Diversity of the Family Cerambycidae (Coleoptera) of the Tropical Dry Forest of Mexico, I. Sierra de Huautla, Morelos

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ABSTRACT The cerambycid fauna of the tropical dry forest of the Sierra of Huautla, Morelos, Mexico, is described. Collections were made between November 1995 and October 1996, during 5 d of every month, and collection methods included light trapping, Malaise trapping, and netting, sweeping and beating. A total of 153 species, 91 genera, 32 tribes, and four subfamilies was recorded. The subfamily with the greatest number of species was Cerambycinae with 78, followed by Lamiinae with 67, Lepturinae with six, and Prioninae with two. The tribes with the largest number of genera and species were Trachyderini with 13 and 17 and Acanthocini with 12 and 23. The genera with the most species were *Phaea* Newman with 11 and *Lepturges* Bates with eight. Estimated richness values using the nonparametric estimators ICE and Chao 2 were 251 and 241, respectively. A few species were very abundant, but many were represented by only a few individuals. The diversity value calculated with the Shannon Index over the entire year was 3.86. Species richness and abundance varied with time, with the highest values recorded in the rainy season and lowest values in the dry season. The fauna was more similar to the fauna of Chamela, Jalisco, than to El Aguacero, Chiapas, and consists of 65% species endemic to Mexico.

KEY WORDS Cerambycidae, tropical dry forest, Mexico, richness, Abundance

Knowledge of the diversity and distribution of the family Cerambycidae in the tropical dry forest in Mexico is scarce and limited to the published information of faunal studies carried out in two small regions of the country (Chemsak and Noguera 1996, Toledo et al. 2002) and to distribution records of the species reviewed in a few taxonomic works dealing with the Mexican fauna (see Noguera and Chemsak 1996 for references). The tropical dry forest is one of the most diverse tropical ecosystems in America but also is a highly threatened community (Janzen 1988). In Mexico it covers 8% of the land area (Trejo and Dirzo 2000) and harbors a large number of habitat-restricted endemic species (Rzedowski 1991, Toledo and Ordoñez 1993, Flores and Gerez 1994, Ceballos and García 1995). Until 1990 only 27% of the original tropical dry forest in Mexico remained as intact forest (Trejo and Dirzo 2000), while the rest has been altered by human activities, primarily for agriculture and cattle grasslands (Toledo 1992, Maass 1995). Although the deforestation rate of the tropical dry forest for the country is unknown, it has been estimated at 1.4% per year for the Mexican state of Morelos, and urgent measures are needed to ensure its conservation for the future (Trejo and Dirzo 2000).

Considering this scenario and the fact that a knowledge of the biodiversity of any natural community is a cornerstone in any conservation effort (Wilson 1988), a long-term study to understand the diversity and distribution of the family Cerambycidae of the tropical dry forest was initiated.

This article presents the results of a study of the family Cerambycidae from a single broad, but biologically uniform, locality, the Sierra de Huautla, Morelos, for the purpose of providing a better understanding of the local diversity of that group and also increasing the existing general knowledge of this group in the tropical dry forest.

Materials and Methods

Study Site. The study was carried out in the Sierra of Huautla Biosphere Reserve (abbreviated herein as Huautla) located in south central Morelos between the parallels 18° 20′ 10′ and 18° 34′ 20′ N and the meridians 98° 51′ 20′ and 99° 08′ 15′ W. According the Köppen classification modified by García (1981), the climate of the region is warm subhumid, type Awo″(w) (i′)g. Average annual precipitation for the

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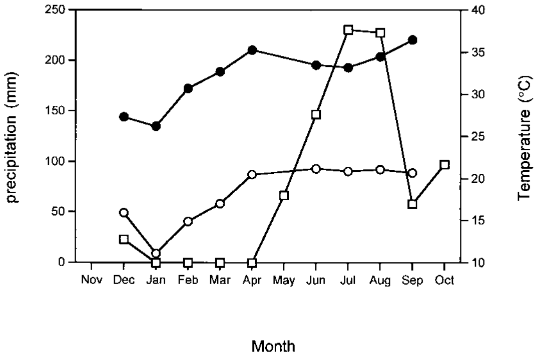

Fig. 1. Total precipitation and maximum and minimum temperature per month recorded during the study period in Huautla, Morelos. Square (□), precipitation; solid circle (●), maximum temperature; open circle (○), minimum temperature.

period 1981–1997 was 824 mm, with 80% of the rain falling between June to September. Mean temperature for the same period was 24.7°C, with an average maximum temperature of 34.3°C and an average minimum temperature of 15.0°C. The highest temperature during that period (36.5°C) was recorded in May, and the lowest temperature (12.5°C) was recorded in February (CNA 2000). Total precipitation during the study period was of 850 mm, with the highest temperature recorded in April and the lowest in January (Fig. 1).

The tropical dry forest at our study site contains 882 known species of vascular plants (Dorado 1997). The most speciose families are Fabaceae, Poaceae, Asteraceae and Burseraceae. Dominant trees in the region are *Conzattia multiflora* (B.L. Rob) Standl., *Lysiloma acapulcense* (Kunth) Benth., *L. divaricatum* (Jacq.) Macbr., and several species of *Bursera* and *Ceiba* (Dorado 1997). Along streams and in narrow canyons, a gallery forest is present, characterized by trees taller than those of the tropical dry forest, such as *Licania arborea* Seem., *Sapindus saponaria* L., *Ficus petiolaris* Kunth, *F. tecolutensis* (Liebm.) Miq., *Enterolobium cyclocarpum* (Jacq.) Griseb., *Astianthus biminalis* (HBK.) Baillon and *Bursera grandifolia* (Schdl.) Engl. Secondary forest has regrown in disturbed areas, dominated by thorny legumes, such as *Acacia farnesiana* (L.) Willd., *A. pennatula* (Cham. & Schltdl.) Benth., *A. cochliacantha* Humb. & Bonpl. Ex Willd., *A. bilimekii* J. F. Macbr., *Pithecelobium acatlense* Benth, *Mimosa polyantha* Benth., *M. chaetocarpa* Brandegee, and *M. benthami* J. F. Macbr. (Pérez-Jiménez et al. 1992).

