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Diversity of Buprestidae (Coleoptera) from El Limón de Cuauchichinola, Tepalcingo, Morelos, Mexico

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Abstract. A systematic survey was conducted to assess the diversity of Buprestidae in the tropical deciduous forest at El Limón de Cuauchichinola, municipality of Tepalcingo, Morelos State, Mexico. Samples were collected five days each month for one year, and the UAEM (CIUM) insect collection was examined for Buprestidae specimens. Four subfamilies, 12 tribes, 19 genera and 73 species were recorded, with the genera *Agrilus* Curtis, 1825, *Chrysobothris* Eschscholtz, 1829, and *Acmaeodera* Eschscholtz, 1829 having the greatest number of species. Nonparametric estimator analysis estimates that only 68% of buprestid species occurring in the forest were recorded. The annual value of diversity calculated with the Shannon-Wiener index was 3.08. Maximum diversity and evenness values were recorded during the rainy season. Maximum richness and abundance values were recorded during July and August, the months with the highest amount of rainfall, and correlated with rainfall 78% and 72%, respectively.

Key Words. Tropical deciduous forest, richness, abundance, seasonality, Reserva Biosfera Sierra de Huautla.

Resumen. Se realizó un trabajo sistemático donde se analizó la diversidad de Buprestidae en la Selva Baja Caducifolia en la localidad de El Limón de Cuauchichinola, Tepalcingo, Morelos, México. Se realizaron muestreos de cinco días cada mes durante un año, y se revisó la Colección de Insectos de la UAEM (CIUM). Se registraron cuatro subfamilias, 12 tribus, 19 géneros y 73 especies, los géneros *Agrilus* Curtis, 1825, *Chrysobothris* Eschscholtz, 1829, y *Acmaeodera* Eschscholtz, 1829 presentaron el mayor número de especies. El estimador no paramétrico indicó que sólo se registró el 68% de las especies de bupréstidos que ocurre en la selva. El valor de diversidad anual calculado con el índice de Shannon-Wiener fue de 3.08. La época de lluvias fue la que tuvo los valores máximos, tanto de diversidad como equitatividad. Los valores máximos observados de riqueza y abundancia fueron registrados en julio y agosto, los meses con mayor precipitación, y estuvieron correlacionadas con la precipitación en 78% y 72%, respectivamente.

Palabras Clave. Selva baja caducifolia, riqueza, abundancia, estacionalidad, Reserva Biosfera Sierra de Huautla.

[†]Deceased 19 August 2013.

Introduction

Beetles of the family Buprestidae are commonly called "jewel beetles" or "metallic woodboring beetles" due to the metallic colors exhibited by the adults and the boring habits of their larvae in wood, roots or stems of woody plants, although some are leaf miners (Bellamy 2003b; Corona-López & Toledo-Hernández 2006, 2007; Hespenheide 1996).

Four subfamilies (Agrilinae, Buprestinae, Chrysochroinae and Polycestinae), 21 tribes, 32 subtribes, 64 genera and 868 species have been recorded from Mexico, with the three most diverse subtribes being Agrilina (287 species), Acmaeoderina (162 species), and Chrysobothrina (96 species). These three subtribes combined represent 63% of the diversity of Buprestidae in Mexico, with most species in these subtribes belonging to the genera *Agrilus* Curtis, 1825 (284 species), *Acmaeodera* Eschscholtz, 1829 (152 species) and *Chrysobothris* Eschscholtz, 1829 (91 species) (Corona-López & Toledo-Hernández 2006, 2007; Hespenheide 1996).

Knowledge of Buprestidae in Mexico is incomplete. Literature pertaining to the family consists primarily of descriptions of new species, scientific notes on new records and distribution, occasional taxonomic revisions at the genus level, and biogeographical works. Material on which this information is based has been obtained through sporadic collecting in restricted parts of the different states of Mexico, primarily those in the tropics and near the U.S. border. Westcott et al. (2008) published a faunal listing for the state of Morelos based on sporadic collections, bibliographical reviews, and material deposited in entomological collections. They reported 139 species in 26 genera, of which 73 species were found in the Sierra de Huautla Biosphere Reserve ("Reserva dela Biosfera Sierra de Huautla" = REBIOSH). Tropical Deciduous Forest (TDF) is the dominant vegetation in the REBIOSH, although one can also find oak forest and a small island of pines in the temperate regions and medium semideciduous forest in the wettest canyons. TDF is the predominant type of tropical vegetation in Mexico, covering more than 60% of the total tropical vegetation area, and exhibits high degrees of biological richness and levels of endemism. Despite this, it is one of the most modified ecosystems, primarily through conversion to agriculture, grazing, and logging. Because of this it is considered the most endangered tropical ecosystem in Mexico (Flores & Gerez 1994, Groombridge 1992, Rzedowski 1978, Toledo & Ordóñez 1998, Trejo & Dirzo 2000).

This work presents the results of a year-long sampling effort to determine the faunal composition and diversity of Buprestidae and its seasonal variation in a locality with TDF located inside the REBIOSH (El Limón de Cuauchichinola, Tepalcingo municipality, Morelos State, Mexico).

