

First record of *Dysschema sacrificata* (Hübner, [1831]) on Soybean (*Glycine max* (L.) Merr) (Lepidoptera: Erebidae, Arctiinae)

E. González & H. M. Beccacece

Abstract

The presence of *Dysschema sacrificata* (Hübner, [1831]) on soybean (*Glycine max* (L.) Merr) is reported for the first time. Larvae of this species were found consuming soybean leaves in soybean fields in Córdoba province, Argentina, and were able to complete their life cycle. Characteristics of adults and larvae are provided for rapid identification in the field. Due to the widespread distribution of this species within the region where soybean is more intensively cultivated in South America, we conclude that *D. sacrificata* is a potential soybean pest. Further studies on infestation frequency, damage levels and control by natural enemies are needed.

KEY WORDS: Lepidoptera, Erebidae, Arctiidae, *Dysschema sacrificata*, soybean, pest, Argentina.

Primer registro de *Dysschema sacrificata* (Hübner, [1831]) en soja (*Glycine max* (L.) Merr) (Lepidoptera: Erebidae, Arctiinae)

Resumen

Se reporta por primera vez la presencia de *Dysschema sacrificata* (Hübner, [1831]) en soja (*Glycine max* (L.) Merr). Larvas de esta especie fueron encontradas comiendo hojas de esta planta de soja en cultivos de la provincia de Córdoba, Argentina, las que pudieron completar su ciclo biológico. Se provee características de adultos y larvas para una rápida identificación en el campo. Debido a la gran distribución de esta especie en la región donde la soja es más intensamente cultivada en Sudamérica, nosotros concluimos que *D. sacrificata* es una potencial plaga de soja. Se requieren futuros estudios que evalúen la frecuencia de infestación, niveles de daño y control por enemigos naturales.

PALABRAS CLAVE: Lepidoptera, Erebidae, Arctiidae, *Dysschema sacrificata*, soja, plaga, Argentina.

Introduction

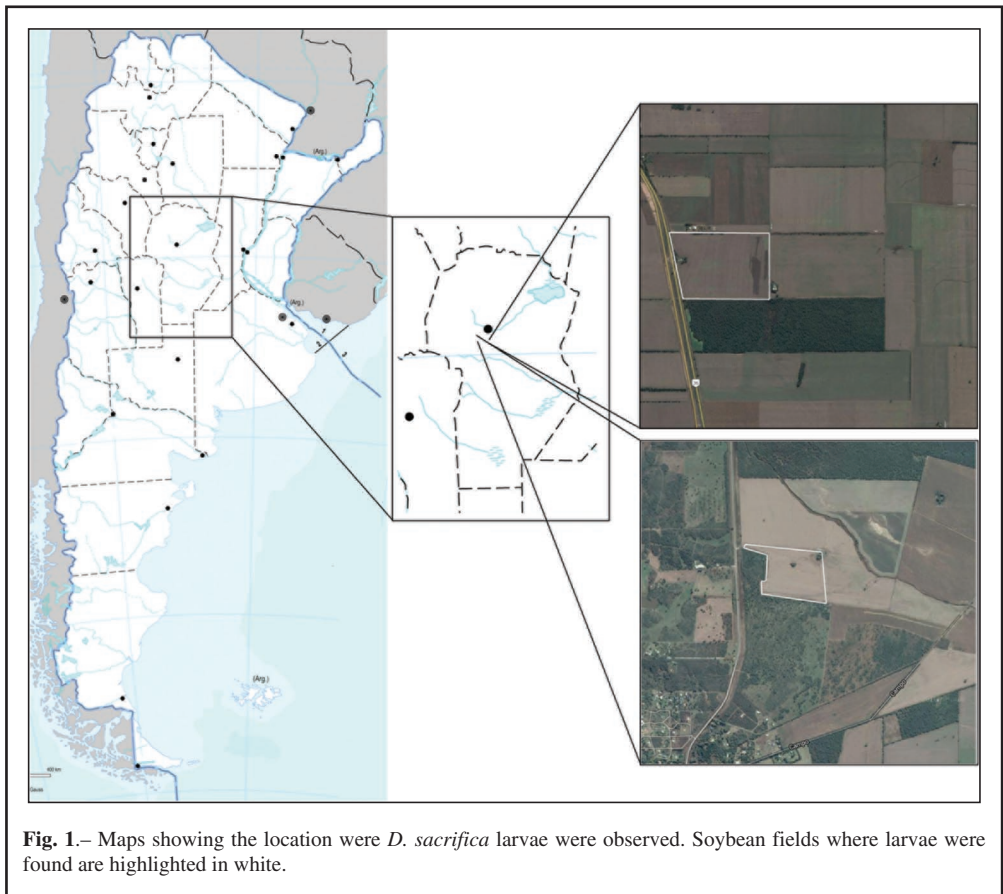
The legume family is the third largest family within the Angiospermae and represents the second economically most important plant family after Poaceae. Soybean, also known as soya (*Glycine max* (L.) Merr) is one of the most important crops within this family (LEFF *et al.*, 2004). It is native to East Asia and the main producers are the United States, Brazil, Argentina, China and India (FORECAST USDA, 2016). In Argentina, soybean represented half of the cultivated surface in 2006 (AIZEN *et al.*, 2009) and 86.5% of the total soybean production corresponds to the Pampean region, situated in the center-east of Argentina (PIASTRELLINI *et al.*, 2015).