Flat areas along the narrow canyons and streams also have been open to agriculture, and in the hills, wood is extracted and sold as fuel. Hillsides are also used as grazing areas for cows and goats, which has resulted in the near disappearance of the native understory (Dorado 1997; unpublished data).

Collection Methods and Sampling Regimes. Fieldwork was carried out between November 1995 and October 1996. Collections were made during 5 d of every month, beginning on the day of the waning quarter moon, because light traps work better when the moon sets early (Janzen 1983). Collection methods included: light trapping, Malaise trapping and direct collecting.

Light trapping employed a combination of two light sources: one mercury vapor lamp and one Minnesota type light trap (see Southwood 1966). The latter had two 20 Watt UV bulbs (one unfiltered) over a single 20-cm-diameter collection jar filled with 70% ethyl alcohol. The light trap and the mercury vapor lamp were placed against a vertical white sheet measuring 1.80 by 1.50 m. These trap systems were located in three different sites and were operated in the same place during each collecting session through the 12 mo. The traps were operated for four hours every day (from 1900 to 2300 hours in the winter and from 2000 to 2400 hours in the summer).

Six Malaise traps, based on the Townes model (Townes 1972), were placed in different locations inside the forest and remained in the same place throughout the year. Each trap was operated for 5 d of every month.

Direct collecting also was carried out during 5 d each month, concentrated between 900 and 1500 hours (1000–1600 hours in the summer time). Netting, sweeping and beating were employed, with efforts concentrated on flowers and woody vegetation in general.

The collecting places were located mainly around the facilities of the Center of Environmental Education and Research Sierra of Huautla (CEAMISH) and in the Canyon of the River Ajuchitlán. The Malaise and light traps were located in the first area only because of security issues for the equipment and samples.

Analytical Methods. The values of richness and abundance correspond to the number of species and individuals recorded. Diversity and evenness was analyzed with the Shannon Index, using the natural logarithm. Evenness is a measure of the distribution of abundance of species, and assumes a value between 0 and 1, with one representing a situation in which all species are equally abundant (Magurran 1988). Those values were obtained with the program BioDiversity Pro (McAleece et al. 1999).

Considering that the observed number of any sample of individuals from a species rich community underestimates the true number of species present (Chazdon et al. 1998), two nonparametric estimators of species richness were performed using the data obtained during the year of the study, with the purpose to determine how close the richness value recorded is of the true local richness. Additionally, the estimated richness was plotted as a function of the cumulative number of months sampled, to evaluate graphically the results on both estimators. The estimators used were ICE and Chao 2, both incidence-based estimators, because they best satisfied the requirements for an ideal species-richness estimator (Chazdon et al. 1998). The first one is based on species found in ≤10 sampling units and its formula is (sensu Colwell 2001):

$$S_{ice} = S_{freq} + \frac{S_{infr}}{C_{ice}} + \frac{Q_1}{C_{ice}} \gamma^2_{ice},$$

where S_{freq} is the number of species found in >10 samples, S_{infreq} is the number of species found in 10 or fewer samples, C_{ice} is the sample incidence coverage estimator, Q_1 is the number of species that occur in a only one sample and γ^2ice is the estimated coefficient of variation of the Qi's for infrequent species. Additional information about this formula is supplied by Colwell (2001).

The second estimator is based on species found in only one or two sampling units and its formula is (sensu Colwell 2001):

$$S_{Chao2} = S_{obs} + \frac{Q_1^2}{2(Q_2 + 1)} - \frac{Q_1 Q_2}{2(Q_2 + 1)^2},$$

where S_{obs} is the total number of species in all samples pooled, Q_1 is the number of species that occur in an only one sample, and Q_2 is the number of species that occur in only two samples.

The estimates were calculated using EstimateS 6.0b1 (Colwell 2001). The species collected within each month were considered one sample unit (12 in total).

For phenology analysis of the data, it was considered that the rainy season lasted from May to November and the dry season from December to April. This was based on the occurrence of individual storm events totaling greater than 15 mm, because the canopy intercepts smaller amounts almost completely (Cervantes 1988).

Voucher Specimens. All the material is deposited in the entomological collection of Chamela Biological Station except some duplicates that are deposited in the entomological collection of CEAMISH of the University of Morelos State.

Results

Richness. We recorded 153 species of cerambycids, of which only 125 could be determined to the specific level. It was not possible to know the identity of the remaining taxa, because they belong to groups with taxonomic problems or apparently are undescribed species. The complete list is presented in *Appendix 1.*

Of the determined species, 72 are recorded for the first time from the state of Morelos.

The species collected belong to 91 genera, 32 tribes, and four of the eight New World subfamilies (Table 1). The subfamily with the greatest number of species was Cerambycinae with 78 (52% of the total), followed by Lamiinae with 67 (43%). At the level of genus and tribe the pattern was similar, recording 50 and 16 in Cerambycinae and 36 and 13 in Lamiinae (Table 2).

The tribes with the greatest number of genera and species were Trachyderini with 13 and 17 and Acanthocini with 12 and 23. There were 17 tribes with only one genus represented and 12 with only one species (Table 2).

The genera with the highest number species in the fauna were *Phaea* Newman with 11 and *Lepturges* Bates with eight (both Lamiiinae). Within the remaining genera, 15 were represented by only two species and 61 by just one species. Thus, almost 84% of the genera recorded were represented by two or fewer species. In contrast, three genera *(Phaea, Lepturges, Stenosphenus* Haldeman) include 15% of the total species and 14 genera combine for 40% of the total species of the site.