Materials and Methods

Study Area. Field studies were conducted in the locality of El Limón de Cuauchichinola, Tepalcingo, Morelos, Mexico, located at N18° 32', W98° 56' at an altitude of 1220 m (INEGI 2004). The climate is warm subhumid (Aw_0) with rain during summer, a mean annual temperature of 22 ºC, and a mean annual precipitation of 817 mm. The principal types of vegetation are TDF, TDF with secondary growth vegetation, and introduced pasture. Land use in the area consists of non-irrigated agriculture (INEGI 2004, CONAGUA 2008). The study area is inside of the REBIOSH.

Field Sampling. Sampling was conducted on five days in one week of each month for one year long, from May 2006 to April 2007. Collecting of specimens was carried out from 10:00 a.m. to 4:00 p.m. by two people (6 hours/person) using aerial nets and beating sheets and by examination of all plants in flower and above and below the bark of trunks and branches recently fallen, or burned, and dying trees and bushes.

Laboratory Studies. Collected specimens were identified to subfamily, tribe, genus, and species level by different means, including taxonomic keys and comparison with material deposited in the Institute of Biology National Insect Collection ("Colección Nacional de Insectos del Instituto de Biología" = CNIN), located in the Autonomous National University of Mexico ("Universidad Nacional Autónoma de México" = UNAM). Specimens were subsequently deposited in the Autonomous University of Morelos Insect Collection ("Colección de Insectos de la Universidad Autónoma del Estado de Morelos" = CIUM), in the Research Center of Biodiversity and Conservation ("Centro de Investigación en Biodiversidad y Conservación" = CIByC).

Statistical Analyses. A faunal list of Buprestidae from the locality of El Limón de Cuauchichinola was obtained and arranged according to the taxonomic classification of Bellamy (2003a). The number of species recorded and the number of individuals collected during sampling over the course of the year were used to construct a smoothed curve using the EstimateS 8 program (Colwell 2016), randomizing the position of the month in the year 1000 times. After construction of the curve, expected richness was estimated using the nonparametric estimator Chao2.

Seasonal variation in Buprestidae was characterized by analyzing the relationship of species richness and abundance to the rainy season (May to October) versus the dry season (November to April) that occurs at El Limón de Cuauchichinola. Pearson correlation analysis was used to recognize the extent to which precipitation is related to species richness and abundance.

Diversity was analyzed over time (annual, seasonal and monthly) with the Shannon-Wiener index (H') using the natural logarithm (Magurran 1988). In order to measure equitativity, the Pielou evenness index (E) was used, which is a measure of the uniformity with which individuals are distributed among the species of a community, expressed as values between 0 and 1, with a value of 1 representing the situation in which all species are equally abundant (Magurran 1988).

Richness, abundance, diversity, seasonality, and species richness estimates were performed only with the species collected during the annual sampling.

Results

Faunal List. During the one-year sampling period at El Limón de Cuauchichinola, 822 individuals were collected representing four subfamilies, 10 tribes, 14 genera, and 55 species. To augment the list of species from that locality, we consulted the CIUM and examined 282 specimens collected sporadically between 2004–2008, which revealed two additional tribes, five additional genera, and 18 additional species. Thus, in total, 1104 individual specimens representing four subfamilies, 12 tribes, 19 genera, and 73 species were obtained from El Limón de Cuauchichinola (Appendix 1). Of these, only 55 could be determined to species level, eight of which are new records from the REBIOSH and two of which (*Actenodes scabrosus* MacRae & Bellamy,

2013 and *Agrilus speciosus* Waterhouse, 1889) are new records from the state of Morelos. The remaining 18 species not identified are probably undescribed, four of which belong to two genera (*Agrilaxia* Kerremans, 1903 and *Leiopleura* Deyrolle, 1864) that also have not yet been recorded from the REBIOSH or the state of Morelos (Appendix 1).

The subfamily represented by the highest number of species (individuals) was Agrilinae with 24 (325) (43.6% and 39.5%, respectively). Buprestinae was next with 17 (305) (30.9% and 37.1%, respectively), followed by Polycestinae with 10 (127) (18.2% and 15.5%, respectively), and Chrysochroinae with four (65) (7.3% and 7.9%, respectively).

The genera represented by the highest number of species (individuals) were *Agrilus* with 20 (316), *Chrysobothris* with 10 (271), and *Acmaeodera* with 9 (126). The genera represented by the fewest species (number of specimens) were *Leiopleura* with 2 (2), *Agaeocera* Saunders, 1871 with 1 (6), *Paragrilus* Saunders, 1871 with 1 (5), *Colobogaster* Solier, 1833 with 1 (2), and *Hiperantha* Gistel, 1834 and *Xenorhipis* LeConte, 1866 with 1 (1) each (Table 1).

The species with the highest number of individuals were *Agrilus delicatulus* Waterhouse, 1889 (109), *Chrysobothris multistigmosa* (Mannerheim, 1837) (103), *C. modesta* Waterhouse, 1887 (90), *Acmaeodera haemorrohoa* LeConte, 1858 (52), and *C. distincta* Gory, 1841 (51). Thirteen additional species were represented by 10–50 individuals, 13 by 3–10, seven by 2, and 17 by a single individual (Fig. 1).

