ECOLOGICAL NOTES ON LOWER RIO GRANDE VALLEY

XYLOCOPA (HYMENOPTERA: ANTHOPHORIDAE)¹

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ABSTRACT

The Middle American Neotropical Xylocopa mexicanorum Cockerell, the eastern Nearctic but Neotropic-derived Xylocopa micans Lepeletier, and the Sonoran Xylocopa tabaniformis parkinsoniae Cockerell are cited from Hidalgo County, Texas. All vary slightly to moderately among themselves in yearly abundance, monthly phenology, diet periodicity, and activity temperature. Some extralimital southwest North American Xylocopa differ notably from their south Texas congeners in certain or all of the above parameters. South Texas Xylocopa are polylectic, but each species apparently visits some plants not attractive to the others. I give the first flower records for X. mexicanorum and new floral data for X. t. parkinsoniae.

Since 1973, I have been surveying Hymenoptera in Hidalgo County,

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Texas, and have published studies on several groups of south Texas Ichneumonidae, Eumenidae, and Sphecidae (Porter 1975a, 1975b, 1976, 1977, 1978a, 1978b, and 1980). I now review the large carpenter bees or *Xylocopa*, whose North American species and world subgenera have been clarified taxonomically (Hurd 1956, Hurd and Moure 1963), but whose south Texas species remain unknown ecologically.

*Xylocopa* includes large, strong, fast-flying bees. They may be active in full sun and at high temperatures. Most are polylectic. They nest in almost any species of woody plant and are selective only with regard to the substrate chosen for nidification (hard wood, soft wood, rotten wood, or hollow stems, according to the particular species of *Xylocopa*). These factors imply ecologic versatility and should endow the carpenter bees with great dispersal powers. However, *Xylocopa* has 164 Neotropical versus 17 Nearctic representatives, and it seems to prefer warm, humid forests. Perhaps there is some correlation between these data and the fact that only 3 *Xylocopa* penetrate south Texas' scrubby, subhumid Lower Rio Grande Valley.

The records of south Texas *Xylocopa* transcribed below were gathered during 4 years of frequent collecting at the Bentsen Rio Grande Valley State Park and the McAllen Botanical Gardens (until 1979 called the Valley Botanical Garden). Periods available for fieldwork normally have included in each year since 1973, 30 days in December and January, 1 week in March, 2 weeks in May, 2 weeks in June, 1 week in August (through 1978), and 1 week in September (through 1978), as well as 1 week in April 1975, 1 week in July 1979, all of July 1980, all of August in 1979 and 1980, and 1 week each in November of 1977 and 1979. The opportunity to collect at all seasons has allowed me to document the relative abundance of the 3 south Texas *Xylocopa* and to report apparent differential trends in their phaenology, flower selection, and temperature and habitat preferences.

**Material Studied**

1. *Xylocopa* (*Schoenherria*) *micans* Lepeletier.


   **Flower Records:** 1 ♀, *Parkinsonia aculeata* L., 21-VII-1980.

   **Monthly Phaenology:** 1 ♂ in III; 1 ♀ in V; 1 ♀ in VI; 1 ♀ in VII; and 1 ♀ in VIII.

   **Yearly Phaenology:** 1 ♀ and 1 ♂ in 1974, 1 ♀ in 1975, 1 ♀ in 1979, and 1 ♀ in 1980.

   **Activity Temperatures:** Flies when the shade temperature is between 25 and 35°C.

   **Diel Periodicity:** The specimen taken on 21-VII-1980 from *Parkinsonia* was collected at 1000 CST.

2. *Xylocopa* (*Notoxylocopa*) *tabaniformis* *parkinsoniae* Cockerell.

Fig. 1. Prosopis-Opuntia Association photographed during January 1978 in the McAllen Botanical Gardens at McAllen, Texas. Prosopis juliflora blooms from March to July and its flowers often are visited by Xylocopa tabaniformis parkinsoniæ and by X. mexicanorum.


All of the above records are new, except for Parkinsonia aculeata.

Sexual Phaenology: Xylocopa t. parkinsoniæ follows a strongly pro-territorial yearly cycle. No males are cited for VII-XII, but they appear from I-VI and become much commoner than females in III.

