Investigation note

Diversity of weevils (Coleoptera: Curculionidae) in orchards of pecanero walnut in the north of Coahuila, Mexico

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Abstract

The northern region of Coahuila is one of the most important nut producing areas in Mexico. *Euplatypus segnis* (Chapuis, 1865) and *Xyleborus ferrugineus* (F. 1801) curculionids plague associated with walnuts in the country, not knowing if there are others present in the orchards. From july 2015 to september 2016 and august 2017, samples were taken from the Germplasm Bank of the INIFAP-Experimental Zaragoza Site, eight commercial orchards and native walnut trees. Using as sampling methods standard entomological network and knocking-sprinkling of the foliage with Cipermetrina. The 1 174 adult insect specimens were collected, six orders were determined, 49% were coleoptera, with Coccinellidae being the most abundant family, 17% were curculionids (203 adults and 32 identified species). *Pandeleteius cinereus* (Horn, 1876), *Compsus auricephalus* (Say, 1824) and *Conotrachelus leucophaetus* (Fahraeus, 1837 were harvested in walnut foliage, currently these species are not of economic importance for the crop. *Smicronyx interruptus* (Blatchley, 1916), *S. sculpticollis* (Casey, 1892) and *Thecesternus hirsutus* (Pierce, 1909) are possible natural biological control agents for *Cuscuta* L., 1753, *Acacia* (Mill, 1754) and *Parthenium* L., 1753. It is important that no specimens were collected from *Curculio caryae* (Horn, 1873), *Euplatypus segnis*, neither *Xyleborus ferrugineus*, curculionidae considered pests of pecan tree in Mexico.

Keywords. Curculionids, distribution, species.

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The pecan tree (*Carya illinoinensis* Koch) belongs to the Juglandaceae family, comprising 20 species, seven of which are cultivated, with *C. illinoinensis* being the most important, native to the southeastern United States of North America and Northern Mexico. The species is widely cultivated from Ontario Canada to the south of Oaxaca, Mexico. It is exploited to a lesser extent in Israel, South Africa, Australia, Egypt, Peru, Argentina and Brazil. The 98% of the world production originates in the American Union and North of Mexico (Thompson and Corner, 2012), which is the second nut producing country in the world (Orona *et al*., 2013), during 2011 more were planted of 85 000 ha and in 2013 there were 103 866 ha, with a production value of $4 612 539 (thousands of pesos) (SIAP, 2013). It is important to note that this value may change due to the interannual variations due to the alternation shown by the crop.

It is noteworthy that in Mexico more than 90% of the planted area is in the north of the country, excelling the states of Chihuahua, Coahuila, Sonora, Nuevo León and Durango. In Coahuila, it is one of the most valued productive chains with $614 133. 82 (thousands of pesos) (SIAP, 2013). In addition, the northern region is of great relevance since it is part of the center of origin of the walnut tree.

The insects with the most common pests in the nogaleras of Coahuila are: the vermillion borer worms (GBR) and walnut (GBN), the yellow and black aphids. For its importance as a plague, highlights the nut borer worm *Acrobasis nuxvorella* Nunzing. In Mexico, *Euplatypus segnis* and *Xyleborus ferrugineus* are the only known curculionids associated with walnut. Although, other species that damage cause are known as: *Cryptorhynchus minutissimus* LeConte, *Conotrachelus hicoriae* Schof, *C. elegans* (Say), *C. aratus* (Germar) and *Curculio caryae*, the latter the most important walnut pest in the USA (Bloem *et al*., 2002; Al-Saqer *et al*., 2010). The objective of the present study was to know the entomowildlife of curculionidae associated with the cultivation of pecan tree in the north of Coahuila.

The adult insect collections were made from July 2015 to September 2016 and August 2017 in eight commercial walnut orchards, the Pecan Tree Germplasm Bank of the Zaragoza Experimental Site, Coahuila and in native walnut trees of the municipalities that comprise the region the five springs, north of Coahuila (Allende, Morelos, Nava, Villa Union and Zaragoza), zone located at coordinates 28°12’ 00’’ at 28° 45’ 39’’ north latitude and 100° 23’ 49’’ at 101° 24’ 58’’ west longitude. The collections were made using two methods, the first a standard entomological network and the second with the technique known as knocking-sprinkling of the foliage, with the entomological network numerous random scraps were given in the scrub and walnut foliage, the second method consisted of in selecting three trees randomly in each orchard to which they placed, on the floor, under the drip zone a white blanket of 6 m^2, made the above, with a backpack sprinkler with a capacity of 15 liters, was sprinkled the foliage with Cypermethrin for each liter of water.

