

**Edible stage:** Larvae.

**Common names:** *gusano del junquillo* (Esp), *gusanito* (Esp), *tzc* (Oto), *papalotillo* (Esp).

**Ethnos:** Náhuatl, Otomí.

**Host:** *Agave striata* Zucc.

**Ecosystems:** Desert.

#### FAMILY GEOMETRIDAE

8. **Subfamily Ennominae**

*Acronyctodes mexicanaria* (Walker 1860)

**Places:** Topilejo, Santa Ana Tlactecuico, San Lorenzo Tlacojucan, San Juan Tepenahuauc, San Pedro Actopan, Milpa Alta, DF.

**Edible stage:** Larvae and pupae.

**Common names:** *Temictli* (Oto), Tetatamachiuhqui (Ntl).

**Ethnos:** Yutozomme, Náhuatl, Otomí.

**Host:** *Budleia* spp.

**Ecosystems:** Savanna, arid tropical scrub, Oak-Forest.

9. **Subfamily Ennominae**

*Panthera pardalaria*Hubner 1823

**Places:** San Simón Tlatlahuipala *Tlaxcala*, Torres del Potrero DF.

**Edible stage:** Larvae.

**Common names:** Huitzitsi (Oto).

**Ethnos:** Náhuatl, Otomí, Yutoazteca.

**Host:** Family Graminae

**Ecosystems:** Cultures of graminae.
Table 1 TAXONOMY (Continued)

FAMILY HESPERIIDAE (Figura 5)

10. - Subfamily Megathyminae

*Aegiale hesperiaris* (Walker 1856) (Figure 5)

**Places:** San Pedro Atotcan, San Salvador Cuahétenco, San Jerónimo Miacatlán, Santa Ana Tlacotencan, San Bartolo Xicomulco, San Lorenzo Tlapocoyan, San Agustín Ohtenco, San Pablo Oztotepec, San Antonio Tecomí, San Francisco Tecoxpa, San Juan Tepehuanac, Milpa Alta DF, San Juan Zitlaltepetl, Santa María Jajalpan, Lomas de Guadalupe, Cuautitlán Izcalli, Cuautitlán de Romero Rubio, Aculco, Almoloya de Juárez, Santiago Tianguistencan, Almoloya del Río, Atlatlcomulco, Ixtlahuaca, Jalatlaco, Ixtipetec, Zumpango, Los Reyes, Ozumba, San Pablo Jalapan, Toluca, Villa del Carbón, Villa Nicolás Romero, Otumba, Arroyo Zarco, Santiago Tlapa, El Oro, Aquatepec, San Pedro de los Baños, San Mateo, Mex, Guanajuato, Guanajuato, Santo Tomás, Huichapán, Chilcuautla, San Nicolás Atexcoco, Maravillas, Zimapán, Cuautpec, Jacalá, Pinalito, Ixmiquilpan, Pozuelos, Cieneguillas, Ajacuba, Apan, Atotonilco el Grande, Atotonilco de Tula, Texcaltepec, Tlalcingo, Tlalcingo, Durango, El Cajón, Pachuquilla, San Miguel Regla, Metztitlán Mixquitla, Molango, Pachuca, Singuilucan, Tula de Allende, Trancas, Isomolintla, Venustiano Carranza, Yate de Guadalupe, San Sebastián Jonacapa, Tinaco, Santa Ana Bertha, Tezontepec, Chipantongo, Tepetitlán, El Sauce, Ixtaltepec, Alfajayucan, El Dethi, San Juanico, Ixmiquilpan, Hidalgo Tlapujahua, San Pedro Tarimbaro Michoacán, Santa María Nduya, Santiago Apoala, Oaxaca, Ciudad Serdán, Acatlan de Osorio, Puebla, San Juan del Río, Querétaro, Calpulalpan, Cuapixtla, Huamantla, Ixtacuixtla, Nativitas, San Pablo del Monte, Tetla, Totolac, Xicotencatl, Mariano Matamoro, Tlaxcoapan, Tulancingo, Durango, el Cajón, Pachuquilla, San Miguel Regla, Perote, Naolinco, Veracruz, Fresnillo, Zacatecas.

**Edible stage:** larvae.

**Common name:** gusano blanco del maguey (Esp), gusanito del maguey (Esp), meocuiles (Ntl), meocuilines (Ntl), ticoco andabi (Mix), zat (Zap), yabi (My), guiaches (Maz), Nnchaama (Tar), Chucugame (Mat), huitzipapalotl (Ntl), papalotl (Ntl).

**Ethnos:** Yutoazteca, Náhuatl, Otomí, Otopame, Mazahua, Matlazinca, Tarasco, Zapoteco, Mixteco, Totonaco, Huasteco, Maya.

**Host:**
- *Agave atrovirens* Karw.,
- *A. salmiana* Otto ex Salm,
- *A. mapisaga* Trel,
- *A. lehmanni* Jacobi,
- *A. maximiliana*, Baker.
- *A.* americana.

**Ecosystems:** Desert, pine-oak forest.

11. - Subfamily Pyrginae

*Achlyodes pallida* (Felder, 1869)

**Places:** San Pablo Huixtepec, Oaxaca, Tenejapa, Chiapas.

**Edible stage:** Larvae.

**Common names:** chiáhuitl (Mix), saltadora (Esp), papalotl (Ntl).

**Ethnos:** Zapoteco, Mixteco, Mixe, Populaca, Chatino, Chinanteco, Mazateco, Zoque, Trique, Huave, Tojolabal, Maya, Tzotzil, Tzeltal, Chol, Lacandón.

**Host:**
- *Agave atrovirens* Karw.,
- *A. salmiana* Otto ex Salm,
- *A. mapisaga* Trel,
- *A. lehmanni* Jacobi,
- *A. maximiliana*, Baker.
- *A.* americana.

**Ecosystems:** Cultures of lucerne and maize.

FAMILY PAPILIONIDAE

12.- Subfamily Papilioninae

*Protographium philolaus philolaus* (Boisduval, 1836) (Figure 6)

**Places:** Caézim, Yucatán.

**Edible stage:** Larvae.

**Common name:** Tlilizic (My).

**Ethnos:** Maya.

**Host:**
- *Annona cherimola*,
- *A. diversifolia*,
- *A. purpurea*,
- *A. reticulata*,
- *Desmopsis bibracteata* and *Sapranthus* spp.