Monthly Phaenology: 3 ♀ and 1 ♂ in I, 2 ♀ and 13 ♂ in III, 5 ♀ and 1 ♂ in V, 5 ♀ and 2 ♂ in VI, 5 ♀ in VII, 4 ♀ in VIII, 3 ♀ in IX, and 1 ♀ in XII.

Yearly Phaenology: 4 ♀ and 1 ♂ in 1973, 4 ♀ and 1 ♂ in 1974, 2 ♀ and 1 ♂ in 1975, 7 ♀ and 4 ♂ in 1976, 1 ♀ and 6 ♂ in 1977, 1 ♀ and 3 ♂ in 1978, 2 ♀ in 1979, 7 ♀ and 1 ♂ in 1980.

Activity Temperatures: Xylocopa t. parkinsoniæ flies on sunny days when the shade temperature ranges between 25.5-38° C.

Diel Periodicity: During July and August, I have collected this bee as early as 0800 and as late as 1500 CST (2 records between 0800-0900, 3 from 0900-1000, 1 from 1000-1100, 1 from 1100-1200, 1 between 1300-1400, and 2 records from 1400-1500). In March the activity period averages a little later
than during summer (1 capture from 1000-1100, 1 from 1100-1200, and 2 from 1500-1600). My few winter records suggest an even tardier phenology and include 1 specimen each from 1200-1300, 1300-1400, and 1400-1500.

3. *Xylocopa (Neoxylocopa) mexicanorum* Cockerell.


These are the first flower records for *X. mexicanorum*.

**Sexual Phenology:** Males of *X. mexicanorum* seem exceptionally rare or elusive. I have never collected or sighted a male in the Lower Rio Grande Valley under natural conditions. In December 1978 I was able to observe a live male which had flown into a neighbor's house and was being kept as a "pet". This specimen showed the usual orange-brown vestiture and integument which makes *Neoxylocopa* males so dissimilar to the variably shining-black females.

**Monthly Phenology:** 3 ♀ in I, 1 ♀ in III, 9 ♀ in VI, 3 ♀ in VII, 16 ♀ in VIII, and 1 ♀ in XII.


**Activity Temperatures:** This species flies on sunny days when the shade temperature is between 25-35° C.

**Diel Periodicity:** During July and August, *X. mexicanorum* appears mainly between 0900-1300 CST (2 records from 0900-1000, 4 from 1000-1100, and 1 from 1200-1300). The 2 January captures with chronologic data imply that the activity period may average later in winter than in summer (1 record from 1300-1400 and 1 from 1400-1500).

**Conclusions**

**Zoogeography:** The *Xylocopa* studied fit 3 of the main biogeographic patterns discernible among almost any segment of the south Texas biota.

*Xylocopa micans* extends from Virginia to Florida west to the Gulf Coast of Texas and Tamaulipas State in northeast México. It belongs to the overwhelmingly Neotropical subgenus *Schoenherria* Lepeletier, with more than 30 species in Middle and South America but just 2 which enter the United States. *X. micans* thus is a northeast North American Neotropic element which perhaps became distinct from originally South American ancestors while isolated during Pleistocene glacial maxima in Florida or the Gulf States and which during the current interglacial has moved southwest again as far as México.

*Xylocopa mexicanorum* is a moderately xerophilous Middle American Neotropic species which penetrates the United States only in south Texas.
and southern Arizona and whose closest relatives are South American. It belongs to the Neotropic subgenus Neoxylocopa Michener, whose zoogeography parallels that of Schoenherria, as discussed above, except that Neoxylocopa contains no living representatives in northeast North America.

Xylocopa tabaniformis parkinsoniæ represents the distinctive subgenus Notoxylocopa Hurd, which occurs from Oregon, California, Nevada, and Utah through Middle America and into South America only as far as Colombia. Notoxylocopa seems more xerophilous than the other subgenera which reach south Texas, and it is centered in the more or less arid southwestern United States and northern México. It thus appears to be a Sonoran element which has invaded also parts of the Neotropic and Nearctic regions (Compare in this regard the ichneumonid wasp genera Campsomerius, Joppidiurn, and Lanugo or the snake genera Crotalus, Rhinocelus, Salvador, and Thamnophis).