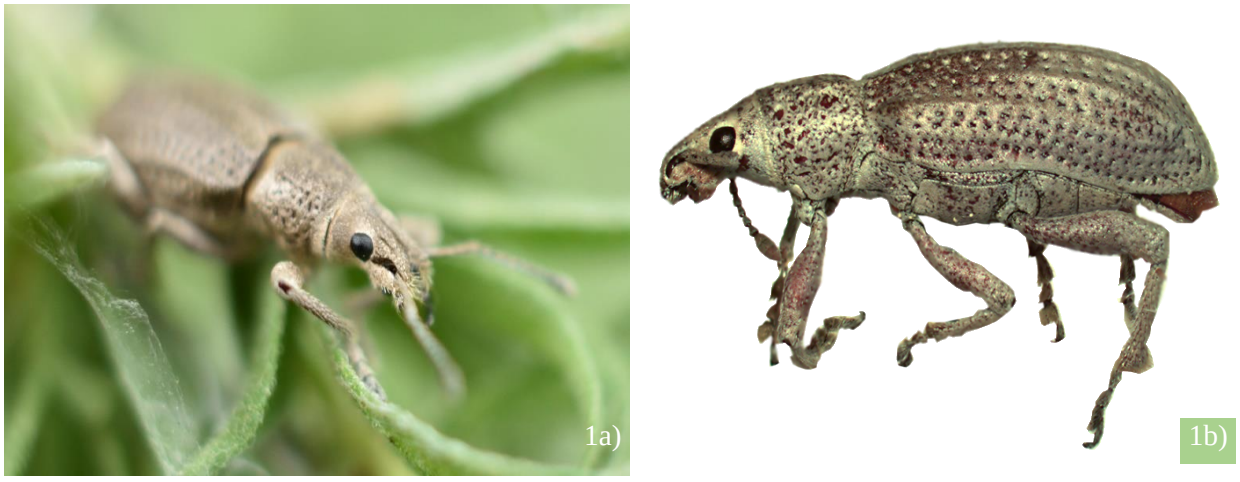
Three trees were randomly selected per orchard, under each tree a white blanket of 6 m^2 was placed. With the support of a ladder the foliage was sprinkled at a concentration of 5 mL/1 L of water using a ladder. We waited 20 min, to proceed then to collect with tweezers or brush the insects knocked down in the blanket. All insects collected by both methods were placed in jars with 96% ethyl alcohol. In the Zaragoza Experimental Site (CIRNE-INIFAP) the adult insects obtained were mounted in entomological pins.

The taxonomic identification was made with the help of a stereoscopic microscope and the use of different taxonomic keys; the catalogs of O'Brien and Wibmer (1982); CONABIO (2008) and recent publications were reviewed to determine the distribution of the species. In this study, the taxonomic classification proposed by Anderson (2002) is followed.

Study results

The 1 174 adult insects were collected, determining six orders: Diptera, Hymenoptera, Coleoptera, Neuroptera, Lepidoptera and Hemiptera. 49% of the specimens were Coleoptera, being Coccinelidae the most abundant family, important insects since larvae and adults are the predators of aphids in the walnut (Tarango, 2014). From Curculionidae, 203 specimens were obtained, determining 32 species in eight subfamilies, the most represented were Curculioninae and Entiminae with seven and nine species respectively. *P. cinereus*, *C. auricephalus* and *C. leucophaetus* were the only species collected in the walnut foliage, the others were collected in weeds and shrub plants near the crop.

None of the species harvested in walnut trees are of economic importance for cultivation in Mexico; *P. cinereus*, recurrent curculionidae in walnut and mesquite (Howden, 1959) feeds on developing branches of *Phoradendron* sp., Although it causes more severe damage in branches of plants of the genus *Juniperus* (Cupressaseae), plants common in the region of the five springs *C. auricephalus* is associated with vegetative structures of cotton and alfalfa and has been reported in *Prosopis* sp. (mesquite) (Ward *et al*., 1977), at the Zaragoza Experimental Site, was observed feeding on the foliage of *Parthenium hysterophorus* L. (Figures 1a and 1b). Of *C. leucophaetus* of which little is known its biology has been collected in plants of the genus *Dianthus* (Caryophyllaceae), its true host plant is unknown.



