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Authors: López-Guillén, G., Teran-Vargas, A. P., Ruiz, J. Gómez, Lara, J. San-Juan, Rosado-Neto, G. H., et al.

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FIRST RECORD OF *RHYSSOMATUS NIGERRIMUS* (CURCULIONIDAE: MOLYTINAE: CLEOGONINI) INFESTATIONS IN SOYBEANS IN MEXICO

G. López-Guillén[1], A. P. Teran-Vargas[2], J. Gómez Ruiz[3], J. San-Juan Lara[4], G. H. Rosado-Neto[5], C. W. O'Brien[6], L. Cruz-López[3], L. A. Rodríguez-del-Bosque[7] and R. Alatorre-Rosas[4]

[1]Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), Campo Experimental Rosario Izapa, Tuxtla Chico, Chiapas, C. P. 30780, Mexico

[2]INIFAP, Campo Experimental Las Huastecas, Ciudad Cuauhtémoc, Tamaulipas, 89610, Mexico

[3]Departamento de Entomología Tropical, El Colegio de la Frontera Sur, Tapachula, Chiapas, CP 30700, Mexico

[4]Colegio de Postgraduados, Montecillo, Edo de Mexico, CP 56230, Mexico

[5]Universidade Federal do Paraná, Departamento de Zoologia. Caixa Postal 19020, 81531-990 Curitiba-PR, Brazil

[6]2313 W. Calle Balaustre, Green Valley, AZ 85614-8047, USA

[7]INIFAP, Campo Experimental Río Bravo, Apartado Postal 172, Río Bravo, Tamaulipas, Mexico 88900

Weevils are members of the beetle family, Curculionidae, which comprises approximately 4,600 genera and 51,000 species (Oberprieler et al. 2007). In Mexico, more than 2,300 species have been reported and 6.5% and 40.5% of the genera and species, respectively, are endemic (Anderson & O'Brien 1996). Most weevils are phytophagous during both larval and adult stages (Marvaldi & Lanteri 2005).

The genus *Rhyssomatus* includes more than 150 Neotropical and Nearctic species, many of which are of agricultural importance (Viale 1951; Viale & Thomas 1954; Santos et al. 2001). In Costa Rica, the presence of a *Rhyssomatus*, **nr.** *R. subcostatus* Fahraeus, was observed attacking yam (*Ipomoea* spp.; Solanales: Convalvulaceae) crops, while in Argentina *R. subtilis* Fiedler was recently reported attacking soybean (*Glycine max* (L.) Merr.; Fabales: Fabaceae) (Viale 1951; Viale & Thomas 1954; Socías et al. 2009). In Mexico, 27 species of *Rhyssomatus* have been reported (Kissinger 1962; O'Brien & Wibmer, 1982; Maes & O'Brien 1990; Salas-Araiza et al. 2001; Morrone et al. 2002); but none has been considered as an agricultural pest.

Soybean is widely planted in Mexico, and in 2011 the surface area dedicated to the soybean crop was 167,925 ha, with a production of 183, 981 t, mainly in the states of Tamaulipas, San Luis Potosi, Chiapas, Veracruz and Campeche (SIAP 2012). However, no information is available of *Rhyssomatus* on soybean. Therefore, this paper reports for the first time, *R. nigerrimus* attacking soybean crops in northern and southern Mexico. It also presents notes on its field bioecology.

For the last 3 yr through pest monitoring in soybean crops in the municipality of Altamira, Tamaulipas, Mexico, in the "Brecha de Corpus" zone and in El Manzano, Tapachula, Chiapas, the presence of a black weevil that attacks soybean in both vegetative and reproductive stages has been detected. In the 2009 spring-summer crop in southern Tamaulipas, the weevil was observed to cause considerable damage to pods on approximately 1800 ha of soybean. Considerable damage caused by this weevil has also been detected on approximately 3,000 ha of soybean crops in Tapachula, Chiapas. In both places the weevils damaged up to 48% of the pods, and the damage was distributed uniformly throughout the soybean crop. Recently, in 2011, the weevil was found in volunteer soybean plants in areas where soybean had been cultivated in the municipality of Ebano, San Luis Potosí.