Although soybean is an exotic plant, the crop has been established in different locations and with increasing areas for many uses. Many arthropods species in the American continent gradually adapted to the crop, sometimes causing considerable damage or becoming pests (CARRARO-FORMENTINI *et al.*, 2015). According to a review, several arthropod herbivores that feed on soybean across the globe were identified and, particularly, 70 species of lepidopteran larvae were reported to produce damages by different

feeding strategies like leaf eaters, leaf-rollers, borers, pod eaters and cutworms (FICHETTI *et al.*, 2013; CARRARO-FORMENTINI *et al.*, 2015). The accurate identification of the species that feed on crops is extremely important for proper management and to avoid economic losses (CARRARO-FORMENTINI *et al.*, 2015). This study reported for the first time a species of Lepidoptera that feeds on soybean leaves.

Materials and methods

Recently, during field sampling of soybean arthropods, in two of twelve fields (March 15th and April 14th, 2016) within Santa María department, Córdoba province, Argentina (Fig. 1) lepidopteran larvae were observed feeding on leaves of soybean. Larvae and leaves of soybean were collected and transported to the laboratory. The larvae were reared to adulthood for determination. Both soybean fields were adjacent to fragments of Chaco forest.



Results and discussion

The larvae collected belong to *Dysschema sacrificia* (Hübner, [1831]). The larvae ate leaves, causing an important defoliation. Life cycle of the species was completed consuming soybean, therefore *Glycine max* can be considered as an alternative feeding source for immature stages. There are three previous

reports of the subfamily Arctiinae, commonly named tiger moths, feeding on soybean leaves (CARRARO-FORMENTINI *et al.*, 2015) (Table I).

Table I.– Species of Arctiinae (Lepidoptera: Erebidae) reported on *Glycine max* crops. * = new report. The reference column refers to the number of the references in text.

Genus / species	Frequency on soybean	Geographical distribution	Reference
<i>Aloa moorei</i> (Snell.)	Sporadic	India, Pakistan	SINGH <i>et al.</i> , 1990
<i>Estigmene acrea</i> (Dry.)	Sporadic	Canada to south of Central America	MARRERO-ARTABE <i>et al.</i> , 2013
<i>Dysschema sacrificica</i> (Hb.)*	Potential	South America	
<i>Paracles cajetani</i> (Rothsch.)	Sporadic	Uruguay	CARRARO-FORMENTINI <i>et al.</i> , 2015
<i>Paracles vulpina</i> (Hb.)	Sporadic	Argentina	CARRARO-FORMENTINI <i>et al.</i> , 2015
<i>Spilarctia casigneta</i> (Koll.)	Sporadic	North Pakistan, Himalaya, Nepal, Bhutan	NEUPANE & SHRESTHA, 2015
<i>Spilarctia dalbergiae</i> Mre.	Potential	Himalayas	TIWARI & KASHYAP, 1990
<i>Spilarctia obliqua</i> Wlk.	Frequent	South East Afghanistan, North Pakistan, India, Bhutan, Bangladesh, Burma	BISWAS, 2013
<i>Spilosoma virginica</i> (F.)	Frequent	North America (introduced in South America)	CARRARO-FORMENTINI <i>et al.</i> , 2015

D. sacrificica has a wide distribution in South America, and is usually present in open and/or disturbed areas (BOURQUIN, 1945). It is present from Northern Brazil to the centre of Argentina, also occurring in Peru, Paraguay, Bolivia and Uruguay. Previous studies showed that immature stages have polyphagous habits, feeding on different plant families, mostly herbaceous plants (BOURQUIN, 1945; PASTRANA, 2004; FONSECA *et al.*, 2014) (Table II). Furthermore, larvae can feed on different hosts plants during their larval stages and complete their life cycle without problems (PASTRANA, 2004). Field observations during sampling of this study revealed that larvae were also found on forest remnants close to the soybean crops, feeding on native herbaceous plants. The profound changes on Córdoba's natural habitats over the last decades have led to deforestation and forest fragmentation (ZAK *et al.*, 2004), mainly for agricultural expansion due to an increase in soybean cultivated surface (ZAK *et al.*, 2008). A recent study found that insects move intensely between forest fragments and soybean crops (GONZÁLEZ *et al.*, 2016), which suggests that *D. sacrificica* can be leaving forest patches occasionally to feed on soybean.