Richness Estimated. In both cases, with ICE and Chao 2, the richness values estimated were larger than the value observed: 254 (SD = 0) and 241 species (SD = 29.24) against 153 species recorded, respectively. This may mean that we only recorded 61 or 63% respectively, of the true local richness. However, the

Table 1. Number of tribes, genera and species of the cerambycids from Huautla, Morelos

Subfamily	No. of tribes	No. of genera	No. of species
Prioninae	2	2	2
Cerambycinae	16	50	78
Lepturinae	1	3	6
Lamiinae	13	36	67
Total	32	91	153

Table 2. Tribes, number of genera and species of the cerambycids from Huautla, Morelos

Subfamily Tribe	No. of genera	No. of species
Prioninae		
Macrotomini	1	1
Cerambycinae		
Methiini	1	1
Eburiini	2	4
Hesperophanini	4	5
Elaphidiini	10	24
Ibidionini	4	6
Obriini	1	2
Rhinotragini	3	4
Callichromatini	1	1
Dryobini	1	1
Clytini	4	4
Anaglyptini	1	1
Tillomorphini	1	4
Rhopalophorini	1	2
Heteropsini	1	1
Lissonotini	1	1
Trachyderini	13	17
Lepturinae		
Lepturini	3	6
Lamiinae		
Lamiini	3	3
Apomecynini	2	2
Onciderini	3	4
Pteropliini	1	1
Pogonocherini	3	3
Desmiphorini	3	6
Anisocerini	1	1
Acanthoderini	3	8
Acanthocini	12	23
Colobotheini	1	1
Phytoecini	1	1
Tetraopini	2	12
Hemilophini	1	2

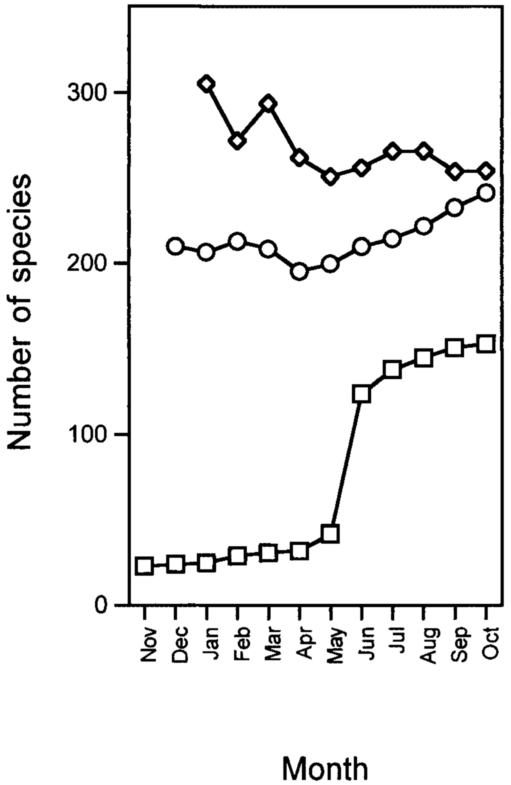

Fig. 2. Observed and estimated species accumulation curves of the cerambycid fauna of Huautla, Morelos, using nonparametric estimators. Square (□), observed richness; circle (○), estimated richness using Chao 2; diamond (◇), estimated richness using ICE.

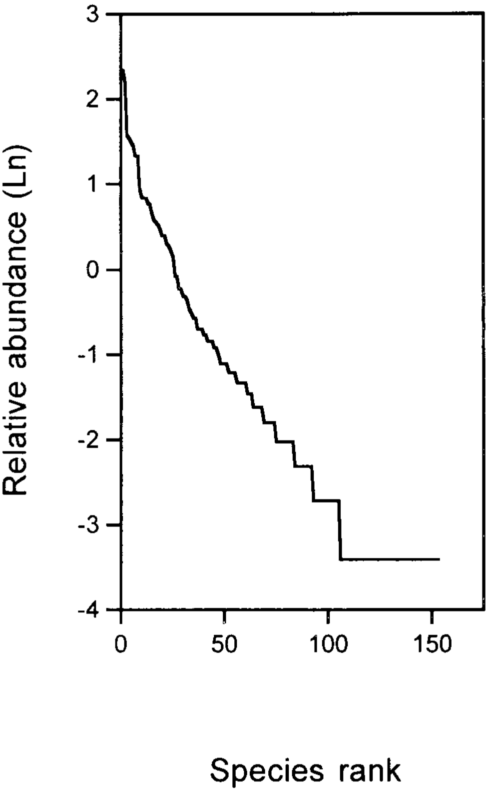

Fig. 3. Rank-abundance pattern of the cerambycid species recorded in Huautla, Morelos.

species-accumulation curves computed with each one of these estimators (Fig. 2), show that with ICE the curve almost reaches the asymptote, but is still increasing with Chao 2. Therefore, depending of the accuracy of these estimators, the number of species present in this area could be considerably greater.

Abundance. Three thousand and twenty five individual specimens were collected during the study overall, with the distribution per species being very heterogeneous; a few species were very abundant, but many others were represented by only one or a few individuals (Fig. 3). The most abundant species was *Essostrutha binotata* Bates with 314 individuals, followed by *Leopinus naeviicornis* (Bates) with 278, *Stenosphenus cribripennis* Thomson with 147, *Pseudocanidia cuernavacae* Dillon with 141, *Tylosis puncticollis asperula* (Bates) with 130, and *Derobrachus sulcicornis* LeConte and *Chyptodes dejeani* (Thomson) each with 115. In contrast, there were 48 species represented by only one individual and 105 represented by 10 or fewer.

Diversity. The diversity value calculated with the Shannon Index over the entire year was 3.86, and the evenness index was 0.78. The diversity values by month varied (Table 3); with the lowest value recorded in April (1.27) and the highest recorded in June (3.58). The lowest and highest values of the evenness index were recorded in April and May (0.55 and 0.90, respectively), but over the rest of the year this index had little variation (Table 3).

Phenology. The number of species active varied with time and was greatest during the rainy season. The highest number of species active was recorded in June (100), coinciding with the beginning of the rainy season, and the lowest number in January (seven), at the beginning of the dry season (Fig. 4). Seasonally, 132 species were present only during the rainy season, five only during the dry season, and 16 species were present during both seasons. Thus, 96% of the species were active during the rainy season.

