ISSN 0065-1737 *Acta Zoológica Mexicana (n.s.), 29(2): 437-440 (2013)*

Nota Científica
(Short Communication)

NATIVE BEES IN BLOOMING ORANGE (*CITRUS SINENSIS*) AND LEMON (*C. LIMON*) ORCHARDS IN YUCATÁN, MEXICO

Grajales-Conesa, J., Meléndez Ramírez, V., Cruz-López, L. & Sánchez, D. 2013. Abejas nativas en huertos de naranja (*Citrus sinensis*) y de limón (*C. limon*) en Yucatán, México. *Acta Zoológica Mexicana (n. s.)*, 29(2): 437-440.

RESUMEN. Este estudio tuvo como objetivo determinar la riqueza y la abundancia de abejas (Hymenoptera, Apoidea) en huertas de naranja y limón en floración en Yucatán, México. Se colectaron ocho especies de abejas; el 98% de los especímenes correspondió a *Apis mellifera*, y el 2% restante a abejas nativas. Estos hallazgos se discuten con base en la ecología de las abejas nativas y en estudios previos en la misma área de estudio.

Palabras clave: riqueza, abundancia, ecología, citricultura, Apoidea

The rapid modification of landscapes, largely caused by the introduction of exotic species and the implementation of modern, intensive agricultural practices, has derived into a worldwide decline of indigenous organisms, including pollinators (Biesmeijer *et al.* 2006, Steffan-Dewenter & Tscharntke 2002). Among insect pollinators, bees are acknowledged to increase noticeably the production of several crops (Kearns & Inouye 1997, Kearns & Thomson 2001, Klein A. *et al.* 2003, Slaa *et al.* 2006). Some of such crops, like coffee (*Coffea* spp) and citrics (*Citrus* spp), give greater yields in the presence of insect pollinators despite they self-pollinate (Rickets 2004, Sanford 1992).

In Mexico, introduced cultivars of *Citrus* are of economic and ecological interest because large extensions of land that are dedicated to this crop seem to foster native bee populations by providing massive amounts of nectar and pollen (Missiaen 1981). On the other hand, introduced species like the honeybee *Apis mellifera,* while beneficial for the pollination service and the goods they provide us*,* represent formidable competitors that might reduce native insect pollinators' abundance (Biesmeijer *et al.* 2006). In Yucatán, Mexico, beekeeping and citriculture (mainly represented by *C. sinensis* and *C. limon*) are commonly observed in the very same sites, providing a

Recibido:10/07/2012; aceptado: 01/02/2013.

good model to study the interaction between honeybees and native bees mediated by blooming crops. The aim of this study was therefore to assess the diversity and abundance of bees visiting blooming orange and lemon crops. Given the massive amounts of pollen and nectar provided by citric crops, we propose the hypothesis that the abundance of bee visitors in such plantations is distributed among the different bee species as described for more preserved sites within the study region (Monforte 2009).

The study took place in orange (n = 2) and lemon (n = 3) orchards in Oxkutzcab, Yucatan, located close to the Protected Area of San Juan Bautista Tabi (N20° 16' 19´´, W89° 30' 44'', 32m altitude), where deciduous forest represents the predominant vegetation (Flores & Espejel 1994). Insects were collected from December 2008 to February 2009 (which comprises the blooming period of citric species in the study area), 9:00 to 13:00h, by using standard insect nets during four days in randomly selected transects within each orchard (80 sampling hours in total). Specimens were mounted and conserved in boxes in the entomological collection of the Universidad Autónoma de Yucatán, until identification. The distribution of bees that visited blooming orange and lemon plantations was compared against an expected distribution using a chi square test: *A. mellifera* 55%, all the remaining bees with similar abundance (Monforte 2009).

We collected a total of 1933 specimens. In both lemon and orange orchards the relative abundance of *A. mellifera* was above 98%, while the remaining 2% were native bees (solitary bees: *Megachile, Augochlora, Lasioglossum, Hylaeus* and *Ceratina;* social bees *Frieseomelitta nigra* and *Lestrimelitta niitkib,* Fig 1). We found a significant departure from the expected distribution in the species-abundance curve in both orange (χ^2= 2786, DF = 6, P < 0.001) and lemon (χ^2= 5586, DF = 4, P < 0.001) orchards. We also found that the distribution of bees between orchards was not significantly different (χ^2= 6.45, DF = 3, P = 0.092). Overall, we did not find evidence to support the proposed hypothesis.