Figures 1. *Compsus auricephalus*. (Say): 1a) in *Parthenium hysterophorus* and 2b) in side view.

List of curculionids collected in the region, the five springs, North of Coahuila.

Family: Curculionidae Letrielle, 1802

Subfamily Baridinae Schoenherr, 1836

Apinocis deplanatus (Casey, 1892). Mexico. Coahuila, Zaragoza. 24-VII-2016. Collected with entomological foliage network of *Prosopis* sp. 1 specimen Colony Soto, H. M.

Apinocsis planiusculus (Casey 1892). Mexico. Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 03-VI-2016, 12-VII-2016. 28° 35' 45'' north latitude, 100° 54' 27'' west latitude. 2 copies. Colony Soto H. M.

Baris prodigal Champion, 1909. Mexico. Coahuila, Zaragoza. Rio San Rodrigo. Native walnut 04-IX-2015. 28° 45' 42'' north latitude, 101° 49'00'' west longitude. 1 foliage specimen of Asteraceae. Colony Soto H. M.

Baris setosella Solari & Solari 1906. Mexico. Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 23-IX-2015. 28° 35'45'' north latitude, 100° 54' 27'' west longitude. 1 foliage specimen of Asteraceae. Colony Soto H. M.

Trepobaris inornata Champion, 1909. Mexico. Coahuila, Villa Unión. Rancho el Pilar. 228° 14' 37'' north latitude, 100° 40' 00'' west longitude. Entomological network Colony Barros B. M.

Linogeraeus capillatus (LeConte, 1876). Mexico. Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 23-IX-2015. 28° 35' 45'' north latitude, 100° 54' 27'' west longitude. 1 specimen in Asteraceae. Colony Soto H. M.

Subfamily Ceutorhynchinae Gistel, 1856

Auleutes asper (LeConte, 1876). Mexico. Coahuila, Zaragoza. Huerta 2015, 100° 54' 27'' north latitude, 100° 54' 47'' west longitude. 1 specimen in *Convolvulus* sp. Colony Soto. H. M. Coahuila, Zaragoza. Walnut Germplasm Bank CIRNE-INIFAP. 31-V-2016, 03-VI-2016. 28° 35' 45'' north latitude, 100° 54' 27'' west longitude. 2 specimens in *Helianthus* sp. Colony Soto H. M.

Conoderinae Schoenherr, 1833

Cylindrocopturus adspersus (LeConte 1876). Mexico: Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 23-V-2016. 28° 35' 45'' north latitude, 100° 54' 27'' west longitude. 1 specimen in Asteraceae. Colony Soto H. M.

Cylindrocopturus cretaceus Van Dike, 1930. Mexico: Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 23-V-2016. 28° 35' 45'' north latitude, 100° 54' 27'' west longitude. 1 specimen, in Asteraceae. Colony Soto H. M. Coahuila, Ciudad Acuña. Río Toritos. 24-VI-2016. 4 specimens, Colony Soto, H. M. Coahuila, Zaragoza. San Rodrigo River (Bridge). 24-VI-2016. 28° 43' 52''north latitude, 100° 54' 49'' west longitude. 3 specimens in Asteraceae. Colony Soto H. M.

Cylindrocopturus bifasciatus Champion, 1906. Mexico. Coahuila, Villa Unión. Rancho el Pilar. 28° 14' 37'' north latitude, 100° 40' 00'' west longitude. Entomological network Colony Barros B. M.

Subfamily Curculioninae Letrielle, 1802

Anthonomus aeneolus Dietz, 1891. Mexico, Coahuila, Zaragoza, Huerta 2015 pecan tree, 18-IX-2015. 28° 27’ 41’’ north latitude, 100° 54’ 47 west longitude. 4 specimens, Solanaceae. Colony Soto. H. M. Coahuila. Saragossa. Pecan tree walnut germplasm bank, CIRNE-INIFAP. 23-IX-2015. 28° 35’ 45’’ north latitude, 100° 54’ 27’’ west longitude. 4 specimens in Solanaceae. Colony Barrera, R. G. Coahuila, Allende. Huerta La Terquedad, 30-IX-2015. 28° 22’ 01’’ longitude north, 100° 53’ 55 longitude west. 1 specimen, Solanacea. Colony Soto H. M.