There were also temporal differences in abundance. The greatest number of individuals was also recorded in June with 1,193 and the lowest in February with 22 (Fig. 4). Seasonally the greatest number of individuals was recorded during the rainy season with 2,828 (93.5%), as opposed to 197 during the dry season (6.5%).

The activity of the species, based upon the number of months in which adults were recorded, was very restricted. Seventy-seven (50%) were active for only 1 mo, 29 (19%) for 2 mo, 20 (13.2%) for 3 mo, 14 (9.9%) for 4 mo, and 13 (7.9%) for more than 4 mo. This indicates that the adults of almost 70% of the species

Table 3. Diversity and evenness indices obtained monthly of the cerambycid fauna from Huautla, Morelos

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Diversity	2.21	1.67	1.49	1.78	1.90	1.27	2.56	3.58	2.99	2.68	2.71	2.30
Evenness	0.70	0.72	0.76	0.77	0.79	0.55	0.90	0.77	0.71	0.73	0.79	0.72

Indices obtained using the Shannon Index

were active for less than two months out of the entire year. Of the 27 species recorded as active during four or more months, 14 were active only during the rainy season, and 13 during the both the rainy and dry seasons; however, of the latter species, six had their highest activity levels during the rainy season, three during the dry season, and only four were relatively uniformly active during the whole year (see Fig. 5 for examples).

Of all species recorded and based upon the time of day that the species were collected, the adults of 84 species are nocturnal, 64 are diurnal, and three were relatively equally active during the day and night.

Captures by Collecting Method. Of the overall species total, 98 taxa were collected by direct collecting, 72 species were taken at light and 16 species were taken by Malaise trap.

Of those species obtained by direct collecting, 64 were not collected by any other method, 24 were also collected at light, eight with Malaise trap, and two with both trap techniques. However, 49 species were collected only at light and four species only with Malaise traps.

Considering the above, direct collecting was the most productive method, recording 64% of the species, followed by light collecting with 48%, and Malaise traps with 10%. Considering only species collected exclusively by one of these methods, direct collecting produced 42%, lights 32%, and the Malaise trap 3% of the species recorded.

Comparison with Other Regions with Tropical Dry Forest. The number of species recorded in Huautla was lower than the number of species recorded in the region of Chamela, Jalisco (306 species) (Chemsak and Noguera 1996) and El Aguacero, Chiapas (203 species) (Toledo et al. 2002) by 50 and 25%, respectively. Chamela is situated almost at the same latitude as Huautla (19° 30′ versus 18° 20′ -34′ N), but at a lower altitude (generally <150 m, Bullock 1988). In contrast, El Aguacero has an altitudinal gradient of 500–700 m (close to the Huautla altitude), but it is situated well south of Huautla (93° 31′ N) (Toledo et al. 2002).

Of the 125 species that were identified from Huautla, 95 (77%) are shared with the region of Chamela (Chemsak and Noguera 1996) and 40 (32%) with El Aguacero (Toledo et al. 2002). At the generic level, 84 genera are shared with Chamela (92%) and 60 with El Aguacero (66%).

Twenty-four species and six genera were recorded in this region but not found either in Chamela, Jalisco, or at El Aguacero, Chiapas. The species thus far known exclusively from this region are *Eburia cruciata* (Linsley), *Haplidus nitidus* Chemsak & Linsley, *Xeranop-*

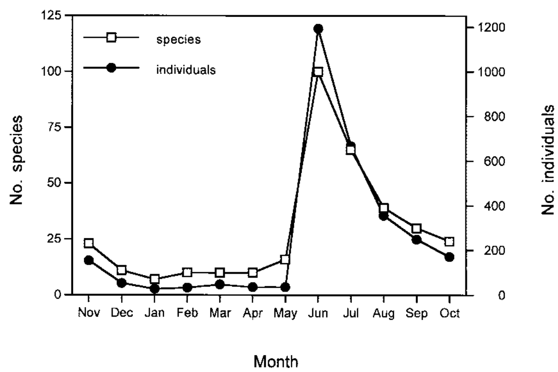

Fig. 4. Pattern of species richness and abundance of Cerambycidae recorded per month in Huautla, Morelos.

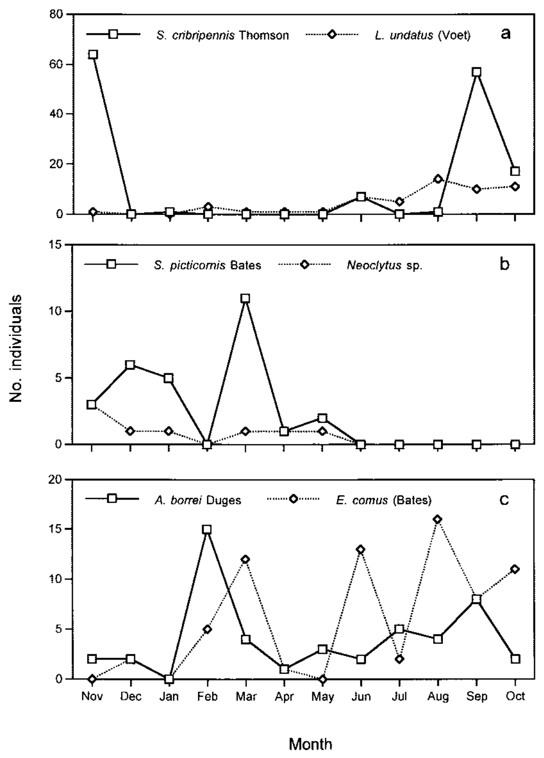

Fig. 5. Annual pattern of activity for six species of Cerambycidae recorded from Huautla, Morelos. (a) Species with highest activity during the rainy season. (b) Species with activity during the dry season. (c) Species with relatively uniform active throughout the year.