**Ecosystems:** Tropical deciduous forest.

13. - Subfamily Papilioninae

*Pterourus multicaudata multicaudata* (Kirby, 1884)

**Places:** Santiago Tezontlale, Hidalgo.

**Edible stage:** adult.

**Common name:** mariposa de colores (Esp), xochiquetzal (Ntl).

**Ethnos:** Náhuatl, Otomí.

**Host:**
- *Fraxinus sp*.,
- *Prunus persica* L.,
- *P. serotina* capuli.

**Ecosystems:** Deciduous forest, Oak forest.

FAMILY PIERIDAE

14.- Subfamily Coliadinae

*Phoebis agarithe agarithe* (Boisduval, 1836) (Figure 7)

**Places:** Caézim, Yucatán.
| Edible stage      | Larvae                          |
|-------------------|--------------------------------|
| Common names      | gusano pinto (Esp), pintillo (Esp), clac (My), xicalpapalotl (Ntl) |
| Ethnos            | Maya                           |
| Host              | Cassia tomentosa L., Inga sp.  |
| Ecosystems        | Tropical deciduous forest      |

15. - Subfamily Coliadinae

*Phoebis philea philea* (Linnaeus 1763)

| Places            | Celaya, Irapuato, Guanajuato |
|-------------------|------------------------------|
| Edible stage      | Larvae                       |
| Common name       | Ocuil (Ntl)                  |
| Ethnos            | Otomi, Tarasco.              |
| Host              | Cassia tomentosa L., Senna spp. |
| Ecosystems        | “Acahual”                    |

16. - Subfamily Coliadinae

*Phoebis sennae marcellina* (Cramer 1779)

| Places            | San Juan Tezompa, Villa Guerrero, Mex |
|-------------------|---------------------------------------|
| Edible stage      | Larvae                                |
| Common names      | Tlaxic (Oto), Papalotl (Ntl), Tzauhqui (Maz). |
| Ethnos            | Otopame, Mazahua, Matlazinca.          |
| Host              | Cassia sp.; Senna, Inga               |
| Ecosystems        | “Acahual”                              |

17. - Subfamily Coliadinae

*Eurema salome jamapa* (Reakirt 1866)

| Places            | Tempocal de Sánchez, Veracruz       |
|-------------------|-------------------------------------|
| Edible stage      | Larvae                              |
| Common names      | Papalotl (Ntl)                      |
| Ethnos            | Totonaco, Huasteco.                 |
| Host              | Picramnia sp, Diphysa robinoides Benth |
| Ecosystems        | “Acahual”                            |

18. - Subfamily Pierinae

*Eucheria socialis socialis* (Westwood 1834) (Figure 8).

| Places            | San Cristóbal de las Casas, Chiapas, Caborachi y sudeste de Chihuahua, San Antonio Tecomitl, San Francisco Tecoxpa, San Mateo, San Lorenzo Tlacuandula, San Agustín Ohtencil, Santa Ana Tlacotengo, San Jerónimo Macatlán, Milpa Alta, Tlatenoco, Topilejo, DF, La Michilia, Durango, Donato Guerra, Villa Victoria, Cerro de las Promesas, Oxtotipac, San Pablo Jalalpan, Valle de Bravo, Villa de Allende, Mex. Chacoalcingo, Guerrero, Santo Tomás, Valle del Mezquital, Atlapexco, Huasca, Durango, Tecocomulco, Actopán, Maravillas, Tezontepec, Hidalgo, Tlapujahua, Cerro del Gallo, San Pedro Tarínbaro, Michoacán, Nochixtlián, Santa María Nduayaco, Santa María de la Asunción, Tlaxiaco, Oaxaca, Ciudad Serdán, Chignahuapan, Tetela de Ocampo, Puebla, Tetla, Tlaxcala, Orizaba, Veracruz |
| Edible stage      | Larvae                              |
| Common name       | mariposa del madroño (Esp), gusano del madroño (Esp), gusano verde de la mixteca (Esp), Nnchaama (Tar). |
| Ethnos            | Maya, Tzotzil, Tzeltal, Chol, Lacandon, Tojolabal Tarahumara, Yutoazteca, Náhuatl, Otomi, Tepehuano, Otopame, Mazahua, Matlazinca, Tlapaneco, Amuzgo, Tarasco, Zapotec, Mixteco, Mixe, Popoluca, Chatino, Chinantepec, Mazateco, Zoque, Trique, Huave, Totonaco, Huasteco. |
| Host              | Arbutus xalapensis H.B.K. A. anizonica, A. glandulosa and A. macrophylla |
| Ecosystems        | Pine-Oak forest, Arid tropical scrub. |

19. - Subfamily Pierinae

*Eucheria socialis westwoodi* (Beutelspacher 1984).

| Places            | La Michilia, Durango               |
| Edible stage      | Larvae                              |
| Common name       | mariposa del madroño (Esp), gusano del madroño (Esp), gusano verde de la mixteca (Esp), Nnchaama (Tar). |
| Ethnos            | Tepehuano, Tarahumara.             |
| Host              | Arbutus sp.                        |
| Ecosystems        | Pine-Oak forest, Arid tropical scrub. |
| Subfamily | Scientific Name | 20. Place | Edible stage | Common name | Ethnos | Host | Ecosystems |
|-----------|----------------|-----------|--------------|-------------|--------|------|------------|
| Pierinae  | *Catasticta teutila teutila* Doubleday 1847 (Figures 9 and 10) | San Francisco Tlalnepantla, Xochimilco, Santa Ana Tlacotenco Milpa Alta, Topilejo, DF. Juchitepec, Mex. Santa María Nduyaco, Santiago Apoala, Oaxaca. | larvae, pupae | Mariposa del tejocote (Esp), Tlilpapálotl (Ntl) | Yutoazteca, Náhuatl, Otomí, Otopame, Mazahua, Matlazinca, Zapoteco, Mixteco, Mixe, Popoluca, Chatino, Chinanteeco, Mazateco, Zoque, Trique, Huave. | *Viscum álbum* L. *Phoradendron velutinum* (DC) Nutt. | Pine-oak forest, Tropical evergreen forest and Tropical deciduous forest. |