Estimate of Richness. The species accumulation curve showed an increase in the number of species not reaching an asymptote, suggesting the number of species in the study area may actually be higher (Figure 2). The Chao2 estimator suggested 31.3% of the richness of bupresid species remains uncollected in the study area. This is supported when taking into account the material at CIUM, which added another 18 species not found during the systematic collecting. Thus, it can be estimated that 91% of the study area's buprestid fauna has been recorded so far.

Seasonal Variation. Analysis of species richness and abundance showed that the highest number of species was recorded in July (31), while the highest number of individuals was collected in July (149) and August (154), the latter values coinciding with the months that had the highest precipitation during the year of sampling (Fig. 3). The lowest species richness and abundance values were recorded in May, with three species and 25 individuals (Table 1). Five species were present during eight or more months of the year: *Acmaeodera rustica* Fisher, 1949, *Agrilus luctator* Kerremans, 1903, *Chrysobothris distincta*, *C. modesta*, and *C. multistigmosa*. Of the remaining 50 species, 17 species (30.9%) were active during three to six months, ten (18.2%) during two months, and 23 (41.8%) during a single month. A majority of species (47) and individuals (505) were recorded during the rainy season, while only 26 species and 317 individuals were encountered during the dry season (Table 1, Fig. 3). Many of the species exhibited marked seasonality; 29 (52.7%) were collected only during the rainy season, and eight (14.5%) were collected only during the dry season. The other 18 species (32.7%) were collected during both seasons (Fig. 3).

Diversity. The diversity and equitativity values for the entire year were 3.08 and 0.77, respectively. Diversity was 2.99 during the rainy season and 2.46 during the dry season with corresponding equitativity values of 0.77 and 0.75, respectively. On a monthly basis, maximum diversity occurred in July (2.83) and maximum equitativity

Table 1. Seasonality of Buprestidae at the locality El Limón de Cuauchichinola, Tepalcingo, Morelos. Numbers of species and individuals (spp/ind), the Shannon-Wiener index of diversity (H'), evenness index (E), recorded monthly for each genus.

	Rainy						Dry					
	May	June	July	August	September	October	November	December	January	February	March	April
Richness	3	13	31	21	18	14	16	12	11	3	6	14
Abundance	25	71	149	154	53	53	80	61	48	38	26	64
H'	0.60	2.04	2.83	2.10	2.46	2.39	2.24	2.14	1.92	0.71	1.29	2.11
E	0.54	0.79	0.82	0.69	0.85	0.90	0.80	0.86	0.80	0.65	0.72	0.80
Chrysobothris	1/1	3/14	4/22	4/17	4/13	3/16	4/22	4/31	5/37	3/38	6/26	5/34
Agrilus	2/24	7/53	17/78	9/113	4/4	1/1	1/16	2/6	1/1			3/20
Acmaeodera		1/1	5/33	4/12	5/24	4/20	4/27	1/4	1/1			1/4
Hippomelas				1/1	2/6	3/9	2/5	3/14	3/8			2/3
Actenodes			2/7	2/3	1/1	1/1	2/7	1/4				
Lampetis				1/8	1/4	1/3	1/1	1/2				1/1
Paragrilus		1/2	1/2		1/1							
Colobogaster									1/1			1/1
Hiperantha		1/1										
Agaeocera			1/6									
Xenorhipis			1/1									
Leiopleura							2/2					
Paradomorphus						1/2						
Polycesta												1/1

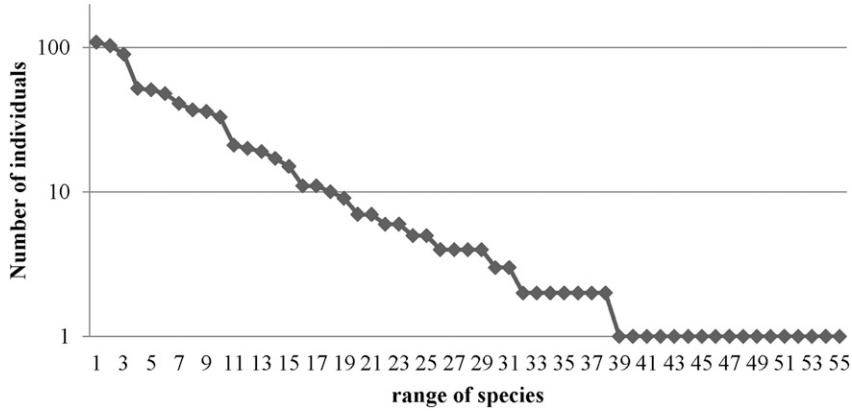

Figure 1. Dominance and diversity of the buprestid fauna at El Limón de Cuauchichinola, Tepalcingo, Morelos, Mexico.

in October (0.90), while minimum diversity and equitativity values were in May (0.60 and 0.54, respectively) (Table 1).