lium bicolor Chemsak & Linsley, *Micropsyrassa opaca* Martins & Chemsak, *M. reticulata* Martins & Chemsak, *Heterachthes w-notatus* Linsley, *Ochraethes nigropunctatus* (Chevrolat), *Clytoderus pygmaeus* Linsley, *Euderces cribripennis* Bates, *Rhopalophora serripenis* Giesbert & Chemsak, *R. tenuis* (Chevrolat), *Paroxoplus ornaticollis* (LeConte), *Sphaenothecus picticornis* Bates, *Megachoriolaus flammatus* (Linsley), *Strangalia biannulata* (Linsley), *S. westcotti* Chemsak & Linsley, *Adetus obliquus* (Bates), *Alphomorphus vandykei* Linsley, *Ecyrus ciliatus* Chemsak & Linsley, *Thryallis sallaei* Bates, *Canidiopsis hebes* Dillon, *Lagocheirus lugubris* (Dillon), *Pseudocanidia cuernavacae* Dillon and *Tetraopes cleroides* Thomson. The genera exclusive to this region were *Styloxus* LeConte, *Haplidus* LeConte, *Clytoderus* Linsley, *Paroxoplus* Chemsak, *Alphomorphus* Linsley, and *Pseudocanidia* Dillon. It should be noted that these comparisons are only for the three study sites, and that most, if not all, of these taxa presently are known from other areas in Mexico or Central America.

Discussion

The reduced species richness recorded in the Huautla study area in comparison with Chamela, Jalisco (306 species) (Chemsak and Noguera 1996), and El Aguacero, Chiapas (203 species) (Toledo et al. 2002), both areas with tropical dry forest, is consistent with the hypothesis that diversity diminishes with increases in the altitude or latitude (Lawton et al. 1987, Begon et al. 1996). However, this value seems an underestimation of the true number of species present locally, as indicated by the estimated richness with both nonparametric estimators (Chao and ICE), and therefore the degree to which our results support this hypothesis is unknown.

Our underestimation of species richness reflects limitations of the sampling methods, because several aspects of the natural history of this group may to influence the effectiveness of collection. For example, the family is strongly seasonal (85% of the species were active as adults only during the rainy season) and their activity as adults is short (69% of the species were active less than two months); therefore it is probable that some species with shorter periods of adult activity were not collected, because they were active during the noncollection intervals (carried out for only 5 d of each month). Moreover, the apparent local or seasonal rarity of some cerambycid species (in 31% of the species recorded only one individual was collected, and in 69% of the species only 10 or fewer specimens were taken), and the heterogeneity of the forest type (Trejo 1998), diminishes the probability of collecting species which only occur in very specific habitats. Supporting these statements, fieldwork in Chamela was carried out for ≈10 yr (Chemsak and Noguera 1996) and still after publication of a species list, additional new records have been obtained (F.A.N., unpublished data). In El Aguacero 121 species were recorded during one year of fieldwork following almost the same methodology used at the Huautla site. Within miscellaneous collections made later or before the one year sampling, the number of species from El Aguacero was increased 40% (Toledo et al. 2002).

Despite our underestimation, the maximum estimated value (254 species, ICE) is still lower than the number of species recorded in Chamela. This could support the hypothesis of a lower richness with a higher altitude but may also reflect differences in the state of conservation of the forest between both regions. In Chamela the forest is well preserved, but in Huautla the forest has been strongly disturbed by the extraction of wood for fuel and pruning of the understory for livestock (Dorado 1997; unpublished data). This may have caused the extinction or reduction of certain species of plants at a local level. Such disturbance may directly influence certain cerambycid species (monophagous species principally), because larval food sources may have disappeared or been greatly reduced.

The marked seasonality observed in richness and abundance of cerambycid species was also recorded in Chamela, Jalisco and El Aguacero, Chiapas. In Chamela 96% of the species were recorded in the rainy season (Chemsak and Noguera 1996) and in El Aguacero 93% of the species and 72% of the individuals occurred in the rainy season (Toledo et al. 2002). This seasonal pattern is probably related to the availability of resources. Larvae of most cerambycid species bore in both branches and recently dead trees and, to a lesser degree, stems of herbaceous plants (Linsley 1961). In the tropical dry forest, the leaf production and growth of most of the annual and perennial plants and the highest values in fallen branches takes place during the rainy season (Bullock and Solís-Magallanes 1990, Martínez-Yrízar 1995). Moreover, the biggest occurrence of dying trees is recorded at the end of the dry season and beginning of the rainy season (J. M. Maass, personal communication). In this way, the reproductive activity of the individuals of this group would be synchronized with the time of greatest availability of resources for larval development. That is, adults of most of the species would mate and oviposit during the rainy season (Fig. 5a). After emergence, the larvae would begin their development, and depending on the species, they would reach the adult state before the beginning of the drought and would pass this period in estivation, or the larvae would continue feeding during the dry season and would reach the adult state at the end of the dry season or beginning of the rainy season. Exceptions to this pattern would be those few species active the whole year (Fig. 5c) and that seemingly have more than one generation within each year, or those species which are active only during the dry season (Fig. 5b)

As more species are recorded at Huautla, Chamela and El Aguacero, the number of species that are shared among areas could diminish or increase. For example, of the species recorded only in Huautla at this moment, *Heterachthes w-notatus* Linsley, *Euderces cribripennis* Bates, *Rhopalophora serripenis* Giesbert & Chemsak, *Strangalia westcotti* Chemsak & Linsley, and *Tetraopes cleroides* Thomson have also been recorded in Nayarit and/or Sinaloa states, and they could also be in Chamela, because both states are located north of this region and are included in the continuous range of the tropical dry forest on the west coast. Also, *Rhopalophora tenuis* (Chevrolat) and *Sphaenothecus picticornis* Thomson have a wide distribution in Mexico (the first one is recorded from another locality in Jalisco) and they could be found in the future in some of the other regions. Nevertheless it seems evident that the fauna of Huautla is more similar to that of Chamela than to that of El Aguacero.