Phaenology: My information about climatic periodicity in south Texas Xylocopa remains scant but suggests differential trends that should be studied further. Xylocopa t. parkinsoniæ has been taken between 0800-1500 CST during July and August and between 1200-1500 in December and January. This species thus flies earlier, and sometimes also later, in the day than X. mexicanorum, for which I have July and August records between 0900-1300 together with December and January captures from 1500-1600.

Daily flight periods have been shown to differ even more markedly among other United States Xylocopa. Hurd and Linsley (1975: 47) report that the southwestern X. californica arizonensis Cresson flies mostly from 0600-0900 MST, whereas the largely sympatric X. tabaniformis andro-leuca Michener flies “during the evening hours shortly before and after sunset”. As noted previously, the south Texas X. tabaniformis parkinsoniæ flies from early morning to mid-afternoon. Geographic variation in X. tabaniformis thus may include behavioral as well as structural characters.

Table 1 summarizes the monthly phenology of south Texas Xylocopa. Xylocopa micans is cited only for the warmer months of March to August. Xylocopa mexicanorum and X. t. parkinsoniæ occur at all seasons and are fairly common in winter. Xylocopa mexicanorum peaks in June and August, while X. t. parkinsoniæ becomes most common from March to June. More satisfactory documentation of these apparent trends will require additional field work.

**Table 1. Monthly Phaenology of Lower Rio Grande Valley Xylocopa.**

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<tbody>
<tr>
<td>1. X. micans</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>2. X. t. parkinsoniæ</td>
<td>4</td>
<td>15</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>3. X. mexicanorum</td>
<td>3</td>
<td>1</td>
<td>9</td>
<td>3</td>
<td>16</td>
<td>1</td>
<td></td>
<td>33</td>
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<tr>
<td>Total species/month</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Total specimens/month</td>
<td>7</td>
<td>17</td>
<td>7</td>
<td>17</td>
<td>9</td>
<td>21</td>
<td>4</td>
<td>2</td>
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<td>Total specimens collected: 83</td>
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Table 2 shows how the species studied fluctuate in abundance from year to year. It illustrates the same kind of drastic population density oscillations shown by the other groups of south Texas Hymenoptera I have investigated (see especially Porter 1977, 1978a, and 1978b). Only X. t. parkinsoniae is captured every year. Xylocopa mexicanorum flies in most years and often becomes common. Xylocopa micans occurs uniformly rare, although it may be abundant in the southeastern states (e.g., Hatteras Island in North Carolina to Florida). Future analysis could reveal correlations between idiosyncrasies of Xylocopa population density and the unstable climate, with its capricious and persistent droughts, which prevails in the south Texas study area.

Temperature and Rainfall: Available records show that Xylocopa mexicanorum and X. micans may be active when shade temperatures range between 25 and 35° C. Xylocopa t. parkinsoniae, which flies between 25.5 and 38° C, occurs slightly more thermophilic, perhaps in accordance with its Sonoran biogeographic affinities. Hurd and Linsley (1975) have documented much greater differences in termic tolerance among certain Xylocopa. For example, X. californica arizonensis may begin activity at 17° C, but the lowest threshold temperature recorded for X. varipuncta Patton is 22° C.

Rainfall correlates with phaenology of south Texas Hymenoptera in such ways that it seems likely to be a significant limiting factor for most species. An intense and protracted drought and heat wave dominated the whole area during June and July of 1980. Daily maximum temperatures averaged between 35 and 42° C (normal maxima 32-35° C). There was only 1 shower in June (about 25 mm rain) and no measurable rain in July. All Xylocopa were present during the drought, with X. t. parkinsoniae and X. mexicanorum uniformly rather common (including sight records). During July, 5 X. t. parkinsoniae were netted, but only a single individual was captured during August (12 August). Xylocopa mexicanorum, in contrast, was actually collected twice during July and once in early August (2 August) but was obtained 7 times between 12 and 24 August. On 10 August 1980, Hidalgo County received some 250 mm of rain from a tropical storm. One hypothesis which could explain these events is that the Neotropic and presumably hygrophilous X. mexicanorum in some way benefitted from the rain, while the more xerophilous Sonoran X. t. parkinsoniae might have been suppressed.