Discussion

We report 73 species of Buprestidae from El Limón de Cuauchichinola, which represent more than 52% of the species recorded from the state of Morelos and 8% of the species from Mexico. Westcott et al. (2008) reported 73 species from the REBIOSH, of which 30 species were not collected in our study at El Limón de Cuauchichinola. Thus, we assume the actual number of species from REBIOSH is even higher, especially considering the estimator indicates about 30% of species in the study site remain to be found.

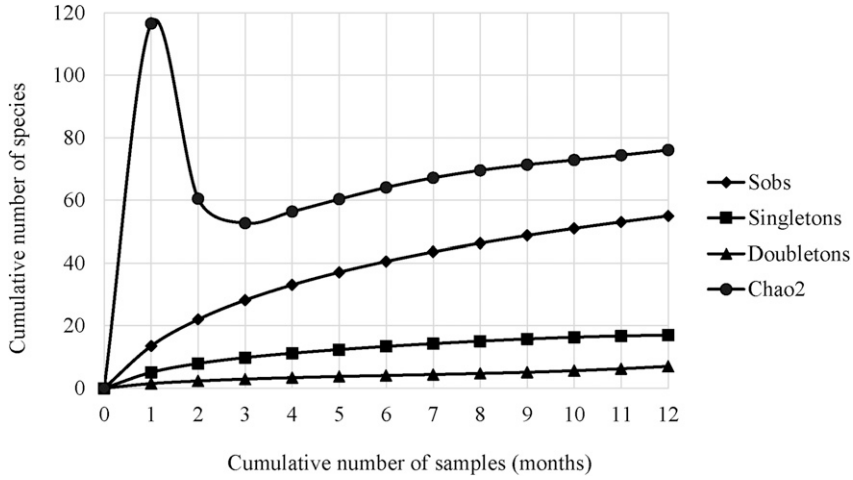

Figure 2. Observed and estimated species accumulation curves of Buprestidae at El Limón de Cuauchichinola, Tepalcingo, Morelos, Mexico. Sobs = Observed richness.

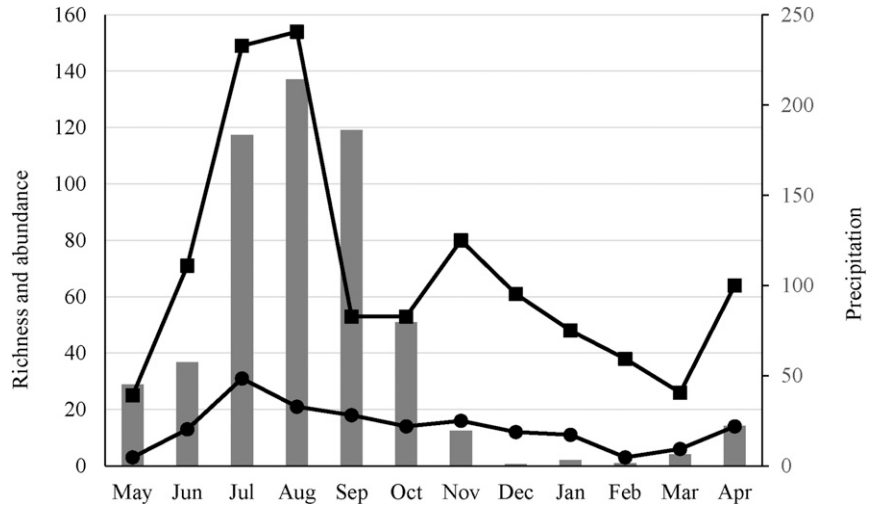

Figure 3. Pattern of richness and abundance of Buprestidae at El Limón de Cuauchichinola. Precipitation was recorded during the one-year duration of the survey. Squares = abundance; circles = richness; bars = precipitation.

Of the species found during systematic collecting at the site during this study, 30 were represented for four or fewer individuals, mostly pertaining to the genera that are the most species-rich and abundant in the family (*Agrilus*, *Chrysobothris*, and *Acmaeodera*). Of these 30 species, 14 were recorded during July, coinciding with the peak of maximum precipitation. The occurrence of rare or sparsely populated species seems to be higher in tropical forests, either due to the presence of limited resources (Halffter & Moreno 2005, Lucky et al. 2002, Martín 1997, Schowalter 2006) or because sampling did not coincide with the adult emergence and activity period, not all relevant collection methods were utilized, or not all suitable habitats were adequately sampled (Longino et al. 2002, Scharrf et al. 2003). As a result, it is suggested for Buprestidae that sampling over a longer period of time, covering a greater geographical area, and making greater use of host plant information may be necessary, as well as the use of other sampling methods such as flight intercept traps, Malaise traps, bright-colored traps, emergence chambers to hold infested plant material, etc.

The abundance, richness, and diversity of Buprestidae at El Limón de Cuauchichinola exhibits marked seasonality, with higher values during the rainy season when adults can take advantage of fresh foliage on their host plants (e.g., *Agrilus*) and lay eggs on trunks and branches of dead and dying trees. Foliation and growth of plants occurs in the wet season in the TDF, offering higher amounts of nitrogen, water, and other nutritional componenents required for reproduction, and it is during this period herbivory is at its highest (Briones & Jerez 2004, Cepeda-Pizarro 1989, Coley & Barone 1996, Filip et al. 1995, Huffaker & Gutiérrez 1998, Schowalter 2006). In addition, trunk and branch dieback tend to occur during this time, resulting in newly available resources for larval development (Bullock & Solís-Magallanes 1990, Maass et al. 2002, Martínez-Yrízar 1995, Pescador-Rubio et al. 2002).