Of the species identified, 81 have been recorded only from Mexico, 30 extend between Mexico and Central America, four between Mexico and South America, three range into the United States and Mexico, three into the United States and Central America, and four species are common to the United States, Mexico, South America, and The Antilles. These values indicate that 65% of the species are endemic to Mexico.

Among the endemic species, 54 are distributed along the slope of the Pacific coast and the Balsas basin, 14 are found only in the Balsas basin, and 13 are distributed in both Pacific and the Gulf coasts. This pattern coincides with that recorded by Lott and Atkinson (2001) for plants, with two areas of very identifiable endemism, the Pacific Slope, from Sinaloa to Chiapas and The Balsas basin (sharing species among both).

Although the results obtained during this study seem to show that our knowledge of the family Cerambycidae is not yet complete, they also indicate that the diversity of this group in that region is high and that it contains a great number of species endemic to Mexico. This makes that region a very important place for natural resource conservation purposes. Although the Huautla region certainly should be included as a high-priority area for conservation in Mexico (Arriaga et al. 2000), according to Trejo and Dirzo (2000), in the state of Morelos only 50% of these forests are still relatively intact. At the present rate of losses, the estimated time required for a reduction to 10% of the original extent will be reached by the year 2030 (Trejo and Dirzo 2000). Given this scenario, we must agree with those authors, in that is urgent the application of conservation measures in the Morelos state, as well as planning management programs for protected and unprotected areas.

We also feel that it is important to perform a longer term study to test the hypothesis that in the region of Huautla there may in fact exist at least 37–39% more species than were recorded during this study. A longer term study also would allow us to evaluate the relative effectiveness and biases of the collection methods and to further evaluate the predictions generated by the no-parametric estimators.

Finally, the differences in faunal compositions recorded within the three Mexican tropical dry forest study regions show that this habitat presents considerable variation along its overall distribution and that it is necessary to continue with studies in other tropical dry forest regions of the country to identify additional high-priority areas of species richness or high percentages of endemism for conservation.

Appendix 1

List of the species of Cerambycidae recorded in the Sierra de Huautla, Morelos, Mexico. An astrerisk indicates that the species is recorded for the first time for the state of Morelos. The list follows the taxonomic classification of Monné and Hovore (2002) and includes numbers of individuals collected, information when the adults were collected, collecting method(s), records of host and/or feeding plants, and in some cases, information about natural history.

Prioninae.

Macrotomini

Nothopleurus lobigenis Bates. 12. February, May and June. At light.

Prionini

Derobrachus sulcicornis LeConte. 115. June to September. At light.

Cerambycinae

Methiini

Styloxus sp. 1. February. At light.

Eburiini

Eburia cruciata (Linsley). 1. June. Malaise trap.

E. perezi Chemsak & Giesbert. 2. June. At light.

E. sp. 7. May. At light.

Eburodacrys callixantha Bates. 1. May. At light.

Hesperophanini

Austrophanes robustum Chemsak & Linsley. 1. June. At light.

Haplidus nitidus Chemsak & Linsley. 3. March and April. At light.

Xeranoplium bicolor Chemsak & Linsley. 2. June. At light and on *Acacia cochliacantha* Humb. & Bonpl. Ex Willd.

X. puncticolle Chemsak & Linsley. 3. June. At light.

Hesperophanini sp. 1. February. At light.

Elaphidiini

Aneflomorpha rectilinea Casey. 1. June. At light.

A. martini Chemsak & Linsley. 4. June and July. At light and on flowers of *Croton* sp.

Aneflus rugicollis Linsley. 17. June. At light and on trunks of recently dead trees.

Anelaphus badius Chemsak. 3. March and April. At light.

A. nitidipennis Chemsak & Linsley. 1. June. At light.

A. piceum (Chemsak). 2. May. At light.

A. sp. June. 2. At light.

Anopliomorpha gracilis Chemsak & Noguera. 1. June. At light.

A. reticolle (Bates). 10. May and June. At light and on trunks of recently dead trees.

Conosphaerion concolor concolor Linsley. 15. June. At light.

Ironeus mutatus Bates. 6. June to August. On flowers of *Croton* sp. and *Cephalanthus occidentalis* L.

I. pulcher Bates. 1. June. At light.

I. submetallicus Chemsak & Linsley. 5. June. At light.

**Micropsyrassa opaca* Martins & Chemsak. 5. May and June. At light.

M. pilosella (Bates). 2. May. At light.

M. reticulata Martins & Chemsak. 3. June. At light.

Orwellion gibbulum gibbulum (Bates). 8. June. At light and on trunks of recently dead trees.

Psyrassa sp. 24. May, June and July. At light and on flowers of *Croton* sp. and *Cephalanthus occidentalis.*

Stenosphenus cribripennis Thomson. 147. January, June, August, September, October and November. On flowers of *Acacia angustissima* (Mill.) Ktze., *A. cochliacantha, Parthenium hysterophorus* L., on dead branches of *Acacia* sp. and on a dead tree of *Pseudobombax* sp.

**S. languroides languroides* Bates. 1. July.

S. proruber Giesbert & Chemsak. 1. June.

S. rufipes Bates. 9. August, September and October. On flowers of *Parthenium hysterophorus.*

**S. trispinosus* Bates. 2. June and July. On flowers of *Stemmadenia galeotiana* (A. Rich) Miers.

**Stizocera plicicollis* (Germar). 1. June. At light.

Ibidionini

Heterachthes w-notatus Linsley. 10. June and July. At light and beating.

H. sp. 4. June. At light.

Hexoplon calligrammum Bates. 1. July.

**Neocompsa agnosta* Martins. 19. June and August. At light and on trunks of recently dead trees.

N. puncticollis asperula (Bates). 130. June and July. At light and on trunks of recently dead trees.

Stenygra histrio Serville. 45. June to September. Malaise trap and on flowers of *Croton* sp., *Trichilia americana, Parthenium hysterophorus.*

Obriini

Obrium discoideum (LeConte). 1. June. At light.