| Subfamily | Scientific Name | 21. Place | Edible stage | Common name | Ethnos | Host | Ecosystems |
|-----------|----------------|-----------|--------------|-------------|--------|------|------------|
| Pierinae  | *Catasticta flisa flisa* Herrich-Schäffer 1853 | San Francisco Tlalnepantla, Xochimilco, Milpa Alta, DF. | larvae | Mariposa del tejocote (Esp), Nixtapapalotl (Ntl) | Yutoazteca, Náhuatl, Otomí. | *Phoradendron velutinum* (DC) Nutt. | Pine-oak forest, Tropical evergreen forest and thorn forest. |

| Subfamily | Scientific Name | 22. Place | Edible stage | Common name | Ethnos | Host | Ecosystems |
|-----------|----------------|-----------|--------------|-------------|--------|------|------------|
| Pierinae  | *Catasticta nimbice nimbice* Boisduval, 1836 | San Francisco Tlalnepantla, Xochimilco, Milpa Alta, DF. | larvae | Papalotl (Ntl), Papalotontle (Oto). | Yutoazteca, Náhuatl, Otomí. | *Phoradendron velutinum* (DC) Nutt. | Pine-oak forest, Tropical evergreen forest and thorn forest. |

| Subfamily | Scientific Name | 23. Place | Edible stage | Common name | Ethnos | Host | Ecosystems |
|-----------|----------------|-----------|--------------|-------------|--------|------|------------|
| Pierinae  | *Pontia protodice* Boisduval & Leconte 1829 | Valle de México. | Larvae. | Tilpapalotl (Ntl) | Otopame, Mazahua, Matlazinca. | *Brassica oleracea* L. | Cultures of lucerne, cabbage, and Oak Forest. |

| Subfamily | Scientific Name | 24. Place | Edible stage | Common name | Ethnos | Host | Ecosystems |
|-----------|----------------|-----------|--------------|-------------|--------|------|------------|
| Pierinae  | *Leptophobia aripa elodia* Boisduval, 1836 | Valle de México. | larvae. | Chiahuítl (Oto) | Otopame, Mazahua, Matlazinca. | *Brassica rapa* L., *Lepidium sativum* L., *Tropaeolum majus* L. | Cultures of cabbage, cauliflower and broccoli. |

| Subfamily | Scientific Name | 25. Place | Edible stage | Common name | Ethnos | Host | Ecosystems |
|-----------|----------------|-----------|--------------|-------------|--------|------|------------|
| Nymphalinae | *Vanessa annabella* Field 1971 | Santo Tomás, Hidalgo. | larvae and pupae | gusano (Esp), Papalotepito (Ntl), Quiloculin (Oto). | Náhuatl, Otomí. | *Malva* sp., *Althaea rosea* L. | Pine-oak forest, arid tropical scrub. |
| No. | Subfamily | Common Name | Edible Stage | Common Name (Esp) | Common Name (Ntl) | Host | Ecosystems |
|-----|-----------|-------------|--------------|------------------|------------------|------|------------|
| 26. | Nymphalinae | Vanessa virginiensis | larvae and pupae. | gusano del llano (Esp) | cochipilotl (Ntl). | Antirrhinum sp., Senecio salignus D.C., Gnaphalium sp., Antennaria sp., Anaphalis sp., Myosotis sp. | Pine-oak forest, arid tropical scrub. |
| 27. | Nymphalinae | Nymphalis antiopa antiopa | larvae. | Temictli (Ntl). | | Salyx babilonica L., Salix sp., Betula, Populus, Celtis, Ulmus | Rain forest, Tropical deciduous forest. |
| 28. | Nymphalinae | Chlosyne lacinia lacinia | larvae. | Gusanito (Esp). | | Helianthus annus L., Xanthium sp., Verbesina sp., Ambrosia sp. | Rain forest, tropical deciduous forest. |
| 29. | Biblidinae | Hamadryas sp | larvae. | Maya. | | Dalechampia sp. Tragia sp. | Tropical deciduous forest. |
| 30. | Satyrinae | Pareuptychia metaleuca | larvae. | gusano gordo, tzotlimichi. | | Panicum sp. Totonaco, Huastrate, Náhuatl, Yutoazteca, Maya, Tzotzil, Tzeltal, chol, Lacandon, Tojolabal. | Rain forest, Tropical deciduous forest, Pine-oak-forest, thorn forest. |
| 31. | Danainae | Danaus gilippus thersippus | larvae. | mariposa del tizmo (Esp), mariposa tiznada (Esp), papalotli (Ntl). | | Asclepias linaria Cav., A. curassavica L., Vincetoxicum sp., Philibertia sp., Nerium sp., Stapelia sp. | Pine-oak forest, Tropical evergreen forest. |
| No. | Subfamily | Species | Place(s) | Edible stage | Common name | Host | Ecosystems |
|-----|-----------|---------|----------|--------------|-------------|------|------------|
| 32. | Danainae | Danaus plexippus plexippus | Tenejapa, Chiapas, Santo Tomás, Tecozautla, Hidalgo, Angangueo, Michoacán | adult | mariposa monarca (Esp), mariposa voladora (Esp), mariposa viajera (Esp), xicalpapálotl (Ntl) | Asclepias linaria Cav., A. curassavica L. | Pine-oak forest, Tropical evergreen forest |
| 33. | Bombycinae | Bombyx mori | Yosotato, Oaxaca | larvae | gusano de seda (Esp), sedaocuilin (Ntl), tzauhquiocuilin (Ntl) | Morus rubra var rubra L. | Cloud forest, Rain forest |
| 34. | Lasiocampinae | Eutachyptera psidii | Laguna Atezca, Molango, Hidalgo | larvae | Mecta'che (Ntl), tecilli (Oto) | | Cloud forest |
| 35. | Arsenurinae | Arsenura armida | Molango, Hidalgo, Jamiltepec, Oaxaca, Cuezalán, Santiago Yacuitalpan, Coatepec de Matamoros, Acatlan de Osorio Puebla, Santiago Tuxtla, Los Tuxtlas, el Bajío, Chocamán, Tzcohuapa, Veracruz | larvae | Cuecla (Ntl), serpiente de mil cabezas (Esp), culebron (Esp), chonocoille (Mix), cuetano (Mix), pochocuil (Zap), Zapala (Mix), tilpapálotl (Ntl), Tecooco (Pop) | Ceiba pentandra L. (Pochote), Chorisia sp., Heliocarpus appendiculatus Turcz. | Tropical deciduous forest, Tropical evergreen forest, Pine-oak forest |
| 36. | Arsenurinae | Arsenura polyodonta | Atzitzihuacán, Atlixco, Puebla | larvae | cuecla (Ntl), zats (Tot), cuiltame (Maz), gusano del jonote (Esp) | | Pine-oak forest |
| 37. | Arsenurinae | Caio championi | sur de Veracruz | larvae | | Malvaceae, Tiliaceae, Chorisia sp. | Pine-oak forest |
Table 1 TAXONOMY (Continued)