The complete life cycle of *D. sacrificica* was previously studied (BOURQUIN, 1945). Nonetheless, we mention some characteristics for quick identification of the species in the field. The adults of this species are medium sized, with females bigger than males (wingspan of males: 41.5-42mm, females: 49-52mm). The identification of the adults is not difficult due to their color pattern, the forewings are brownish dark with a white cross-like mark. There is also sexual dichromatism, since hindwings in females are darker than males. The final larval instar has a size of approximately 45 mm and the dominant coloration is greenish yellow with longitudinal black lines, verrucae are metallic blue and reddish brown bearing black and white setae, head and thorax legs are shiny black. (Fig. 2).

We suggest that producers should control their crops in future soybean campaigns in order to develop an early response. Also, more research is needed to determine the areas where *D. sacrificica* feeds on soybean and if damages are economically significant. Moreover, since it is a native species, it is likely that natural enemies are attacking all life stages, so this should also be considered in future studies. A large number of predators and parasitoids move between natural and cultivated habitats (GONZÁLEZ *et al.*, 2016) and more species are found near forest fragments and in landscapes with high forest cover

(GONZÁLEZ *et al.*, 2015). Therefore, populations of this moth could be naturally controlled in the sampled fields.

Table II.– Host plants of *Dysschema sacrifica*. *= new host plant here reported.

Family	Genus	species
Amaranthaceae	<i>Amaranthus</i> <i>Amaranthus</i>	<i>hybridus</i> ssp. <i>cruentus</i> (L.) Thell <i>hybridus</i> L. ssp. <i>hybridus</i>
Asteraceae	<i>Artemisia</i> <i>Austroeupeatorium</i> <i>Bidens</i> <i>Chromolaena</i> <i>Chrysanthemum</i> <i>Eremanthus</i> <i>Helianthus</i> <i>Lactuca</i> <i>Senecio</i> <i>Taraxacum</i> <i>Vernonanthura</i>	<i>absinthium</i> <i>inulifolium</i> (Kunth) R. M. King & H. Rob. sp. <i>odorata</i> (L.) R. M. King & H. Rob. spp. <i>erythropappus</i> (DC.) MacLeish <i>annuus</i> L. <i>sativa</i> L. <i>brasilensis</i> (Spreng.) Less. <i>officinale</i> F. H. Wigg. <i>phosphorica</i> (Vell.) H. Rob.
Fabaceae	<i>Glycine</i>	<i>max</i> (L.) Merr.*
Mirtaceae	<i>Eucalyptus</i>	spp.
Nyctaginaceae	<i>Pisonia</i>	<i>zapallo</i> Griseb.
Urticaceae	<i>Boehmeria</i>	<i>caudata</i> (Poir.) Bonpl.

Conclusions

Soybean (*Glycine max* (L.) Merr) is registered as a new host plant for the tiger moth *D. sacrifica*. The species has a wide distribution that coincides with the region where soybean is more intensively cultivated in South America, which makes it a potential pest of this crop. More studies are needed to understand how frequently this species attacks soybean plants, the damage it produces and how natural enemies can be used to control it.

Acknowledgments

We would like to thank the landowners of the soybean fields for their permission for work. This study was partially funded by CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina), through a posdoctoral grant to authors.