Leaves are not the only component of vegetation, but also flowers, fruits, roots, and wood (Bullock 2002). With regards to flowering in the TDF, more species bloom than

produce leaves during the dry season (Bullock 2002, Parra & Bullock 2002, Poulin et al. 1992). Herbaceous plants show a tendency to flower at the end of the rainy season at the end of their growth cycle. Certain taxonomic patterns are evident at the family level, such as the tendency to flower between September and November in the Asteraceae, Convolvulaceae, and Cucurbitaceae (Parra & Bullock 2002). Thus, the peak occurrences of species in the genus *Acmaeodera* tend to coincide with the period of greatest flowering of both trees and herbaceous plants to ensure the availability of these resources for feeding and reproduction.

In the case of the genus *Chrysobothris*, it is not clear what resources in the TDF are utilized by adults for feeding, as literature records only mention adult host plants but do not indicate if they were feeding on the flowers or buds or were simply encountered resting on the plant. In El Limón de Cuauchichinola, some species of this genus were encountered on species of fabaceous plants in the genera, *Vachellia* Wight & Arn.—e.g., *V. campechiana* (Mill.) Seigler & Ebinger (flowers from April to June, produces fruits from October to January), *V. farnesiana* (L.) Wight & Arn. (flowers from August to March, produces fruits from September to May) and *V. pennatula* (Schltdl. & Cham.) Seigler & Ebinger (flowers from January to May, produces fruits from August to December); *Conzattia* Rose—*C. multiflora* (B. L. Rob.) Standl. (flowers and produces fruits from May to January); and *Pithecellobium* Mart.—e.g. *P. dulce* (Roxb.) Benth. (flowers from September to May, produces fruits from March to June) (Dorado et al. 2005). In some of these cases they were found ovipositing and in others they were simply found on plants with flowers and buds, raising the possibility that they were utilizing this resource for food. The multiple peaks of abundance and species richness observed for the genus *Chrysobothris* during the study period could be a result of multiple generations per year, and the ability to utilize diverse resources for feeding could allow them to obtain food from different species of fabaceous plants at any time of the year (Pérez-Contreras 1999).

The marked seasonality demonstrated for Buprestidae at El Limón de Cuauchichinola has also been observed in at least 21 other families of Coleoptera that have been studied in TDF at different places within the REBIOSH (Burgos 2003, Caballero 2003, Cifuentes 2009, Gómez 2005, Jiménez-Sánchez et al. 2009, Noguera et al. 2002, Ordóñez-Reséndiz et al. 2008, Paulin 2004, Pérez 1999, Toledo-Hernández et al. 2015, Zaragoza-Caballero et al. 2003, Zurita 2004).

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Literature Cited

Bellamy, C. L. 2003a. An illustrated summary of the higher classification of the superfamily Buprestoidea (Coleoptera). *Folia Heyrovskiana Supplement* 10:1–197.

Bellamy, C. L. 2003b. The stunning world of jewel beetles. *Wings, Essays on Invertebrate Conservation* 26:13–17.

Briones, R. & V. Jerez. 2004. Coleópteros asociados al follaje y fenología de *Lithrea caustica* (Mol.) (Anacardiaceae) en un fragmento de bosque costero, VIII región, Chile. *Gayana* 68:43–52.

Bullock, S. H. 2002. La fenología de plantas en Chamela pp. 491–498. *In:* F. A. Noguera, J. H. Vega, A. N. García & M. Quesada (Eds.), *Historia Natural de Chamela.* Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City, 568 pp.

Bullock, S. H. & J. A. Solís-Magallanes. 1990. Phenology of canopy trees of a tropical deciduous forest in Mexico. *Biotropica* 22:22–35.

Burgos, S. A. 2003. *Platypodidae y Scolytidae (Coleoptera) de la Reserva de la Biosfera Sierra de Huautla, Morelos, México*. Doctoral thesis, Colegio de Postgraduados, Texcoco, Estado de México, México, 93 pp.

Caballero, P. U. 2003. *Staphylinidae necrófilos (Insecta: Coleoptera) de la Reserva de la Sierra de Huautla, Morelos*. Bachelor thesis, Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México, Mexico City, 110 pp.

Cepeda-Pizarro, J. G. 1989. Actividad temporal de tenebriónidos epígeos (Coleoptera) y su relación con la vegetación arbustiva en un ecosistema árido de Chile. *Revista Chilena de Historia Natural* 62:115–125.

Cifuentes, P. R. 2009. *Distribución temporal de Tenebrionidae (Insecta: Coleoptera) en una localidad de bosque tropical caducifolio en la Reserva de la Biosfera Sierra de Huautla, Morelos*. Masters thesis, Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City, 95 pp.

Coley, P. D. & J. A. Barone. 1996. Herbivory and plant defenses in tropical forests. *Annual Review of Ecology and Systematics* 27:305–335.