| Host       | Ecosystems                                    |
|------------|-----------------------------------------------|
| Bombacopsis sp., Chorisia sp., Tilia sp. | Tropical deciduous forest, Tropical evergreen forest. |

38. **Subfamily** Arserurinae

**Caio richardsoni** (Drude, 1890).

**Places**: Cahuaré, Chapantongo Hidalgo.

**Edible stage**: Larvae.

**Common names**: Guano oscuro (Esp), ocul (Ntl), culli (Oto).

**Ethnos**: Maya, Tzotzil, Tzeltal, Chol, Lacandon, Tojolabal, Nahuahtl, Otomi.

**Host**: Chorisia sp., Ceiba pentandra L.

**Ecosystems**: Mesquite-grassland, Arid tropical scrub, Tropical deciduous forest, Tropical evergreen forest.

39. **Subfamily** Ceratocampinae

**Eacles aff. ormondei yucatanensis** (Lemaire, 1988)

**Places**: Zongolica, Ixcohuapa Veracruz.

**Edible stage**: Larvae.

**Common name**: Tlecocoz (Oto).

**Ethnos**: Náhuatl, Yutoazteca, Otomí.

**Host**: Quercus sp., Rhus sp.

**Ecosystems**: Cloud forest, Oak-forest.

40. **Subfamily** Ceratocampinae

**Eacles** sp. Hübner

**Places**: Puerto Morelos, Quintana Roo.

**Edible stage**: Larvae.

**Common name**: gusanito (Esp), xixicalticon (My).

**Ethnos**: Maya.

**Host**: Malvaceae, Melastomataceae.

**Ecosystems**: Tropical evergreen forest.

41. **Subfamily** Hemileucinae

**Hemileuca** sp. (Walker, 1855)

**Places**: Zinacantepec, Mercado de Toluca, Almoloya de Juárez, Calixtlahuaca, Villa Victoria, Mex.

**Edible stage**: Larvae.

**Common name**: zacamiches (Maz).

**Ethnos**: Otopame, Mazahua, Matlazinca.

**Host**: Salix sp., Fagaceae, Leguminosae, Rosaceae.

**Ecosystems**: Pine-Oak forest.

42. **Subfamily** Hemileucinae

**Hylesia frigida** Schaus, 1911.

**Places**: Navenchauc, Zinacantán, Coapilla, Chiapas. Santa María Nduayaco, Santiago Apoala, Asunción Nochixtlán, Oaxaca.

**Edible stage**: Larvae.

**Common name**: Nh-chám (Tzo), calociullin (Ntl), calociullin (Tze).

**Ethnos**: Maya, Tzotzil, Tzeltal, Chol, Lacandon, Tojolabal, Zapoteco, Mixteco, Mixe, Popoloca, Chatino, Chinanteco, Mazateco, Zoque, Trique, Huave.