Pollinators' decline is seemingly caused by anthropogenic disturbances (Cairns *et al.* 2005, Kremen *et al.* 2002). In a scenario of habitat fragmentation derived by agricultural practices, remnants of natural and seminatural habitat can act as refuges for pollinators (Chacoff *et al.* 2008, Kremen *et al.* 2002). In our study sites, where natural habitats meet agricultural landscapes, we observed overwhelming numbers of *A. mellifera* in orange and lemon flowers (≈98%), despite it is known that this species is not an efficient pollinator for this crop (Chacoff *et al.* 2008). Native bees were heavily underrepresented in our surveys, which does not necessarily means they are less abundant in the area surrounding the crops: our study sites were selected such that the nearest colonies of native bees and honeybees were 1 km away from the forest remnants. At this location, where the forest limits with citric crops, other study reported higher numbers of native bees, but still *A. mellifera* had 55% of relative abundance, followed by *Lasioglossum*, *Hylaeus*, *Ceratina*, *Scaptotrigona pectoralis*

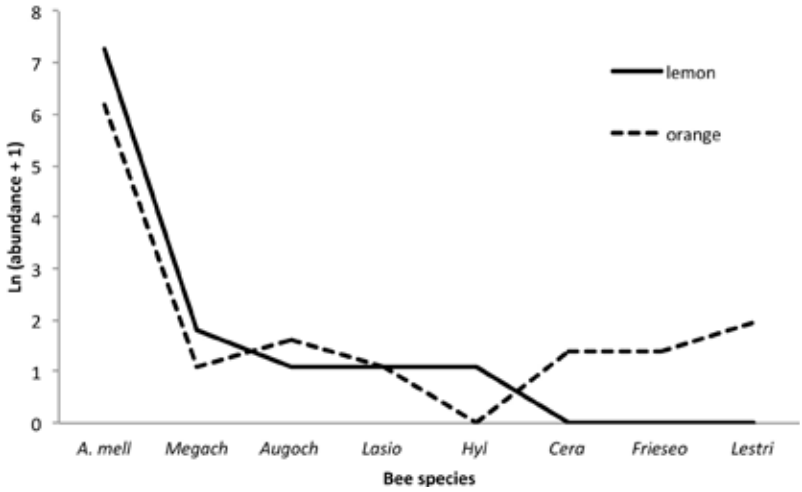

Figure 1. Bee species found on orange and lemon flowers in Oxkutzcab, Yucatan (Data transformed (Ln [abundance species i+1]). A. mell: *Apis mellifera*; Megach: *Megachile*; Augoch: *Augochlora*; Hyl; *Hylaeus*; Cera: *Ceratina*; Frieseo; *Friseomelittanigra*; Lestri: *Lestrimelittaniitkib.*

and *Cephalotrigona zexmeniae* (Monforte 2009). A distance effect was thus observed, with higher abundance of native bees in the edges, gradually declining towards our sampling transects. Studies on *C. paradisi* in Argentina, showed that 95% of the insect visitors were *A. mellifera,* whereas their abundance declined by half within 1 km from the forest, similar to studies in coffee plantations (Chacoff & Aizen 2006, Klein A *et al.* 2003). Thus flight range, in addition to the availability of nesting substrates within the orchards, might be important factors that contribute to explain our findings. Moreover, a single colony of *A. mellifera*, with several thousands of individuals, might be the only source of our collected specimens and in the studies cited lines above. Thus molecular approaches might be useful to estimate the number of colonies contributing to our samplings, which are considered the reproductive units of eusocial bees. In conclusion, our results show bee diversity differences in citric orchards surrounded by preserved and fragmented areas in the study site, suggesting the necessity to develop studies focused on the rescue of introduced and native pollinators in agricultural systems in Yucatán, Mexico.

ACKNOWLEDGMENTS. We want to acknowledge the support of CONACYT and UNACH for a scholarship given to Julieta Grajales Conesa. This research was possible thanks to the support of CONACYT-SAGARPA Project number 24031 and to SEP-CONACYT project number 128702 “Evolución de la Cleptobiosis en *Lestrimelitta* (Apidae, Meliponini)”.