BIBLIOGRAPHY

- AIZEN, M., GARIBALDI, L. A. & DONDO, M., 2009.– Expansión de la soja y diversidad de la agricultura argentina.– *Ecología Austral*, **19**: 45-54.
- BISWAS, G. C., 2013.– Insect pests of soybean (*Glycine max* L.), their nature of damage and succession with the crop stages.– *Journal of the Asiatic Society of Bangladesh*, **39**: 1-8.
- BOURQUIN, S., 1945.– *Mariposas Argentinas: vida, desarrollo, costumbres y hechos curiosos de algunos lepidópteros Argentinos*: 5 + 209 pp., 2 pls. S. Bourquin ed., Buenos Aires.
- CARRARO-FORMENTINI, A., SOSA-GÓMEZ, D. R., PAULA-MORAES, S. V., MONTEIRO DE BARROS, N. & SPECHT, A., 2015.– Lepidoptera (Insecta) associated with soybean in Argentina, Brazil, Chile and Uruguay.– *Ciencia Rural*, **45**: 2113-2120.
- FICHETTI, P. C., NÚÑEZ-BUSTOS, E. & AVALOS, S. D., 2013.– Primera cita de *Strymon eurytulus* (Lycaenidae: Eumaeini) sobre cultivos de soja y alfalfa.– *Historia Natural*, **3**: 29-35.
- FONSECA, A. J., MENEZES, C. W. G. de, ASSIS-JÚNIOR, S. L., DINIZ-SILVEIRA, R., COLA-ZANUNCIO, J. &

- ALVARENGA-SOARES, M., 2014.– *Dysschema sacrificata* (Lepidoptera: Arctiidae): First record on the medicinal plant *Eremanthus erythropappus* (Asteraceae) in Brazil.– *Florida Entomologist*, **97**: 1266-1269.
- FORECAST (USDA), 2016.– GLOBAL SOYBEAN PRODUCTION. Disponible en <http://www.globallysoybeanproduction.com> (accedido el 3 de noviembre de 2016).
- GONZÁLEZ, E., SALVO, A., DEFAGÓ, M. T. & VALLADARES, G., 2016.– A moveable feast: insects moving at the forest-crop interface are affected by crop phenology and the amount of forest in the landscape.– *Plos One*, doi: 10.1371/journal.pone.0158836.
- GONZÁLEZ, E., SALVO, A. & VADALLARES, G., 2015.– Sharing enemies: evidence of forest contribution to natural enemy communities in crops, at different spatial scales.– *Insect Conservation and Diversity*, **8**: 359-366.
- LEFF, B., RAMANKUTTY, N. & FOLEY, J. A., 2004.– Geographic distribution of major crops across the world.– *Global Biogeochemical Cycles*, **18**: GB1009. doi:10.1029/2003GB002108, 2004.
- MARRERO-ARTABE, L. & BORGES-ÁLVAREZ, A., 2013.– Consumo foliar de larvas de *Estigmene acrea* (Lepidoptera: Arctiidae) sobre tres variedades de soya (*Glycine max*).– *Fitosanidad*, **17**: 35-39.
- NEUPANE, B. P. & SHRESTHA, J., 2015.– Scenario of entomological research in legume crops in Nepal.– *International Journal of Applied Sciences and Biotechnology*, **3**: 367-372.
- PASTRANA, J. A., 2004.– *Los lepidópteros argentinos: sus plantas hospedadoras y otros sustratos alimenticios*: 334 pp. South American Biological Control Laboratory USDA-ARS / Sociedad Entomológica Argentina, Buenos Aires.
- PIASTRELLINI, R., CIVIT, B. M. & ARENA, A. P., 2015.– Influence of agricultural practices on biotic production potential and climate regulation potential. A case study for life cycle assessment of soybean (*Glycine max*) in Argentina.– *Sustainability*, **7**: 4386-4410.
- SINGH, K. J. & SINGH, O. P., 1990.– Biology of red hairy caterpillar (*Amsacta moorei*) (Lepidoptera: Arctiidae) on soybean *Glycine max* in Madhya Pradesh.– *The Indian Journal of Agricultural Sciences*, **60**: 192-194.
- TIWARI, S. N. & KASHYAP, N. P., 1990.– Potential host range of *Spilosoma dalbergiae* (Moore) n. ssp. (Lepidoptera: Arctiidae) in India.– *The Journal of Research on the Lepidoptera*, **28**: 105-111.
- ZAK, M. R., CABIDO, M., CÁCERES, D. & DÍAZ, S., 2008.– What drives accelerated land-cover change in central Argentina? Synergistic consequences of climatic, socioeconomic, and technological factors.– *Environmental Management*, **42**: 181-189.
- ZAK, M. R., CABIDO, M., HODGSON, J. G., 2004.– Do subtropical seasonal forests in the Gran Chaco, Argentina, have a future?.– *Biological Conservation*, **120**: 589-598.

E. G.

Centro de Investigaciones Entomológicas de Córdoba
 Instituto Multidisciplinario de Biología Vegetal
 CONICET-UNC
 Avenida Vélez Sársfield, 1611
 5000 Córdoba
 ARGENTINA / ARGENTINA
 E-mail: ezenofx@gmail.com

* H. M. B.