**Host**: Pinus sp., Bursera sp. Anacardiaceae, Lauraceae, Melastomataceae.

**Ecosystems**: Pine-oak forest, Pine-Forest, Cloud forest, Deciduous Forest.

43. **Subfamily** Hemileucinae

**Hylesia coinopus** Dyar, 1913.

**Places**: Cahuaré, Chiapas.

**Edible stage**: Larvae.

**Common name**: mariposa de hilo grande (Esp), ciulicuactl (Tze).

**Ethnos**: Maya, Tzotzil, Tzeltal, Chol, Lacandon, Tojolabal.

**Host**: Pinus sp., Bursera sp. Anacardiaceae, Lauraceae, Melastomataceae.

**Ecosystems**: Tropical deciduous forest.
| #  | Subfamily | Taxonomy | Places | Edible stage | Common names | Ethnos | Host | Ecosystems |
|----|-----------|----------|--------|--------------|--------------|--------|------|-----------|
| 44.| Hemileucinae | Hylesia sp. | Santa María Asunción, Tlaxiaco, Santa María Nduayaco, Asunción Nochixtlán, Oaxaca | Larvae | Cuitlicalli (Mix) | Zapoteco, Mixteco, Mixe, Popolaca, Chatinos, Chinantecos, Mazatecos, Zoques, Triques, Huave. | Pinus sp., Bursera sp. | Pine-oak forest, Savannah, Desert, Palmar |
| 45.| Hemileucinae | Paradirphia hoegei (Druce, 1886) | Tehuacán Puebla | Larvae | Cuchamac (Ntl) | Nahuatl, Totonaco. | Platanus lindeniana Mart et Gall, Salix chilensis Mol., Prunus sp., Robinia sp. | Rain forest, Tropical decidous forest, Decidous forest, Oak forest |
| 46.| Hemileucinae | Paradirphia fumosa (Felder, 1874) | Zapotitlán y regiones circunvecinas en la reserva de la Biosfera Tehuacán, Puebla | Larvae | cuchamá (Ntl) | Nahuatl, Totonaco. | Eysenhardtia polystachya, Ortega (Sarg), Prosopis laevigata, Cercidium praeceps (R et Pav) Haráš, Acacia constricta Benth. | Rain forest, Tropical decidous forest, Decidous forest, Oak forest, Arid tropical scrub |
| 47.| Hemileucinae | Pseudodirphia mexicana (Bouvier, 1924) | Zongolica, Veracruz | Adult | | Náhuatl, Yutoazteca, Otomi. | Fagus sp., Quercus sp., Ulmáceae, Leguminosae, Rosaceae, Fraxinus uhdei (Wenz) Ling. | Cloud forest, Oak forest |
| 48.| Saturniinae | Antheraea polyphemus mexicana (Hoffmann, 1942) | Zongolica, Veracruz | Larvae | Tzucalli (Oto) | Náhuatl, Yutoazteca, Otomi. | Quercus sp., Juglans sp., Tilia sp., Prunus sp., Crataegus sp., Salix sp. | Oak forest, Deciduous forest |
| 49.| Saturniinae | Actias luna (Linnaeus, 1758) (Figure 13) | Sierra Tarahumara, Chihuahua | Larvae | gusano manchado (Esp), cola de novia (Esp) | Tarahumara. | Liquidambar sp., Juglans cinerea L., Diospyros virginiana L., Quercus rubra L. | Cloud forest, Pine-Oak forest, Desert |
| 50.| Saturniinae | Actias truncatipennis (Sonthonnax 1899) | Sierra Tarahumara, Chihuahua | Larvae | | | | |
Table 1 TAXONOMY (Continued)

| Common name | ethnos | Host | Ecosystems |
|--------------|--------|------|------------|
| gusano gordo (Esp), papalotli (Ntl). | Tarahumara. | Liquidambar sp, Juglandaceae | Cloud forest. |
| **FAMILY SPHINGIDAE** | | | |
| 51. Subfamily Macroglossinae | | | |
| *Pachylia ficus* (Linnaeus, 1758) | | | |
| Places: Motozintla, Chiapas | Edible stage: larvae. | Common name: gusano (Esp). | Ethnos: Maya, Tzotzil, Tzeltal, Chol, Lacandon, Tojolabal. |
| | | Host: *Ficus cookii* Stand. | |
| | | Ecosystems: Forest of *Poepigia procera* Presl. | |
| 52. Subfamily Sphinginae | | | |
| *Cocytius antaeus* (Cramer, 1777) (Figure 14). | | | |
| Places: Cahuaré, Chiapas, Tixtla, Guerrero | Edible stage: larvae. | Common name: gusano cornudo (Esp), gusano del cuerno (Esp). | Ethnos: Maya, Tzotzil, Tzeltal, Chol, Lacandon, Tojolabal, Náhuatl, Tlapaneco, Amuzgo. |
| | | Host: *Anona* spp. | |
| | | Ecosystems: Thorn forest. | |
| 53. Subfamily Sphinginae | | | |
| *Manduca sexta* (Linnaeus, 1763). | | | |
| Places: Cahuaré, Chiapas, Ixcohuapa, Veracruz | Edible stage: larvae, adult. | Common name: gusano grande verde (Esp). | Ethnos: Náhuatl, Yutoazteca, Otomi. |
| | | Host: *Nicotiana tabacum* L. | |
| | | Ecosystems: Cloud forest, Oak forest. | |
| 54. Subfamily Sphinginae | | | |
| *Manduca* sp | | | |
| Places: Ixcohuapa, Veracruz | Edible stage: larvae, adult. | Common name: gusano grande verde (Esp). | Ethnos: Náhuatl, Yutoazteca, Otomi. |
| | | Host: *Nicotiana tabacum* L. | |
| | | Ecosystems: Cloud forest. | |
| **FAMILY NOCTUIDAE** | | | |
| 55. Subfamily Calpinaeae | | | |
| *Ascalapha odorata* (Linneaus, 1758) (Figure 15). | | | |
| Places: Tuxtla Gutiérrez, Bochil, Frontera, Bethel, Selva Lacandona, Chiapas. Coyoacán, DF. Tixtla, El Potrero, Zacazonapan, Colotlita, Mezquital, Quechultenango, Chilpancingo, Guerrero. Teotitlán del Camino, Oaxaca. San Juan Epatlán, Tizimin de Matamoros, Atlizco, Ajalpan, Coatepec de Matamoros, Puebla. Puerto Morelos, Quintana Roo. | Edible stage: larvae. | Common name: mariposa del muerto (Esp), cuetla (Ntl), cuetlacuahuetl (Ntl), pochocuiles (Oto), cuetano (Mix). | Ethnos: Maya, Tzotzil, Tzeltal, Chol, Lacandon, Tojolabal, Yutoazteca, Náhuatl, Otomi, Tlapaneco, Amuzgo, Zapotec, Mixtec, Mixe, Popoloca, Chatino, Chinanteco, Mazateco, Zoque, Trique, Huave, Totonaco. |
| | | Host: Melastomataceae | |
| | | Ecosystems: Thorn forest, Tropical evergreen forest, Rain forest, Tropical deciduous forest. | |
| 56. Subfamily Calpinaeae | | | |
| *Ascalapha agarista* Cramer, 1777. | | | |
| Places: Chilpancingo, Guerrero | | | |
Table 1 TAXONOMY (Continued)

| Edible stage | Larvae. |
|--------------|---------|
| Common name  | Mariposa de la muerte (Esp), mariposa del muerto (Esp). |
| Ethnos        | Nahuatl, Tlapanceno, Amuzgo. |
| Host          | Melastomataceae. |
| Ecosystems    | Tropical decidous forest |

57. **Subfamily** Agaristinae

*Gerra sevorsa* (Grote, 1882).

| Places       | Pedregal de San Ángel, DF, San Miguel Regla, Hidalgo, Misantla, Veracruz. |
|--------------|-----------------------------|
| Edible stage | Larvae. |
| Common name  | Gusano del maíz (Esp) |
| Ethnos        | Yutoazteca, Nahuatl, Otomi, Totonaco, Huasteco. |
| Host          | Unknown |
| Ecosystems    | Cloud forest, Pine-Oak forest, and Arid tropical scrub. |