**O. ruficolle* (Bates). 4. June and July. At light.

Rhinotragini

Acyphoderes cribricollis Bates. 5. June and July. Malaise trap and on unidentified flowers.

**A. suavis* Bates. 9. May, June, August and September. Malaise trap and on flowers of *Croton* sp.

**Odontocera aurocincta* Bates. 2. July. On flowers of *Trichilia americana* (Sesse & Moc.) Pennington.

Ommata (*Eclipta*) *championella* Bates. 14. June. On flowers of *Croton* sp.

Callichromatini

**Plinthocoelium sapphirum* (Bates). 1. June. On flowers of *Mimosa arenosa* (Willd.) Poir.

Dryobini

**Ornithia mexicana* (Sturm). 1. June. On trunks of recently dead trees.

Clytini

**Mecometopus sarukhani* Chemsak & Noguera. 2. June. On flowers of *Sapium macrocarpum* Muell.

Neoclytus sp. 8. March, April, November and December. Malaise trap and beating branches of recently dead trees.

**Ochraethes nigropunctatus* (Chevrolat). 9. November. On flowers of *Iresine* sp.

**Placosternus difficilis* (Chevrolat). 28. January, March and June to December, except October. On flowers of *Sapium macrocarpum, Cephalanthus occidentalis, Mimosa guatemalensis* (Hook & Arn.) Benth.

Anaglyptini

**Clytoderus pygmaeus* Linsley. 1. May. Malaise trap.

Tillomorphini

Euderces cribripennis Bates. 21. June. On flowers of *Croton* sp.

E. longicollis (Linsley). 17. June and July. Malaise trap and on flowers of *Croton* sp.

**E. pulcher* (Bates). 13. June and July. Malaise trap and on flowers of *Croton* sp., *Mimosa guatemalensis, Sapium macrocarpum, Trichilia americana* and on trunks of recently dead trees.

E. sp. 1. July. Beating recently dead branches.

Rhopalophorini

Rhopalophora serripennis Giesbert & Chemsak. 65. June. On flowers of *Croton* sp. and *Trichilia americana.*

R. tenuis (Chevrolat). 8. June. Malaise trap and on flowers of *Croton* sp.

Heteropsini

**Chrysoprasis hypocrita* Erichson. 78. June and July. On flowers of *Croton* sp., *Sapium macrocarpum, Acacia cochliacantha, Mimosa arenosa, Stemmadenia galeotiana* and on trunks of recently dead trees.

Lissonotini

**Lissonotus flavocinctus* DuPont. 3. June to August. On trunks of recently dead trees.

Trachyderini

**Axestoleus quinquepunctatus* Bates. 13. June and July. On flowers of *Croton* sp., *Eysenhardtia platycarpa* Pennell & Safford and *Trichilia americana.*

Elytroleptus scabricollis Bates. 15. June and July. On flowers of *Croton* sp. and *Trichilia americana.*

**Ischnocnemis caerulescens* Bates. 5. September.

Lophalia prolata Chemsak & Linsley. 1. September.

**Metaleptus pyrrhulus* Bates. June and July. 9. On flowers of *Croton* sp., *Eysenhardtia platycarpa, Mimosa guatemalensis* and *Trichilia americana.*

**Muscidora tricolor* Thomson. 6. October and November.

Noguerana sp. 14. October, November and December. On flowers of *Iresine calea* (Ibañez) Standl.

**Paroxoplus ornaticollis* (LeConte). 3. June, July and October.

Sphaenothecus bivittatus (DuPont). 6. July, September, November and December. On flowers of *Gliricidia sepium* (Jacq.) Kunth ex Steudel, *Eysenhardtia platycarpa* and *Acacia angutissima.*

S. picticornis Bates. 28. January, March to May and November and December. On flowers of *Gliricidia sepium, Guazuma ulmifolia* Lam.

S. trilineatus DuPont. 51. October to January. On flowers of *Ipomoea* sp., *Gliricidia sepium,* and on the trunk of a dead tree of *Pseudobombax* sp. One individual was collected at light.

Stenaspis verticalis Serville. 1. October.

**Stenobatyle eburata* (Chevrolat). 1. June. On flowers of *Croton* sp.

**S. gracilis* Chemsak. 8. June. On flowers of *Croton* sp.

**S. miniaticollis* (Chevrolat). 1. August. On flowers of *Acacia angustissima.*

**Triacetelus sericatus* Bates. 6. June. On flowers of *Croton* sp. and *Stemmadenia galeotiana.*

Tylosis puncticollis Bates. 135. July to November.

Lepturinae

Lepturini

Megachoriolaus flammatus (Linsley). 3. June. On flowers of *Sapium macrocarpum* and *Mimosa arenosa.*

**Nemognathomimus pallidulus* (Linsley). 9. June. On flowers of *Croton* sp. and *Amphilophium paniculatum* (L.) HBK.

Strangalia biannulata (Linsley). 59. June and July. On flowers of *Croton* sp., *Cephalanthus occidentalis, Stemmadenia galeotiana, Mimosa guatemalensis, Trichilia americana* and *Eysenhardtia platycarpa.*

**S. cavaventra* Chemsak. 2. June and August. On flowers of *Stemmadenia galeotiana.*

**S. doyeni* Chemsak & Linsley. 22. June to August. On flowers of *Cephalanthus occidentalis, Mimosa arenosa, Trichilia americana.*

**S. westcotti* Chemsak & Linsley. 2. June. On unidentified flowers.

Lamiinae

Lamiini

**Chyptodes dejeani* (Thomson). 115. June to November. At light, on flowers of *Croton* sp. and on trunks of recently dead trees of *Conzattia multiflora* (Robinson) Standley, *Bursera* sp. and *Amphipterygium adstringens* (Schldl.) Schiede. On the last two species, aggregates of up to 50 individuals were found in the afternoon (around 1800 hours). Individuals were very active on the dead tree trunks and it was common to see several males attempt to mate with one female. Of the individuals collected, the sex ratio was two males to one female.