Anthonomus sphaeralciae Fall, 1903. Mexico. Coahuila, Zaragoza. 24-VI-2016. 29° 05’ 37’’ north latitude, 100° 53’ 30’’ west longitude. 1 specimen in foliage of *Helianthus* sp. Colony Ordáz Silva. S.

Anthonomus texanus Dietz, 1891. Mexico. Coahuila, Zaragoza. Rio Toritos, 2100° 53’ 30’’ north latitude, 100° 53’ 30’’ west longitude. 10 specimens, collected in foliage of *Helianthus* sp. Colony Soto H. M.

Macrorhoptus sphaeralciae Pierce, 1908. Mexico. Coahuila, Zaragoza. 24-VI-2016. 29° 05’ 37’’ north latitude, 100° 53’ 30’’ west longitude. 1 specimen in foliage of *Helianthus* sp., Colony Ordáz Silva. S. Coahuila, Zaragoza. Walnut Germplasm Bank CIRNE- INIFAP. 24-VII-2016. 3 foliage specimens of *Helianthus* sp. Colony Soto H. M.

Smicronyx pinguis Blatchley, 1916. Mexico, Coahuila, Zaragoza. Experimental Site Zaragoza, CIRNE-INIFAP. 31-V-2016. 28° 35’ 45’’ north latitude, 100° 54’ 27’’ west longitude. 5 specimens in *Helianthus* sp. Colony Soto H. M.

Smicronyx interruptus Blatchley, 1916. Mexico. Coahuila, Zaragoza. 24-VI-2016. 29° 05’ 37’’ north latitude, 100° 53’ 30’’ west longitude. 2 specimens in foliage of Huizache (*Acacia* sp.). Colony Soto H. M.

Smicronyx sculpticollis Casey, 1892. Mexico. Coahuila, Zaragoza. 24-VI-2016. 29° 05’ 37’’ north latitude, 100° 53’ 30’’ west longitude. 2 specimens in foliage of Huizache (*Acacia* sp.). Colony Soto H. M.

Subfamily Dryophthorinae Schoenherr, 1825

Sphenophorus coecifrons Gyllenhal, 1838. Mexico. Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 03-VI-2016. 28° 35’ 45’’ north latitude, 100° 54’ 27’’ west longitude. 1 specimen in *Eragrostis* sp. Colony Barrera R. G.

Subfamily Entiminae Schoenherr, 1823

Colecerus marmoratus (Horn, 1876). Mexico. Coahuila. Jiménez, San Carlos, El Carmen. 02-06-2016. 29° 00’ 21’’ north latitude, 100° 54’ 53’’ west longitude. 2 foliage specimens of *Prosopis* sp. Colony Soto H. M.

Compsus auricephalus (Say, 1824). Mexico: Coahuila, Zaragoza. 19-X-2015. 28° 22' 06'' north latitude, 100° 50' 49'' west longitude. 1 specimen in foliage of pecan tree. Colony Barrera R. G. Coahuila, Allende. Huerta Santa María. 01-X-2015. 28° 19' 27'' north latitude, 100° 45' 16'' west longitude. 3 specimens in walnut foliage. Colony Soto H. M. Coahuila. Villa Unión. Huerta Santo Cristo. 01-X-2015. 28° 14' 48'' north latitude, 100° 44' 30'' west longitude. 1 specimen in walnut foliage. Colony Barrera R. G.

Epicaerus lepidotus Pierce, 1910. Mexico. Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 16-VI-2016. 28° 35' 45'' north latitude, 100° 54' 27'' west longitude. 2 specimens in mesquite foliage (*Prosopis* sp.). Colony Soto H. M.

Epicaerus imbricatus (Say, 1824). Mexico. Coahuila, Villa Unión. Rancho el Pilar. 28° 14' 37'' north latitude, 100° 40' 00'' west longitude. Entomological network Colony Barros B. M.

Ophryastes decipiens LeConte, 1853. Mexico. Coahuila. Jiménez, San Carlos, El Carmen. 06-02-2016. 2 specimens in mesquite foliage (*Prosopis* sp.). Colony Soto H. M.