58. **Subfamily** Calpinae

*Latebraria amphipyroides* (Guenée, 1852).

| Places       | Frontera, Echeverría, Argovia, las Cañitas, Selva Lacandon, Ixtapa, Bethel, Independencia, Frontera, Chiapas, San Pedro Atocpan, San Salvador Cuahtenco, San Jerónimo Micatlan, Santa Ana Tacotenco, San Bartolo Xicomiculco, San Lorenzo Tlacoyucan, San Agustín Ohtenco, San Pablo Ozotepec, San Antonio Tecomitl, San Francisco Tecoxpa, San Juan Tepelahuac, Milpa Alta, DF, Huejutla de Reyes, Atlapeco, Durango, Santo Tomás, Xochitlán, Chilcuautla, Romantla, Hidalgo, Santa María Nduyacoc, Santiago Apoala, Hualuapan de Léon, Yosototl, Puerto Esccondido, Oaxaca, Izúcar de Matamoros, Tehuitzingo, Santa Inés Ahuatempan, Puebla, Ozaba, Tlapalulco, Chocaman, Veracruz. |
|--------------|-----------------------------------------------|
| Edible stage | Larvae. |
| Common name  | Cuetla (Ntl), Cuetlmami (Oto), culebra gorda (Esp), culebra cornuda (Esp). |
| Ethnos        | Maya, Tzotzil, Tzeltal, Chol, Lacandon, Tojolabal, Yutoazteca, Nahuatl, Otomi, Totonaco, Huasteco, Mixe, Popoluca, Chatino, Chinantecco, Mazateco, Zoque, Trique, Huave. |
| Host          | Unknown |
| Ecosystems    | Rain forest, Tropical deciduous forest, Pine-Oak forest, Arid tropical scrub, Pine-Forest. |

59. **Subfamily** Calpinae

*Thysania agrippina* (Cramer, 1776).

| Places       | Tenejapa, Chiapas. |
|--------------|-------------------|
| Edible stage | Larvae. |
| Common name  | Mariposa águila (Esp), mariposon (Esp), mazacuata (Tzo). |
| Ethnos        | Maya, Tzotzil, Tzeltal, Chol, Lacandon. |
| Host          | Unknown |
| Ecosystems    | Rain forest, Tropical evergreen forest. |

60. **Subfamily** Heliotinae

*Helicoverpa zea* (Boddie, 1850).

| Places       | San Pedro Atocpan, San Salvador Cuahtenco, San Jerónimo Micatlan, Santa Ana Tacotenco, San Bartolo Xicomiculco, San Lorenzo Tlacoyucan, San Agustín Ohtenco, San Pablo Ozotepec, San Antonio Tecomitl, San Francisco Tecoxpa, San Juan Tepelahuac, Milpa Alta, Pedregal de San Ángel, DF, Villa de Allende, Polotitlán, Jilotepic, San Francisco Chimalpa, San José Tezompa, Temamatla, Santiago Tilapa, Tequixquiac, Mex, Quechultanengo, Mezcaantepec, Chilpancingo, Guerrero, Atlapeco, Chilcuautla, Valle del Mezquital, Durango, Santo Tomás, Xochitlán, Molango, Santa María Regla, Tlaxcoapan, El Dexthi, San Juanico kixmilquilan, Hidalgo, Santa María Nduyacoc, Santiago Apoala, Oaxaca, Tenancingo, Tetla, Tlacalca, Ixcouapa, Veracruz. |
|--------------|---------------------------------------------------------------|
| Edible stage | Larvae. |
| Common name  | Gusano del maíz (Esp), gusano de la milpa (Esp). |
| Ethnos        | Yutoazteca, Nahuatl, Otomi, Otopame, Mazahuatl, Matlazinca, Zapotec, Mixteco, Mixe, Popoluca, Chatino, Chinantecco, Mazateco, Zoque, Trique, Huave, Totonaco, Huasteco. |
| Host          | Zea mays L. |
| Ecosystems    | Cultures of maize mixed with beans, green beans and lucerne. |

61. **Subfamily** Xyleninae

*Spodoptera exigua* (Hubner, 1808).

| Places       | Zapotitlán, Tláhuac, DF. |
|--------------|-------------------------|
| Edible stage | Larvae. |
| Common name  | Gusano soldado (Esp). |
Table 1 TAXONOMY (Continued)

| Ethnos                  | Host                      | Ecosystems               |
|-------------------------|---------------------------|--------------------------|
| Yutoazteca, Náhuatl, Otomi. | Zea mays L.              | Cultures of maize.       |

62. **Subfamily** Xyleninae

**Spodoptera frugiperda** (Smith, 1797)

**Places:** San Pedro Atocon, San Salvador Cuahuetlan, San Jeronimo Miaclatlan, Santa Ana Tlacotenco, San Bartolo Xicomeco, San Lorenzo Tlacoyucan, San Agustin Ohtenco, San Pablo Otzotepec, San Antonio Tecomitl, San Francisco Tecoxpa, San Juan Tepenahuan, Milpa Alta, DF. Villa de Allende, Polotitlan, San Jose Tezompa, Santa Anita, Tetamamatla, Tequixquiac, Mex.