Flower Records and Habitats: Table 3 synthesizes flower records documented by preserved specimens of Xylocopa. Carpenter bees often visit the loftiest flowers of trees or shrubs at heights beyond the reach of a standard insect net. Certain flowers thus attract more Xylocopa than formal data would suggest. This is particularly true of X. mexicanorum and X. t. parkin-

### TABLE 2. Yearly Phaenology of Lower Rio Grande Valley Xylocopa.

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<tbody>
<tr>
<td>1. X. micans</td>
<td>—</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2. X. t. parkinsoniae</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>3. X. mexicanorum</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>Total species/year</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Total specimens/year</td>
<td>5</td>
<td>7</td>
<td>4</td>
<td>17</td>
<td>10</td>
<td>6</td>
<td>12</td>
<td>22</td>
</tr>
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</table>
soniae with regard to Prosopis juliflora, Cordia boissieri, and the high-climbing vine, Sarcostemma cynanthoides. Xylocopa t. parkinsoniae also frequently visits the topmost flowers of Parkinsonia aculeata.

Table 3 and the more detailed floral records given under each species suggest that the south Texas Xylocopa eventually may prove to evince some constant differences in flower preference. Only exhaustive field studies can demonstrate the validity of this conjecture, since Xylocopa are known to be very broadly polylectic, as exhaustively documented by Hurd (1979: 2183-7).

For the moment, it can merely be remarked that in Hidalgo County, Texas, Xylocopa mexicanorum is the only carpenter bee to have been cited from Helianthus debilis, an unidentified ornamental labiate, and Rhynchosia texana, while X. t. parkinsoniae is the only species I have collected on Acacia farnesiana and Croton sp. On the other hand, Cordia boissieri, Prosopis juliflora, and Sarcostemma cynanthoides attract both of the above mentioned bees, whereas I have found only X. micans and X. t. parkinsoniae on Parkinsonia aculeata.

All Xylocopa were netted in bright sun in habitats such as open trails through subtropical scrub, at the edge of deep woods, in old fields, less often in pioneering fields, and on isolated flowering plants in parks or gardens. The optimum habitat seems to be overgrown fields and open woods, such as the Prosopis-Opuntia association illustrated in Fig. 1. Collation of my floral data with those of Hurd (1979: 2183-7) proves that all the 3 species may visit flowers in all strata of their communities, from understory herbs to overstory trees.

**Collections**

The Xylocopa studied have been deposited in the Florida State Collection of Arthropods (Division of Plant Industry, P. O. Box 1269, Gainesville, FL 32602) and in the author's collection at 301 North 39th Street, McAllen, TX 78501.

**Acknowledgments**

My Hidalgo County field work has been supported in 1976-77 by United

**TABLE 3. Flower records for Lower Rio Grande Valley Xylocopa.**

<table>
<thead>
<tr>
<th>X. micans</th>
<th>X. mexicanorum</th>
<th>X. t. parkinsoniae</th>
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<tbody>
<tr>
<td>Acacia farnesiana</td>
<td>—</td>
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<tr>
<td>Cordia boissieri</td>
<td>—</td>
<td>2</td>
</tr>
<tr>
<td>Croton sp.</td>
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<tr>
<td>Helianthus debilis</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>Labiatae sp.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Parkinsonia aculeata</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>Prosopis juliflora</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>Rhynchosia texana</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>Sarcostemma cynanthoides</td>
<td>—</td>
<td>5</td>
</tr>
<tr>
<td>Total species of plants</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Visited/Xylocopa species.</td>
<td>—</td>
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</tbody>
</table>
States National Science Foundation Grant DEB-75-22426 and during 1973-75 and 1979 by grants from the Committee for Research and Exploration of the National Geographic Society. Collecting permits for Bentsen Park were issued by the Texas Parks and Wildlife Department (current Permit Number 2-80). Mr. Anthony F. Cerbone of Fordham University assisted me during some of the field work involved in this project.

LITERATURE CITED