Colwell, R. K. 2016. EstimateS: statistical estimation of species richness and shared species from samples. Version 9.1.0 user's guide and application. Available from http://purl.oclc.org/estimates (accessed October 2016).

Comisión Nacional del Agua (CONAGUA). 2008. Datos no publicados de la precipitación y temperatura de El Limón de Cuauchichinola. Dirección General Organismo de Cuenca Balsas. Morelos. Unpublished data.

Corona-López, A. M. & V. H. Toledo-Hernández. 2006. Patrones de distribución de la Familia Buprestidae (Coleoptera) pp. 333–391. *In:* J. J. Morrone & J. Llorente-Bousquets (Eds.), *Componentes Bióticos Principales de la Entomofauna Mexicana*. Las Prensas de Ciencias, Universidad Nacional Autónoma de México, Mexico City, 562 pp.

Corona-López, A. M. & V. H. Toledo-Hernández. 2007. Acercamiento al conocimiento de Buprestidae en México (Insecta: Coleoptera). *Entomología Mexicana* 6(2): 1267–1272.

Dorado, O., D. M. Arias, R. Ramírez & M. Sousa. 2005. *Leguminosas de la Sierra de Huautla. Imágenes y descripciones*. Comisión nacional para el conocimiento y uso de la biodiversidad, Universidad Autónoma del Estado de Morelos, Cuernavaca, Morelos, México, 176 pp.

Filip, V., R. Dirzo, J. M. Maass & J. Sarukhán. 1995. Within and among year variation in the levels of herbivory on the foliage of trees from a Mexican tropical deciduous forest. *Biotropica* 27:78–86.

Flores, O. & P. Gerez. 1994. *Biodiversidad y conservación en México: vertebrados, vegetación y uso del suelo*, 2nd edition. Comisión nacional para el conocimiento y uso de la biodiversidad, Universidad Nacional Autónoma de México, Mexico City, 439 pp.

Gómez, J. G. 2005. *Los macro-coleópteros necrófilos (Scarabaeidae, Trogidae y Silphidae) de la Reserva de la Biosfera de Huautla, Morelos, México*. Bachelors thesis, Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México, Mexico City, 63 pp.

Groombridge, B. 1992. *Global biodiversity, status of the earth's living resources*. Chapman and Hall, London, U.K., 585 pp.

Halffter, G. & C. E. Moreno. 2005. Significado biológico de las diversidades alfa, beta y gamma, pp. 5–18. *In:* G. Halffter, J. Sobéron, P. Koleff & A. Melic (Eds.), *Sobre diversidad biológica: El significado de las diversidades alfa, beta y gamma*. Monografías Tercer Milenio, Zaragoza, Spain, 142 pp.

Hespenheide, H. A. 1996. Buprestidae (Coleoptera), pp. 411–421. *In:* J. Llorente-Bousquets, A. N. García-Aldrete & E. González-Soriano (Eds.), *Biodiversidad, taxonomía y biogeografía de artrópodos de México: Hacia una síntesis de su conocimiento*. Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City, 660 pp.

Huffaker, C. B. & A. P. Gutiérrez. 1998. *Ecological Entomology*, 2nd edition. John Wiley and Sons, Toronto, Canada, 776 pp.

Instituto Nacional de Estadística Geografía e Informática (INEGI). 2004. Tepalcingo, Morelos. Municipal Statistical Notebook, Tepalcingo, Morelos, Mexico. http://www3.inegi.org.mx/sistemas/biblioteca/ficha.aspx?upc=702825000668 (accessed October 2016).

Jiménez-Sánchez, E., S. Zaragoza-Caballero & F. A. Noguera. 2009. Variación temporal de la diversidad de estafilínidos (Coleoptera: Staphylinidae) nocturnos en un bosque tropical caducifolio de México. *Revista Mexicana de Biodiversidad* 80:157–168.

Longino, J. T., J. Coddington & R. K. Colwell. 2002. The ant fauna of a tropical rain forest: estimating species richness three different ways. *Ecology* 83:689–702.

Lucky, A., T. L. Erwin y J. D. Witman. 2002. Temporal and spatial diversity and distribution of arboreal Carabidae (Coleoptera) in a Western Amazonian rain forest. *Biotropica* 34: 376–386.

Maass, J. M., V. Jaramillo, A. Martínez-Yrizar, F. García-Oliva, A. Pérez-Jiménez & J. Sarukhán. 2002. Aspectos funcionales del ecosistema de selva baja caducifolia en Chamela, Jalisco, pp. 525–542. *In:* F. A. Noguera, J. H. Vega, A. N. García y M. Quesada (Eds.), *Historia Natural de Chamela*. Instituto de Biología, Universidad Nacional Autónoma de México, 568 pp.

Magurran, A. E. 1988. *Ecological diversity and its measurement*. Princeton University Press, Princeton, New Jersey, 179 pp.

Martín, F. 1997. Apuntes sobre biodiversidad y conservación de insectos: dilemas, ficciones y ¿soluciones? *Boletín Sociedad Entomológica Aragonesa* 20:25–55.