**Ecosystems:** Cultures of maize.

**Edible stage:** Larvae.

**Common name:** gusano elotero (Esp).

**Ethnos:** Yutoazteca, Náhuatl, Otomi, Otopame, Mazahua, Matlazinca.

**Host:** Zea mays L.

63. **Subfamily** Xyleninae

**Spodoptera sp.**

**Places:** Milpa Alta, DF.

**Edible stage:** larvae.

**Common name:** gusano soldado (Esp).

**Ethnos:** Yutoazteca, Náhuatl, Otomi.

**Host:** Zea mays L.

**Ecosystems:** Cultures of maize.

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FAMILY ARCTIIDAE

64. **Subfamily** Arctiinae

**Pelochyta cervina** (Edwards, 1884)

**Places:** Zongolica, Veracruz.

**Edible stage:** adult.

**Common Name:**

**Ethnos:** Náhuatl, Yutoazteca, Otomi.

**Host:** Scientific name unknown, common name “cucharilla real”.

**Ecosystems:** Rain forest and Tropical deciduous forest.

65. **Subfamily** Arctiinae

**Elysius superba** (Druce, 1884) (Figure 16)

**Places:** Zongolica, Veracruz.

**Edible stage:** larvae.

**Common name:** gusano del palo mulato (Esp).

**Ethnos:** Náhuatl, Yutoazteca, Otomi.

**Host:** Bursera simaruba Sarg., Ficus sp.

**Ecosystems:** Rain forest and Tropical deciduous forest.

66. **Subfamily** Arctiinae

**Amastus ochraceator** (Walker, 1865) (Figure 17)

**Places:** Zongolica, Veracruz.

**Edible stage:** larvae.

**Common name:** gusano de los palos (Esp), xicaltecon (Ntl).

**Ethnos:** Náhuatl, Yutoazteca, Otomi.

**Host:** Inga jinicuil Schl.

**Ecosystems:** Rain forest and Tropical deciduous forest.

67. **Subfamily** Arctiinae

**Estigmene acrea** (Drury, 1773) (Figure 18)

**Places:** Zongolica, Veracruz.

**Edible stage:** adult.

**Common name:** oruga salina (Esp).
for helping people to have a good health and satisfaction of energy and proteins requirements.

Marketing and Gastronomy
The trade of Lepidoptera larvae still persist being sold in markets in several areas of the country and even at the capital, as the red and white agave worms. In five forks restaurants of Mexico City. These species are in great demand, in large part due to their exquisite flavor, though the eating of these worms is also an ancestral tradition and a signal of power in diverse sectors of the population. Due to the high demand for these species, some sellers of them have special refrigerators for freezing and storing them. In this way, they can offer and prepare them at high prices after the collecting season.

There are other genera, such as Phassus, for which people search laboriously, it has a very similar flavor to chicken, while Laniífera cyclades “nopal worm” has a flavor of a fried potato. In the humid-tropical areas, “cuetla” and “cuecla” larvae, corresponding to Latebraria amphipyroides and Arsenura armida are pickled to give the larvae a flavor similar to herring, while the Spodoptera spp. is similar to that of corn (Table 4).

Unfortunately, these organisms are the subject of massive gathering in several of the States of Mexico, where they are profusely eaten. Thus, they could be in danger of extinction, due to the lack of rules regarding their collection, distribution and commercialization [31].

Cultures and Proto-cultures
In Mexico, some Lepidoptera are raised. Leptophobia aripa elodia, Pieris brassicae also the silk worm Bombyx mori in the States of Oaxaca and San Luis Potosí. Their industrial management is widely known, because of their economical importance in China, Japan, India, France, and Italy.

Eucheira socialis socialis the green worm of the Huasteca region widely distributed has larvae that are located inside a secreted silk enclosure of paperyaceous consistency. The larvae hang on the branches of Arbutus xala-pensis, feeding on young leaves [32]. In some parts of it, people make a “protoculture” that maintain on the edges of their house roof. They hang at least three silk enclosures (each bag contains only one sex), if they do that, the protoculture will survive. In the zone of the Oaxaqueña Mixteca, specially in the towns of Santa María Nduayaco and Santiago Apoala, this species disappeared due to the great degree of consumption; this species has since been reintroduced from Durango and Mexico states [33].

Some ethnobiological studies have been conducted on the red and white agave worms [34]. We investigate on their biology, ecology, and ethology, to increase their production by optimization of their culture particularly in Santo Tomás, Montecillo, and Apan in the State of Hidalgo and in the laboratory [35,36] with this we developed the biotechnology that would allow their culture on a greater scale. In fact, this technology for such cultures can be purchased in the Intelectual Property Direction of the UNAM [37]. Also, studies have been conducted to characterize the development of the larvae of the red agave worm [38].

Table 2 Families and species number

| Family       | Species | Family   | Species | Family | Species |
|--------------|---------|----------|---------|--------|---------|
| Hepialidae   | 3       | Hesperiidae | 2       | Saturniidae | 16      |
| Cossidae     | 1       | Papilionidae | 2       | Sphingidae | 4       |
| Pyralidae    | 1       | Pieridae   | 11      | Noctuidae | 9       |
| Sesiidae     | 1       | Nymphalidae | 8       | Arctiidae | 4       |
| Castniidae   | 1       | Bombycidae | 1       | Total of species | 67 |
| Geometridae  | 2       | Lasiocampidae | 1       |        |         |

Figure 1 Species Number by families of Edible Lepidoptera, Mexico.
Sustainable Management

The management and conservation of the species Paradirphia fumosa has been implemented in Mexico at the Biosphere Reserve of Tehuacán-Cuicatlán [39,40]. In this aspect we must also recognize the deep knowledge that indigenous people all over the world have, as they possess 90% of the planet’s germplasm [41,42] because they have maintained a high degree of sustainability with the majority of their resources.

Biomass obtention

These species are recollected by their abundance, because in some ones their recollection could be measured in tons [43] as it happens today with Ascalapha odorata or Latebraria amphypirioides stored in big cotton sacks of 50 kg and offered in market day or in a “tianguis” (market of little towns). Other species they could also sell alive while they are inside a little sac that they build in silk form their nests, as it is in gregarious