Sampling was conducted in soybean growing areas in the states of Tamaulipas, Chiapas and San Luis Potosí to collect adult weevils, which were preserved in 70% alcohol. The coordinates of each of the points where the insects were collected were georeferenced with a GPS instrument (Garmin 12, Olathe, Kansas, USA) (Fig. 1). The weevil specimens were identified as *Rhyssomatus nigerrimus* Fahraeus 1837 (Curculionidae: Molytinae: Cleogonini) by Dr. Germano Rosado-Neto. Identification was corroborated independently by Dr. Charles O'Brien. The voucher specimens were deposited in the collection of El Colegio de la Frontera Sur, Chiapas, Mexico, in the collection "Pe. Jesus S. Moure" of the Zoology Department, Federal University of Paraná, Curitiba, Brazil, and in the personal collection of Dr. Charles O'Brien, Green Valley, Arizona, USA.

Rhyssomatus nigerrimus has been recorded in the Lesser Antilles, Belize, Honduras, Panama, Guatemala and Mexico (Champion 1902 cited by Burke 1961; O'Brien & Wibmer 1982; Peck 2009). In San Vicente, this weevil species has been reported attacking yams, *Ipomoea batatas* (L.) Lam.; Solanales: Convolvulaceae (Bailey 1994; Peck 2009), while in Mexico it has been collected

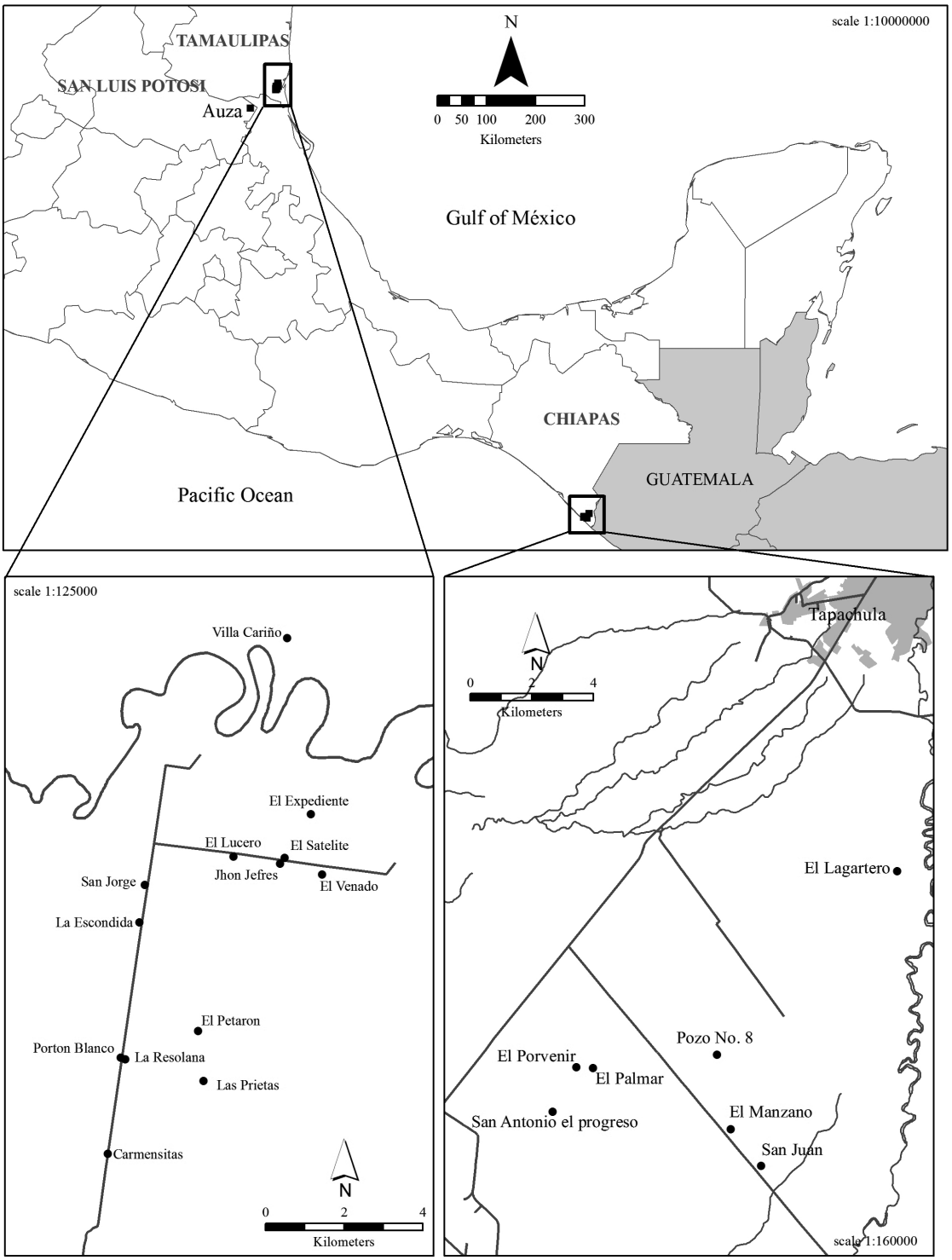

Fig. 1. Distribution of *Rhyssomatus nigerrimus* in Tamaulipas, Chiapas and San Luis Potosí, Mexico.