Martínez-Yrízar, A. 1995. Biomass distribution and primary productivity of tropical dry forests, pp. 326–345. *In:* S. H. Bullock, H. A. Mooney & E. Medina (Eds.), *Seasonally dry tropical forests.* Cambridge University Press, Cambridge, New York, 450 pp.

Noguera, F. A., S. Zaragoza-Caballero, J. A. Chemsak, A. Rodríguez-Palafox, E. Ramírez-García, E. González-Soriano & R. Ayala. 2002. Diversity of the Family Cerambycidae (Coleoptera) of the tropical dry forest of Mexico, I. Sierra de Huautla, Morelos. *Annals of the Entomological Society of America* 95:617–627.

Ordóñez-Reséndiz, M. M., N. Acevedo-Reyes & Y. Mora-Puente. 2008. Curculionoidea de las Sierras de Taxco-Huautla, México, pp. 1012–1016. *In:* E. G. Estrada-Venegas, A. Equihua-Martínez & J. E. Padilla-Ramírez, A. Mendoza-Estrada (Eds.), *Entomología Mexicana*. Sociedad Mexicana de Entomología, Mexico City, Mexico, 1092 pp.

Parra, V. & S. H. Bullock. 2002. La polinización en la selva tropical de Chamela, pp. 499–515. *In:* F. A. Noguera, J. H. Vega, A. N. García & M. Quesada (Eds.), *Historia Natural de Chamela*. Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City, 568 pp.

Paulin, M. J. 2004. *Estudio de la familia Chrysomelidae (Insecta: Coleoptera) de la Reserva de la Biosfera Sierra de Huautla, Morelos, México*. Bachelors thesis, Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México, Mexico City, 147 pp.

Pérez, G. A. 1999. *Los Coleópteros Melolonthidae de la Reserva de Huautla, Morelos*. Masters thesis, Facultad de Ciencias, Universidad Nacional Autónoma de México, Mexico City, 84 pp.

Pérez-Contreras, T. 1999. La especialización en los insectos fitófagos: una regla más que una excepción. *Boletín Sociedad Entomológica Aragonesa* 26:759–776.

Pescador-Rubio, A., A. Rodríguez-Palafox & F. A. Noguera. 2002. Diversidad y estacionalidad de Arthropoda, pp. 183–201. *In:* F. A. Noguera, J. H. Vega, A. N. García & M. Quesada (Eds.), *Historia Natural de Chamela*. Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City, 568 pp.

Poulin, B., G. Lefebvre & R. McNeil. 1992. Tropical avian phenology in relation to abundance and exploitation of food resources. *Ecology* 73:2295–2309.

Rzedowski, J. 1978. *Vegetación de México*. Limusa, Mexico, Mexico City, 432 pp.

Scharrf, N., J. S. Coddington, C. E. Griswold, G. Hormiga & P. de Place Bjørn. 2003. When to quit? Estimating spider species richness in a northern European deciduous forest. *The Journal of Arachnology* 31:246–273.

Schowalter, T. D. 2006. *Insect ecology an ecosystem approach,* 2nd edition. Elsevier, San Diego, CA, USA, 774 pp.

Toledo, V. M. & M. de J. Ordóñez. 1998. El panorama de la diversidad de México: una revisión de los hábitats terrestres, pp. 739–757. *In:* T. P. Ramamoorthy, R. Bye, A. Lot & J. Fa (Eds.), *Diversidad Biológica de México: Orígenes y Distribución*. Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City, 792 pp.

Toledo-Hernández, V. H., J. Rifkind, A. M. Corona-López, A. Flores-Palacios & J. M. Leavengood, Jr. 2015. Faunistic Composition of Cleridae (Coleoptera) in El Limón de Cuauchichinola, Morelos, Mexico. *Annals of the Entomological Society of America* 108:771–776.

Trejo, I. & R. Dirzo. 2000. Deforestation of seasonally dry tropical forest: a national and local analysis in Mexico. *Biological Conservation* 94:133–142.

Westcott, R. L., H. A. Hespenheide, J. Romero, A. Burgos, C. L. Bellamy & A. Equihua. 2008. The Buprestidae (Coleoptera) of Morelos, Mexico, with description of six new species, and a partially annotated checklist. *Zootaxa* 1830:1–20.

Zaragoza-Caballero, S., F. A. Noguera, J. A. Chemsak, E. González-Soriano, A. Rodríguez-Palafox, E. Ramírez-García & R. Ayala. 2003. Diversity of Lycidae, Phengodidae, Lampyridae and Cantharidae (Coleoptera) in a tropical dry forest region in Mexico: Sierra de Huautla, Morelos. *The Pan-Pacific Entomologist* 79:23–37.

Zurita, G. M. 2004. *Elateridae (Coleoptera) de la Reserva de la Biosfera Sierra de Huautla, Morelos, México*. Bachelors thesis, Facultad de Ciencias, Universidad Nacional Autónoma de México. Mexico City, 107 pp.

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Appendix 1. List of Buprestidae species recorded from El Limón de Cuauchichinola, Tepalcingo, Morelos, Mexico. Superscript letters indicate the following: a = species recorded during the one year of sampling; b = species recorded by sporadic collecting; c = species recorded previously by Westcott et al. (2008); d = new record for REBIOSH; e = new record for Morelos.