Pandeleteius cinereus Horn, 1876. Mexico. Coahuila. Allende. Huerta Santa María. 18-IX-2015. 28° 19' 27'' north latitude 100° 45' 16'' west longitude. 17 specimens in walnut foliage. Colony Soto. H. M. Coahuila, Zaragoza. 19-X-2015. 28° 22' 06'' north latitude, 100° 50' 49'' west longitude. 6 specimens in walnut foliage. Colony Barrera R. G. Coahuila, Zaragoza. Río San Rodrígo. 04-IX-2015. 28° 45' 42'' north latitude, 101° 49' 00'' west longitude. 13 specimens in native walnut foliage. Colony Soto. H. M. Coahuila, Zaragoza. Huerta 2015. 18-IX-2015. 28° 27' 41'', 100° 54' 47'' north latitude west longitude. 6 specimens in walnut foliage. Colony Soto H. M.

Mitostylus setosus (Sharp, 1891). Mexico: Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 20-V-2016. 28° 35 45'' north latitude, 1100° 54' 27'' west longitude. 17 specimens in *Eragrostis* sp. Colony Soto H. M.

Mitostylus tenuis Horn 1876. Mexico. Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 03-VI-2016. 28° 35' 45'' north latitude, 100° 54' 27'' west longitude. 12 specimens in *Eragrostis* sp., Colony Soto H. M.

Thecesternus hirsutus Pierce, 1909. Mexico. Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 23-IX-2015. 28° 35' 45'' north latitude, 100° 54' 27'' west longitude. 1 specimen in *Parthenium* sp. Colony Soto H. M.

Subfamily Lixinae Schoenherr, 1823

Lixus scrobicollis Boheman, 1836. Mexico. Coahuila, Zaragoza. 24-VII-2016. Collected with entomological foliage network of *Prosopis* sp. 1 specimen Colony Ordáz, S. S.

Subfamily Molytinae Schoenherr, 1823

Chalcodermus inaequalis Horn 1873. Mexico. Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 23-IX-2015. 28° 35' 45'' north latitude, 100° 54' 27'' west longitude. 1 specimen in *Convolvulus* sp. Colony Soto H. M.

Conotrachelus leucophaetus Fahraeus, 1837. Mexico: Coahuila, Zaragoza. 18-IX-2015. 28° 27' 41'' north latitude. 100° 54' 47'' west longitude. 1 specimen in walnut foliage. Colony Soto H. M. Coahuila, Villa Unión. Huerta Santo Cristo. 01-X-2015. 28° 14' 48'' north latitude, 100° 44' 30'' west longitude. 1 specimen in walnut foliage. Colony Barrera R. G.

Pheloconus cribricollis (Say) 1831. Mexico. Coahuila. Zaragoza. Walnut Germplasm Bank CIRNE-INIFAP. 19-VII-2016. 28° 35' 45'' north latitude, 100° 54' 27'' west longitude. 2 foliage specimens of Solanaceae. Colony Soto H. M.

Rhyssomatus palmacollis (Say, 1831). Mexico. Coahuila. Saragossa. Walnut Germplasm Bank CIRNE-INIFAP. 23-IX-2016. 28° 35' 45'' north latitude, 100° 54' 27'west longitude. 2 specimens in *Convolvulus* sp. Colony Soto, H. M.

The pecan tree has been one of the crops with the most economic value, which is why entomological studies have focused mainly on insect pests and their control. In Mexico, the curculionidae associated with pecan tree are: *E. segnis* and *X. ferrugineus*, which perforate trunk wood and branches, affecting more walnut trees without management and stressed (Aguilar, 2007, Tarango, 2014), these species were not collected, like neither *C. caryea* that is present in Texas and widely distributed in the nogales zones of the USA (Al-Saqer *et al*., 2010).

The majority of weevil species were collected in the Germoplasm Bank of pecan tree, which harbors 77 genotypes between varieties and Creole selections. It is an orchard with little agronomic management considered organic, since it avoids the use of synthetic pesticides and mineral fertilizers, actions that protect the environment and promote biodiversity (Aguilar, 2014). *S. interruptus*, *S. sculpticollis* and *T. hirsutus* stand out for their importance as possible beneficial agents of natural biological control. The first two species have not been studied in Mexico, they are developed in cuscuta (Convulvulaceae) and huizache (Fabaceae) (Anderson, 1962).