in Nayarit, Guanajuato and Tabasco (Salas-Araiza et al. 2001; Morrone et al. 2002). Salas-Araiza et al. (2001) mentions that in Guanajuato, Mexico, *R. nigerrimus* was found on *Acacia* spp., *Am-*

aranthus spp.; *Baccharis salicifolia*; *Ficus* spp.; Gramineae; *Ipomoea* spp., *I. hederacea*; *Mimosa* spp., *Prosopis* spp.; and *Prunus persica*. However, *R. nigerrimus* previously had not been reported attacking soybean.

In the states of Tamaulipas and Chiapas, *R. nigerrimus* has been found feeding on both vegetative and reproductive parts of soybean. The vegetative stage is attacked by adults that feed on tender sprouts of both seedlings and well-developed plants. The weevil also attacks the stems and branches of developed plants where perforations without oviposition have been found. Also, the damage caused to the vegetative stage of soybeans can be observed in seedlings and buds, and can even cause death of the plant. In the reproductive stage of soybeans determined by Fehr et al. (1971), the female weevils can feed and deposit their eggs inside the pods from full pod (R4) to full maturity (R8). When the larvae hatch, they feed on the endosperm of the green seeds until they destroy them, partially or completely. The weevil, in addition to directly damaging the soybean seeds, facilitates the development of phytopathogens in the seeds, which may lower the quality of soybean oil.

It has been observed that the larvae, after feeding on the seeds, fall to the soil as prepupae; there they bury themselves 10 to 30 cm deep to continue their development as pupae and adults for approximately five mo. The time lapse between harvest of the previous crop and the appearance of adults in the following crop indicates that this insect has 2 developmental phases: one active phase that occurs in soybean plant and a latent phase, or diapause, which occurs in the soil. The duration of pupal and adult stage in soil was determined by soil sampling randomly with the excavation and examination of the soil of 5 holes of 20 × 20 × 30 cm per ha per wk. The soil samples collected were processed in laboratory to look for immature and mature stages of weevil, and when larvae, pupae and adults were found, they were observed to determine if they were in a latent phase. In southern Tamaulipas it has been found that with the arrival of the first rains, just when the seedlings emerge, mass emergence of weevils also occurs. In addition, *R. nigerrimus* has been found to feed on other host plants, such as *Leucaena leucocephala* (Lam.) de Wit (Fabales: Fabaceae), *Tithonia tubiformis* (Jacq.) Cass. (Asterales: Asteraceae), *Convolvulus arvensis* L. (Solanales: Convolvulaceae) and *Ipomea purpurea* (L.) Roth (Solanales: Convolvulaceae) in Tamaulipas; while in Chiapas it has been found feeding only on *I. purpurea*. Apparently, the weevil produces only 1 generation per yr, the pupal stage lasts approximately 5 wk and a wintering stage as adult for approximately 15 wk. It is necessary to conduct more detailed studies of its biology to determine the exact duration of each of its stages.

The adult *R. nigerrimus* has a black or brownish black oval, glabrous or almost glabrous body, measuring approximately 3.7 to 5.3 mm long and 2 to 2.5 mm thick (Fig. 2a). The head is small and the prothorax densely, obliquely rugose; the compound eyes are located in the upper back part of the head. The snout is thin, curved, and as long as the head and prothorax. The antennae are located on the middle part of the snout. The elytra have dotted longitudinal lines (= striae) along their entire length; the interstriae are weakly carinate. All femora are claviform and dentate internally; the internal margin of each tibia is strongly sinuate, meso- and the hindtibia is angulate or toothed on the outer edge towards the apex; tarsal claws are cleft, and subapproximate at the base. The eggs are cylindrical with rounded edges, measuring approximately 1 mm long and 0.5 mm wide; they are creamy white or transparent (Fig. 2b). The larvae are 1.0 to 8.6 mm long by 0.40 to 2.3 mm wide; they are typical of most Curculionidae; having no legs, the body curved in a C-shape, and yellowish white. The head is light brown or caramel-colored, hard with well-developed mouthparts (Fig. 2c). The pupa is exarate, yellowish white and its size is similar to that of the adult (Fig. 2d).