Subfamily Polycestinae
Tribe Acmaeoderini
Acmaeodera aeneoflava Westcott, 1998[b, c]
Acmaeodera alacris Horn, 1878[b, c]
Acmaeodera crossi Barr, 1992[b, c]
Acmaeodera cuprina Spinola, 1838[a, d]
Acmaeodera haemorrohoa LeConte, 1858[a, b, c]
Acmaeodera lauta Barr, 1972[a, b, c]
Acmaeodera noguerai Wescott, 2008[b, c]
Acmaeodera philippinensis Obenberger, 1924[a, b, c]
Acmaeodera rustica Fisher, 1949[a, b, c]
Acmaeodera scalaris Mannerheim, 1837[a, b, c]

Tribe Polycestini
Polycesta embriki Obenberger, 1936[a, d]

Subfamily Chrysochroinae
Tribe Dicercini
Hippomelas brevipes Casey 1909[a, b, c]
Hippomelas mexicanus (Laporte & Gory, 1837)[b, c]
Hippomelas saginatus (Mannerheim, 1837)[a, b, c]
Lampetis (*Spinthoptera*) *cyanitarsis* Corona, 2005[a, b, c]

Subfamily Buprestinae
Tribe Buprestini
Agaeocera gigas (Gory & Laporte, 1839)[a, b, c]

Tribe Stigmoderini
Hiperantha interrogationis (Klug, 1825)[a, c]

Tribe Anthaxiini
Anthaxia (*Agrilaxia*) sp. 1[b, e]
Anthaxia (*Agrilaxia*) sp. 2[b, e]

Tribe Xenorhipidini
Xenorhipis parallelus (Waterhouse, 1889)[a, d]

Tribe Melanophilini
Melanophila atra Gory, 1841[b, c]

Tribe Actenodini
Actenodes biarti Bleuzen, 1989[b, c]
Actenodes calcaratus (Chevrolat, 1835)[a, d]
Actenodes chalybeitarsis (Chevrolat, 1833)[a, b, c]
Actenodes scabrosus MacRae & Bellamy, 2013[a, b, c]

Tribe Chrysobothrini
Chrysobothris acutipennis Chevrolat, 1835[a, c]
Chrysobothris analis LeConte, 1860[a, b, c]
Chrysobothris distincta Gory, 1841[a, b, c]
Chrysobothris modesta Waterhouse, 1887[a, b, c]
Chrysobothris multistigmosa (Mannerheim, 1837)[a, b, c]
Chrysobothris nigropicta Nelson, 1988[b, c]
Chrysobothris paratabalipa Nelson, 1975[a, c]
Chrysobothris tessellata Wescott, 2008[a, b, c]
Chrysobothris viridiimpressa Gory & Laporte, 1837[a, b]
Chrysobothris sp. 1[a]
Chrysobothris sp. 2[a]
Chrysobothris sp. 3[b]
Colobogaster aureoviridis Fisher, 1933[a, d]

Subfamily Agrilinae
Tribe Agrilini
Paragrilus lesueuri Waterhouse, 1889[a, b, c]
Agrilus alborubronigrus Hespenheide, 1990[a, c]
Agrilus atkinsoni Hespenheide, 1990[a, d]
Agrilus atripennis Chevrolat, 1835[a, b, c]
Agrilus aurantioguttatus Hespenheide, 1990[a, c]
Agrilus aurulentus Hespenheide, 1990[a, c]
Agrilus cavatus Chevrolat, 1838[a, d]
Agrilus delicatulus Waterhouse, 1889[a, b, c]
Agrilus detractus Waterhouse, 1889[a, b, c]
Agrilus fuscus Hespenheide, 1990[a, b, c]
Agrilus latifrons Waterhouse, 1889[a, b, c]
Agrilus luctator Kerremans, 1903[a, b, c]
Agrilus mecoatli Fisher, 1938[a, b, c]
Agrilus nodifrons Waterhouse, 1889[a, d]
Agrilus paraimpexus Hespenheide, 2007[a, b, c]
Agrilus rubrovittatus (Waterhouse, 1889)[a]
Agrilus sallei Dugès, 1878[a, b, c]
Agrilus speciosus Waterhouse, 1889[b, e]
Agrilus tinctipennis Fisher, 1933[b, c]
Agrilus sp. 1[a]
Agrilus sp. 2[a]
Agrilus sp. 3[b]
Agrilus sp. 4[a, b]
Agrilus sp. 5[b]
Agrilus sp. 6[b]
Agrilus sp. 7[b]

Agrilus sp. 8[b]
Agrilus sp. 9[b]
Agrilus sp. 10[a]
Omochyseus terminalis Waterhouse, 1887[a, c]
Paradomorphus emarginatus Waterhouse, 1889[a, c]

Tribe Tracheini
Brachys exquisitus Hespenheide, 2008 [b, c]
Leiopleura sp. 1[a, e]
Leiopleura sp. 2[a, e]
Hylaeogena sp. 1[b]