Table 3 Genus and species number

| Genus            | Species | Species | Genus   | Species | Genus   | Species |
|------------------|---------|---------|---------|---------|---------|---------|
| Phassus          | 3       | Eucheira| 2       | Caio    | 2       | Helicoverpa |
| Comadia          | 1       | Pontia  | 1       | Eacles  | 2       | Latebraria |
| Laniifera        | 1       | Leptophobia | 1 | Hemileuca | 1 | Spodoptera |
| Synantedon       | 1       | Casticta| 3       | Hylesia | 3       | Thysania |
| Castnia (Synpalamides) | 1 | Cynthia | 2       | Paradiaphia | 2 | Pelochyta |
| Acronyctodes     | 1       | Nymphalis| 1       | Pseudodirphia | 1 | Ellis |
| Phanteroides     | 1       | Chlosyne| 1       | Antheraea| 1 | Amastus |
| Aegiale          | 1       | Hamadyas| 1       | Actias  | 2       | Estigmene |
| Achlyodes        | 1       | Pateypychia| 1 | Pachylia | 1 | Total of species 67 |
| Protographium    | 1       | Danaus  | 2       | Cocytius| 1       |         |
| Pierorusus       | 1       | Bombyx  | 1       | Manduca | 2       |         |
| Phoebis          | 3       | Eutachyptera| 1 | Ascalapha | 2 |         |
| Eurema           | 1       | Arsenura| 2       | Germa  | 1       |         |
Table 4 Genus and Species most consumed in México

| Family          | Genus     | Species     | Family          | Genus     | Species     |
|-----------------|-----------|-------------|-----------------|-----------|-------------|
| Hepialidae      | Phassus   | Trajesa     | Saturniidae     | Arsenura  | polyadonta  |
|                 | P.        | triangularus|                 | Caio      | richardsoni |
|                 | P.        | sp.         |                 | Hylesia   | coinopus    |
| Cossidae        | Comadia   | redtenbacheri|               |           |             |
| Castniidae      | Castnia   | chelone     | Noctuidae       | Ascalapha | odorata     |
| Pyralidae       | Laniferia | cylades     |                 | A.        | agarita     |
| Geometridae     | Acronyctodes | mexicanaria |                 | Helicoverpa | zea         |
| Hesperidae      | Aegiale   | hesperianis |                 | Latebrana | amphiphthoides |
| Pieridae        | Catasticta| teutila teutila |               | Spodoptera | frugiperda  |
|                 | C.        | flisa flisa |                 |           | exigua      |
| Saturniidae     | Arsenura  | armida      |                 |           |             |

Figure 3 Comadia redtenbacheri (♂).

Figure 4 Castnia synpalamides chelone (♂).

Figure 5 Aegiale hesperianis.

Figure 6 Protographium philolaus philolaus (♂).

Figure 7 Phoebis agarithe agarithe (♂).

Figure 8 Eucheira socialis socialis (♀).
species, *Eucheira socialis* or *Hylesia frigida*. Other species are captured by the use of net as is *Phoebis agarithe*, or the “monarch butterfly” (*Danaus plexipus plexipus*, *D. gilippus thersippus*) or *Pterourus multicaudata multicaudata* where people do not eat the larvae because this makes the heart stop, but adults. In other species they could be found many individuals together inside their hosts as in *Comadia redtenbacheri* or *Lanifera cyclades*, with the help of a hunting knife or even collected the prepupa digging the soil around.

**Preparation**

Generally is the larvae that are eaten. They are prepared roasted with salt, and in populations with a higher economic purchase they are fried with oil or lard joining always pepper, salt, in tortillas (maize crepes). They could be boiled and roasted in a “pan” or justly fried with salt and pepper, wormseed leaves. Also, boiled split into longitudinal axis, mixed with oil. Boiled, drained and stuffed with fresh cheese, or it could be with tuna or cooked with eggs, like an omelette. Also in a pie accompanied or mixed with rice, as are the shrimps in the “paella” transferring to rice a very special and good flavour.

They could be preserved in brine, and cutted into small pieces in the same way as used croutons or bacon.

The flavours are really peculiar and it is difficult to compare with something known, but we can said they varied from light delicious flavours to strong and different unkown flavours.

Peasants qualified them as a very good and nutritious “worms”, ¡pure vitamine!, to refer to the quantity of proteins they lodged.

**Trade and Marketing Nets**

Many species are traded and sell by fits or sardine cans. Another way to sell them is already boiled in salt water or preserved in brine. Generally, they are not offer in fixed places in trough the market, but street sellers are walking in different corridors of these, asking people to buy them, by example *Comadia redtenbacheri*, *Aegiale hesperiaris*, *Arsenura armida*, *Ascalapha odorata*, and *Latebraria amphipyroides* are sold on the plaza days, market days, in ambulant markets or on roadsides and even in the Mexico City market. They are offered in big plastic boxes or baskets and are measured in tuna or sardine cans, or frequently in “cazuelitas” (little ceramic dishes of different sizes). Some of the recorded edible Lepidoptera thus clearly constitute an important part of the nutrition and economy of the Mexican people [33,34], particularly for the indigenous collectors, middlemen, distributors, salesmen, and restaurant owners. In addition, canned white agave worms are exported to the United States and Canada by the enterprises Clemente Jacques and Elan, S.A., and thus generate foreign income for Mexico. This worm has been sold for $250.00 USD per kilogram (2006), which is ten times more expensive than a fish or beef fillet. The exported cans cost $50.00 Canadian dollars; these cans contain only 5 or 6 larvae of the last or penultimate larval stage.

Other species have also been commercialized, such as “zacamiches”, *Hemileuca* sp. at Toluca market, “gusanillo”, *Phassus triangularis*, and *P. trajesa* at different markets in the Veracruz State and “cuchama” (*Paradiphiopsis fumosa*) in Tehuacán, Puebla.

A little more than 10% (8 species) of edible Lepidoptera larvae are commercialized, but many more species are sold in the adult stage at very high prices.

Some African species in the larval stage are preserved by pickling and are then exported to European cities. In Paris, France, for example, they are offered in the market of La Rue Moufetard in the Latin neighborhood. These are sold in huge fiber baskets, and can be seen in the street markets in several localities for sale on different days of the week. They are mostly bought by immigrants in those countries [32].

Some examples of Edible Lepidoptera of Mexico are Figures 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17 and 18.
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All authors read and approved the final manuscript. JRE, Author responsible for the project and publication, writing, editing of the manuscript. JPM, Collect, preliminary preparation of the manuscript, editing, labels, catalogs, literature review. AH, Assembly and identification of species of Lepidoptera. ILT, Collect of different species in diverse states of Mexico. HOR, Identification of host plants. VHMC. Writing and formatting the manuscript, references research on internet and all computer work.

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Competing interests
The authors declare that they have no competing interests.

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