The morphology, biology, damage and behavior in the field of *R. nigerrimus* are similar to those described by Socías et al. (2009) for *R. subtilis*, which recently was reported to be a pest of soybean pods in Argentina. Nevertheless, the two are distinctly different species, according to the identification by Germano Rosado-Neto and Charles O'Brien, who have collections with specimens of the 2 species.

In conclusion, *R. nigerrimus* is an insect that causes direct and indirect damage to soybeans. The adults and larvae of the weevil feed on the vegetative and reproductive parts of the plant. The direct damage merits special attention because it negatively affects yield and quality of the crop. With more knowledge of the bioecology, behavior, damage and other aspects of the Mexican soybean weevil, it should become possible to provide recommendations for the integrated management of *R. nigerrimus*.

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Summary

The Mexican soybean weevil (MSW), *Rhyssomatus nigerrimus*, has recently been observed causing damage to soybean crops in Tamaulipas

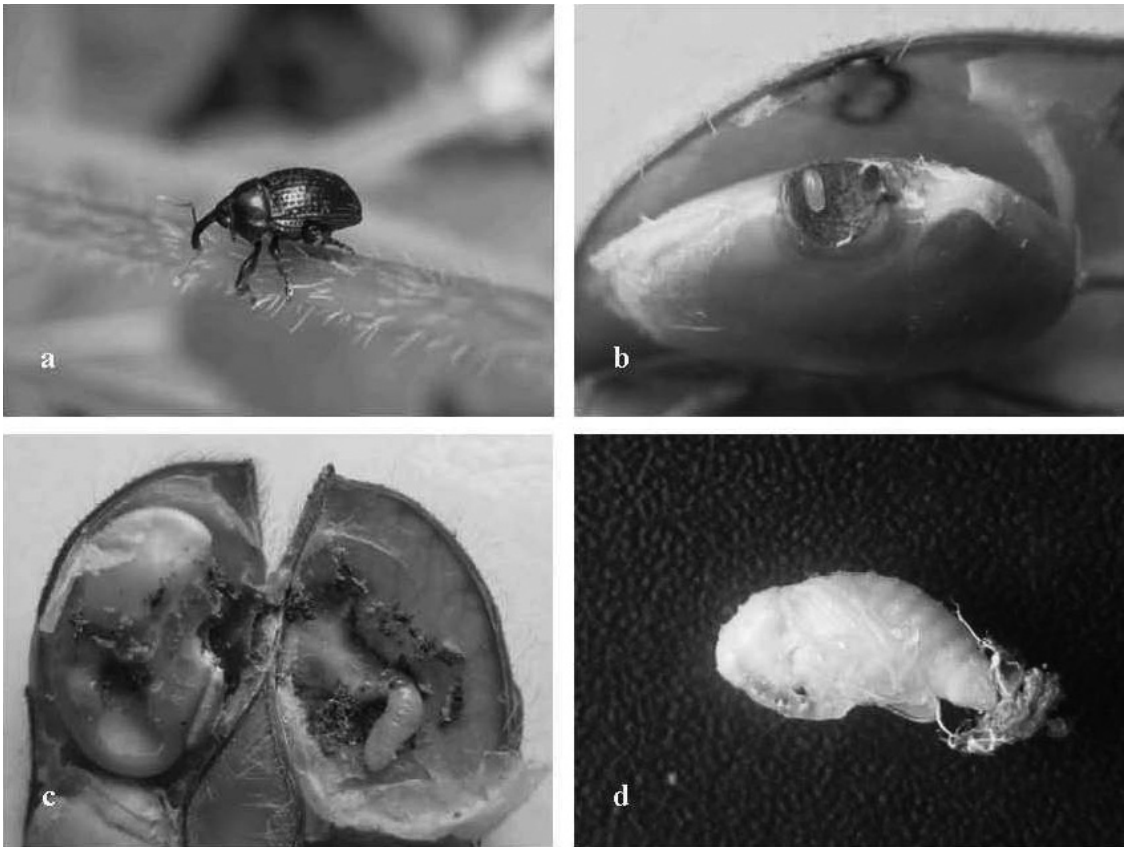

Fig. 2. Life stages of *Rhyssomatus nigerrimus* on soybean; a, adult; b, egg; c, larvae; and d, pupae.

and Chiapas, Mexico. The weevil adults have been found feeding on vegetative parts of soybean while larvae develop and feed in the plant's reproductive parts. The pest may migrate to other Mexican regions in the near future to cause a threat to soybean crops. The genera *Phaseolus* and *Ipomea batata* are potential hosts of the MSW in Mexico. Our finding appears to be the first published report of MSW as a pest of soybean in Mexico.

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