Centro de Investigaciones Entomológicas de Córdoba
 Instituto de Investigaciones Biológicas y Tecnológicas
 CONICET-UNC
 Avenida Vélez Sársfield, 1611
 5000 Córdoba
 ARGENTINA / ARGENTINA
 E-mail: beccacehernan@gmail.com

* Autor para la correspondencia / *Corresponding author*

(Recibido para publicación / *Received for publication* 5-XI-2016)

(Revisado y aceptado / *Revised and accepted* 12-XII-2016)

(Publicado / *Published* 30-IX-2017)

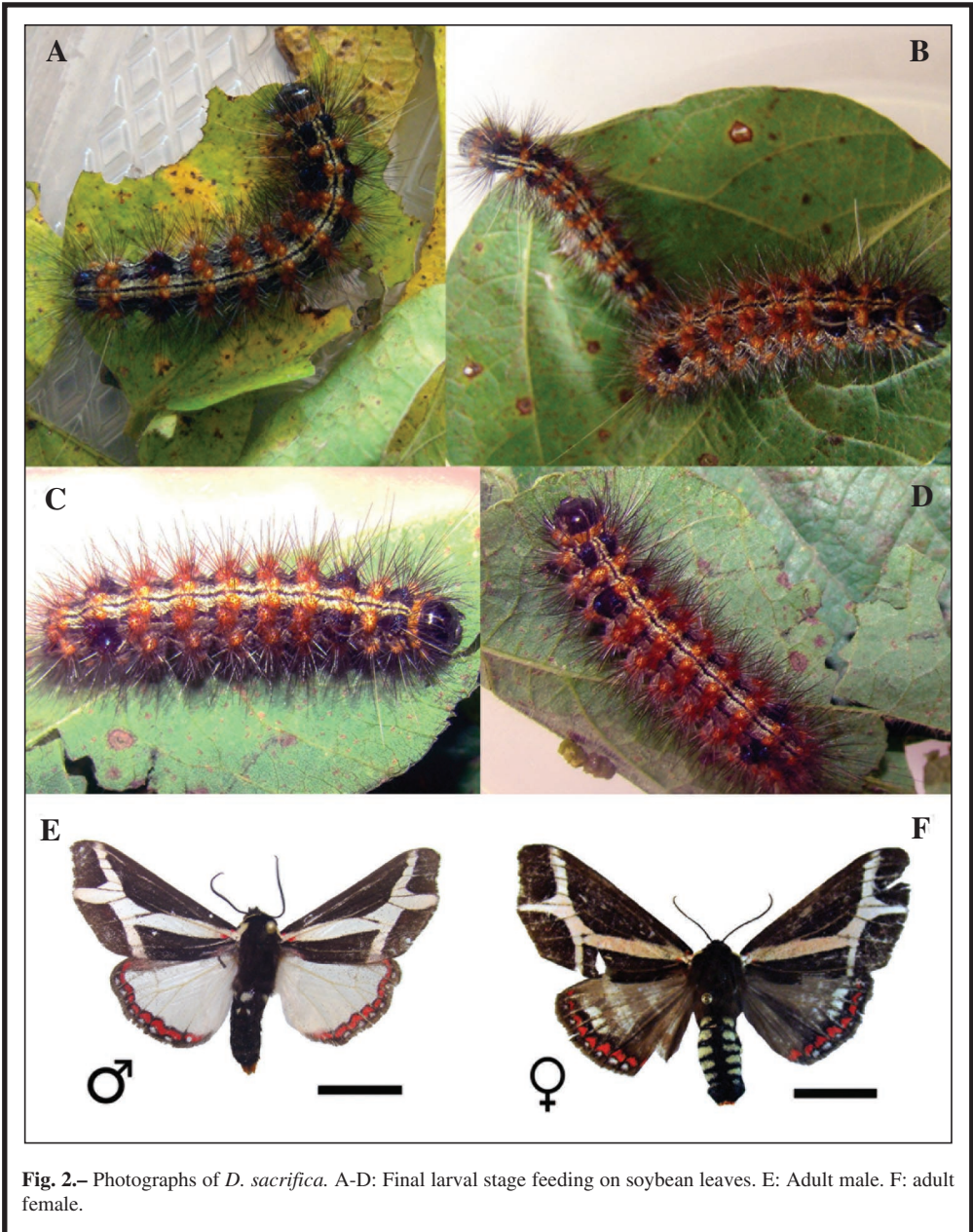


Fig. 2.— Photographs of *D. sacrifica*. A-D: Final larval stage feeding on soybean leaves. E: Adult male. F: adult female.