REFERENCES

Biesmeijer, J., Roberts, S., Reemer, M., Ohlemuller, R., Edwards, M., Peeters, T., Schaffers, A., Potts, S., Kleukers, R., Thomas, C., Settele, J. & Kunin, W. 2006. Parallel declines in pollinators and insect-pollinated plants in Britain and the Netherlands. *Science*, 313: 351-354.

Cairns, C., Villanueva-Gutiérrez, R., Koptur, S. & Bray, D. 2005. Bee Populations, Forest Disturbance, and Africanization in Mexico. *Biotropica*, 37: 686-692.

Chacoff, N. & Aizen, M. 2006. Edge effects on flower-visiting insects in grapefruit plantations bordering premontane subtropical forest. *Journal of Applied Ecology*, 43: 18-27.

Chacoff, N., Aizen, M. & Aschero, V. 2008. Proximity to forest edge does not affect crop production despite pollen limitation. *Proceedings of the Royal Society B*, 275: 907-913.

Flores, S. & Espejel, I. 1994. *Tipos de vegetación de la península de Yucatán*. Universidad Autónoma de Yucatán, 136 pp.

Kearns, C. & Inouye, D. 1997. Pollinators, Flowering Plants, and Conservation Biology. *BioScience*, 47: 297-307.

Kearns, C. & Thomson, J. 2001. *The natural history of bumblebees: a sourcebook for investigations*. University Press of Colorado, 130 pp.

Klein, A., Steffan-Dewenter, I. & Tscharntke, T. 2003. Fruit set of highland coffee increases with the diversity of pollinating bees. *Proceedings of the Royal Society of London B*, 270: 955-961.

Klein, A., Steffan-Dewenter, I. & Tscharntke, T. 2003. Pollination of *Coffea canephora* in relation to local and regional agroforestry management. *Journal of Applied Ecology*, 40: 837-845.

Kremen, C., Williams, N. & Thorp, R. 2002. Crop pollination from native bees at risk from agricultural intensification. *Proceedings of National Academy of Sciences* USA, 99: 16812-16816.

Missiaen, E. 1981. *Citrus fruit industry: Mexico.* Department of Agriculture, Foreign Agriculture Service, 38 pp.

Monforte, A. 2009. Diversidad de abejas nativas en un paisaje fragmentado de Yucatán, México. *VI congreso Mesoamericano sobre Abejas Nativas.* La Antigua Guatemala, Guatemala.

Rickets, T., Daily, G., Ehrlich, P. & Michener, C. 2004. Economic value of tropical forest to coffee production. *Proceedings of National Academy of Sciences* USA, 101: 12579-12582.

Sanford, M. 1992. *Pollination of Citrus by Honey bees.* RF-AA092, Florida cooperative Extension Service. University of Florida, 6 pp.

Slaa, J., Sánchez-Chavez, A., Malagodi-Braga, K. & Hofstede, F. 2006. Stingless bees in applied pollination: practice and perspectives. *Apidologie*, 37: 293-315.

Steffan-Dewenter, I. & Tscharntke, T. 2002. Insect communities and biotic interactions on fragmented calcareous grasslands -a mini review. *Biological Conservation*, 104: 275-284.

JULIETA GRAJALES-CONESA[1], VIRGINIA MELÉNDEZ-RAMÍREZ[1], LEOPOLDO CRUZ-LÓPEZ[2]& DANIEL SÁNCHEZ[2]*

[1]Universidad Autónoma de Yucatán. Campus de Ciencias Biológicas y Agropecuarias. Km 15.5 carretera Mérida–Xmatkuil. A.P. 4-116 Col. Itzimná, 97100. Mérida, Yucatán, México. <grajales79@yahoo.com.mx>; <virmelen@uady.mx>

[2]El Colegio de la Frontera Sur. Unidad Tapachula. Carretera Antiguo Aeropuerto, Km. 2.5, Tapachula, Chiapas, México, 30700. México. lcruz@ecosur.mx; dsanchez@ecosur.mx

Corresponding author: <dsanchez@ecosur.mx>