The *Cuscuta* sp., Is one of the main parasitic plants in the cultivation of alfalfa, reduces the yield and increases the production costs (Tovar *et al*., 2014), the huizache (*Acacia* sp.), is an invasive grassland plant which becomes an economic and ecological problem, currently one of the most effective methods for its control is the use of synthetic herbicides (Ramírez *et al*., 1998). *T. hirsutus* is considered by McClay and Anderson (1985) as a possible biological control agent in *Parthenium hysterophorus*, a species little studied in Mexico. It is important to study these three species more in order to better understand their biology and potential use.

Conclusions

No species of Curculionidae collected and identified is plague of the pecan tree, also confirms the absence of *Curculio caryae* which is considered one of the main pests in the crop in the Southeastern United States of America.

Cited literature

Aguilar, P. H. 2007. Principales plagas del nogal en el norte de Coahuila. CIRNE-INIFAP. Campo Experimental Saltillo. Folleto técnico Núm. 14. Coahuila. México. 30 p.

Aguilar, P. J. H. 2014. Manual para el manejo orgánico del nogal pecanero. Palibrio. Indiana. USA. 274 p

Anderson, D. M. 1962. The weevil genus Smicronyx in America North of Mexico (Coleoptera: Curculionidae. Proceedings of the United States National Museum. 113(3456):185-372.

Anderson, R. S. 2002. Family 131. Curculionidae Latreille 1802. *In*: Arnett, Jr. R. H.; Thomas, M. C.; Skelley, P. E. and Howard, F. J. (Eds.). American beetles. Volume II: Polyphaga: Scarabaeoidea through Curculionoidea. CRC Press LLC, Boca Raton. 722-806 pp.

Al-Saqer, S. M.; Weckler, P., Solei, J.; Stone, M. and Wayadande, A. 2010. Identification of pecan weevils through image processing. Am. J. Agric. Biol. Sci. 6(1):69-79.

Bloem, S.; Mizell, R. F. and O'Brien, C. W. 2002. Old trasps for new weevils: new recors for curculionids (Coleoptera: Curculionidae), Brentids (Coleoptera: Brentidae) and Anthribids (Coleoptera: Anthribidae) from Jefferson, Co., Florida. Florida Entomol. 85(4):632-644.

CONABIO. 2008. Catálogo taxonómico de especies de México. Comisión Nacional para el Conocimiento y uso de la Biodiversidad (CONABIO). *In*: Sarukhan, J. (Ed.). Capital natural de México CD.1. México, D. F. 6-190 pp.

Howden, A. T. 1959. A revisión of the species of *Pandeleteius* Schonherr and *Pandeleteinus* Champion of America North of Mexico. Proceeding of the California Academy of Sciences. 29(10):361-421.

McClay, A. S. and Anderson, D. M. 1985. Biology and immature stages of *Thecesternus hirsutus* Pierce (Coleoptera: Curculionidae) in northeastern Mexico. Proc. Entomol. Soc. Washington. 87(1):207-215.

Orona, C. I.; Sangerman-Jarquín, D. M.; Fortis, H. M.; Vázquez, V. C. y Gallegos, R. M. A. 2013. Producción y Comercialización de nuez pecanera (*Carya illinoensis* Koch.) en el norte de Coahuila. Rev. Mex. Cienc. Agríc. 4(3):461-476.

Ramírez, M. F.; Enríquez, C. E., Miranda, Z, H. Ortega, G. C. y Silva, O. M. F. 1998. Control de Huizache (*Acacia farnesiana*) con Tebuthiuron en la parte central de Sonora. Rev. Téc. Pec. 36(3):243-248.

SIAP. 2013. http://www.siap.gob.mx/cierre-de-la-produccion-agricola-por-estado/.

Tarango, R. S. H. 2014. Manejo integrado de plagas en el nogal pecanero. CIRNOC-INIFAP. Delicias, Chihuahua. Libro Técnico Núm. 1 307 p.

Thompson, T. E. and Corner, P. J. 2012. Chapter 20, pecan. *In*. Badenes, M. L. and Byrne D. H. (Eds). Fuit brending. Handbook of Plant Breeding 8. Springer Science. USA. 771-801 pp.

Tovar, H. H.; Morales, S. N. L. y Ruiz, M. M. Control de cuscuta en alfalfa para forraje en el Valle de Mexicali; plagas y enfermedades. Fundación Produce Baja California. México. 29 p.

Ward, C. R.; O'Brien, C. W. Foster, D. E. and Huddleston, E. W. 1977. Annotated checklist of new world insects associated with *Prosopis* (mesquite). Technical Bulletin USDA. 1557. 115 p.