**Deliathis batesi* Gahan. 1. June.

**Neoptychodes trilineatus* (Linnaeus). 4. July, August and October. At light and on *Euphorbia mexicana.*

Apomecynini

**Adetus obliquus* (Bates). 1. September.

Dorcasta sp. 18. July, August and November.

Onciderini

Lochmaeocles cornuticeps federalis Dillon and Dillon. 1. August. At light.

**L. pseudovestitus* Chemsak & Linsley. 1. September. At light.

**Taricanus truquii* Thomson. 5. September and October. At light and girdling branches of *Conzattia multiflora.*

**Trachysomus mexicanus* Dillon & Dillon. 1. August. At light.

Pteropliini

Ataxia sp. 1. July.

Pogonocherini

Alphomorphus vandykei Linsley. 4. June, July and September. At light and beating vegetation.

**Ecyrus ciliatus* Chemsak & Linsley. 10. June, July and September. At light and Malaise trap.

**Poliaenus hesperus* Chemsak & Linsley. 1. September. Malaise trap.

Desmiphorini

**Cymatonycha castanea* Bates. 3. June and July.

**C. fasciata* Chemsak & Noguera. 15. June. At light.

**Estoloides* (*Estoloides*) *chamelae* Chemsak & Noguera. 1. November. Beating vegetation.

E. sp. 1. July. Beating vegetation.

Eupogonius sp. 1. July. At light.

E. sp. 1. June. At light.

Anisocerini

Thryallis sallaei Bates. 5. August. On branches of one recently dead tree of *Conzattia multiflora.*

Acanthoderini

**Aegomorphus albosignus* Chemsak & Noguera. 12. August to October. On branches of a recently dead tree of *Conzattia multiflora.*

**A. borrei* Duges. 48. All months except March. At light.

A. sp. 1. 1. June. At light.

A. sp. 2. 7. June. At light.

Oreodera brailovskyi Chemsak & Noguera. 4. January to March. At light and beating vegetation.

O. copei McCarty. 1. July. At light.

O. glauca glauca (L.). 1. July. At light.

**Steirastoma anomala* Bates. 70. April May, July and October. On recently dead trees, one of which was *Pseudobombax* sp. The diameter of the main trunk of those trees was ≈80 cm and the cerambycids usually were resting in the beneath the trunk and thicker branches. On occasion numerous individuals were observed arriving to the trunk among 1:00 and 2:00 p.m. and walking actively on the trunk in search of a mate to copulate.

Acanthocini

**Atrypanius conspersus* (Germar). 3. February, November and December. At light.

Canidiopsis hebes Dillon. 10. June to October. At light, Malaise trap and beating.

**Eutrichillus comus* (Bates). 70. February to April and June to December. At light and beating vegetation.

Lagocheirus araneiformis ypsilon (Voet). 1. October.

L. lugubris (Dillon). 1. July. At light.

L. undatus (Voet). 54. February to November. At light, Malaise trap and on recently dead trees of *Conzattia multiflora* and *Amphipterygium adstringens.*

L. xileuco Toledo. 1. June. On recently dead tree.

Leptostylus sp. 11. July to November. At light and beating vegetation.

Lepturges sp. 1. 4. June. At light.

L. sp. 2. 24. February, April, June and November. At light and beating recently dead trees.

L. sp. 3. 2. June and August. At light and beating branches of recently dead trees.

L. sp. 4. 1. June. At light.

L. sp. 5. 1. June. At light.

L. sp. 6. 2. June and July. At light.

L. sp. 7. 1. June. At light.

L. sp. 8. 1. June. At light.

Mecotetartus antennatus Bates. 54. March, June to August and October. At light and on trunks of recently dead trees of *Bursera* sp. and another unidentified species.

Olenosus serrimanus Bates. 41. June and August to October. At light.

Pseudocanidia cuaernavacae Dillon. 141. June to September. At light and Malaise trap.

Leopinus naeviicornis (Bates). 278. All year. At light, on recently dead trees of *Conzattia multiflora* and *Acacia* sp. and beating on *Acacia cochliacantha* e *Ipomoea* sp.

Urgleptes sp. 1. 40. June, July, October and November. At light and beating dead branches.

U. sp. 2. 1. May. At light.

Acanthocini sp. 1. 22. June, July and November. At light and beating on *Sapium macrocarpum.*

Colobotheini

Colobothea sinaloensis Giesbert. 35. June and August to October. On one recently dead tree of *Conzattia multiflora.*

Phytoecini

Mecas oberoides Bates. 5. August, September and November.

Tetraopini

Phaea biplagiata Chemsak. 66. June to November. On leaves of *Stemmadenia galeotiana* and *Thevethia obatoides.* It was also recorded on *Trichilia trifolia,* but this could have been circumstantial. In the first two species it was observed that the individuals eat the central and basal veins of the leaves.

P. hogei Bates. 7. June and July. On leaves of *Stemmadenia galeotiana* and *Thevethia obatoides.*

P. juanitae Chemsak & Linsley. 1. August.

P. kellyae Chemsak. 1. June.

P. maccartyi Chemsak. 1. July. On leaves of *Gonolobus* sp.

P. maryannae Chemsak. 38. June to September. On leaves of *Stemmadenia galeotiana* and *Thevethia obatoides.*

P. maxima Bates. 1. July.

P. mirabilis Bates. 13. June and July. On leaves of *Stemmadenia galeotiana.*

P. rufiventris Bates. 4. June to August.

P. tenuata Bates. 2. July.

P. vitticollis Bates. 45. June to August. On *Gliricidia sepium, Cephalanthus occidentalis.*

Tetraopes cleroides Thomson. 4. June and July. On leaves of *Stemmadenia galeotiana.*

Hemilophini

Essostrutha binotata Bates. 314. June to September. Malaise trap and on leaves of *Hamelia patens* Jacq., *Stemmadenia galeotiana.*

E. laeta (Newman). 71. June to August. On leaves of *Gliricidia sepium* and *Melampodium divariccatum* (A Rich) DC.

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